DRAINAGE & WASTEWATER MANAGEMENT PLAN

Dŵr Cymru Welsh Water

Drainage and Wastewater Management Plan

2024 – Technical Summary

Draft – July 2022

IN PARTNERSHIP WITH

rps ATKINS Member of the SNC-Lavalin Group wsp

PREFACE

We have completed our first DWMP. This Draft DWMP is being published as a consultation. We welcome your comments on what we have produced and your opinion on how we intend to prepare future DWMP's. We are particularly interested in your thoughts with regards to our approach to customer and environmental priorities and how those priorities are to be used in the production of future plans.

This plan is different to other plans we prepare as it tries to answer, not only how to remain compliant with our operating licence, but also tries to prepare the company for the future challenges in society.

One of these is the legacy of combined sewers, which are reliant on storm overflows to prevent localised customer flooding. We need to transition to separate foul and surface water sewers to reduce the need for storm overflows where possible, whilst maintaining our performance. The environmental benefit of achieving this separation over time is to reduce nutrients such as phosphates and nitrates which we as customers use entering the water courses. This is a major driver going forward to achieve high standards in our rivers and oceans to meet the water framework directive.

We need to set out the complexity of the drainage issues across our operating area. Our combined sewers often accept inflows of surface water from roads, car parks, building roofs and even land drainage, which we do not own or control. We need to work closely with other stakeholders, and need their ongoing support, to gather the evidence and deliver the right long-term solutions to these challenges.

Our DWMP shows that the costs of making this transition will be significant. The DWMP provides an evidence base to begin discussion with Welsh Government and our regulators on the pace of change that they expect to see. It goes beyond the current focus on storm overflows, influencing long-term integrated drainage priorities for Wales and the border areas of England within which we operate.

We recognise that stakeholders are looking towards us to re-address storm overflows and minimise their use. Our preferred approach considers how to make widespread improvements at an affordable rate for our customers. We have estimated that to remove storm overflows and customer flooding would cost between £9 billion and £27 billion. This quantum, when considered as a bill increase, is not tenable and unlikely to be acceptable to our customers. Ultimately, the pace of the improvements we can make will be heavily dictated by the scale of water and sewerage bills that our customers can afford to pay.

As part of developing our first DWMP we have followed the national DWMP Framework but have also developed our own innovative approaches to planning, which allow choices to be made in terms of what needs to be achieved in the short term, and then creating a pathway for each local area to maintain progress to that destination.

It builds on principles developed by all companies for water and sewerage planning to gain a holistic catchment approach to finding risks, developing options to resolve those risks, and providing an indicative timeline of when that risk may materialise and when the solution will need to be resolved.

The Plan and the regional summaries lay out the types of risks that we are facing, the strategic option types that are needed in each location to address those risks and a high-level cost to get to improved performance in our wastewater systems.

This is a consultation to discuss the approach we have taken, the pace of change that is realistic and how we can integrate our approach with other stakeholders to deliver the best solutions for customers and the environment. We have identified several different investment scenarios to get us to our long-term destination in systematic affordable steps. We would like your opinion on which approach to take for our next cycle. The plan and the regional summaries, which support it, lay out the types of risks that we are facing, the strategic option types that are needed in each location to address those risks and a high-level cost to get to a future improvement.

Alongside the Plan, we have also undertaken a Strategic Environmental Assessment (SEA) and Habitats Regulations Assessment (HRA) of the options developed so far. These documents are also being published for consultation.

All consultations will be assessed via the main consultation forum of the virtual room.

The consultation is a significant milestone in considering how we should deal with long term sewerage and drainage planning and we welcome your views and comments.

The consultation will run for 10 weeks, starting on 27th July 2022 and closing at midnight on 7th of October 2022.

Please respond to the consultation using one of the routes below.

Using the virtual room and consultation feedback questionnaire

Via an email to our mailbox at the DWMP@dwrcymru.com

And finally, via a printed response to our head office

Mr Steve Wilson
Dŵr Cymru Welsh Water
DWMP Consultation
Linea
Fortran Road
St Mellons
Cardiff
CF3 0LT

We would recommend the virtual room as the simplest route to viewing the consultation material.

Contents

Table of Figures

List of Tables

1 Overview

This document represents the Technical Summary of the first draft Drainage and Wastewater Management Plan (DWMP) prepared by Dŵr Cymru Welsh Water (DCWW). This plan combines previous methods of sewerage planning with the latest government guidance and outlines our long-term options to respond to the socioeconomic and environmental challenges of population growth, urban creep, and climate change

1.1 How to use these documents

This Technical Summary follows the structure of the Main Plan and of the Non-Technical Summary document. It introduces the approaches taken in developing the plan and the initial outputs from this first cycle.

We recommend that you read this document as an introduction to the technical documentation.

The DWMP is a framework for developing a shared vision for environmental water quality, drainage, and wastewater management. The DWMP is a long-term planning study, driven by the water company, which looks at the investment required in our wastewater system over the next 25-years, for the benefit of the environment and customers.

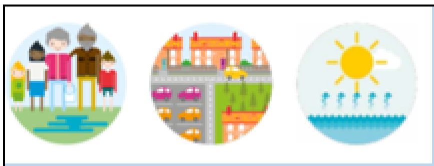
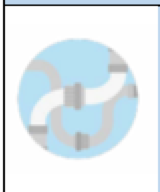
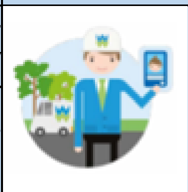
	This is a customer driven plan that will set out how we intend to manage future challenges brought about by population growth, urban creep and climate change
 It will set out how we intend to extend, improve and maintain drainage and wastewater systems across Wales and the areas of England that we serve.	 It plans for the Long-term, setting out targets that are appropriate to the risks we face, but for a minimum period of 25 years that covers both England and Wales.
 It is a best practice approach-built on processes already established such as Water Resources Management Plans and Sustainable Drainage Plans.	 It demonstrates greater transparency, robustness and line of sight to investment decisions that affect our customers.
Developing this plan will help us work towards our Welsh Water 2050 vision to "earn the trust of our customers every day" and to achieve our mission of becoming "a truly world-class, resilient and sustainable service for the benefit of future generations".	

Figure 1-1 – What is a DWMP?

This first, non-statutory version of the DWMP is referred to as 'Cycle 1'. Whilst our approach has built upon our previous sewerage planning methodology (the Sustainable Drainage Plan) and has been developed in line with the national DWMP Framework (WaterUK, 2018), some elements of the DWMP process (such as how to develop integrated plans with local authorities) are still being established. We are undertaking a series of trials to support this evolution of our plan, which will ensure that it offers greater value to stakeholders in future cycles.

1.2 Services covered by the plan

Our sewerage network performs the critical public health function of protecting customers by transporting the sewage away from their homes and places of work to a point where it can be treated and returned to our rivers and the sea safely. In our towns and cities, the responsibility for most of this sewerage infrastructure falls to Welsh Water. Across our operating area we are responsible for around 36,000km of sewer.

In many parts of that operating area, this sewerage infrastructure originates from the Victorian era, where sewage and rainwater (from roofs, yards and often roads) are carried in the same pipe, known as a combined sewer. Such an approach relies on overflows from these sewers into the environment, as a means of protecting customers from sewer flooding during heavy rainfall. We have inherited over 2,000 of these overflows, which continue to serve the role they were designed for in reducing flood risk, but their impact on the environment is under increasing scrutiny.

In those combined sewers, surface water, which could safely be discharged to rivers and streams, is often pumped, and then treated before it can be returned to the environment – increasing the sizes of pipes needed to carry the flows and the capacity of our treatment works too. This approach, which was right for that time in history, is now perceived as being less acceptable in a 21st Century sewerage system but will require significant investment to address.

On newer, post war developments, the concept of separate foul and surface water sewers was introduced. In most cases, this infrastructure ensures that rainwater is soaked away into the ground or drained to a nearby stream but, occasionally the surface water is also connected into the nearest combined sewer.

The DWMP extends to our wastewater networks (foul, combined, and surface), Wastewater Treatment Works, and the effects on the waters we discharge to, such as rivers, streams, and other watercourses, estuaries, and coastal waters. It also considers the interconnections with private drainage systems, such as inflows from highway drainage, car parks and building drainage and how improvements to the performance of our sewers and treatment works may also be dependent on changes to those inflows.

As a result, we have developed a plan that considers our own wastewater systems (sewerage), as well as the impact in wet weather from those interconnections with other drainage systems (drainage):

- Sewerage (foul, combined and surface) – how we collect, transport, treat and return it to the environment.
- Drainage – how to manage drainage networks that impact the wastewater system across a geographical area.

1.3 Planning for a secure sustainable service

Whilst the DWMP sets out the scale of our longer-term wastewater investment needs, it also identifies the roles we need Government and Regulators, Stakeholders, communities, and customers to take, to meet our objectives for customers and the environment. Through later cycles of the DWMP, further guidance and growing familiarity with the process are expected to clarify those roles and interactions.

In developing our plan, we have reflected heavily on the Water Resource Management Plan (WRMP) process, which has been in place for over 20 years, to provide additional direction.

The following three stages have been replicated in the DWMP:

1. Pre-consultation and prepare the draft plan
2. Publish the draft plan and carry out a formal consultation
3. Assess consultation responses, revise the draft plan, and after direction from Government, publish a final Plan

The following sections outline the roles of the key players in the development of the plan, the actions required to be carried out and who is required to deliver them to create a joint DWMP.

1.4 The Water Company

It is the water company's responsibility to deliver the plan. The company must complete the following actions:

- Coordinate with other organisations, Government, and Regulators to ensure the plan is developed.
- Prepare a draft plan.
- Undertake Environmental Assessment of the plan outcomes, incorporate the Strategic Environmental Assessment (SEA) in the process and the completion of a Habitats regulation assessment (HRA) where there are possible risks to designated areas and species.
- Communicate the plan to customers, stakeholders, Regulators, and Government.
- Carry out a formal consultation of the plan and the SEA and HRA and address any responses in a formal report named a Statement of Response (SOR).
- Revise the plan based on consultation responses.
- Publish a final plan when Government has given their endorsement in line with Ministerial directions, including the preparation of a Post Adoption SEA statement and review the HRA in an iterative process against the Programme Appraisal.

1.5 Government

Welsh Water are a company that operates "wholly or mainly in Wales". As such, it is the responsibility of the Welsh Government to provide the initial direction to enable the plan to be developed. Such direction is usually provided in a suite of legislation that is yet to be written. They are likely to include Regulations, Directions and Guiding Principles. The first Guiding Principles for Drainage & Wastewater Management Plans (Defra, 2022) was published after much of the first cycle plan had been developed. As a result, there has been limited time to incorporate all the principles that it contains. However, it will be extensively used in the development of Cycle 2.

Before publication of the plan the Welsh Government must also agree that the Water company has addressed issues of national security appropriately within its plan, and then direct the company to publish the final plan, once they are satisfied that it meets any Ministerial direction.

1.6 Regulators

In the context of the first cycle DWMP, the Government have not specified how they will gain assurance that the plan meets the objectives set out within the newly enacted section 94A of the Water Industry Act 1991, and their "Guiding principles for drainage and wastewater management plans". In a WRMP context, the role of advisor to Government would be performed by NRW and the EA but, in the context of the DWMP, NRW and the EA are considered as stakeholders to the plan.

Ofwat, who are appointed by Government as the economic regulator to the water industry, will carry out their economic assessment of the proposals developed in this plan, as part of the 5-yearly price review process for the sector.

1.7 Stakeholders

Stakeholders, including local authorities, Natural Resources Wales and the Environment Agency, will play a significant role in the successful delivery of the DWMP by providing information, attending collaborative meetings and supporting the development of joint programmes of work.

In this first cycle, the level of information gathering from stakeholders and the modelling needed to develop integrated drainage solutions has not been possible within the time available. Despite that, the plan, and especially the regional summaries, highlight the scale of the challenge we must deal with, and the approaches we need to develop to respond to those challenges. However, the DWMP provides a platform from which routine dialogue and increased data sharing can begin. It also offers an opportunity for stakeholders to align the key DWMP outputs with their own long-term strategies.

1.8 How we form and maintain a plan

This first cycle of the DWMP will provide a mechanism to convert our previous methods of wastewater planning (our Sustainable Drainage Plans) to the national approach set out in the DWMP Framework (WaterUK, 2018). To supplement those techniques, we have developed and applied a range of innovative approaches, not previously utilised in wastewater planning. As outlined above, these include approaches that have been developed by the UK water industry for water resource management planning.

The DWMP Water UK framework (WaterUK, 2018) forms the basic structure of the plan.

The plan consists of 5 stages listed below. These are presented in detail in Figure 1-2 and in the following Chapters.

- Stage 1: Setting and reviewing the strategic context and planning areas
- Stage 2: Undertaking and updating risk assessments
- Stage 3: Developing options and carrying out options and environmental appraisal
- Stage 4: Producing a best value programme
- Stage 5: Carrying out a formal consultation on the draft plan and publishing the final plan

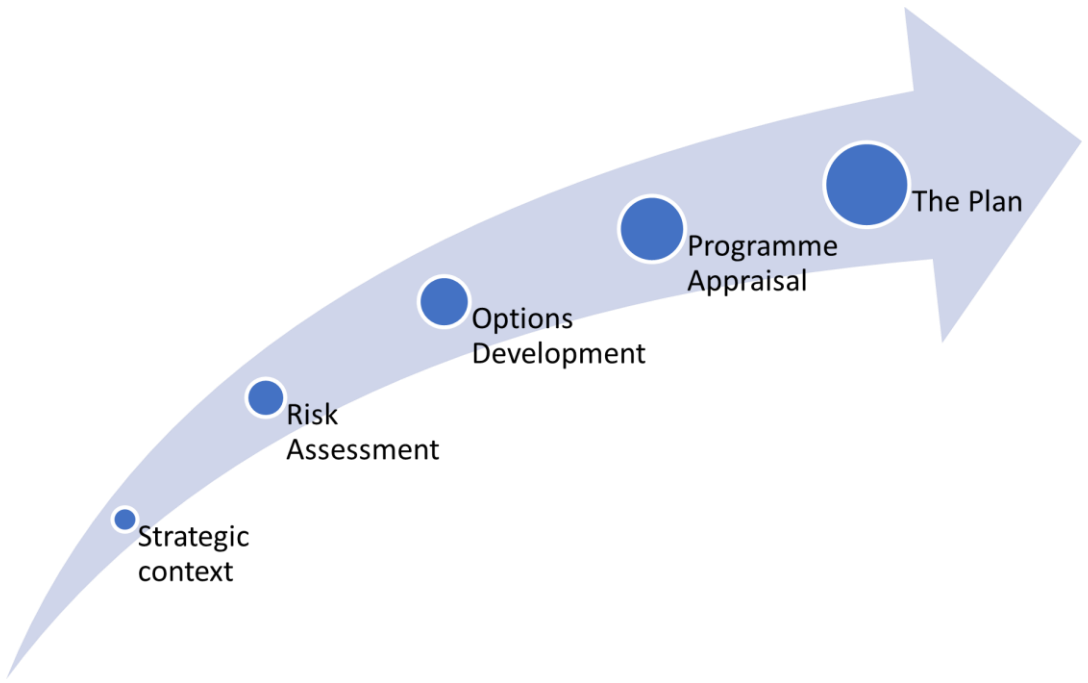


Figure 1-2 – Stages of the plan

1.9 The structure of our plan

This document forms the main plan, developed as part of a suite of documents, which together formulate the first DWMP.

This suite of documents is comprised of:

- **The Main Plan** – A technical appraisal of risk, utilising different methodologies to inform and establish local and national best practice. This includes a Strategic option assessment to aid understanding of the scale of the task to manage future pressures, supported by a staged option appraisal methodology. The document also includes programme appraisal methodology to ensure consistency with other long-term planning in the water industry and examples that highlight how we propose to undertake this detailed assessment in the second DWMP cycle.
- **The Technical Summary** (this document) – An executive summary of the main plan including the main points.
- **The Non-Technical Summary** – A Stakeholder facing summary of the key points and messages.
- **The Customer Summary** – A Customer facing summary of the key points and messages.
- **The Area Summaries** – A series of summaries, setting out the proposed regional (L2) and local strategy (L3), risks, options, and preferred options.
- **The Consultation Brochure** – A list of questions that have been drawn up to direct customers and stakeholders to answer specific points aimed at refining our approach in the second plan cycle.
- **Strategic Environmental Assessment** – A formal review of the potential environmental impact of the proposals being promoted by the DWMP, to ensure that the most sustainable options are being promoted.
- **Habitats Regulations Assessment** – A formal review of the potential impact of the DWMP proposals on protected habitats.

2 Strategic Context

The water industry has experience in developing long term management planning for water resources, an approach that has been maturing for over 20 years. Despite that, the industry has not had a similar method for wastewater planning. This is needed to ensure that adequate investment is targeted towards our drainage infrastructure, and to ensure it remains suitable to meet the long-term needs of customers and the environment.

2.1 The potential benefits

The anticipated outcomes and benefits of the DWMP process are summarised in

Figure 2-1 below.

Figure 2-1 – Anticipated DWMP process outcomes

We have adopted the DWMP to achieve the following benefits:

- A collective view of the current and future challenges and actions needed to respond to them.
- Transparency and consistency in planning approach to the production of the DWMP.
- Greater confidence for customers, regulators, and stakeholders through the creation of a 'line of sight' from identification of risks to the investment decisions taken to address them.
- Responsive and flexible plans that can respond to rapid changes such as climate change and population growth.
- Supporting the development of plans for economic growth and resilient communities across Wales.
- A platform for effective engagement with customers and stakeholders.
- A culture of partnership working and co-creation of solutions that will benefit the economy, society, and environment over the long-term.

- Better investment decisions made by unlocking combined funding sources.

2.2 The need for collaboration

DWMPs will only fully realise their potential in delivering a robust and resilient drainage and wastewater service we aspire towards, by working in partnership with key stakeholders at both strategic and local levels.

Areas for collaboration can range from opportunities to help raise awareness with customers and stakeholders, to the introduction of sustainable drainage or natural flood management measures to slow the movement of surface water. By working in synergy with our key stakeholders, interest groups, communities, and our customers, the DWMPs will complement and integrate with other existing plans and strategies that manage drainage and environmental water quality, as shown in Figure 2-2below.

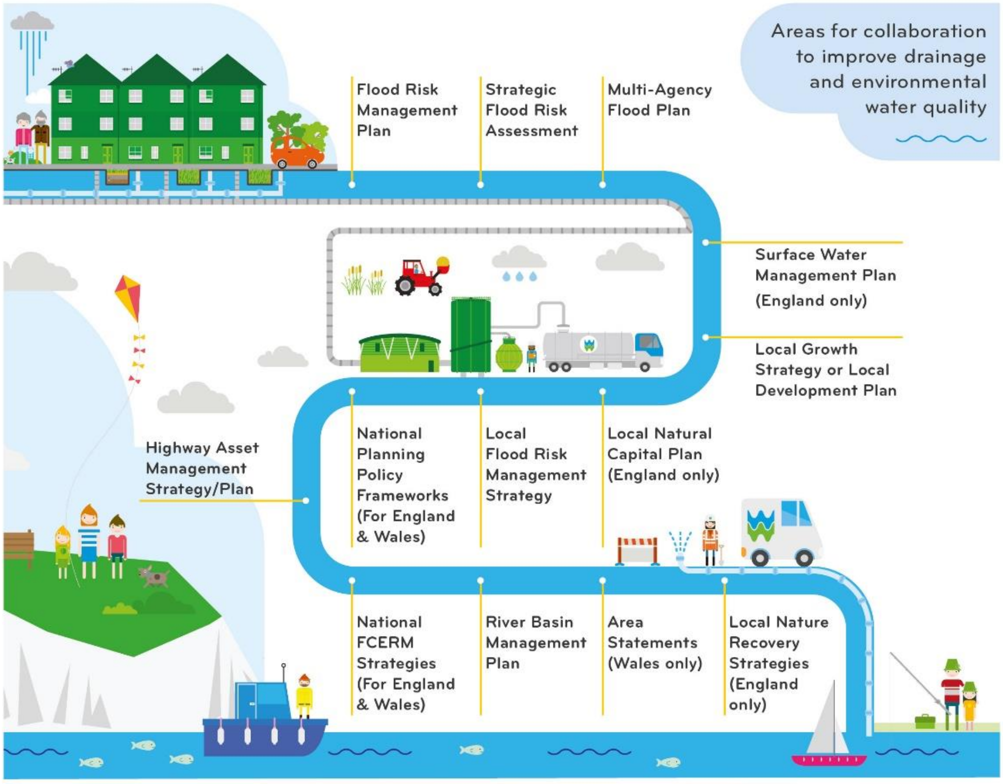


Figure 2-2 – DWMP integration with existing plans

2.3 Future requirements

This first cycle of the DWMP is not a legal requirement. However, Welsh Water, together with the other UK water and sewerage companies, has committed to prepare a plan in readiness for this planning approach becoming a statutory requirement. We are keen to develop our approach to the DWMP in this and the next cycle of the DWMP and would like to hear the views of customers and stakeholders as part of our consultation, and beyond. This will help us to ensure that the plan provides a valuable output, which adequately supports the plans and strategies of other organisations.

Despite the non-statutory status of this plan, the Welsh Government is the devolved Government for Wales and has powers to manage the environment. The Welsh Minister will direct DCWW to publish this plan in 2023, and give us our direction, once the future statutory requirements are introduced.

2.4 Emerging trends and challenges

The nature of the environment in which we operate presents future uncertainties that are likely to have a significant impact on our service provision. We have considered these future trends, and the likely impact on our services, in our long-term business planning framework: Welsh Water 2050 (DCWW, 2018). The future trends are summarised in Figure 2-3 below. It is essential that the DWMP considers how long-term wastewater planning can help mitigate these challenges.

Changing climate patterns The increasing frequency and severity of extreme weather events such as drought and flooding	**Emerging and persistent contaminants** Continuing to find solutions to legacy contaminants such as microplastics and pharmaceutical compounds. This includes issues with recycling of biosolids/sludge recycling, micropollutants, nitrate vulnerable zone designations and potential associated changes in regulations.
Decarbonisation and sustainable business practices The resource cost and trade-offs linked to implementing the necessary move towards net zero carbon to achieve 2050 target, as well as the need for energy efficiency in operations, circular economy practices, and sustainable supply chains.	**Increasing customer and stakeholder expectations** Keeping up with accelerating customer expectations around service levels and technology, while ensuring we retain customer and stakeholder trust against a background of increasing environmental concerns such as carbon net zero, water quality impacted by phosphate levels and CSO discharges, recycling of bioresources, and the other concerns of stakeholders and pressure groups.
Price caps, affordability and potential trade-offs The constraints of balancing affordability concerns for customers, price caps imposed by regulators limiting necessary investment, and the need to invest in initiatives such as improving infrastructure and environmental protection.	**Legacy Infrastructure** Considering the set of risks posed by physical, biological and chemical degradation of infrastructure and/or lack of capacity in design of legacy infrastructure. Also considering the risks posed by ageing digital infrastructure.
Regulatory changes The UK Environment Act (2021), and several other regulatory changes which will become law in a post-Brexit Wales by 2025, are likely to bring tighter environmental standards, driving significantly increased monitoring and investment costs.	**Environmental responsibility** Managing the impact of our activities on freshwater biodiversity and the important ecosystem services biodiversity brings. Considering the overall environmental responsibility of DCWW in their operations.

 **Drainage and combined sewer overflows (CSOs)** Managing issues of river water quality and pollution, linked to lack of treatment capacity or functionality in drainage systems, exasperated by climate change, whilst facing increasing public pressure and expectations to resolve such issues.	 **Demographic and behaviour changes** The growth of homeworking and its implications and preparing for a growing and ageing population.

Figure 2-3 – Future trends influencing the DWMP

Through this analysis of future trends, risks and resilience, Welsh Water 2050 identified three key themes for investment planning:

- That the customer perception of risk has increased, following the recent pandemic, with greater expectation for authorities to do more to prepare for these risks.
- That protecting our service from climate change is a key priority.
- That we need to work collaboratively to ensure we make the best choices for the future of the services we deliver.

2.5 Legislative influences

As a water and sewerage company based “wholly or mainly in Wales” many of the requirements on us originate from Welsh Government legislation and regulation. In addition to those requirements, legislation, regulation, and guidance also sets out the aspiration of government, which we need consider.

One example which this plan takes account of is the Environment (Wales) Act 2016. The Act aims to enable the environment in Wales to be managed in a more ‘proactive, sustainable and joined up way’ and embed Sustainable Management of Natural Resources (SMNR) principles as a core consideration in the decisions made by public authorities. Whilst not yet a mandatory requirement, the nine principles of Adaptability, Scale, Working Together, Engaging with the Public, Evidence, Understanding the Benefits Received from Natural Resources, Long-Term and Prevention are incorporated into our approach to the development of the DWMP.

2.6 Welsh Water policy influences

The DWMP has allowed us to look at the consequences of climate change, growth, and urban creep to estimate how the risk of flooding and pollution will increase over time. To do this we combined our Welsh Water 2050 strategic responses, national planning objectives and feedback from customers and stakeholders into three high level planning themes:

- **Water Quantity** - Reduce the risk of (internal and external) flooding to communities.
- **Water Quality** – Improving water quality for the environment.
- **Resilience & Maintenance** - Adaptiveness to change while maintaining critical services and protecting the environment.

2.7 DWMP Framework

The DWMP framework has been developed through Water UK and builds on the principles outlined in the Drainage Strategy Framework (Ofwat, 2013). We have founded our approach to our first DWMP on the national DWMP framework, published by Water UK (2018), and have integrated elements of Water Resources Management Planning (WRMP) processes from the 2020 Guidance (EA/NRW/OWS, 2020), to address any gaps in the current guidance. The later stages of this document relate to the steps required in the DWMP framework, as show in Figure 2-4, below:

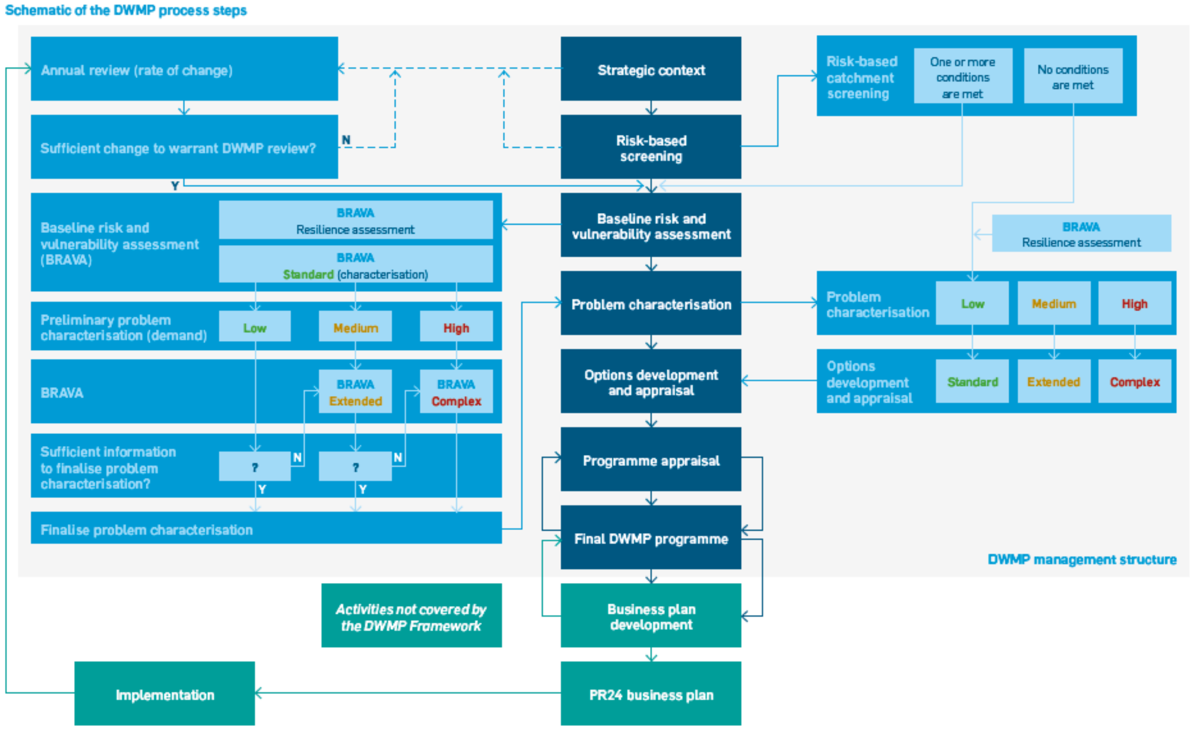


Figure 2-4 – Water UK DWMP Framework

The DWMP framework defines three new levels of planning which direct the granularity of the assessments being undertaken, and the levels at which the outputs of the DWMP will be consulted on and published:

> **Level 3** – the basic **Tactical Planning Unit** will be the wastewater treatment works and its catchment (or aggregations thereof for small catchments, or discrete sub-catchments for larger wastewater treatment works catchments). Companies can opt to disaggregate these level 3 tactical planning units further and designate those smaller areas as Level 4.
>
> **Level 2** – an aggregation of Level 3 units into larger **Strategic Planning Units**. The Level 2 strategic planning areas are used to describe strategic drivers for change, as well as facilitating a more strategic level of planning above the detailed catchment assessments.
>
> **Level 1** – planning at Level 2 and Level 3 to be brought together at an overarching **Water Company Operational Level** to provide a strategic, long-term plan for drainage and wastewater resilience and associated investment over the plan period.

The Water UK DWMP Framework therefore required Welsh Water to define geographical areas which aligned with the definitions of those different plan levels.

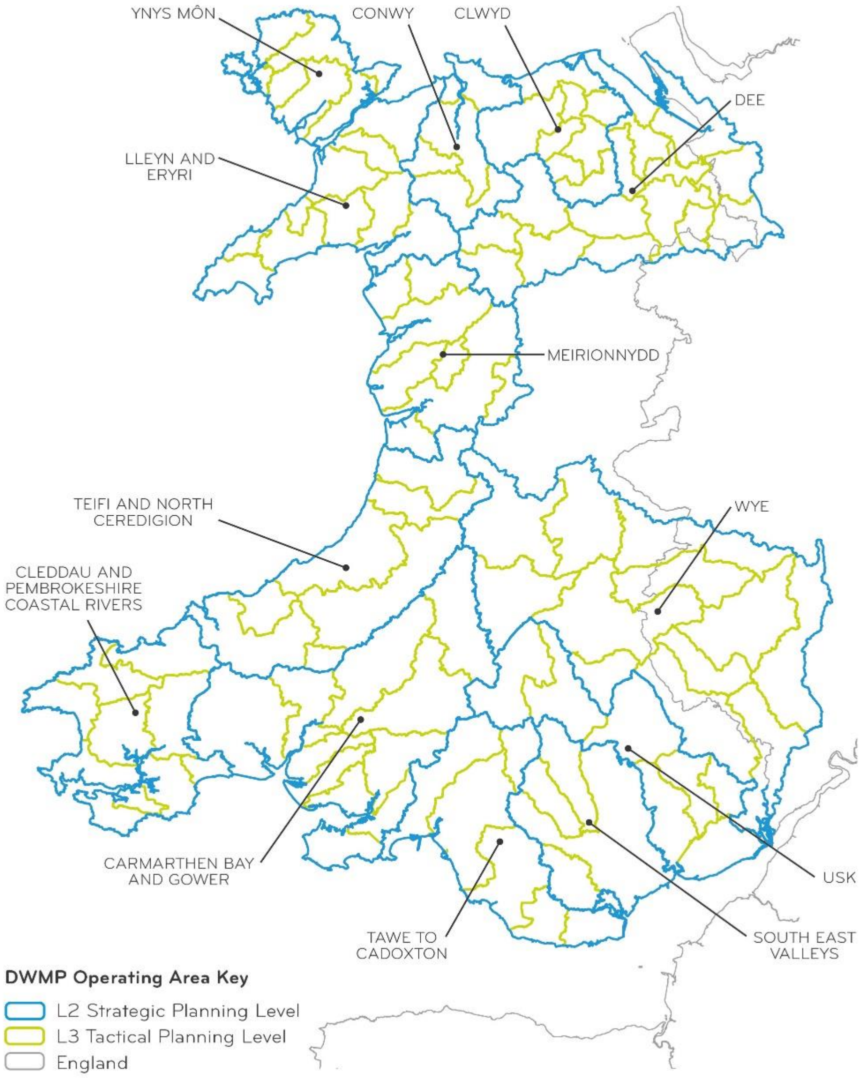


Figure 2-5 DWMP Operational area map

Figure 2-5 shows a map of Welsh Water's supply area, divided by blue border lines into the 13 strategic planning units – also known as 'Level 2' or 'L2' areas, and divided again by green border lines into the 106 Tactical Planning Units – also known as 'Level 3' or 'L3' areas.

The whole of the Welsh Water supply area, including all L2 and L3 areas, is the Company Operational Level - also known as 'Level 1' or 'L1'.

3 Engagement

3.1 Introduction

Engagement with stakeholders and customers is central to achieving our shared vision for the future improvement of environmental water quality and the management of drainage and wastewater.

Initial work with customers involved research groups to determine awareness, expectations, and support around the DWMP management options, and of wastewater services in general. Findings suggested that the DWMP objectives align with our customers' expectations of what Welsh Water should strive to achieve in the longer-term, to deliver the best outcome for the communities we serve and the environment we operate in.

3.2 Methodology

The focus of engagement for the DWMP is to work in collaboration with stakeholders to develop plans and identify the benefits of the DWMP to stakeholders and customers. Key stakeholders were allocated to the Company (Level 1) and Strategic (Level 2) levels of the plan (shown in Figure 2-5) according to their geographic alignment and the level of plan detail they have an interest in.

The engagement objectives that we have derived are to:

- Engage all stakeholders proactively in a manner that meets different needs and expectations.
- Engage early, consistently, and meaningfully with key stakeholders to ensure that their views are understood and properly considered at every stage of the DWMP development process.
- Build a broad public awareness of the scale and complexity of the challenge involved in delivering the DWMP, by outlining the extent of the challenge through accessible material.
- Ensure that all DWMP communications are consistent in terms of style, tone and content to avoid mixed messaging.
- Identify risks early and proactively implement effective actions to minimise or neutralise reputational or programme damage.

3.3 Outputs

Work on Welsh Water's DWMP was piloted in the Clwyd region of north Wales. As such, engagement at a regional level was also piloted in this region. As the Baseline Risk and Vulnerability Assessment (BRAVA) stage developed, the outputs of these catchment risk assessments were used as an introduction to the DWMP for stakeholders, and as an opportunity for stakeholders to provide their own risks or objectives which might align with the DWMP. Through a series of meetings, stakeholders were able to highlight specific areas on a map which they felt might be impacted by growth, flood risk or water quality, for consideration in the DWMP.

The approach to engagement undertaken in Clwyd was to be rolled out across all other parts of the Welsh Water operating area.

DWMP launches were held in Llyn and Eryri, Meirionnydd, Ynys Mon and Conwy and meetings held with several local authorities.

However, in March 2020, social distancing policies were enforced in response to the spread of the COVID-19 virus. The DWMP Engagement Plan was reviewed to comply with Government guidelines and prioritise the safety of staff, stakeholders, and the communities in which we operate. The activities and timings for engagement with key stakeholders were adapted so that the programme could continue to be delivered remotely, without any face-to-face contact. The consequence of these changes, and the associated impact on the work programme, has meant that much of our 1-2-1 regional stakeholder engagement, ahead of the consultation on Cycle 1, has not been possible. However, Table 3-1 sets out the communication activity achieved.

Table 3-1 – Overview of engagement at each stage

Programme	Activities	Engagement purpose	Engagement outcomes
Strategic context	Customer Research	To gain and understanding of customers' awareness and understanding of drainage and wastewater; the level of service that customers expect, and customers' views on DCWW's 25-year plan for drainage and wastewater.	Awareness raising regarding the DWMP. An understanding of customer knowledge of drainage and wastewater and its future challenges. An understanding of customers' expectations for their drainage and wastewater service for the next 25 years
	Emails to L1 and L2 stakeholders Meetings with L1 and L2 stakeholders Presentations to L1 and L2 stakeholders Website	Setting the direction and explaining the purpose of the DWMP and wastewater management, and the important role which stakeholders can play in its development. This will also be an opportunity to begin to understand and identify future trends such as population growth, economy, and climate change.	Awareness raising regarding the DWMP. Confirmation of specific stakeholder contacts within each organisation. Initial understanding of the most engaged stakeholders. Production of Strategic Context Customer Overview document
Risk and issues (Baseline Risk and Vulnerability Assessment – BRAVA)	Joint working meetings and workshops with L1 and L2 stakeholders Presentations to L1 and L2 stakeholders Website	Discussing outputs from the Baseline Risk and Vulnerability Assessment and understanding if/where this aligns with stakeholder plans and policies.	Agreed areas of drainage and wastewater risk, now and in the future. Initial understanding of where and how Welsh Water and stakeholders may be able to work together to solve shared problems. Production of 'Where and How we want to work with you document.
Options	Meetings and workshops with L1 and L2 stakeholders Presentations to L1 and L2 stakeholders	Discussing and characterising the risks and problems previously identified in more detail and defining potential solutions to those problems. Environmental Assessment on the preferred options	Mapping of different drainage and wastewater options. Managing expectations as to the realistic timescales of potential solutions. Understanding of opportunities which will

Programme	Activities	Engagement purpose	Engagement outcomes
			require collaboration and/or co-funding.
Action Plan: (Optimised Plan and Investment)	Presentations to L1 and L2 stakeholders	Review of previous risk and options work undertaken, and how this is to be reflected in the final draft DWMP. Review of DWMP investment solutions and priorities across different DWMP cycles.	Early understanding of overall feedback on the DWMP and progress made. Consensus on investment priorities and how this will be implemented through the DWMP.
Draft DWMP Strategic Environmental Assessment and Habitat Regulations Assessment and Consultation	A 10-week public consultation on the draft DWMP. Open to all stakeholders and the public.	An opportunity to provide formal comment on the plans, including assessment work undertaken and identification of options.	Collation and analysis of formal responses received to the DWMP consultation from all stakeholders. Understanding and reiteration of key issues and concerns from stakeholders regarding drainage and wastewater management.

Figure 3-1 and Figure 3-2 are two examples of outputs from the engagement activity.

The Strategic Context Document was used by the DWMP Planning Team as an introduction to the DWMP timelines and objectives.

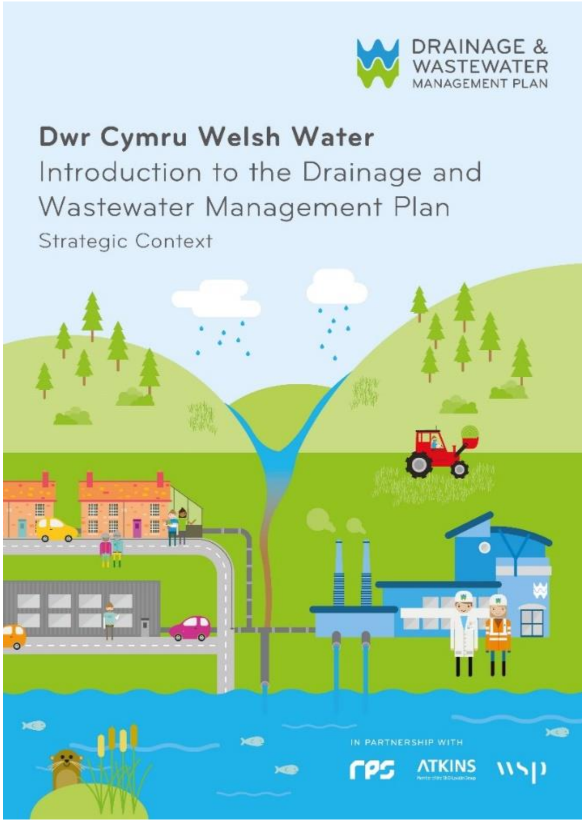


Figure 3-1 - DWMP Strategic context document

The ‘How and where we want to work with you’ document was produced following engagement with stakeholders at the BRAVA stage.

The document highlights the areas and risk themes identified from the baseline risk and vulnerability assessment. This enabled stakeholders to identify areas where they can work with DCWW to start addressing future risks and reducing the effects of climate change.

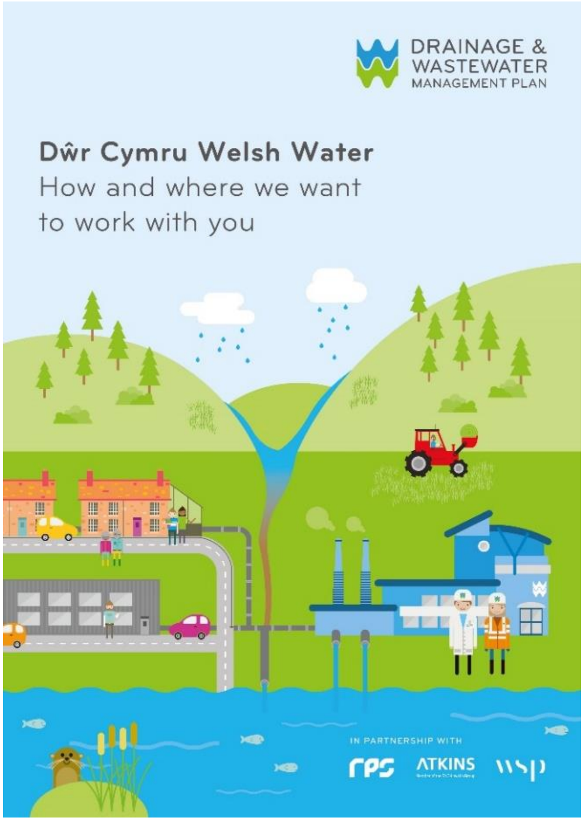


Figure 3-2 – ‘How and where we want to work with you’ document

One of the challenges in delivering the regional engagement activity in Wales has been the lack of the Catchment Based Approach (CaBA). In England, this approach provides an existing platform for dialogue between organisations involved in the water environment.

A trial started in June 2021 with Isle of Anglesey County Council, aimed at developing a regional Project Board, through which decisions on collaborative investigation and delivery could be made in the interests of water quantity (flooding), water quality (pollution) and asset resilience (coastal and other pressures). The group continues to operate and involves the local authority, and DCWW with NRW joining when needed. Our aim in Cycle 2 is to create similar joint working arrangements through the set-up and repurposing of programme and project boards across Wales.

4 Planning Objectives

4.1 Introduction

The DWMP incorporates planning objectives (PO) to measure risk throughout the Company area, aligned to the Business Plan and Welsh Water 2050. POs are a combination of nationally derived common planning objectives for industry comparison, which are supplemented with a set of local objectives tailored to Welsh Water's stakeholders following consultation. POs are then grouped under three themes - water quality, water quantity, and resilience and maintenance – to communicate them to those stakeholders.

4.1.1 *Defining DCWW planning objectives*

The final POs adopted for Cycle 1 are detailed in Table 4-1 below. This highlights where specific objectives sit within the three themes, and their national/local status. Each PO has a detailed definition, assessment methodology, and approach. This allows a robust grading of each PO's performance over the various time horizons considered in the DWMP risk analysis stage.

Table 4-1 – DCWW planning objectives with description and units

Planning Objective		Description	Units
Water Quality			
National	WwTW Compliance DWF / Biological Capacity	STW Numeric performance limit compliance.	% Population served
National	Storm Overflow Performance	Assessment of spill performance based on annual rainfall.	Spill Count
Water Quantity			
National / Local	Internal Sewer Flooding (HO)	Properties affected by flood waters due to hydraulic overload conditions.	Property Count
National / Local	Internal Sewer Flooding (OC)	Properties affected by flood waters due to causes other than hydraulic overload.	
National / Local	External Flooding (HO)	Property curtilage affected by flood waters due to hydraulic overload conditions.	
National / Local	External Flooding (OC)	Properties curtilage affected by flood waters due to causes other than hydraulic overload.	
National	Wastewater Resilience	Risk of flooding in a 1 in 50-year storm affecting population.	% Resident Population
Local	Worst Served Customers – Waste (HO)	Risk of repeat internal or serious external flooding due to hydraulic overload.	Property Count
Local	Worst Served Customers – Waste (OC)	Risk of repeat internal or serious external flooding due to causes other than hydraulic overload.	Property Count
Resilience and Maintenance			
National / Local	Waste Pollution Incidents (HO)	Pollution incidents as reported by EA/NRW (Category 1-3).	Incident Count
National / Local	Waste Pollution Incidents (OC)		
National	Sewer Collapses	Where structural deterioration has caused a collapse resulting in service failure.	Incident Count
Local	Asset Resilience (above ground)	Assets assessed against a pre-defined set of resilience criteria.	% Score

Planning Objective		Description	Units
Local	Asset Resilience (below ground)	Assets assessed against a pre-defined set of resilience criteria.	% Score

Based on population or sewer length, the targets for this first DWMP cycle's planning objectives have been normalized across the company area. An example of the distribution of targets, and the risk trigger thresholds applied, can be seen in Figure 4-1.

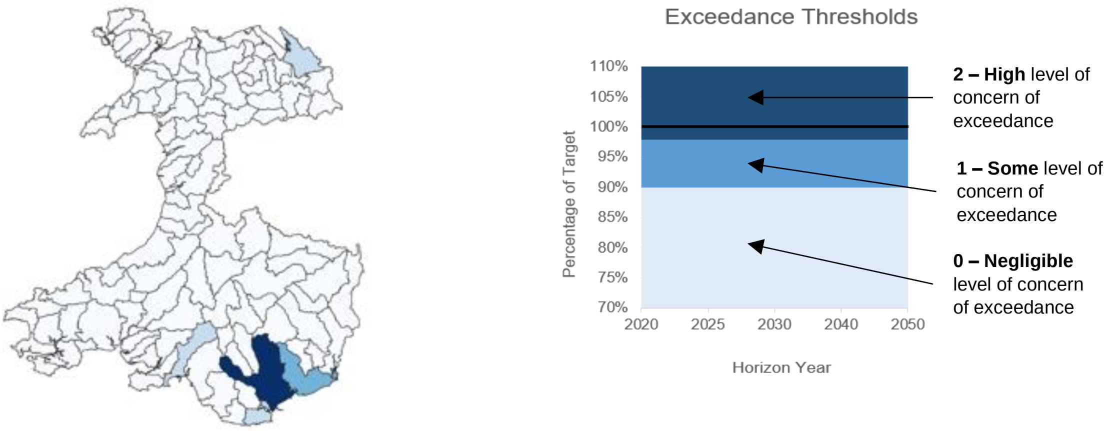


Figure 4-1 – Example PO target map (internal flooding) and target exceedance thresholds

4.2 Methodology

4.2.1 *Understanding catchment capacity*

The Environmental Act 2021 has amended the Water Industry Act 1991 to include a new requirement for water companies, which implies understanding sewer and drainage capacity is essential for success. At present, there is no standard method for assessing sewerage system capacity, and the industry is working towards developing this. Taking a pragmatic approach to this we have developed a workable methodology, for use in this initial DWMP, to enable capacity to be considered across our operating area. This understanding of strategic network capacity, alongside performance against the specific planning objectives should support options development within the DWMP.

4.2.2 *Defining the minimum capacity of the network*

We have undertaken a company-wide assessment of network capacity using a simple geospatial approach to calculate the volume of flow within the network. Full Dry Weather Flow (DWF) is used to assess if the pipes, pumps, off-line storage, and wastewater treatment works are sized appropriately. Any capacity shortfalls are highlighted as 'at risk' and put forward for options development. Multiple growth, creep, and climate change forecasts are be used to calculate the risk of not being able to contain and treat DWF throughout the plan period.

A second pass of the same assessment is also calculated to add allowance for drainage volumes using typical rainfall event intensity. Any other assets that are identified as not having sufficient capacity are then taken forward into Options Development.

4.2.3 *Defining the capacity of our treatment facilities*

Initially, we assume our treatment works will have the same capacity as the permit for the site. This initial definition assumes that capacity will not change over time. Meter installations are in progress to assess compliance with permitted flow pass-forward requirements by our treatment works in line with a methodology newly agreed by regulators. Additionally, we have developed an approach for calculating treatment capacity on a process-by-process level, based on site data. Biological processes are incorporated into the design of this tool so it can directly compare with network capacity assessment.

Using these approaches, sites where there has been a shortfall in permit or design capacity can be identified for further optioneering.

4.2.4 *Defining the capacity of the environment to receive wastewater and drainage flow*

Changes in environmental conditions (climate change and land use in particular), in combination with population growth, pose significant challenges to the DWMP. Under the new DWMP framework, investing in water industry assets must be informed by conditions downstream of those assets. To support this SAGIS (Source Apportionment GIS), modelling can identify catchments and infrastructure which may be sensitive to changing environmental circumstances.

SAGIS provides a breakdown of in-river chemical concentrations from contributing sectors, so that regulators and water companies can use a common system to develop programmes of measures while maintaining the polluter pays principle.

It is anticipated that changes in policy, the environment, socio-economic factors, and asset performance may substantially alter the DWMP context in the future. To respond to this, SAGIS provides scenario analysis at various DWMP-relevant time scales, whereby ‘what if’ questions can be used to explore the implications of change and/or specific actions.

DCWW intended to use SAGIS as part of a method development framework to investigate how scenario planning might be used to inform the DWMP. The specific objectives were:

- Develop a methodology for identifying catchments and wastewater infrastructure whose management may be sensitive to environmental changes over the longer term (focusing on phosphate, ammonia, nitrate, and BOD).
- Establish a reporting and data visualisation protocol (i.e., how to present the vast amount of data generated by modelling in a way that facilitates easy interpretation).
- Support DCWW's planning capability with tools and approaches.

4.2.5 *Understanding strategic network capacity- Dry Weather Flow (DWF) risk*

When assessing the impact of sewage treatment works discharges on the environment, DWF is a critical factor. The DWF represents the volume of foul flow generated by our domestic and trade customers (excluding surface drainage), as well as infiltration passed to the WwTW. When combined with the WwTW permits, it allows us to calculate the treatment load on the WwTW and, where needed, to compare that with the capacity of the environment to accept those discharges across our catchments.

We have adapted the WRMP's supply and demand concept to better understand capacity risk assessment. We must, however, recognize that there are fundamental differences between water, wastewater, and drainage networks. In urban areas, runoff from rainfall changes the volumes in the wastewater system during storms. This requires layers of complexity and uncertainty that are not needed for water management planning.

A comparison of the wastewater network DWF capacity with the treatment works capacity at a strategic level suggests there are future DWF risks i.e., that our treatment capacity could be insufficient to treat all the loads we receive under dry weather conditions by 2050. The assessment process provides a strategic prioritisation tool to focus work where Network capacity DWF and Treatment capacity DWF (combining treatment and environmental capacity together) are shown to not have enough headroom between them to ensure continued resilient service into the future. If there is a risk at Level 2 then the tool highlights that there is a greater risk in that area than in another area. The assessment is then continued to Level 3 so that the contributing risk at a high level is found at a catchment scale and programmes of work to resolve the risk can be created.

The tool also allows scenarios of risk to be assessed with the introduction of Headroom. This is a simple approach where several different percentages are added to the network side until the level of resilience is determined. Again, those will lower headroom percentages are those that are at greatest risk in the future.

We have investigated the use of a DWF supply demand assessment to identify areas where capacity needs are forecast to be limited. However, these areas do not state that the whole area is not at risk it shows strategically that at a high level there would be enough capacity if the zones network and treatment and environmental were all connected together. The assessment information and conclusion are outlined in the table below.

4.2.6 *Top-down capacity assessment methodology*

The analysis of our company's total treatment capacity in relation to the total DWF demand, implies that we have some risk of insufficient capacity on a strategic level if all the processes are linked together. However, this ignores the spatial inequalities in DWF and treatment capacity, i.e., where the DWF arises and its networked connection to a WwTW. The same analysis can be repeated at Levels 2 (SPU) and 3 (TPU) to determine areas in which shortages of supply and demand are likely to occur and to inform our planning approach in these areas.

Mathematically DWF is defined as:

$$PG + Imax + E = DWF$$

Where:

> Imax = the maximum Infiltration occurring within the network (an evidence-based winter value)
>
> PG = Population (P) multiplied by Consumption (G) defining residential contribution
>
> E = Trade Effluent

In assessing the needs of planning for greater headroom, we have assumed a flat percentage increase based on population forecasts in line with our company demand forecast. There is significant uncertainty around future infiltration and commercial flow volumes, and these have not been varied in future scenarios, but need development within Cycle 2. In addition, as demand from customers and trade varies during the year, it shows that even at a company level, a different approach to how the industry undertakes this planning should be considered in Cycle 2.

This is a new approach to assessing capacity at the strategic level. We are using this to get a more holistic view of our network and WwTW's capacity. There are some drawbacks to this approach as with previous Wastewater planning, namely, multiple assessments are needed to understand capacity. Nonetheless, drilling down into the detail allows the components that make up the risk area to be better identified. During cycle 1, this top-down approach will be expanded toward cycle 2 as a possible long-term planning approach.

4.2.7 *Hydraulic capacity assessment tool – A bottom-up approach*

With this initial definition of treatment capacity, Cycle 1 can compare it with the high-level Cycle 1 network assessment and produce a simple network capacity versus treatment capacity risk assessment.

Wastewater capacity can be calculated based on WRMP's supply and demand mass balance principles. WRMP dry conditions are equivalent to DWMP dry weather flow capacity. During a year, there are on average 236 days without rainfall. The WRMP considers the critical period, or the most challenging demand conditions, for water supply at peak hot and dry days, but the DWMP evaluates such conditions in relation to peak rainfall that occurs after an extended period of wet weather i.e., storm duration and antecedent conditions.

This can be calculated using the same equation, but multiplied by a standard variable, defined by wastewater practitioners as 3x, 6x, or 12x DWF, and the maximum estimated infiltration rate (Imax) that occurs under these conditions (calculated from the treatment works flow meter or the CSO event duration monitor, typically a winter maximum). Multipliers correspond to storm volumes. The use of the Multiplier in front of the DWF is a pseudo reference the volume of rainfall entering the sewer system. IE DWF is no rainfall all the way to 12xDWF which could be classed as heavy daily rainfall and 16X DWMP could represent the future climate change volume. For instance, the 12x multiplier represents a worst-case winter storm. Peak rainfall volume would then be estimated as:

$$12(PG) + Imax + 12E = 12DWF$$

The component-based capacity assessment has been part of the commitment for some time. However, by bringing these together into a single view, capacity can be viewed as a single value for supply and a single value for demand.

Capacity demand is influenced by both customer need and rainfall runoff. This makes its definition more difficult. It is not possible to retain all the flows and treat the drainage flow to a combined sewerage network under all weather conditions. Consequently, the wastewater system is typically equipped with storage and/or relief points, Combined Storm Overflows (CSOs) that allow excess flows to pass to the environment without backing up and flooding customers' premises. Hence, any assessment of supply and demand is extremely complex, but we believe it is appropriate to continue to develop this methodology and use it as the foundation for a new approach to the assessment of wastewater.

During this cycle of the DWMP, the assessment of capacity was primarily based on permitted discharge volumes. However, in a few prioritised WwTW catchment areas, a process-by-process capacity calculation tool has been developed to improve the process at a detailed process level. Based on this assessment, we will be able to anticipate when the hydraulic capacity of sites will be exceeded as population, trade load and drainage volumes change.

Cycle 2 of the DWMP evidence improvement programme will focus on:

- Further define the components to calculate Capacity.
- Further Improve the tools developed during cycle 1.
- Enhance the reliability and confidence in the calculation by developing robust procedures.
- Building on CSO EDM monitoring already in place, install a permanent and temporary monitoring system on our network and treatment sites.

This will provide an improved assessment of the demand side balance concluding with more certainty of the location for the next investment.

The results will provide a more accurate assessment of the supply/demand balance, resulting in a better estimate of where the next investment should be made.

The Table 4-2 Supply Demand Balance risk at level 2 below shows the Level 2 assessment of DWF risk using the approach alongside a resilience assessment at 20% Headroom. Multiple variations of this table can be easily draw using the DWF, 3x, 6x and 12x DWF approach and then varying the Headroom analysis alongside allowing a very rapid risk assessment to be carried out for prioritisation of detailed work and at all levels of planning such as level 2, and Level 3 and so on.

	Dry Weather	Dry Weather with 20% allowance for resilience
Dee		
Clwyd		
Conwy		
Llyn and Eryri		
Anglesey		
Meirionnydd		
Teifi		
Pembrokeshire		
Swansea Bay		
Tawe to Cadoxton		
SE Valleys		
Usk		
Wye		

Table 4-2 Supply Demand Balance risk at level 2

4.2.8 *Storm response – Additional uncertainty in drainage resilience*

Our world is highly complex and comparing all types of storms to a single assessment obscures the reality of the situation. The different impacts of summer vs. winter storms on hydraulic performance, on capacity of the network, on flooding, and environmental risks are all important. In this first cycle of the DWMP, we are exploring what these scenarios mean to customers.

We have characterised 'Risk' by using different types of rainfall/storms that impact different assets and catchments. Risk assessments have considered these differing rainfall patterns to ensure continuity of risk analysis now and into the future.

For our first cycle of the DWMP, we utilized a summer season, 60-minute storm with a one-year return period as our baseline. Statistically, this occurs only once every year. The baseline allows us to explore how storms impact sewer flooding, and how this risk may change because of climate change, growth, and urban creep between now and 2050.

4.3 Outputs

4.3.1 *Catchment level results summary*

SAGIS Scenario modelling was undertaken, generating both high-level and site-specific results for now and 2050 covering phosphate, ammonia, BOD, and nitrate which summarise water quality conditions upstream and downstream of all DCWW assets. The tool also lists discharges upstream and downstream of a selected "feature". This enables users to track other upstream or downstream inputs. This is useful because a target exceedance downstream of any individual treatment works might be substantially attributable to other upstream discharges.

The primary scenario results include:

- Baseline Scenario: Simulated conditions within the model calibration period (2010-2012).
- 2050 BRAVA: As in baseline, except treatment works discharge flows are updated for 2050 (based on DCWW's BRAVA).
- 2050 BRAVA with variability: Conditions averaged across a range of scenarios (based on an ensemble of 27 individual scenarios), where the discharge treatment works discharge flows are those expected to occur in 2050.
- Permit scenario with variability: the same as the previous scenario, except treatment works have been modelled at the permit limit.

4.3.2 *Strategic summaries*

The information for individual treatment works has been aggregated for phosphate, ammonia, BOD, and nitrate and presented in bar chart form, for a range of modelled scenarios from baseline conditions to 'pessimistic' worst-case conditions.

The charts show, at a high level, how many DCWW treatment works are likely to exceed ('fail') or not exceed relevant environmental quality standards (EQS). This shows the percentage of treatment works that might be subject to some form of quality control upon discharge. Site-specific summaries can help planners and stakeholders understand the implications and challenges involved in planning to mitigate long-term impacts by providing a tangible illustration of what might happen in the future.

Comparing different permit variant scenario results ('face value', 'optimistic' and 'pessimistic') is most useful. This is because investment needs are usually based on the impact on receiving waters that may occur at the discharge permit limit. Underestimating the need for investment could lead to environmental damage, while overestimating it may withhold resources from other needs. Following this approach, DCWW and its stakeholders can assess and quantify these risks in advance, and agree the base planning assumptions.

Conclusions and recommendations of the SAGIS study are:

- Phosphate exceeds the EQS in the greatest number of treatment works currently (baseline) and in future scenarios. Phosphate will likely drive the most significant investment and the majority will be managed through the Wate Industry environmental Programmes (WINEP and NEP).
- There are significant differences in the number of treatment works at which investment may be required for the baseline, optimistic and pessimistic scenarios. in the most extreme case, 'optimistic' and 'pessimistic' the differences are most noticeable for phosphate (142), followed by BOD (56), ammonia (41) and nitrate (25). in the case of baseline and pessimistic, the same trend is repeated for phosphate (105), followed by

ammonia (50), BOD (46) and nitrate (19), The values in brackets indicate the different relative number of treatment works potentially exceeding EQS between scenarios.

- This illustrates that the uncertainties around future conditions are relative larger for phosphate than other determinants, and that plans based on current conditions are unlikely to provide adequate protection for the future.
- These results highlight the importance of understanding the contributions from other sectors, such as agriculture, as well as developing approaches that will allow all sectors to contribute to meeting water quality goals.
- In support of shorter-term planning processes, the assessments may be repeated following business-as-usual updates and other improvements to SAGIS.
- Data visualisation tools provide a tangible illustration of the implications of environmental changes that might occur within DWMP planning horizons. These tools support DCWW's efforts to engage stakeholders in defining future scenarios DCWW should be planning for. Going forward, DCWW planners, stakeholders, and customers could refine the alternative scenarios to shape a common vision.
- The modelling spreadsheet contains the priority treatment works for each scenario. Therefore, these can be used to develop an investment program spanning multiple AMP cycles, with consideration for how environmental conditions might change.

5 Plan Development – Catchment Vulnerability and Risk

5.1 Introduction

In the PR19 Framework and Methodology (OFWAT, 2017), OFWAT established a new requirement for annual reporting to provide a measure of the resilience of sewerage undertaker's drainage systems to extreme wet weather. An outline of how water and sewerage companies might assess how resilient their wastewater networks are was developed by ATKINS "Developing and Trialling Wastewater Resilience Metrics Final Report" in 2017 (Atkins, 2017). This report provides a metric for measuring the resilience of the wastewater system to the specific threat of sewer flooding from a 1 in 50-year return period storm.

During the 2019 price review, WASCs produced resilience estimates based on a variety of different approaches based on Atkins' principles. Because the Atkins methodology was applied differently across the sector, it was impossible to establish industry baseline figures for resilience. Water UK held a meeting on 'Consistency of Reporting for the Common Performance Measure (resilience metric)' in February 2019, and all companies agreed to align with the Atkins report, especially where suitable models were unavailable. This led to DCWW to add Catchment Vulnerability Assessments to the process.

5.2 Methodology

DCWW has developed a set of parameters to measure resilience, drawing on a wide range of data sources, including GIS layers, incident datasets, and telemetry data. We have used Aktins proposed metric of a 1 in 50-year storm return period for all wastewater hydraulic models that were previously verified as part of the development of our sustainable drainage plans (SDPs). By using pseudo 2D flood routing methods, the 1 in 50-year return period was also used to produce exceedance flood routing. After overlaying these flood paths on background maps, we were able to estimate the percentage of the population which would be at risk from sewer flooding. For catchments where current hydraulic models were not available, the results were extrapolated across the whole DCWW region.

The final resilience metric from this analysis is expressed as number of (or percentage of) customers at risk to 1 in 50-year flooding event. The metric also forms part of the Risk Based Catchment Screening (RBCS) as a Tier 2 metric for determining which Level 3 catchments should be assigned a Baseline Risk and Vulnerability Assessment (BRAVA).

The 16 vulnerability criteria (or metrics/ assessment parameters), labelled A to P, are provided in Table 5-1 below:

Table 5-1 – Vulnerability parameters

Assessment Metric / Parameter	Vulnerability Description
A	General catchment geographic topography funnelling all flows into one area
B	Catchments with a rapid response
C	Unknown asset data
D	Only drainage system in catchment / high proportion of combined sewers
E	Sewer flooding risk from historic reported incidents
F	Repeated blockage risk from historic reported incidents
G	Urban density (high population concentration)
H	Proximity to sea / river level
I	Large complex networks with many dependencies
J	Dependence on pumping
K	Proximity to water table

Assessment Metric / Parameter	Vulnerability Description
L	Growth potential (unplanned)
M	Consequence of flood risk management by others
N	Growth potential (planned)
O	Catchments with a slow response - flat sewers and septicity
P	Where no key issues identified

The Atkins' guidance has been interpreted for use by DCWW, as well as the process of assessing each metric. There is a detailed description of each vulnerability criterion, the vulnerability grade assigned to that criterion, and the detailed description provided by Atkins to assist the assessment. Next, the detailed methodology and criteria for scoring is considered.

5.3 Outputs

Outputs of the Catchment Vulnerability Assessment (CVA) are captured as a report spreadsheet, which has been formatted to align with OFWAT's requirements for reporting, as of April 2019. This spreadsheet provides an overview of the results of the assessments of each catchment against each of the metrics, as well as the assessed vulnerability grade. This grade is derived from the maximum vulnerability assigned by evaluating each of the 16 metrics for each catchment. The results have been integrated into the resilience metrics, and the risk-based catchment screening process of DWMP.

6 Plan Development – Risk Based Catchment Screening

6.1 Introduction

Following the process of setting out the Strategic Context and understanding the key drivers of the DWMP, the first stage of the risk assessment process, or 'Understanding the problem' is a high-level **Risk Based Catchment Screening** (RBCS). RBCS identifies which sewerage catchments are likely to be most vulnerable to future changes, and it provides an initial screening of all DCWW catchments using existing quantitative and qualitative data to determine the level of assessment required at the next stage of the DWMP process.

6.2 Methodology

This series of metrics provide an indication of the environmental and customer impact of the sewerage and drainage in the area. These results are then aggregated against the 106 L3 TPUs. These performance indicators are detailed in Table 6-1below.

Table 6-1 – RBCS performance indicator metrics

Number	Performance Indicator (RBCS metric)
1	Catchment Characterisation (*Tier 2*)
2	Intermittent discharges impact on bathing or shellfish waters
3	Continuous or intermittent discharges impact upon other discharge to sensitive waters (Part A)
4	Continuous or intermittent discharges impact upon other discharge to sensitive receiving waters (Part B) (*Tier 2*)
5	Storm Overflow Assessment Framework (SOAF)
6	Capacity Assessment Framework (CAF)
7	Internal Sewer Flooding
8	External Sewer Flooding
9	Pollution Incidents (categories 1, 2 and 3)
10	WwTW Quality compliance
11	WwTW Dry Weather Flow compliance
12	Storm overflows
13	Risks from interdependencies between RMA drainage systems
14	Planned residential new development
15	The Water Industry National Environment Programme (WINEP / NEP)
16	Sewer Collapses
17	Sewer Blockages
18	Bespoke Indicators* (*Tier 2*)

Tier 2 - Indicators have been classified into two tiers, providing a mechanism to differentiate between the priority of each indicator tier when considering whether further assessment is justified (all other indicators being 'first tier').

*Bespoke indicators (Metric 18) will be included during Cycle 2.

Each metric was then assessed following the approach set out in the DWMP Framework.

6.3 Outputs

The primary output of the assessment is the completed RBCS spreadsheet which provides a list of the catchments which should proceed to BRAVA, and detail on all triggered metrics for each catchment in a tabular format. This provides the starting point for BRAVA requirements at all TPUs.

Following three iterations of the process, all **106 L3 TPUs have been progressed to BRAVA,** having triggered sufficient screening metrics.

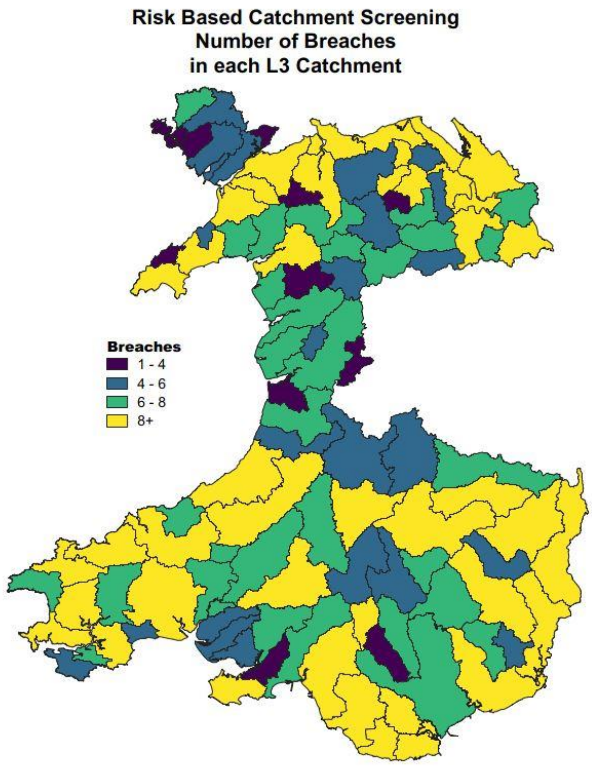


Figure 6-1 – RBCS L3 catchment breaches

6.4 Future recommendations

As part of the development of the RBCS process, the following items have been identified which will influence this stage of the DWMP within future cycles:

- **Frequency of Iterations –** With the annual assessments undertaken in Cycle 1, the results suggest no discernible difference in L3 catchment triggering. It is suggested that a 3-year frequency for this assessment will align with data and trends.
- **Catchment Triggering** – Triggering all 106 L3 catchments places a burden on the BRAVA process. For Cycle 2, it is suggested that there is a review of triggering thresholds to enable enhanced prioritisation.
- **Pollution extension** – Inclusion of Category 3 incidents to support better understanding of performance.
- **Improved RMA Data** – Enhancing the data relating to other RMA sites will provide a more robust understanding of RMA interactions and potential collaborative risks.

7 Plan Development – Baseline Risk and Vulnerability Assessment

7.1 Introduction

In the DWMP process, Baseline Risk and Vulnerability Assessment (BRAVA) follows the Risk-Based Catchment Screening (RBCS) procedure that first identified which catchments require investigation. Its objectives are to:

4. Review the performance of the current wastewater and drainage system.
5. Investigate the broader resilience concerns in the highlighted catchments.

The BRAVA process evaluates system performance against 'baseline' and future planning scenarios to 2050, with a view to understand the risk of service failure, and when it is most likely to happen (under chronic stresses or acute events).

There are a series of key steps within the methodology which define the level of input and assessment required at this stage, determining both the **complexity of the assessment,** and ultimately **informing the level of optioneering required**.

7.2 Methodology

7.2.1 *Preliminary problem characterisation*

The BRAVA employs a tiered approach to ensure the level of investigation in each catchment is appropriate to the availability of data and complexity of the challenges identified in the RBCS. **Preliminary Problem Characterisation** (PPC) is the first step of the process and uses a **Preliminary Strategic Needs Score** (PSNS), and a Population Growth Uncertainty Score (GUS), to determine a Preliminary Problem Characterisation Score via a decision matrix. This determines the complexity of the BRAVA assessment undertaken within the given catchment, as shown in Table 7-1 below.

Table 7-1 – Preliminary problem characterisation decision matrix, based on DWMP Framework Appendix C, Table C-1 and BRAVA level mapping

			Preliminary Strategic Needs Score			
			Negligible	Small	Medium	Large
			1-2	3-4	5-6	7-8
Growth Uncertainty Score	High	± >10,000 population	Standard	Extended	Complex	Complex
	Medium	± 5000-10,000 population	Standard	Standard	Extended	Extended
	Low	±<5000 population	Standard	Standard	Standard	Standard

The focus of this score is to understand the level of demand within the catchment, by combining growth with the performance challenges faced within the catchment, and equating it to a level of BRAVA complexity (Standard, Extended, Complex).

7.2.2 *BRAVA Assessment*

Following on from the allocation of an initial level of BRAVA assessment from the PPC, DCWW has decided to further sub-divide the Standard assessment into two levels: **Standard non-Modelled** and **Standard Modelled**. This formalises a level of investigation that is performed in catchments where there is less accessible data, or where tools to support modelling decisions are unavailable.

All catchments had Standard non-Modelled assessments undertaken to provide a consistent baseline across the entire region. Catchments with models available had additional processes undertaken, with a focus on catchments with historical internal flooding issues. This highlights the plan develop need with regards to model coverage.

Table 7-2 0 BRAVA Levels

BRAVA Level	Description
Standard	**Non-modelled** No decision support tools (DSTs) are available, assessment is based on available data and engineering judgement.
	Modelled DSTs are available to produce modelled results to forecast future risk for some planning objectives. A central estimate of growth is applied.
Extended	Run standard BRAVA DST modelled scenarios but also apply ±30% uplift on growth projections to address uncertainties.
Complex	Run standard and extended BRAVA modelled scenarios but also multiple climate change uplifts, bespoke growth and creep scenarios defined in consultation with L2 SPG. Examples of the types of scenarios which may be proposed include: ± % climate change in line with local upper and lower estimates. Full build out rate for predicted growth. For cycle 1 of the DWMP there were no complex assessments undertaken.

The summary of L4 catchment allocation to a BRAVA assessment can be seen in Table 7-3 below. This data is also summarised in Level 3 and Level 2.

Table 7-3 – BRAVA Allocations

No BRAVA	Standard Non-Modelled	Standard Modelled	Extended	Complex
37	606	172	10	0

To support prioritisation as part of the BRAVA stage across DCWW, all catchments have undergone an additional assessment to generate a priority allocation score. This is based on a series of performance critical planning objectives, and an allocation against whether it is a main priority driver, a secondary priority driver or not a driver. The results of this assessment can be seen below.

Table 7-4 – BRAVA Priority Level 4 catchment allocation

	Hydraulic modelling programme for cycle 1 of DWMP						
	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5	Priority 6	Priority 7
Number of catchments	25	106	51	7	17	592	37

With these considerations, a score of 0-2 is allocated for each catchment based on the likelihood of achieving the planning objective targets. This provides an overall score for each catchment against all planning objectives.

As part of the BRAVA stage, and the future time horizons under investigation, there are a series of strategic considerations which are included within the assessments:

- **Population Growth and Development** – Growth forecast and specific development sites from local plans are included within the various time horizon scenarios. This ensures the impact of future growth is included within assessment.

- **Climate Change** – The principal impact of changing rainfall patterns is considered within BRAVA assessments, with additional consideration when required for additional factors. These factors include sea level and tidal range.
- **Urban Creep** – Increased im-permeability, caused by a change in land allocation at property level (e.g., paving over a front garden or a property extension) is included based on industry standard methodologies.

7.2.3 *Outputs*

Table 7-5 below gives an example of the outputs from the BRAVA stage for two planning objectives and 5 L3 catchments.

Table 7-5 – Example BRAVA output across two planning objectives

L3 Catchment	WwTW Compliance					Waste Pollution Incidents HO				
	2020	2025	2030	2040	2050	2020	2025	2030	2040	2050
Aeron - confluence with Gwili to tidal limit	0	0	0	0	0	2	2	2	2	2
Afan - confluence with Pelenna to tidal limit	1	1	1	1	1	2	2	2	2	2
Afon Chwefru - source to conf R Irfon	2	2	2	2	2	2	2	2	2	2
Afon Llynfi - conf Dulas Bk to conf R Wye	0	0	0	0	0	2	2	2	2	2
Afon Lwyd - conf Dowlais Bk to Pont Sadwrn	0	0	0	0	0	1	2	2	2	2

The results were also used to generate **opportunity maps**, identifying regions where specific challenges had been identified and there was an opportunity for collaboration with local stakeholders.

7.2.4 *Strategic picture*

Whilst individual assessments have been undertaken at L4/L3 catchment level, the indication of whether DCWW will meeting its targets over the planning periods can be generated, providing that strategic insight into future risk. Table 7-6 below provides the results summary. The analysis shows that without solutions in AMP7 to AMP12 the PR19 targets will not be met. Please note this assessment has been carried out priori to AMP7 being delivered and no correctio n has been made to solutions that are programmed to be delivered before 2025.

Table 7-6 – Results summary

	Do the BRAVA results show that the company will meet its PR19 targets? Yes /No		
	2025	**2030**	**2050**
Internal Flooding	No	No	No
Pollution	No	No	No
External Flooding	No	No	No
Sewer Collapse	No	No	No
WSC	No	No	No
Asset Resilience Wastewater (above ground)	Yes	No	No
Asset Resilience Wastewater (below ground)	No	No	No

8 Plan Development – Final Problem Characterisation

8.1 Introduction

Final Problem Characterisation (FPC) seeks to ensure that the approach to options development and appraisal processes are appropriate and proportionate. In a similar approach to the method used in PPC, FPC establishes a **Final Strategic Needs Score** (FSNS) and a **Complexity Factor Score** (CFS) which are combined via a decision matrix to determine the **Final Problem Characterisation Score** (FPCS) and ultimately the optioneering approach within the Options Development and Appraisal stage.

8.2 Methodology

The first stage is the calculation of a FSNS which describes the magnitude of the problem. The FSNS is established for each theme at near/medium term and long term. Using the guidance, this is based on the following questions:

- What is the level of concern that, without intervention, will impact planning objectives related to Demand?
- What is the level of concern that, without intervention, will impact planning objectives related to Supply?

The BRAVA scores for each catchment have been used as the best available proxy to answer these questions within Cycle 1 of the DWMP, given that the BRAVA score indicates the scale of problem within the catchment.

The Second stage in the FPC is an assessment of the complexity factors which influence how challenging the problems are to solve. This challenge is represented by the CFS. The assessment explores the risks and vulnerabilities within the DWMP. The goal is to identify whether these complicating factors, alongside the overall level of strategic risk, should lead us beyond standard planning approaches. The resulting CFS provides a general direction for developing suitable options.

The focus for the complexity factor assessment is risks associated with **supply** and **demand** in line with the first stage of the FPC process. The questions in the complexity factors assessment use a scale of significance to characterise their answers.

The questions which address <u>demand</u> risks can be summarised as:

- What is the level of concern about near/medium, or long-term, system performance, due to pressures from climate change, new development, and urban creep?
- To what extent is the uncertainty associated with the socioeconomic forecasts a cause for concern to the required level of investment?

The questions which address <u>supply</u> risks can be summarised as:

- What is the level of concern about near/medium, or long-term system performance, based on historical performance or unexperienced (but likely) future circumstances?
- What is the level of concern about near/medium, or long-term system performance, based on impacts of; asset deterioration, system misuse; data availability?
- What is the level of concern about potential changes to the regulatory requirement for newly emergent contaminants entering the wastewater system?
- Are there opportunities for cross catchment interventions which increase capacity or address supply needs?

In a similar approach to FSNS, the CFS is derived from the sum of the maximum scores from each of the above questions in each time horizon (near/medium and long term).

The FSNS and CFS are concatenated via a decision matrix to generate a Final Problem Characterisation Score (FPCS) which is used to in the optioneering stage. This can be seen in Table 8-1 below.

Table 8-1 – Problem characterisation decision matrix

		Strategic needs score ("How big is the problem?")			
		Negligible	Small	Medium	Large
		1-2	3-4	5-6	7-8
Complexity factors score ("How difficult is it to solve")	High (8+)	Low	Medium	High	High
	Medium (5-7)	Low	Low	Medium	Medium
	Low (<4)	Low	Low	Low	Medium

The allocated FPCS (low, medium, and high) indicates the categorisation of options development approaches suitable to the scale of challenge identified:

Low / Standard (green) – process defaults to companies existing investment planning practices to maintain existing levels of service.

Medium / Extended (amber) – the options development and appraisals process will build upon the standard processes to provide extended analytic approaches in supporting investment planning practices.

High / Complex (red) – the options development and appraisal process are undertaken considering a wide range of tools and approaches to explore.

8.3 Outputs

The results of the problem characterisation can be summarised at the different DWMP levels for both the catchment, but also for each of the planning themes. The full results have been summarised for the company in Table 8-2 below.

Table 8-2 – Company-wide problem characterisation results

Theme	Quality	Quantity	Resilience	Maintenance
High - Complex Optioneering Option	3	0	3	2
Medium – Extended Optioneering Option	41	5	16	25
Low - Standard Optioneering Option	467	478	8	623
No Issue	235	245	806	70
Monitoring	82	98	1	97
DST Development	7	9	1	18

Please note that an area characterised appears in each column once.

8.3.1 *How does the supply demand approach, worst risk approach and RBCS/BRACA approach compare?*

As a comparative example, Conwy L2 area was highlighted in the supply demand capacity assessment, as a Level 2 area with a shortfall in either network or treatment capacity. The result of that assessment shows that it should be the first strategic (L2) area to focus on going forward.

The same Level 2 area was also highlighted in the Problem Characterisation (PC) method. However, in terms of PC, the DWMP process ranks risks into Standard, Enhanced and Complex, with a key element of the ranking being driven by population size and growth risk. Both the PC and Supply Demand methods identified the Conwy Level 2 area as a risk but, because the Level 2 catchment was not ranked as Enhanced and Complex, it was not taken forward to options development.

Nevertheless, we did find that, because the Supply demand capacity assessment uses the same assessment to drill down to level 3, it provides added value at a tactical level, which further refines the geographical area to focus on.

The worst risk approach has helped us identify where to prioritise the efforts in options development and appraisal (ODA). Through the worst risk approach, we have found that the focus for Conwy and other L2 areas has not been on the greatest risk but the greatest improvement to both customers and the environment. We have also concluded that the RBCS and BRAVA assess risk versus planning objectives but as the Environment Act 2021 isn't asking the company to assess planning risk via objectives, but it is asking each company to assess its capacity risk. to understand the level of risk in terms of pure capacity in the network assets, Treatment assets and the environment our recommendation would be to use the Supply Demand tool to assess this going forward and to ensure that each level 2 and level 3 remains positive.

9 Plan Development – Options Development and Appraisal – Building our Plan

The options stage sets out the scope, cost and likely timing of interventions that could be chosen to achieve long-term company objectives. It assesses the value of different options, in terms of impact on flooding and pollution, but also their wider benefits to nature and to people.

9.1 Methodology

9.1.1 *Wastewater Networks Assessment*

9.1.1.1 Options Development Appraisal – The DWMP Framework Strategy

Options development drives towards best value or preferred options that could feasibly address each identified risk, across catchments where risks have been identified Consistency in approach is driven by the options development pathway:

- **Generic Options** – Developed within the DWMP framework and expanded to a list of 85 generic sub-options considering future stakeholder requests. Within DCWW this is referred to as the **Options Long List**.
- **Unconstrained Options** – This involved peer review of the Options Long List for political and customer/stakeholder acceptability, filtering out options that had one of these 'red flag' criteria. Remaining options were then scored against service measures based on their ability to solve the problem.
- **Constrained Options** – Challenging the unconstrained list to provide a catchment level toolkit that has options that: fix the problem, are applicable at WwTW level, suitable for catchment characteristics and does the right thing.
- **Feasible Options** – Additional criteria applied to the constrained list ensuring acceptability for the specific catchment in terms of feasibility and risk and wider operational impact. Within DCWW this is referred to as the **Options Short List**.
- **Preferred Options** – At localised risk areas these are the options developed for each risk cluster and TOTEX calculated, with additional wider benefits assessment through B£ST. Selected options are based on Average Incremental Cost (AIC) or Average Increment and Social cost (AISC), with additional HRA and SEA review.

9.1.1.2 Developing the Plan – An options development approach for all catchments

Based on assessments through BRAVA and Problem Characterisation, risk areas that required option development is categorised within one of the following:

Standard – follow company's 'existing investment planning practices to maintain or enhance existing levels of service.' It was anticipated that a 'standard' approach would be applicable to most tactical planning units.

Extended [Enhanced in DCWW terminology] – 'build upon standard processes to provide extended analytical approaches.'

Complex – 'Uncertainties in the forecasts. The likely complexity of the interventions required to meet all planning objective exceedances is high involving multiple options and/or stakeholders and the potential lead in times are long.' An adaptive pathway approach may be applicable in complex risk areas. **Note, no Complex Optioneering was identified.**

Our approach to options development has four elements which test the suitability of the approach:

- **Area assessment - Long-list of options to address all risks but mainly focusing on flooding and pollution risk** - Through consultation with stakeholders, we have developed a long list of generic options that could address flooding and pollution risks. However, the characteristics of each treatment works catchment, including the specific issues within that catchment, will influence the most suitable options.

- **Resilience for growth** – We carried out a regionwide assessment of current and future asset capacity to ensure that our networks are not a blocker to economic development in Wales now, and in the future.
- **Set the catchment strategy** – These tests have set our long-term direction for each catchment, assessing what type of options are likely to have the greatest benefit in each catchment, with a focus on sustainable drainage
- **Localised option tests** – Where we have a known, significant risk, we have spent more time testing and refining options, aligned to long term catchment strategy, providing a higher level of confidence in the likely scale of investment needed in priority areas.
- **Strategic assessment -** Capacity risk for assets such as pipes, rising mains and pumps.
- **Strategic Green opportunity assessment –** Developed opportunities to work with 3rd party stakeholders such as Local authorities.

BRAVA drives catchment performance based on current PR19 planning objectives, but evolving pressures such as increased focus on overflow performance and the new Environment Act can shift targets. To support these shifts, '**reference option'** costs were developed to inform all stakeholders the likely cost to hit future levels of service, with a focus on the key network performance metrics of flooding and overflow discharges. This assessment included:

- **Storm overflow assessment** - Calculating required storage volume to reduce spill frequency from storm overflows for a range of scenarios (up to removing all spills) using hydraulic modelling which was then costed to support comparative assessment.
- **Sewer flooding assessment** - Calculation of required storage volume for storage of network sewer escapes for a range of scenarios and time horizons using hydraulic model outputs, which was then costed to support comparative assessment.
- **Non modelled assessment** – extrapolating the results from the modelled catchments storm overflow and sewer flooding assessments to provide a holistic view of cost

9.1.1.3 Setting the catchment strategy – Defining the pathway

Where available, hydraulic model tests were undertaken to assess which of the generic sub-options were likely to benefit a given treatment works catchment. These tests focused on the whole catchment, not localised risks, and enabled us to see which options should form part of the strategy for an individual catchment – termed its 'pathway'.

To achieve this, the feasible options were grouped into option 'bins', based on the model test required. Six 'bins' were created to cover all the options on the unconstrained options list. These were then further reduced to a list which could be rapidly tested using hydraulic models, which represented: percentage reduction in impermeable area connected to the sewerage network (10, 25 & 50% removal), percentage removal of base flow infiltration (50%), per capita consumption reduction (100 l/h/d target) and percentage reduction in trade flow (25%).

These scenarios were tested using current and 2030/2050 growth creep and climate change scenarios, demonstrating the improvement in performance within the catchments assessed. The 'Feasible Options Impact Assessment Tool' was used to review the effectiveness of options against a range of service measures, providing an overview of the impact of the proposed option bins on the catchment's performance against objectives for flooding and pollution.

Where hydraulic models were not available, a 'surrogate' approach was required. This non-modelled approach was run on all catchments using MCERT data, consent/permit data, infiltration assessments and theoretical impermeable area connection within catchments, applying a total volumetric reduction based on these two sources of information in line with the option bins tested in hydraulic models.

Within specific high priority risk areas (containing either worst-served customers or overflows spilling to SACs), it was agreed that option development at the tactical level would be steered by the pathway, but not constrained by it. Engineering judgement could be used to deviate from the overarching strategy; catchment knowledge could be used to identify a more feasible or beneficial approach in a specific zone. However, the catchment pathway guides the order of option testing. This more tactical options development approach was undertaken for all Priority 1 catchments. Options included sustainable and traditional solutions as well as a blend of the two to meet performance objectives.

9.1.2 *Methodology – Wastewater Treatment Works Assessment*

Three types of assessment have been undertaken at WwTW to support capacity assessment:

- Supply/Demand Balance - to readily assess whether our wastewater treatment works have adequate capacity now and, in the future, when reviewing consented/estimated flows under both dry weather and wet weather conditions.
- WwTW Capacity Assessment Tool – Focussing on Priority 1 catchments and reviewing the capacity of each part of the treatment stream with incoming flow at the site.
- WwTW Environmental Resilience – Exploring the use of SAGIS to decide the type of future to be planned for from a catchment perspective, incorporating wider impacts on water quality within river catchments.

9.1.3 *Methodology – Rising Main, Pumps and Pipes*

The strategic assessment tool Infoasset Manager has been used to indicate the need for a detailed investigation locally. This assessment has been carried out on Network pipes to understand capacity without storage for Dry weather flow and for multiples of rainfall such as 3 and 6x DWF (Which is similar to Formula A). a similar strategic assessment has been carried out to assess the capacity of Rising mains, Pump requirements and the consequence of failure of an asset.

9.1.4 *Adaptive Planning*

In this plan we have created a two-step adaptive plan for each hydraulically connected area that we have developed solutions. This means that we have developed multiple programmes to meet the risks likely to materialise by 2030 and then solutions to meet risks likely to materialise by 2050. These steps have been created using choices of Traditional solutions or sustainable solutions. We also looked at how to develop adaptive planning using level of service and the conclusion from these trials is to develop solutions not only to achieve a future date in time but to also to achieve differing levels of service giving differences in growth and creep forecast and climate change. The possibilities however multiple into the future and further work to rationalise this approach will be trialled.

9.2 Outputs

9.2.1 *Options appraisal, costing and benefits*

Options selected within catchments need to be based on greatest benefit. Option costs for the DWMP are based on the DCWW Unit Cost Database (UCD), generating industry standard cost models for solutions identified. The enhanced Solution Target Pricing Tool (STPT) used for DWMP uses UCD supported by additional indirect associated with options scopes.

OPEX expenditure has also been determined, supported by historical information to drive a TOTEX cost for the scope detail. There are also carbon models to support this, which review embodied carbon within the scope.

Assessing scheme benefit requires the quantification of Least Cost, in addition to Average Incremental Cost (AIC), when delivering optimisation to identify the scheme to progress. The cumulative net present value, including CAPEX, OPEX, Carbon, is divided by the benefit to arrive at the AIC. Based on the principles of WRMP a consistent volumetric benefit metric of the 'volume of escape', which allowed quantification for both a flooding and overflow performance assessment, using a 1 in 30-year, 60-minute storm event to drive further consistency, with value driven by scheme implementation.

The principles of driving a best value plan within the WRMP have been reviewed and the DWMP aligned where possible and the following have been undertaken in Cycle 1:

- We have considered environmental and social costs (B£ST) to determine which of the localised options tested offers best value (AISC).
- We have considered any technical constraints, as part of option testing.
- We have prepared a stakeholder consultation on options for later this year, through which customer views will be considered as part of 'do the right thing' assessment for the long list of options.
- We have considered multi-criteria optimisation and sensitivity testing and will work to develop our approach further in later plan cycles.

In addition, a review of Natural Capital accounting tools considering all ecosystem services within the options process was carried out. This resulted in the CIRIA B£ST tool being defined as the assessment tool of choice.

The Coarse assessment section of B£ST has been aligned to the DWMP options process to provide a timely and comparable multi-benefit estimate. Six key questions were used to monetise the benefits focusing on tree planting, social benefit to residents, flood benefits, land-based biodiversity enhancement and length of watercourse improvement. These assumptions also developed a specific SuDS type benefits table used within the wider options assessment. As well as natural capital, carbon equivalent costs were developed for options within the STPT.

9.2.2 *Opportunities for working together*

Within Cycle 1, we have undertaken mini projects to identify our best opportunities to work with others, the outcomes of which will form part of our DWMP consultation. These initiatives are focussed on opportunities to work with stakeholders, customers and in the community:

- SuDS Retrofit in Schools & public places – Strategic opportunities to deliver SuDS at local authority owned sites where there is often significant impermeable area and potentially shorter timescales and especially where local development growth is restricted due to capacity.
- Education on Water Efficiency and Consumption – Options to progress and enhance existing campaigns within DCWW. Indicative programme options developed and costed that will enhance the company baseline programme.
- Education on Blockage formation through Fats, Oils & Grease - Options to progress and enhance existing campaigns within DCWW. Indicative programme options developed and costed that will enhance the company baseline programme.

- Misconnections – Establishing surface water misconnection and removing runoff will be a part of long-term network management. Opportunities to work with the local councils in the first instance to identify large misconnections will be developed through the Project boards.
- Sea Level Rise – Climate change will influence sea level. We have reviewed likelihood of outfalls becoming impacted in the future, considering the impact of locked outfalls on the upstream network. We will continue to work with stakeholders in relation to sea defences and interaction with DCWW assets and the Shoreline Management Plan.

9.2.3 *Capacity improvements and Adding operational Resilience*

The outcome from the infoasset analysis has provided additional risk information and also allowed programme level costs to be derived in terms of investigation at an asset level and also costs using a simple size times average cost to be derived. This analysis will be used ging forward to direct investigations outside of the NEP programmes to further clarify investment for AMP9 onwards.

9.3 Future Recommendations

An important evolution in benefits assessment in Cycle 2 relates to improving the definition of Multi-Capital Benefits. This will extend the work carried out within the B£ST tool to enhance the assessment of options against Social Capital, Human/Intellectual Capital, Financial Capital, Manufactured Capital, and Natural Capital.

10 Programme Appraisal

10.1 Introduction

The programme appraisal stage considers the formulation of a portfolio of interventions, optimised to deliver 'best value', considering drainage and wastewater planning objectives. It has been developed at a company level to support strategic decision making, and is designed to optimise the delivery of interventions across multiple investment periods spanning AMP8 toAMP12.

In this cycle of the DWMP, the programme appraisal has been carried out on the Preferred Options for each risk cluster at a company level by collating individual preferred options for our highest risks and where tactical interventions have been developed through the DWMP. The interventions developed in this cycle of the DWMP are designed to address existing Worst Served Customer flooding and reduce CSO spills within a Special Area of Conservation to 0 spills. The solutions set out to resolve the existing issue, and provide future protection to 2050, in line with the approach set out in Figure 10-1.

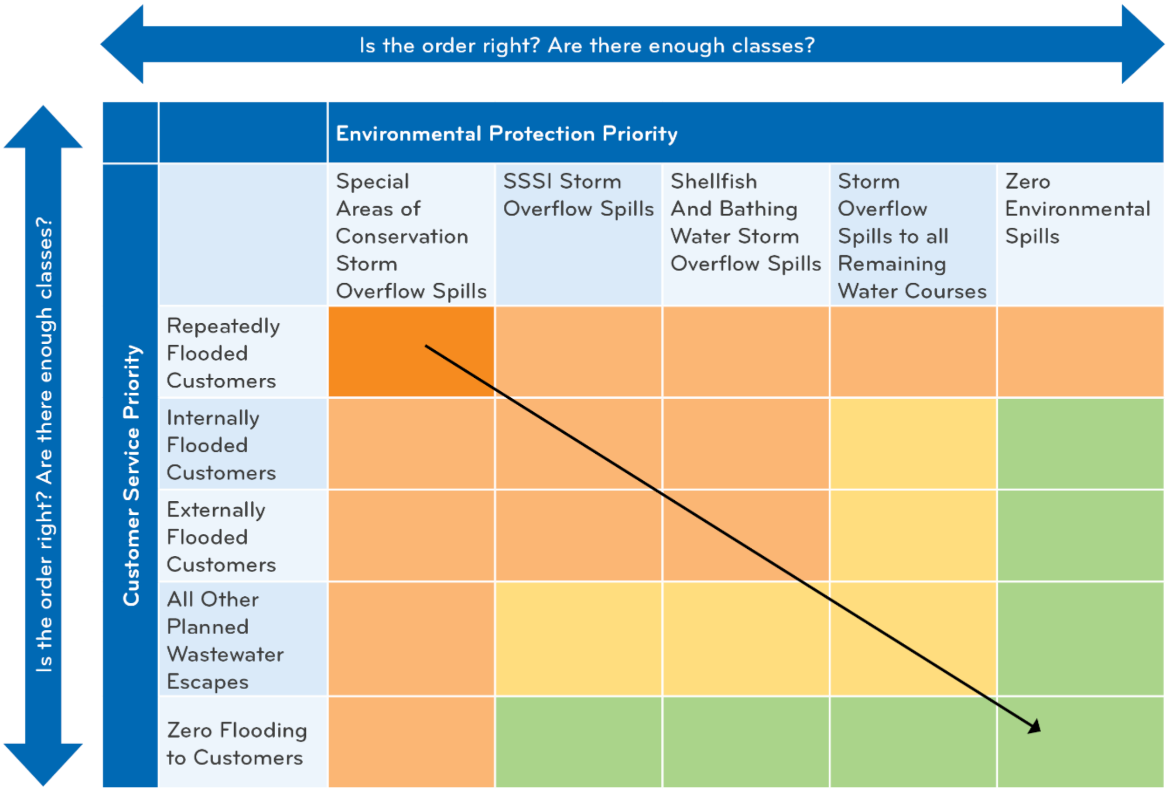


Figure 10-1 – Priority matrix principle

Three delivery approaches have been developed and are calculated in the programme appraisal tool. These approaches provide the flexibility and variability to support the investment planning and scenario testing to optimise the delivery of outcomes.

The Programme Appraisal delivery methods are as follows:

- Delivery Approach 1 – Fixed Budget (Constrained delivery plan approach)
- Delivery Approach 2 – Variable Budget (per AMP)
- Delivery Approach 3 - AMP8 Full delivery, AMP9+ Flat Variables

Each of the delivery approaches takes the output from the NPV Optimisation process at individual catchment level and collates them at Company level (L1). Once collated, all preferred options are prioritised into investment planning periods based on AISC value as this was the preferred approach from our Stakeholders. The least cost ranked approach was also presented but requests favoured the AISC approach. The schemes are then turned into a programme of investment priority via the fixed CAPEX cost to align with company decisions in business planning. for the available DWMP delivery budget within each investment planning period. This ensures alignment with the business approach to delivery planning.

The approach is carried out twice once prior to the environmental assessment SEA and HRA and then again post SEA and HRA to take account of any negative environmental impacts which are removed for reassessment rather than taken forward for down the line assessment.

10.2 Methodology

During cycle 1, the ambition was to achieve a strategic view of the scale of the problem that needed to be solved. It became clear that to “Solve” an area overall would require a considerable volume of water to be either stored in the network and treated, or removed from the network and redirected elsewhere.

For the first cycle, we needed an approach that was easy to use, already in existence requiring very little alteration but would also allow us to discuss the difference between a least cost scheme and a scheme with added benefit. In conclusion, the jointly created AIC and AISC comparison approach from the WRMP EA tables was the logical choice.

Once the zonal best value option was chosen, these were collated together to create a programme at Level 3. These were then ordered by their AISC, and within their time horizon, to create an environmental benefit plan for 25 years.

10.3 Outputs

Throughout the Cycle 1 plan, decisions have had to be made in respect of what is strategic decision making and what is tactical decision making and, as a result, what level of information is required for each section of the plan.

Our bottom-up approach is a maturing process. The outputs from this programme appraisal will be included within the business plan. This will help us to trial the process and develop a greater understanding of how a DWMP fits with price reviews. It will also allow us to combine processes together to bring added efficiencies.

10.3.1 *Delivery Approach 1 – Fixed Budget (Cost Constrained and post SEA/HRA assessment)*

This approach uses a fixed budget available for delivery in AMP, and the budget is consistent across each AMP. In the outputs below, the value of the fixed budget has been set at £60m per AMP. The budget has been applied as a parameter for scenario testing. This approach allows the assessment of how many schemes could be delivered in one planning period and highlights the number of planning periods required to deliver all schemes. If a scheme CAPEX is greater than the remaining budget in an AMP period, the scheme will be programmed for delivery in a later period, and the next available scheme in the ranking that can be delivered within the remaining budget will be programmed in the delivery period.

Where a scheme CAPEX is greater than the total in period budget, the scheme will be programmed into the future planning period, beyond those within the DWMP cycle of AMP8-AMP12. This sometimes results in schemes with a greater AIC or AISC value being placed in priorities lower than those with a smaller AIC or AISC value, but it is designed in such a way to maximise efficiency from the available budget.

Table 10-1 details the intervention programme for Priority 1 to 6 schemes across DCWW, and a definition of the investment priority profile Figure 10-2. In these examples, Investment Priority 1 schemes are expected to be delivered in the first investment period (i.e., AMP8), Priority 2 schemes in AMP9, and so on.

Table 10-1 – Intervention Programme Fixed Budget Assessment

Delivery Approach 1 - Fixed Budget			
Priority	Total Number schemes	Total Cost	Proportion of total schemes
Inv. Priority 1	39	£60,357,976.17	36%
Inv. Priority 2	13	£60,468,264.42	49%
Inv. Priority 3	25	£60,406,235.26	72%
Inv. Priority 4	7	£60,372,735.07	79%
Inv. Priority 5	21	£60,404,734.97	98%
Inv. Priority 6	2	£84,353,874.51	100%

Table 10-1 demonstrates that, at a spend profile of £60m per AMP in 5 AMP periods, 98% of schemes would have been delivered. This would leave two large projects for delivery in subsequent AMPs, requiring further investment of £84.35m.

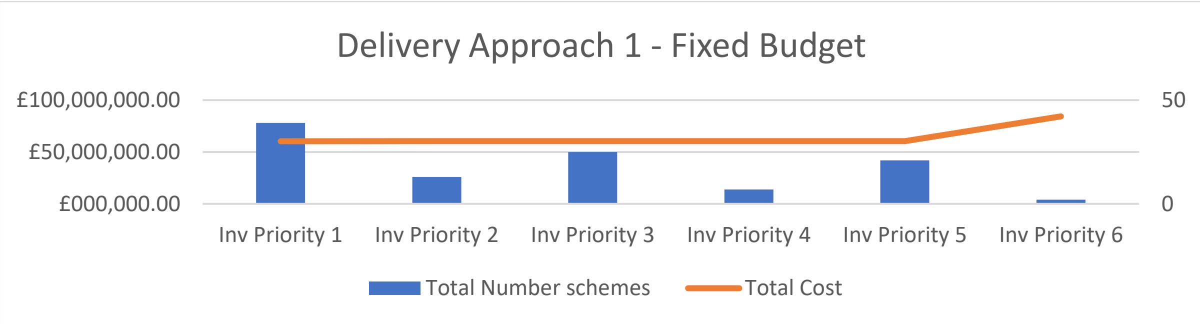


Figure 10-2 Fixed Budget Investment Priority Profile

10.3.2 *Delivery Approach 2 – Variable Budget (per AMP)*

This approach considers a variable budget over each AMP period. The methodology can apply any budget constraint to an AMP period and allows the spend profile of schemes within each AMP to be adjusted accordingly. In the scenario below, the value of the fixed budget has been set at £60m in AMP8 and then at over £80m for subsequent AMP periods.

Table 10-2 details the intervention programme for Priority 1 to 6 schemes across DCWW and the investment priority profile is defined in Figure 10-3.

Table 10-2 – Intervention Programme Variable Budget Assessment

Delivery Approach 2 - Variable Budget			
Priority	Total Number schemes	Total Cost	Proportion of total schemes
Inv. Priority 1	39	£60,357,976.17	36%
Inv. Priority 2	18	£81,401,352.35	53%

Inv. Priority 3	26	£81,474,385.78	78%
Inv. Priority 4	21	£78,753,289.02	97%
Inv. Priority 5	3	£84,376,817.08	100%
Inv. Priority 6	0	£000,000.00	100%

The table above demonstrates how, at the proposed variable budget distribution, all 107 schemes will have been completed over 5 AMP periods.

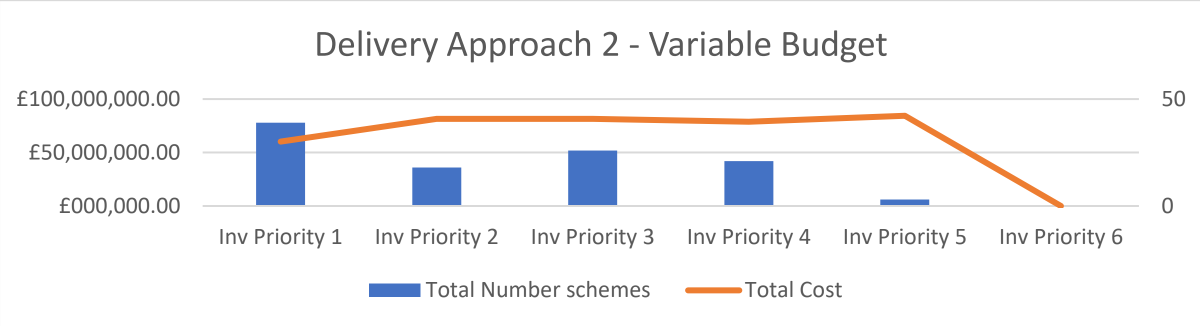


Figure 10-3 Variable Budget Investment Priority Profile

10.3.3 *Delivery Approach 3 – Investment Priority 1 Full Delivery, Investment Priority 2 + Flat Variables*

This approach provides an indication of the total cost required to deliver the preferred options for each scheme to resolve all worst-served customers and stop SAC spills within the first planning period (AMP8). The delivery of enhancement schemes, to provide the additional protection up to 2050 (no flooding or spills at these locations) is then split across the remaining AMPs of the DWMP. This is distributed across the AMPs via the total CAPEX averaged across each AMP.

Table 10-3 below details the intervention programme for Priority 1 to 6 schemes across DCWW and the investment priority profile is defined in Figure 10-4.

Table 10-3 – Intervention Programme Investment Priority 1 Full delivery, Investment Priority 2 + Flat Variables Assessment

Delivery Approach 3 – Inv. Priority 1 Full delivery, Inv. Priority 2+ Flat Variables			
Priority	**Total Number schemes**	**Total Cost**	**Proportion of total schemes**
Inv. Priority 1	84	£344,173,241.89	79%
Inv. Priority 2	17	£10,639,901.08	94%
Inv. Priority 3	2	£14,405,474.95	96%
Inv. Priority 4	2	£15,858,609.21	98%
Inv. Priority 5	2	£1,286,593.27	100%
Inv. Priority 6	0	£000,000.00	100%

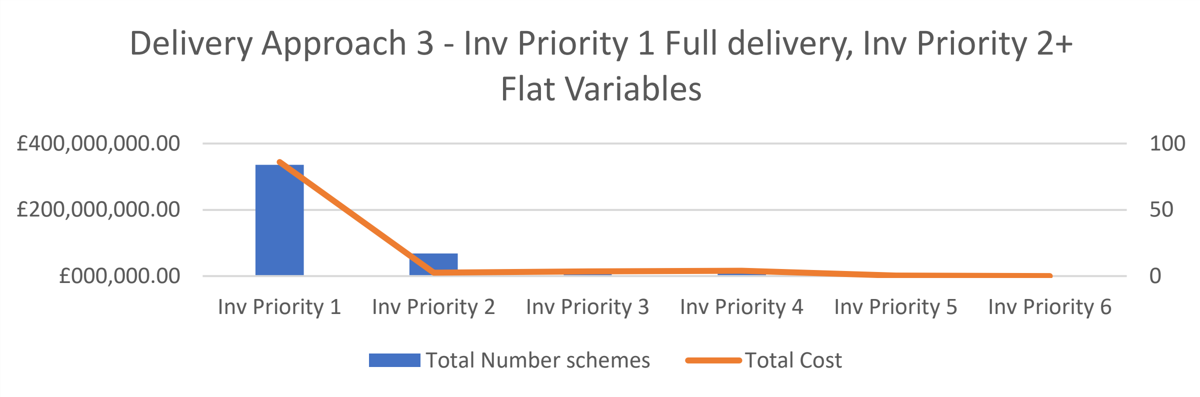


Figure 10-4 Variable Budget Investment Priority Profile

The above investment scenarios demonstrate that solving all the worst served customer flooding issues and addressing pollution to protected water bodies would not be practical or affordable in a single AMP period, as set out in Delivery Approach 3. It does, however, show that both the fixed and variable budget approaches could be viable.

The assessment also highlights that the choice made when the solution is developed can seriously impact the ability of the optimiser to programme a solution to meet the risk. The Table 10-4 distribution of solutions by date below shows that from the list of solutions there are 24 solutions that need to be delivered by 2030 costing £72 Million, however the optimiser and the way we have created our solutions also indicates that it is more cost beneficial to early prioritise a further 60 solutions as the 5-year cost benefit is less cost effective than an early delivered 25-year solution.

	Total Overview	
	Total Number schemes	**Total Cost**
2025-2030	24	£72,916,196
2030-2050	23	£42,190,579
2025-2050	60	£271,257,046
Total	107	£386,363,820

Table 10-4 distribution of solutions by date

The outputs of these approaches will now be assessed, as part of our PR24 investment planning work, to determine whether the indicative budget, outlined in **Error! Reference source not found.**, can be funded in AMP8. If it can be funded, we'll examine what the preferred spend profile for future AMPs will be to allow the relevant schemes to be selected for AMP8 delivery.

10.3.4 *Regional Investment Strategies*

For each of the 13 L2 River Basin Catchments, a summary overview report has been generated. As well as providing the pathway for that region through the DWMP process. They present a review of the best value plan for the region, which included the testing of types and combination of schemes, through to the 2050 Time Horizon and strategically to the End Destination.

These regional strategies have identified the likely costs required to mitigate future predicted pollution through CSO performance and catchment flooding, two critical network planning objectives. These likely costs across the region are presented as a series of scenarios towards achieving performance improvements based on current catchment conditions as well as the Future Scenarios where the additional impact of growth, creep and climate change influence the investment needs. These summaries include detailed model driven options development, as well as non-modelled approaches to determine strategic costs.

11 Environmental Assessment of the Plan

Following the identification of priority schemes across the DCWW region, their environmental impact must be reviewed to ensure that they have no detrimental impact on the environment. Initially the principles of environmental assessment were incorporated into the options developed assessment and to conclude the legal requirements and facilitate this, a Strategic Environmental Assessment, and a Habitats Regulations Assessment, were planned and undertaken for the preferred options sites to document the conclusions. The process for these two assessments is detailed below.

Where the environmental impacts were deemed to exceed the identified thresholds within the two assessments, these schemes were removed from the plan, and included for more detailed review in Cycle 2 to understand in more detail how the environmental impacts can be mitigated.

11.1 Strategic Environmental Assessment (SEA)

A strategic environmental assessment (SEA) is a formal, systematic process that identifies and analyses the potentially significant and cumulative effects a plan, or program, may have on the environment. The SEA regulations apply to statutory planning obligations of large-scale activities according to various screening criteria.

As the DWMP process is not yet a legal requirement, a draft DWMP is not within the scope of the SEA regulations and completion of an SEA is regarded as a demonstration of best practice. In future cycles, the DWMP will become part of the normal planning duties, thus making the SEA a requirement.

The purpose of the SEA of the DWMP will be to:

- Identify the potentially significant environmental effects of the draft plans in terms of the drainage and wastewater management proposals being considered.
- Help identify appropriate measures to avoid, reduce or manage adverse effects and to enhance beneficial effects associated with the implementation of the draft plan wherever possible.
- Give the statutory SEA bodies, stakeholders and the wider public the ability to see and comment upon the effects that the draft plan may have on them and encourage them to make responses and suggest improvements to the draft plans.
- Inform the selection of drainage and wastewater management proposals to be taken forward into the final version of the plan.

11.1.1 *SEA Process*

The SEA has five key stages:

- Stage A: Scoping.
- Stage B: Develop and Refine Alternatives and Assess Effects.
- Stage C: Prepare Environmental Report.
- Stage D: Consult on the Draft Plan and Environmental Report and Prepare the Post Adoption (SEA) Statement.
- Stage E: Monitor Environmental Effects.

The first stage of the SEA was a review to identify the major economic, social, and environmental concerns that will be considered in the DWMP. The key issues identified have informed the framework that will be used to analyse the consequences of the proposed DWMP.

The assessment of the DWMP involved a quantitative risk assessment, and qualitative appraisal, of the likely impacts. These impacts will be mitigated through implementing different options. The SEA looked to identify mitigation measures including specific proposals to minimize, eliminate, reduce, or offset significant adverse effects on environmental considerations, identified through stages within the DWMP process.

To be compliant with the SEA, a plan or program must consider the cumulative effects of its provisions. This includes the overall impact of the proposed DWMP in conjunction with other plans and programmes, as well as the individual impacts of specific measures within it. The proposed approach is considered in accordance with Schedule 2 (6) of the SEA regulations.

11.1.2 *SEA Assessment*

The impact of the measures proposed in the DWMP were evaluated based on its type, when it occurs, the geographic scope, sensitivity of human or environmental receptors that may be affected, and the duration of any impact. For each of the SEA goals, a set of criteria was established to determine what constitutes a significant, minor or no impact.

The proposed assessment objectives are assessed against the core sustainable and traditional options considered within the DWMP and assessed against their positive or negative impacts during construction and operation. This generic assessment is detailed in Table 11-1. This assessment was undertaken for each of the options generated across the DWMP.

Table 11-1 – Generic assessment of options

Option	Stage	1. Biodiversity	2. Soils, Geodiversity and Land Use	3. Water Quality	4. Flood Risk	5. Air Quality	6. Greenhouse Gas Emissions	7. Climate Change Resilience	8. Economic and Social Well-being	9. Human Health	10. Water Resources	11. Waste and Materials	12. Historic Environment	13. Landscape
Sustainable	Construction (negative)	-/?	-/?	0	-/?	-/?	-/?	-/?	0	-/?	0	-/?	-/?	-/?
	Construction (positive)	+/?	+/?	0	0	0	0	0	+/?	0	0	+/?	0	0
	Operation (negative)	0	0	0	0	0	0	0	0	0	0	0	-/?	-/?
	Operation (positive)	+/?	0	+/?	+/?	0	0	+/?	+/?	+/?	+/?	0	0	+/?
Traditional	Construction (negative)	-/?	-/?	0	-/?	-/?	-/?	-/?	0	-/?	0	-/?	-/?	-/?
	Construction (positive)	0	+/?	0	0	0	0	0	+/?	0	0	+/?	0	0
	Operation (negative)	0	0	0	0	0	-/?	0	0	0	0	0	-/?	-/?
	Operation (positive)	+/?	0	+/?	+/?	0	0	+/?	+/?	+/?	+/?	0	0	0

The specific detail for all options reviews across the entire DCWW region can be found in the full DWMP SEA Environmental Report. The assessment of Across the full L2 River Basin

Catchments, the full summary of options screened in, likely effects identified and specific comments from the assessment, is illustrated in Table 11-2. This does identify schemes where there are potentially significant negative effects against SEA objectives.

Table 11-2 – Summary of options screened for assessment and findings

L2 River basin catchment	WwTW Catchment area	Number of options screened in	Likely significant effects identified	Comments
Carmarthen Bay and the Gower	Gowerton Llanelli Coastal	2 1	☒ ☒	A range of minor and moderate positive and negative effects for construction and operation have been identified and assessed, reflecting the small scale of the proposed schemes
Clwyd	Kinmel Bay	2	☑	Two proposed schemes with likely significant negative effects against one SEA objective during construction.
Conway	Ganol STW	6	☑	One proposed scheme with likely significant negative effects against one SEA objective during construction.
Dee	Five Fords (Wrexham) Llanasa (Nr Prestatyn)	2 5	☑ ☑	Two proposed schemes with likely significant negative effects against one SEA objective during construction. In operation, likely significant positive effects against one SEA objective. Two proposed schemes with likely significant negative effects against one SEA objectives during construction.
Llyn and Eryri	Bangor Treborth Porthmadog	9 4	☑ ☒	One proposed scheme with likely significant negative effects against two SEA objectives and one likely significant positive effect during construction. In operation, likely significant positive effects against four SEA objectives
Meirionnydd	Tywyn	3	☑	One proposed scheme with likely significant negative effects against one SEA objective during operation.
Southeast Valleys	Cardiff Bay Cilfynydd Newport Nash	2 1 27	☒ ☒ ☑	15 proposed schemes with likely significant negative effects against up to five SEA objectives and one likely significant positive effect during construction. In operation, likely significant positive effects against up to five SEA objectives.

L2 River basin catchment	WwTW Catchment area	Number of options screened in	Likely significant effects identified	Comments
Tawe to Cadoxton	Pen-Y-Bont Swansea Bay	2 2	☒ ☑	One proposed scheme with likely significant negative effects against three SEA objectives and one likely significant positive effect during construction. In operation, likely significant positive effects against five SEA objectives.
Total		68*		

Construction activity is unlikely to lead to cumulative significant effects on receptors (unless this activity is of significant scale, concentrated in specific localities and occurring concurrently). It is anticipated that the effects of the options can be managed through the application of the mitigation hierarchy, and a range of construction mitigation practices.

However, for schemes that represent significant engineering works and capital investment, there will be individual and cumulatively significant positive and negative effects in terms of SEA Objectives 6 ‘Greenhouse Gas Emissions’, 8 ‘Economic and Social Wellbeing’ and 11 ‘Waste and resources’ which need to be considered where appropriate.

11.1.3 *SEA next steps*

Once the draft DWMP has been adopted, the selected schemes for managing drainage and wastewater contained in it will need to be implemented through specific projects. As part of this process, each project may be subject to further assessment to understand and manage its potential environmental and social impacts.

These assessments, which may additionally include HRA and EIA, will take account of the issues discussed in this report but will also be informed by the greater detail available as the work progresses about construction techniques, building materials, and agreed locations and routes.

11.2 Habitats Regulations Assessments (HRA)

Habitats Regulations Assessment (HRA) – examines the potential effects of a plan or project on nature conservation sites that are designated to be of European importance. The HRA is mandated by the Conservation of Habitats and Species Regulations 2017 (the ‘Habitats Regulations’), which transposes into UK law the European Directive 92/43/EEC (The Habitats Directive).

The HRA process begins when the development of the DWMP has reached sufficient progress to include specific details about potential projects, such as location and scale. There are no formal guidance or precedent cases to directly inform the application of a HRA to the DWMP. Therefore, there is a degree of flexibility for the HRA process. This allows the process to be ran in a manner that provides maximum benefit for plan development and decision-making.

11.2.1 *HRA Process*

Stage 1 – Screening or 'Test of significance'

This stage looks for the potential consequences of a project or plan on a designated site, either alone, or in combination with other projects or plans, and assesses whether these outcomes are likely to be significant.

Stage 2 – Appropriate Assessment (including the 'Integrity test')

This stage is a more thorough analysis of the plan or project, in which the consequences on relevant locations have been identified as significant or uncertain and is required to assess the likely significant effects of the proposal on the integrity of the site and its conservation objectives.

The HRA test must show beyond all reasonable scientific doubt if an adverse effect on the site's integrity can be ruled out; this is called the 'Integrity Test'.

Mitigation measures, which have been included in the plan, or have been developed during the HRA process in response to the potential adverse effects, must be assessed to determine likely effectiveness.

Stage 3 – Assessment of Alternative Solutions

Where adverse effects remain after the inclusion of mitigation measures, Stage 3 examines alternative ways of achieving the objectives of the plan that avoid these impacts. A plan that has adverse effects on the integrity of a designated site cannot be permitted if alternative solutions are available, except for reasons of overriding public interest.

Stage 4 – Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain

This stage assesses compensatory measures where it is deemed that there are no alternatives that have no or lesser adverse effects on designated sites, and the project or plan should proceed for imperative reasons of overriding public interest (IROPI).

The HRA process will therefore be used iteratively to inform the optioneering stage by providing a mechanism for proposal assessment that ensures proposals are not ultimately prohibited under the Habitat regulations.

11.2.2 *HRA Scope and approach*

A key issue for the HRA is the level at which assessment can be reasonably and meaningfully undertaken. For a DWMP L3 level, which is relatively wide-ranging; an HRA undertaken would necessarily be quite high-level also and would likely defer much of the assessment to a lower planning tier due to the absence of detail on the location of interventions. With risk clusters considered at greater resolution within individual WwTW catchments to resolve issues, the scope of the HRA is based on a review of the scale and characteristics of the specific options proposed. Following high level screening against proximity to European sites, options which could not be excluded from having an impact had an additional '**appropriate assessment**' undertaken to identify in closer detail other features that may be relevant to site integrity including typical species, supporting habitats and functional habitats.

In most instances, the environmental changes associated with the options will almost certainly be manageable or avoidable at the scheme level. However, this relies on mitigation assumptions and, as such, some options and WwTW Catchments are 'screened in' for appropriate assessment.

The following L4 areas and European sites are therefore considered in an 'appropriate assessment'.

Table 11-3 – WwTW Catchments where appropriate assessments were undertaken and site triggers

WwTW Catchment	Sites
Bangor Treborth	Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC Traeth Lafan/ Lavan Sands, Conway Bay SPA
Five Fords	Johnstown Newt Sites SAC River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC
Ganol STW	Liverpool Bay / Bae Lerpwl SPA Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC
Llanasa	The Dee Estuary Ramsar The Dee Estuary SPA
Llanfaglan	Afon Gwyrfai a Llyn Cwellyn SAC Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC
Newport Nash	River Usk/ Afon Wysg SAC River Wye/ Afon Gwy SAC
Porthmadog	Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC
Tywyn	Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC

Specific details of the 'appropriate assessments' for the WwTW Catchments, including potential effect pathways and mitigation and effect assessment, can be found in the full DWMP HRA document. The key points are summarised below:

- Whilst options are identified the proposals are not intended to be definitive plans for schemes that cannot be deviated from; in practice, none of the options are of a scale or type where adverse effects (through construction or operation) are likely to be an unavoidable consequence of their delivery.
- For all options, the environmental changes associated with construction will be manageable or avoidable at the scheme level using standard project-level avoidance and mitigation measures that are known to be available, achievable, and effective.
- Regarding operation, the options within the current iteration of the DWMP are fundamentally addressing relatively small-scale local flow-management issues to reduce spills or flooding at a particular location and ensure that these volumes can be passed to the relevant WwTW for treatment (in accordance with the WwTW's permits). As such, their operational effect on receiving waters is likely to be positive (or at least neutral) compared to the status quo.

The effects of options operating 'in combination' have been explored through the screening and appropriate assessment phases. These assessments have concluded that adverse effects 'alone' are not likely to occur for any European sites or features as any such effects can be avoided or mitigated at the project level; this also applies to 'in combination' effects between options due to the following:

- The environmental changes and zones of influence of options in different L4 areas will be negligible and will not overlap spatially or temporally; nor will this result in complex synergistic or temporally dispersed effects.
- Mitigation can be relied on to reduce the effects from any individual option to the extent that there will effectively be 'no effects' due to construction or operation.

As such, the options will not have adverse effects 'in combination' that are likely to be unavoidable at the project level.

Regional and local plans have been reviewed at a high level to determine whether there are any likely significant 'in combination' effects with proposed options. This review has not indicated any potential or likely 'in combination' effects that could occur because of cumulative development pressure. Furthermore, the timescales involved in the implementation of the DWMP options, and the absence of detail on allocation proposals, makes any 'in combination' assessment difficult and of limited value. However, the DWMP options account for anticipated local and regional growth and are inherently unlikely to operate 'in combination'.

11.3 SEA and HRA Consultation

It is important to recognise that the DWMP consultation includes the separate formal consultations of the draft SEA and HRA. The responses to those consultations will be collated and reviewed. Consultation responses will be provided in the form of a published statement of response (SOR). A revised draft SEA and HRA will then be developed, which will form the final SEA and HRA, once the Welsh Government gives its direction to publish the final DWMP.

11.4 Impacts to Net Carbon

In the production of delivery solutions, the carbon impact was also quantified. The additional carbon from the programme has been noted and a further assessment is being considered to build in an offsetting process. Trials and cost of an offsetting process will need to be built into the overall solution if best practice on this topic can be derived.

12 Concluding the Plan

12.1 Implementation

This first non-statutory cycle of the DWMP has developed the tools and approach for meeting the stages of the national DWMP framework.

The DWMP assessment of risk has allowed us to highlight the areas at greatest risk, but also those areas where there is remaining uncertainty. The certain and complex risks have been taken forward to optioneering, and then into programme appraisal. At programme appraisal, solutions have been selected to achieve the best suite of options to meet the recommended customer destination and environmental destination for the localised area. These localised solutions have been aggregated to develop a programme of investment at DWMP Level 2 and Level 1, which has been phased over short to long-term timescales to deliver the most effective strategic wastewater investment programme.

It must be noted that, during this first non-statutory cycle of the DWMP, this strategic investment programme does not identify the specific solutions required to meet each performance commitment. This task will be developed as part of our PR24 and subsequent price reviews. However, the DWMP does identify the type of solutions required to meet the overall destination over time.

Whilst the DWMP may not yet have developed a plan for implementation it does give us tools and outputs that can help inform national policy on the pace and affordability of change. It also demonstrates the scale of the challenge of managing surface water inflows to our combined sewers in addressing customer and environmental risk.

The disjointed ownership of drainage in our urban communities will mean that implementation of our plan in future cycles will require considerable integration with other stakeholders. We view this ability to inform and influence policy decisions, that will inform future DWMP cycles, as an essential long-term component of this first iteration.

12.2 Monitoring

Twelve months after the plan is published, the first Annual review of the plan will be required, and annually on the same date each year until the next DWMP plan is published. The annual review steps, which are outlined in the national framework (WaterUK, DWMP Framework, 2018), and are summarised below, ensure that any new information is reviewed and assessed in a timely manner. Any new information that alters the direction of the DWMP sufficiently to alter the policies or direction from Government will trigger the production of a new plan.

12.3 Conclusions

To ensure that our strategic long-term wastewater plan can help inform this policy debate, we have considered the likely outcome of various policy impacts and their potential consequences for customer bills. However, as a society, we cannot single out storm overflows alone for improvement. We need to ensure that our long-term plans set out to deliver the broader aspects of wastewater resilience at our treatment works and sewers, to manage water quantity and quality in the face of the impacts of climate change, growth, and urban creep.

In developing our plan, we have explored the impact from an affordability, deliverability, skill shortage and resource perspective. This has led us to promote a set of realistic investment scenarios for consideration in our PR24 business plan preparations in addition to the wider, more strategic level outputs of our plan.

Observations driven from the first cycle of plan development are summarised below:

- Intensive modelling will be required to fully understand catchment performance from a quality and quantity scale, particularly the interactions with other drainage systems. This reliance on modelling, to increase confidence in the bottom-up assessments, will have an impact on the pace of improvements and the accuracy of our plan in future cycles.
- Even after modelling, if the root cause is not fully understood, then confidence over whether we are choosing the highest priority location to address is compromised.
- If many solutions are required in a 5, or 10-year period, a traditional approach is more likely to be chosen than a more sustainable approach. This is mainly because the lead time before getting to site is longer for SuDS and other sustainable solutions.
- Collaborative schemes that take multiple organisations to get together to resolve drainage or pollution take a longer lead time, sometimes greater than 5 years in discussions and planning.
- Joint funding of collaborative solutions is not clearly defined in government processes, presenting significant challenges in aligning funding, accounting for benefits, and ensuring delivery programmes can be met.
- Ofwat do not have a clear policy on co-funding schemes that others will deliver.

12.4 Recommendations

We must recognise that during the first cycle a range of pilots and other learning activities have been undertaken to identify the most appropriate tools and approaches to deliver a DWMP. This work has identified that, to achieve a mature, resilient, repeatable plan we will need to invest in data that we have not collected before. We also need to consider investing in systems to analyse that data and expert staff resources to apply the processes.

Building on our learning from Cycle 1, the following general recommendations are proposed going forward:

- We need to increase the data collected to support our modelling and data improvement aspirations.
- We need to develop integrated systems not just within Welsh Water but jointly with our colleagues from Councils, Natural Resources Wales and the Environment Agency and Environmental NGO's so that we collect and work from the same data, improving the usefulness of that data and increasing our joint understanding so that we all work together to improve the environment from both Quality (pollution impact) and Quantity (flooding and drought impact) perspective.
- We need to increase our understanding of asset capacity and increase the coverage of our hydraulic models to forecast that capacity, including integrated models that consider the implications of our surface water separation plans on other catchment drainage systems.
- We need to improve and automate our DWMP analysis tools to integrate these results together to provide more time to review data and less time checking and verifying.
- We need to acknowledge that we must continue to capture lessons learned by those responsible for DWMP production, as the first iteration is completed, so that they can be embedded in time for second cycle DWMPs.
- We need to continue to work with the contacts and groups created during the development of the framework, and associated workshops, as a practitioner support network throughout the DWMP process, enabling a shift in focus to a shared vision, to obtain the greatest benefit from net gains.

- We need to ensure that the DWMP Framework and process continues to evolve and embeds current good/best practice.
- We need to develop the framework to facilitate collaborative working with other organisations who can play a role in the implementation journey for the DWMP, such as local authorities.

12.5 Preferred Approach to future planning

The plan sets out the approach recommended for the next iteration of planning. This is being recommended because we recognise that the aspiration of society is currently at a high with regards to storm overflows river pollution and social amenity. In our first plan we have already concluded that we cannot make as many changes as society would like and we need to prioritise and gain agreement with regards to that priority. So, the proposal being put forward in terms of planning is made up of milestones to achieve an end destination of zero spills everywhere and no more risk of internal sewer flooding from a capacity driven risk.

To break that destination down into milestones the proposal states how to select an area for planning i.e. Its greatest risk from the Matrix and then whether to apply small steps 1a or to use the small zone approach 1b. This has been recommended to deliver as many improvements as affordable in each 5-year period across our operating area rather than fewer large-scale improvements in only a selected few locations. Our programme appraisal tool allows affordability to change and alternative programmes to be developed to aid planning purposes. The alternative is to continue with the current approach to meet company targets rather than zonal targets.

1. Preferred approach - As part of the Plan, we have looked at how to improve both storm overflows and network capacity at the same time, covering both the water quality and water quantity themes of our plan,

   a) On an incremental improvement basis - We have looked at how more benefits can be achieved through increasing overall system capacity.

   b) Small zone approach - We have also looked at reducing the impact of both storm overflows and customer sewer flooding on a zone-by-zone basis, where we would deliver improvements in one step.

2. Standard approach – This would involve continuing with the current approach of investing to meet individual company level performance commitments, and targets agreed with regulators, to gain the greatest target reduction.

Our customers are being asked currently to their preference and we will conclude their choice ready for the next plan.