

# River Basin Catchment Summary



## Llyn and Eryri

### How to read this document

This document outlines detail relating to the planning areas of our DWMP.

The document has been structured to begin by outlining the information for Strategic Planning Units (Level 2) and then proceeds onto detailing the Tactical Planning Units (Level 3).

The reader is advised to scroll down the document until they find the appropriate section.

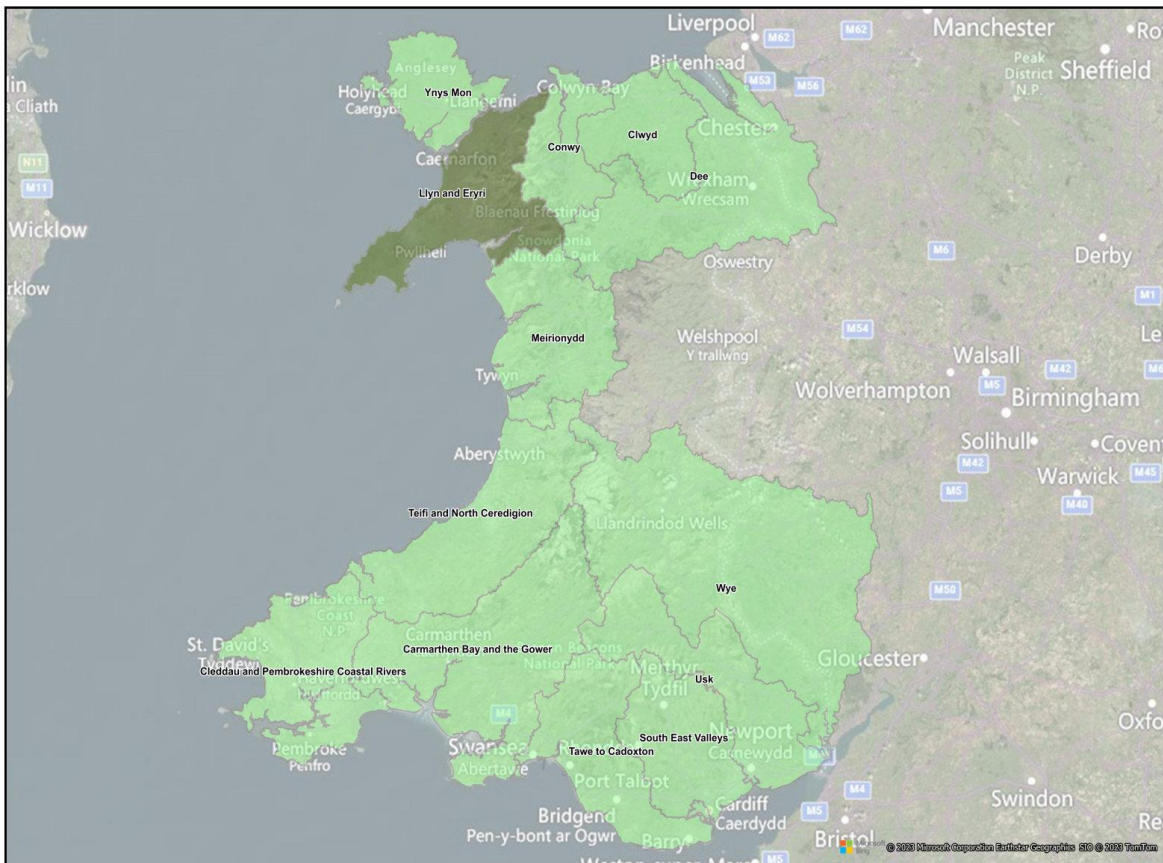
### 1.0 Introduction

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

### 1.1 Catchment Information

Llyn and Eryri (see Figure 1) consists of 93 wastewater catchments with a total population of 538752. There is a total sewer length of 910km, where 248km is associated to the foul system, 67km is associated to the surface water system and 572km is associated to the combined system. There are 93 Wastewater Treatment Works (WwTW), 537 Sewerage Pumping Stations (SPSs), and 358 Combined Storm Overflows (CSOs) across this river basin catchment level.

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



**Figure 1 - River basin location detailing associated strategic planning areas**

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

## 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.

In collaboration with our stakeholders, we have produced the following documents at the completion of each stage of the DWMP:

- Strategic Context: 'Introduction to the Drainage and Wastewater Management Plan', a Strategic Context document with details of the six national planning objectives and the DWMP action plan. A customer overview of the 'Introduction to the Drainage and Wastewater Management Plan', document which summarises what is included in the DWMP and why and how we created it has also been published.
- Risk Assessment: 'Where we want to work with you', which details our vision for future joint working on current and future risks.

- Options Development: An Options Development document is currently being developed with stakeholders and will be published later in 2023. This document will communicate how we have developed options that apply across all areas.
- Programme Appraisal: We are developing a ‘Programme Appraisal’ document in conjunction with our Options Development Option which will be published in 2023 and will outline how we take preferred solutions from the Options Development Process and develop a programme of work and timescales to implement them.
- Consultation: We produced this DWMP Plan, along with supporting documents to help stakeholders and customers make informed decisions at the consultation stage. Supporting documents to the DWMP include: a Customer Version DWMP; a DWMP brochure and questionnaire and a non-technical document. These were all published for the public consultation between July and October 2022.
- Following on from the consultation, we have produced a Statement of Response and a customer version Statement of Response to provide our stakeholders and customers with our responses to the items raised as part of the consultation.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

Plans	Stakeholder Engagement	Responsible Bodies/Primary Stakeholder
Local Management Plans	Natural Resources Wales (NRW) Llyn and Eryri Management Catchment Strategy	Natural Resources Wales Environment Agency Local partnerships
Flood Risk Management Plans (FRMP)	The Llyn and Eryri Flood Risk Management Plan is located on the NRW webpage. The report highlights that flood risk is varied due to the large geographical area that Llyn and Eryri covers. The main risk is tidal flooding in Pwllheli, Porthmadog and Llanfairfechan which impacts river outfalls and results in overtopping upstream.	Welsh Government Water companies Coastal Groups (local authority led) Natural Resources Wales Environment Agency Lead Local Flood Authorities

Shoreline Management Plans (SMP)	The Llyn and Eryri catchment is covered by SMP 21 – St Anne’s Head to the Great Orme. Further information can be found here <a href="https://www.grwparfordirolgorllewincymru.cymru/page/home-page">https://www.grwparfordirolgorllewincymru.cymru/page/home-page</a>	Coastal Groups (local authority led) County Councils Lead Local Flood Authorities
River Basin Management Plan (RBMP)	River Basin Management Plans (RBMPs) set out how a combination of organisations and parties work together to improve water quality and environment within a catchment under the Water Framework Directive (WFD). The Llyn and Eryri catchment comes under the Western Wales RBMP, which can be found and on the NRW webpage.	Water companies Coastal Groups (local authority led) Natural Resources Wales Welsh Government Environment Agency DEFRA
Flood and Coastal Erosion Risk Management Programme (FCERM)	There is opportunity to work with other strategically outlined FCERM schemes planned in the region from 2021 to 2022, as shown in Figure 2.	Coastal Groups (local authority led) Natural Resources Wales Welsh Government Environment Agency DEFRA
Local Development Plans (LDPs)	The latest local development plans have been incorporated into the plan and future iterations of LDPs will be amended into the DWMP in future cycles.	Local Councils
Other Stakeholders and Non-Governmental Organisation (NGOs)	There are a range of other stakeholders of varying interests regarding water in this region including national charities and organisations, as well as local conservation groups for wild swimming and angling (see right).	North Wales Wildlife Trust North Wales Rivers Trust Snowdonia Society Bangor University Abersoch Angling

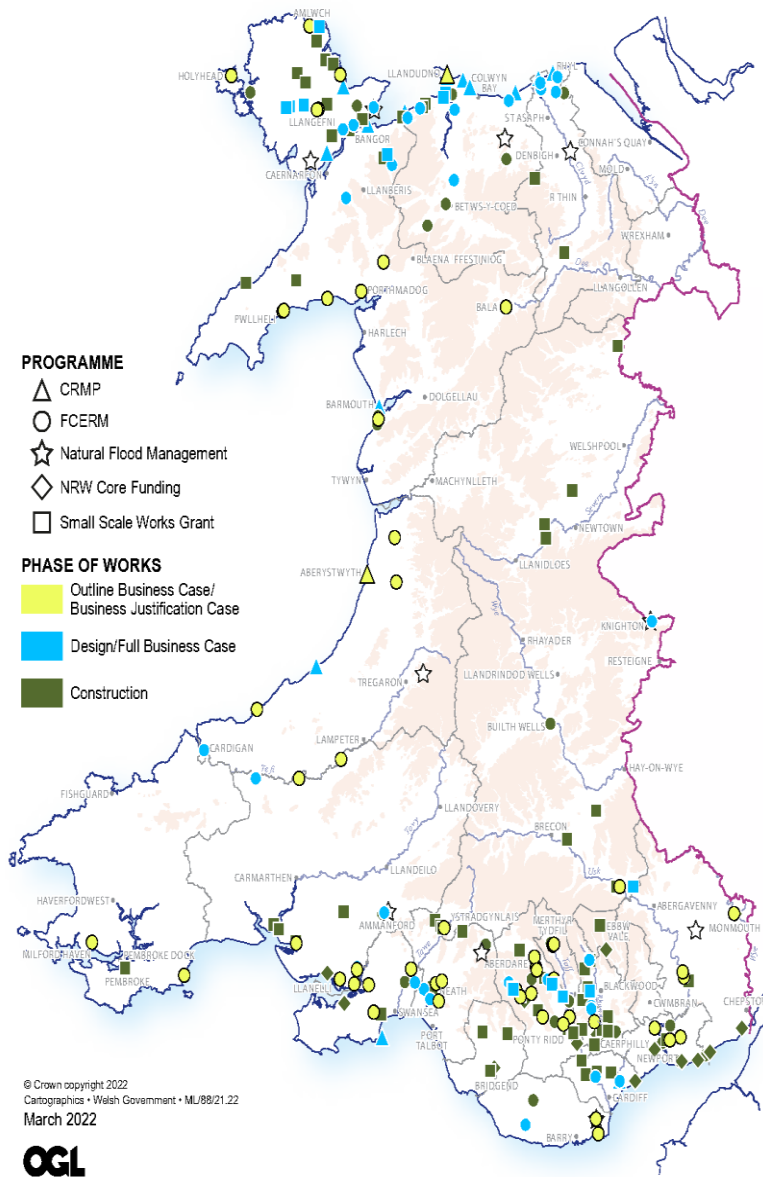
**Table 1 - Stakeholder opportunity partnerships**

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the Welsh Water DWMP page: <https://www.dwrcymru.com/en/our-services/wastewater/drainage-and-wastewater-management-plan>



# WALES

## FLOOD AND COASTAL CAPITAL INVESTMENT 2022-23



**Figure 2 - Flood and Coastal Investment overview**

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

### 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 the population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how surface water connected to the sewer network may 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems.](#)

Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall is predicted to happen more frequently.

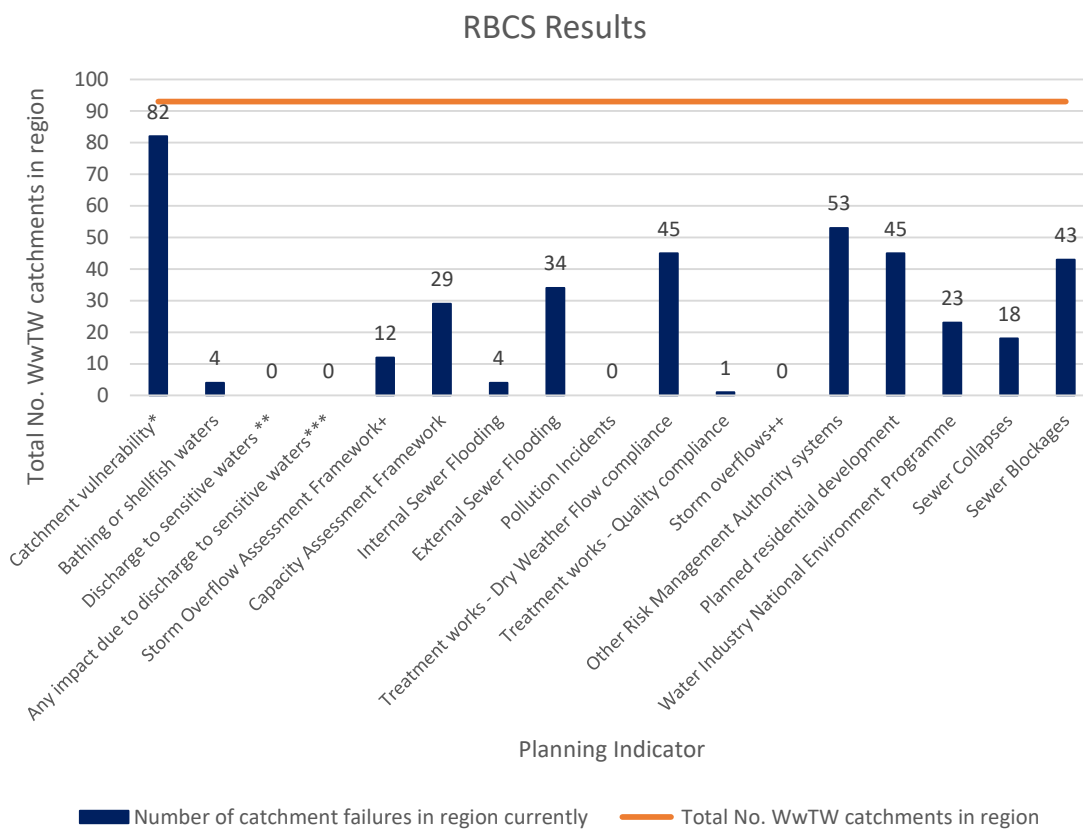
Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

The population in the Llyn and Eryri region is set to decrease to 458700 by 2050, a change of -15% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Caernarfon - Stad ddiwydiannol Cibyn and Bangor - Bryn Cegin. For a further breakdown of population change in the L2 region, please see the L3 reports.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments are passed through to a more detailed risk assessment (BRAVA).

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



■ Number of catchment failures in region currently     — Total No. WwTW catchments in region  
 \* To sewer flooding due to extreme wet weather events.  
 \*\* Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.  
 \*\*\* Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.  
 + Frequency investigation triggered.  
 ++Overflow risks not covered by other indicators.

**Figure 3 - Risk Based Catchment Screening results**

### 3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment in Lyn and Eryri.

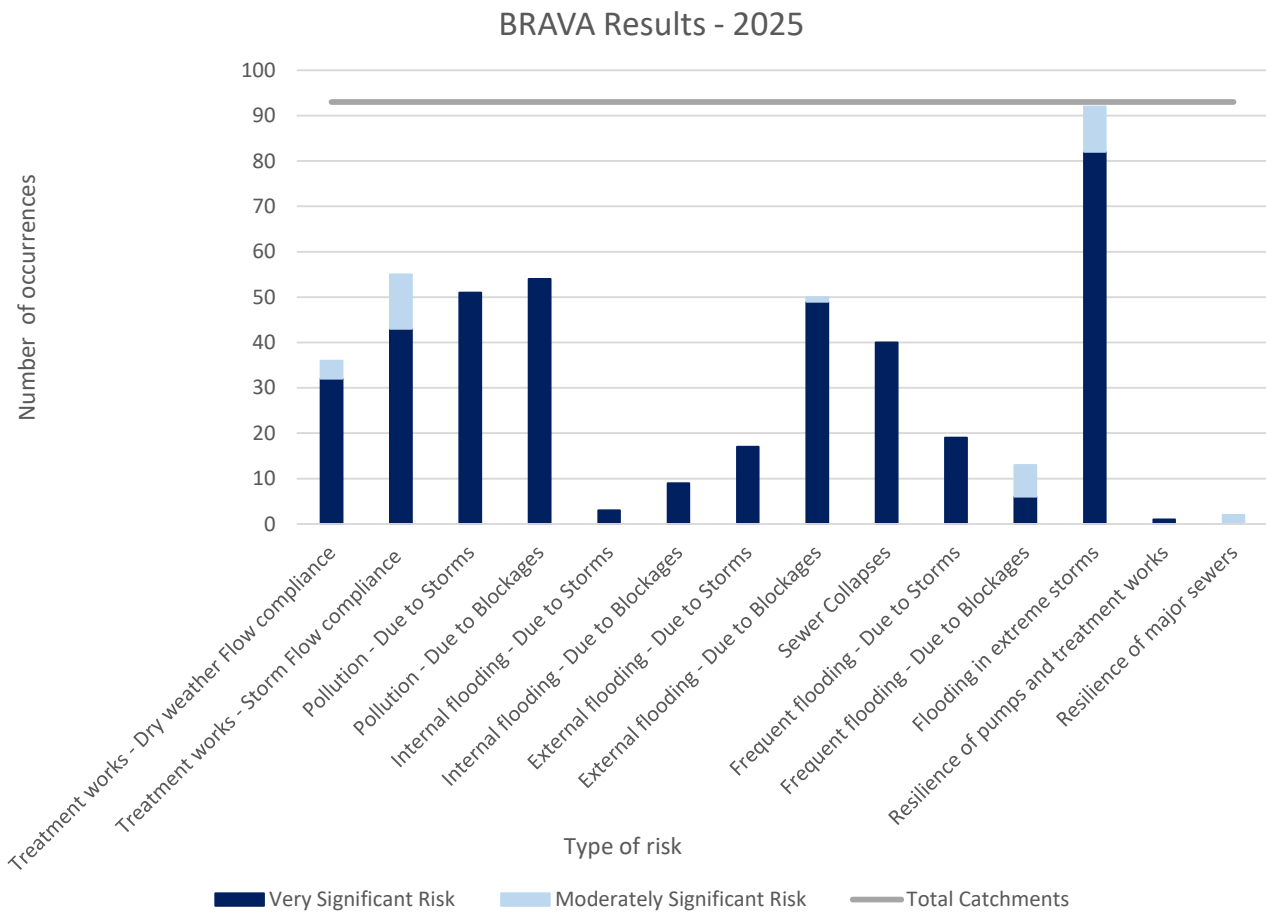
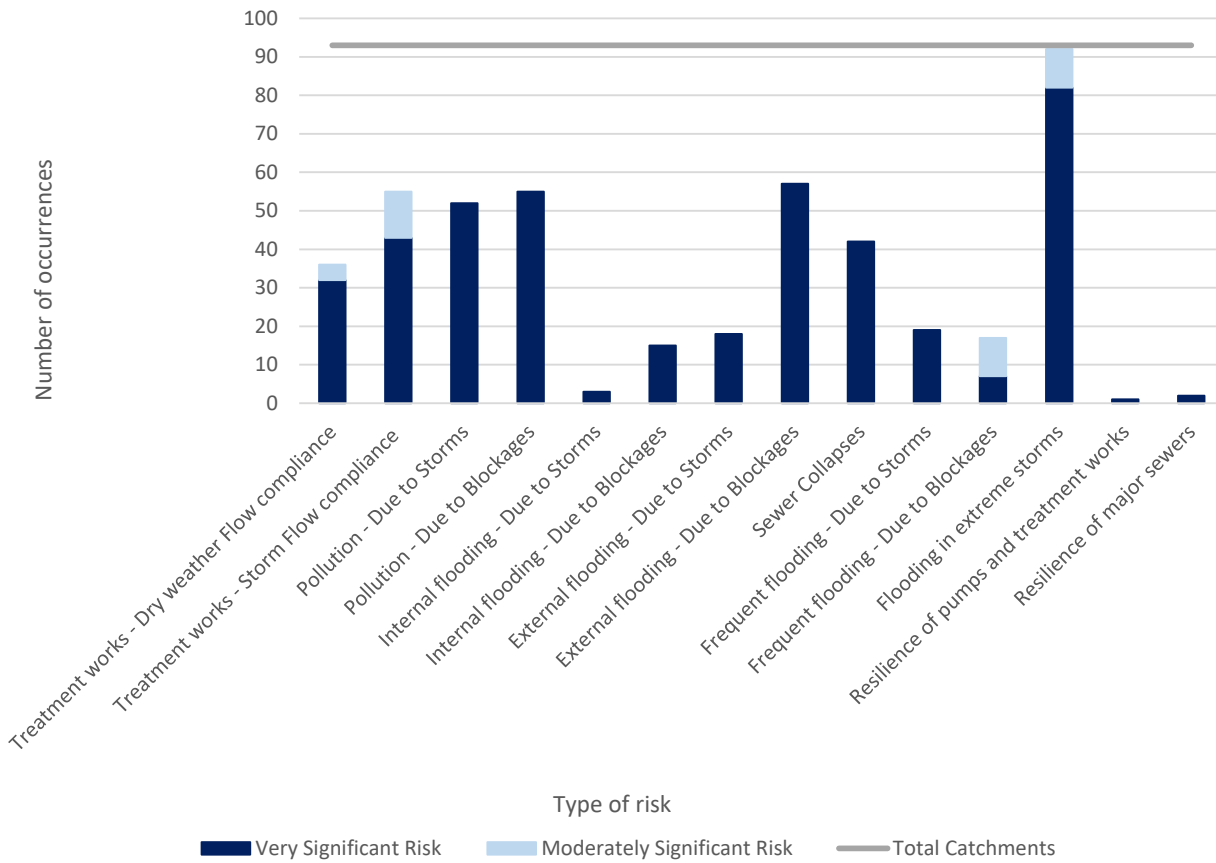


Figure 4 - BRAVA 2025 Summary

### BRAVA Results - 2050



**Figure 5 - BRAVA 2050 Summary**

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

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities 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.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

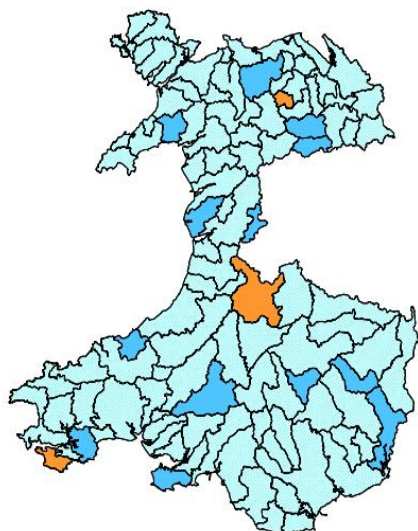
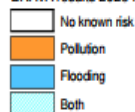


Figure 6 - Associated Strategic Planning Area priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

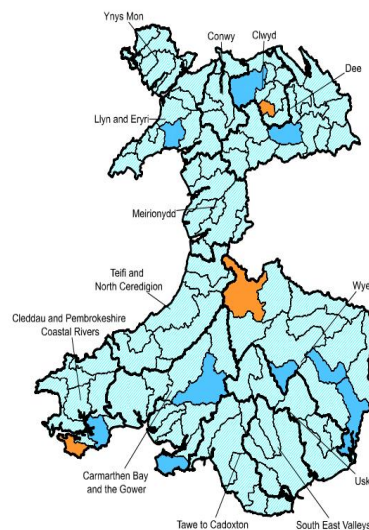
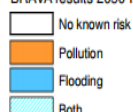


Figure 7 - Associated Strategic Planning Area priority (2050)

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L2 Area	Total	Good	Moderate	Poor	Bad
Llyn and Eryri	46	18	27	1	0

Table 2 - WFD status'


#### 4.0 Supply Demand


The supply-demand balance is an assessment of overall capacity of the network versus the current consented capacity of the treatment works. The current discharge consent includes the quality parameters which are fundamental to the current discharge consent. The presentation of the supply demand balance is showing the status of catchment in terms of the dry weather components of a network when added together compared to the current discharge consent today and into the future. In areas where this assessment shows a risk that the capacity of the network is greater than the capacity of the current discharge permit then an assessment into the route cause is required. The resultant solution could be a need to alter the discharge permit; upgrade of the treatment work; or an upgrade of stretches to the network.

Table 3 shows the supply-demand assessment for this catchment. Where a region may not have adequate capacity, it is flagged dark blue for further investigation. There may be local incapacity issues at individual treatment works within the catchment.

L2 Area	2025	2030	2035	2040	2045	2050
Llyn and Eryri	Pass	Pass	Pass	Pass	Pass	Pass

 Pass

 Close Fail

 Close Pass

 Fail

**Table 3 - Supply Demand Balance**

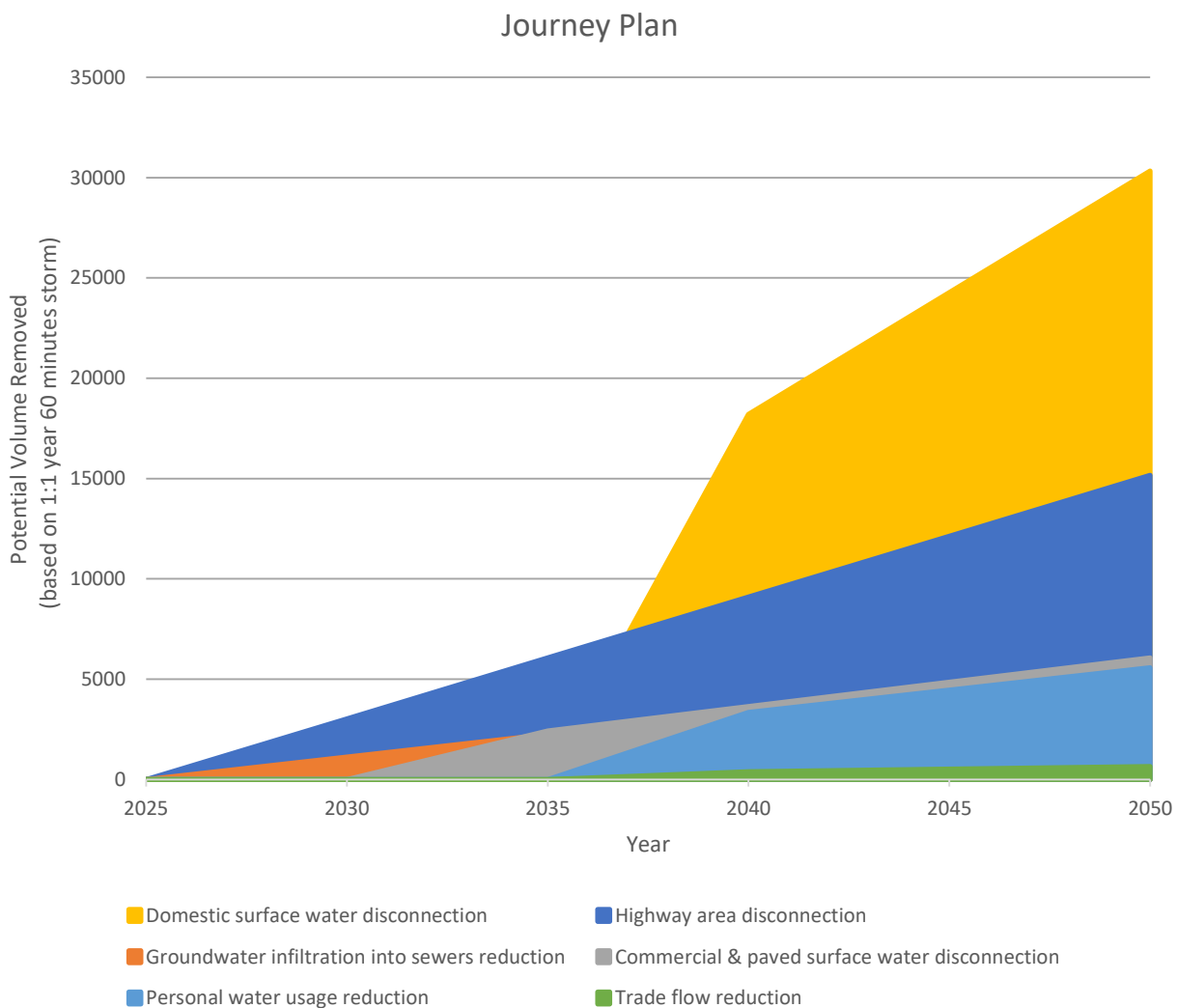
Table 3 shows that for the Llyn and Eryri region the balance between supply and demand is currently acceptable across the region and is projected to remain so through to 2050. However, it should be noted that local issues are present in the following L3 regions: Dwyfawr – lower, Dwryrd – lower, Erch – lower, Glaslyn - tidal to Afon Croesor, Gwyrfai, Ogwen – lower, Seiont – lower, Soch, Un-named near Soch region and Un-named to

#### 5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment’s rainfall in just a few storms. In sewer modelling these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.



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 combinations of schemes, to ensure a robust plan is delivered. Figure 8 shows our Journey Plan. This describes the scheme types that are most likely to be beneficial in this region and the timescales over which solutions types might be implemented which can reduce risks to customers and the environment. We can reduce rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding.

Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 4 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

At the time of publishing, over 200 assessments of the environmental impact of our storm overflows have been completed and by the end of 2025 this should rise to over 750 assessments. These assessments are made at individual assets across the company area. Our approach follows the Storm Overflow Assessment Framework Stage 2 assessments and includes assessment of aesthetic and visual impacts alongside water quality impact (through a combination of invertebrate or water quality modelling). We will provide an update to the area summaries when the output data becomes available.

Table 5 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 4 are in addition to those in Table 5, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£174,000,000.00	£268,400,000.00
40 spills in a typical year	£81,000,000.00	£86,000,000.00	£90,000,000.00
20 spills in a typical year	£134,000,000.00	£140,000,000.00	£159,000,000.00
10 spills in a typical year	£203,000,000.00	£211,000,000.00	£237,000,000.00
0 spills in a typical year	£476,000,000.00	£515,000,000.00	£566,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	0.93	1.69	1.75

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

**Table 4 - Summary of Combined Storm Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£18,000,000.00	£23,000,000.00	£26,000,000.00
External escapes in gardens	£9,000,000.00	£13,000,000.00	£13,000,000.00
Escapes in highways	£202,000,000.00	£224,000,000.00	£251,000,000.00
All other remaining flooding	-	£139,000,000.00	£104,000,000.00
<b>Total</b>	<b>£229,000,000.00</b>	<b>£399,000,000.00</b>	<b>£394,000,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

#### **Table 5 - Summary of Flooding Option Investments Strategy Costs**

Costs in Table 4 and 5 are strategic indications needed to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios provides a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. They have been analysed in terms of their long term benefit, environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against pollution and flooding events. Appendix A shows the number of solutions within this river basin catchment.

A summary of the options considered within suitability tests can be found in the Main Plan alongside the methodology. More detailed information can be seen in the Level 3 reports.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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 the Welsh Government and our regulators.

## Appendix A - Schemes in L3 catchment within L2 region

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L3 catchment within L2 region**

L3 Zones	No. Schemes
Dwryrd - lower	0
Un-named to Caernarfon Bay South	0
Soch	0
Glaslyn - tidal to Afon Croesor	4
Erch - lower	0
Seiont - lower	0
Gwyrfai	3
Ogwen - lower	9
Dwyfawr - lower	0
Un-named near Soch catchment	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW Q compliance	Historical measure relating to the performance of the treatment works (discharge permit compliance (numeric)).

WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Dwyfawr - lower

### 1.0 Introduction

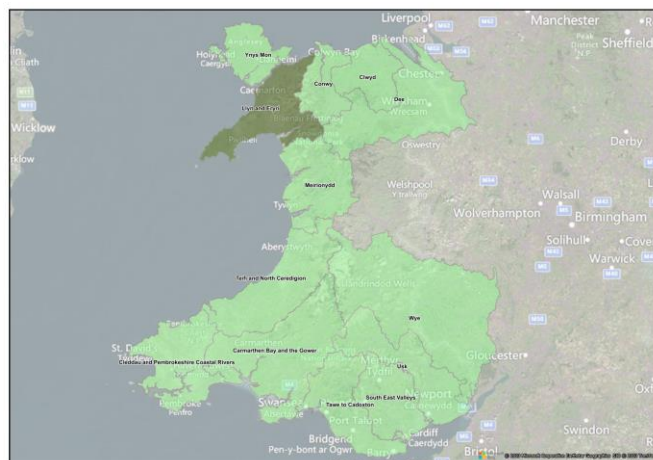
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### 1.1 Catchment Information

The Dwyfawr - lower planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

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

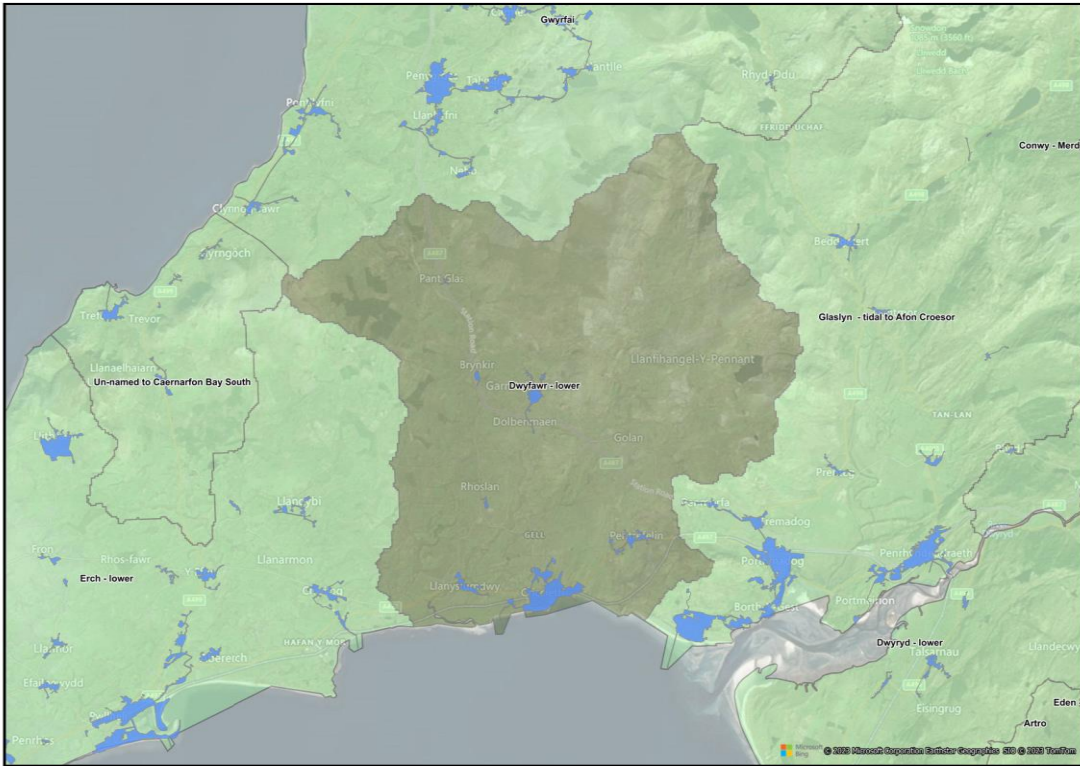
This planning catchment consists of 7 wastewater catchments (see Figure 2). There is a combined population of 3758, this is set to decrease to 3500 by 2050, a change of -6%. There is a total sewer length of 31km, with a foul sewer length of 11km, a surface water length of 1.51km and a combined sewer length of 17km. There are 7 Wastewater Treatment Works (WWTW), 4 Sewerage Pumping Stations (SPSs), and 7 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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





**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

### Stakeholder Engagement Opportunities

Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

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A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Dwyfawr - lower region is set to decrease to 3500 by 2050, a change of -6% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Llanystumdwy - Park Amaeth and Criccieth - land near North Terrace

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

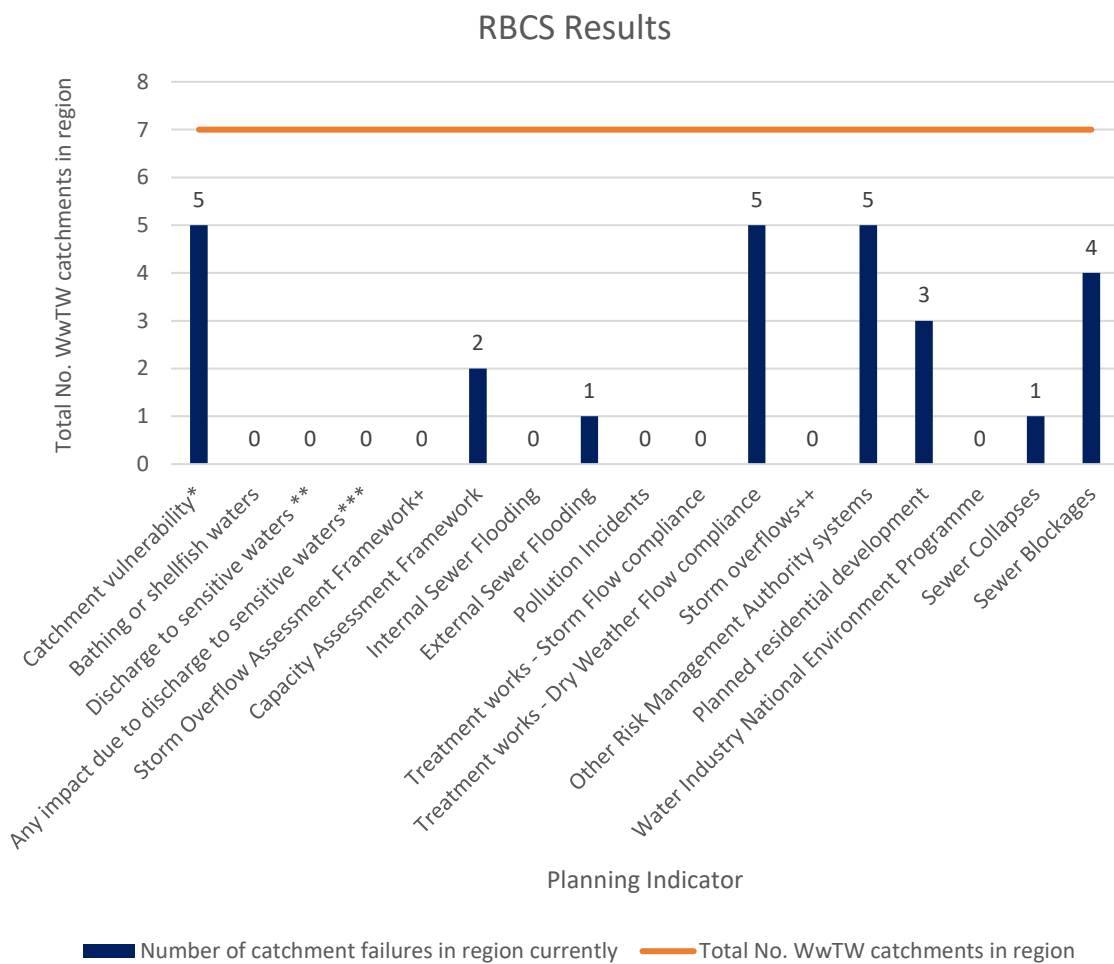
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

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



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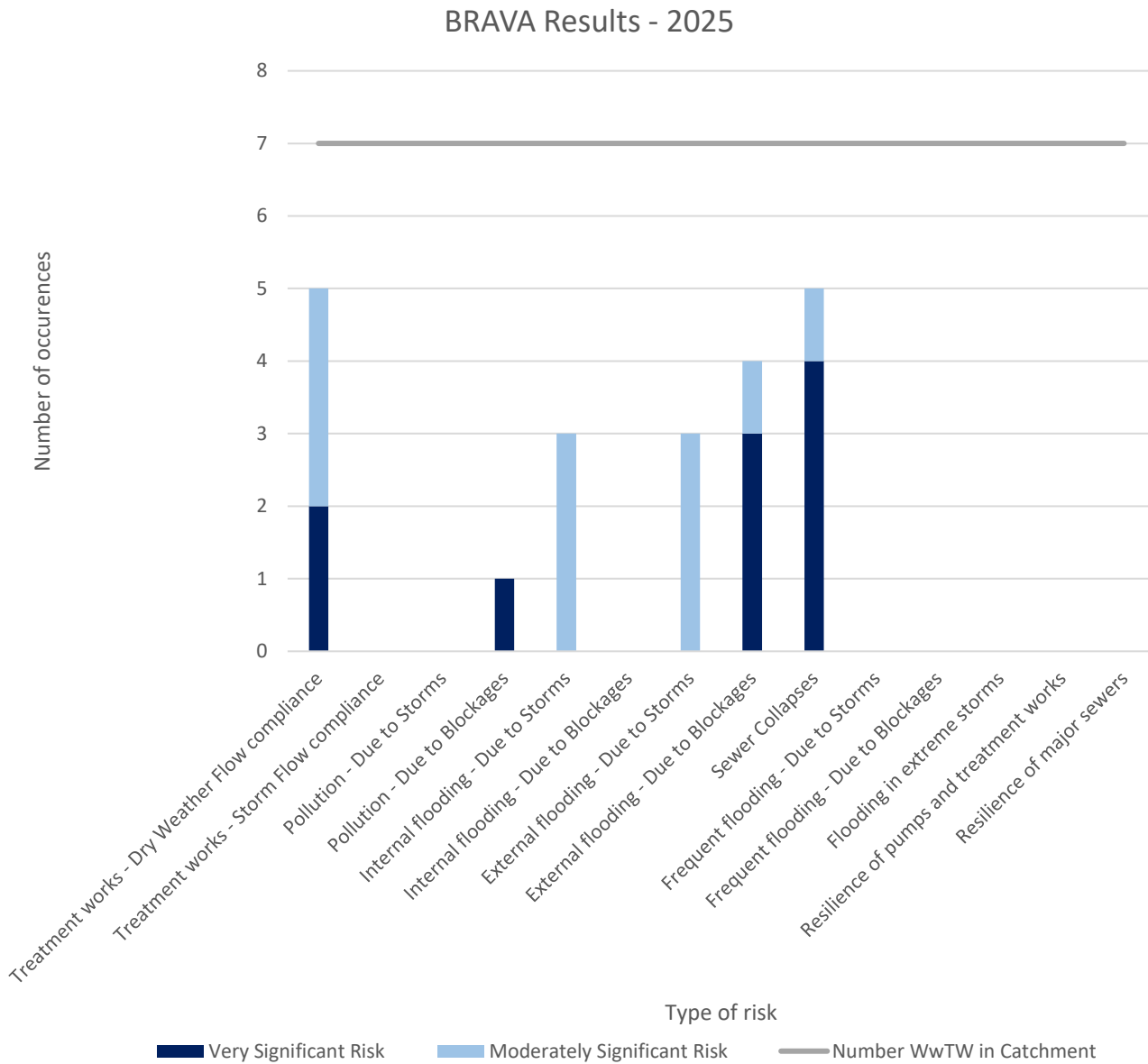
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Figure 3 - Risk Based Catchment Screening results

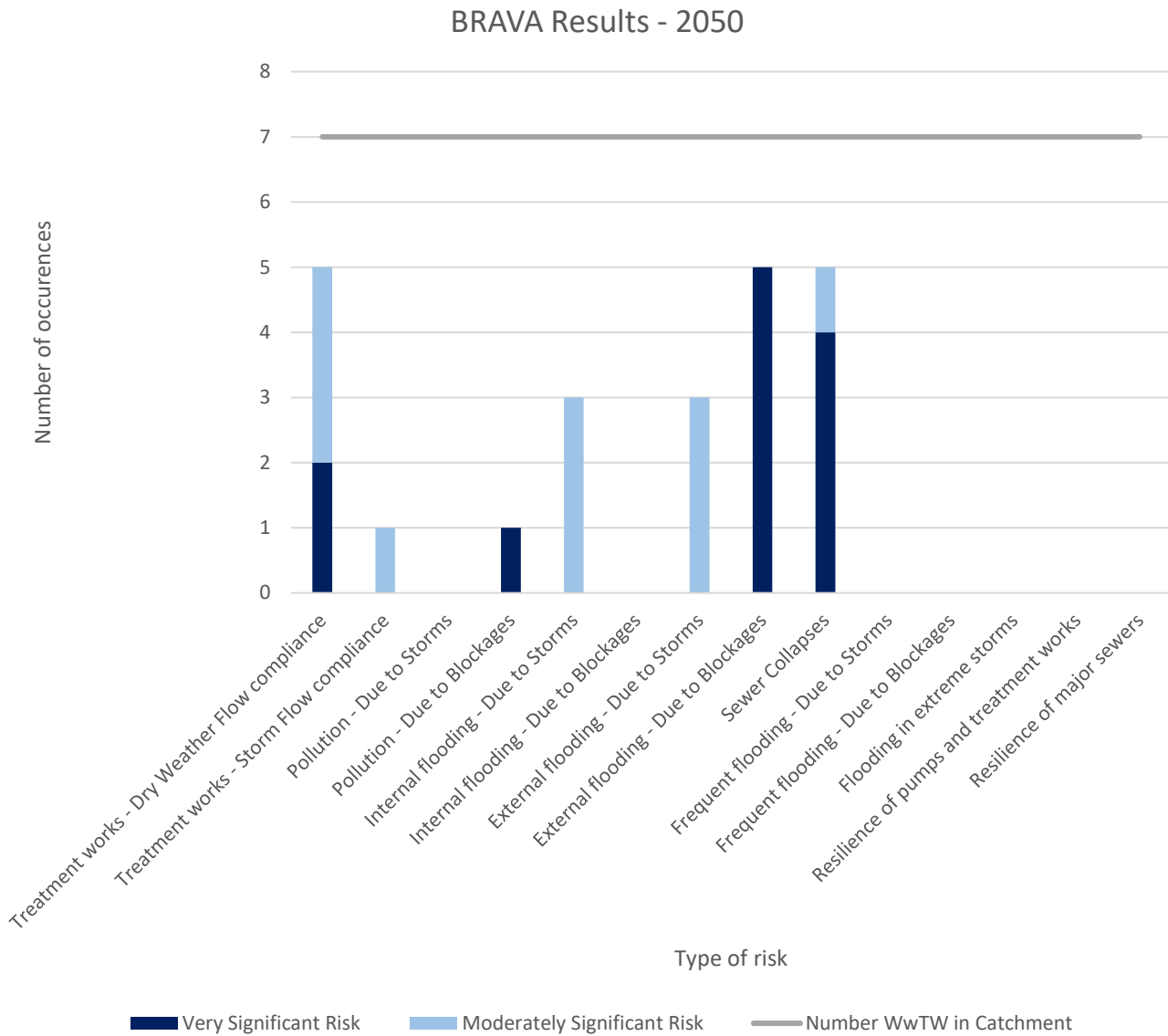
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**Figure 4 - BRAVA 2025 Summary**

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

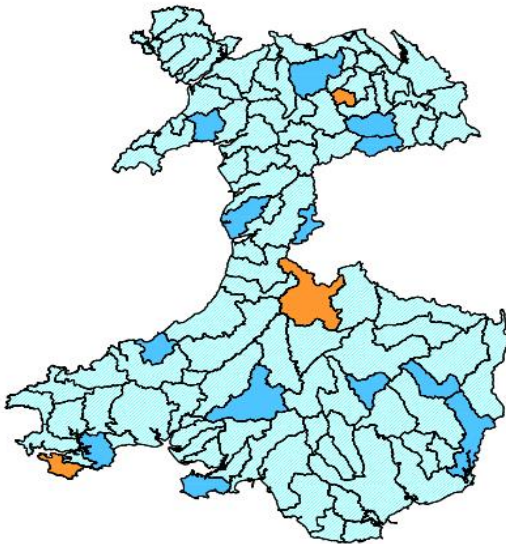
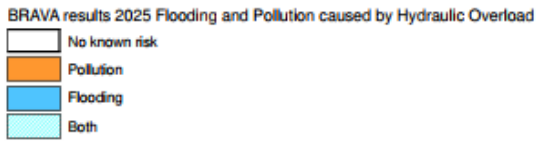


**Figure 5 - BRAVA 2050 Summary**

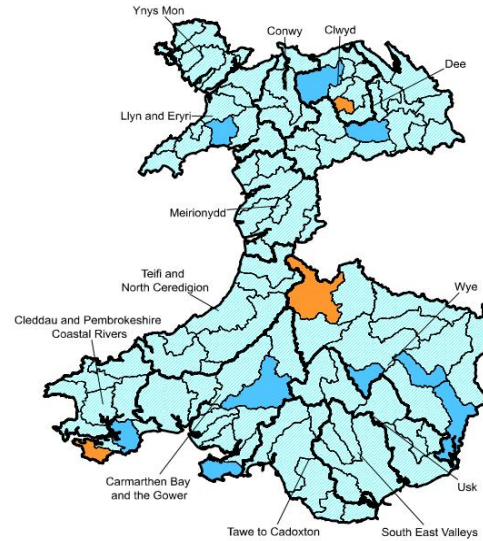
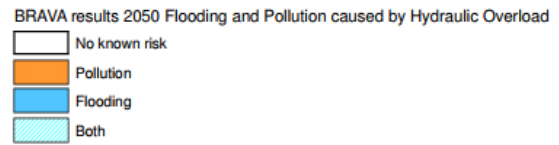
In 2050, sewer collapses and treatment works - DWF compliance are the biggest concern in the Dwyfawr - lower catchment.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities 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.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Dwyfawr - lower	4	1	3	0	0

**Table 2 - WFD status'**

## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

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L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Dwyfawr - lower	Headroom	Pass	Pass	Pass	Pass	Pass	Pass	Close Pass	Close fail
	Wet weather capacity	>90%	>90%	>90%	>90%	>90%	>90%	80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Dwyfawr - lower catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Pantglas and Pentrefelin Dwyfor L4 catchments. Further detail is provided in the relevant L4 summaries.



## 5.0 Options

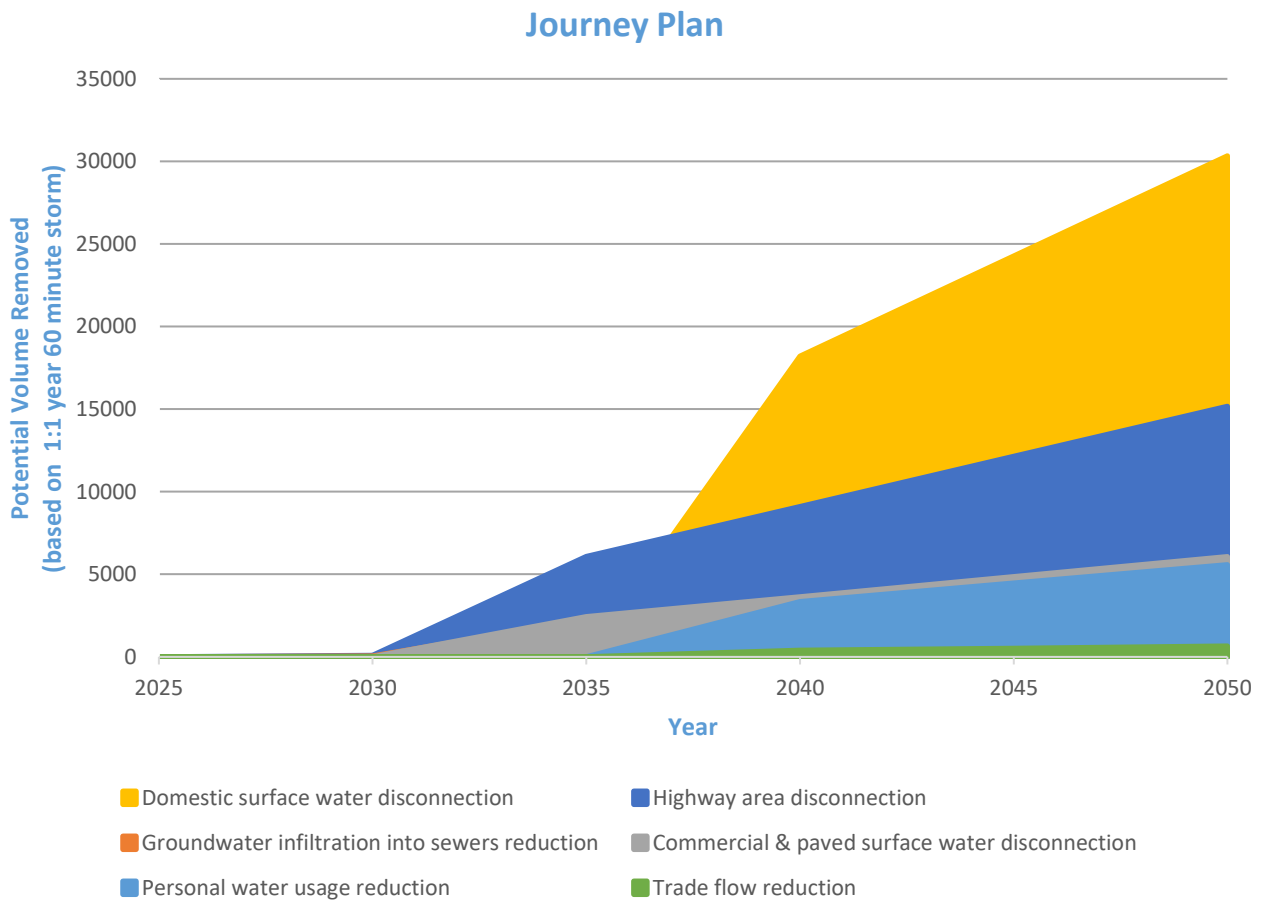
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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 combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£28,000,000.00	£44,000,000.00
40 spills in a typical year	£6,000,000.00	£5,000,000.00	£5,000,000.00
20 spills in a typical year	£10,000,000.00	£10,000,000.00	£12,000,000.00
10 spills in a typical year	£14,000,000.00	£14,000,000.00	£17,000,000.00
0 spills in a typical year	£28,000,000.00	£30,000,000.00	£34,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	55.00	61.00	66.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£1,300,000.00	£1,600,000.00	£2,500,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£1,300,000.00</b>	<b>£1,600,000.00</b>	<b>£2,500,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
RHOSLAN	0
PANT GLAS	0
BRYNCIR	0
GARNDOLBENMAEN	0
LLANYSTUMDWY (W PORTHMADOG) A	0
PENTREFELIN DWYFOR	0
CRICCIETH	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Dwryd - lower

### 1.0 Introduction

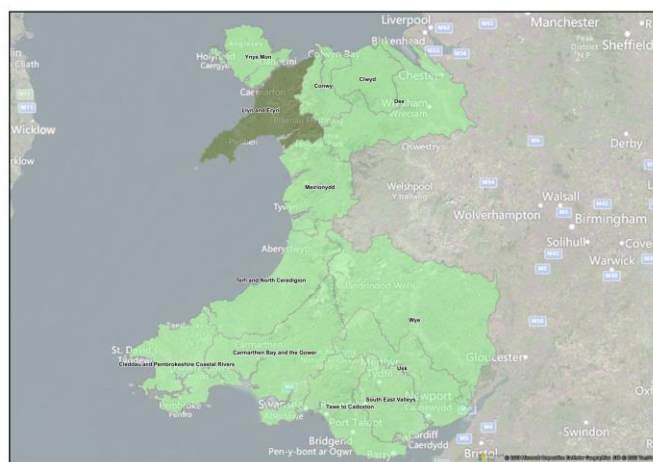
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers 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 Dwryd - lower planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

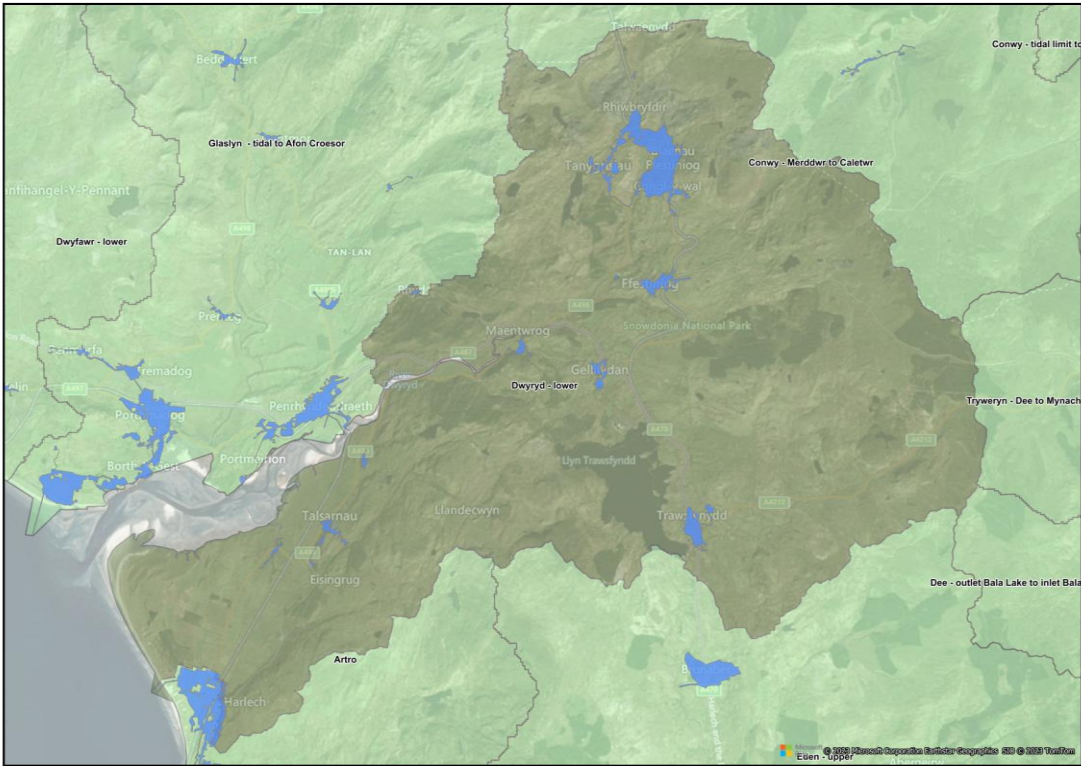
The Dwryd - lower catchment reaches the sea at Cardigan Bay. The River Dwryd flows down into the sea near Harlech. Blaenau Ffestiniog and Llan Ffestiniog are the largest urban areas.

This planning catchment consists of 12 wastewater catchments (see Figure 2). There is a combined population of 6759, this is set to decrease to 5900 by 2050, a change of -12%. There is a total sewer length of 56km, with a foul sewer length of 3km, a surface water length of 1.58km and a combined sewer length of 51km. There are 12 Wastewater Treatment Works (WwTW), 11 Sewerage Pumping Stations (SPSs), and 15 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Dwyrdd - lower region is set to decrease to 5900 by 2050, a change of -12% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including two in Blaenau Ffestiniog - Cae Rygbi and former playning fields

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

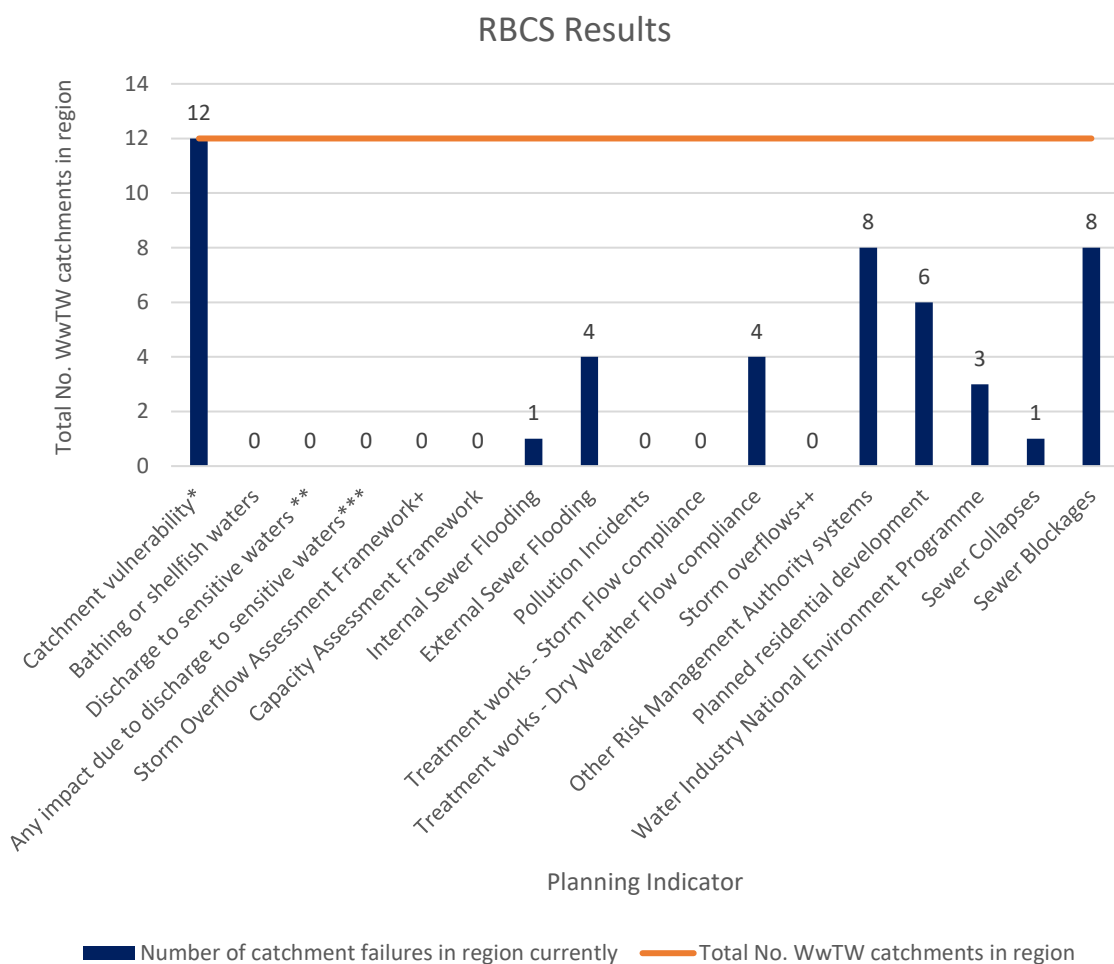
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### 3.1 Risk Based Catchment Screening

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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

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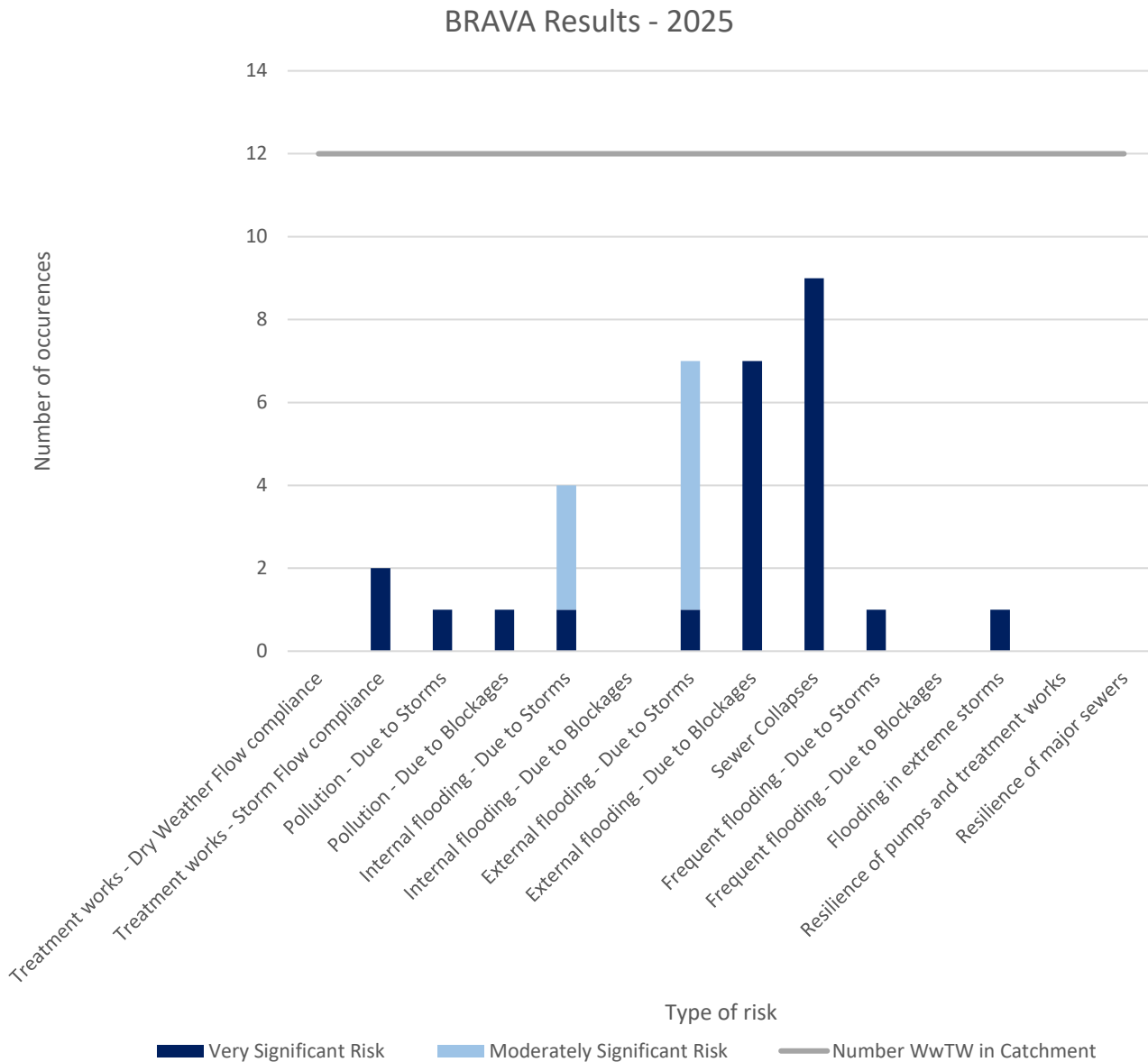
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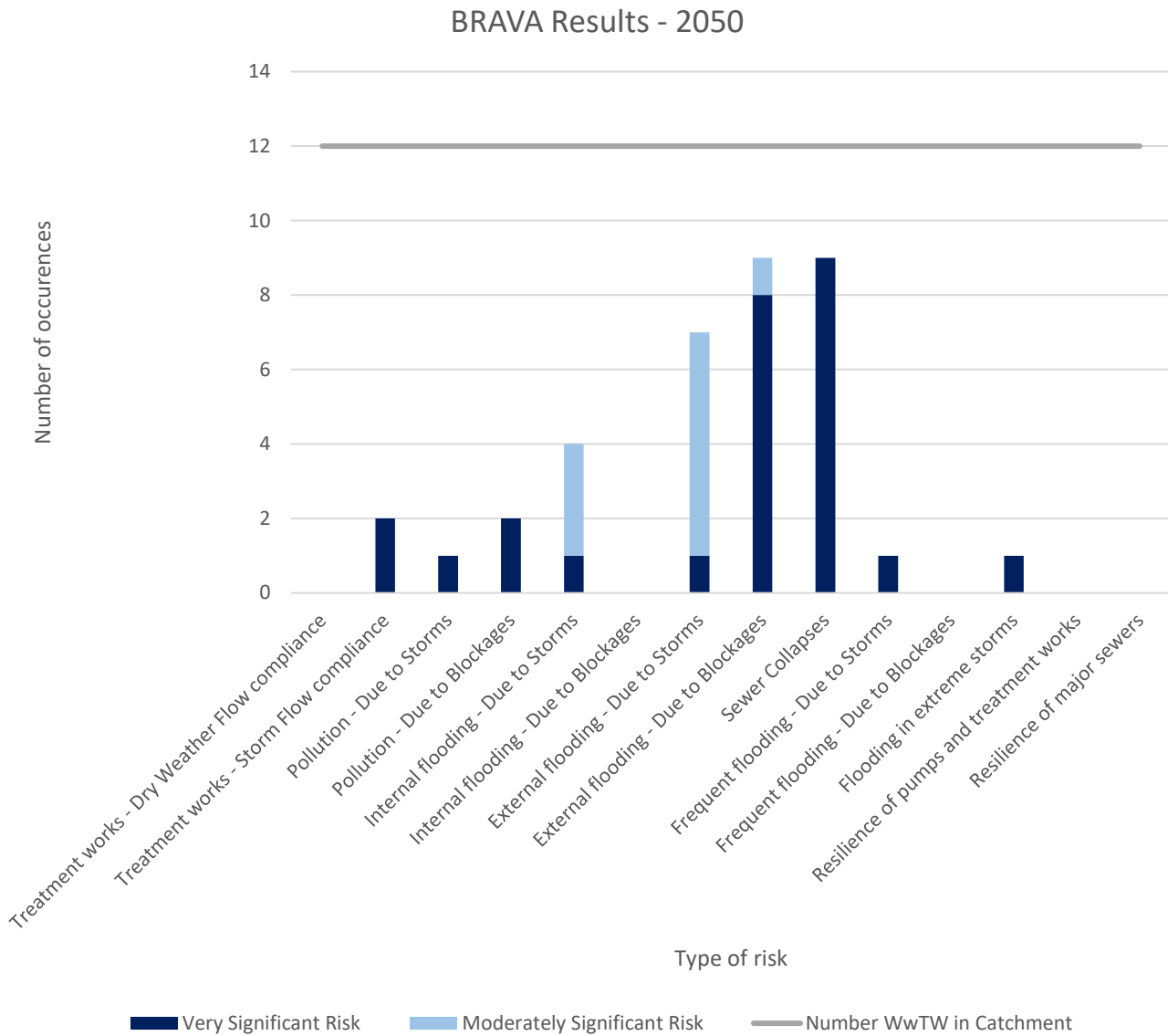
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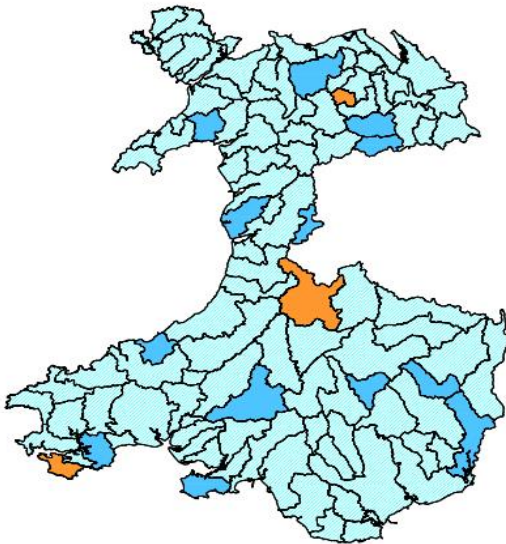
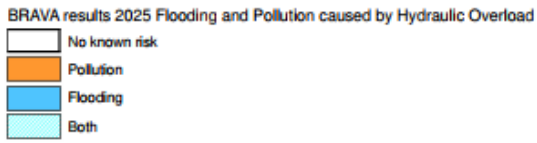
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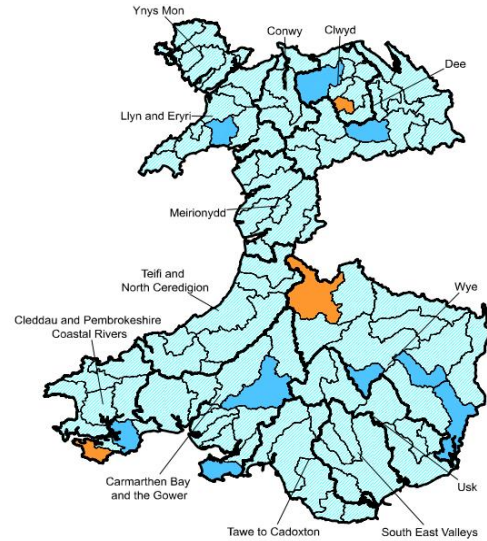
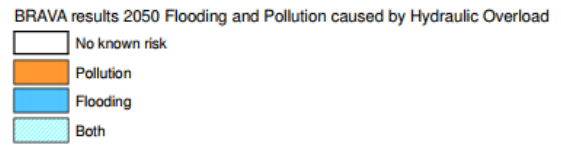
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From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.





**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Dwyrhyd - lower	8	1	6	1	0

**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

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L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Dwyrdd - lower	Headroom	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Pass	Close fail
	Wet weather capacity	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Close Pass	Fail
		Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	>90%	70%-80%
		Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Dwyrdd - lower catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. There are currently no local issues present in the L4 catchments.

## 5.0 Options

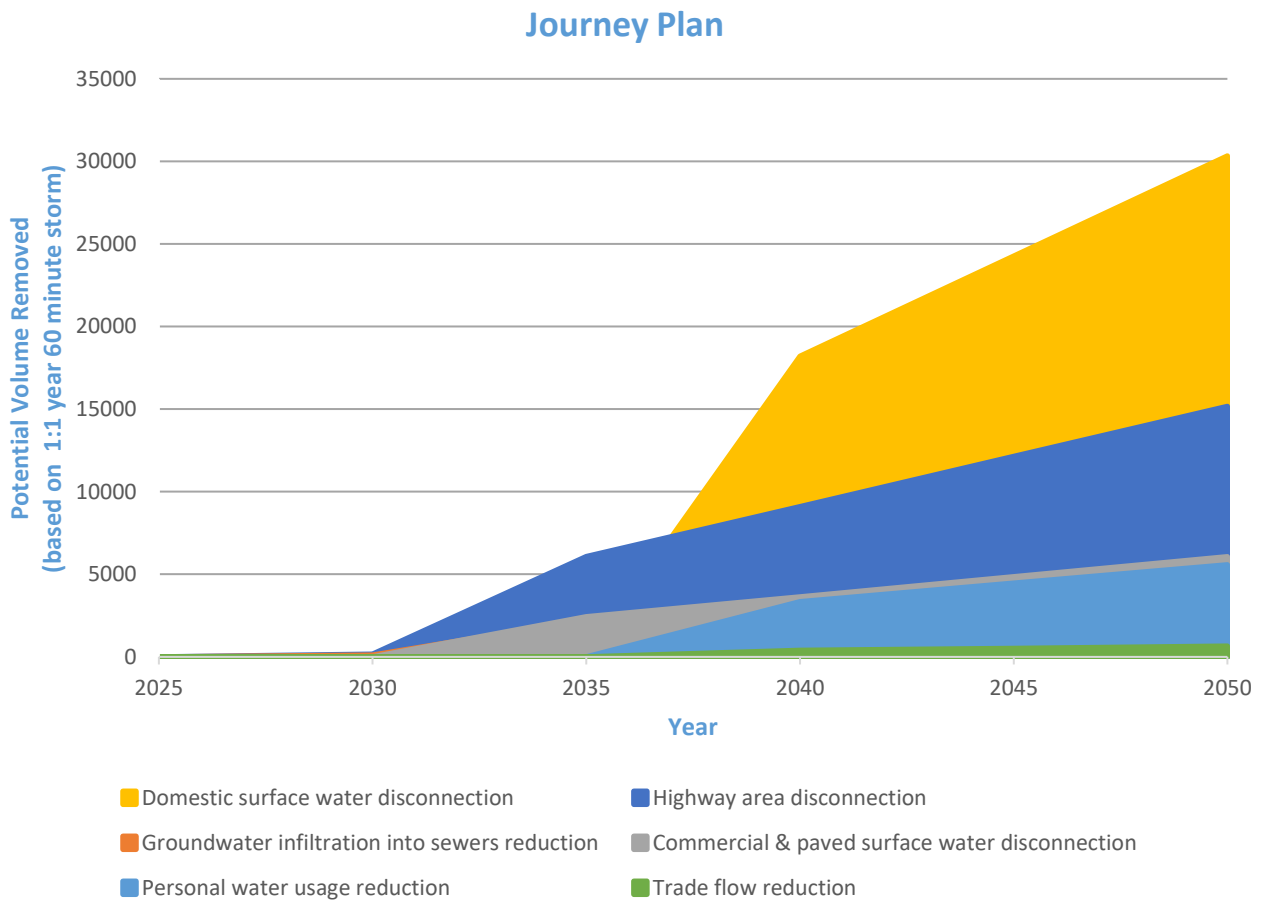
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£35,000,000.00	£54,000,000.00
40 spills in a typical year	£17,000,000.00	£19,000,000.00	£19,000,000.00
20 spills in a typical year	£27,000,000.00	£29,000,000.00	£32,000,000.00
10 spills in a typical year	£34,000,000.00	£36,000,000.00	£39,000,000.00
0 spills in a typical year	£63,000,000.00	£67,000,000.00	£77,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	-47.00	240.00	245.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£700,000.00	£800,000.00	£1,200,000.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£2,300,000.00	£2,800,000.00	£4,000,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£3,000,000.00</b>	<b>£3,600,000.00</b>	<b>£5,200,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
LLAN FFESTINIOG	0
TAN Y GRISIAU (CROMLECH)	0
Rhyd-y-sarn, Gwynedd Septic Tank	0
RHYD	0
TALWAENYDD SEPTIC TANK	0
YNYS	0
LLANDECWYN (E OF PORTHMADOG) CILFOR	0
MAENTWROG STW	0
TALSARNAU	0
GELLILYDAN	0
TRAWSFYNYDD (FRONGALED)	0
BLAENAU FFESTINIOG	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Erch - lower

### 1.0 Introduction

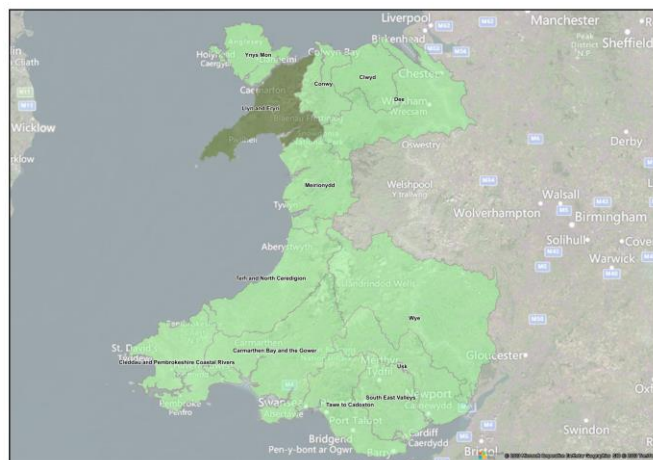
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers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

### 1.1 Catchment Information

The Erch - lower planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

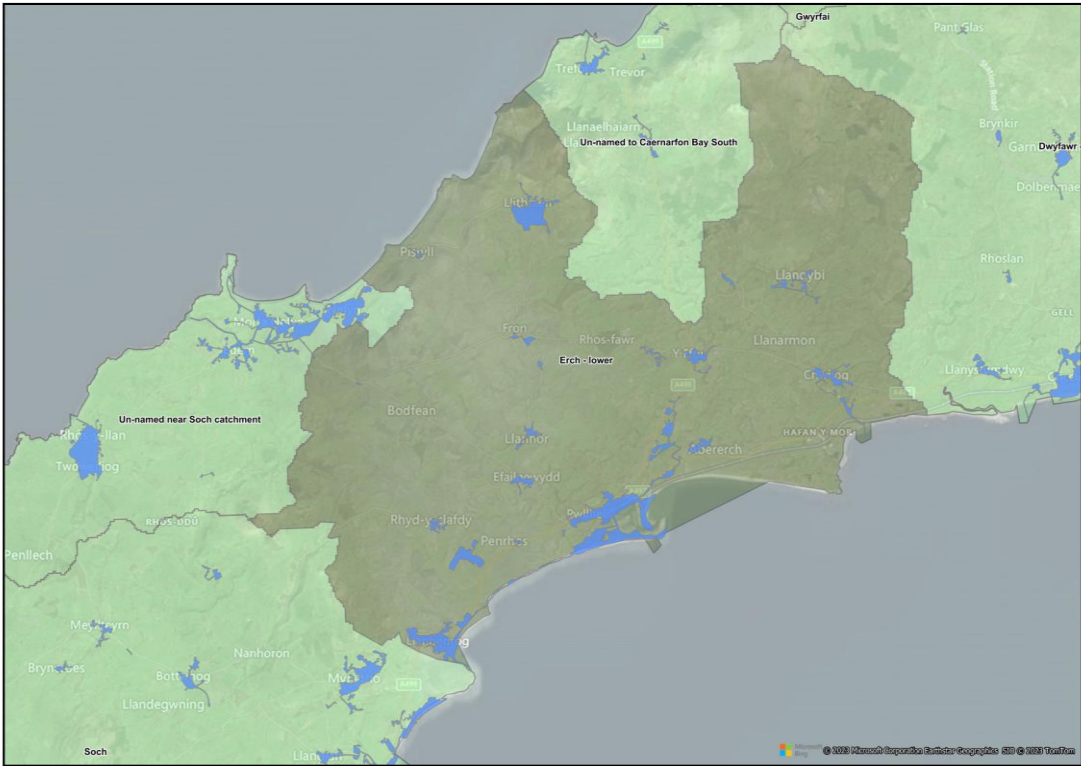
The Erch - lower catchment stretches across the Llyn peninsula, bordering the Irish sea in the North and South. The River Erch flows down into the sea near Pwllheli. Pwllheli and Lithfaen are the largest urban areas.

This planning catchment consists of 19 wastewater catchments (see Figure 2). There is a combined population of 10764, this is set to decrease to 9400 by 2050, a change of -13%. There is a total sewer length of 72km, with a foul sewer length of 19km, a surface water length of 1.69km and a combined sewer length of 48km. There are 19 Wastewater Treatment Works (WwTW), 23 Sewerage Pumping Stations (SPSs), and 18 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

**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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

Stakeholder Engagement Opportunities
<p>Stakeholder engagement meetings commenced in 2022. These meetings are being 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.</p>

**Table 1 - Stakeholder opportunity partnerships**

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Erch - lower region is set to decrease to 9400 by 2050, a change of -13% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Pwllheli - Adwy'r Hafan & Stad Glanydon and Rhosfawr - Safle Wynstay Farmers

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

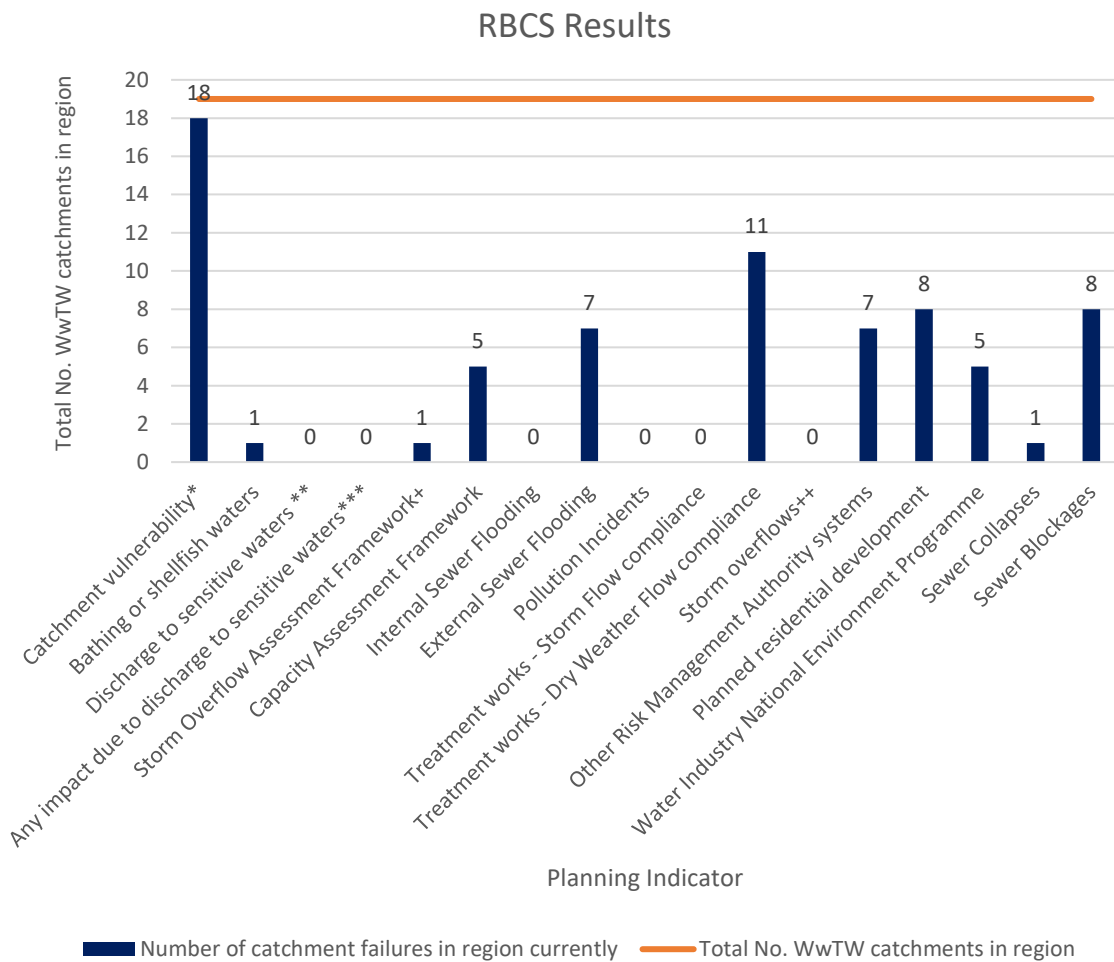
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For the Erch - lower catchment the biggest risks indicated by the RBCS are - catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography).



\*To sewer flooding due to extreme wet weather events.

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

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

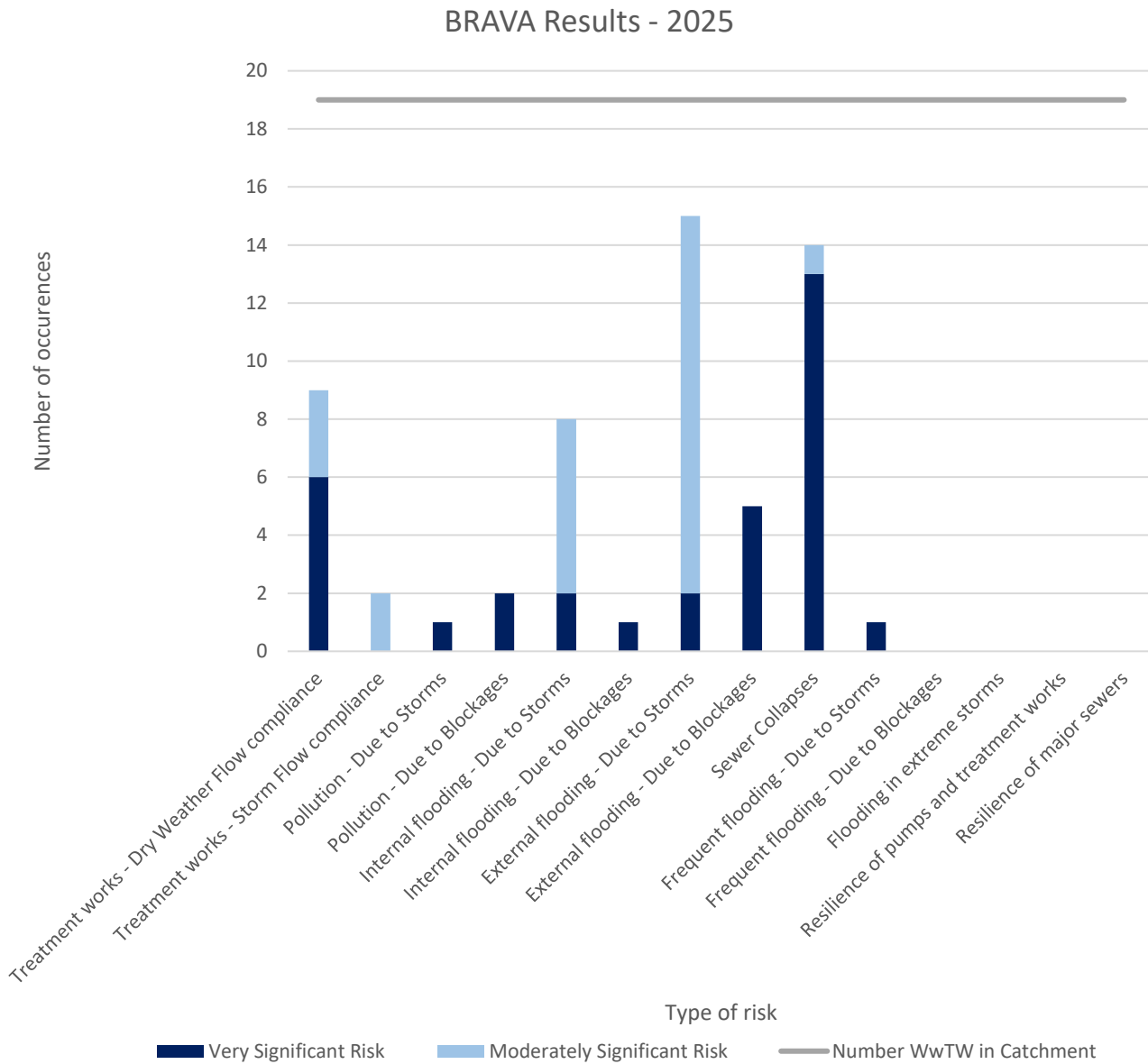
+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

### 3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

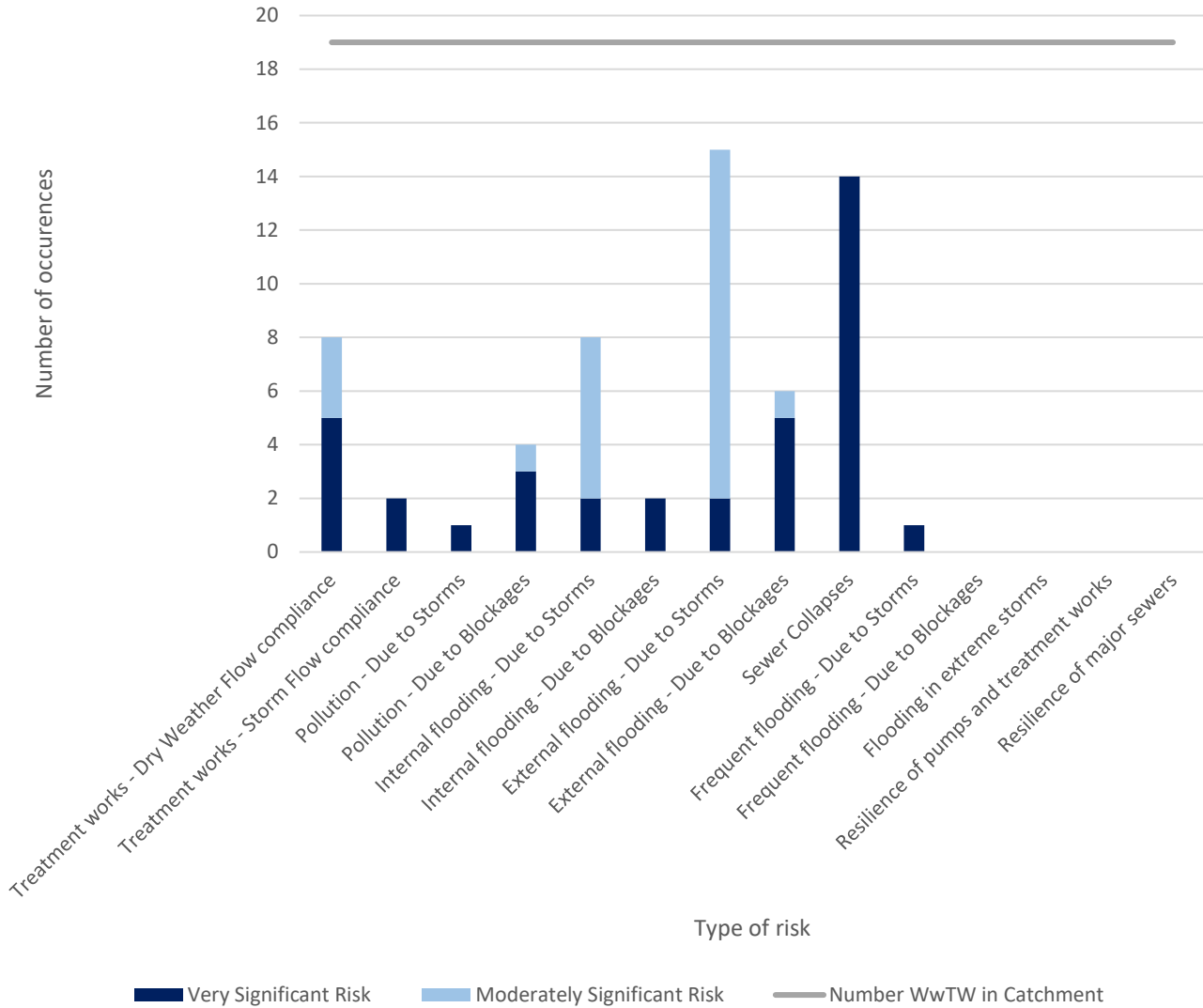
Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.



**Figure 4 - BRAVA 2025 Summary**

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

## BRAVA Results - 2050

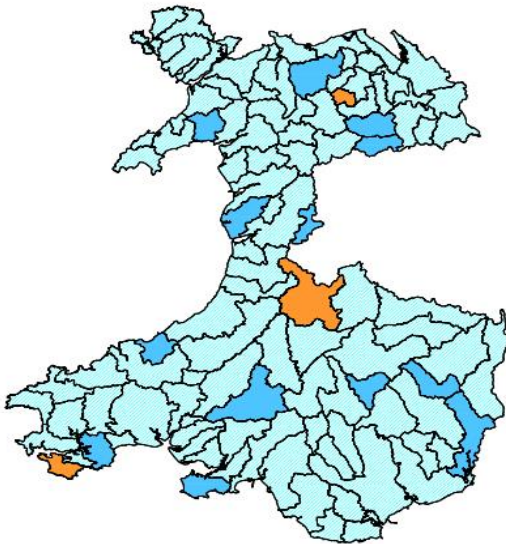
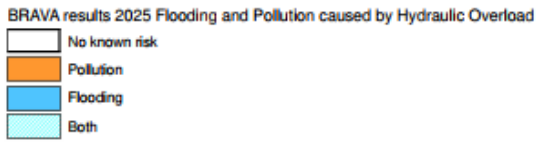


### Figure 5 - BRAVA 2050 Summary

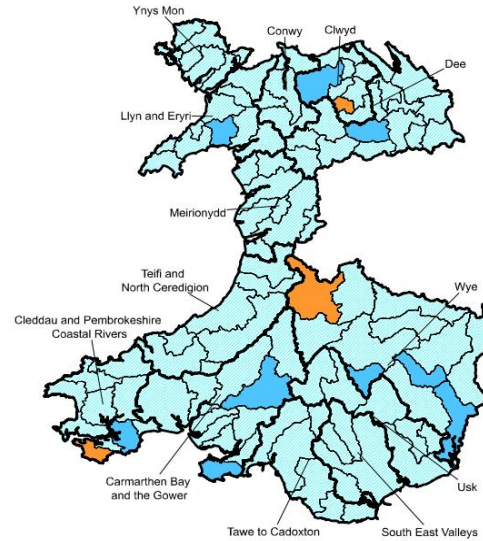
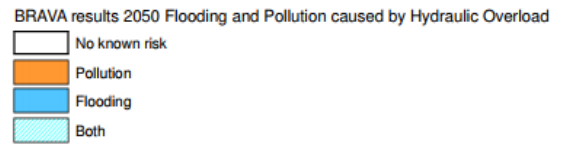
In 2050, external flooding due to storms and sewer collapses are the biggest concern in the Erch - lower catchment.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities 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.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Erch - lower	5	3	2	0	0

**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Erch - lower	Headroom							Pass	Close fail
								Close Pass	Fail
	Wet weather capacity							>90%	70%-80%
								80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Erch - lower catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Abererch, Efailnewydd, Fourcrosses, Pencaenewydd, Penrhos and Pistyll L4 catchments. Further detail is provided in the relevant L4 summaries.

## 5.0 Options

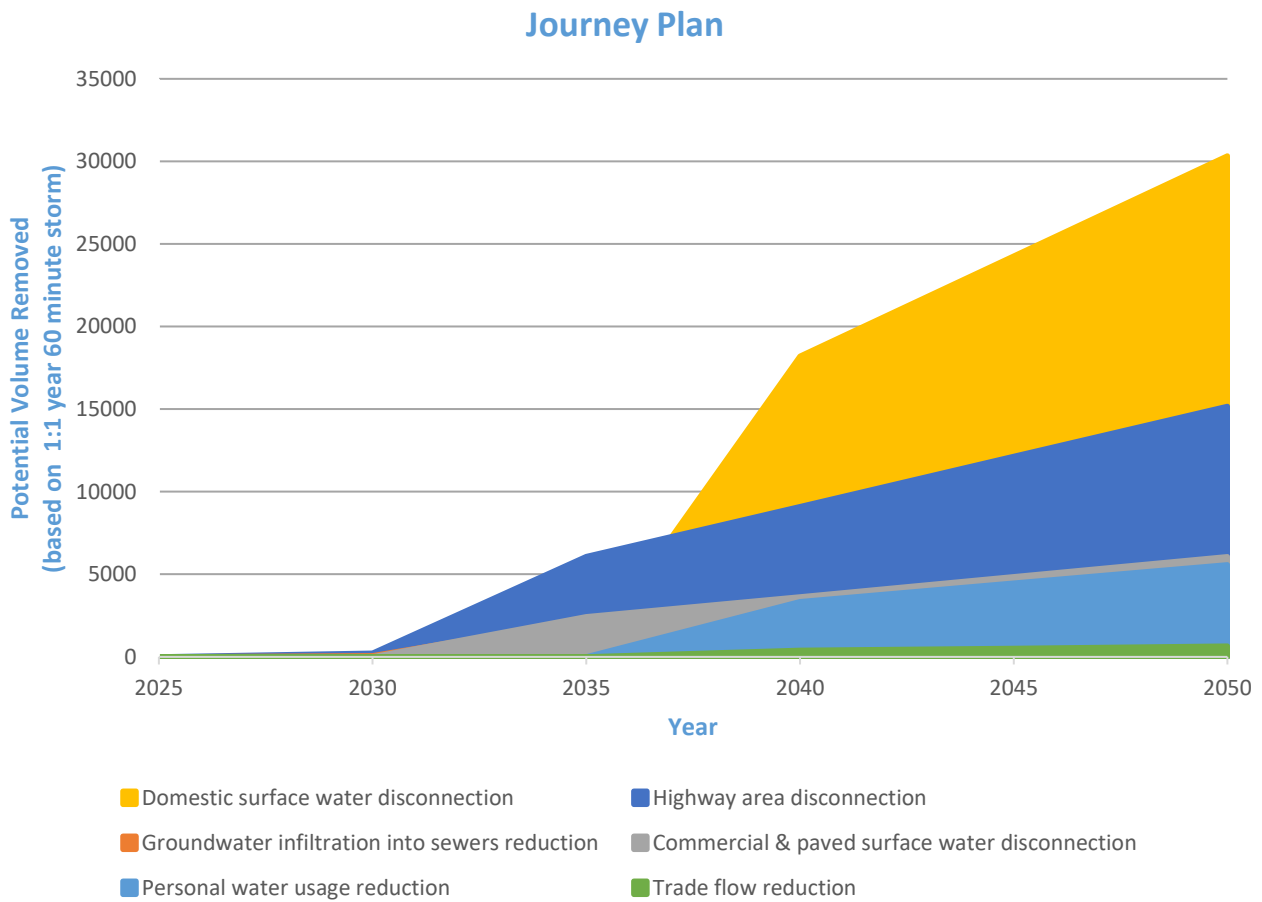
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50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing 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
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Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

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Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£28,000,000.00	£38,000,000.00
40 spills in a typical year	£8,000,000.00	£8,000,000.00	£8,000,000.00
20 spills in a typical year	£10,000,000.00	£10,000,000.00	£12,000,000.00
10 spills in a typical year	£21,000,000.00	£21,000,000.00	£22,000,000.00
0 spills in a typical year	£54,000,000.00	£59,000,000.00	£64,000,000.00
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Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
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Escapes in highways	£5,700,000.00	£7,200,000.00	£8,600,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£9,400,000.00</b>	<b>£11,700,000.00</b>	<b>£13,400,000.00</b>

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If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
RHYD-Y-CLAFDY (NR PWLLHELI) STW	0
PENPRYS	0
PWLLHELI RIVERSIDE	0
BODUAN	0
PENTREUCHAF	0
RHOS-FAWR	0
PENRHOS (W OF PWLLHELI)	0
AFONWEN	0
LLANGYBI (W OF PORTHMADOG)	0
PENCAENEWYDD	0
PISTYLL	0
LLANNOR	0
LLITHFAEN	0
EFAILNEWYDD	0
ABERERCH STW	0
PWLLHELI	0
Y FFOR STW	0
CHWILOG	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Glaslyn - tidal to Afon Croesor

### 1.0 Introduction

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

### 1.1 Catchment Information

The Glaslyn - tidal to Afon Croesor planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

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

This planning catchment consists of 10 wastewater catchments (see Figure 2). There is a combined population of 12122, this is set to decrease to 9300 by 2050, a change of -23%. There is a total sewer length of 71km, with a foul sewer length of 18km, a surface water length of 8.27km and a combined sewer length of 41km. There are 10 Wastewater Treatment Works (WwTW), 27 Sewerage Pumping Stations (SPSs), and 16 Combined Storm Overflows (CSOs) across this strategic planning area.

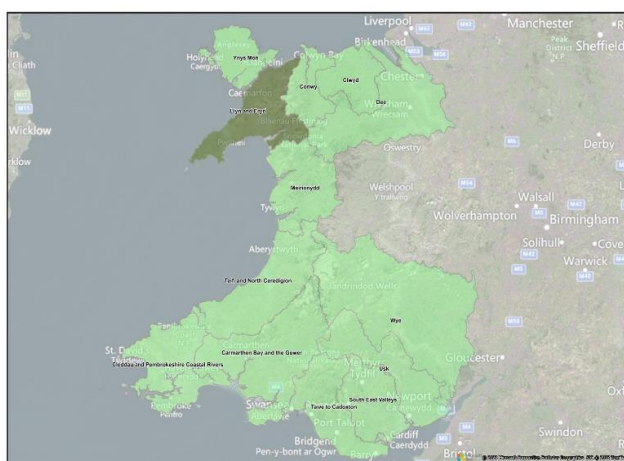


Figure 1 - River basin location detailing the strategic planning area

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## **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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

### **Stakeholder Engagement Opportunities**

Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships**

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems.](#) Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Glaslyn - tidal to Afon Croesor region is set to decrease to 9300 by 2050, a change of -23% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Porthmadog - Stad Penamser and Penrhyndeudraeth - Park Eryri

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

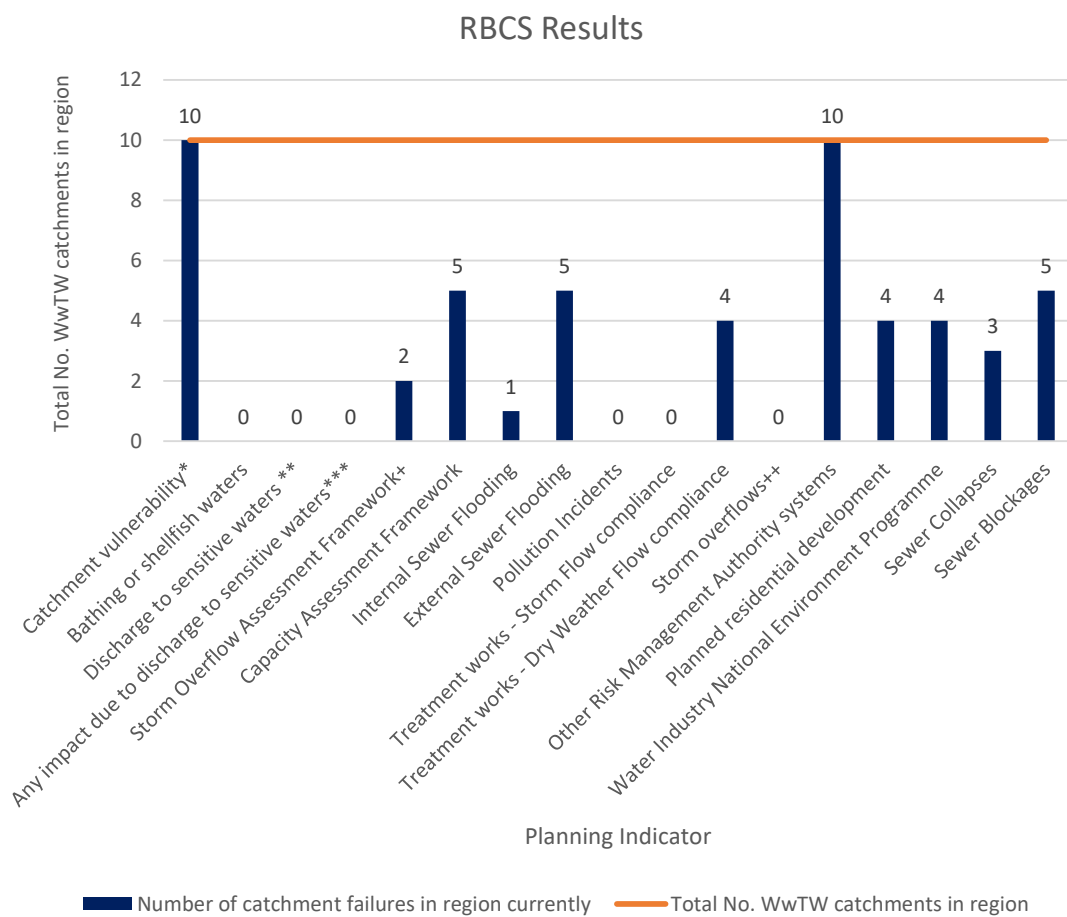
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For the Glaslyn - tidal to Afon Croesor catchment the biggest risks indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography) and other RMAs.



\*To sewer flooding due to extreme wet weather events.

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

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

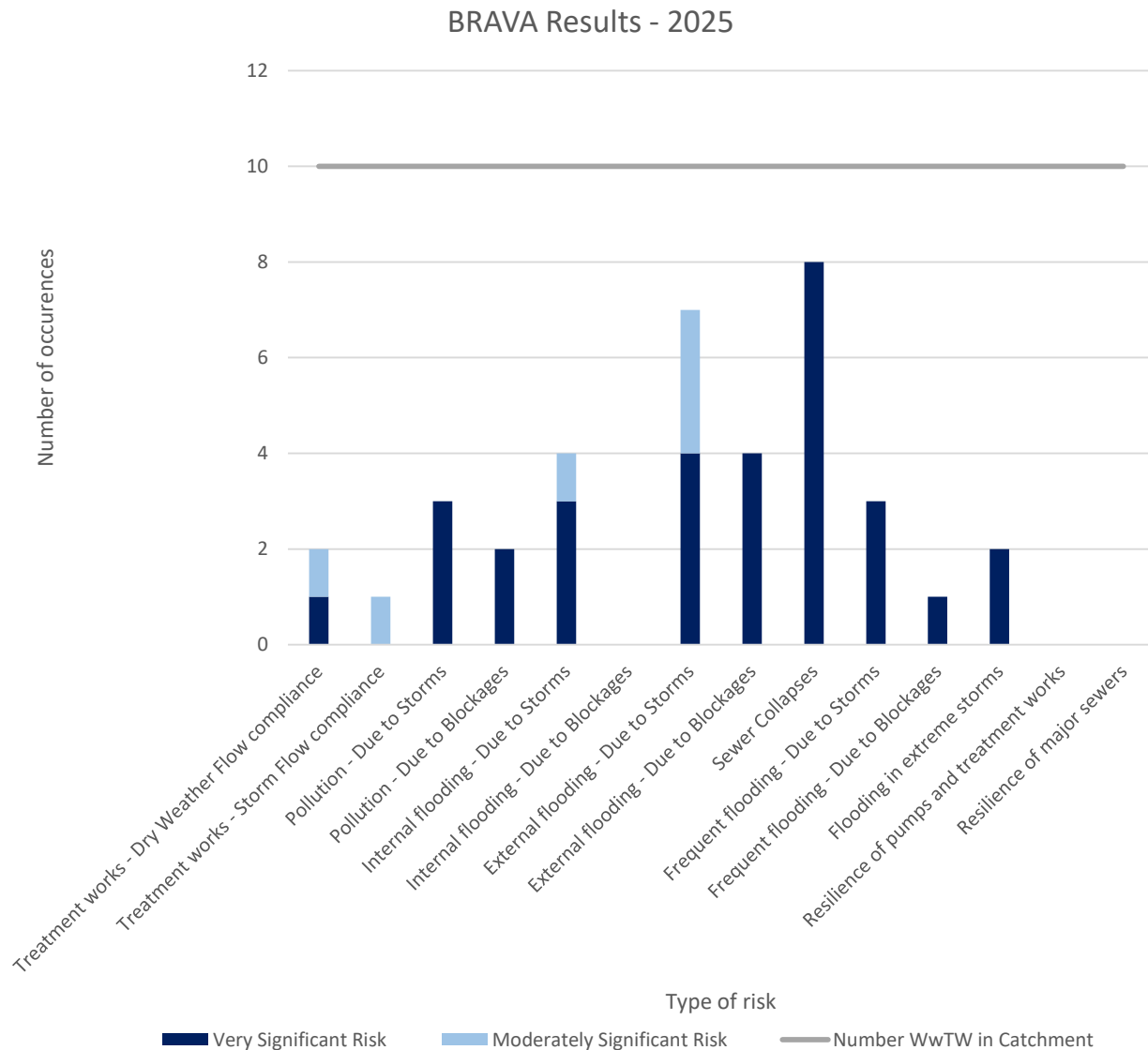
+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

**Figure 3 - Risk Based Catchment Screening results**

### 3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

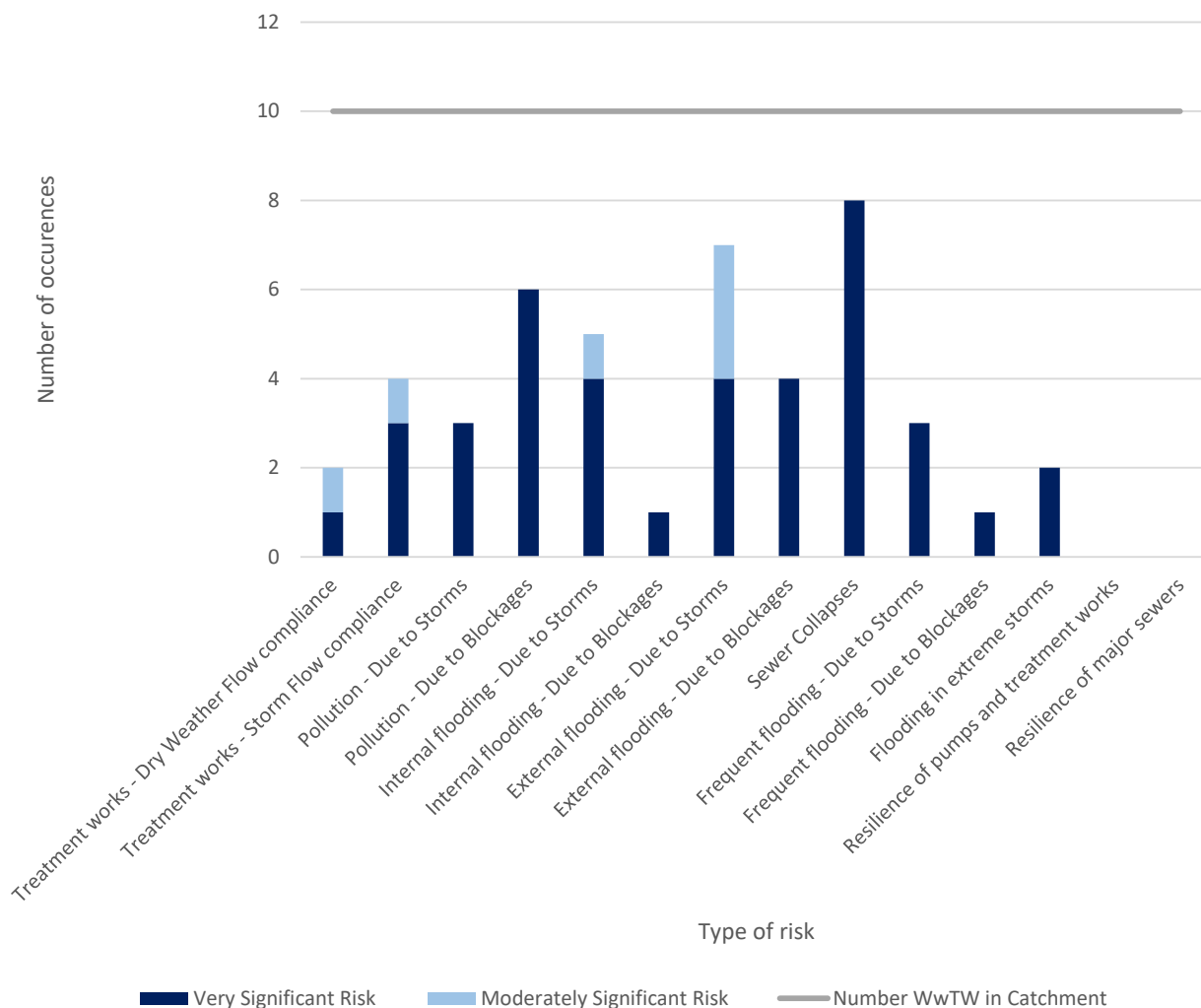
Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.



**Figure 4 - BRAVA 2025 Summary**

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

### BRAVA Results - 2050



**Figure 5 - BRAVA 2050 Summary**

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

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities 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.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload  
 No known risk

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload  
 No known risk

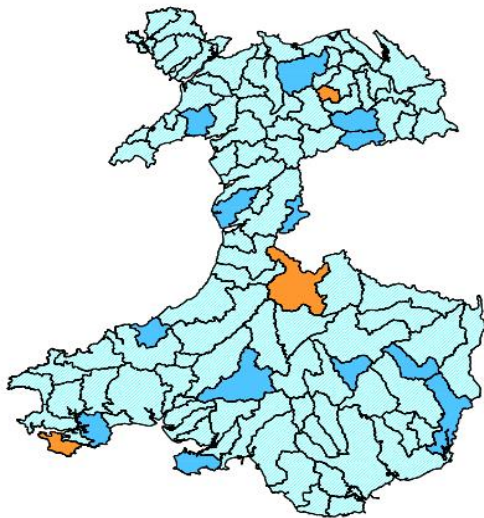
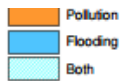


Figure 6 - Associated Strategic Planning Area priority (2025)

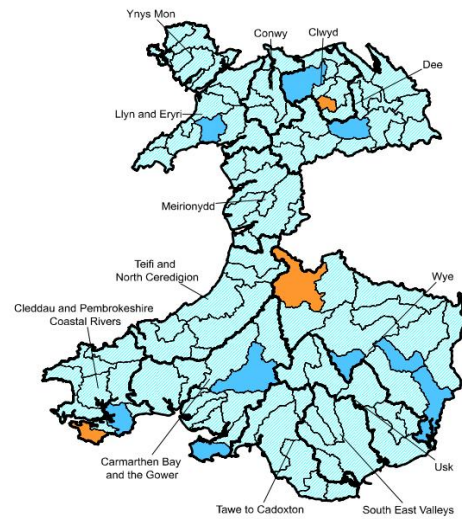
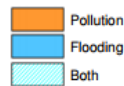


Figure 7 - Associated Strategic Planning Area priority (2050)

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Glaslyn - tidal to Afon Croesor	9	0	9	0	0

Table 2 - WFD status'

### 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
Glaslyn - tidal to Afon Croesor	Headroom	Pass	Close Pass	Close Pass	Close Pass	Close Pass	Close Pass	Close fail Fail
	Wet weather capacity	>90%	80%-90%	80%-90%	80%-90%	80%-90%	80%-90%	70%-80% <70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Glaslyn - tidal to Afon Croesor catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. There are currently no local issues present in the L4 catchments.

## 5.0 Options

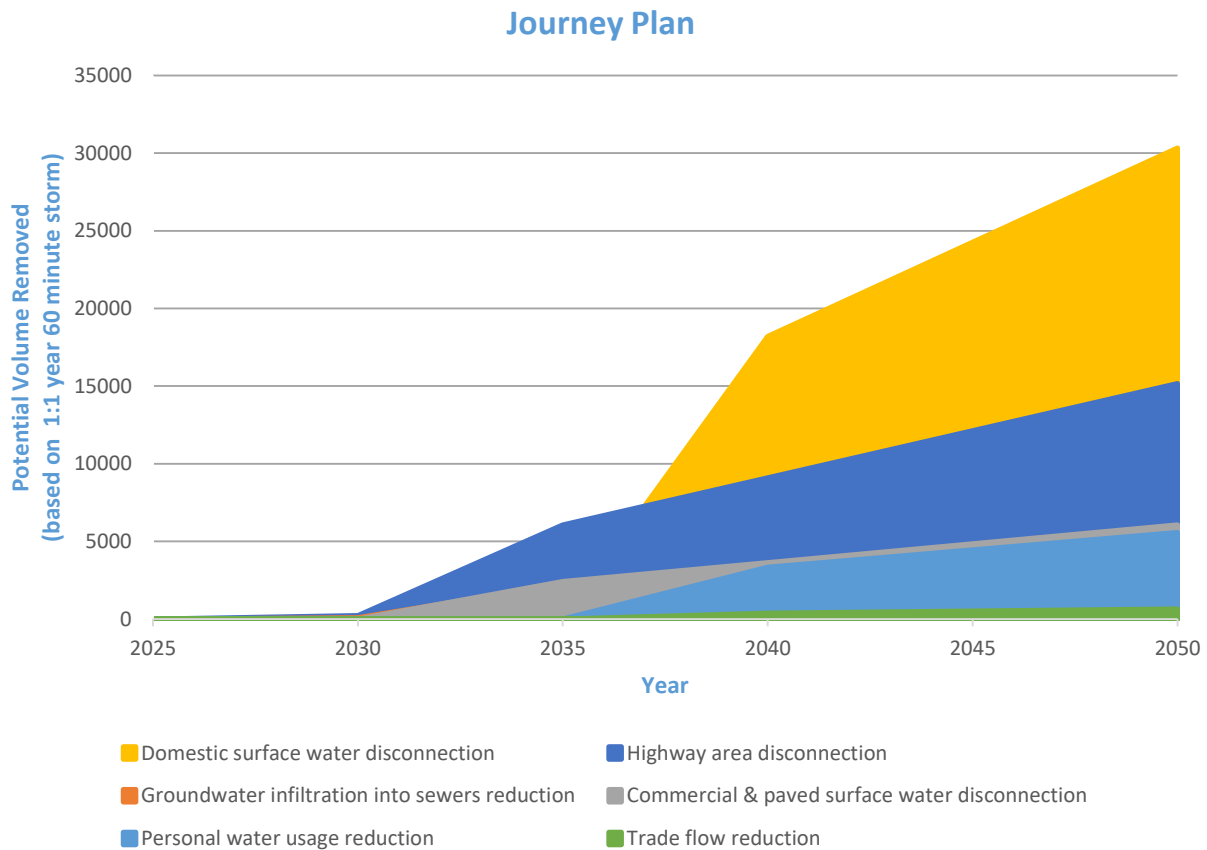
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment’s rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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 combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£9,000,000.00	£13,000,000.00
40 spills in a typical year	£4,000,000.00	£5,000,000.00	£7,000,000.00
20 spills in a typical year	£11,000,000.00	£11,000,000.00	£14,000,000.00
10 spills in a typical year	£19,000,000.00	£15,000,000.00	£16,000,000.00
0 spills in a typical year	£53,000,000.00	£57,000,000.00	£61,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	60.00	151.00	150.00

\* 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 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£1,200,000.00	£1,500,000.00	£1,200,000.00
External escapes in gardens	£400,000.00	£600,000.00	£400,000.00
Escapes in highways	£10,800,000.00	£13,300,000.00	£16,500,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£12,400,000.00</b>	<b>£15,400,000.00</b>	<b>£18,100,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
PENRHYNDEUDRAETH	0
LLANFROTHEN GARREG	0
NANT GWYNANT	0
CROESOR 3	0
NANTMOR	0
NANT GWYNANT BETHANIA	0
BEDDGELERT STW	0
PRENTEG	0
PORTHMADOG	4
Morfa Bychan WwTW	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Gwyrfai

### 1.0 Introduction

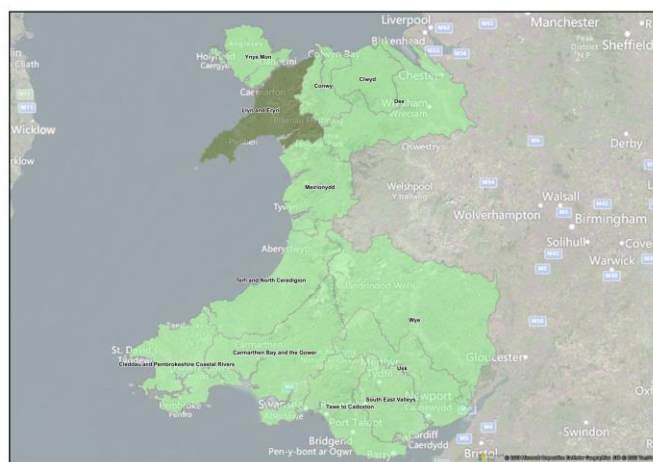
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers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

### 1.1 Catchment Information

The Gwyrfai planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

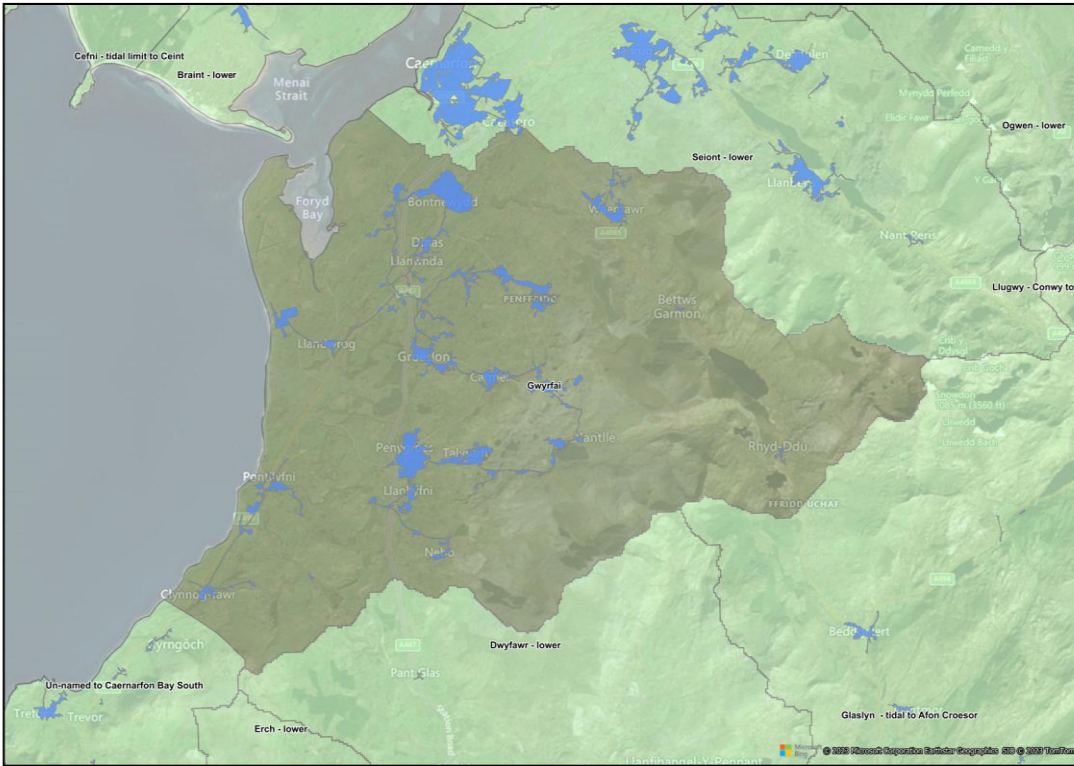
The Gwyrfai catchment is just South of Anglesey, bordering the Irish sea to the West. The River Gwyrfai flows down into the sea near Caernarfon Airport. Y Bontnewydd and Groeslon are its major urban areas.

This planning catchment consists of 7 wastewater catchments (see Figure 2). There is a combined population of 10908, this is set to decrease to 9900 by 2050, a change of -9%. There is a total sewer length of 120km, with a foul sewer length of 31km, a surface water length of 6.56km and a combined sewer length of 79km. There are 7 Wastewater Treatment Works (WwTW), 17 Sewerage Pumping Stations (SPSs), and 30 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

### Stakeholder Engagement Opportunities

Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Gwyrfaï region is set to decrease to 9900 by 2050, a change of -9% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Penygroes - Stad ddiwydianol Penygroes and Land adjacent to Maes Dylun

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

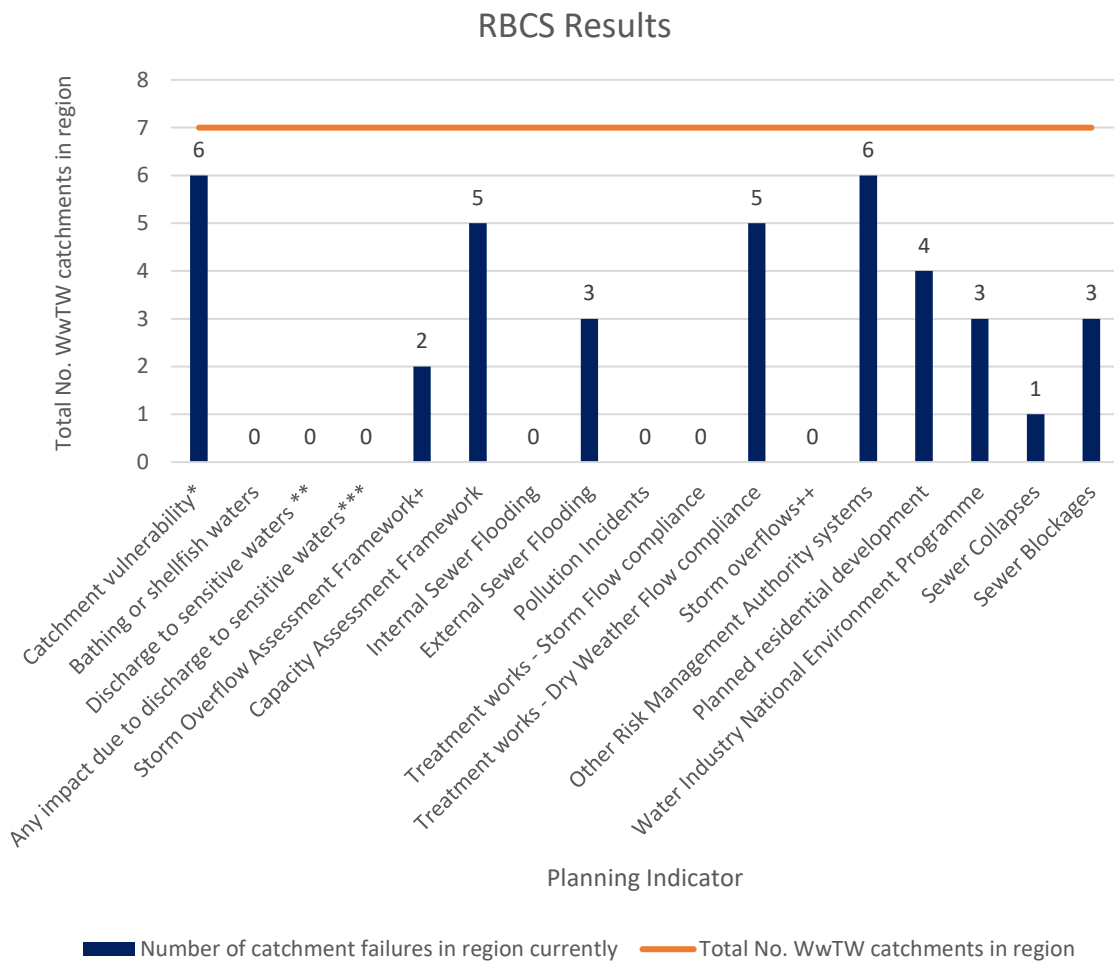
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For the Gwyrfai catchment the biggest risks indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography) and other RMAs.



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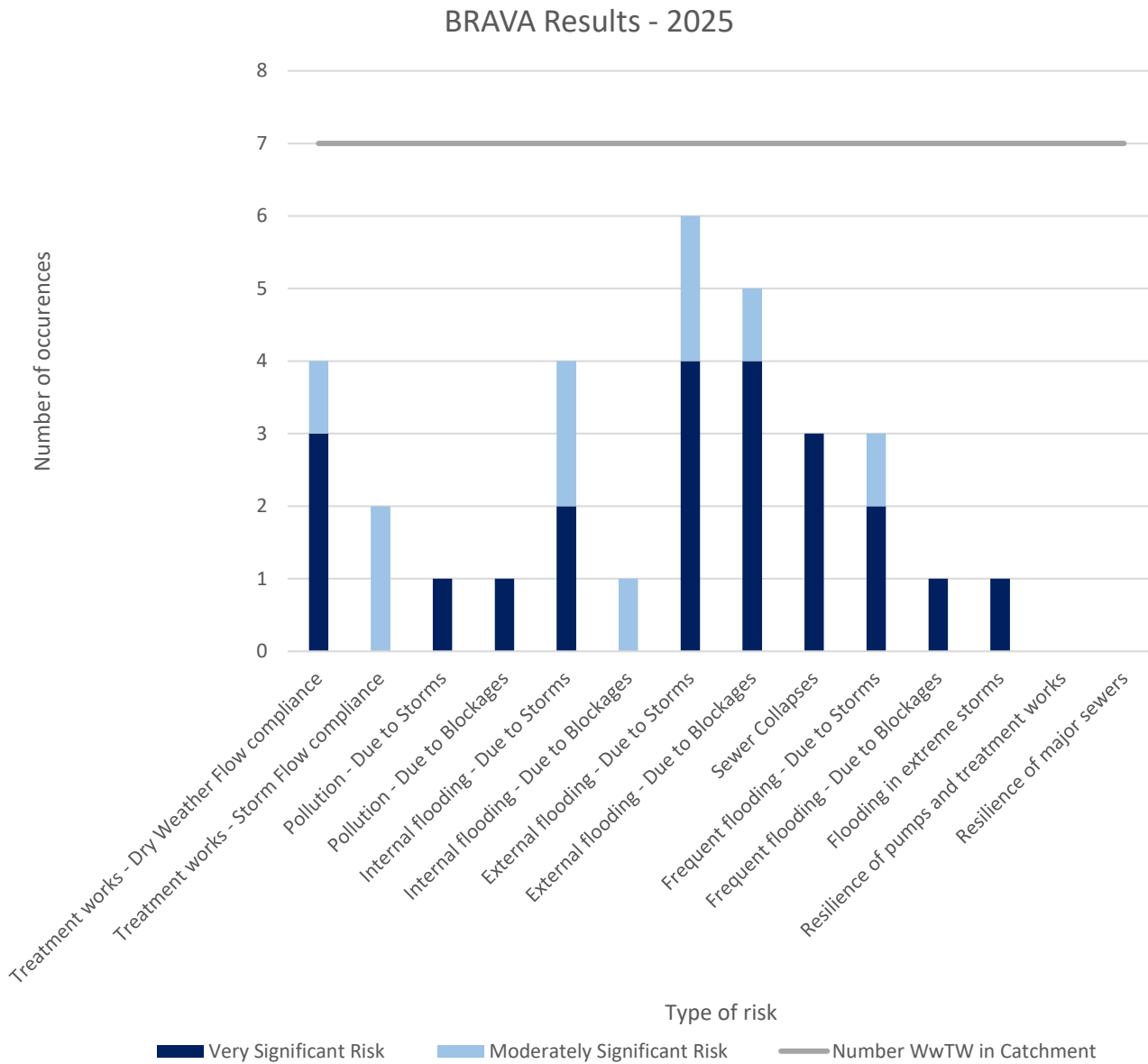
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Figure 3 - Risk Based Catchment Screening results

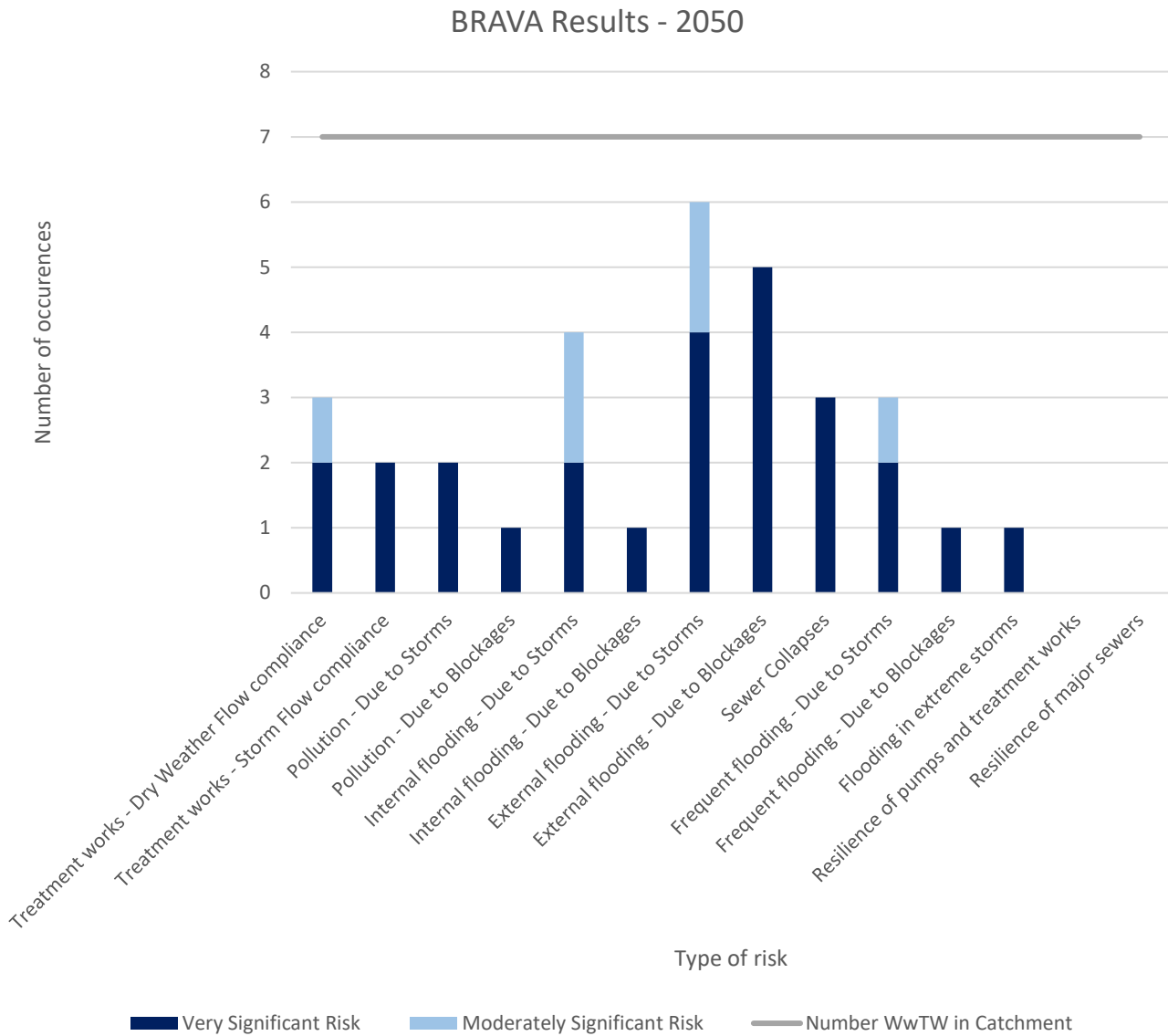
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**Figure 4 - BRAVA 2025 Summary**

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



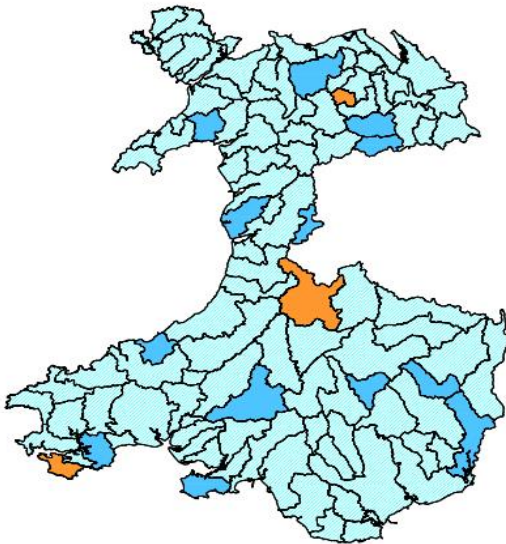
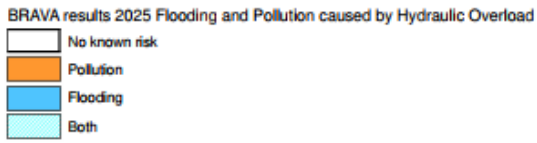
**Figure 5 - BRAVA 2050 Summary**

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

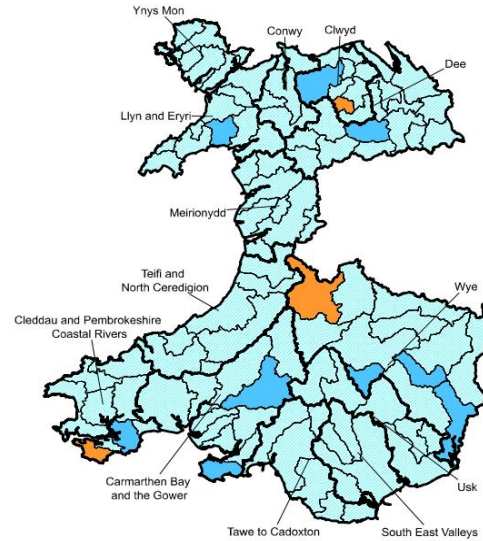
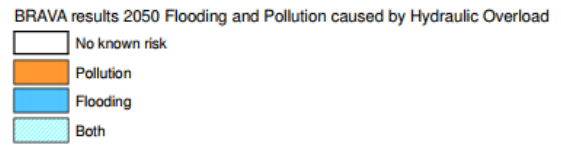
Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.





**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Gwyrfai	5	3	2	0	0

**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Gwyrfai	Headroom							Pass	Close fail
	Wet weather capacity							Close Pass	Fail
								>90%	70%-80%
								80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Gwyrfai catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Llanfaglan and Betws Garmon L4 catchments. Further detail is provided in the relevant L4 summaries.

## 5.0 Options

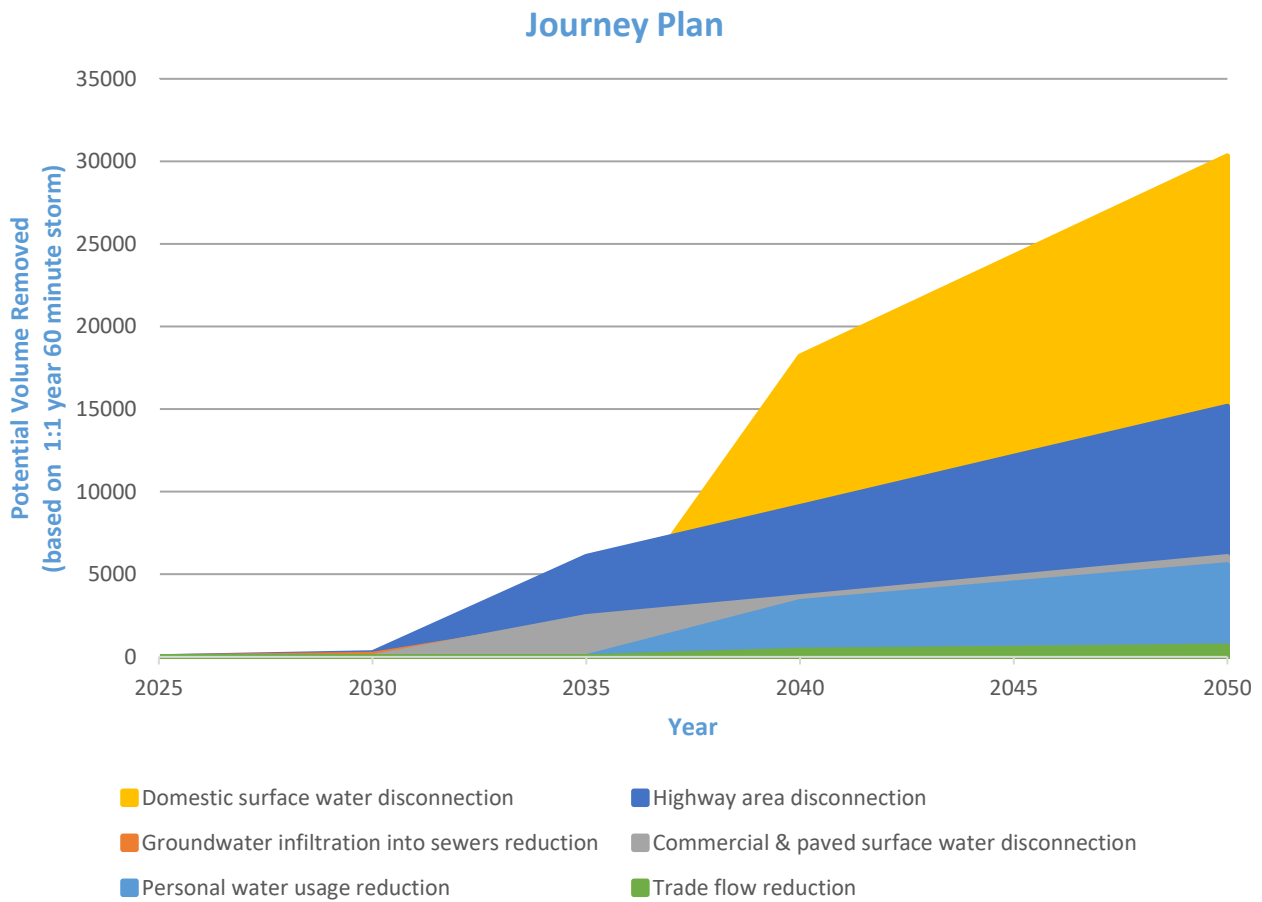
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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 combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£8,000,000.00	£14,000,000.00
40 spills in a typical year	£5,000,000.00	£5,000,000.00	£6,000,000.00
20 spills in a typical year	£7,000,000.00	£7,000,000.00	£8,000,000.00
10 spills in a typical year	£13,000,000.00	£15,000,000.00	£15,000,000.00
0 spills in a typical year	£31,000,000.00	£32,000,000.00	£35,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	39.00	44.00	49.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£2,700,000.00	£3,600,000.00	£3,600,000.00
External escapes in gardens	£1,000,000.00	£1,200,000.00	£1,600,000.00
Escapes in highways	£11,500,000.00	£14,100,000.00	£19,000,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£15,200,000.00</b>	<b>£18,900,000.00</b>	<b>£24,200,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
TAI'N LON	0
BETWS GARMON (SE OF CAERNARFON) STW	0
RHYD-DDU	0
PONTLLYFNI STW	0
WAUNFAWR STW	0
LLANFAGLAN	3
LLANLLYFNI	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Ogwen - lower

### 1.0 Introduction

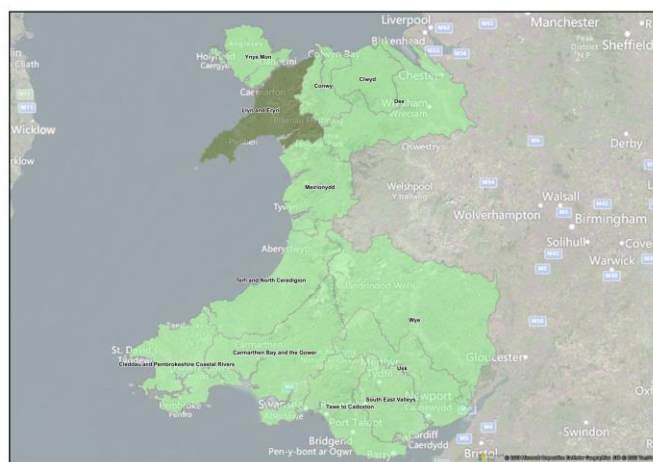
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers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

### 1.1 Catchment Information

The Ogwen - lower planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

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

This planning catchment consists of 9 wastewater catchments (see Figure 2). There is a combined population of 51988, this is set to decrease to 42500 by 2050, a change of -18%. There is a total sewer length of 331km, with a foul sewer length of 94km, a surface water length of 27.91km and a combined sewer length of 200km. There are 9 Wastewater Treatment Works (WWTW), 59 Sewerage Pumping Stations (SPSs), and 53 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

### Stakeholder Engagement Opportunities

Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

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Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Ogwen - lower region is set to decrease to 42500 by 2050, a change of -18% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Bangor - Bryn Cegin and Park Menai

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

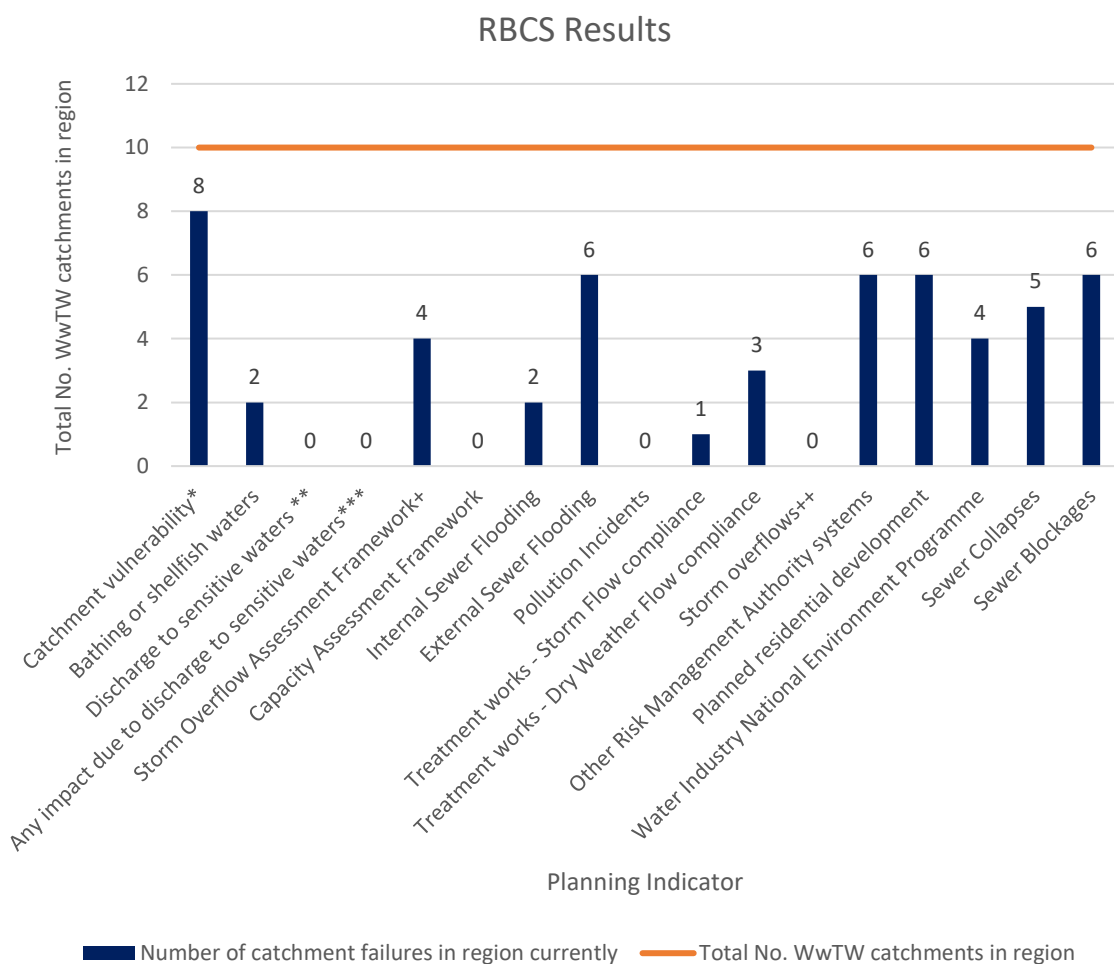
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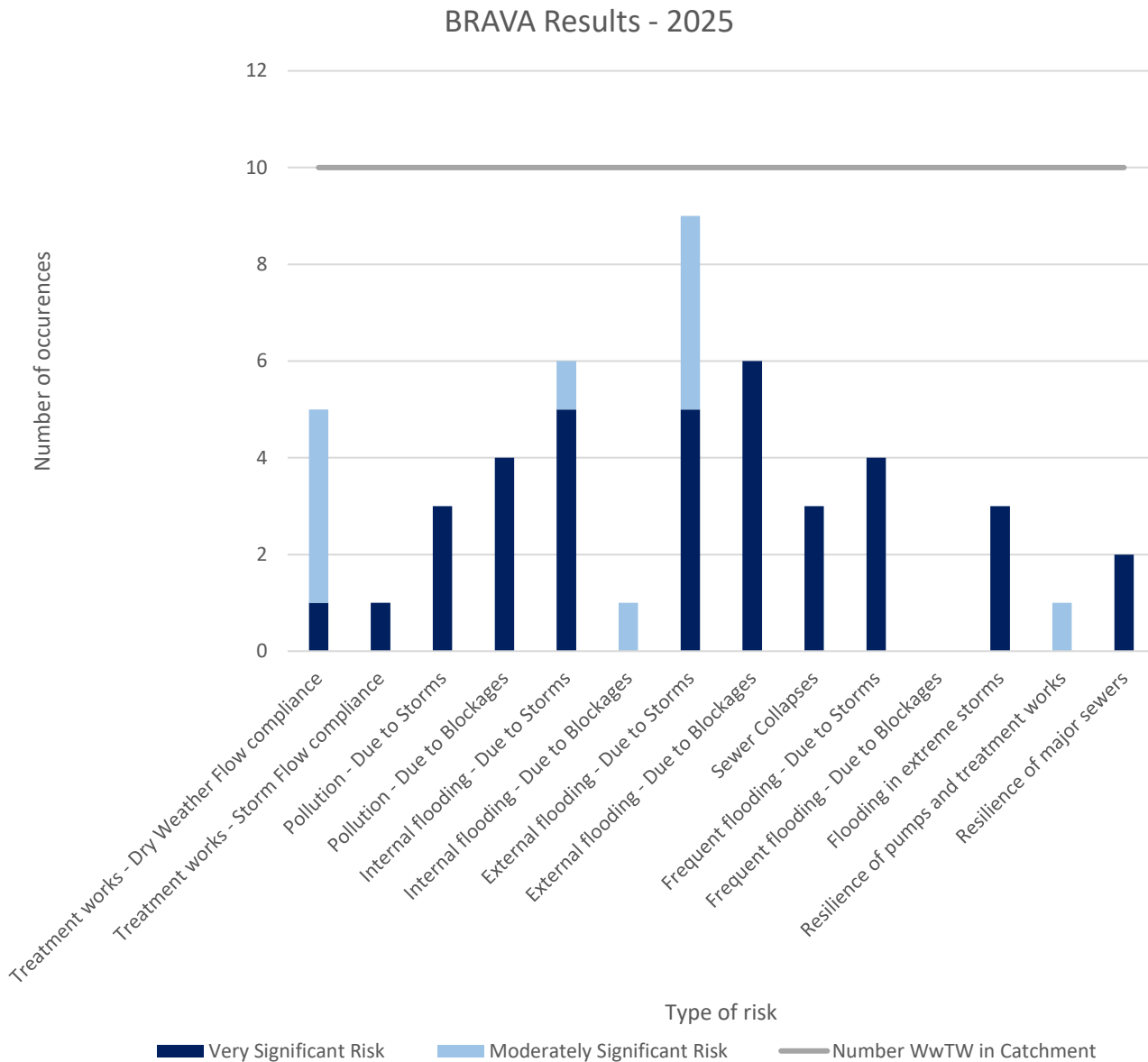
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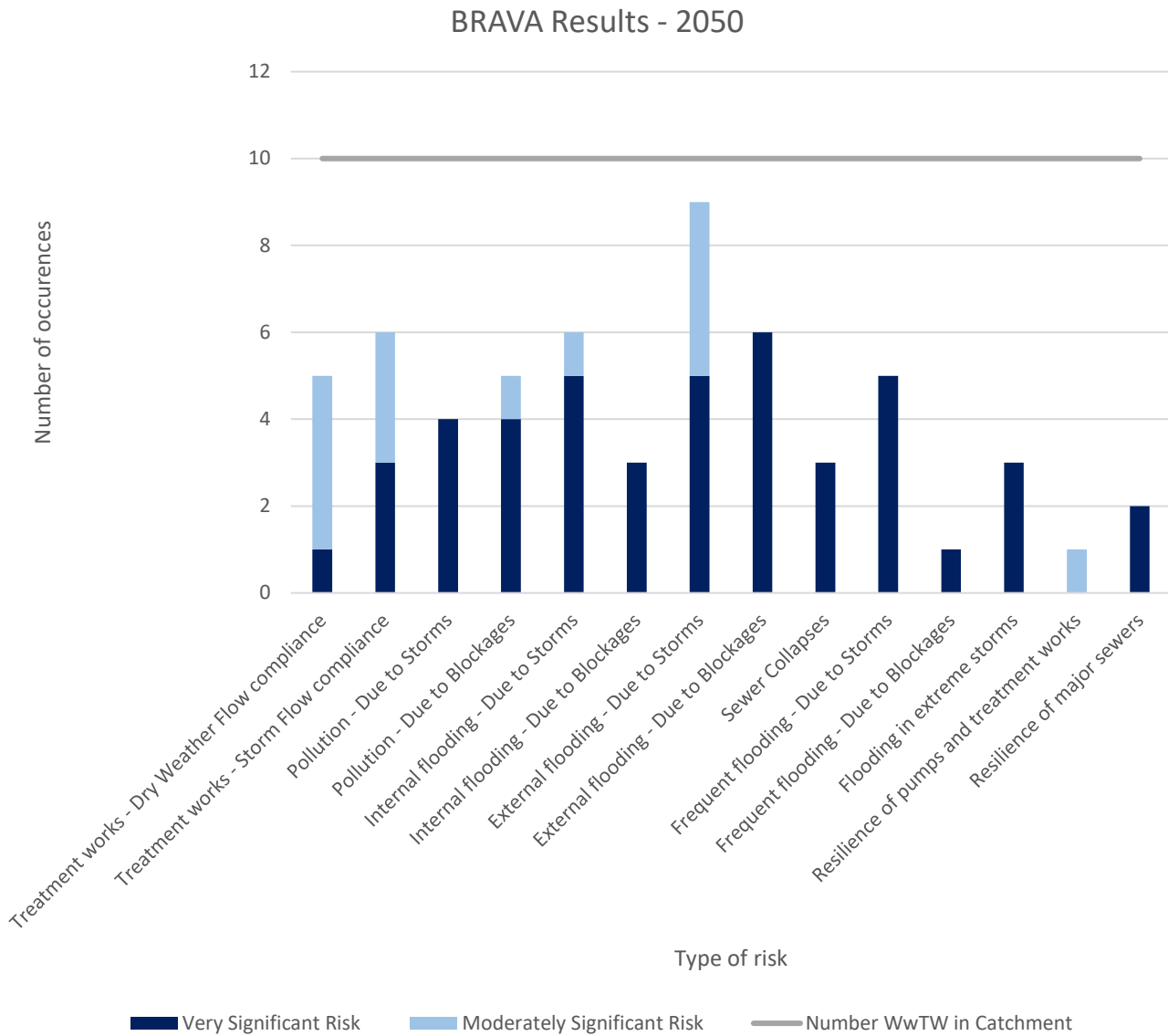
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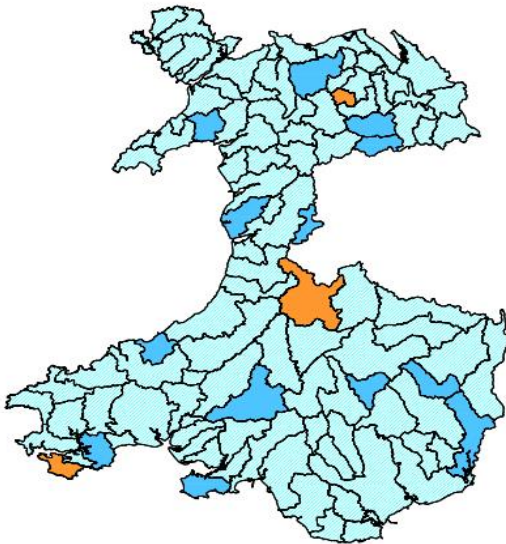
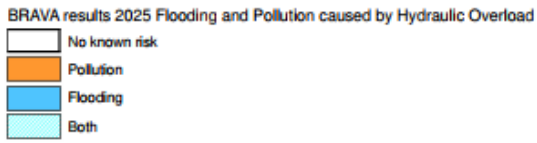
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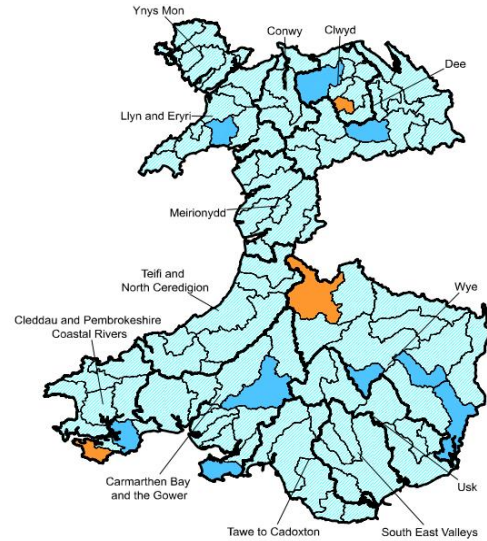
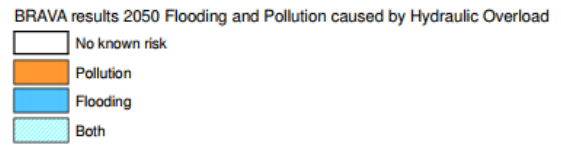
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From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.





**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

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**Table 2 - WFD status'**



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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.

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L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Ogwen - lower	Headroom	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Pass	Close fail
	Wet weather capacity	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Close Pass	Fail
								>90%	70%-80%
								80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Ogwen - lower catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Llanfairfechan, Llandegai and Penmaenmawr L4 catchments. Further detail is provided in the relevant L4 summaries.

## 5.0 Options

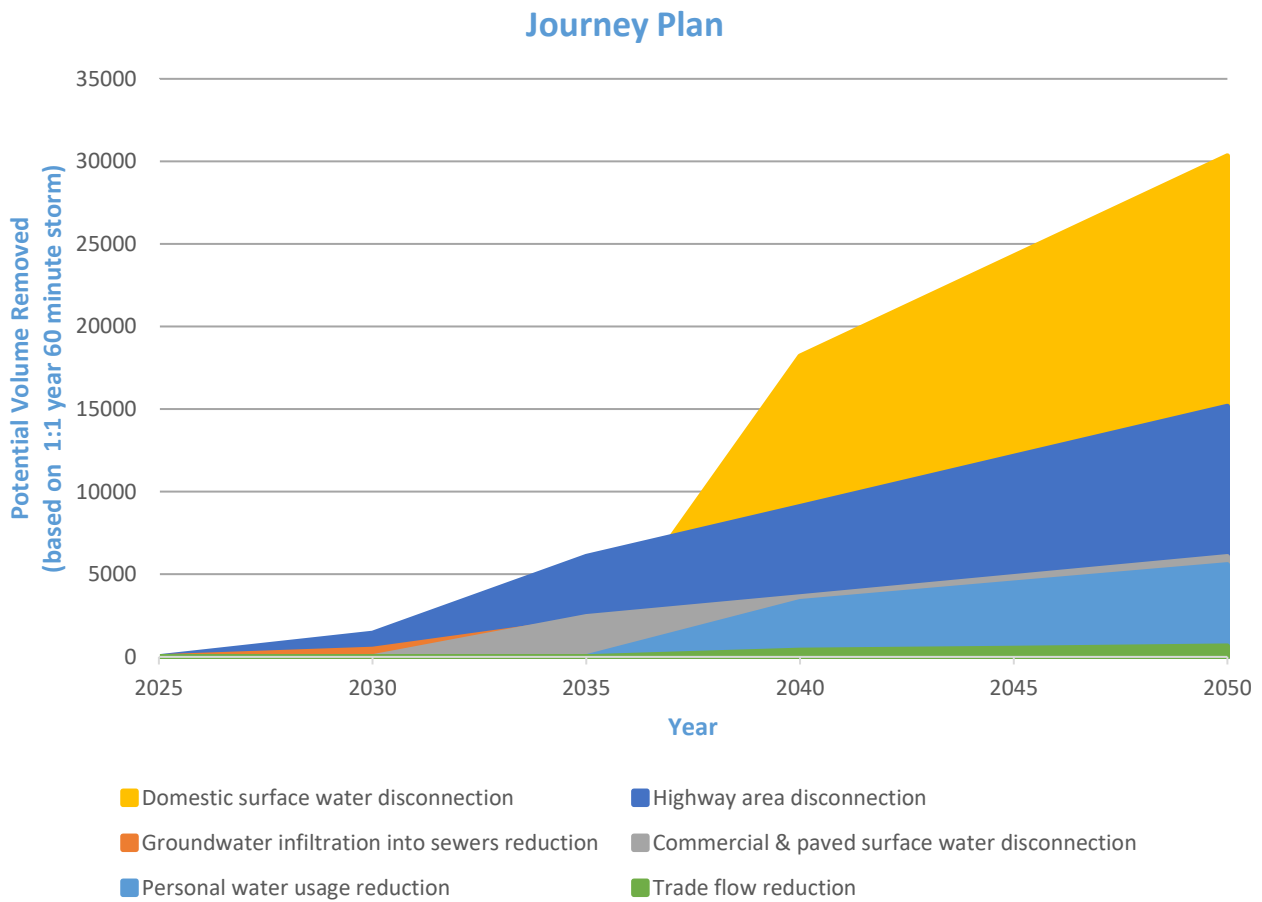
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Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£16,000,000.00	£30,000,000.00
40 spills in a typical year	£30,000,000.00	£32,000,000.00	£33,000,000.00
20 spills in a typical year	£45,000,000.00	£49,000,000.00	£55,000,000.00
10 spills in a typical year	£69,000,000.00	£74,000,000.00	£86,000,000.00
0 spills in a typical year	£183,000,000.00	£194,000,000.00	£208,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	194.00	203.00	193.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£4,700,000.00	£6,100,000.00	£7,600,000.00
External escapes in gardens	£5,500,000.00	£8,800,000.00	£7,200,000.00
Escapes in highways	£146,700,000.00	£155,400,000.00	£162,000,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£156,900,000.00</b>	<b>£170,300,000.00</b>	<b>£176,800,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
SEION 1	0
SEION 2	0
LLANDEGAI	0
TAL-Y-BONT (SE OF BANGOR)	0
RHIWLAS	0
PENMAENMAWR	0
LLANFAIRFECHAN	0
TREGARTH	0
BANGOR TREBORTH	9
BETHESDA	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Seiont - lower

### 1.0 Introduction

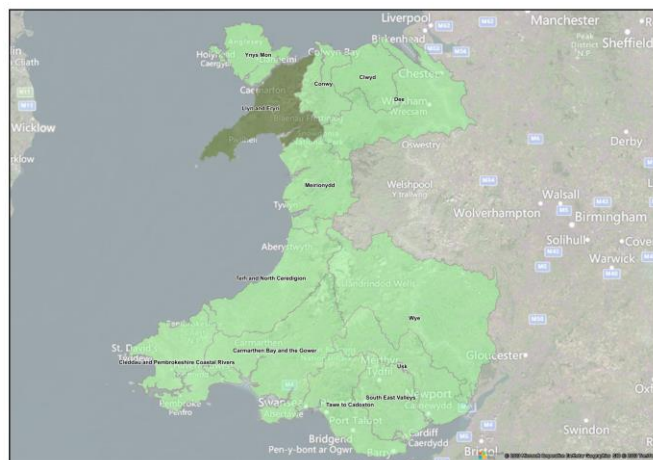
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers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

### 1.1 Catchment Information

The Seiont - lower planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

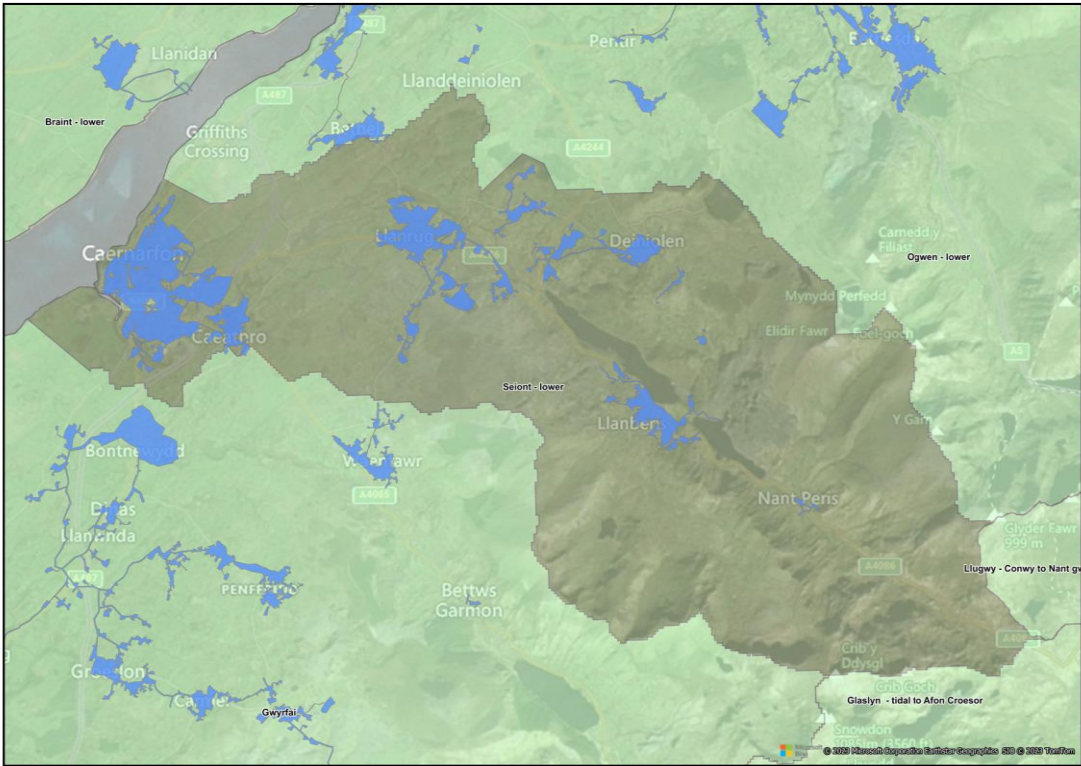
The Seiont - lower catchment sits adjacent to the Menai Straits, opposite Anglesey. The River Seiont flows down to join the Sea near Caernarfon. Caernarfon and Llanrug are its major urban areas.

This planning catchment consists of 9 wastewater catchments (see Figure 2). There is a combined population of 22283, this is set to decrease to 17400 by 2050, a change of -22%. There is a total sewer length of 126km, with a foul sewer length of 28km, a surface water length of 16.54km and a combined sewer length of 80km. There are 9 Wastewater Treatment Works (WWTW), 26 Sewerage Pumping Stations (SPSs), and 26 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

**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. Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships**

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here: [Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Seiont - lower region is set to decrease to 17400 by 2050, a change of -22% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Caernarfon - Stad ddiwydiannol Cibyn and Llanberis - Glyn Rhonwy

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

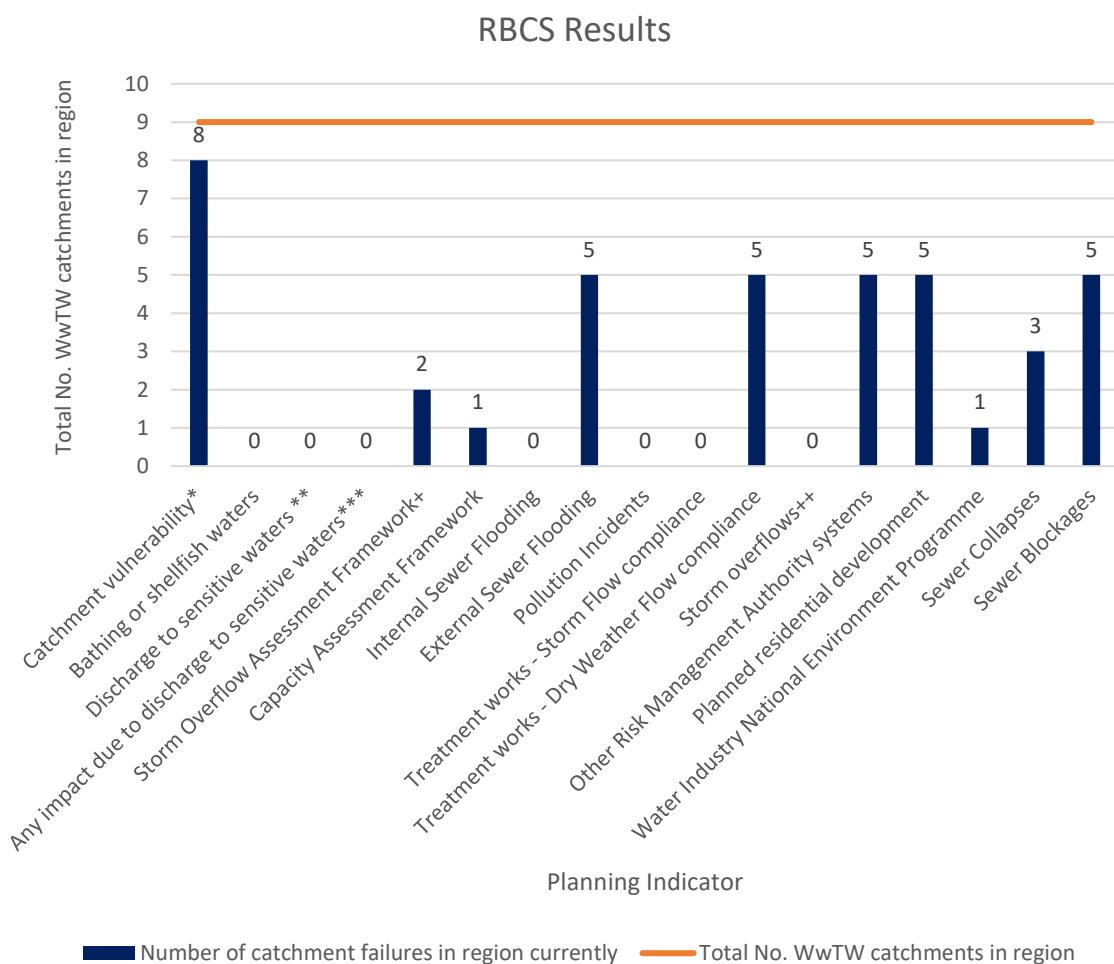
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For the Seiont - lower catchment the biggest risk indicated by the RBCS is catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography).



\*To sewer flooding due to extreme wet weather events.

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

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

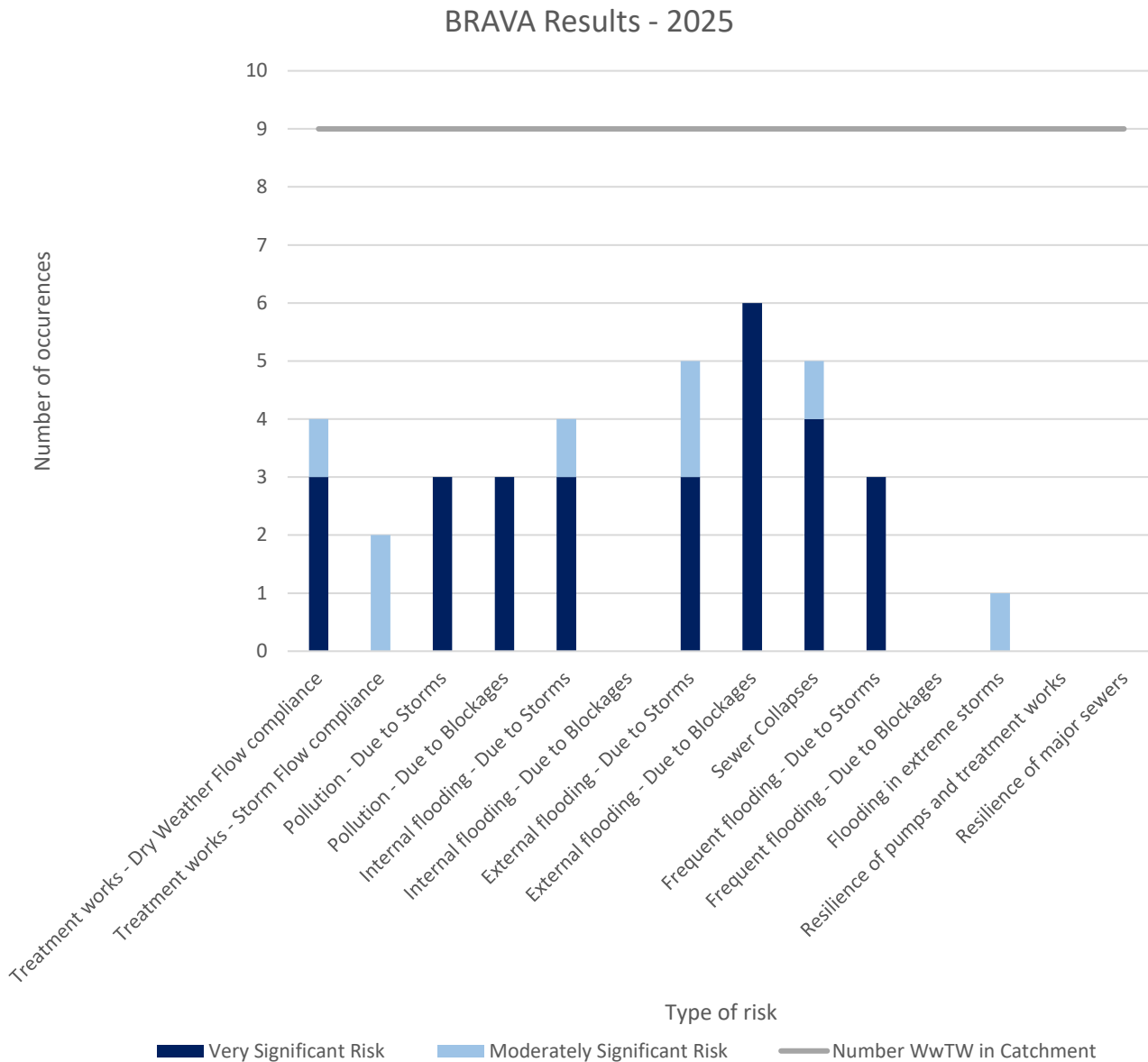
+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

### 3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

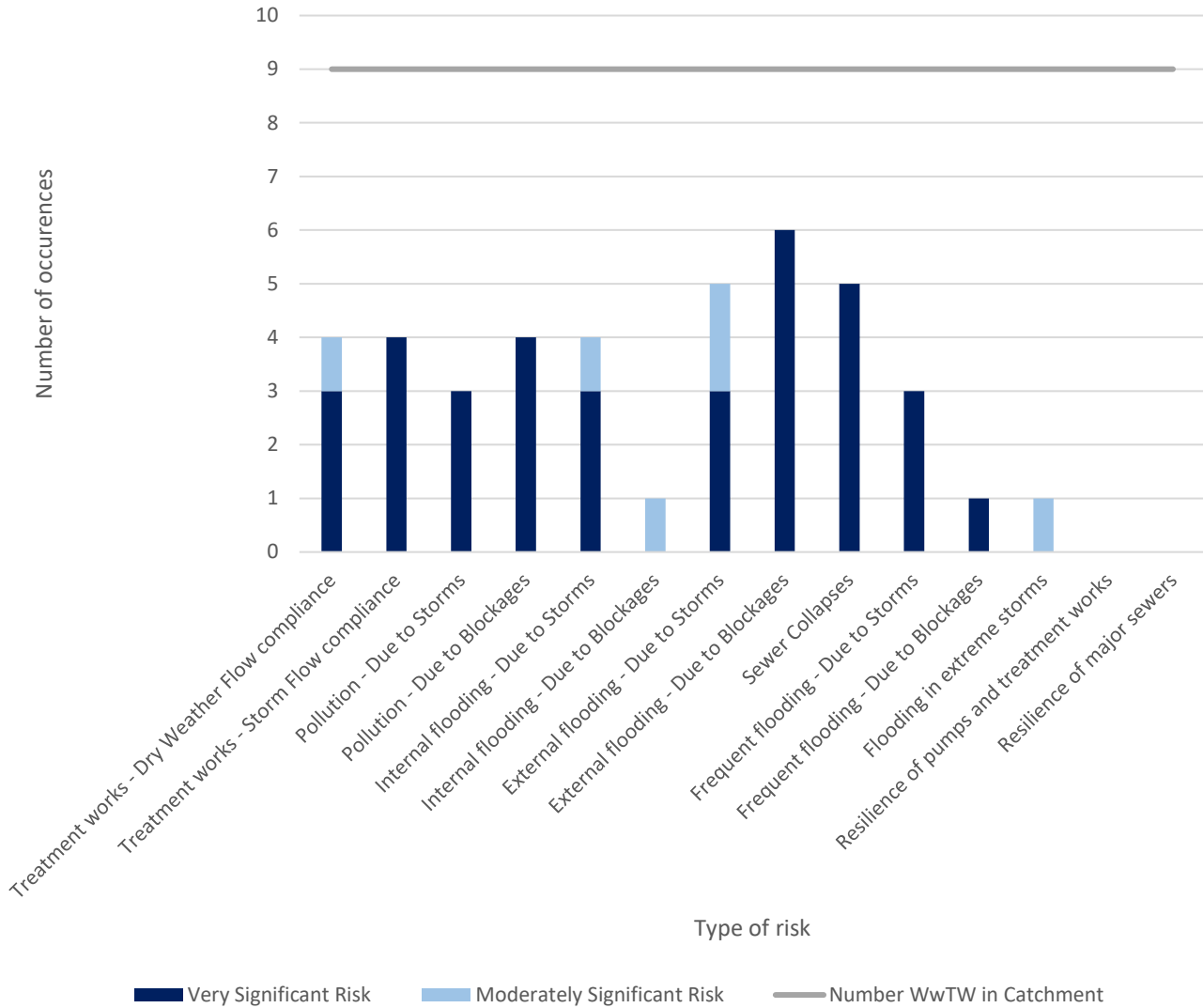
Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.



**Figure 4 - BRAVA 2025 Summary**

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

## BRAVA Results - 2050



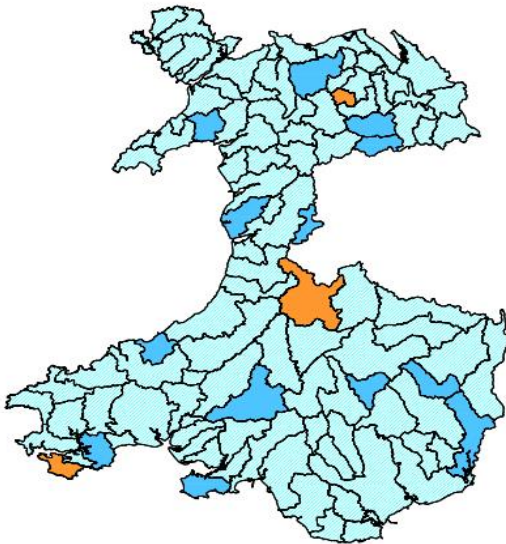
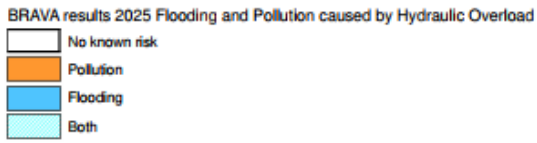
### Figure 5 - BRAVA 2050 Summary

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

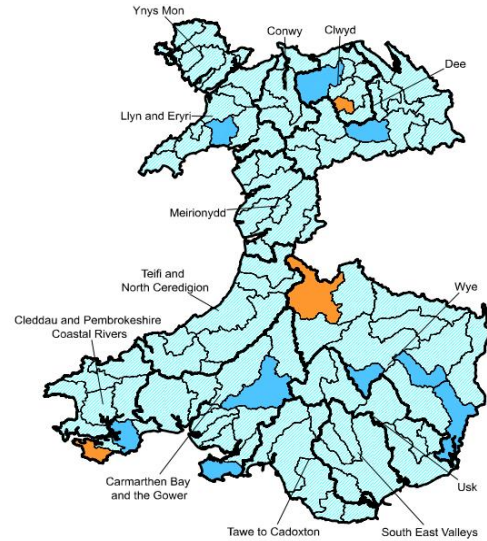
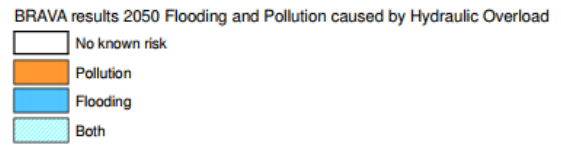
Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.





**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Seiont - lower	3	3	0	0	0

**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

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L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Seiont - lower	Headroom	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Close fail
	Wet weather capacity	Close Pass	Close Pass	Close Pass	Close Pass	Close Pass	Close Pass	Close Pass	Fail
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**Table 3 - Supply Demand Balance**

Table 3 shows that for the Seiont - lower catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Llanberis and Deiniolen (Gallyfoel) L4 catchments. Further detail is provided in the relevant L4 summaries.

## 5.0 Options

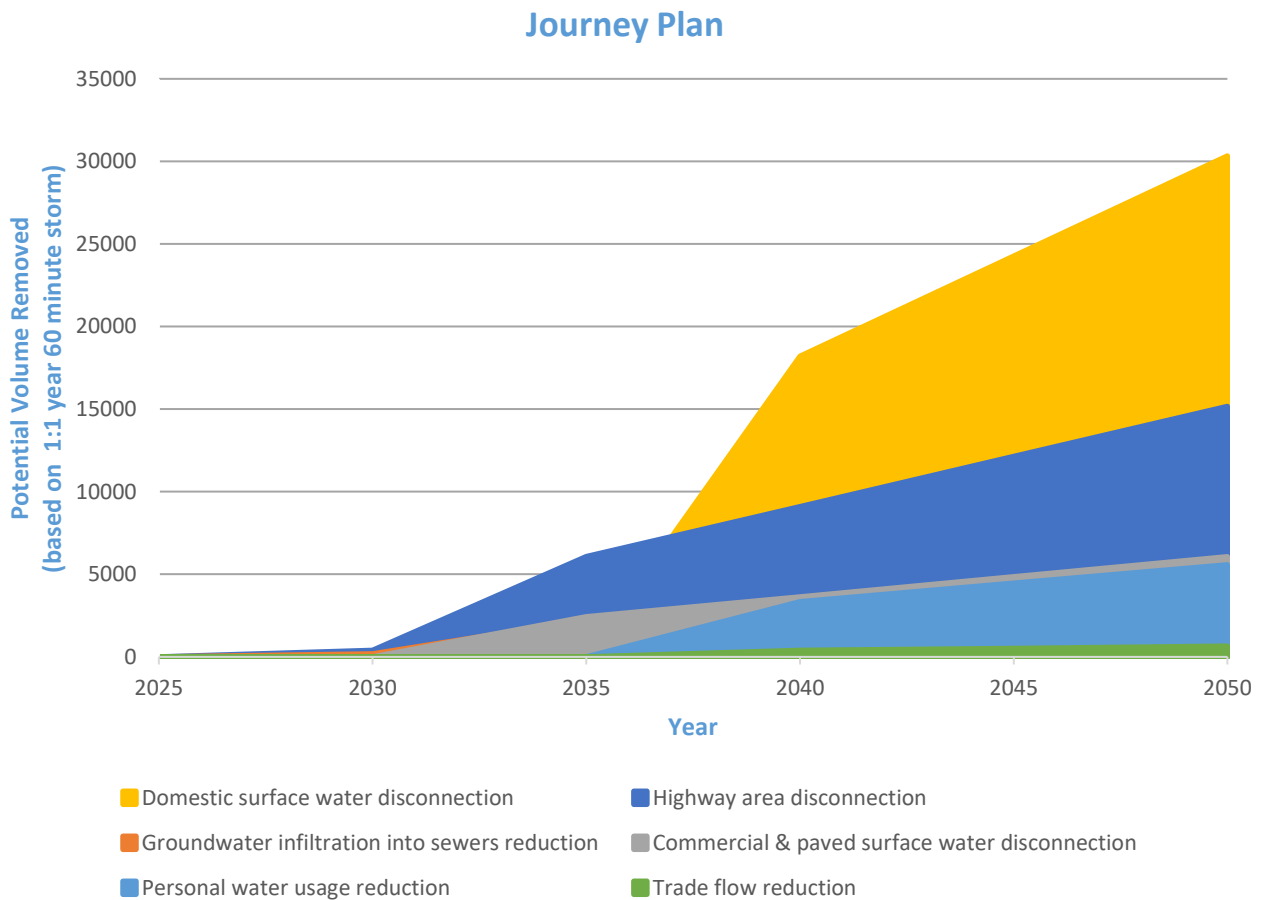
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Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
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**Table 4 - Scheme types**

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Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£16,000,000.00	£22,000,000.00
40 spills in a typical year	£4,000,000.00	£4,000,000.00	£6,000,000.00
20 spills in a typical year	£7,000,000.00	£9,000,000.00	£9,000,000.00
10 spills in a typical year	£12,000,000.00	£14,000,000.00	£18,000,000.00
0 spills in a typical year	£26,000,000.00	£37,000,000.00	£43,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	36.00	68.00	76.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£1,400,000.00	£1,900,000.00	£1,400,000.00
External escapes in gardens	£300,000.00	£300,000.00	£300,000.00
Escapes in highways	£16,300,000.00	£20,800,000.00	£25,400,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£18,000,000.00</b>	<b>£23,000,000.00</b>	<b>£27,100,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
DINORWIC 3 MINFFORDD	0
DINORWIC 4 CHAPEL	0
GALLT-Y-FOEL (DEINIOLEN)	0
NANT PERIS	0
PENISA'R WAUN WwTW	0
DEINIOLEN BRYNREFAIL	0
LLANBERIS	0
LLANRUG	0
CAERNARFON	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Soch

### 1.0 Introduction

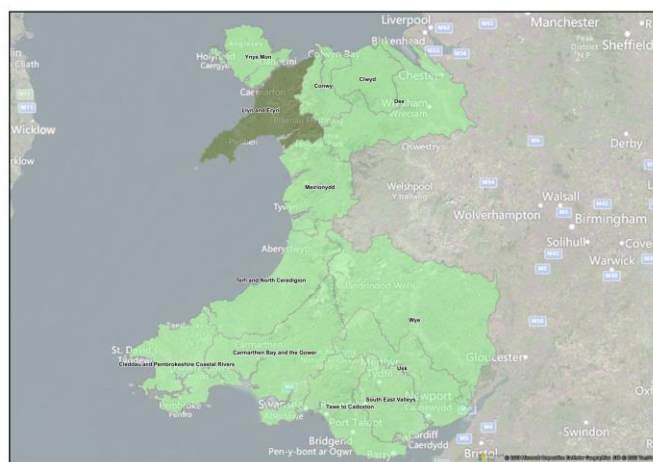
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers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

### 1.1 Catchment Information

The Soch planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

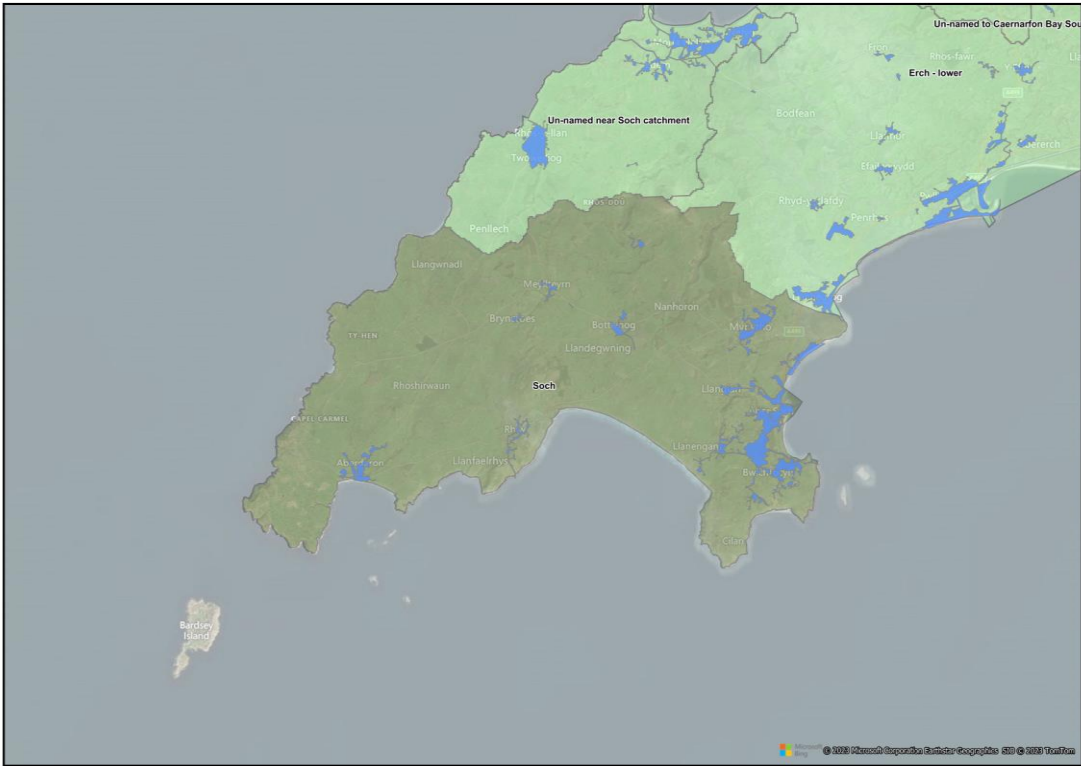
The Soch catchment sits at the end of the Llyn Peninsula. The River Soch flows down to join the sea at Abersoch. Abersoch and Mynytho are its largest urban areas.

This planning catchment consists of 10 wastewater catchments (see Figure 2). There is a combined population of 8027, this is set to decrease to 6100 by 2050, a change of -24%. There is a total sewer length of 62km, with a foul sewer length of 34km, a surface water length of 0.41km and a combined sewer length of 26km. There are 10 Wastewater Treatment Works (WWTW), 15 Sewerage Pumping Stations (SPSs), and 9 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

### Stakeholder Engagement Opportunities

Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Soch region is set to decrease to 6100 by 2050, a change of -24% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Botwnnog - Cae Cefn Capel and land adjacent to Pentre

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

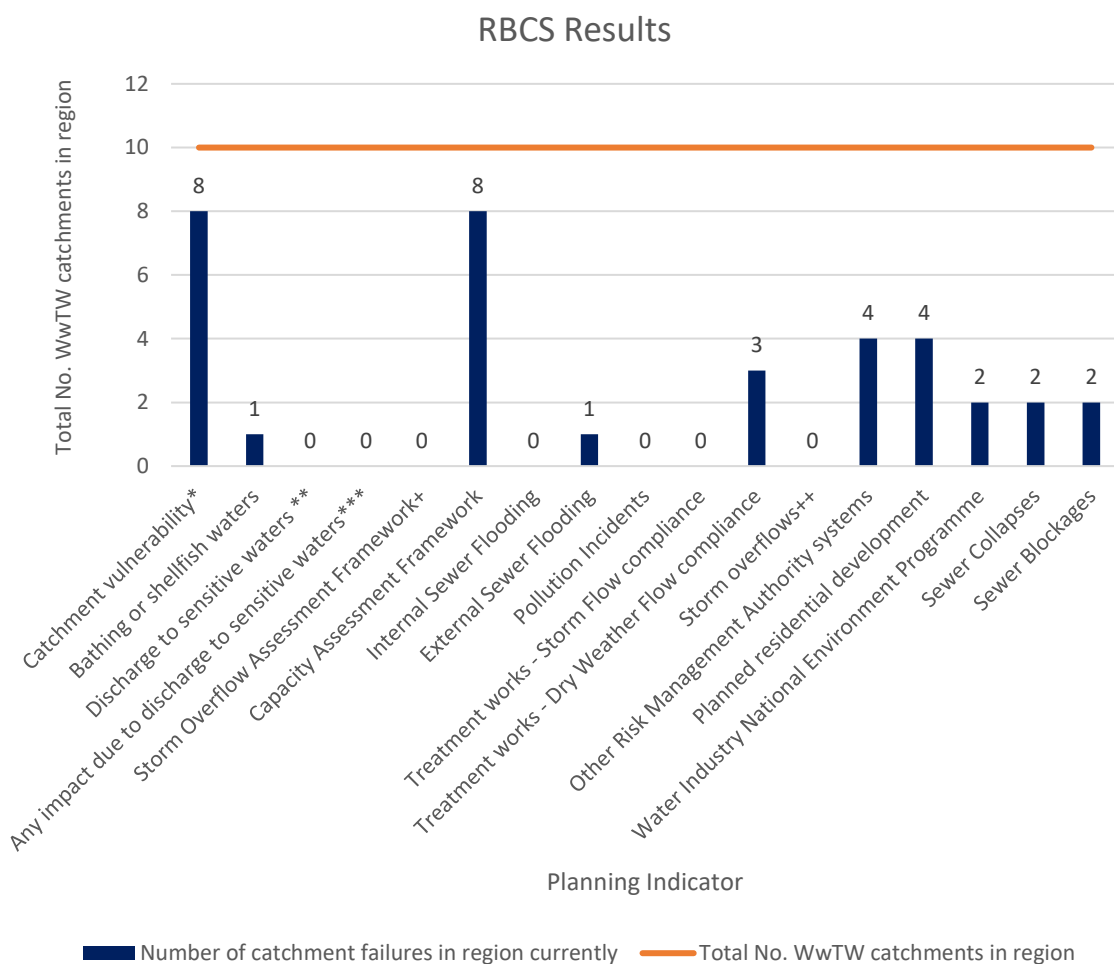
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For the Soch catchment the biggest risks indicated by the RBCS is catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography) and Capacity Assessment Framework.



\*To sewer flooding due to extreme wet weather events.

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

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

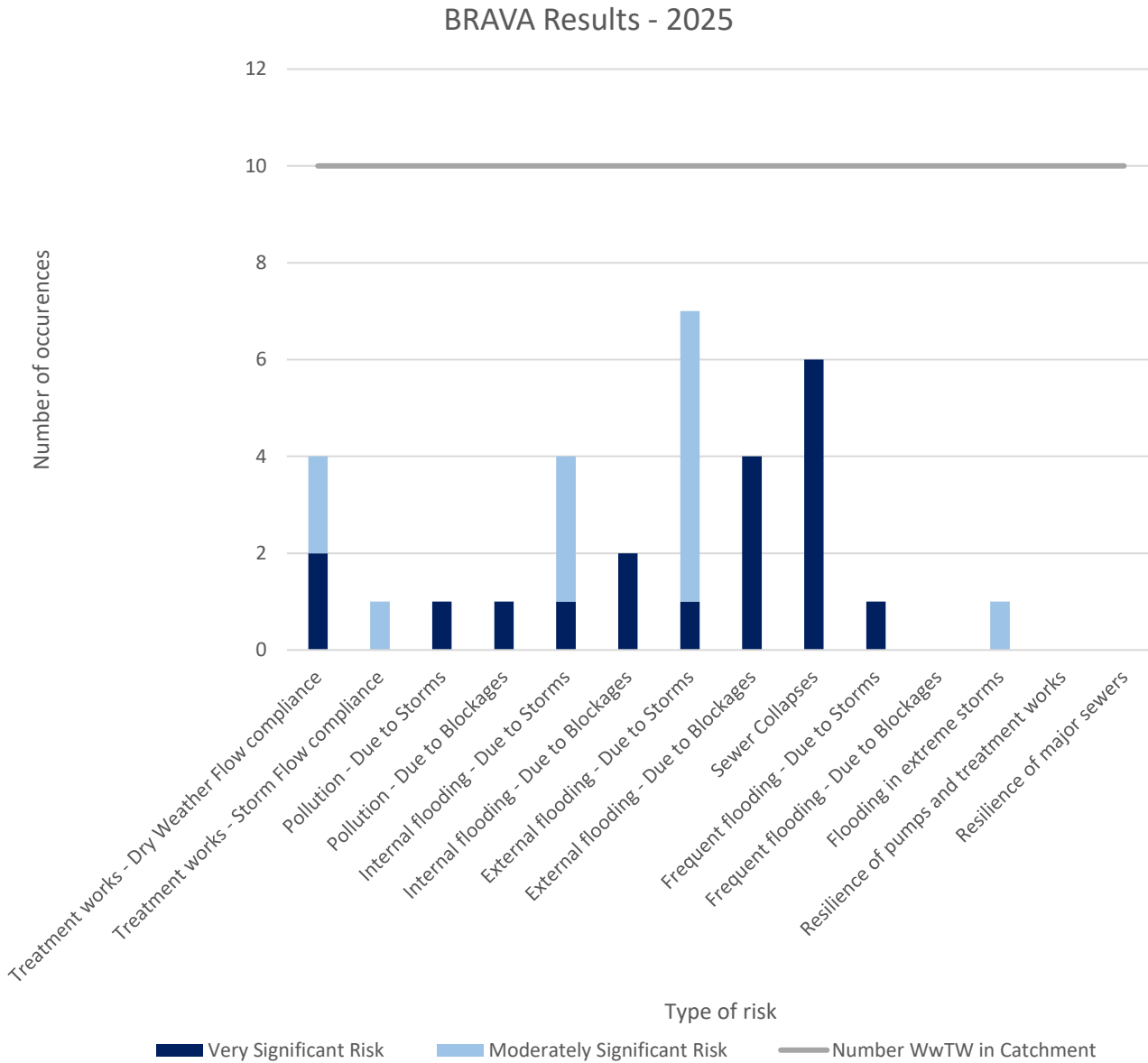
+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

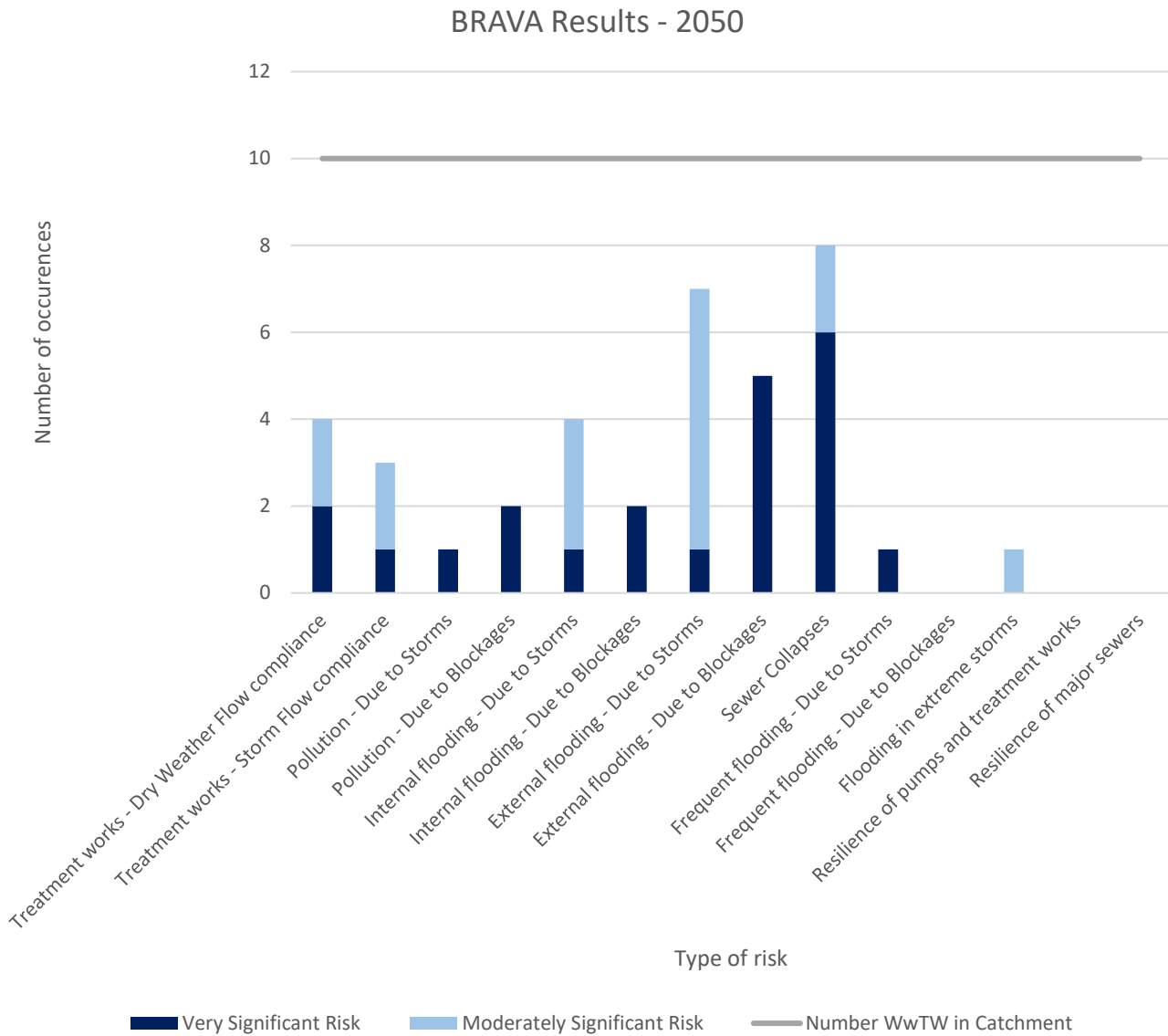
### 3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.



**Figure 4 - BRAVA 2025 Summary**

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

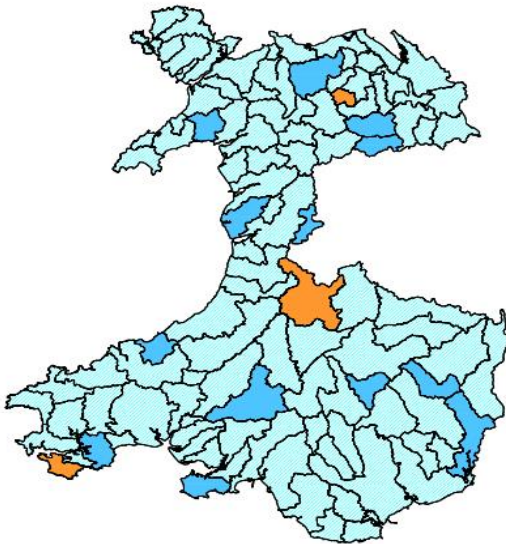
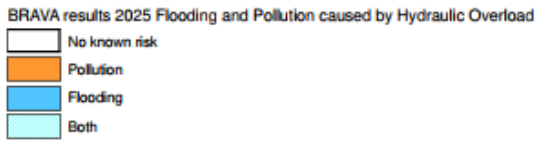


**Figure 5 - BRAVA 2050 Summary**

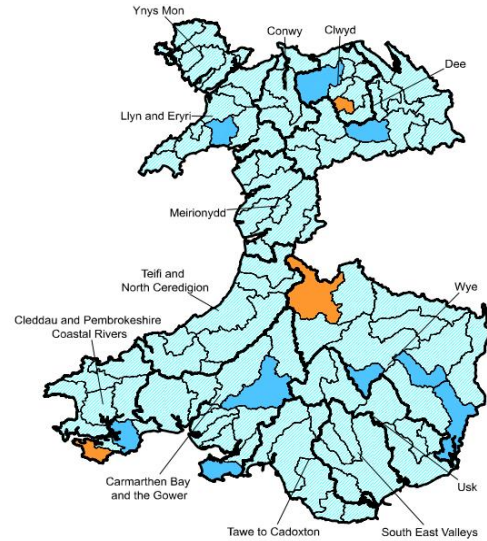
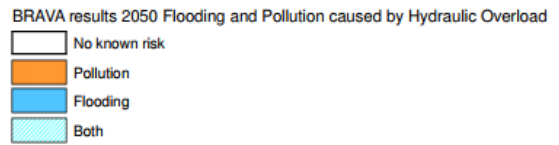
In 2050, external flooding due to storms and sewer collapses are the biggest concern in the Soch catchment.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities 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.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.



**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Soch	1	0	1	0	0

**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Soch	Headroom	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Pass	Close fail
	Wet weather capacity	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Close Pass	Fail
								>90%	70%-80%
								80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Soch catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Aberdaron and Llaniestyn L4 catchments. Further detail is provided in the relevant L4 summaries.

## 5.0 Options

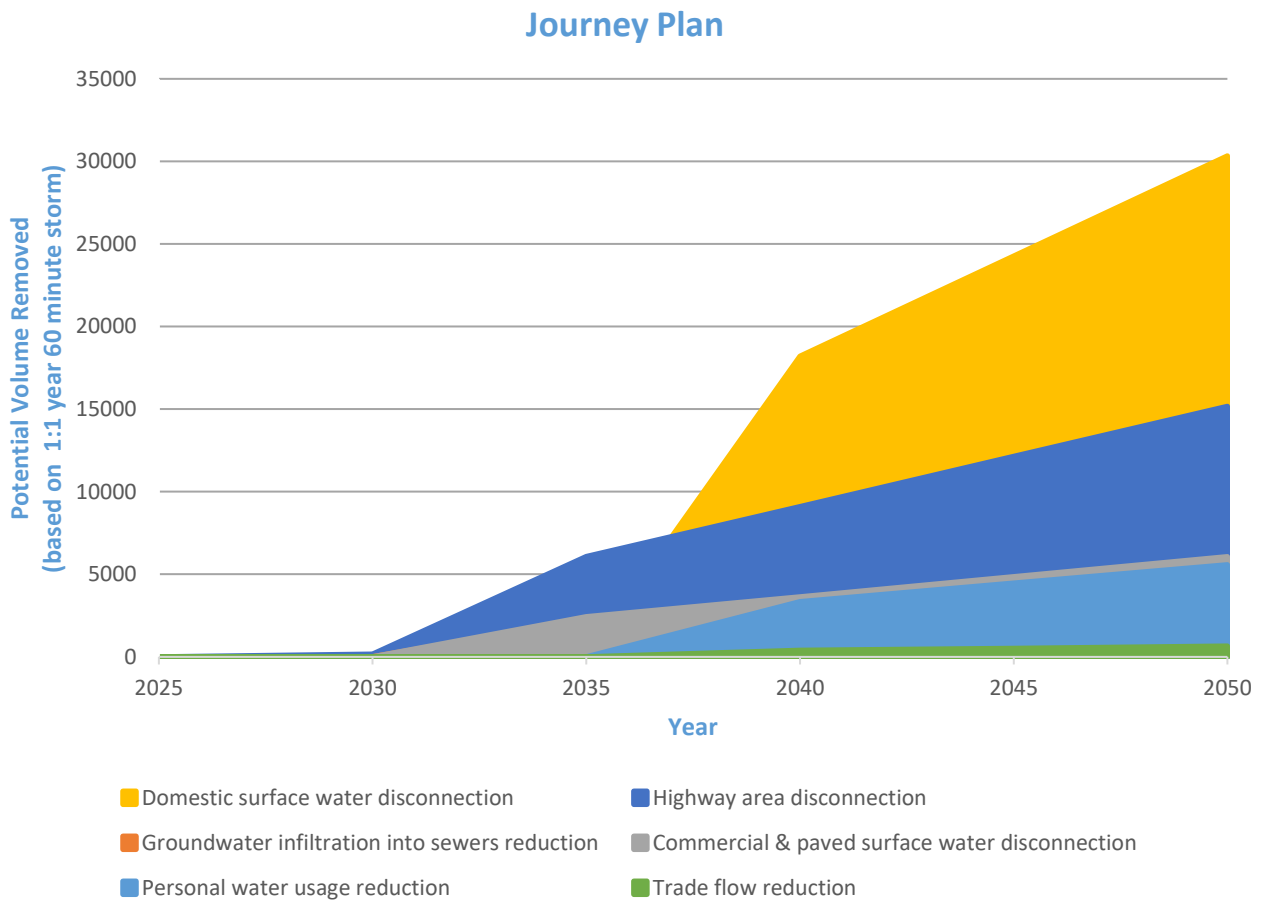
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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 combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£7,000,000.00	£10,000,000.00
40 spills in a typical year	£0.00	£0.00	£0.00
20 spills in a typical year	£4,000,000.00	£3,000,000.00	£4,000,000.00
10 spills in a typical year	£6,000,000.00	£6,000,000.00	£6,000,000.00
0 spills in a typical year	£9,000,000.00	£9,000,000.00	£10,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	7.00	8.00	8.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£2,600,000.00	£3,100,000.00	£3,700,000.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£4,800,000.00	£5,700,000.00	£8,200,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£7,400,000.00</b>	<b>£8,800,000.00</b>	<b>£11,900,000.00</b>

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We will continue to work with the 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.

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**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
BOTWNNOG	0
COED Y FRON	0
SARN	0
BRYNCROES	0
LLANIESTYN	0
Y RHIW STW	0
MYNYTHO	0
SARN MEYLLTEYRN	0
ABERDARON STW	0
ABERSOCH	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
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Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.



## Un-named near Soch catchment

### 1.0 Introduction

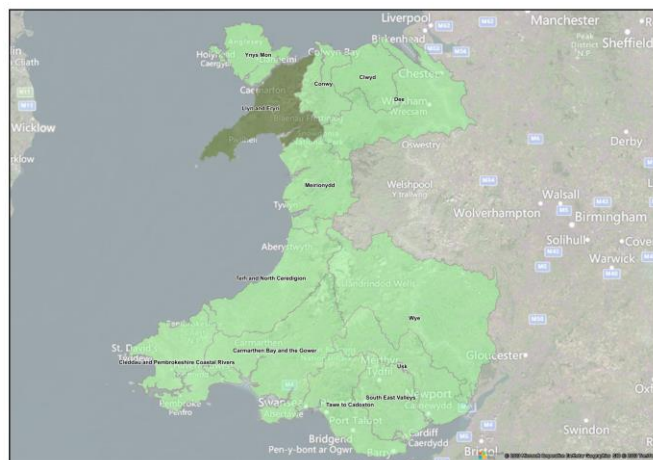
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### 1.1 Catchment Information

The Un-named near Soch catchment planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

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

This planning catchment consists of 3 wastewater catchments (see Figure 2). There is a combined population of 3462, this is set to decrease to 2900 by 2050, a change of -17%. There is a total sewer length of 37km, with a foul sewer length of 7km, a surface water length of 2.25km and a combined sewer length of 25km. There are 3 Wastewater Treatment Works (WwTW), 8 Sewerage Pumping Stations (SPSs), and 15 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

### Stakeholder Engagement Opportunities

Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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 which are within our operating region, 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. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found [here, Impact of Urban Creep on Sewerage Systems](#). Climate change is predicted to increase the intensity of storms by around 35% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). 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 Un-named near Soch catchment region is set to decrease to 2900 by 2050, a change of -17% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, including Nefyn - Stad Ddiwydiannol Nefyn and land adjacent to Helyg

The core management plan for the Llyn and Eryri provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here:

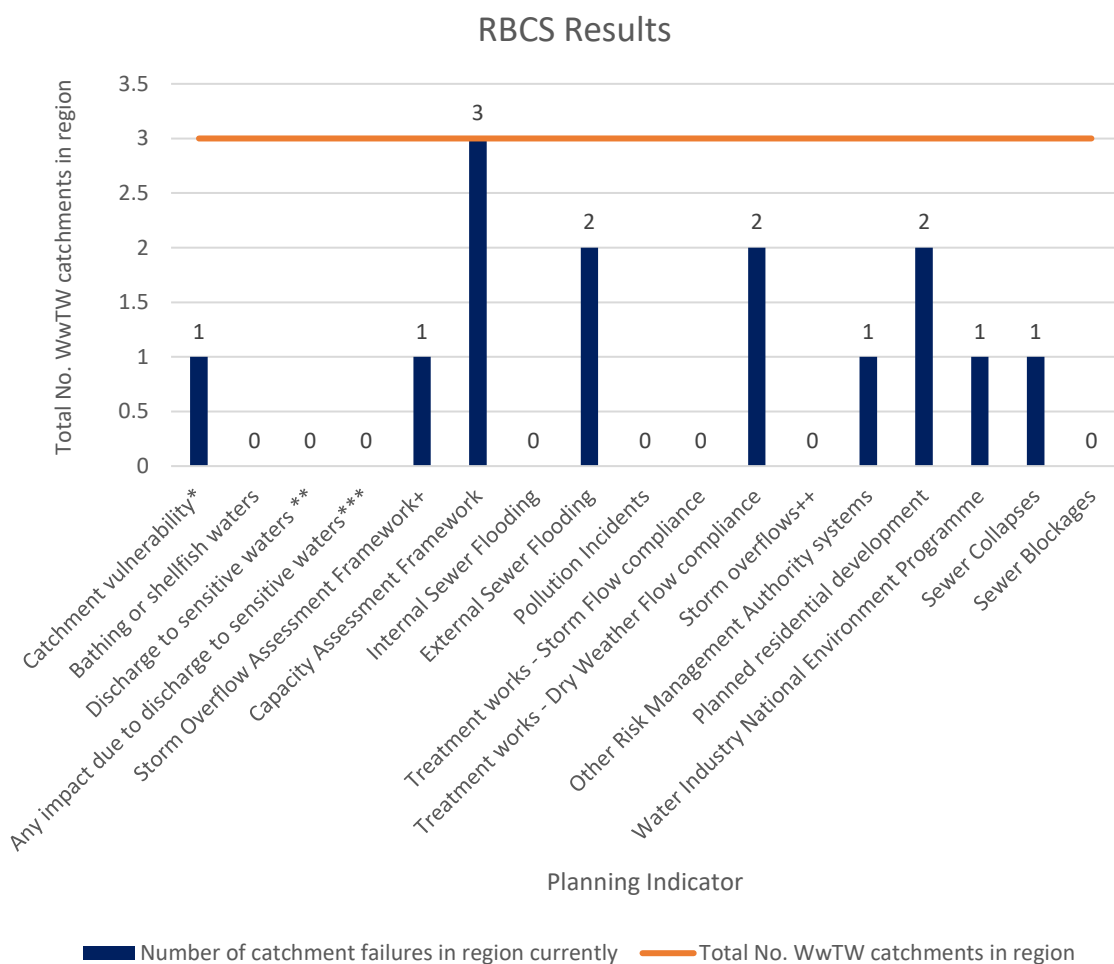
#### [Core Management Plan](#)

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

### 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. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For the Un-named near Soch catchment the biggest risk indicated by the RBCS is Capacity Assessment Framework.



\*To sewer flooding due to extreme wet weather events.

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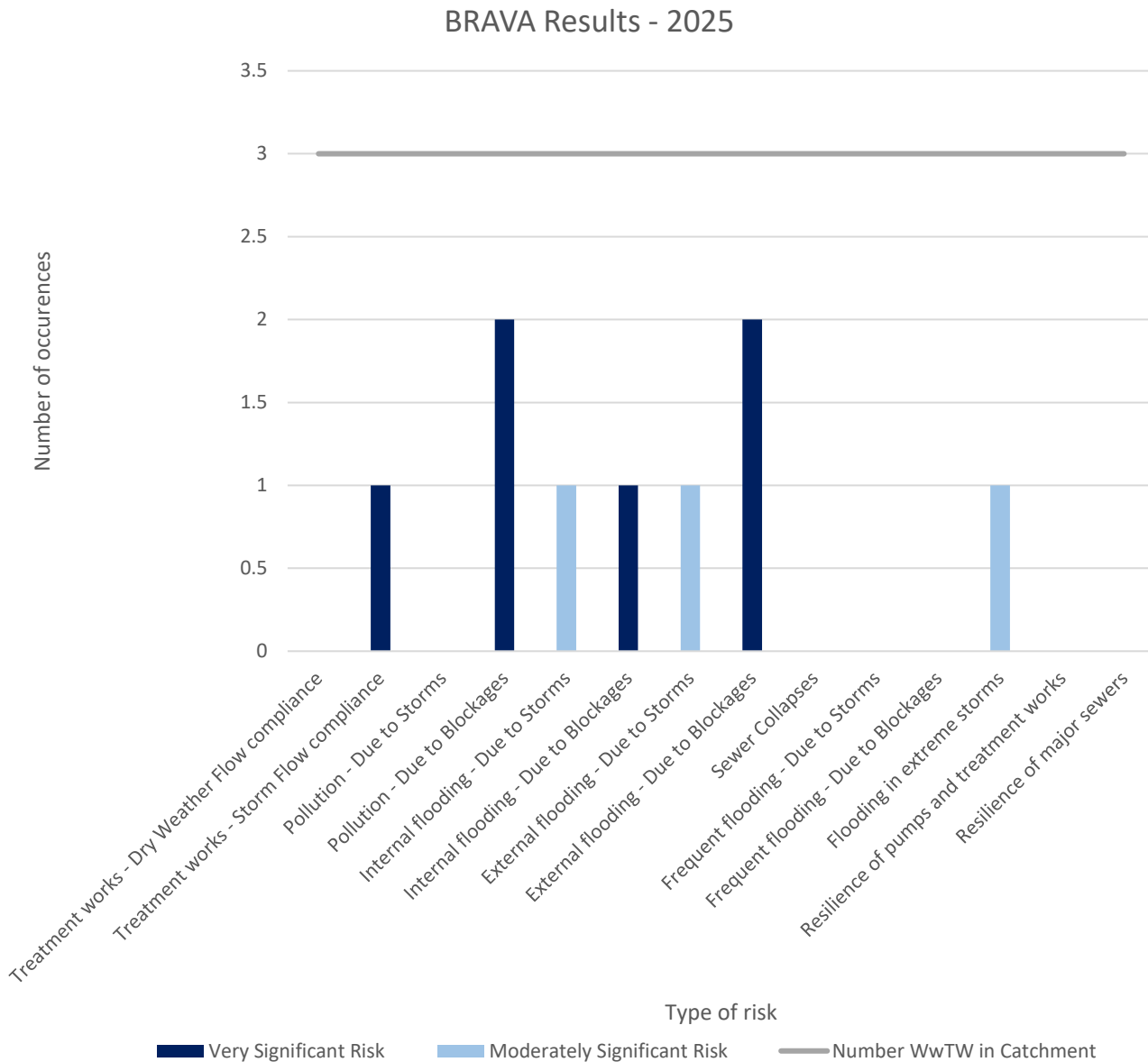
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**Figure 3 - Risk Based Catchment Screening results**

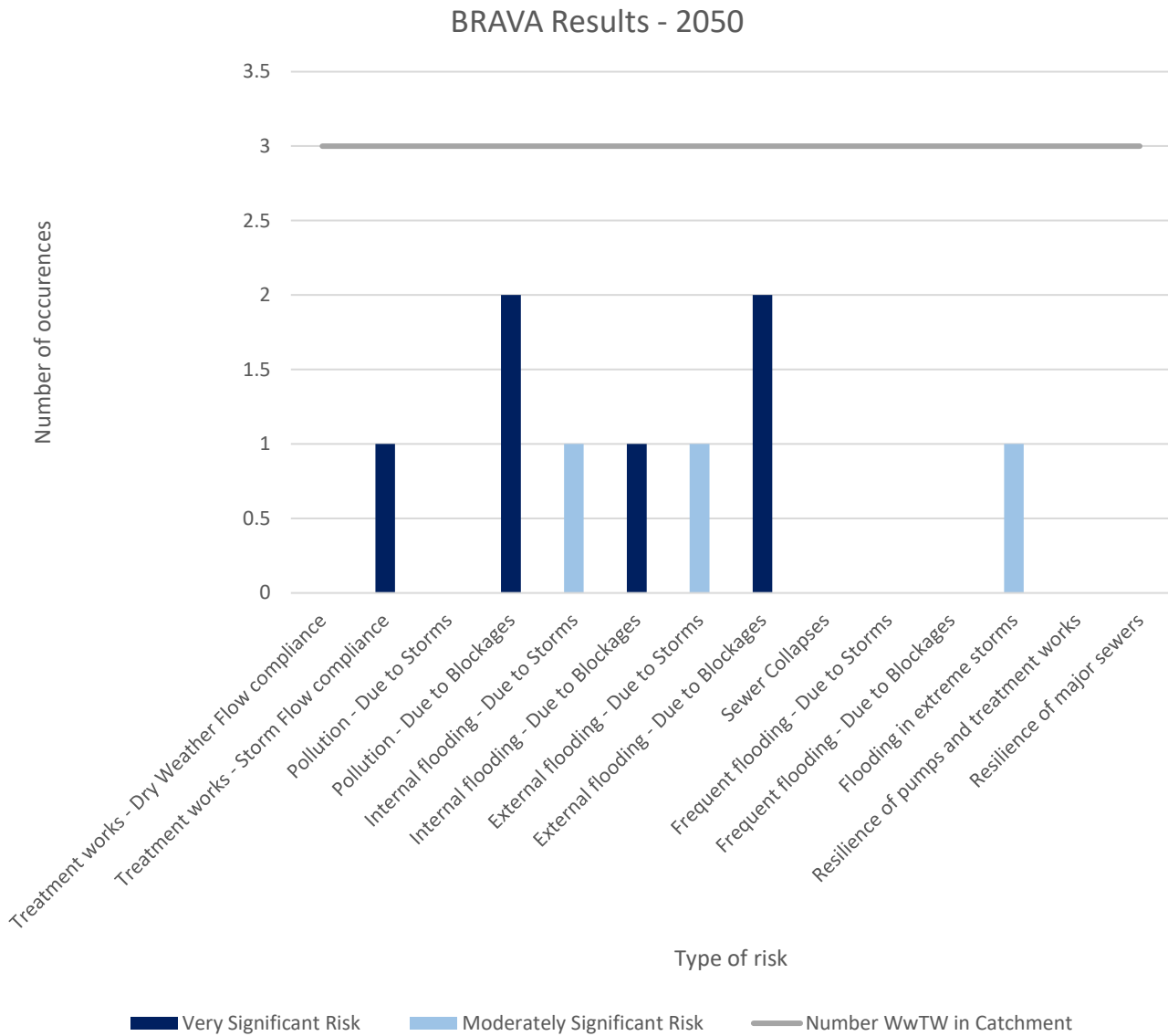
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Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.



**Figure 4 - BRAVA 2025 Summary**

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

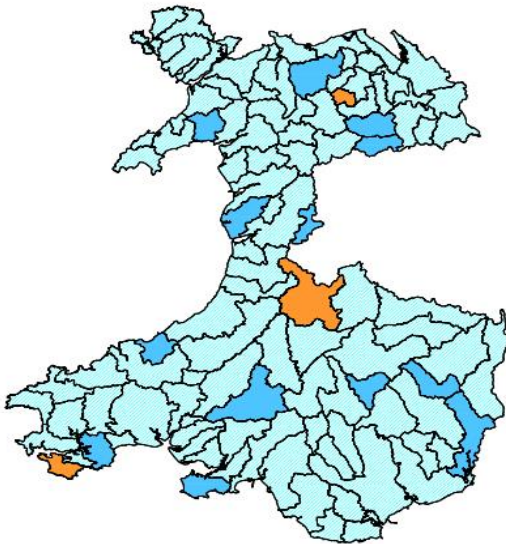
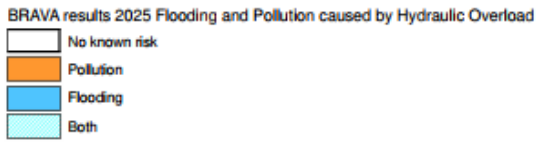


**Figure 5 - BRAVA 2050 Summary**

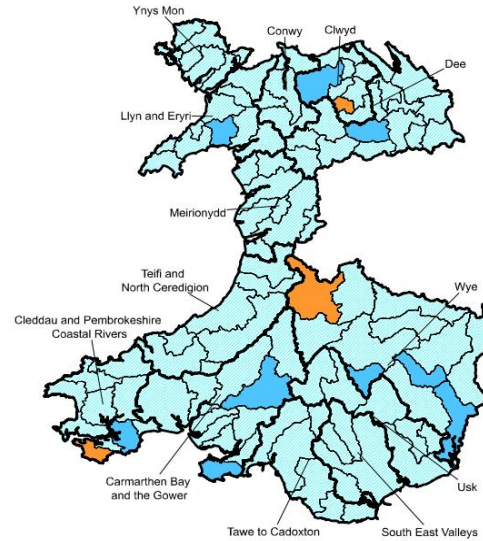
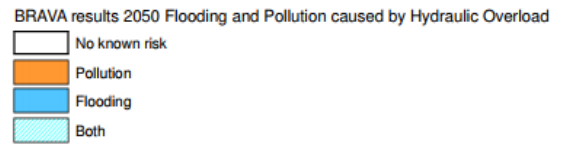
In 2050, external flooding and pollution due to blockages are the biggest risks in the Un-named near Soch catchment catchment.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities 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.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



**Figure 6 - Associated Strategic Planning Area priority (2025)**



**Figure 7 - Associated Strategic Planning Area priority (2050)**

### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Un-named near Soch catchment	2	0	2	0	0

**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Un-named near Soch catchment	Headroom	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Lightest Blue	Pass	Close fail
	Wet weather capacity	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Close Pass	Fail
								>90%	70%-80%
								80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Un-named near Soch catchment catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. There are currently no local issues present in the L4 catchments.

## 5.0 Options

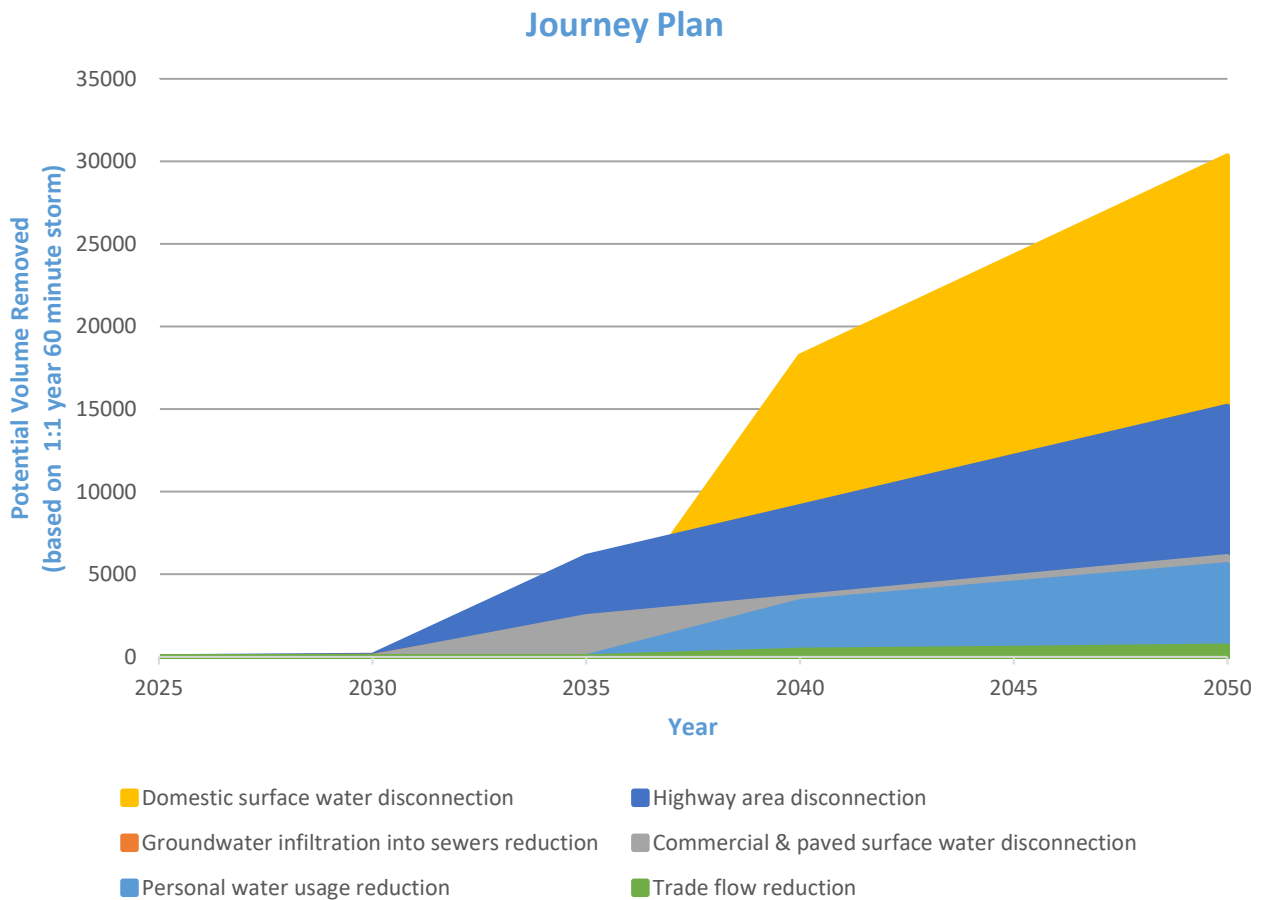
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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 combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£21,000,000.00	£34,000,000.00
40 spills in a typical year	£4,000,000.00	£4,000,000.00	£4,000,000.00
20 spills in a typical year	£9,000,000.00	£8,000,000.00	£10,000,000.00
10 spills in a typical year	£12,000,000.00	£12,000,000.00	£15,000,000.00
0 spills in a typical year	£21,000,000.00	£22,000,000.00	£27,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	54.00	59.00	64.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£1,300,000.00	£1,600,000.00	£2,500,000.00
External escapes in gardens	£2,000,000.00	£2,400,000.00	£3,700,000.00
Escapes in highways	£2,000,000.00	£2,400,000.00	£3,700,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£5,300,000.00</b>	<b>£6,400,000.00</b>	<b>£9,900,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
DINAS (LLEYN PENINSULA)	0
TUDWEILIOG	0
NEFYN NEW SWK	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

# DWMP Strategic Planning Area Summary



## Un-named to Caernarfon Bay South

### 1.0 Introduction

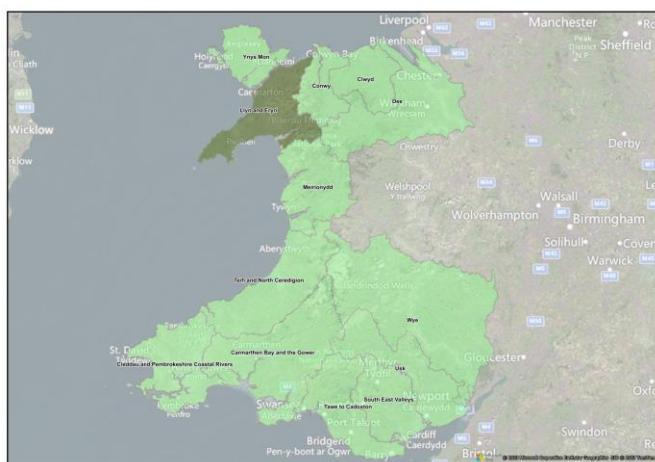
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers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

### 1.1 Catchment Information

The Un-named to Caernarfon Bay South planning catchment lies within the Llyn and Eryri catchment (see Figure 1).

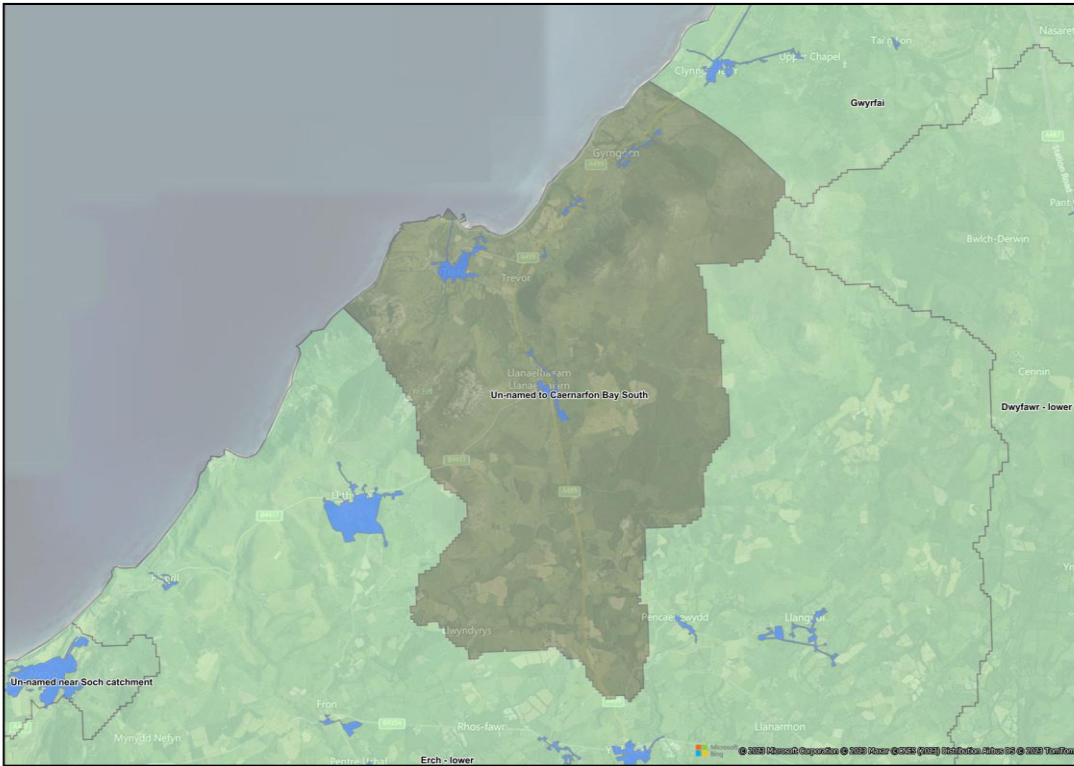
The Un-named to Caernarfon Bay South catchment sits on the northern edge of the Llyn Peninsula. Trefor and Llanaelhaearn are its largest urban areas.

This planning catchment consists of 6 wastewater catchments (see Figure 2). There is a combined population of 1106, this is set to increase to 1100 by 2050, a change of 3%. There is a total sewer length of 8km, with a foul sewer length of 4km, a surface water length of 0km and a combined sewer length of 4km. There are 6 Wastewater Treatment Works (WwTW), 0 Sewerage Pumping Stations (SPSs), and 2 Combined Storm Overflows (CSOs) across this strategic planning area.



**Figure 1 - River basin location detailing the strategic planning area**

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



**Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)**

## 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.

Further information on how we are and will continue to engage with stakeholders can be found in the ‘How have we engaged with customers and stakeholders?’ chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings commenced in 2022. These meetings are being 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 - Stakeholder opportunity partnerships

The ‘Where we want to work with you’ document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

[Drainage Wastewater Management Plan](#)

### 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.

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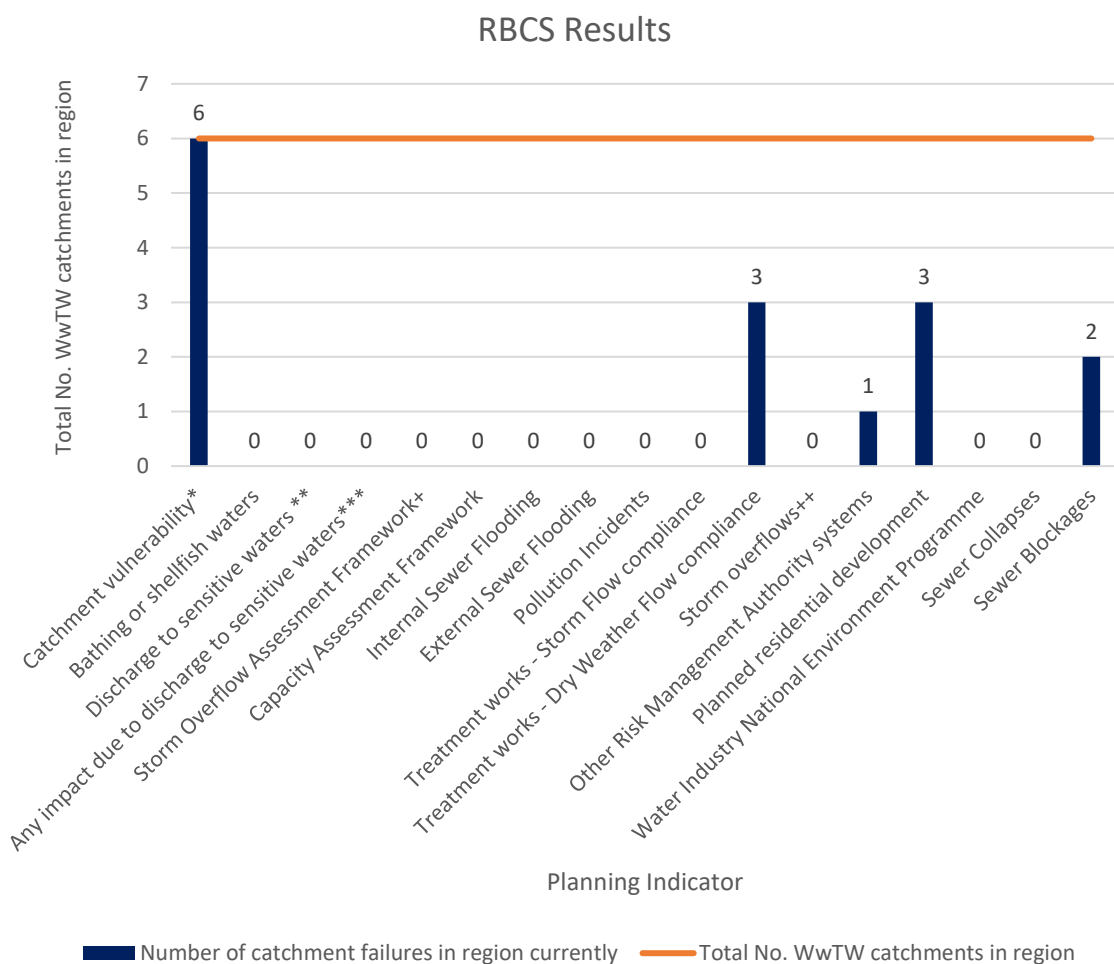
#### [Core Management Plan](#)

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For the Un-named to Caernarfon Bay South catchment the biggest risk indicated by the RBCS is - catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography).



\*To sewer flooding due to extreme wet weather events.

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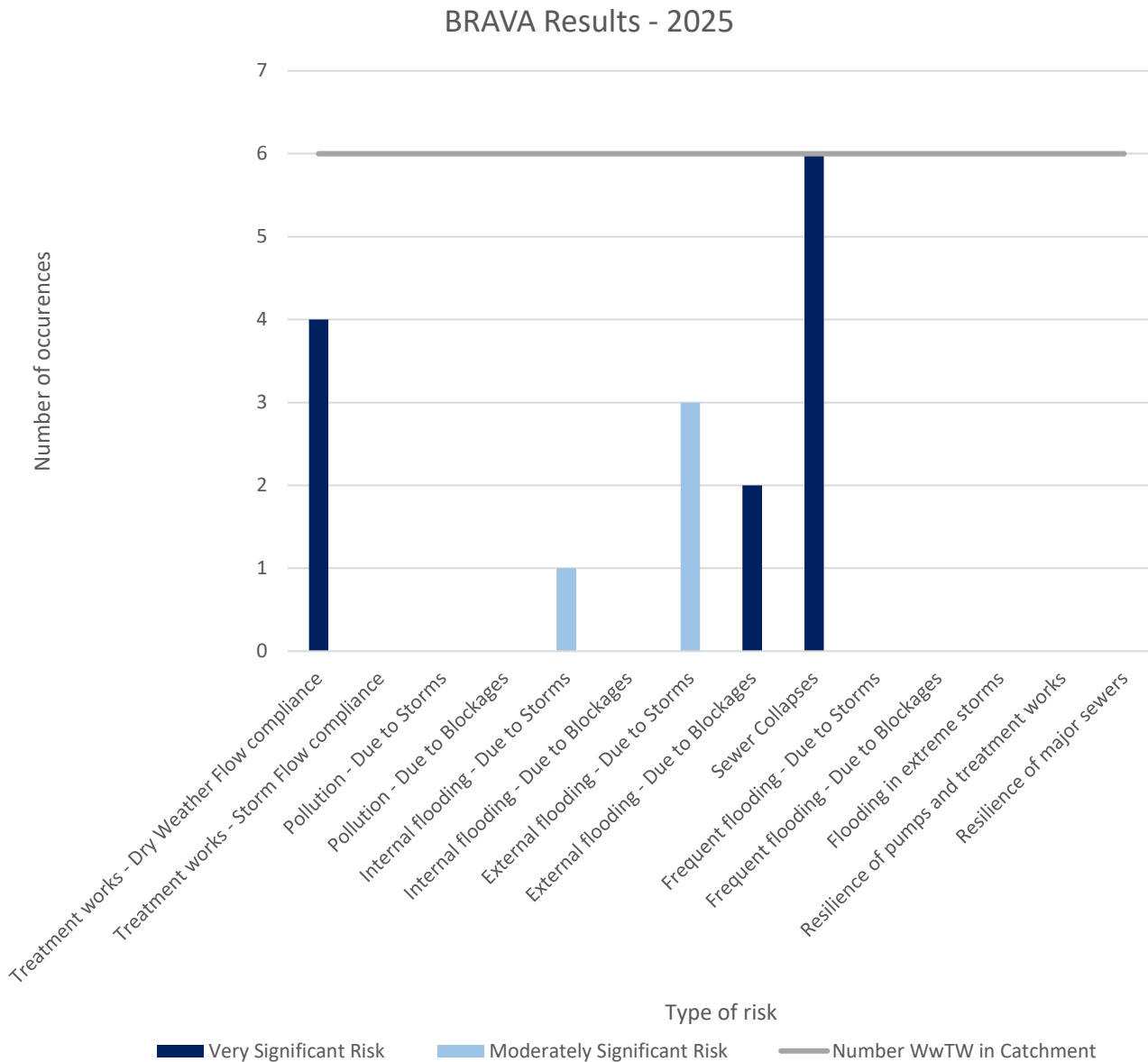
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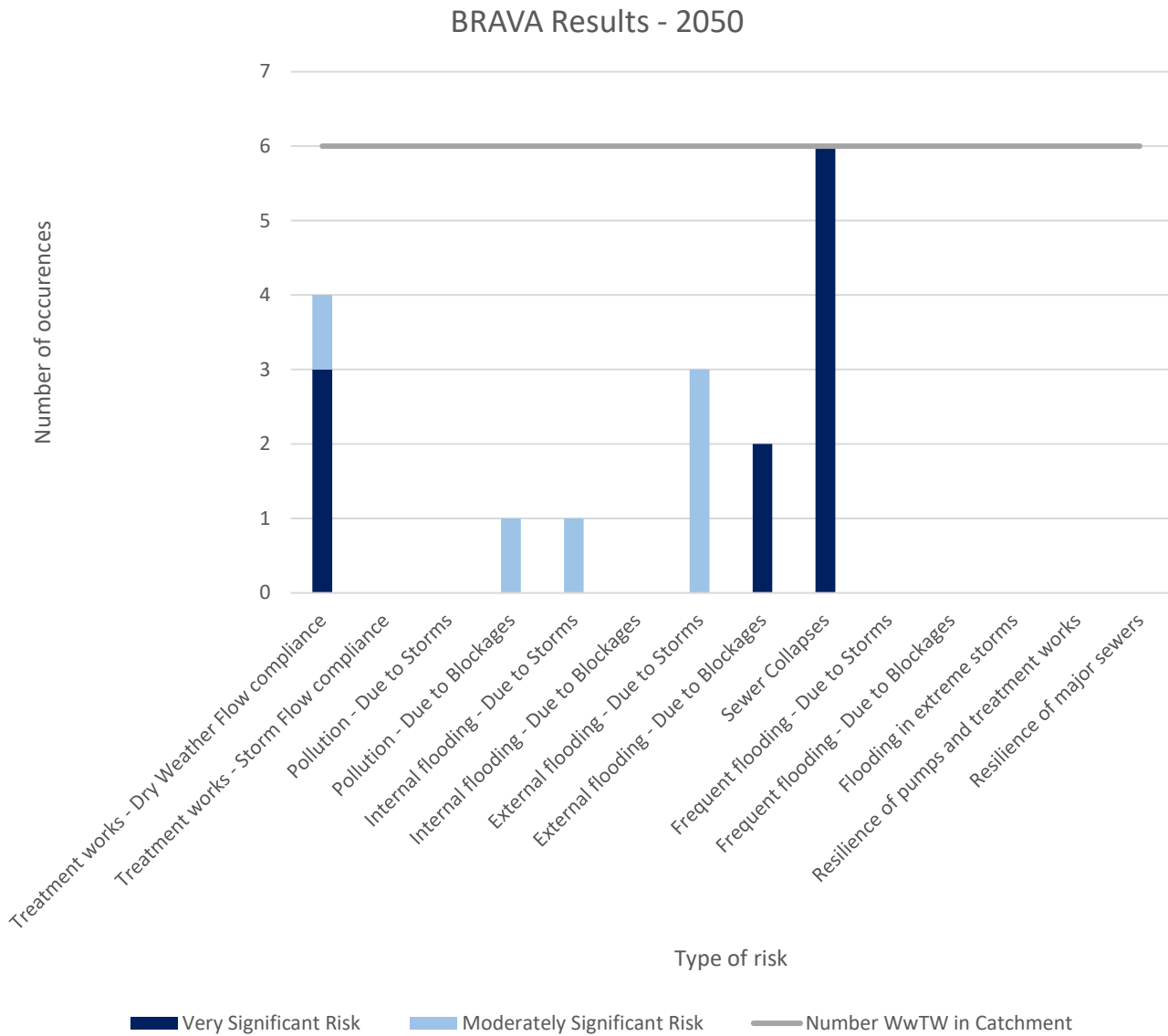
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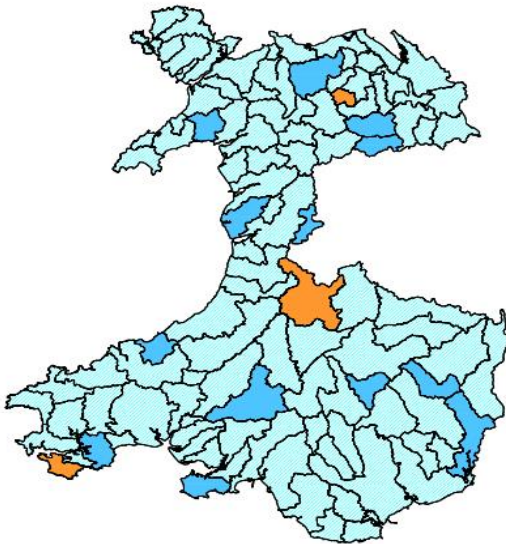
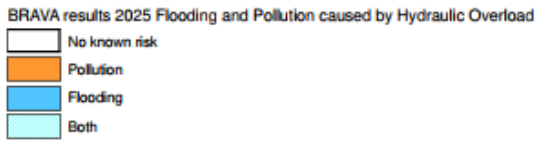


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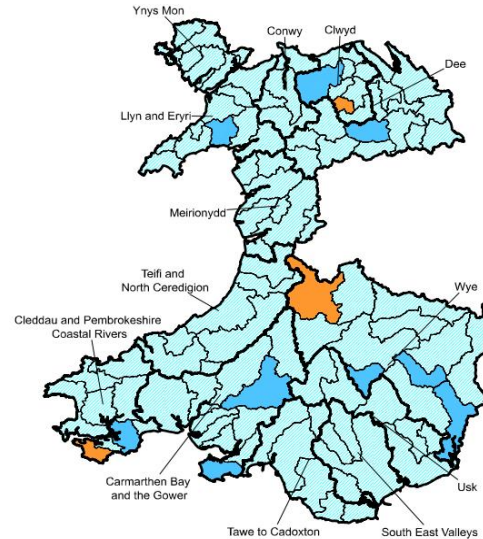
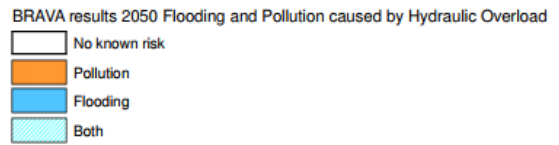
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From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



**Figure 6 - Associated Strategic Planning Area priority (2025)**



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### 3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
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**Table 2 - WFD status'**



## 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 DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
Un-named to Caernarfon Bay South	Headroom	Pass	Pass	Pass	Pass	Pass	Pass	Close Pass	Close fail
	Wet weather capacity	>90%	>90%	>90%	>90%	>90%	>90%	80%-90%	<70%

**Table 3 - Supply Demand Balance**

Table 3 shows that for the Un-named to Caernarfon Bay South catchment the balance between supply and demand currently passes the assessment criteria available, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Llanaelhaearn and Trefor (Gwydir Mawr) L4 catchments. Further detail is provided in the relevant L4 summaries.

## 5.0 Options

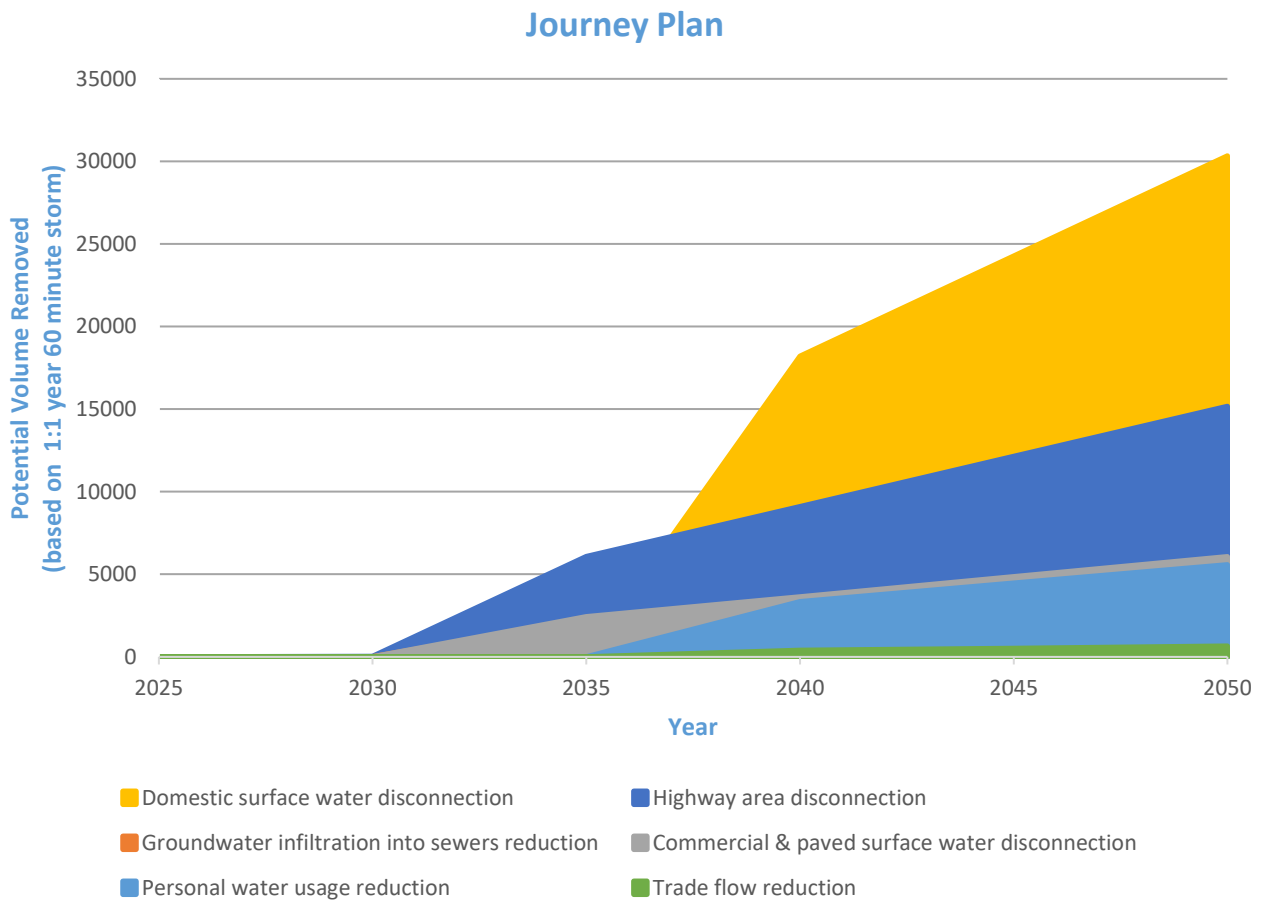
To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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 combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

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 4 - Scheme types**

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. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



**Figure 8 - Journey Plan**

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.

Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£7,000,000.00	£10,000,000.00
40 spills in a typical year	£3,000,000.00	£3,000,000.00	£3,000,000.00
20 spills in a typical year	£3,000,000.00	£3,000,000.00	£3,000,000.00
10 spills in a typical year	£4,000,000.00	£4,000,000.00	£4,000,000.00
0 spills in a typical year	£7,000,000.00	£7,000,000.00	£8,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	29.00	33.00	35.00

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

**Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs**

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£700,000.00	£800,000.00	£1,200,000.00
All other remaining flooding	-	£0.00	£0.00
<b>Total</b>	<b>£700,000.00</b>	<b>£800,000.00</b>	<b>£1,200,000.00</b>

\*Internal escapes - All flooding that results in flooding within a property is stopped

\*External escapes in gardens - All flooding within the curtilage of the property is stopped

\*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

**Table 6 - Summary of Flooding Option Investments Strategy Costs**

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at [DWMP@dwrcymru.com](mailto:DWMP@dwrcymru.com).

We will continue to work with the 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.

## Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

**Table A1 - Number of schemes in L4 catchment within L3 catchment**

L4 Catchments	No. Schemes
TREFOR (GWYDIR MAWR)	0
TREFOR NORTH-WEST	0
SEA VIEW COTTAGES	0
TYDDYN HYWEL	0
GYRN GOCH	0
LLANAELHAEARN	0

## Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WWTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit



WwTW DWF compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.