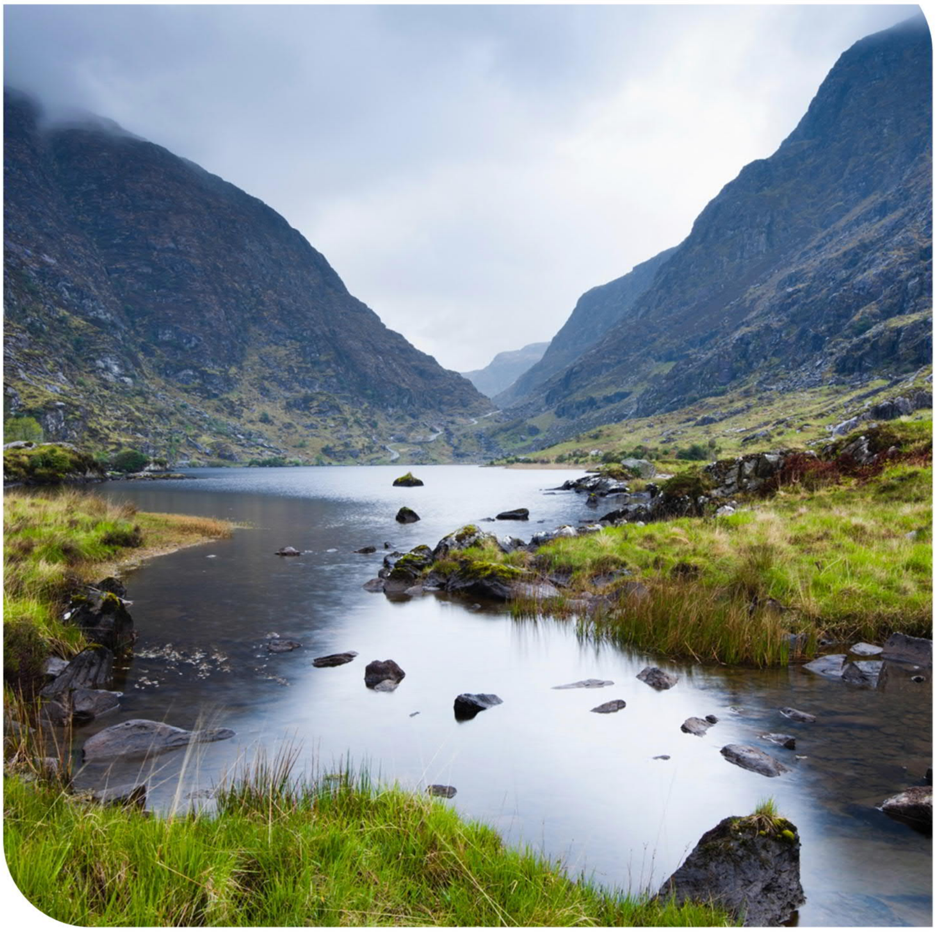
Winter 2020

# National Water Resources Plan – Draft Framework Plan

## Irish Water's 25 Year Plan for Our Water Assets



Tionscadal Éireann
Project Ireland
2040

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**Data Disclaimer:**

This document uses best available data at time of writing. Some sources may have been updated in the interim period. As data relating to population forecasts and trends are based on information gathered before the Covid 19 Pandemic, monitoring and feedback will be used to capture any updates. The National Water Resources Plan will also align to relevant updates in the National Planning Framework.

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# 1 Introduction

# 1 Key Points

**This section contains the following information:**

- **The National Water Resources Plan (NWRP) and its relation to other Irish Water Strategies, Government Policy and Legislation;**
- **An outline of current water services in Ireland; and**
- **A summary of future challenges faced in serving the needs of our customers.**

## 1.1 Introduction

**Did you know?**

- **Irish Water was created in 2013**
- **We serve 4.2 million people**
- **We deliver water services to approximately 87% of the population**
- **Irish Water currently manages 539 individual water supplies in Ireland**
- **We produce over 1.7 million litres of drinking water every day and take wastewater away for treatment before it is returned to our rivers and seas.**

**Thousands of assets are operated and maintained to provide these services, including:**

- **749 water treatment plants, which deliver water through over 65,000km of pipelines.**
- **Collecting Wastewater through an estimated 25,000km of sewer network for treatment in over 1,000 wastewater treatment plants, with associated pumping stations and sludge treatment centres.**

## 1.2 Who we are

On the 1st of January 2014, through the Water Services Act (No. 1) 2013, Irish Water assumed statutory responsibility for the provision of public water services and management of water and wastewater investment. Irish Water's role is to provide public water and wastewater services throughout the country. We are the custodian with the responsibility to manage the precious water resources and, with our Local Authority partners, secure it for future generations. It is our responsibility to ensure that all our customers receive a safe and secure supply of drinking water and have their wastewater collected, appropriately treated and returned to the environment. We support Ireland's social and economic growth in a sustainable manner through appropriate investment in water services and strive to protect the environment in all our activities.

Irish Water is regulated by:

- The economic regulator, the Commission for Regulation of Utilities (CRU), is charged with protecting the interests of the customer. The CRU also approves appropriate funding to enable the utility to deliver the required services to specified standards in an efficient manner.

- The environmental regulator, the Environmental Protection Agency (EPA), sets standards and enforces compliance with EU and National Regulations for drinking water supply and wastewater discharge to water bodies. The EPA liaises with the Health Services Executive in matters of public health.

## 1.3 What is the National Water Resources Plan

Effective water services, including the delivery of a sustainable and reliable clean water supply and safe disposal of wastewater, are essential for a modern country. Being able to understand and estimate how much water is required, where it is required, and when it is required, is essential to plan appropriately for our Country's future.

A Water Resources Plan is a strategic plan used to identify deficiencies and need across a water supply and to develop plan level capital and operational solutions to address these issues.

Irish Water's National Water Resources Plan will be the first resources plan for the public water supply in the Republic of Ireland. It will allow us to integrate Government Policy, Legislation and external factors that have the potential to impact our water supplies into the planning and operation of our existing and future supply asset base.

The objective of the National Water Resource Plan is to manage customer and communities needs while meeting their requirements over the short, medium and long term by ensuring safe, secure, sustainable and reliable water supplies. The NWRP will:

- Enable Irish Water to address needs across our water supplies in the most effective way over time, through the regulated investment cycles;
- Ensure that there is a transparent framework to develop the most appropriate projects/programmes to meet statutory obligations in relation to water supply;
- Provide a framework to track outcomes, allowing interventions to be prioritised in order to bring the water supply up to the required standards in the shortest possible timeframe; and
- Deliver a plan to ensure that all of our customers have access to safe, secure, reliable and sustainable water supplies, wherever they live.

As a basis for broad public and stakeholder engagement, the National Water Resources Plan (the Plan) will be delivered, as described in section 1.9. During this consultation, Irish Water will consult on the methodologies we have developed in the draft Framework Plan (this document) in order to identify need and find solutions to address need across all of our supplies. We will also assess need across each of the 539 public water supplies nationally, in terms of:

- **Water Quantity** that Irish Water can provide;
- **Water Quality** that Irish Water can provide; and
- Performance and operational efficiency of Irish Water's **Asset Base**.

Water Resources Plans are reviewed on a cyclical basis to take account of new information, data, policies and laws and are typically updated every 5 years. We know things will change over the next 25 years so, within the Plan, we have considered a range of possible futures, some more challenging than others. This approach is called adaptive planning and means we are ready and flexible whatever the future holds.

A glossary of technical terms used is included at the end of the document.

## 1.4 Water Supply in Ireland

Water is currently abstracted from approximately 1,090 individual sources and treated in 749 Water Treatment Plants (WTPs). The size of these WTPs varies significantly across the country, with the largest 72 producing 73% of the water supplied and the smallest 500 producing on average about 6% or 0.2Ml/d of the total supply.

The WTPs feed water into supply areas known as Water Resources Zones (WRZs). Each WRZ is an independent water supply system serving a region, city, town or village and is governed by topography or the extent of the water distribution network in an area. Within a WRZ most customers receive the same Level of Service (LoS), measured as a probability of interruption to services (for example one interruption to supply in 50 years). There are 539 WRZs in Ireland. These range in size, serving populations of less than 30 people (small rural areas) up to 1.6 million people (Greater Dublin Area - GDA).

Ireland has a dispersed population and water supplies were historically developed in response to need in the immediate vicinity. As a result, some supplies were developed using surface or groundwater sources with limitations in terms of quantity available and/or variable raw water quality. Also, due to long term under investment in water services, many of our water supply assets (WTPs, water mains etc) are in need of upgrades or additional infrastructure is required.

As a result, there are a number of key issues that impact the quality, sustainability and reliability of our existing water supplies.

- **Single Source Supplies**: Many WRZs rely on a single source of supply, meaning they are more vulnerable to interruptions to supply;
- **Inappropriate Water Sources**: Current supplies often come from small local rivers. We must ensure that our abstractions do not adversely impact the environment so that Ireland can comply with its obligations under the Water Framework Directive;
- **Treatment Capacity**: Rapid growth in some areas has meant that some of our WTPs are undersized and treat water in quantities that exceed the original design capacity of these facilities;
- **Water Quality**: Although 99.6% of samples passed quality tests in 2019, some of our water treatment facilities and distribution systems do not function as effective barriers to reduce risk and may not consistently ensure safe drinking water at Customer's taps. A legacy of under-investment has exacerbated the problems with some water supply assets.
- **Network Performance:** The performance of our distribution networks does not meet European norms and leakage and distribution losses are unacceptably high. Key issues include:
    - The average age of the water mains infrastructure in Ireland is estimated at between 65 and 85 years. This compares to an EU average of 36 years[1]
    - Some of the cast iron mains in our cities and towns are often heavily corroded and vary in age from 50 to 160 years, giving rise to high leakage, rust discolouration and high risk of failure causing supply disruption.
    - Other pipe materials such as uPVC and Asbestos Cement laid between the 1960s and 1980s can also be problematic with high burst frequency
- **Constrained Funding:** Due to long term underinvestment in water services many of our assets are failing and are in need of significant capital investment. Coupled with stricter EU standards, treated water quality and protection of the environment are driving the need to increase as opposed to reduce expenditure.

[1] European Benchmarking Cooperation 2013

## 1.5 Progress to date

Irish Water has made positive progress in improving water quality for our customers by developing policies and strategies for our water supplies. We have progressed projects and programmes to deliver the requirements of these policies. Irish Water's Investment periods, (known as Revenue Control periods) set out how much Irish Water can spend on projects and programmes for that period.

The first Capital Investment Plan covered the period 2014-2016. The second investment plan covered 2017 to 2019. We are currently at early implementation stages of the new investment plan for 2020-2024.

Between January 2014 and December 2019 Irish Water invested €3.9 billion in public water and wastewater infrastructure, with a further projected spend of circa €5bn by 2024. We have invested in a range of water projects and programmes that will support and enable proper planning and sustainable development at a national, regional and local level. The objective of this approach has been to deliver a balanced portfolio of investment across the three themes of Quality, Conservation and Future Proofing.

### 1.5.1 Water Quality

Irish Water aims to lift Boil Water Notices (BWN) through targeted investment and we have successfully achieved this for 79,507 people since 2014. Nearly 16,000 of these people were on long term boil water notices. Through investment in water assets and infrastructure, Irish Water has removed 174 public water schemes from the EPA's remedial action list. Over the same period (2014-2019) an additional 86 schemes have been added, leaving 52 schemes with remedial works remaining.

Since the start of 2014, 72 WTPs have been rationalised by Irish Water by laying a water main connection to a neighbouring treatment plant. We are also delivering a range of national programmes to address high risk water supplies. Through our National Disinfection Programme, we have upgraded a total of 255 WTPs and under our National Lead Programme we have replaced a total of 32,641 lead services, representing a significant investment in protecting public health.

### 1.5.2 Water Conservation

Water conservation is a key focus for Irish Water. Our National Leakage Reduction Programme is reducing leaks across Ireland by fixing or replacing old, damaged pipes and removing lead service pipes from the network. Through this programme we have achieved total gross leakage savings of 154.2 Ml/d on the private side and 233.2 Ml/d on the public side of the water distribution network for the 2014-2019 period.

### 1.5.3 Future Proofing

Between 2014 and 2019 we delivered key outcomes to support growth including constructing 11 new WTPs and upgrading 36 WTPs. We have also laid a total of 1,906km of new and rehabilitated water main. Major national strategic infrastructure water projects have also been progressed during this time, including the Vartry Water Supply Scheme (Co Dublin and Wicklow) and Lough Guitane WTP (Kerry). These projects are of vital importance and critical to meeting Ireland's growing water needs.

Despite this progress, Irish Water will have further challenges to address. Therefore, it is essential that we put in place a National Water Resources Plan in order to keep making progress in a strategic and prioritised way for the next 25 years. This Plan will then help Irish Water inform the capital investment plans for each future investment cycle.

## 1.6 Our Future Challenges

Ireland has a temperate climate with relatively high annual average rainfall, so while it is easy to assume that there is plenty of water available for supply, this is not always the case. Rainfall is unevenly distributed across the country, with more falling in the west than the east. Figure 1.1 shows that the areas with lowest rainfall have the greatest population density, meaning resources in our most populated areas can become stressed.

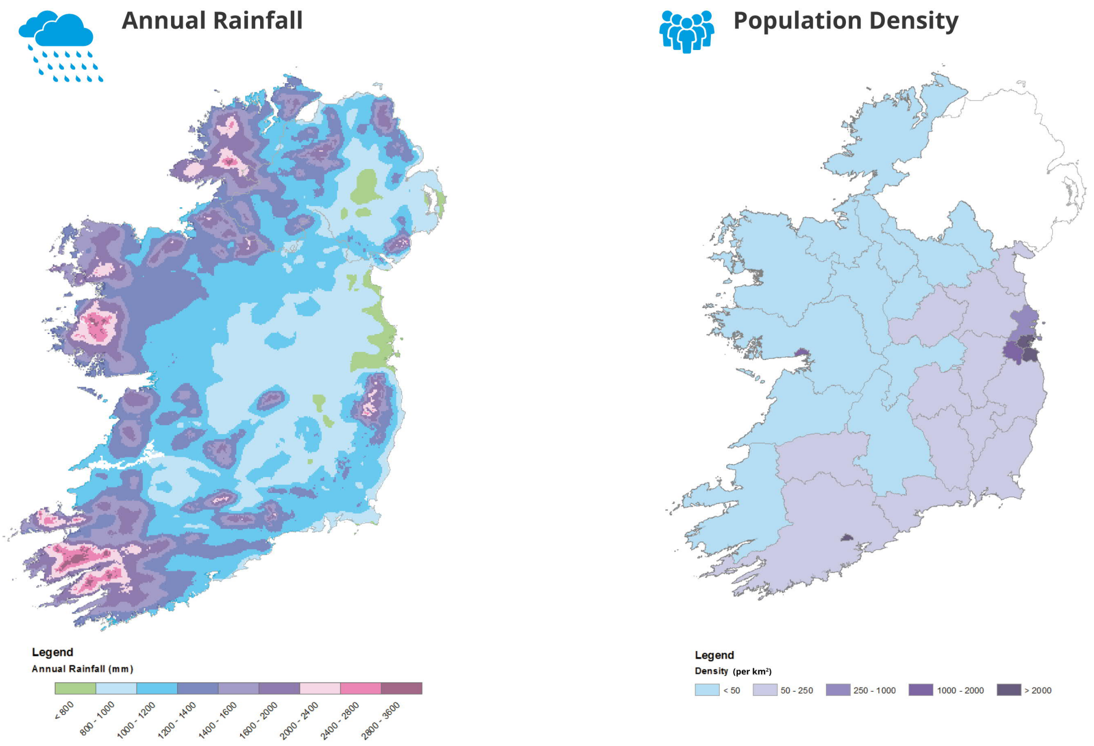



Figure 1.1 - Rainfall in Ireland compared to population density

In addition, we also face key challenges over the coming years, which have the potential to exacerbate the current problems with our water supplies:

- **A growing population:** The country's population is expected to increase by 21% or 1.2 million people over the next 25 years, this will impact on the demand for water;
- **Changes in land use and emerging contaminants:** Increasing pressure on the quality of water in the natural environment before it is treated, due to changes in land use, emerging contaminants and higher quality/supply standards required under the recast Drinking Water Directive;
- **A changing climate:** Changing weather patterns reducing available supplies and increasing the frequency of droughts and other extreme weather events that can result in interruptions to supply; and
- **An Environment in Need:** We currently abstract water from rivers and groundwater aquifers for the purpose of water supply. We need to make sure we leave enough water in the environment to protect the health of rivers and wildlife. Forthcoming Abstraction Legislation, required to ensure that Ireland can meet its obligations under the Water Framework Directive, may reduce the amount of water we are able to abstract from some of our sources in the future.

If we can address these challenges as part of our Plan, we will ensure that future infrastructure development is proportionate to identified need and is sustainable, reliable and resilient.

## 1.7 Thinking Ahead

The consequences of not planning properly are significant for society, the economy and the environment. We need to take proactive steps to make sure that we have sufficient water for future generations, and that our supplies are safe, secure, reliable and sustainable.

We've looked at a wide range of options to address identified needs under three key pillars:

**Lose Less:** This pillar focuses on reducing water lost through leakage and improving the efficiency of our distribution networks. Only a tiny proportion of leaks within our distribution networks come to the surface as visible leaks. Most water leakage is absorbed into the ground or escapes into sewers and drains, so cannot be seen at ground level. The lose less pillar includes the actions which will improve our understanding of leakage, ways to reduce it, and the tools required to help us to find and fix leaks.

**Use Less:** This pillar focuses on the potential for us all to use less water in our everyday lives and looks at activities to help understand water use habits, influence behaviour, to encourage change and promote water efficient devices and appliances for domestic and non-domestic customers.

**Supply Smarter:** This pillar focuses on improving the quality, resilience and security of our supplies through infrastructure improvements, operational improvements and developing new sustainable sources of water. The Supply Smarter pillar includes actions to proactively engage in the protection our natural water resources, improve the performance and resilience of existing supplies, improve interconnectivity within our supply networks, increase the amount of water available for use, reduce risk, improve compliance, address the environmental impacts of existing abstractions and mitigate the impacts of climate change. We also support this through asset maintenance, operations and by delivering process optimisation and training.


Figure 1.2 - Key option types

The key option types for infrastructure improvements under the supply smarter pillar are shown in Figure 1.2.

## 1.8 Context for the National Water Resources Plan – A Plan based on Policy

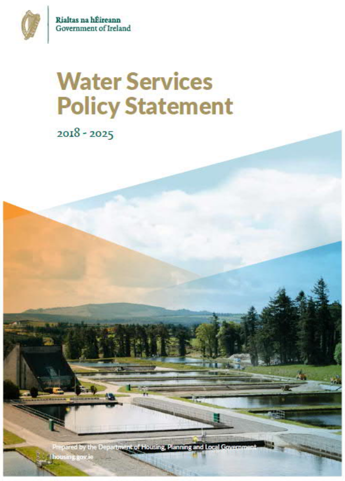
The context for the NWRP lies primarily in Government Legislation and Policy for water services, growth and development, protection of the environment and climate change adaptation.

We operate under an economic regulatory regime which requires us to operate efficiently, having regard to whole life cost of supplies. We must develop a strategic plan for our water supply infrastructure that provides a clear and transparent roadmap for how we operate, maintain, reinforce, develop and invest in our asset base aligned to national policy that ensures the best outcomes for water users.

The key policies feeding into our NWRP are:

- Water Services Policy Statement (WSPS);
- Project Ireland 2040 – National Planning Framework (NPF);
- Water Framework Directive (WFD) & River Basin Management Plan (RBMP) for Ireland;
- National Adaptation Plan (NAP) & Adaptation Plan for Water Quality and Water Services Infrastructure; and the
- Recast Drinking Water Directive (DWD).

### 1.8.1 Water Services Policy Statement




The WSPS (2018-2025) identifies high-level objectives and priorities for delivery of water and wastewater services between 2018 and 2025. It was prepared by the Department of Housing, Planning and Local Government, in line with the Water Services Act (2017) giving clear direction to strategic planning and decision-making on water and wastewater services in Ireland. The themes and policy objectives contained within the WSPS are complementary to the strategic objectives set out in Irish Water's Water Services Strategic Plan (WSSP).

The NWRP is aligned with the three themes in the WSPS namely:

- Water Quality;
- Water Conservation; and
- Futureproofing of Assets.

### 1.8.2 Project Ireland 2040 - National Planning Framework

Project Ireland 2040 - National Planning Framework (NPF)[2] is a high-level strategic planning and development guidance for the country over the next 20 years, underpinning population growth that is economically, socially and environmentally sustainable.


We have used the best available information from the NPF and Regional Assemblies when developing our demand forecasts within this iteration of the draft Framework Plan. Therefore, our draft Framework Plan directly aligns with national policy on growth and allows us to understand the role of the public water supply in supporting future growth and development.

The Local Authority Development Plans, required under the Planning and Development Act, 2000 as amended, must be consistent with the NPF. Therefore, as pertinent demographic information from the Development Plans becomes available, it will be incorporated into our NWRP on a county by county basis. This will ensure that our strategic plans best reflect need in the communities we serve. In turn, information from Irish Water's capacity registers will be made available for the purposes of Development Plans. This process will involve an ongoing feedback loop between the Resources Planning process and the forward planning processes in Irish Water, the Regional Assemblies and the Local Authorities.

### 1.8.3 Water Framework Directive and River Basin Management Plan for Ireland 2018-2021

The European Union Water Framework Directive (WFD) (2000/60/EC) and the subsequent River Basin Management Plan (RBMP), are referenced by the Plan as they set the objectives for managing the water bodies in our natural environment from abstraction to final discharge.

The RBMP sets out the WFD objectives for Ireland.  It considers the actions Ireland will need to take to improve water quality and to achieve at least "Good" ecological status in waterbodies (rivers, lakes, estuaries and coastal waters) by 2027.

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[2] Project Ireland 2040 – National Planning Framework (Feb 2018)

The RBMP drives a programme of measures to deliver a more considered and balanced approach to the water taken from the environment and any potential impacts arising.

The RBMP will influence from where, in what quantities, and under what conditions we can abstract water for the public water supply. The RBMP sets the constraints around our existing abstractions including any measures that may need to be undertaken to reduce the environmental impacts on these existing sources. It will also set the legislative framework within which any new abstractions we develop must conform.

### 1.8.4 National Adaptation Framework – Sectoral Adaptation Planning

Building on the work completed under the National Climate Change Adaptation Framework (NCCAF 2012), the Department of Communications, Climate Action and Environment published Ireland's first statutory National Adaptation Framework (NAF), in January 2018. The NAF sets out the national approach to adaptation in Ireland in order to reduce the negative impacts of climate change. The approach requires each government department to develop a Sectoral Adaptation Plan for their area of responsibility.

As part of this framework, the Department of Housing, Planning and Local Government (DPHLG) produced the Sectoral Adaptation Plan for Water Quality and Water Services Infrastructure. Figure 1.3 lists the acute priority impacts on water services and their associated risk controls and adaptation measures as stated in the Adaptation Plan.

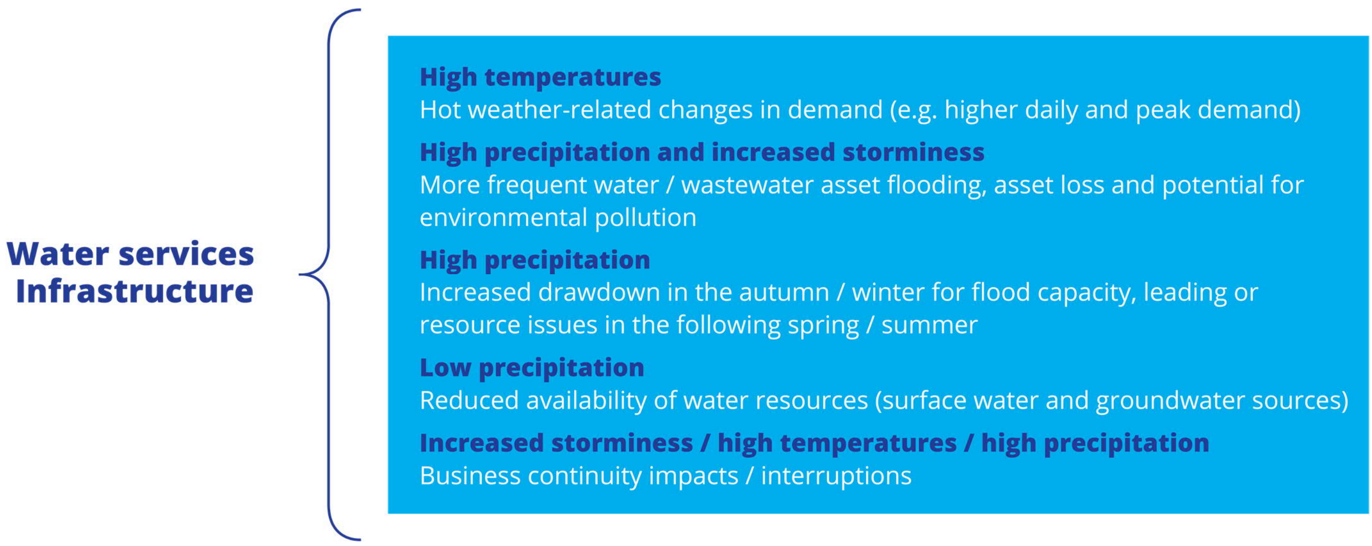



Figure 1.3 - Adaptation Plan Acute Priority Impacts

The NWRP is called out as an adaptation measure under all the identified acute priority impacts within the Sectoral Adaptation Plan.

### 1.8.5 Drinking Water Directive

The Recast Drinking Water Directive (DWD)[3] has updated the quality standards for water intended for human consumption and has introduced minimum hygiene requirements for materials in contact with drinking water (e.g. pipes, taps). A watch-list mechanism will allow for the monitoring of substances or compounds of public or scientific concern to health, such as endocrine disruptors, pharmaceuticals and microplastics.

[3] Drinking Water Directive (98/83/EC), Provisional Agreement of Recast Directive 18th December 2019

In addition, EU Members must ensure the safety of drinking-water supplies with a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. Greater transparency on water quality information must also be provided.

### 1.8.6 How Our Plan is Designed to Incorporate Policy

On the 1st of January 2014, through the Water Services Act (No. 1) 2013, Irish Water assumed statutory responsibility for the provision of public water services and management of water and wastewater investment. Subsequent legislation, the Water Services (No. 2) Act 2013, required that Irish Water prepare a Water Services Strategic Plan (WSSP) setting out the company's objectives in relation to the provision of public water services for the State over a 25-year period. Under the Act, the WSSP is required to address the following aspects:

- Drinking Water Quality;
- The prevention or abatement of risk to human health or environment relating to provision of water services;
- Existing and projected demand for water services;
- Existing and planned arrangements for provision of water services;
- Existing and reasonably foreseeable deficiencies in the provision of water services;
- Existing and planned water conservation measures; and
- The management of the property of Irish Water.

Work on the WSSP commenced in early 2014 and included the publication of the WSSP Issues Paper in July 2014, which was subject to public consultation for a period of five weeks. Further to responses on the WSSP Issues Paper and stakeholder engagement, statutory consultation as part of Strategic Environmental Assessment (SEA) on the draft WSSP was conducted between the 19 February 2015 and 17 April 2015. The final WSSP was approved by the (then) Minister of Environment Planning and Local Government in October 2015.

The adopted WSSP sets out six strategic objectives, to achieve the statutory requirements of the plan:

- Meet Customer Expectations;
- Ensure a Safe and Reliable Water Supply;
- Provide Effective Management of Wastewater;
- Protect and Enhance the Environment;
- Support Social and Economic Growth; and
- Invest in Our Future.

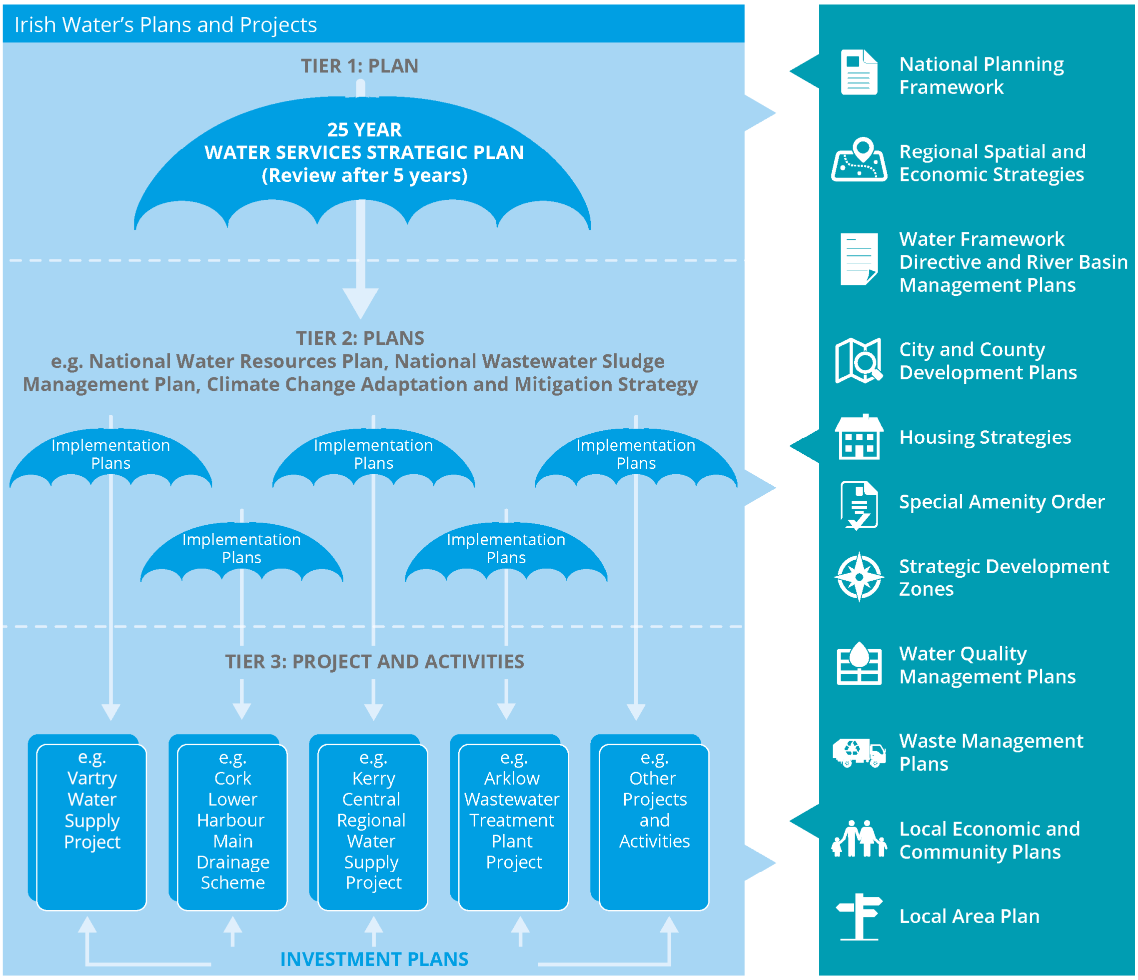
Figure 1.4 shows that the WSSP is a Tier 1 Plan, which sets out the strategic objectives for the business. It also sets the context for the Tier 2 implementation plans which are the framework by which we develop the processes, programmes and projects to meet the objectives set out in the WSSP.

The NWRP is one of our Tier 2 Implementation Plans and was called out as a requirement within the WSSP. The NWRP focusses on water supply, particularly in relation to five of the six objectives set out in the WSSP:

- Meet Customer Expectations;
- Ensure a Safe and Reliable Water Supply;
- Protect and Enhance the Environment;
- Support Social and Economic Growth; and
- Invest in Our Future.

The NWRP will ensure that we have a transparent Framework Plan and Regional Water Resources Plans to allow us to provide a safe, secure, reliable and sustainable water supply now and into the future.

In line with the statutory requirements of the WSSP, once adopted, the NWRP will become Irish Water's strategic framework for the delivery of water services, which in turn will assist in planning projects and programmes to address water supply issues. These will then be prioritised and brought forward through our regulated 5-year investment cycles. Figure 1.4 also shows that the NWRP will be the means by which we directly align government policy with our strategic plans for water services.




It should be noted that the listing of the documents on the right of the graphic is not intended to show a hierarchy of plans or an alignment of the plans with the Irish Water Tier 1, Tier 2 and Tier 3 plans/ projects.

Figure 1.4 - How Irish Water incorporates government policy into our strategic plans. Please note the NWRP consists of Phase 1 National Water Resources Plan-Framework Plan & Phase 2 (x4) Regional Water Resources Plans.

## 1.9 National Water Resources Plan – What is the Process?

The National Water Resources Plan is subject to the provisions of the European Council Directive on assessment of the effects of certain plans and programmes on the environment (Directive 2001/42/EC). This is known as the Strategic Environmental Assessment (SEA) Directive and its provisions are transposed into Irish law by European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (S.I. No. 435 of 2004 as amended in 2011[4]). The Directive is applicable to the National Water Resources Plan.

As this is our first National Water Resources Plan, we have divided it into two distinct phases, the combination of which will form our overall National Water Resources Plan.

**Phase 1** is a National Water Resources Plan – Framework Plan, which will be subject to Strategic Environmental Assessment and Appropriate Assessment.

**Phase 2** comprises of four Regional Water Resources Plans each of which will be subject to Strategic Environmental Assessment and Appropriate Assessment.

### 1.9.1 What has happened to date?

The development of the NWRP commenced in 2017 and involved:

- Identifying best practice that could be applied for water resource planning in Ireland;
- Identifying all issues related to water supply including, quality, quantity, leakage, reliability and sustainability;
- Developing a robust methodology to identify and prioritise programs of work to address the identified need; and
- Early stakeholder engagement and consultation with key stakeholders.

SEA screening was conducted in August 2017 by Irish Water (as the responsible authority) and we determined that SEA of the NWRP was required in accordance with Directive 2001/42/EC.

Irish Water developed:

- An SEA Scoping Report outlining the geographical and temporal scope of the NWRP Methodology and SEA;
- The baseline environment for the plan; and
- A proposed framework of SEA objectives to inform the strategic assessment.

Consultation with the Environmental Authorities and non-statutory consultation was carried out on the Strategic Environmental Assessment Scoping Report between November 2017 and January 2018. Feedback from this consultation has been incorporated into our Plan and the SEA process.

Further non-statutory consultation and engagement has been ongoing with Local Authorities and stakeholders during 2019 and 2020. Our consultations to date are summarised in Figure 1.5 and further detail is provided in Appendix A. A high-level overview of the NWRP consultation roadmap is summarised in Figure 1.6.

[4] http://www.irishstatutebook.ie/eli/2011/si/200/made/en/print

| NWRP SEA Consultation | Non-statutory Local Authority and Stakeholder Consultation |
|---|---|
| • 1,186 Website hits<br>• 150 update emails<br>• 71 queries<br>• 36 stakeholder briefings<br>• 18 pieces of media coverage<br>• Conferences and workshops | • 29 workshops across 31 Local Authorities between June and July 2019<br>• Over 1800 comments reviewed<br>• Data validated for 539 WRZs, 1090 Abstractions and 749 WTPs |

Figure 1.5 - Summary of NWRP Consultation

The SEA requirements have been integral to the development of the NWRP to ensure the environment is considered throughout the process. This is described fully in the accompanying SEA Environment Report.

SEA objectives identified through SEA scoping consultation process have been taken into account in the assessment of the draft Framework Plan and the Options Assessment Methodology set out therein. This Options Assessment Methodology will be applied to each Water Resource Zone as part of Phase 2 of the NWRP, the Regional Water Resources Plans.


Figure 1.6 - Consultation Roadmap

### 1.9.2 Where Are We Now - Phase 1 Consultation

This draft Framework Plan is currently open for public consultation with accompanying SEA Environmental Report and Natura Impact Statement.

The Framework Plan includes:

- A description of the methodology we propose to use for Water Resources Planning:
  - How we assess quantity need through the Supply Demand Balance
  - How we assess quality and reliability need through the Barrier Assessment
  - How we address sustainability by ensuring that all new options for water supply must be based on conservative approaches to protecting water sources
  - Our Options Assessment Process
  - Our Preferred Approach Development Process

- An assessment of Need across our asset base in terms of Quality, Quantity, Reliability and Sustainability for all of our supplies nationally (Figure 1.7).

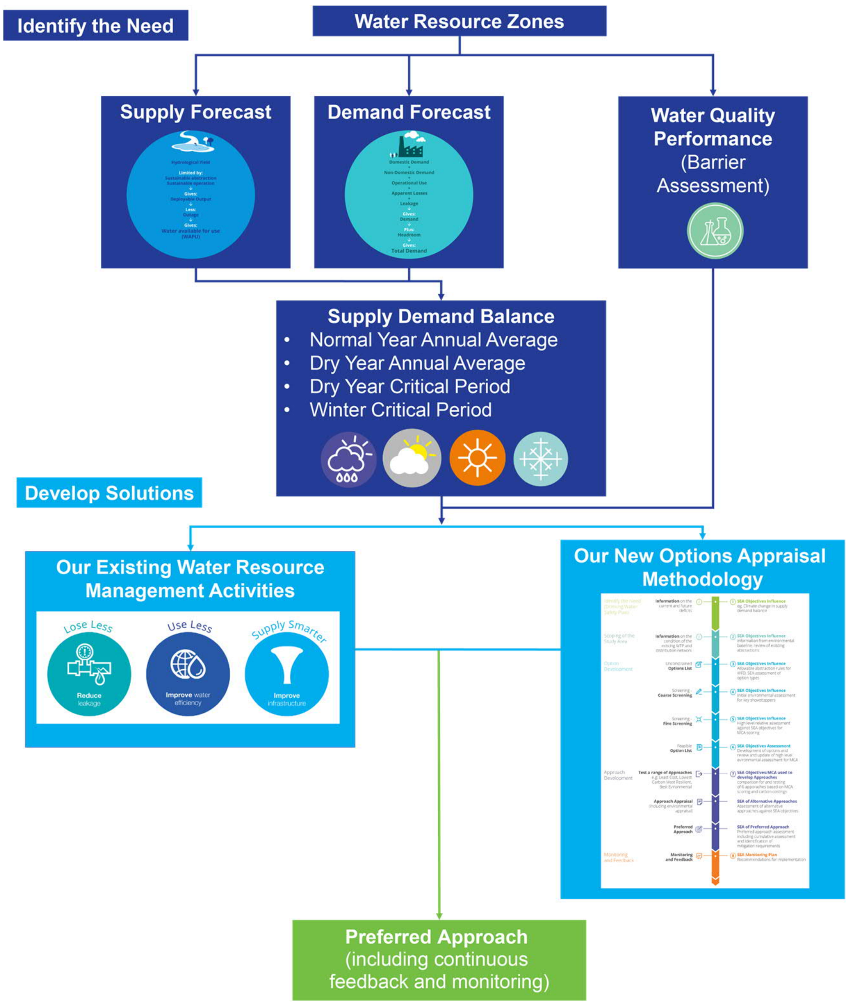



Figure 1.7 – Our NWRP Options Process

As part of this stage of the public consultation, and for illustrative purposes, we are including a case study that will help people understand how the methodology is applied to an area (to bring it to life). This is not a full or final plan for this area, as the full Regional Water Resources Plans are still to be developed, following the adoption of the NWRP – Framework Plan in 2021.

Figure 1.8 summarises the component parts of the parts of the National Water Resources Plan and how these interact. Phase 1 of the overall Plan, the Framework Plan (this phase), is highlighted in a blue box.

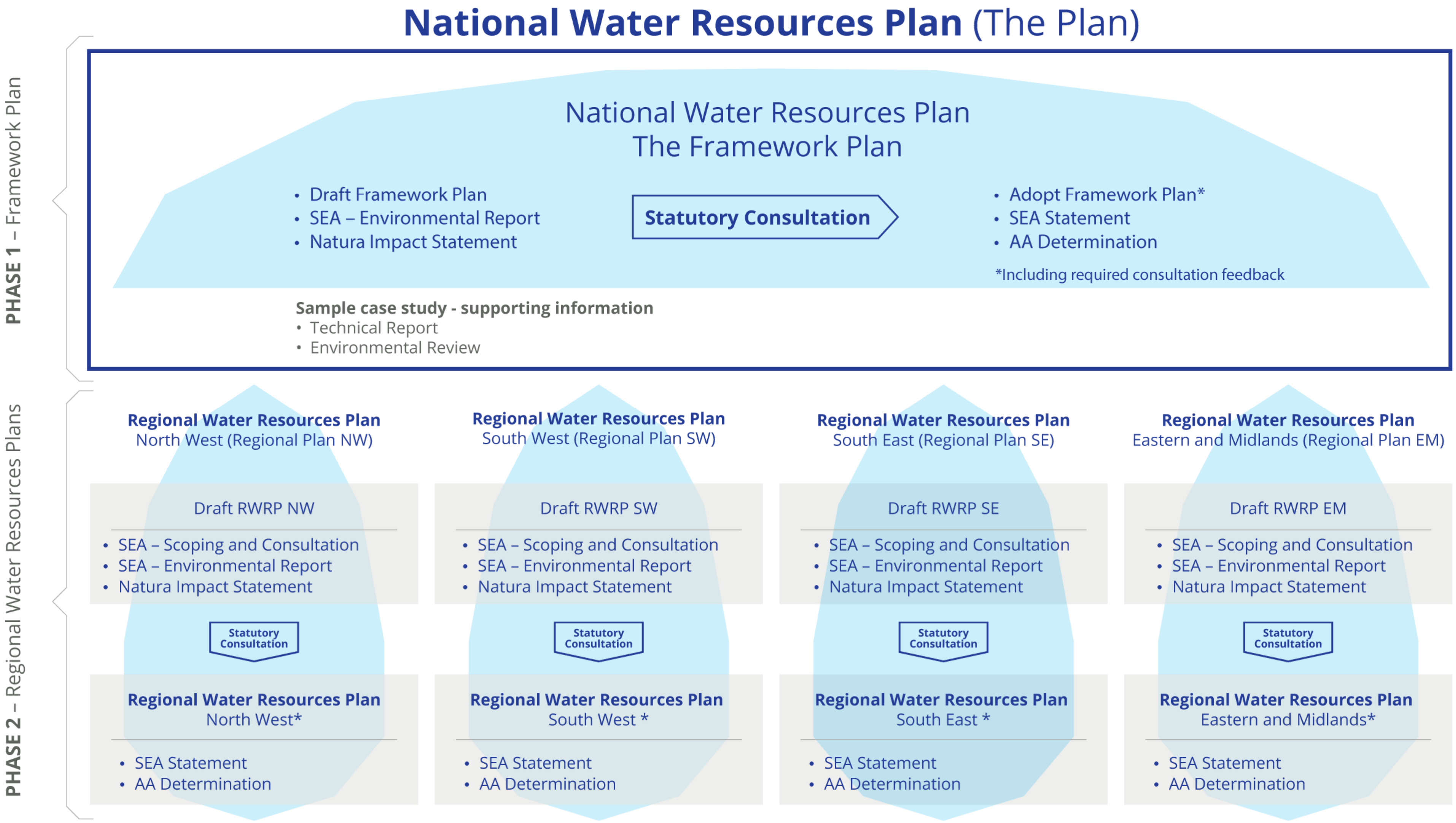



Figure 1.8 – Component Parts of National Water Resources Plan

The consultation on the draft Framework Plan will last for 10 weeks, and Irish Water is inviting feedback on the following consultation questions

- *Do you have any suggestions that you would like Irish Water to consider as part of the draft Framework plan?*
- *Do you have any suggestions that you would like Irish Water to consider as part of how we assess supply/demand balance, water quality, quantity and resilience?*
- *The draft Framework Plan sets out Irish Water's methodology to find high level solutions to address short, medium and long-term issues. Do you have any comments on our methodology?*
- *Do you have any comments on the Strategic Environmental Assessment (SEA) Environmental Report and associated Natura Impact Statement (NIS) which accompanies the draft Framework Plan?*
- *The project roadmap has been updated. Do you have any comments or feedback on this?*
- *How would you like Irish Water to communicate with you as the NWRP progresses?*

### 1.9.3 What are the next steps? Adopting the National Water Resources Plan – Framework Plan

Following on from the consultation phase, there is still some important work to be done before the Framework Plan is finalised.

The submissions/ observations received from public consultation will be taken into consideration, and the Framework Plan updated if required.

The Final NWRP – Framework Plan will then be produced, accompanied by a Strategic Environmental Assessment Statement and an Appropriate Assessment Determination.

The SEA statement will be prepared and will outline the issues raised and demonstrate the amendments that were made to the Framework Plan as a result of the consultation.

### 1.9.4 Commence Phase 2 – Drafting the Regional Water Resources Plans

In order to manage the delivery of Phase 2, the public water supply will be divided into the four Regional groups shown in Figure 1.8. The formation of these groups is based on:

**Environmental Impact:** In order to be able to assess the cumulative impact on proposed and existing water supplies, the first spatial zones designated are the water body catchment and sub-catchment areas, as delineated by the Environmental Protection Agency under the River Basin Management Plans.

**Irish Water Operational Regions (North and West, Eastern and Midlands, and Southern Region):** In order to allow us to optimize the staffing resources during the roll out of the four Regional Water Resource Plans.

**The Water Resource Zone boundaries:** To represent our current supplies. Due to the disproportionate volume of WRZs in the Southern region, for administration of the roll out process, the area has been split into two groups, South West and South East.

**Local Authority boundaries:** This allows us to align the Local Authority Development Plans to our Supply Demand forecasts, and to assess the full options assessments process with our colleagues in the Local Authority Water Services Sections

Using these rules, we have split the national supply into four individual regions. The Regional Plans will develop preferred approaches as set out above. As part of the SEA and Appropriate Assessment process Irish Water will examine any potential cumulative and in combination impacts, across all regions.

These include;

- Regional Water Resources Plan: North West (Group Area 1)
- Regional Water Resources Plan: South West (Group Area 2)
- Regional Water Resources Plan: South East (Group Area 3)
- Regional Water Resources Plan: Eastern and Midlands (Group Area 4)

Each Regional Resources Plan will:

- Apply the Framework Methodology to the Regional Group Areas of Water Supplies
- Develop Plan Level Preferred Approaches (solutions) for all water supplies within these group areas.

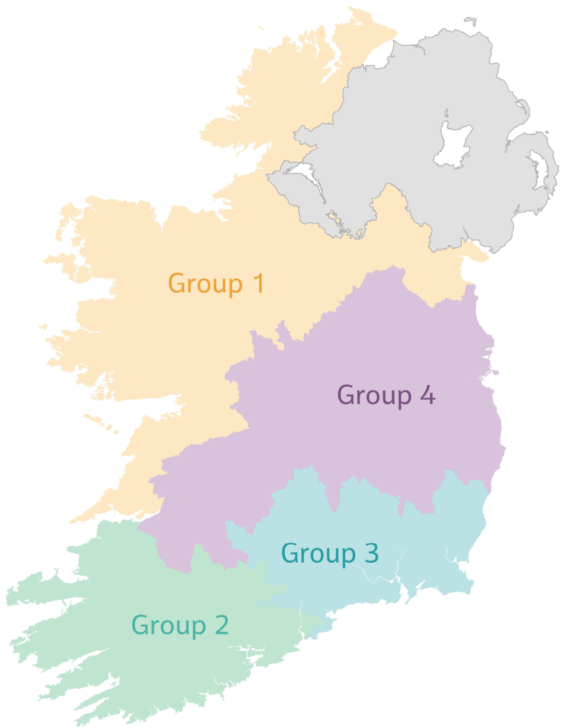


Figure 1-9 - Regional Group Areas for roll-out of Phase 2 of the NWRP

For the purposes of completing the Regional Plans, each Regional Group Area has been subdivided into Study Areas. In order to illustrate how the NWRP methodology is applied to our water supplies, we have prepared a Case Study for a sample study area to accompany the Phase 1 consultation documentation. This has been provided in order to demonstrate the implementation of the methodology being consulted on.

As the area within the Case Study is a component part of the Regional Water Resource Plan - Eastern and Midlands Area, it is not being consulted upon as part of Phase 1 and is for illustrative purposes only. The technical/environmental information in this area will be updated to account for any required changes to the Framework Plan, once it has been adopted, and will be formally consulted on as part of Phase 2.

## 1.10 Summary

Water Resources Planning plays an essential part in ensuring that we have a safe, secure, sustainable and reliable public water supply that supports Government Policy and Irish Water Policy. The NWRP will be Irish Water's first strategic plan for water services and will form the basis for the transformation of these services in Ireland over the short, medium and long term.

In this part of the draft Framework Plan we have:

- Described the current status of water services in Ireland;
- Outlined the specific challenges we face in serving the future needs of our customers;
- Outlined the context for the NWRP and its relationship to other Irish Water strategies, government policy and legislation;
- Our Consultation on the NWRP to date; and
- The structure and phasing of the NWRP.


Leixlip Water Treatment Plant, County Dublin

# 2

# Water Resources Planning & Key Concepts

# 2 Key Points

**This section contains the following information:**

- **The Resource Planning process that we have adopted for this Framework Plan including the use of Drinking Water Safety Plans (DWSPs) to assess risk**
- **An introduction to the key water resource planning concepts**

## 2.1 The Water Resources Planning Process

Water Resources Plans are standard practice for other utility companies that are involved in drinking water supply on a regional basis. Irish Water needs to develop a National Water Resources Plan that is specific to the public water supply in this state, accounting for:

- Ireland’s dispersed low-density population;
- The historical development of our existing water supply system; and
- The baseline condition of our assets and risks we must manage as part of our supplies.

### 2.1.1 Basis for this Plan

This section outlines the reasons we selected a water resources planning methodology based on the methodology approved by the UK's Water Services Regulation Authority (OFWAT) out of the available alternatives.

Prior to developing this draft Framework Plan, the resources planning methodologies used in other jurisdictions were reviewed, including the United Kingdom, France, Italy, Spain, Germany, Australia, New Zealand and the USA.  Methods for water service provision vary greatly across the countries summarised in Table 2.1. Within the European Union, there is a common Legislative Framework across all countries, governed primarily by the Drinking Water Directive (98/83/EC) as amended and the Water Framework Directive (2000/60/EC) as amended.

The regulation of water service providers varies considerably across the countries. The process in Ireland is most similar to that of the United Kingdom (including England and Wales). Providers of water services are supervised by independent regulators for quality, environmental and financial regulation, namely the Environment Agency and OFWAT in the UK, and the Environmental Protection Agency and Commission for the Regulation of Utilities in Ireland.

In most countries water service provision is fragmented, with large urban supplies managed separately to rural supplies or regionalised where a utility provides water services for urban and rural settlements within a defined geographical region. Irish Water is a single national water utility. However, in terms of population and scale, the public water supply in this state is of similar size to regional supplies in larger countries such as the UK and Italy.

Although the Water Framework Directive and associated River Basin Management Plans, require cross jurisdiction collaboration and planning in relation to the environmental health of the natural raw water environment, most water service providers in the countries assessed do not have uniform prescribed guidelines or fully Integrated Water Resources Planning.

However, in order to ensure resilience and to respond to external risks such as climate change, financial constraints and aging infrastructure, it is likely that there will be an increased focus on water resources planning in all countries into the short, medium and long term.

Recently the OECD has recognised the need for its member countries to undertake strategic water supply planning to address the financial and environmental constraints on the provision of water services into the future[5].

As Irish Water is the single national utility for water services, we must take a proactive approach to strategic planning, and we have committed to developing a Water Resources Plan within our primary business objectives as set out in our Water Services Strategic Plan.

There are a number of key considerations that influence the development of a water resources plan, including, legislative, regulatory, climatic and asset base, as listed in Table 2.1. In the development of this plan we reviewed these considerations across a number of jurisdictions and identified the commonalities when compared to Irish Water's supply.

Table 2.1 - Comparison of water resource planning considerations across jurisdictions

| | Republic of Ireland | France | Germany | Spain | Italy | United Kingdom | Australia | New Zealand | Canada | United States |
|---|---|---|---|---|---|---|---|---|---|---|
| Legislative Framework | | | | | | | | | | |
| - Quality | x | x | x | x | x | x | | | | |
| - Environment | x | x | x | x | x | x | | | | |
| Regulation of Water Service Providers | x | | | | | x | | | | |
| Provision – Local (fragmented), Regional, National | N | F | F | F | F | R | F | R | R | F |
| Prescribed Process for Integrated Water Resource Planning | | | | | | x | x | x | | |
| Climate | x | | | | | x | | | | |
| Technical Standards | | | | | | | | | | |
| - Treatment Types | x | x | x | x | x | x | x | x | x | x |
| - Distribution | x | | | | | x | | | | |
| - Domestic | x | | | | | x | | | | |

As water services provision in the Republic of Ireland has the most commonalities with that of the United Kingdom, we have used the *"Final Water Resources Planning Guidelines 2016",* developed by the Environment Agency and Natural Resources Wales in England and Wales respectively as the starting point for our Framework Plan.

As summarised in Table 2.1, the main reasons for this decision are:

[5] 2019 OECD Challenges in Financing Water Supply, Sanitation and Flood Protection – Challenges in EU Member States and Policy options

- Ireland's legislative framework for water services is similar to that in England and Wales (and the UK including Scotland & Northern Ireland);
- Ireland's national population is similar to the population of some of the UK's water resources planning catchments;
- Our natural climatic conditions are more similar than the other countries considered;
- Our water asset base is technically comparable in terms of treatment, distribution and domestic plumbing arrangements (for example in Ireland and the UK, domestic plumbing systems use storage tanks in attics, as opposed to the pressurised systems more frequently used elsewhere in Europe. As these tanks can fill at night time, they need to be accounted for in minimum night flow calculations, and therefore impact leakage and demand estimation)
- Our water supply asset base, particularly supplies in the large urban centres, developed in parallel to those in the UK with the same design philosophy, distribution process, and materials used; and
- The regulatory framework for water services is similar, including the separation of responsibility for water services provision, environmental regulation and economic regulation.

However, there are some key differences as described below:

- **Licencing:** In general, water abstractions in other jurisdictions are licenced and environmental considerations have been factored into the long-term viability and planning for water sources. Historically in Ireland there has been limited regulation of abstraction of water from the natural environment for the purposes of public water supply. Within our existing asset base some abstractions may not be able to provide the supply of water to meet the demand required particularly during dry weather periods. As demand increases over time, this issue will become more evident and therefore needs to be given more consideration in our Plan.
- **Quality**: Many of our water supplies are at risk of not achieving the standards set out in the Drinking Water Regulations. They therefore require significant investment in maintenance and upgrades to ensure continued protection of public health of our customers. This may require us to commit capital investment into sites in the short term to address public health and water quality issues even though some of these supplies may not be viable in the medium to long term. Therefore, the NWRP must consider quality as well as quantity issues, and allow for interim steps to incrementally improve our water supplies.
- **Asset Performance**: Due to historic under investment in capital maintenance, our asset base is in poor condition compared those in the UK. This manifests itself in high leakage rates across our networks and low levels of service to our customers. These deficits require sustained long-term investments and actions across many areas that will deliver gradual improvements over multiple investment cycles. Therefore, asset performance and reliability needs must be considered within our Plan.
- **Data**: Water Resources Planning in UK utilities follows a well-defined process that has been developed over a 25-year period and is built off prescribed operational data for both supply and demand. At present, our information systems were not designed for the purposes of water resources planning and do not capture all of the required data sets. Therefore, within this draft Framework Plan we have had to use a combination of best available data and surrogate data from other jurisdictions where necessary.
- **WRZs:** The national public water supply in Ireland has significantly more WRZs than a typical UK utility, which reflects the dispersed population in Ireland and the way that water services have developed over time. This adds a level of complexity to our resources plan, due to the extent of identified need we must address. To mitigate against this, Irish Water will develop our Preferred Approaches (solutions) for each water supply within four Regional Water Resources Plans.

## 2.2 Tracking Progress through the Drinking Water Safety Plan

Our existing water supplies are constantly changing as new assets are incorporated into our networks and existing assets deteriorate over time. The legislative environment within which we operate is also evolving and our natural water resources are impacted by activities within the catchments and by climate change.

Irish Water's NWRP will be developed on a five-year cycle, but within these cycles reviewed annually, as we must constantly monitor and react to emerging risk and need. Monitoring and feedback into the Plan is outlined in Chapter 8 of this document.

The most effective way of monitoring our supplies is through a comprehensive risk assessment process that encompasses all steps in water supply from water sources (catchment) to consumer (tap). This approach is known as the Drinking Water Safety Plan (DWSP), as recommended by the World Health Organisation (WHO) in their Guidelines for Drinking Water Quality (2004) and Water Safety Plan Manual (2009).

Historically DWSPs were predominantly used to assess risk in terms of drinking water quality and compliance with the Drinking Water Regulations. However, Irish Water proposes to incorporate the DWSP into the way we work and use it as the means to manage risk as part of our resources planning process. The completion of Drinking Water Safety Plans is also a requirement in the Recast Drinking Water Directive (2020).

As such, we will expand our use of the DWSP to incorporate, quantity, quality and sustainability issues, as summarised in Figure 2.1.


Figure 2.1 - Water Resources Planning – The DWSP approach

DWSPs must be set up to align with our WRZs in order to enable us to manage quantity, quality and sustainability risk from 'source to tap' on a catchment basis, for the short, medium and long-term demand horizons. This process will allow us to progress and track tactical and operational interventions, and to address the risks that sit outside of the capital investment planning process. This will become increasingly important when our abstractions are regulated and subjected to licenced conditions.

## 2.3 Key Concepts in Water Resources Planning

Within this section we introduce some of the key concepts that we have used to develop the NWRP, including:

- Water Resource Zones (WRZs);
- Weather Event Planning Scenarios;
- Levels of Service (LOS); and
- Supply Demand Balance (SDB).

Each concept is summarised in the paragraphs below.  More detailed technical information is also provided in Appendix B (Planning Scenarios), Appendix C (Supply Assessment) and Appendix D (LoS), respectively.

### 2.3.1 Water Resources Zones and Water Supply Zones

When assessing the need for water across a very large asset base, the first concept to be considered is the geographic definition of our water supplies. Figure 2.2 demonstrates a schematic of a simple water supply network, which consists of a water source with a treatment plant and network to deliver water to meet water demand in a particular area.

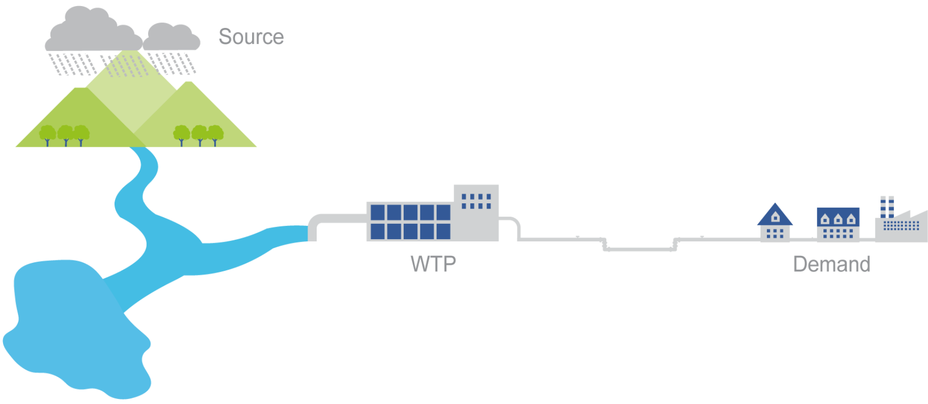



Figure 2.2 – Simple Water Supply Schematic

This configuration is only representative of our most basic remote water supplies or our more vulnerable large supplies that rely on a single source of water. As these types of supplies have no connectivity to a wider network, they have little resilience to planned or unplanned events within the asset base, which can result in water outages or boil water notices.

Some of our larger water supplies consist of multiple interconnected sources and treatment plants, with the ability to transfer large amounts of water around trunk main networks. This allows improved resilience for planned and unplanned events.

Management units need to be developed to enable us to describe, understand, manage and plan for water supplies both now and into the future. Therefore, our resource planning unit of management must allow us to consider not only the capital and operational interventions we need to make to the existing asset base, but also how we need to transform and improve connectivity between and within our supplies.

Table 2.2 and Figure 2.3 outline the different scales for the management of water supplies required to function as a regulated water service provider, and how these relate to each other.

Table 2.2 – Water Resource Spatial Management Units

| Scale | Management Unit | Purpose | Regulatory Interface |
|---|---|---|---|
| National | WSSP | Setting our Business Objectives | DHLGH |
| | NWRP – Framework Plan | Implementing the objectives of the WSSP and applicable legislation and guidance | CRU, EPA |
| Regional | NWRP Regional Resource Plan Group Areas | Developing of Asset Management Plans covering Irish Water's Operational Regions, for the purpose of planning investment and improving operations | CRU, EPA |
| Sub Regional | Catchments | Assessing our water abstractions and wastewater discharges in relation to legislative requirements including WFD, Habitats Directive, Birds Directive and pending abstraction legislation | EPA, DPHLG, NPWS |
| Sub Regional | Water Resource Zones (WRZ) | Identifying baseline issues with Supply and Demand, forecasting future issues with Supply and Demand, drought and critical period planning, adaptive planning, bulk transfer and strategic storage requirements.<br>Identifying baseline need in relation to water quality and barrier risk and assessing the customer base that will be impacted by a deterioration in water quality or the failure or non-performance of a Water Treatment Plant within a complex network. | CRU, EPA |
| Local | Water Supply Zone (WSZ) | Water Resource Zones consist of multiple Water Supply Zones. Water Supply Zones are used to delineate differing areas of our water supplies in order to assess the quality and compliance of drinking water, including within complex networks, where multiple water types are blended. The primary function of a WSZ is to report on Drinking water compliance to our regulator the EPA. | EPA |
| | District Metered Area (DMAs) | Each Water Supply Zone consists of a number of District Metered Areas. These are small discrete areas of our water distribution network which are used for leakage management, network control, emergency network interventions, and ensuring water quality at the extremities of our distribution networks. | CRU |

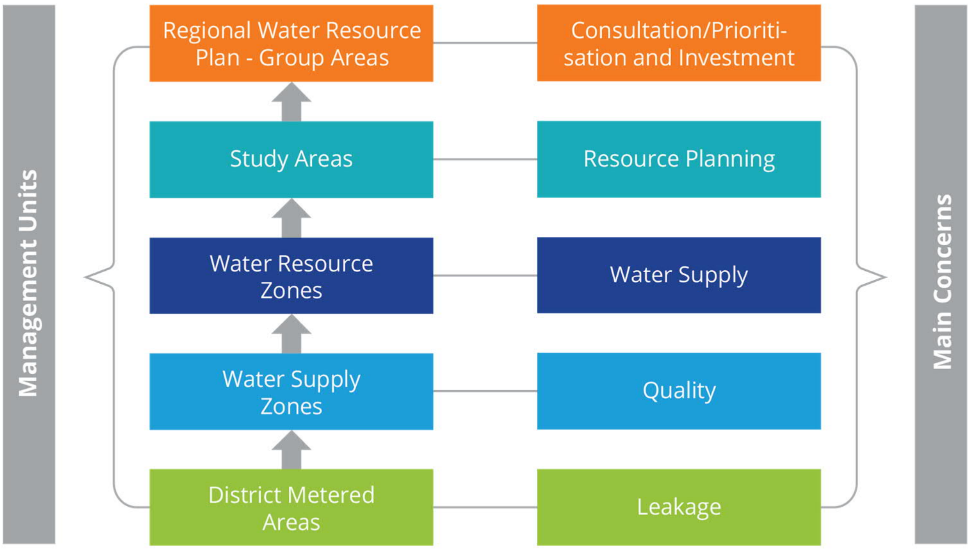



Figure 2.3 – Water Resource Planning Spatial Management Units

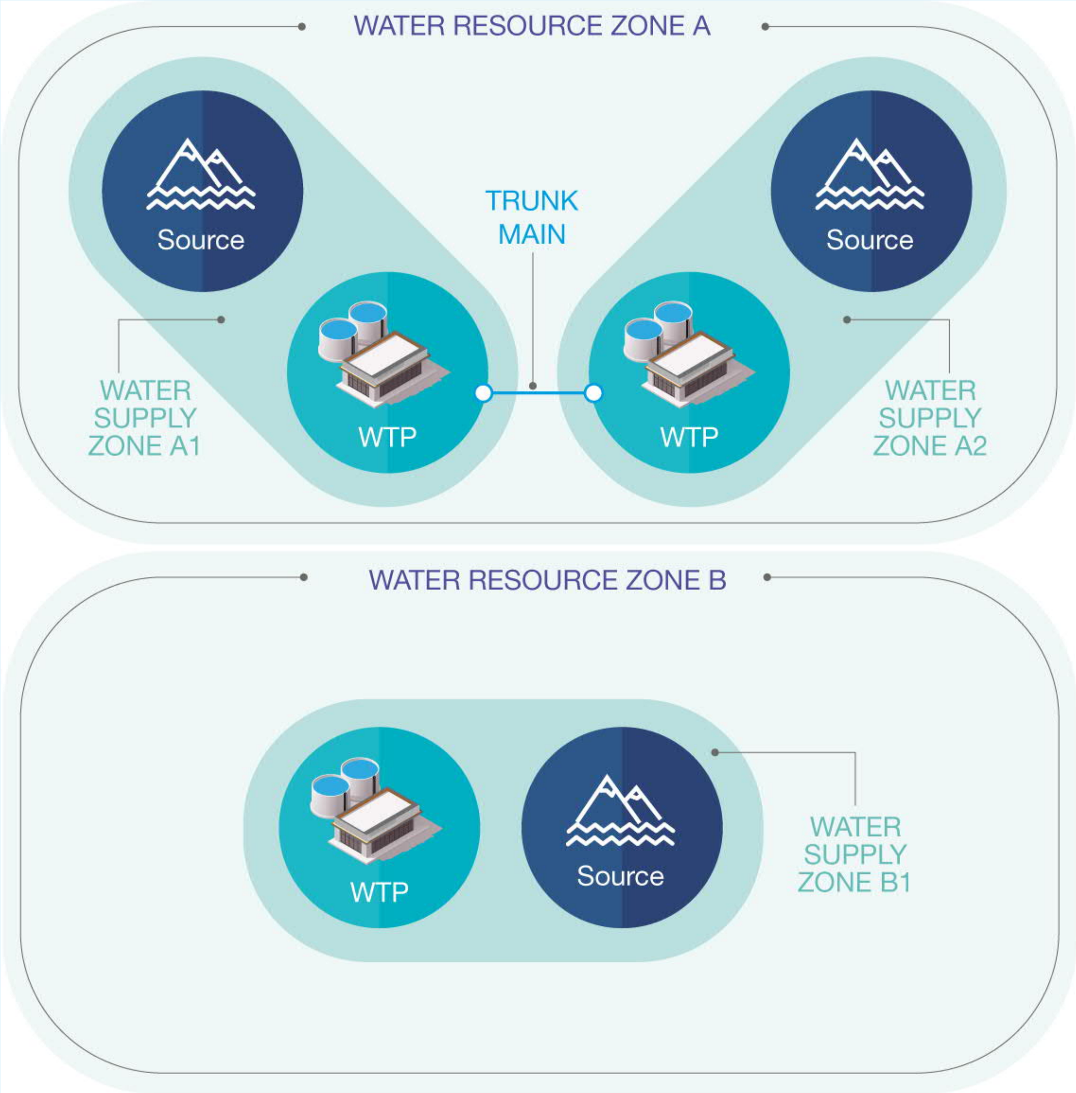
All of these spatial units relate to each other, with DMAs being the smallest component part of our supply.

Groups of DMAs form WSZs, groups of WSZs form WRZs and groups of WRZs form the NWRP Regional Water Resource Plan Group Areas. As there can be multiple water sources and water supply zones in a complex network, WRZs are the management units at which water resource planning is undertaken.

WRZs represent an area where the supply and demand are largely self-contained. It is where the resources, supply infrastructure such as the water treatment plants, and the customers are interconnected. As part of this draft Framework Plan, the Supply Demand Balance is calculated for each WRZ.

Examples of WRZs and WSZs are shown in Boxes 2.1 and 2.2.

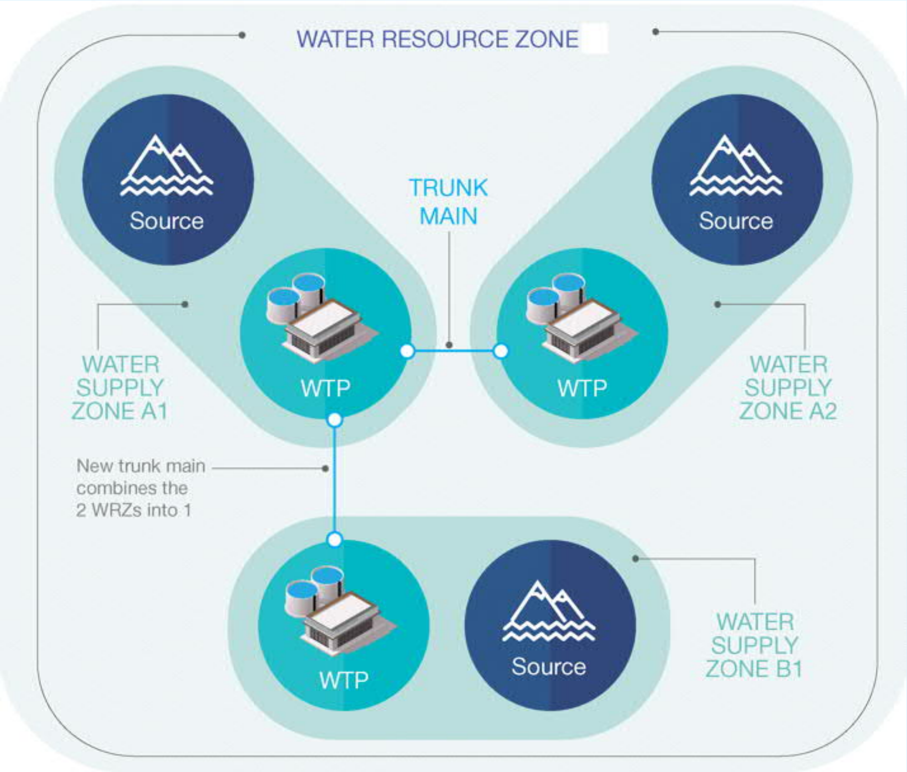
**Box 2.1 – Example WRZ and WSZs**




In this example, there are two WRZs and three WSZs. WRZ “A" contains two WSZs, which are connected by a trunk main. If there was an outage at the water treatment plant in WSZ A1, the area could continue to be supplied from the water treatment plant located in WSZ A2 (should sufficient spare capacity be available).

WRZ B contains just one WSZ and is not connected to any other WSZs. If an outage occurred at the source, treatment plant or trunk main network in this supply, the majority of customers could be impacted.

**Box 2.2 – Example Water Resource and Supply Zones 2**




In this example there is one WRZ and three WSZs. A trunk main connects WSZs A1 and A2 with B1 to form a single WRZ. This arrangement offers greater resilience as, if there is an issue at the water treatment plant or with a source in WSZ B1, customer supply could be maintained from WSZ A1 or A2 (should spare capacity be available).

As part of the draft Framework Plan, all of the WRZs that make up the national public water supply have been delineated. We have also associated the DMAs and WSZs to each WRZ, allowing us to monitor quality, quantity, capital maintenance need and risk across all of our supplies.

WRZ boundaries are dynamic and can change over time, for example, if we construct new trunk mains to connect separate water supplies (see Box 2.2). To establish a measurable baseline for the NWRP, we have defined our WRZs as they will be in 2021, which includes planned and ongoing improvement to our water supply networks, as set out in our current Capital Investment Cycle.

There are 539 WRZs in Ireland. Each zone varies in size from small rural systems with populations of less than 30 to the GDA with a population of 1.6 million.

A comparison with the WRZs from a number of UK water utilities is shown in Table 2.3 and Figure 2.4.

Similar sized populations served with fewer WRZs with more connectivity can achieve economies of scale and bring resilience and reliability of supply to customers. Our current model presents challenges of efficiency, consistent maintenance and service performance. A secondary effect is that in many WRZs, we have fewer connections per unit length of pipe, a factor that impacts leakage statistics and comparisons.

Table 2.3 - UK water utilities WRZ comparison

| Water Utility | Number of WRZs | Total number of customers |
|---|---|---|
| Northern Ireland Water | 7 | 1.7 million |
| Welsh Water | 24 | 3 million |
| United Utilities | 4 | 7 million |
| Southern Water | 10 | 3 million |
| Scottish Water | approx. 220 | 5 million |
| **Irish Water** | **539** | **4.2 million** |

Figure 2.4 shows that we have significantly more WRZs than our UK counterparts, which reflects the dispersed population in Ireland and the way that water services has developed over time.

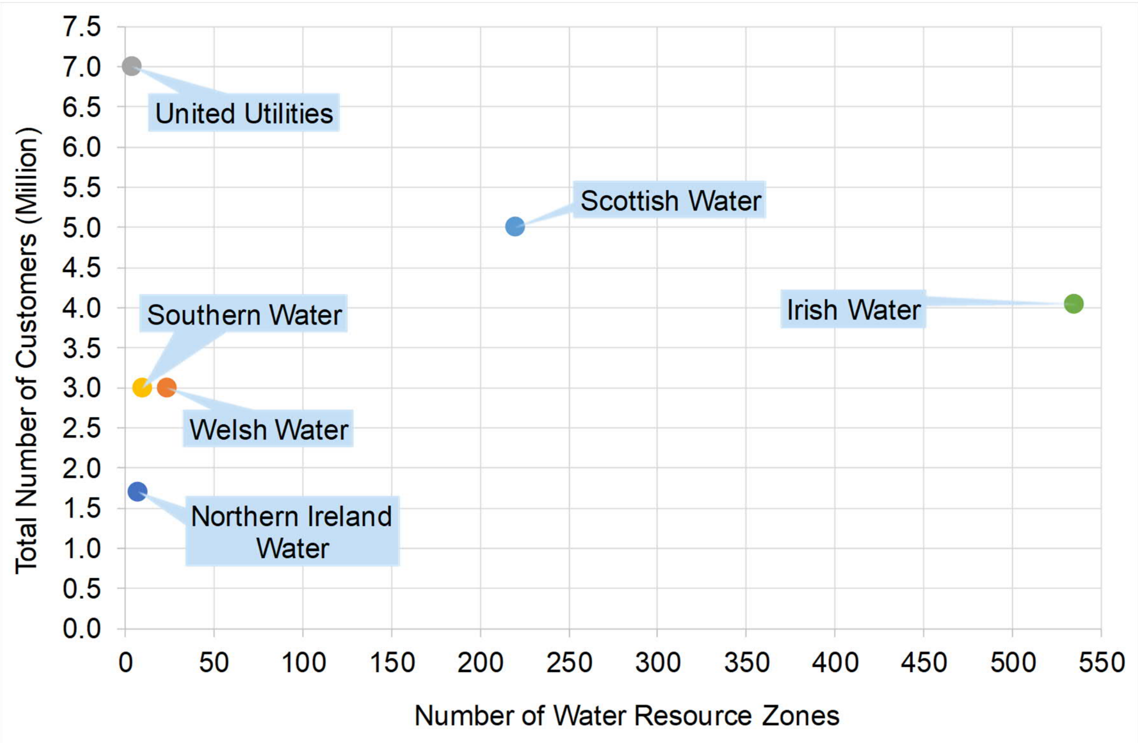



Figure 2.4 - UK water company WRZ comparison

We expect the number of WRZs in Ireland to reduce as we invest in providing strategic infrastructure throughout the country. This process will be driven by the requirement to deliver the required quality and quantity of water in the most efficient manner. This rationalisation journey will require both new sources and substantial provision of trunk mains and reservoirs, with an associated need for investment. However, it is likely that we will have to continue to operate a substantial number of WRZs for the foreseeable future, particularly in low density and remote areas. A staged approach to the development of a National Plan is needed in light of the fact that we are at an early stage of this process and have a far greater number of diverse WRZs than our UK counterparts.

### 2.3.2 Weather Event Planning Scenarios

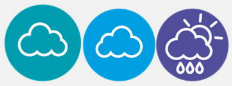
As access to a good quality uninterrupted water supply is essential for public health, we must ensure that our water supplies can withstand changes in climatic conditions.

Although we live in a temperate climate, as global temperatures continue to rise, Ireland may experience more frequent extreme weather events, such as droughts and storms. Irish Water must plan for these events and develop a resilient water supply system to limit the impacts of extreme events on our customers.

During certain years, the water supply systems in Ireland have experienced major stress. For example, during Storm Emma (2018), there was an increase in burst water mains due to periods of sub-zero temperatures followed by relatively rapid warming. In contrast, summer 2018 and spring 2020 saw prolonged warm dry weather resulting in low flows and decreased water levels in our rivers and lakes. This resulted in reduced water availability for our public water supplies which also coincided with an increase in customer demand.

Table 2.4 outlines the four Weather Event Planning Scenarios considered in this draft Framework Plan. More information on these scenarios is contained within Appendix B.

Table 2.4 – Weather Event Planning Scenarios

| Scenario | Scenario Description and Weather Type | Feels like |
|---|---|---|
| NYAA | Normal Year Annual Average: The normal year scenario describes the demand and supply available to Irish Water in a typically average weather year |  |
| DYAA | Dry Year Annual Average: The dry year scenario is when there is low rainfall but no constraints on demand. Demands are based on the average daily demands experienced over the year under "dry" year weather conditions. Demands would be higher than in normal years |  |
| DYCP | Dry Year Critical Period: This occurs within the dry year, generally a few weeks during the summer where demands can be significantly above the annual average |  |
| WCP | Winter Critical Period – The WCP generally occurs as a result of Freeze–Thaw incidents such as Storm Emma in 2018. High demands during these periods are driven by an increase in leaks from burst of pipes as a result of the very low temperatures |  |

Supply availability for a WRZ varies for each Planning Scenario. For example, when we consider surface water sources such as rivers or lakes, more water is naturally available for abstraction during winter months than summer months. Therefore, in a WRZ supplied by surface water sources, more water will be available during the Winter Critical Period (WCP) than during other planning scenarios, and the limiting factor on supply availability is usually water treatment capacity or network capacity. Whereas, in the same WRZ, during a Dry Year Critical Period, the water source tends to be the limiting factor.

Demand also fluctuates under the four Weather Event Planning Scenarios. Figure 2.5 illustrates that during a prolonged period of warm dry weather typically associated with a Dry Year Critical Period (DYCP), our customers can use significantly more water than during other scenarios, particularly if temperatures are high.

During a WCP, the demand is even higher due to water lost from the extremities of the network. Cold weather makes pipes more prone to bursts and impacts shallow private connection pipes that feed individual properties from our distribution mains. Connection pipes are a particular problem as historically many of these were laid at very shallow depths, leaving them prone to frost damage.

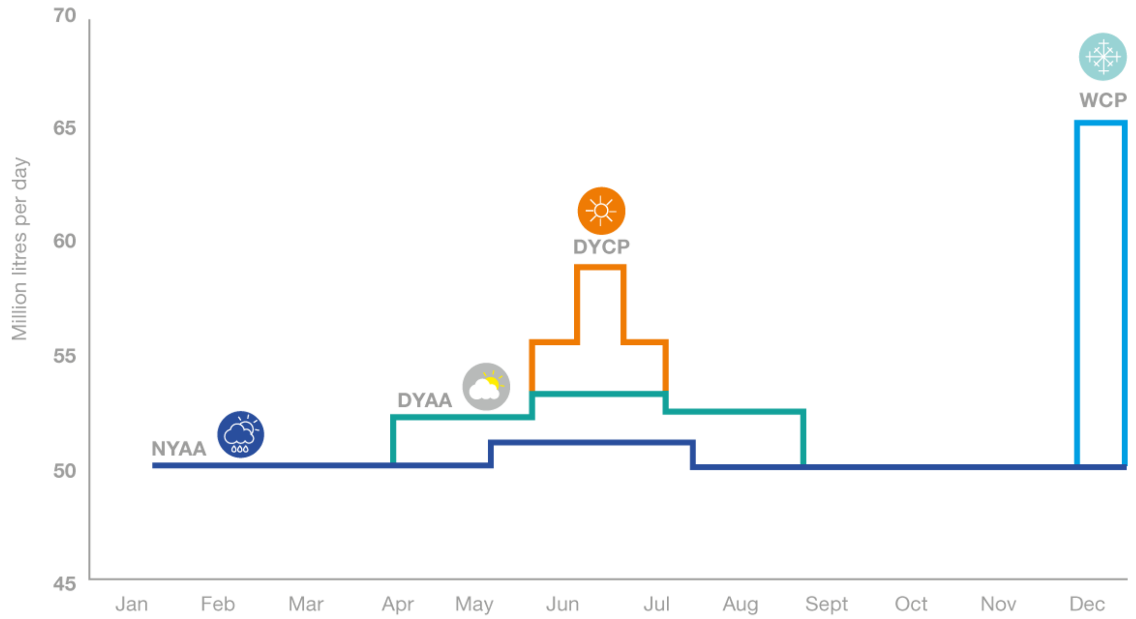



Figure 2.5 – Demand profiles for Weather Event Planning Scenarios

We use 'peaking factors' to calculate how demand changes for each Planning Scenario. Ideally, peaking factors would be based on historical data of water use during the planning scenarios. However, country-wide reliable historical data is not presently available, so we have used data from other water utilities with similar characteristics. Further information on peaking factors and how they are applied is provided in Chapters 3 and 4. Box 2.3 provides context of the weather conditions in Ireland.

### Box 2.3 – Drought Conditions in Ireland

Ireland is known for its rain, so it's easy to assume there's plenty of water available. But historical records show that in the past Ireland experienced extreme weather conditions and droughts more frequently than we have done in recent years.

Historic data indicates that Ireland experienced significant drought conditions approximately once every 10 years between the 1850's and 1970's. However, as the majority of our supplies have been developed and expanded since the 1970's they have never been tested against these types of historical extreme weather conditions. Therefore, our asset base may be vulnerable to changes in weather patterns as a result of climate change.

### 2.3.3 Level of Service

Level of Service (LoS) refers to the reliability of the supply that our customers can expect to receive and is expressed as a frequency or return period of supply failure (refer to Appendix D Level of Service). For example, if the LoS is stated as 1 in 50, as a consumer, you would only ever expect to experience a water outage or severe limitations to your supply, on average, once every 50 years. This standard of service is particularly important in larger supplies, where the social and economic consequences of failure to supply are significant and where mitigation measures such as tankered supplies are not feasible due to scale of demand.

The LoS in Ireland varies according to location, ranging from lower than 1 in 10 to better than 1 in 50. As summarised in Figure 2.6, approximately 50% of the population are at risk of receiving a LoS of lower than 1 in 50 during normal conditions (NYAA).

In this draft Framework Plan, Supply Demand Balance assessments have been developed for each WRZ based on a 1 in 50 Year LoS. This means Irish Water will aim to provide a uniform minimum of 1 in 50-year LoS across the entire public water supply over time. However, it should be noted that while customers within a WRZ with this LoS should not expect a major disruption to supply, they may experience some infrequent water use restrictions such as water conservation orders. The identification of and response to drought conditions that exceed these return periods is described in Appendix E Drought Planning.

Given that the current LoS in Ireland is low compared to international norms, the minimum of 1 in 50 LoS was set as a comparatively achievable target until our data and understanding of our water supplies improves. In comparison, in the UK, current best practice is to provide a 1 in 100-year LoS. This may take multiple investment cycles to realise and is not considered to be realistic for this first iteration of the NWRP.

The drought during June and July 2018 was a short but significant weather event, which had a major impact on Ireland's water bodies and the public water supply, in particular in the south, east and midlands of the country. During this event we did not experience a loss of supply to all of the areas identified as having a LoS of less than 1 in 50 years, as outlined in Figure 2.6. This was due to the emergency measures implemented by Irish Water in conjunction with our Local Authority partners.

These measures included: operating treatment facilities beyond their design capacities, tankering water to local communities, network management, implementing water conservation orders, and in extreme cases creating temporary obstructions in water bodies to maintain flow into our treatment plants. All of these measures represent undesirable and high-risk operations, potentially compromising the natural environment, impacting our ability to provide compliant drinking water and risking damage to our supply assets.

Normal LoS considerations in water resource planning place the focus on ensuring that our supplies are robust enough to produce enough water to meet demand across all Weather Event Planning Scenarios, thus reducing or removing the need for high risk operations.

Due to the condition of our asset base, Irish Water also needs to consider maintenance requirements when assessing Levels of Service. The condition of our distribution networks or treated water storage availability also has an impact on interruptions to our customer's supplies. Therefore, as part of Irish Water's water resources planning process, we will also identify key needs in relation to asset renewal and network requirements.

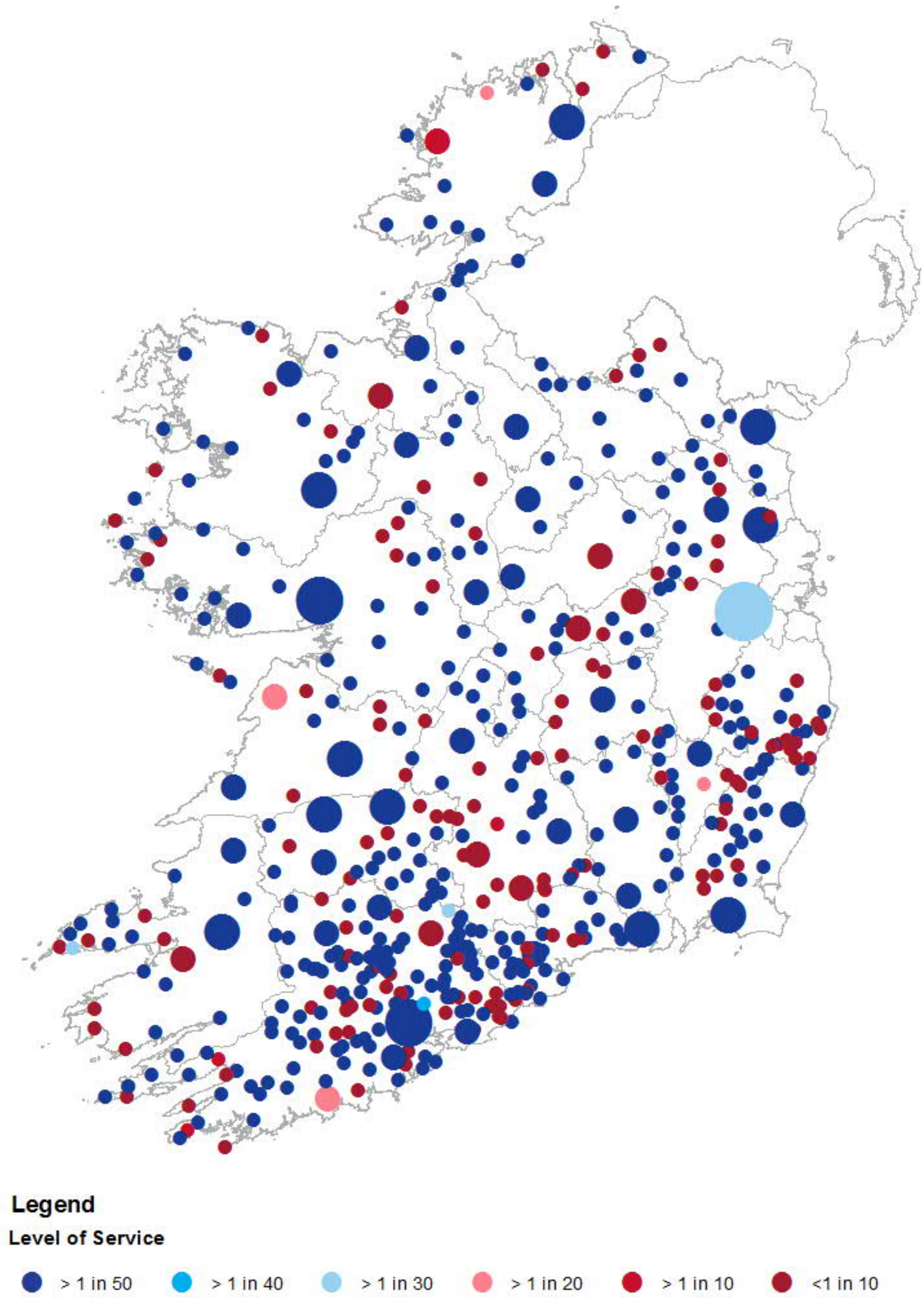



Figure 2.6 - LoS in each WRZ for a normal year (NYAA)

### 2.3.4 Supply Demand Balance

The Supply Demand Balance (SDB) is the difference between the water we have available in our supplies compared to the demand for water under each Weather Event Planning Scenario.

In terms of supply availability, the SDB considers water availability in the natural environment, current abstractions, water treatment capacity, process losses, trunk main constraints, and required allowances to ensure continuity of supply during planned and unplanned events.

When all of these factors have been considered, we can develop a Water Available for Use (WAFU) for each water resource zone. As part of our supply forecasts we must consider reducing supply availability due to climate change and risks in relation to sustainability driven reductions in allowable abstraction from waterbodies.

We must produce enough water supply at the top of our distribution networks to ensure that customers receive the volume of water they require at the extremities of a complex distribution network. The demand for water must therefore account for network efficiency and losses across the network during distribution.

When we assess demand for water as part of the Supply Demand Balance, we assess the current water balance which includes; domestic demand, non-domestic demand, operational usage (such as flushing water mains and fire hydrants), apparent losses and leakage. As part of demand forecasting, we must consider, leakage reduction, growth in demand, and allow for uncertainties (provision of headroom).

A deficit in the SDB means that the demand for water is higher than the available supply. In the event of an identified deficit, we consider what actions could be taken in response, e.g. reduce future demand, increase supply or a combination of both.

Figure 2.7 identifies the components of the SDB. In Chapters 3 and 4 of the draft Framework Plan, we outline how each of these components is calculated. Box 2.4 shows an example SDB projection over 25 years.

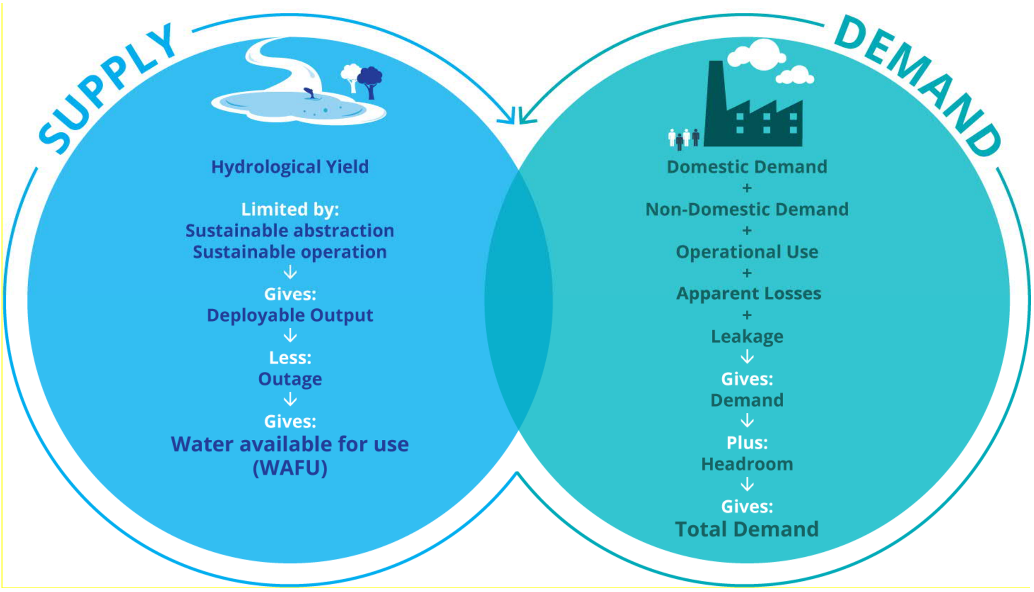
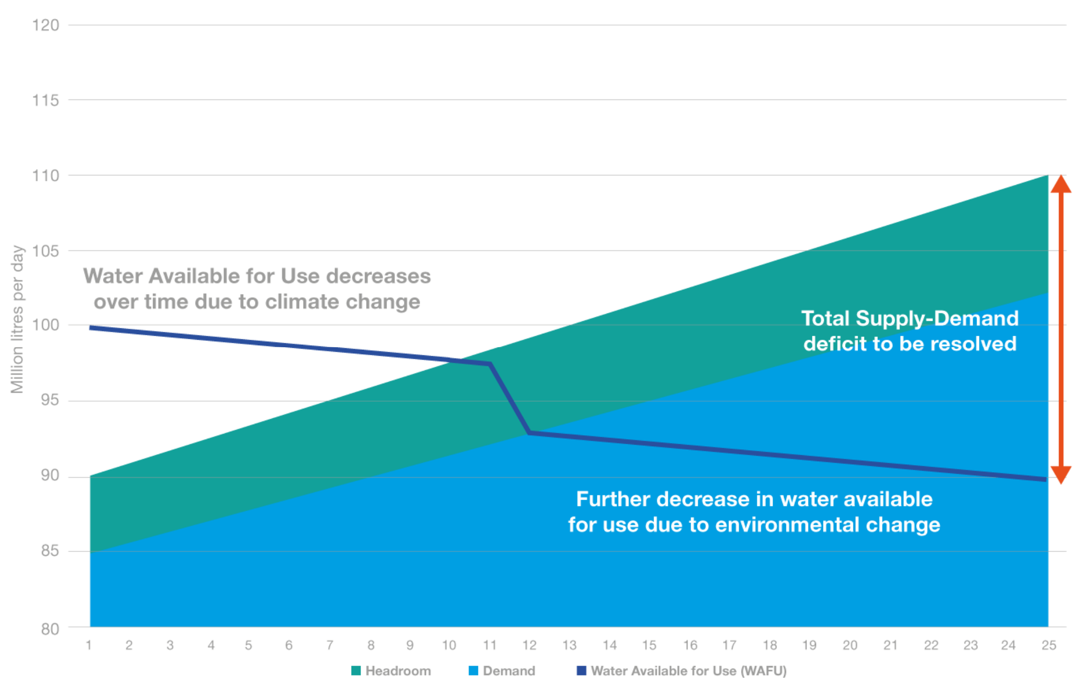



Figure 2.7 - Components of the SDB

**Box 2.4 – Example SDB**




This Figure demonstrates the demand for water increasing over time, which is typical of a growing population and economy. Our forecasts and assessments of demand require assumptions, including data accuracy and the reliability of our future projections.

The available water supply, WAFU is anticipated to reduce over the 25-year period due to climate change impacts. There is also a risk that in some locations that our WAFU will need to reduce over time, in order to meet the requirements of the River Basin Management Plans or abstraction licensing, where the current level of abstraction is considered to be causing environmental damage.

Headroom is the term given to a buffer in the SDB. It accounts for the uncertainty with data and the assumptions used in the supply and demand estimates and forecasts. The headroom allowance is added to the demand forecast (as set out in Chapter 4).

In this example, the SDB is in surplus from Years 1 to 9. The WAFU is decreasing due to climate change and a deficit occurs in the SDB from Year 10. This deficit increases through to Year 25 reaching 20 million litres per day (Ml/d). In this example, there is a sudden drop in the WAFU in Year 11 due to potential licensing constraints affecting abstraction. Interventions would be required to reduce demand or increase supply to address the deficit shown in this example.

## 2.4 Summary

As Irish Water is at the start of the water resources planning journey, we have had to adapt best international practice to suit the constraints and condition of our existing asset base. We have also had to amend our approach to the resource planning process to reflect the data and information systems that we have available to us at present.

In this section of the Plan we have summarised:

- The Resource Planning process that we have adopted for this draft Framework Plan including the use of DWSP to monitor and assess risk;

We have also summarised some of the key concepts in water resources planning, that are necessary to understand the methodologies outlined in the subsequent Chapters, including:

- Water Resource Zones;
- Weather Event Planning Scenarios;
- Levels of Service; and
- Supply Demand Balance.

In the next three Chapters of this document, we provide an overview of how we assess our current and future supply availability and demand requirements. We also identify our current needs in relation to quality and performance across the existing water supply asset base.

# 3 Identify the Need – Public Water Supply

# 3 Key Points

**In this Chapter we:**

- **Outline and describe how we estimate the components of Supply**
- **Set out the current Water Available for Use (WAFU) and how we expect this to change over the next 25 years**

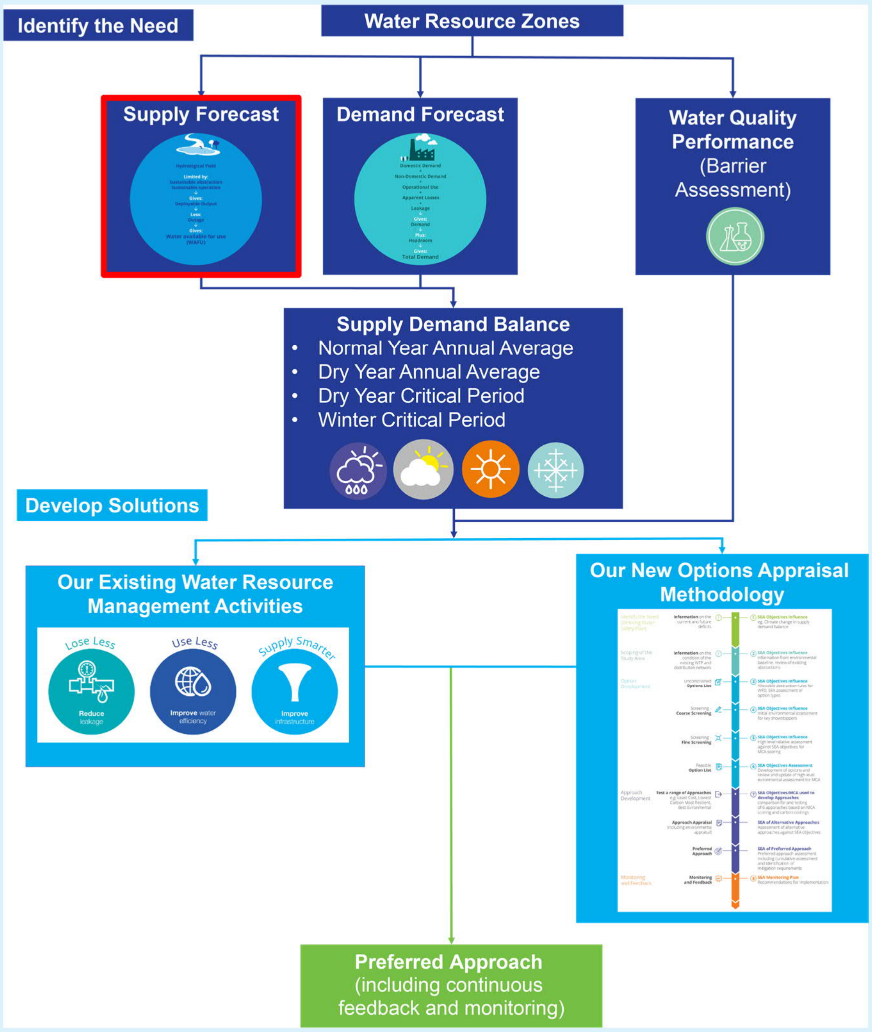



Figure 3.1 – NWRP Process – Supply Forecast

## 3.1 Introduction to Supply

To plan for future water availability, Irish Water must determine the amount of water that we can currently supply to our customers and then forecast how this might change over the next 25 years (Figure 3.1).

The amount of water we can currently supply depends on a number of factors including:

- The quantity of "raw water" we can safely abstract from the natural environment, when considering the Level of Service, we strive to achieve;
- The amount of this water we can convert to drinking water using our existing treatment facilities; and
- How much of this treated drinking water we can send into our distribution systems via our bulk distribution networks (trunk mains).


Figure 3.2 - Summary of Supply Components

By considering all of these factors we can properly identify the constraints in our water supply systems. In some cases, we may have an abundance of natural raw water, however, we are constrained by the capacity of our current treatment facilities. Conversely, in other areas, we may have appropriate treatment capacity, but our existing natural supplies are at risk, particularly during drought conditions. Our treatment processes can also come under pressure when raw water quality deteriorates following storm events.

In order to ensure that water customers receive safe and secure supplies, we must also consider reliability and risk to supply in our assessments. This is due to the fact that no water sources, treatment facilities and bulk distribution networks can operate at 100% capacity all of the time.

When we account for availability, capacity in production, capacity in transfer mains, reliability and risk within our existing supplies, we call the amount of water we have available to supply our customers Water Available for Use (WAFU).

This section outlines how we calculate the current WAFU in each Water Resource Zone (WRZ) and how we forecast that this will change over time.

Figures 3.2 and 3.3 illustrate the steps involved:

**Step 1**: Calculate the Hydrological Yield

**Step 2:** Allow for Sustainable Operation

**Step 3:** Calculate the Deployable Output (DO)

**Step 4:** Allow for Outage

**Step 5:** Calculate the Current WAFU

**Step 6:** Forecast the components of supply to derive the Future WAFU

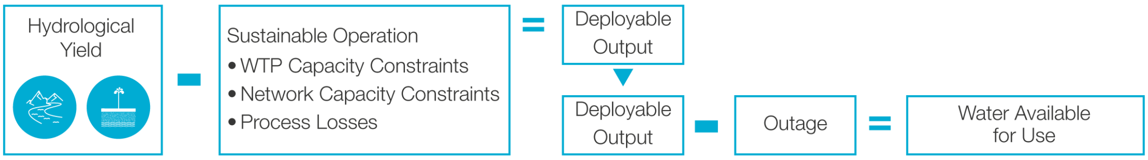



Figure 3.3 - WAFU Calculation Process

Further details on each of these steps are provided in the sections below.

## 3.2 Step 1 – Calculate the Hydrological Yield

To determine the WAFU we must understand the Hydrological Yield, which is the amount of water that is available from a source, be it a river, lake or groundwater body. The Hydrological Yield is dependent on the size, location and hydrological properties of the catchment from which we abstract and the Level of Service we aim to provide.

At present, we abstract more water from surface water sources (rivers and lakes) than from groundwater sources (boreholes and springs) for the provision of public water supply. This is illustrated in Figure 3.4 which shows that although we have 293 surface water sources and 797 groundwater sources, our surface water sources provide 83% of our total supply, whilst groundwater sources provide only 17% of the supply.

This is driven by a number of factors, including the historical development of public water supplies, complexity in assessing the availability of groundwater as a water source, and the natural geological conditions in Ireland. Whilst most of Ireland's bedrock is classified as an aquifer, it is relatively poor at storing and transmitting groundwater, thus limiting the volumes available for abstraction and in some cases resilience during dry periods. Furthermore, 7.5% of the total national supply abstracts from vulnerable groundwater sources pumped from karstified and fissured limestone bedrock, which may be susceptible to surface contamination.

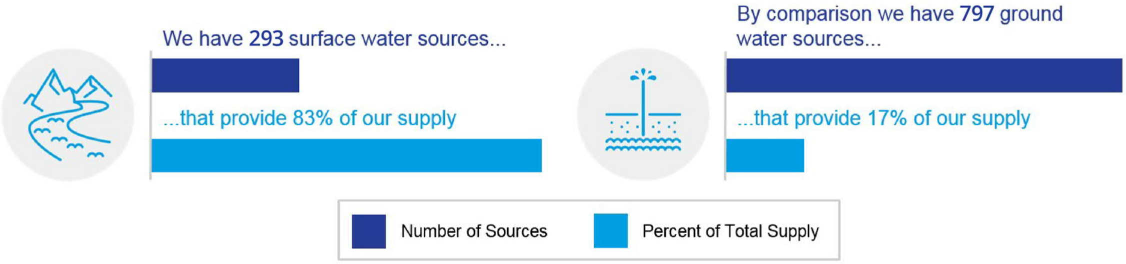



Figure 3.4 – Supply Summary

### 3.2.1 Surface Water Sources

The volume of water available to us from our surface water sources naturally varies throughout the year. Less water is typically available from April to September, and significantly less if we experience a drought. Our method for calculating the Hydrological Yield from River and Lake sources is summarised below. A more detailed outline of how the hydrological yield is calculated is provided in Appendix C.

#### River Sources

We consider the following information is required to determine the hydrological yield for a river source:

- Catchment area;
- The standard annual average rainfall for the catchment;
- Q95, the river flow which is equalled or exceeded 95% of the time;

- Qmean; the river flow which is equalled or exceeded 50% of the time, and
- Slope of the Flow Duration Curve (FDC) see Box 3.1.

Where possible, data has been taken from nearby river gauging stations to produce FDCs for our abstraction sites. However, in Ireland many river sources are ungauged, and to ensure a nationally consistent approach across the plan, a "transposition method" has been used.

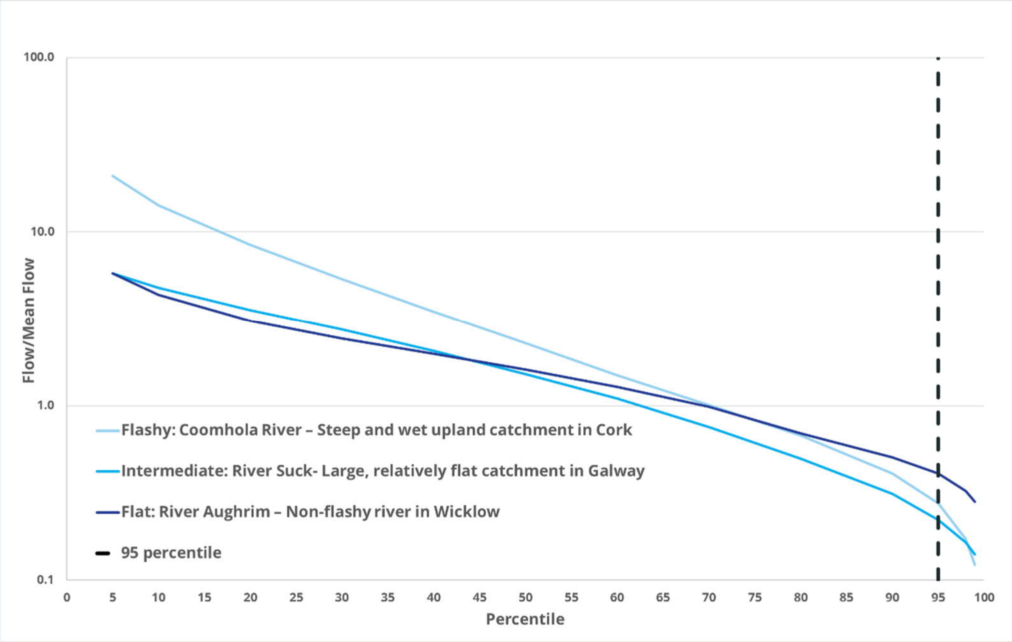
Using this method, data is taken from a gauging station with a similar catchment and used as a "donor gauge" to produce the FDC for an ungauged river abstraction source. Based on discussions with the EPA, for the draft Framework Plan, we developed a list of over 100 "donor catchments" that were used to produce FDCs for all our ungauged abstraction sites. Further information on the "transposition method" is provided in Appendix C.

### Box 3.1 – Example of an FDC

The interaction between a river catchment and the prevailing weather conditions means flows can vary between different rivers. We summarise this variation in flows through Flow Duration Curves (FDCs).

An FDC describes the amount of time that the flow in a river is likely to equal or exceed a particular rate at a specific location. The time period is stated as a percentage so, for example, the 95th percentile flow, which is known as the Q95 flow, is the flow that is equalled or exceeded 95% of the time.

FDCs for three example river catchments in Ireland are shown in the graph below.




An FDC is shown for the Coomhola River. This is a small, steep upland catchment, which is referred to as being a 'flashy' river catchment type, as it will respond quickly to rainfall. This FDC is compared to the River Aughrim which is a larger, lowland river and is a 'flatter' river catchment type that takes longer to respond to rainfall. The graph shows that the 'flashy' Coomhola River experiences a wider range of flows and would be expected to have a comparatively smaller Q95 or low flow compared to the 'flatter' River Aughrim. The River Suck, which is a large, moderately sloped catchment in Galway, has an FDC which lies between the flashy and flat river catchment types.

To calculate the Hydrological Yield, we then input the FDC and other information for each source including rainfall data into the Institute of Hydrology Report No.108 Low flow estimation in the United Kingdom Method. We then use this method to calculate the Hydrological Yield for a given source based on maintaining a 1 in 50 Year LoS.

As presently no suitable equivalent techniques have been developed specifically for Irish rivers, we have adopted this method from the UK. The climatic and physical similarities between Irish and UK river catchments facilitates the application of this method with an acceptable degree of accuracy until an Irish specific technique is developed.

### Lakes and Reservoirs

A similar approach is used to determine the Hydrological Yield for lakes and impounding reservoir sources. In addition to the information used to assess river sources, in order to determine the Hydrological Yield in the lake or impounding reservoir we also need to consider the water storage available. The following information is required:

- The surface area of the lake or reservoir;
- The potential rate of evaporation; and
- The usable storage which is the volume between the highest and the lowest potential water levels. Any water that is stored below the lowest potential lake or impounding reservoir level is known as “emergency” or “dead storage” and is not considered to be available for use in our hydrological yield calculations.

Example of a lake water source

For most of our lakes and impounding reservoirs all of this information is not available. Therefore, the potential storage has been estimated based on the surface area with an assumed a storage depth of 1 metre. Where operational information is available, it has been used as part of our assessments within the draft Framework Plan.

We then calculate the Hydrological Yield using the available storage, FDC, rainfall data and other information using the Institute of Hydrology Report No.108 Low flow estimation in the United Kingdom Method. The Hydrological Yield is also based on maintaining a 1 in 50 Year LoS.

### 3.2.2 Groundwater Sources

Due to the potential for large variations in sub-surface geology, even over short distances, producing robust desktop assessments of water availability from our existing groundwater abstractions is very difficult (Figure 3.5). Ideally, yield estimates would be based on a three-dimensional assessment of the geology within the vicinity of the supply, supplemented with long term records on pumping and drawdown of water levels over many years. Irish Water does not have this type of information available for most of our groundwater supplies. Irish Water will aim to complete site-specific studies of groundwater availability. However, as we have 797 groundwater abstractions, this may take many years. This activity will also be driven by the requirements of the pending legislation and regulations on abstraction from the natural environment.

As information becomes available, we will feed this into our supply demand balance assessments, in accordance with the process set out in Chapter 8, of this draft Framework Plan.

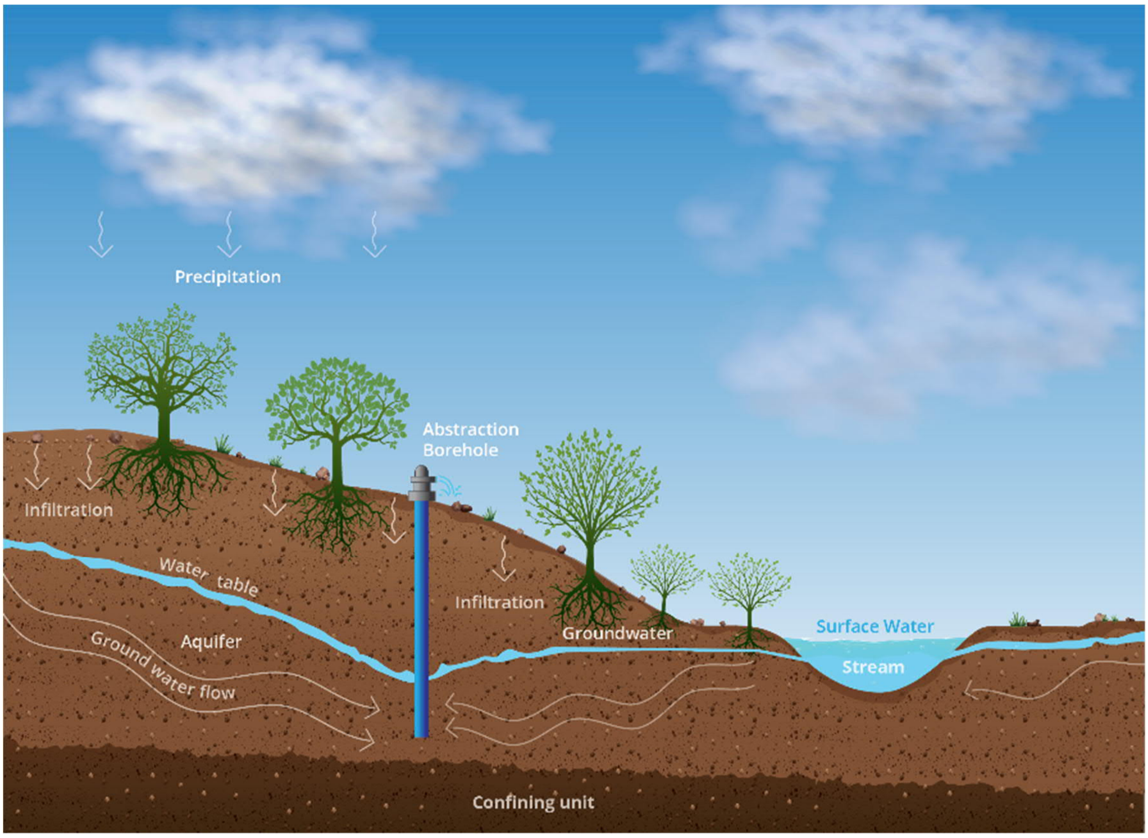



Figure 3.5 - Conceptual Model of a Groundwater Abstraction

For the purposes of the Plan a simple methodology has been developed for assessing the Hydrological Yield of our groundwater sites. This is carried out by:

- Defining the Zone of Contribution (ZOC), or the land area that contributes water to the well or spring; and
- Calculating a water balance for the source using the abstraction rate and the recharge rate as estimated from the Geological Survey Ireland (GSI) recharge maps.

The water balance shows the area needed to supply the yield and is then compared to the delineated ZOC. The water balance needs to be larger than the ZOC for a safe yield, which would not be expected to impact the ecological status.

Yields of wells and boreholes are assessed from sustained pump tests with monitoring of boreholes required to help confirm hydrogeological yields. With a few exceptions, groundwater yields in Ireland have proven to be disappointing for larger abstraction volumes (in excess of 1 Ml/d). Groundwater potential is assessed from historical data on wells and boreholes, and used in the hydrogeological categorisation of aquifers, informing potential for abstraction. In general, groundwater potential is constrained by geological factors primarily: glacial till, shallow aquifers with surface connectivity and limestone bedrock with open fissures and surface interface (as well as high hardness, iron and manganese) as frequent constraints.

## 3.3 Step 2 – Allow for Sustainable Operation

Sustainable Operation reflects the amount of water we can supply based on the capacity of our water treatment plants and bulk distribution network. It also accounts for unavoidable water losses that occur during treatment (known as Process Losses).

### 3.3.1 WTP and Network Capacity

Our water treatment plants (WTPs) and the distribution networks transferring treated drinking water from these WTPs to homes and businesses have maximum capacities. This maximum capacity can limit the volume of water that can be obtained from a source, regardless of the hydrological yield or raw water availability. We assess capacity of the WTPs and network supplying each WRZ to see if this is the factor limiting water available for use.

### 3.3.2 Process Losses

All production processes from manufacturing to energy production to construction involve losses. This is difference between the amount of raw materials required at the start of a process to deliver the amount of product produced at the end of a process. For example, in furniture manufacturing, some pieces of wood end up as saw dust or offcuts, in energy generation some output is lost through efficiency of turbines. For water treatment it is the same, there is a difference between the volume of raw water we transfer to our treatment facilities and the volume of drinking water that is produced. This loss is known as Process Loss. It is an unavoidable element of water supply and is generally a function of the raw water quality and the amount of treatment required to bring this water up to the standards required by the drinking water regulations. The amount of water ‘lost’ as Process Losses depends on the type of water treatment plant.

There are three main types of water treatment plants operated by Irish Water, summarised as follows:

- WTPs which include some type of chemical coagulation and filtration process, where losses would be moderate to high. These types of treatment plants are usually at surface water or ground water sites where there is a potential for contamination of the water source;
- WTPs which include filtration plus disinfection processes, where losses would be moderate to low. These treatment plants are usually required at well protected sources with high raw water quality, and moderate to low potential for contamination;
- WTPs which involve disinfection only, where losses would also be moderate to low. This type of treatment process is usually only applied to well protected and constructed groundwater abstractions, where there is no potential for contamination and continuous monitoring is in place.

Other Treatment Processes, such as Desalination or Effluent reuse involve significant process losses, due to the quality, for example, it can take over two litres of saline water to produce 1 litre of drinking water in a desalination process.

Table 3.1 summarises the Process Loss percentages that are applied to the three treatment plant types in our supply assessments, when we have no site specific WTP data available. These losses are consistent with industry standards.

Filtration of water

In some of our larger WTPs, where raw water quality is very good, coupled with performing assets and careful operational practice, process losses can be significantly less than these amounts. For example, at the largest water treatment plant in Ireland, Ballymore Eustace, although a Coagulation, Flocculation, Clarification and Filtration process is used, process losses are typically less than 2%. Where site specific information has been made available, it has been used within the draft Framework Plan.

As part of our Options Appraisal Methodology, we will consider the possibility of plant upgrades to reduce process losses as an option to address supply demand balance deficits, where feasible.

Table 3.1 - Percentage Process Losses Accounted for the different treatment types

| WTP treatment type | Process Losses (%) |
|---|---|
| Coagulation, flocculation, clarification and filtration (includes waste residuals) | - 8 |
| Filtration and disinfection | - 3 |
| Disinfection only | - 1 |

## 3.4 Step 3 – Calculate the Deployable Output

> The Deployable Output (DO) is the total amount of water that we can supply to our customers from our water treatment plants and through our distribution networks before we account for risk and reliability in terms of planned and unplanned events across our supply asset base.

The DO calculation for a simple WRZ consisting of a single source, feeding a WTP that in turn feeds a bulk distribution network is determined as:

- The hydrological yield of the water source minus process losses, where the Hydrological Yield is the constraining factor; or
- The water treatment plant output and/or bulk distribution network capacity where the hydrological yield is not the constraining factor.

For more complex WRZs where there are multiple raw water sources, supplying multiple WTPs with complex bulk distribution networks, we use an industry standard water resource simulation model called Aquator to calculate DO. Using Aquator, the DO is developed based on a behavioural modelling analysis of the supply system, using long-term inflow time series that have been derived for each of the sources. The model is tested to failure at a daily time step to support increasing levels of demand in a series of iterations, allowing a DO to be generated for a given LoS.

The DO for each of our water supplies, where the DO is not constrained by WTP capacity, is a function of hydrological yield and can vary considerably over the course of the year. In winter conditions, when precipitation and water availability in the natural environment is high, treatment capacity and bulk transfer capacity tend to be the limiting factor in DO. In contrast in summer periods or drought conditions, water availability in the natural environment tends to be the limiting factor.

As Irish Water must supply water in all conditions, we calculate DO for each WRZ for the following Weather Event Planning Scenarios (as described in Chapter 2).

- Normal Weather (NYAA);
- Dry Conditions (DYAA);
- Drought Conditions (DYCP); and
- Winter Conditions (WCP).

The DO calculation considers the variability in the natural environment and the design parameters around our WTPs and bulk transfer networks. It does not consider reliability of our assets or the planned or unplanned activities that form part of normal water services operations.

## 3.5 Step 4 – Allowance for Outage

> An Outage is a planned or unplanned event that results in a short-term reduction in DO. An outage might occur when quality in our water sources deteriorates, when a piece of equipment fails at a source or treatment plant, or when we need to carry out planned maintenance. For our larger supplies we apply an Outage factor to account for this within our calculation of the WAFU.

All of our assets do not operate at 100% output all of the time; therefore, it is necessary to cater for the planned and unplanned activities that take place across our asset base throughout the year. Fluctuations in raw water quality may occur which will reduce the volume of water which can be sustainably produced at our treatment plants, or maintenance activities may need to be carried out on a continuous programme.

Unplanned events such as the failure of a component of one of our WTPs, a break along one of our raw water intake mains or bulk distribution mains must be considered. These are normal characteristics of a water supply system that result in an “outage”.

In water supplies where raw water sources are well protected and sustainable, coupled with high performance, appropriately designed and well-maintained assets, the frequency and duration of an outage will be low compared to a poorly planned, designed and maintained supply. However, there is always a risk of outage, and as part of water resource planning, outage allowances are applied to DO calculations.

Outage allowances are usually calculated for each WRZ individually based on a history of planned and unplanned outage events, severe weather interruptions, water quality issues and an analysis of cause to determine future allowances. At present, due to limited availability of historical operational records, an individual analysis is not possible for the majority of our supplies.

In other jurisdictions, outage allowances range from 2% to 9%. Further to a review of other water utilities and our own experience, for this draft Plan we have applied a 5% outage allowance to Large and Very Large WRZs only.

For Medium and Small sized WRZs where there is often only one source of water, there is no benefit of applying an Outage allowance, as in these cases, any significant incident will result in the total loss of supply.

Table 3.2 summarises the outage allowances included in the SDB assessment, in our draft Framework Plan.

Table 3.2 - NWRP Outage Allowance

| WRZ | Outage allowance |
|---|---|
| Very Large zones (> 200Ml/d) | 5% |
| Large zones (10–200Ml/d) | 5% |
| Medium zones (1–10Ml/d) | 0% |
| Small zones (<1Ml/d) | 0% |

## 3.6 Step 5 – Calculate the Baseline WAFU

When considering supply availability as part of water resources planning, all the component parts of the individual water supplies that have the potential to impact on our ability to produce and distribute water to our customers are considered. This allows us to identify the limiting factors in our current supplies, and the interventions which may be required. It also allows us to identify the components of our supplies that have unacceptable risks associated with them in terms of maintaining a safe, secure and reliable water supply.

As shown in Figure 3.6, an analysis of each WRZ considers all the factors outlined in Steps 1 to 4, including hydrological yield, sustainable operation and outage allowance. Step 5 is to calculate the WAFU.  As outlined previously, this is estimated as:

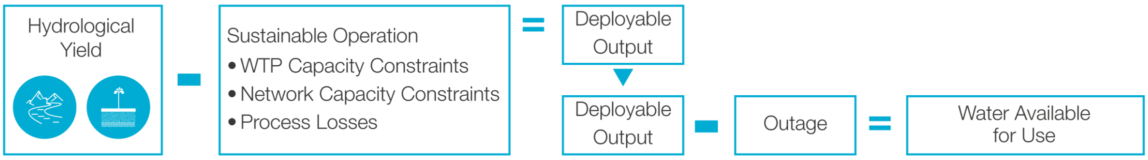



Figure 3.6 – WAFU Calculation Process

The WAFU is estimated for each of the Weather Event Planning Scenarios described in Chapter 2 of the Plan.

## 3.7 Step 6 – Forecast the components of supply to derive the Future WAFU

As the purpose of water resources planning is to ensure that we have sufficient water supplies in place for our customers now and into the future, we take the baseline WAFU developed for each WRZ and forecast how it may change over the next 25 years.

Many of the current challenges with existing water supplies relate to asset performance, characterised by undersized WTPs or inadequate treatment processes. Across our groundwater supplies, uncertainties around sustainable yield are also an issue. These deficiencies are largely within our control and, although the scale of funding required to address them will be significant, they can be addressed over time through investment, improved operation, maintenance and site investigations.

However, in the coming years the emerging issues which have the greatest potential to impact on our ability to supply water will relate to the natural environment and will largely be outside of our control.

As noted in Chapter 1, our water supply network developed over time, usually based on the need in the immediate vicinity. Some of our 1,090 abstractions are at risk of not meeting the requirements of pending abstraction legislation which will be based on environmental sustainability. In addition to this, the majority of our supplies were developed during a relatively consistent climatic period in Ireland over the past 50 years, with comparatively few dry periods compared to the long-term historical record. The forecasts for future WAFU must consider how climate change impacts may affect the hydrological yield of our sources, which may not be resilient to more extreme weather conditions.

Due to the condition of our existing supply asset base, particularly in relation to compliance with drinking water regulations, there will be competing needs for limited financial resources in the coming years. This means essential funding requirements to improve compliance and the condition of our asset base will limit the amount of funding available to move towards a more sustainable supply model in the short to medium term.

As part of the draft Framework Plan, the impact of climate change and pending abstraction legislation on water supply forecasts have been considered.

### 3.7.1 Climate Change

Our WAFU forecast considers the impact of climate change on our existing sources by adjusting the future hydrological yield of each source using Ireland-specific climate change factors, which were developed by the ICARUS (Irish Climate Analysis and Research Unit) Department of NUI Maynooth in 2008. The work involved assessing nine catchment types across Ireland to develop seasonal adjustment factors that could be applied to hydrological yield.

The central estimate of the impact of climate change on water availability has been included within the SDB for each WRZ. The uncertainty around the central estimate has been included in the headroom calculations in line with UK guidance.

In 2018, Irish Water commissioned further research with the ICARUS Department in NUI Maynooth under the Climate Sensitive Catchments Project. This project has used the latest climate change projections and a best practice risk-based approach to assess the impacts of climate change on flows in 206 catchments in Ireland.

The Climate Sensitive Catchments Project is not included in this draft Framework Plan, as we must develop an operational means of applying the research outputs into our Hydrological Yield assessments. Based on our work to date, it is clear that the full application of the techniques presented in the study to all our surface water sources will require a multi-year programme of work including:

- Hydrological measurements;
- The development of additional rainfall-runoff models;
- Groundwater studies; and
- An assessment of the significance of reservoir and lake storage on a catchment's runoff response.

In addition to this, as part of the TRANSLATE project, Met Éireann, are developing standardised national climate projections for Ireland and climate services support. This will provide the necessary information requirements for sectoral adaptation planning. Irish Water will work with Met Éireann to adopt these projections when they become available, in order to ensure that our NWRP is always aligned with national policy.

As our understanding of the impacts of climate change improves, incremental improvements will be incorporated into the SDB calculations, in accordance with the process set out in Chapter 8 of this draft Framework Plan.

Additional information on Irish Water's approach to considering the effects of future climate change and the Climate Sensitive Catchments Project is provided in Appendix F.

### 3.7.2 Abstraction Legislation

Most of our abstractions were in operation long before any modern environmental legislation. Historically, when new supplies were developed, the emphasis was placed on the capacity of the WTPs or the capacity of the bulk transfer mains.

Although some consideration was given to the sustainability of water bodies, through the requirements for environmental assessment in compliance with the Planning and Development Acts as amended, many water supplies pre-dated this. Most surface abstractions in recent decades, apart from those from ESB hydroelectric schemes, were approved under the Water Supplies Act 1942, which included some level of hydrological assessment. However, many of our smaller supplies were never formally permitted.

More stringent environmental standards may mean that abstractions that were once regarded as acceptable may now be considered to be unsustainable, particularly in dry weather conditions, in the context of new legislation. These abstractions may in the future be subject to modifications to meet the requirements of the WFD.

In summer 2018, a draft Bill was published proposing alignment of abstraction licencing with the requirements of the Water Framework Directive. We have assessed our existing abstractions and taken a precautionary approach based on our current understanding of how abstraction legislation might be applied, as outlined in Appendix C. This assessment suggests that certain schemes may be subject to reduction in abstraction. Figure 3.7 shows how the abstraction legislation could change the way that we calculate the WAFU.

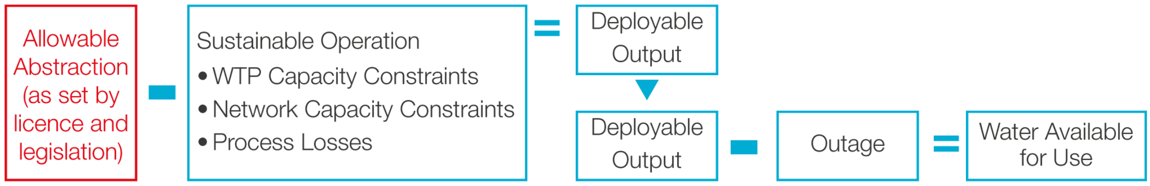



Figure 3.7 – Potential Impact of the Abstraction Legislation on the WAFU Calculation Process

As we do not have full visibility of the future regulatory regime and have not progressed through the licencing process on a site by site basis, we have not included our estimation of sustainable abstraction within the SDB calculations. Instead we use the hydrological yield, water treatment capacity and bulk transfer limitations in our calculation of DO. We also use the sustainable abstraction assessment to assess the sensitivity of the Preferred Approaches (solutions) we develop as part of the NWRP.

Therefore, our draft Framework Plan assumes that existing abstractions can continue on a transitional basis, subject to the registration requirements as outlined in the General Scheme of a Water Environmental (Abstractions) Bill published by the Government in December 2017.

For these abstractions, further studies will be undertaken in conjunction with the EPA and appropriate stakeholders. Following investigation, if an abstraction is confirmed to be affecting a waterbody status the Supply Demand Balance will be updated and solutions will be delivered through the future cycles of RBMPs and/or Regional Water Resources Plans.

As the objective of our NWRP is to achieve, safe, secure, reliable and sustainable supplies, all new abstractions developed by Irish Water as part of our Regional Water Resources Plans will be based on conservative assessments of sustainable abstraction. This will ensure that our water supplies continually improve in terms of environmental sustainability over time. More information on Regulatory and Licensing Constraints can be found in Appendix G.

## 3.8 Baseline and Forecast Supply

When we apply the WAFU assessment methodology set out in this Chapter to our existing supplies, and forecast the change in these supplies, we can assess how our supplies might perform now and into the future.

Figure 3.8 shows our calculation for the WAFU nationally for our weather event planning scenarios between 2019 to 2044. A summary of this information is also provided in Table 3.3.

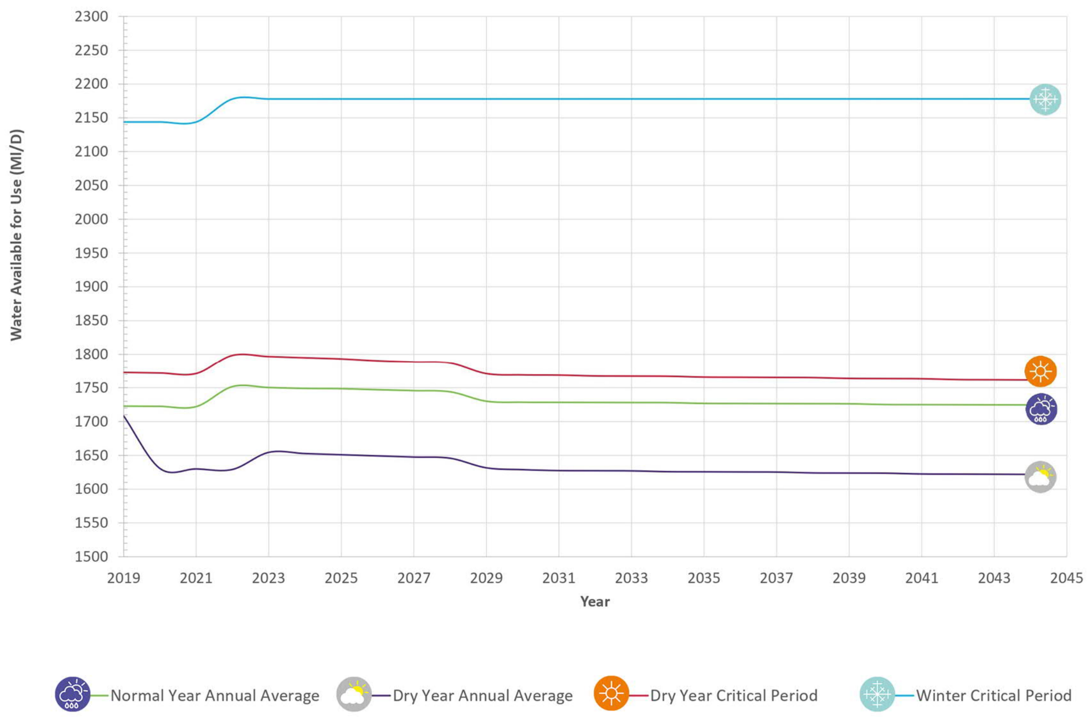



Figure 3.8 – National Summary of WAFU, 2019 to 2044

Table 3.3 - Change in WAFU, 2019 to 2044

| Weather Planning Scenario | WAFU (Ml/d) | | Change in WAFU from 2019 to 2044 | |
|---|---|---|---|---|
| | 2019 | 2044 | Total (Ml/d) | (%) |
| NYAA | 1,723 | 1,725 | 2 ↑ | 0 |
| DYAA | 1,708 | 1,622 | -86 ↓ | -5 ↓ |
| DYCP | 1,773 | 1,762 | -12 ↓ | -1 ↓ |
| WCP | 2,139 | 2,173 | +34 ↑ | +2 ↑ |

↑ = Increased in WAFU

↓ = Decrease in WAFU

Presently, for a normal year (NYAA) the maximum WAFU is 1,723Ml/d. This will increase in the short term to 1,761Ml/d as a result of delivery of projects to increase WAFU during the current investment cycle. By 2044 however, the maximum WAFU is reduced back to 1,725Ml/d, due to the impacts of climate change.

For a dry year (Dry Year Annual Average) the maximum WAFU is 1,708Ml/d. This reduces to 1,622Ml/d in 2044. The WAFU is less in a dry year than in a normal year as dry weather conditions reduce the amount of raw water (Hydrological Yield) that we can abstract from our sources.

Although there is less raw water availability from water sources, during a DYCP we allow our WTP's to operate at peak output over 22 hours. This means that in water supplies where hydrological yield is not a limiting factor, we allow a peak deployable output from these sites.

The WAFU is higher during the WCP. This type of event tends to be short in duration and in some cases, we may be able to increase the operating period of our treatment plants to address demand increase. Raw water availability is not normally a constraint during the WCP, which usually occurs when river and lake levels are at their highest.

Between 2019 and 2044 we are predicting 5% and 1% decrease in the WAFU during the DYAA and DYCP respectively. This is due to climate change, which is expected to reduce the amount of water that we can abstract from our surface water sources.

At present, our forecast WAFU does not include the potential effects of the Abstraction Legislation, which are likely to further reduce the amount of water we are able to abstract from our sources. The effects of the abstraction legislation are too wide ranging to be assessed at this stage with a more detailed site-by-site assessment required when the legislation is enacted. However, as part of our Options Assessment Methodology (see Chapter 8) we include a Sensitivity Assessment to understand how the abstraction legislation could impact our preferred options and programmes for each WRZ.

## 3.9 Summary

In this Chapter we have:

- Outlined and described how we estimate the components of supply.
- Set out the current WAFU and how we expect this to change over the next 25 years.
- We have also applied the baseline and forecast WAFU assessment methodology to our existing supplies.

The output of this assessment will be used in our Supply Demand Balance Calculations.

# 4 Identify the Need - Demand for Water for Public Water Supply

# 4 Key Points

## In this Chapter we will:

- **Outline the components of demand;**
- **Describe how we estimate current demand and forecast future demand for domestic and non-domestic purposes;**
- **Explain how we estimate leakage and leakage forecasts;**
- **Outline operational water use;**
- **Explain the concept of headroom and how this is used to provide for uncertainty in our estimates;**
- **Describe our approach to calculate peaks in demand under the Weather Event Planning Scenarios; and**
- **Set out the overall demand forecast for the next 25 years.**

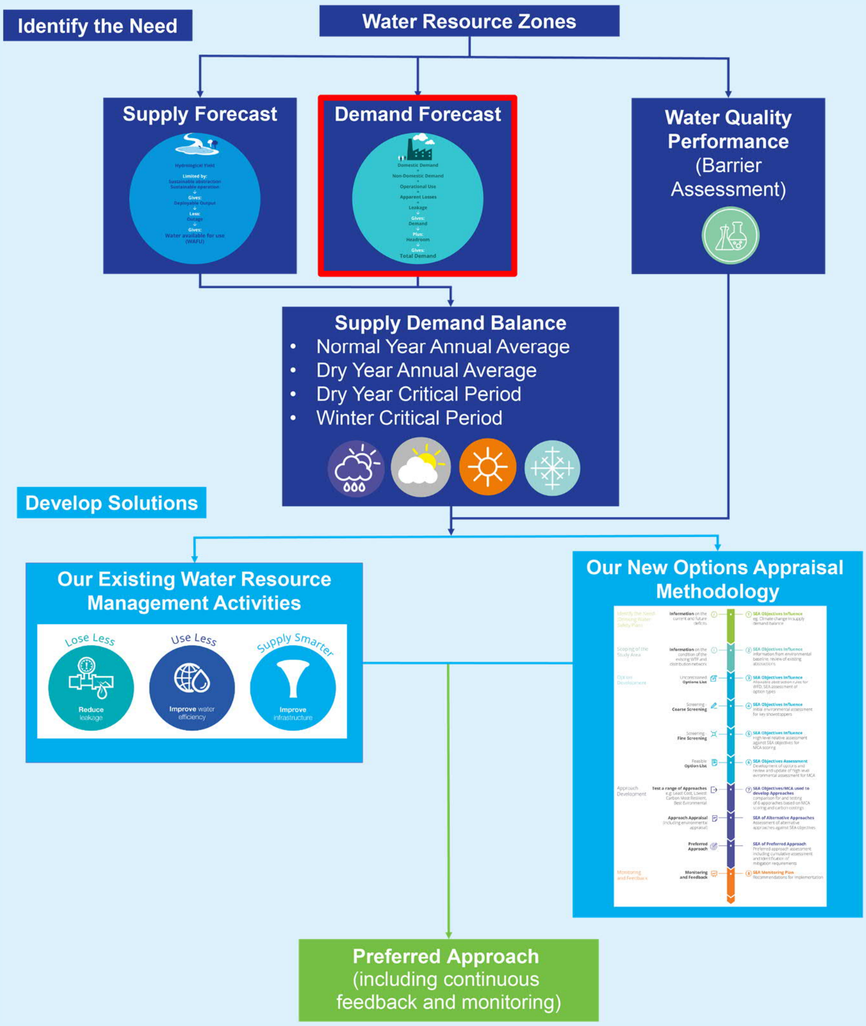



Figure 4.1 – NWRP Framework Process – Demand Forecast

## 4.1 Introduction to Demand

To plan for future water demand, Irish Water must understand the current demand for water, and then forecast how this might change over the next 25 years (Figure 4.1).

The term 'demand' refers to the amount of water we need to input into our distribution networks at water treatment plants to ensure that we can meet our customer's water requirements in the homes and businesses at the boundaries of our networks.

Our water distribution networks are extensive, for example the distribution network for Clonakilty in County Cork contains approximately 450 kilometres of water mains (approximately the distance between Cork and Letterkenny). As our water supplies travel through large networks before they reach our customers, the network performance or leakage needs to be considered in our demand calculations.

Figure 4.2 shows the baseline components of demand. The components are assessed separately as they each involve different patterns of use and are subject to different drivers for change over the next 25 years.


Figure 4.2 - Deriving forecasts of total demand

The following demand components have been assessed:

- Domestic water use – water used in homes. It is often calculated by multiplying the population served by the average Per Capita Consumption rate (PCC);
- Non-domestic water use – water used in metered or unmetered non-domestic premises;
- Operational use – water used by Irish Water in carrying out its operations and hydrant use;
- Apparent Losses – water use from connections that are not recorded on our systems; and
- Leakage from pipes and joints in the supply network, or from overflows at storage tanks.

The total amount of water supplied into the distribution network (from our treatment works) is known as "distribution input". Therefore, for each WRZ, the demand components combine to give distribution input, i.e.

Demand for water in any WRZ fluctuates daily, seasonally and during critical periods such as drought or freeze thaw conditions. The fluctuations occur for a variety of reasons, including:

- Changing weather affects the way water is used. For example, watering of gardens can increase demand significantly during a dry spring or summer;
- Movement of people during holiday times or at weekends can result in increases in water demand in some WRZs and decreases in others;
- Non-domestic demand, for example in schools, offices and other places of work, may be lower during weekends or holiday times;
- Some non-domestic customers, such as the agricultural sector, may increase their demand during hot or dry weather; and
- Leakage from the distribution network and our customers supply pipes tends to increase during very cold weather. Ireland experienced very large increases in leakage following severe cold weather in the winters of 2009/10, 2010/11 and Storm Emma in 2018.

We consider these factors as part of our Weather Event Planning Scenarios, as outlined in Chapter 2.

To forecast demand over the next 25 years, we first need to develop an understanding of how water is currently used once it enters the distribution system. This section outlines our understanding of current water usage in 2019 (this is the base year from which we start our forecasts of demand) and sets out how this forecast will change over time.

We describe the steps to derive the demand forecast:

**Step 1**: Calculate base year demand (the water balance)

**Step 2:** Calculate forecasts for each component of demand

**Step 3:** Calculate headroom

**Step 4:** Calculate the total demand forecast

**Step 5:** Derive and apply factors to convert demand to Weather Event Scenarios.

Water demand forecasts for the period 2019 to 2044 have been developed for each of the 539 WRZs that Irish Water supplies water to.

## 4.2 Step 1 – Calculate Base Year Demand

### 4.2.1 Overview of Base Year Water Balance

Irish Water currently supplies about 1,730 million litres per day (Ml/d) of water to approximately 4.2 million people. This represents about 87% of the total population of Ireland (the remainder receive water from private supplies or Group Water Schemes). The public water supply serves approximately 1.6 million domestic and 0.2 million non-domestic properties. A summary of Irish Water's current supply is provided in Table 4.1.

Table 4.1 - Summary of Irish Water's water supply

| Item | Number in 2019 |
|---|---|
| Total population served | 4.2 million |
| Number of domestic properties served | 1.6 million |
| Number of non-domestic properties served | 0.2 million |
| Total quantity of water supplied | 1,732 Ml/d |
| Number of WRZs | 539 |

Table 4.2 highlights how our WRZs vary significantly in size. In most zones, the population served is less than 1000. The five largest WRZs account for 57% of the total population served by Irish water and account for 50% of the total volume of water put into distribution.

Table 4.2 - Summary of Irish Water's WRZs

| WRZ category | Population served category | Number of WRZs in category | Population in 2019 (million) (% of total) | Average Demand in 2019 (Ml/d) (% of total) |
|---|---|---|---|---|
| Very large WRZs:<br>• GDA<br>• Cork City<br>• Galway City<br>• Limerick City<br>• South Louth / East Meath | over 100,000 | 5 | 1.72 (41%)<br>0.29 (7%)<br>0.15 (4%)<br>0.12 (3%)<br>0.11 (3%) | 572 (33%)<br>132 (8%)<br>75 (4%)<br>44 (3%)<br>34 (2%) |
| Large WRZs | 25,000 to 100,000 | 14 | 0.62 (15%) | 276 (16%) |
| Medium WRZs | 5000 to 25,000 | 72 | 0.79 (19%) | 387 (22%) |
| Small WRZs | 1000 to 5000 | 133 | 0.33 (8%) | 167 (10%) |
| Very small WRZs | 0 to 1000 | 315 | 0.08 (2%) | 44 (3%) |
| Total | | 539 | 4.2 million (100%) | 1732 Ml/d (100%) |

*Due to rounding the percentage figures may not add to 100%*

Since Irish Water was established in 2014, we have been collating all data held by Local Authorities into our centralised systems in order to understand how water is used once it is put into supply.

In late 2018, a Leakage Management System (LMS) which draws together a range of live data including numbers of customers, metered customer usage and water put into supply, was developed. The key features of the LMS allow us to assess leakage trends in a uniform way across our supplies, and to manage active leakage control activities.

Although the LMS is in its early stages and will take a number of years to fully calibrate, we are continuously improving our knowledge of leakage across our distribution networks. Our estimation methodologies are based on best international practice, and the LMS provides us with a platform for analysis of data. We have used the first full year of output from LMS to develop the baseline demand and water balance for the draft Framework Plan.

The components of national distribution input for 2019, national public water supply, are shown in Table 4.3.

Table 4.3 - National Water Balance for 2019

| Water balance component | Volume in 2019 | % of total in 2019 |
|---|---|---|
| Domestic consumption | 556 Ml/d | 32% |
| Non-domestic consumption | 407 Ml/d | 23% |
| Operational use | 17 Ml/d | 1% |
| Apparent Losses | 12Ml/d | 1% |
| Leakage | 741 Ml/d | 43% |
| **Distribution input (i.e. total water supplied)** | **1,732 Ml/d** | **100%** |

## 4.2.2 Demand Components

### 4.2.2.1 Base year population

The estimated population currently living in each WRZ has been based on the 2016 Census data. Forecasts for future populations have been based on draft growth projections from the National Planning Framework (NPF), and updated information from the Regional Spatial and Economic Strategies (RSES) and Local Authority Planning sections (where available).

The 2016 population was assigned to District Metering Areas (DMAs) by mapping the Central Statistics Office (CSO) data to DMA boundaries.

We have projected the 2016 population forward to 2019 using the growth projections in the NPF to establish our base year populations. Our approach to forecasting population growth is described in Section 4.3

### 4.2.2.2 Base year domestic demand

> We measure domestic demand as Per Household Consumption (PHC) or Per Capita Consumption (PCC) in litres per household per day or litres per person per day based on a combination of metered data and estimates for unmetered properties.

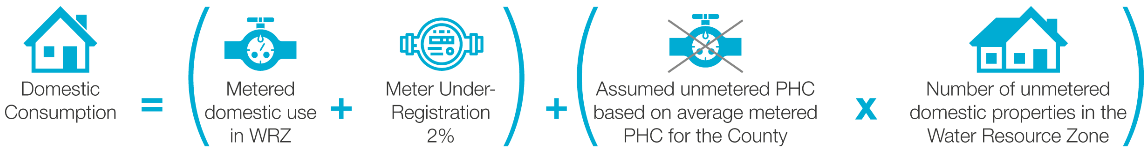
PHC and PCC are made up of micro-components of use such as: toilet flushing, personal washing, clothes washing, dishwashing and outdoor use. The demand associated with these micro-components relates to either individual use or shared use. Individual use covers activities such as toilet-flushing and personal washing and is largely independent of the number of people living in a property. Shared use includes activities like washing clothes in a machine and is dependent on the number of people living in a property. Understanding this breakdown of usage in the base year helps forecast changes in demand. In

Ireland we do not currently have detailed information about water-using behaviour and a breakdown by micro-component.

Currently, the percentage of metered properties varies by WRZ but, on average 57% of domestic properties in Ireland are fitted with meters. For these properties we have good data on the demand for water.

For each WRZ the average metered PHC for those properties has been taken within the WRZ. An allowance of 2% for Meter Under Registration (MUR) has then been applied. This reflects that meters do not record usage to 100% accuracy and that the accuracy deteriorates with age of meter. The allowance we apply is based on evidence from the UK WRc report 'CP360 Commercial Meter Under-Registration' taking into account age and type of meter. The evidence for small commercial meters has been applied to our domestic meters. For the unmetered domestic properties, we have assumed that we can extrapolate the metered data and then apply it to the unmetered properties.

The average PHC is calculated for each county using data from metered domestic properties within that particular county. This county-wide PHC value was assigned to unmeasured properties in all WRZs in that county. This allows us to account for significant deviations from average use in small WRZs.




The results summarised in Table 4.4, show that the average PHC across Ireland was 354 litres/household/day and the average PCC was 133 litres/person/day in 2019.

The assumption that metered properties are representative of all domestic properties in Ireland may not be correct.  In order to understand this, we need to identify appropriate domestic characteristics that influence water use. We can then use this information to classify our households and examine the representativeness of the metered data. This exercise will require a number of pilot studies across our supplies over the coming years. In the interim, for this draft Framework Plan, we have assumed that the metered data is applicable to the entire domestic customer base. This may initially result in an underestimate of PHC and domestic demand, and an overestimation of leakage in our distribution networks.

Table 4.4 - Comparison of PHC and PCC across Ireland

| WRZ | PHC in 2019 (l/h/d) | PCC in 2019 (l/p/d) |
|---|---|---|
| GDA | 354 | 122 |
| Cork City | 382 | 143 |
| Galway City | 383 | 147 |
| Limerick City | 330 | 125 |
| South Louth & East Meath | 369 | 122 |
| Other 534 WRZs | 348 | 143 |
| Average for all 539 WRZs | 354 | 133 |

Domestic meters are generally fitted in the footpath meaning any water losses from the customer connection supplying the house, or internal plumbing leaks is included in the metered data. In the UK, water utilities report leakage as "Total Leakage" to their regulators. Total Leakage is the combined water losses across the public distribution networks in addition to leakage in private customer supply pipes and private plumbing systems (based on estimated values for customer side leakage).

At present, Irish Water reports leakage as Distribution Network Leakage to our regulator the CRU and does not include Customer Side Leakage (CSL) within this assessment. However, due to the potential underestimation of PCC in non-metered households, our Distribution Network Leakage may be overestimated, and in reality, closer to a Total Leakage assessment.

Due to our current treatment of CSL, the PCC for Irish Water may not be directly comparable with the PCC as reported in the UK.

As Customer supply pipes are not part of the public water distribution network, leaks from these pipes are the responsibility of the property owner. However, Irish Water proactively promotes water conservation and encourages customers to repair leaks. We also offer a free repair under our First Fix Free scheme, where such leaks are identified.

The First Fix Free scheme was initially very successful, but uptake has reduced to relatively low levels since the domestic charges were abolished. The savings associated with the First Fix Free scheme to date are estimated to be 120Ml/d (gross leakage savings). However, it must be noted that gross leakage savings do not translate directly into reductions in overall demand for the following reasons:

- Savings are continuously offset by Natural Rate of Rise (NRR) (the rate at which leakage would increase if it is not managed) and new leaks within properties or on other supply pipes
- CSL Savings are at the ends of long distribution network, and water saved results in small increases in service to other customers who may have low water pressure in their supplies.

We will continue to monitor take up rates with the First Fix Free scheme when the excessive use charge is implemented (see Chapter 7).

For this iteration of the NWRP, the CSL element of domestic demand is considered to remain static, based on empirical data trends from the "First Fix" scheme to date, and based on the assumption that domestic charges will not be introduced.

Across all WRZs the base year average PCC is 133 litres per person per day (l/p/d). The total domestic demand in Ireland for 2019 was calculated to be 556Ml/d.

#### 4.2.2.3 Base year non-domestic demand

Non-domestic demand includes manufacturing and non-manufacturing industries, agriculture, utility companies, commercial businesses, retailers, hotels, leisure businesses, local authorities, communal establishments, schools and hospitals. They use water in a variety of ways, including industrial processes, site washing, catering and office facilities. Most non-domestic customers have meters fitted and pay for water based on the volumes they use.

Non-domestic usage in Hospitals and Healthcare Facilities

Base year water use in non-domestic properties in each WRZ has been estimated based on the available metered data. Where current metered data is not available, we have used estimated consumption data based on previous meter readings where these are available or an assumed average usage per property. We have applied an allowance of 5% for MUR. This reflects that meters do not record usage to 100% accuracy and that the accuracy deteriorates with age of meter. The allowance is based on evidence from the UK WRc report 'CP360 Commercial Meter Under-Registration' taking into account age and type of meter. We have a small number of non-domestic customers that are not metered. The consumption for these properties is calculated based on the same assumed average usage per property.

We calculated the non-domestic water use for 2019 to be 407Ml/d.

#### 4.2.2.4 Base year operational use

Operational use includes water used by Irish Water at our sites, for mains cleaning in operating the distribution network, at hydrants for firefighting, and by local authorities for road and gully cleaning. We do not have data which allows us to make a direct estimate of the quantity of operational use in each WRZ. We have therefore assumed that the operational use of water is 1% of distribution input, based on data from the other water utilities in other jurisdictions with similar characteristics.

We estimate that the operational use of water is 1% of distribution input for 2019.

#### 4.2.2.5 Apparent Losses

Apparent Losses include water that is used in properties (both domestic and non-domestic) through permanent and temporary connections that are currently unknown to us. We do not have data which allows us to make a direct estimate of the quantity of apparent losses in each WRZ. Therefore, we have assumed that this amounts to 1% of distribution input in urban areas, based on data from UK water utilities with similar characteristics. We have reduced the allowance to 0.5% in rural areas reflecting the lower density of connections.

> We estimate that apparent losses amount to 1% of overall demand for 2019 in urban areas and 0.5% in rural areas.

#### 4.2.2.6 Leakage Forecasting

Leakage comprises losses from the distribution network through bursts and seeps. The volume is not measured directly but can be estimated as the amount of water that is put into supply but cannot be accounted for as water that is used by our domestic and non-domestic customers, apparent losses or in our operations. This is calculated as:


Managing leakage is important in the context of the NWRP as leakage reduction can create greater headroom between Demand and the amount of Water Available for Use (Supply). As a result, leakage reduction is an integral part of managing the Supply Demand Balance now and into the future, and is one of our Three Pillar solution types, Lose Less, as outlined in Chapters 1 and 7.

Example of leakage

#### 4.2.2.7 Base year leakage

The process of developing the LMS and migrating DMAs from the different Local Authority areas into this intelligence system started in late 2018. All Local Authorities were fully operable in LMS in October 2019, and work continues in order to achieve the complete data configuration. When the LMS has been calibrated, we will be able to fully adopt best practice methodologies in estimating leakage.

For base year demand, based on best available data, leakage has been calculated as 741Ml/d nationally.

Due to the potential variation around our estimates of domestic and non-domestic water use, it is likely that some customer consumption (which we are not aware of and are unable to quantify) may be included in our current estimates of leakage. As our data around customer consumption improves, we will be able to reassess our estimates of leakage.

Another key area of future data improvement is on the assumption that unmetered household properties use water in proportion to metered household properties. Further pilot studies are planned in order to understand whether this is an appropriate assumption. As we improve our data and understanding of the differences between metered and unmetered usage, we will adjust our estimate for domestic demand and leakage. We will then update our SDB calculations via the monitoring and feedback loop described in Chapter 8 of this draft Framework Plan.

In 2019, baseline leakage was estimated to be 741Ml/d.

## 4.3 Step 2 – Calculate Forecasts for Components of Demand

### 4.3.1 Overview of demand forecasts

Over the next 25-years, it is forecasted that:

- Water use by domestic customers will increase due to the significant population growth;
- Non-domestic water use is expected to increase due to economic growth; and
- Large reductions in leakage are planned.

Further details of our approach are provided in the following sections.

### 4.3.2 Demand component forecasts

#### 4.3.2.1 Population forecasts

The NPF "Project Ireland 2040 – Our Plan" has enabled Irish Water to estimate the change in population over the next 25 years. It predicts that at least 50% of future population growth will be focused in the five cities of Dublin, Cork, Galway, Limerick and Waterford and their suburbs.

The growth rates from the NPF and Regional Spatial and Economic Strategy (RSES) have been used to forecast populations in each WRZ. The NPF sets target population numbers and our growth rates are based on these targets. As some WRZs comprise a mix of different settlement types, and can serve both urban and rural areas, we have proportionally allocated different growth rates for these mixed WRZs.

The NPF ends in 2040 and our forecasts extend to 2044. We have continued the growth rates from the end of the NPF and RSES to 2044 to cover the whole 25-year period of our draft Plan.

Table 4.5 - Population growth rate of settlements based on the draft NPF

| Settlement/type of settlement | Percentage population growth 2019 to 2044 (%) | Comment |
|---|---|---|
| Dublin City and suburbs | 26% | Growth from 1,208,841 in 2019 to 1,523,230 in 2044 |
| Cork City and suburbs | 54% | Growth from 211,933 in 2019 to 325,838 in 2044 |
| Galway City and suburbs | 53% | Growth from 80,615 in 2019 to 123,662 in 2044 |
| Limerick City and suburbs | 61% | Growth from 98,465 in 2019 to 158,886 in 2044 |
| Waterford City and suburbs | 56% | Growth from 53,661 in 2019 to 83,764 in 2044 |
| Towns with population over 10,000 in 2016 | On average 29% | 41 settlements across three regions |
| Towns with population between 1,500 and 10,000 | 11 specific towns | 31% growth assumed for Carrick-on-Shannon, Monaghan, Nenagh and Roscommon. 15% growth assumed for other towns |
| Settlements with population <1,500 | 16% | 15% growth assumed for all settlements with population <1,500 |

Further details of the population forecasts are provided in Table 4.5. These figures will be further developed when Local Authority Development Plans are adopted.

The NPF envisages 26% growth in the Dublin City and suburbs between now and 2040 with various rates for the remainder of the country ranging from 16% to 61% based on settlement type and size. The Water Resource Zone that covers the Greater Dublin Area, includes Dublin City and suburbs and parts of Meath, Kildare, Wicklow and county Dublin. Therefore, the anticipated growth in this WRZ is a weighted combination of Dublin City and Suburbs, and applicable growth rates for the other areas. The domestic demand forecasting used by Irish Water for the Greater Dublin Area front loads the growth to 1.3% between 2020 and 2030, to reflect observed patterns, then reduces the rate to meet the same NPF end point. The growth rate is extrapolated from the end of the NPF to 2044. The growth rate across the rest of Ireland is linear over the 25-year period within our draft Framework Plan.

#### 4.3.2.2 Domestic demand forecasts

To calculate future domestic demand, it is important to consider how PCC will change over time. We can then multiply forecast PCC by the population forecast, to estimate future domestic demand. Some factors that may drive change are shown in Figure 4.3

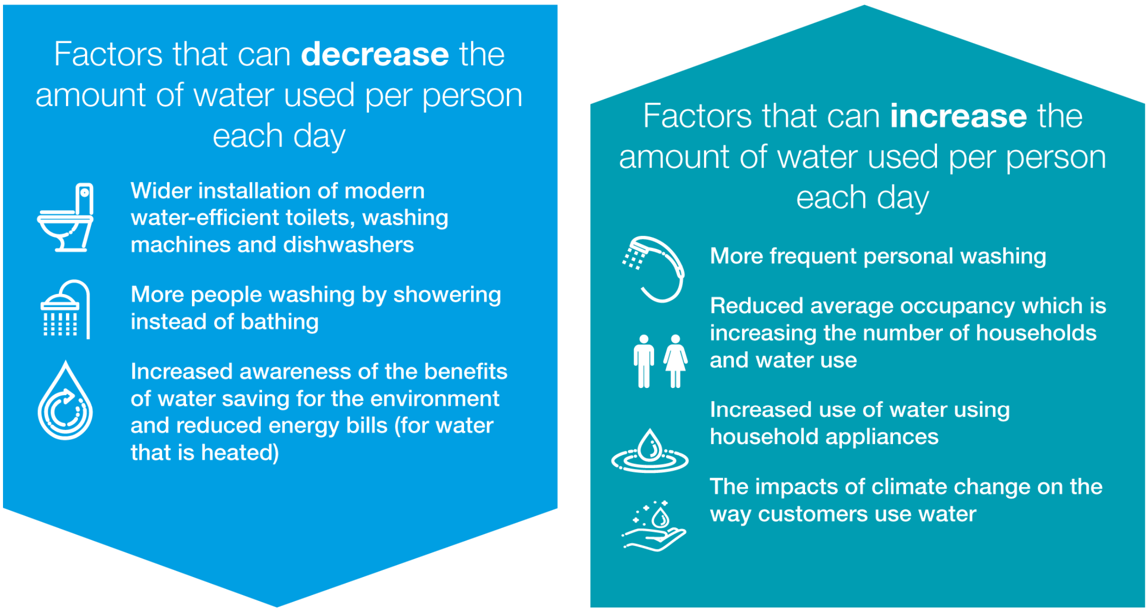



Figure 4.3 - Factors that drive change in PCC

It is expected that the occupancy rate of homes in Ireland will decrease in the future meaning the average household will be smaller. This will tend to increase PCC levels as the components of water use which are shared amongst the household, will be spread across fewer occupants. However, recent models of appliances such as washing machines and dishwashers use less water per cycle, which can off-set increases from lower occupancy rates.

Due to current data limitations in Ireland, data from the UK was used in our draft Framework Plan to assess potential changes to PCC for the period of the Plan. We have considered how the improvement in appliance efficiency combined with falling occupancy (based on the NPF) would impact PCC over the next 25-years. This work has indicated that in Ireland, PCC would be expected to increase by 1l/p/d by 2044, largely driven by reduced household occupancy rates.

By comparison UK water companies are, in some cases, forecasting significant reductions in PCC due to active customer engagement to change water using behaviour. Domestic customers in the UK pay for water services-based household usage and have an incentive to reduce water use if they are metered.

As the level of household metering in the UK resulted from a combination of customer choice (Opt-in) and supply demand need (with associated water efficiency initiatives), UK companies use higher demand estimates for unmetered connections (whereas in our plan we have assumed that metered and unmetered connections have the same PHC).

On a conservative basis for the purposes of this draft Framework Plan, we have taken the view that we should not allow PCC to increase by 1l/p/d from current levels. Therefore, our domestic demand forecasts are based on no change in PCC over the 25-year period of the Plan.

We have forecast there will be no change in PCC over the 25-year period of this plan.

For each WRZ, the domestic demand has been estimated for annually, by multiplying the forecast WRZ populations by the estimated PCC values for each year.

The domestic consumption forecast is summarised in Table 4.6 for all areas served by Irish Water, and in Table 4.7 for the 5 largest WRZs supplied by Irish Water.


Table 4.6 - Summary of domestic consumption forecast for the total population served by Irish Water

| | 2019 | 2024 | 2034 | 2044 |
|---|---|---|---|---|
| Population served by Irish Water (millions) | 4.2 | 4.4 | 4.8 | 5.3 |
| Average PCC (l/head/day) | 133 | 133 | 133 | 133 |
| Domestic consumption (Ml/d) | 556 | 586 | 645 | 700 |

Table 4.7 Summary of domestic consumption forecast by WRZ (Ml/d)

| | 2019 | 2024 | 2034 | 2044 |
|---|---|---|---|---|
| GDA | 207 | 218 | 240 | 257 |
| Cork City | 41 | 44 | 52 | 60 |
| Galway City | 22 | 23 | 27 | 30 |
| Limerick City | 15 | 17 | 20 | 23 |
| South Louth & East Meath | 13 | 14 | 15 | 16 |
| Other 534 WRZs | 258 | 270 | 292 | 313 |
| Total (all 539 WRZs) | 556 | 586 | 645 | 700 |

*Note: Values may not sum exactly due to rounding

Based on forecast population growth it is estimated that domestic water demand will increase from 556Ml/d (in 2019) to 700Ml/d in 2044. We are not allowing for any increase in PCC over the period of the plan.

#### 4.3.2.3 Non-domestic demand forecast

##### Overview of non-domestic demand forecast

There are significant differences in water use trends amongst non-domestic customers across our WRZs. This is because water use at non-domestic properties varies enormously from sector to sector, and from property to property. The consumption volumes are primarily related to economic factors, water-use intensity and how this is changing, rather than to numbers of business customers.

Therefore, an allowance for non-domestic growth will be required for towns and cities identified as strong growth areas in Project 2040. For other areas, it is assumed that there will be no significant increase in non-domestic demand, as shown in Table 4.8.

Table 4.8 - Summary of non-domestic consumption forecast

| | 2019 | 2024 | 2034 | 2044 |
|---|---|---|---|---|
| GDA | 139 | 178 | 215 | 232 |
| Cork City | 33 | 34 | 35 | 36 |
| Galway City | 15 | 16 | 16 | 17 |
| Limerick City | 12 | 13 | 13 | 14 |
| South Louth & East Meath | 6 | 6 | 6 | 7 |
| Other 528 WRZs | 201 | 201 | 202 | 203 |
| Total (all 539 WRZs) | 407 | 448 | 487 | 508 |

We have estimated the non-domestic water use for 2019 to be 407Ml/d. Across the national public water supply, this is projected to increase to 508Ml/d by 2044.

Further details of our approach to different areas are provided below.

##### Greater Dublin Area

Due to its size and complexity, the non-domestic demand forecast for the GDA was developed by independent economic analysts. This assessment considered:

- Customer water usage data provided by Irish Water;
- Census of Industrial Production and other CSO data on output on a sector-by-sector basis;
- Position papers on development in the Greater Dublin Area;
- Government strategies on key industries and activities (for example Data Centres);
- Findings from econometric modelling of the likely future water intensity output; and

- Long-term economic forecasts for the Irish Economy.

Low, medium and high non-domestic demand scenarios were developed for the GDA, based on the potential performance of the Irish economy through to 2060 allowing for variable growth rates.

The medium demand scenario, which assumes the economy performs in line with the baseline long-term forecasts, has been used to forecast non-domestic demand for GDA in this plan. We have also allowed for specific identified increases in contracted demand, for example, where customers have notified us of expected increases in water use.

### Regional Growth Cities

The NPF identified Athlone, Cork City, Drogheda, Dundalk, Galway City, Letterkenny, Limerick City, Sligo and Waterford as strong growth areas. We have considered the following data to derive an appropriate demand forecast for these WRZs:

- Intelligence from Local Authorities regarding any specific known expansions;
- New Connection Applications; and
- Growth rates from the NPF.

For these regional cities the NPF identified an expected population growth of 50% by 2040. We have taken a view that a significant increase in population will also drive an increase in non-domestic demand. However non-domestic growth trends in these areas may be lower than the growth in domestic demand, as our non-domestic customers are incentivised to use less water through volumetric tariffs. It is therefore assumed that there will be a 10% growth in non-domestic demand for these regional centres over 25 years.

### Rest of Ireland

A review has been undertaken of the non-domestic demand forecasts in the UK. On the basis of trends, we have concluded that there will be no increase in non-domestic demand in areas outside of the GDA and Regional Growth Cities as the growth in non-domestic demand is assumed to be offset by water efficiency.

However, Irish Water continually assesses the potential for non-domestic activity through our interface with the Local Authority Planning Sections and the Connection Developer Services Function in Irish Water. Therefore, where data on significant non-domestic growth emerges, we will update the SDB.

While it is noted that farming production is expected to increase significantly over the coming years (Food Wise 2025), the impact this will have on the volume of treated water required is uncertain. Therefore, we have not allowed for growth for agricultural demand in our forecasts. We will engage with the agricultural sector to understand their water requirements over the coming years. However, existing agricultural demand is accounted for in our 2019 baseline demand.

This will be monitored as per the process described in Chapter 8, monitoring and feedback into the plan.

## Box 4.1: 10-year Capacity Register

The purpose of the National Water Resources Plan is to ensure that the Public Water Supply in Ireland evolves over time in a planned manner to meet best international standards, and to eradicate the current issues within our supplies. It will also be used to identify areas where investment must be prioritized, based on critical need.

However, it is recognised that it will take a significant period of time and investment over many years to achieve these standards, and that the public water supply must be able to ensure both continuity of supply to existing customers and to meet Irish Water's objective to support sustainable growth and economic development in Ireland during this journey.

Therefore, the supply demand balance and barrier standards in the National Water Resources Plan are not intended to be used as a deterrent to new connections to the network, or as an indicator of where growth and economic development can progress within areas of supply.

In many cases we will be able to support growth whilst delivering our strategic plan, even in critical or high-risk areas by:

- Addressing availability through improving our knowledge of our supplies and improved operation of existing supplies;
- Reducing leakage within our existing supplies;
- Progressing interim upgrades to existing supplies;
- Progressing medium to long term investments.

In addition to this Plan, Irish Water has developed a 10-year capacity register based on an amended Supply Demand Balance to provide the LAs with an indication of settlements with potential capacity constraints. This allows Irish Water to both inform the next review of Regional Planning Strategies, the preparation of Local Authority Development Plans and also to respond to growth and development needs.

It is envisaged that the majority of Growth and Development needs within the next ten years will be facilitated through leakage reduction which will initially be targeted at settlements towards the upper end of regional and county settlement hierarchies. However, this will be an interim measure as leakage reduction alone will be insufficient to address all of the supply demand balance issues and will not address existing Level of Service issues within the current supplies.

**Monitoring and Feedback**

The Irish Water Forward Planning team interfaces directly with the Regional Assemblies and the Local Authority Planning Departments during the preparation of the regional growth strategies and the County Development Plans. As these strategies and plans are completed, the information at settlement level will be updated in the Supply Demand Balance. The Supply Demand Balance will be formally updated as per the process set out in Chapter 8.

#### 4.3.2.4 Operational use forecast

We have kept our assumption that the operational use of water is 1% of distribution input and will remain flat throughout the forecast period based on standard practice.

#### 4.3.2.5 Apparent Losses

In the base year apparent losses are estimated as 1% of distribution input. We have kept this element of demand flat at this volume throughout the forecast period i.e. the volume in Ml/d of apparent losses remains constant but the percentage of distribution input varies across the period.

### 4.3.3 Leakage – Approach to Leakage Reduction Forecast

In addition to the consideration of leakage as a solution to some supply demand balance issues across our water supplies, leakage reduction is also driven by the "value" of the water lost across our distribution networks.

By value of water, we do not just mean the operating costs of the water produced for supply (including power, chemical and treatment costs) but also the social and environmental costs of producing water (abstraction from the natural environment), and the cost of managing the efficiency of our distribution networks (the costs involved in continuously addressing leakage, disruption to water supplies, the impacts of the construction works required to reduce leakage).

When the total costs of producing water (including environmental and social) are greater than the cost of reducing leakage, there is a natural driver to further reduce leakage to achieve equilibrium. This is known as the Sustainable Economic Level of Leakage (SELL).

In the UK, the industry regulators for water supply set leakage reduction targets for the individual water utilities based on SELL. As our Framework Plan has been developed based on UK water resources planning guidelines (see Chapter 2), the forecast for leakage reduction within the Supply Demand Balance or as a solution to address SDB deficits, has been SELL for the public water supply in Ireland.

The SELL forecasts have been calculated using the latest available data from the LMS for 2019, using best practice methodologies for calculating SELL within the UK. Whilst there remain a number of areas where the data used for our calculations will improve significantly over the coming few years, the SELL targets in this Framework Plan have made best use of all data improvements that Irish Water has achieved to date. As part of the Framework Plan we have estimated SELL for:

- Irish Water overall;
- The GDA; and
- The remainder of Irish Water as the residual of Irish Water minus the GDA

The calculation of SELL uses a model that collates data inputs. The detail around the estimation of SELL is included in the report contained in Technical Appendix H: SELL – 2019 update.

For the purposes of calculating the SELL, the baseline position for 2019 is taken as the 2019 target.

There are two options for assessing SELL, summarised as follows:

- **Short Run SELL** which identifies the leakage reduction to be achieved over the coming years based on the value of water compared to the cost of water losses through leakage
- **Long run SELL** which identifies the leakage reduction to be achieved over a longer planning horizon allowing for investment in further pressure management, asset renewal, district metering and telemetry, smart metering, smart networks and measures to control customer side losses where possible.

  In WRZs where the SDB is in deficit, the Long Run SELL can be used to evaluate further leakage reduction options alongside water conservation measures and supply side measures to make more water available.

At present due to data availability, and the need to understand the delivery and response of our networks to Short Run SELL targets, it is not possible to calculate Long Run SELL. Therefore, within this iteration of the NWRP, we consider the Short Run SELL targets. However, as part of the Options Assessment Methodology within this Framework Plan, we test all Preferred Approaches (solutions to address identified need) to sensitivities in leakage reduction, including the possibility of exceeding targets for leakage reduction. The draft Framework Plan also includes a feedback and monitoring process, whereby data improvements are continually fed into our SDB assessments and fed into the Regional Water Resources Plans. Further reference to SELL within this document is in relation to the Short Run SELL unless otherwise stated.

#### 4.3.3.1 Main data inputs to SELL

In estimating the Short Run SELL there are a number of key data inputs:

- The estimation of background leakage/policy minimum formulae for estimating background leakage are also considered in the SELL
- The Marginal Cost of Water (MCW) is the cost of water saved if demand is reduced by 1 Ml/d
- Analysis of steady state repair data is used to determine how much effort is required to maintain leakage levels
- The variable cost element of Active Leakage Control (ALC) costs is required and used in the SELL
- Externalities (external costs), of which the most significant is related to the cost of carbon, based on forecasts of the shadow price of carbon

The derivation of these data inputs for SELL calculation are based on best available information and are detailed in Appendix H: SELL – 2019 update.

#### 4.3.3.2 SELL Assessment

The assessment of SELL as part of this draft Framework Plan is fully described in Appendix H, and includes:

- The methodology used and basis for selecting the methodology;
- An estimation of SELL for the GDA and the rest of Irish Water's supplies;
- A sensitivity analysis of SELL;
- The factors influencing the transition to SELL;
- The SELL glidepaths, or annual leakage reductions over time to achieve the SELL target, for the GDA and rest of Ireland; and
- Consideration of Data improvements

Based on the analysis of SELL used in this draft Framework Plan, a summary of the calculated GDA and National SELL targets using different scenarios is summarised in Table 4.9.

Table 4.9 - Summary of Potential SELL scenarios forecast for GDA and Nationally (Ml/d)

| GDA (Ml/d) | National (Ml/d) | Remainder (non-GDA) (Ml/d) | Description of scenario |
|---|---|---|---|
| 119 | 539 | 420 | Estimate using best 2019 data available |
| 127 | 576 | 449 | Upper bound |

| GDA (Ml/d) | National (Ml/d) | Remainder (non-GDA) (Ml/d) | Description of scenario |
|---|---|---|---|
| 113 | 509 | 396 | Lower bound |
| 114 | 534 | 420 | Estimate using best 2019 data available plus additional economic pressure management in GDA |
| 130 | 534 | 404 | Estimate using Managing Leakage 2011 estimate for background leakage and a less optimistic view of ALC efficiency plus additional economic pressure reduction in GDA. |

For the purposes of this draft Framework Plan, the SELL targets we have used in the SELL scenario are based on the methodology identified in the UKWIR Report – Managing Leakage 2011[6], as highlighted in red in Table 4.9.

The associated glidepaths to achieve these leakage targets for the GDA are summarised in Table 4.10 and Figure 4.4. As can be seen, the target SELL target in the GDA is calculated as being 130 Ml/d by 2034. This SELL glidepath has been built into the Supply Demand Balance assessment for the GDA within the draft Framework Plan. Figure 4.4 illustrates the Glidepath to achieving SELL outside the GDA (extract from Appendix H 2019 SELL report).

Table 4.10 - GDA leakage level included in demand forecast (Ml/d)

| | 2019 | 2024 | 2033 | 2034 |
|---|---|---|---|---|
| GDA leakage level | 215 | 185 | 131 | 130 |

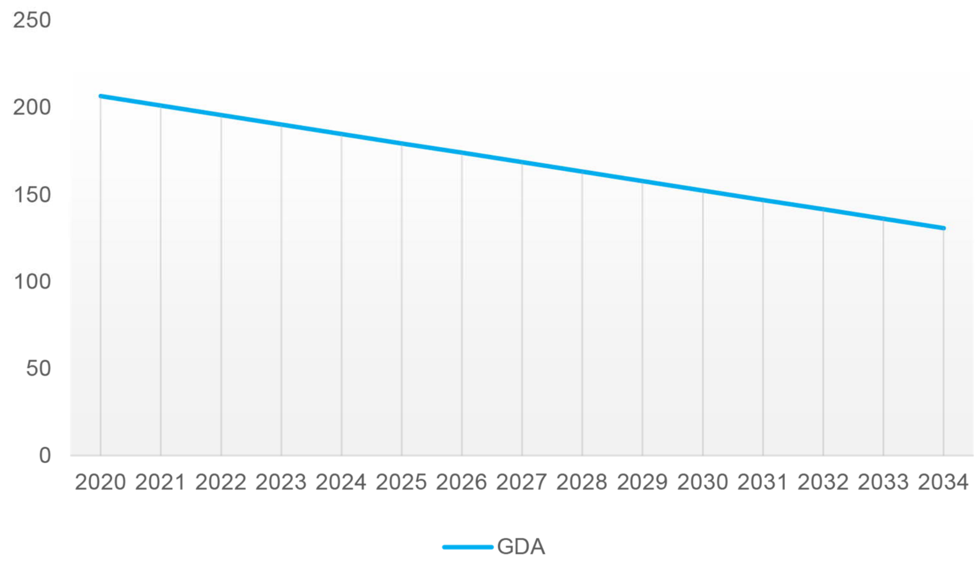



Figure 4.4 – Leakage glidepath to achieving SELL in the GDA (Ml/d) (extract from Appendix H - 2019 SELL report)

[6] UKWIR Managing Leakage 2011 (ref. 10/WM08/42 www.ukwir.org)

The SELL for the rest of Ireland is estimated as 404Ml/d, as summarised in Table 4.11 and Figure 4.6, or a net leakage reduction of 120 Ml/d by 2034.

Table 4.11 - Leakage level included in demand forecast (Ml/d)

| | 2019 | 2024 | 2033 | 2034 |
|---|---|---|---|---|
| Leakage level outside GDA | 524 | 513 | 404 | 404 |
| Irish Water leakage level | 739 | 698 | 534 | 534 |

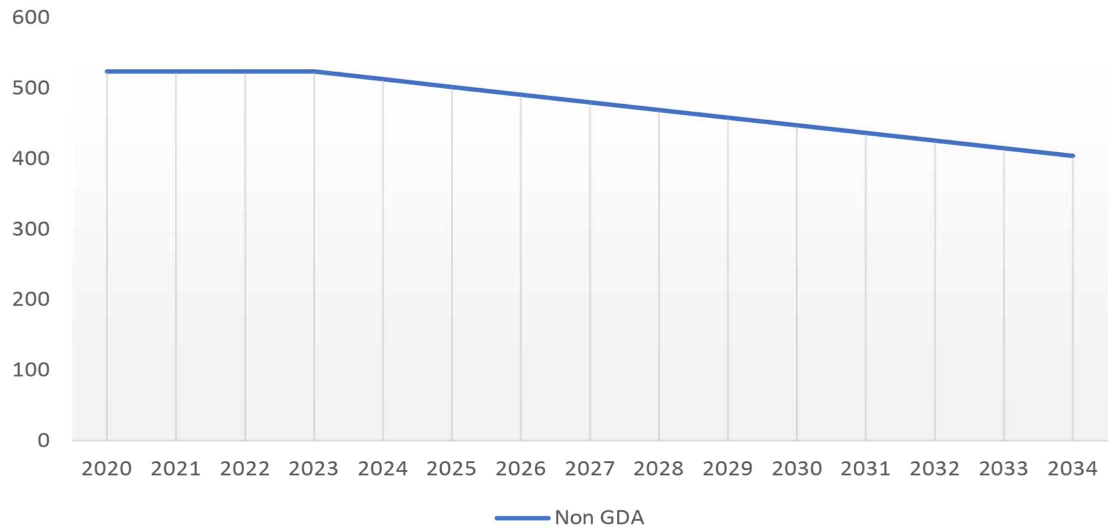



Figure 4.5 - Glidepath to achieving SELL outside the GDA (Ml/d) (extract from Appendix H 2019 SELL report)

At present we have focussed the SELL for the rest of Ireland on priority WRZs based on

- Supply demand deficit;
- Existing abstractions with sustainability issues; and
- Drought impacts.

As the net leakage reduction targets are prioritised on an annual basis, for the WRZs outside of the GDA, SELL targets have not been automatically assigned to the SDB assessments within this plan. Instead they have been prioritized based on key deficits and are applied to the identified SDB deficits within the WRZs as part of the Preferred Approach. We will continue to focus operational efforts to off-set the natural rate of rise of leakage in all other areas.

We have explored the sensitivity of our forecasts in Appendix H.

### 4.3.4 Climate Change

Research shows that climate change has an impact on water use. We have applied factors for climate change to our demand forecasts. These factors are based on the UKWIR 2013 study 'Impact of Climate Change on Demand'.  We have used a single change factor, shown in Table 4.12 for peak and average conditions as the changes are small, and our local data series does not cover a long enough period to develop Ireland specific values for peak and average conditions. We anticipate using different values for peak and average events in the future, as data permits.

Table 4.12 Climate change factors

| | 2019 | 2024 | 2034 | 2044 |
|---|---|---|---|---|
| Change factor for peak and average conditions | 1.0017 | 1.0029 | 1.0052 | 1.0073 |

These change factors are applied to the demand peaking factors in the Dry Year Critical Period Weather Planning Scenario (see Chapter 2).

### 4.3.5 Water Conservation Initiatives

The NWRP introduces three solution pillars (Lose Less, Use Less, Supply Smarter), to address identified SDB deficits.


The middle pillar of 'Use Less' – relates to demand side interventions.  The Use Less pillar focuses on activities to help understand water use habits, influence behaviour, to encourage change and promote water efficient devices and appliances for domestic and non-domestic customers.

The ability to reduce demand based on technology, behaviour and metering is uncertain and sensitive to the situational context and the awareness of need. For example, in England and Wales there have been significant reductions in demand related to increased metering in the south east of the country, facilitated by the designation by the Environment Agency of the area as a water scarce region. In contrast, in the northwest and northeast of England where water scarcity is not as prevalent, there is less metering and less impetus to reduce demand.

Technology offers benefits, but the changeover rates to new technologies are uncertain. Monitoring regimes need to be designed and maintained to understand significant changes that have been made and their result on water use. It is therefore difficult to assess at this time the potential benefit of water conservation activity in Ireland. Also, due to the funding mechanisms for water services, findings from water efficiency measures developed in the UK cannot be directly applied to Ireland.

Within this iteration of the NWRP, we have considered water conservation within our Domestic and Non-Domestic forecasts in the following ways:

**Domestic Demand Forecasts:** Even though occupancy rates are falling within households, which normally results in increased demand, we have held our per-capita consumption rates as static across our supplies. This means that increased per capita consumption growth will need to be addressed through water efficiency.

**Non-Domestic Demand Forecasts:** Even though the population and economy are forecast to grow considerably over the coming years, we have limited non-domestic water demand to relatively low levels within the regional Cities and have capped non-domestic growth within other settlements, on the basis that growth in non-domestic water use will be offset by efficiency and water conservation.

Further studies will be required to improve our understanding of the extent to which water conservation can influence the SDB.

### 4.3.6 Excessive Use Charge

Recent government policy has allowed for the Household Water Conservation Charge or Excess Use Charges to highlight high usage to our customers. The revised policy sets an allowance per household including a higher limit for large families. Once this is exceeded, they incur a charge. The policy came into effect in late 2019 and the earliest date for customers to receive a charge is January 2021. As there is limited data relating to the water saving benefits of this approach, at present it has not been factored into the demand forecasts.

When this charge has been in place for a period of time, we will be able to assess the benefits and include any potential water savings within the SDB forecasts using the monitoring and feedback process described in Chapter 8.

### 4.3.7 Non-domestic Tariff Framework

The Commission for Regulation of Utilities (CRU) published a decision paper on the non-domestic tariff framework and developing harmonised charging arrangements.

This paper considered;

- Geographic basis of charging;
- Customer classification into tariff bands;
- How tariffs will be structured; and
- Cost of providing water/wastewater to each customer class.

Irish Water do not yet have the required base data to overlay the impact of this tariff model in order to assess the subsequent impact those tariffs may have on water use in the non-domestic sector.

Upon completion of our data improvement/acquisition programme, it will be possible to undertake this next level of modelling to acquire greater understanding of the customer categories and differences by region and we will update our demand forecasts, as described in Chapter 8.

## 4.4 Step 3: Calculate Headroom

When developing forecasts and assessments, assumptions need to be made on the accuracy of existing data and how likely our future projections will be.  Headroom is the safety margin which is applied to demand forecasts to allow for uncertainties in our calculations on both the demand side and the supply side. The allowance is calculated and added to demand to provide a buffer in the SDB. Typically, headroom includes uncertainty associated with:

- The assessment of the hydrological yield at surface water sources associated with the limited gauged data available; and
- Future population projections, which are demonstrated, for example, by the range of projections produced by the CSO.

Using best practice, headroom is calculated for each WRZ individually by quantifying the supply-side and demand-side uncertainties based on available data. The UK Water Industry Research Ltd (UKWIR's) Improved Methodology for Assessing Headroom (2002) is the method used by the UK water utilities to calculate headroom (see Figure 4.6).

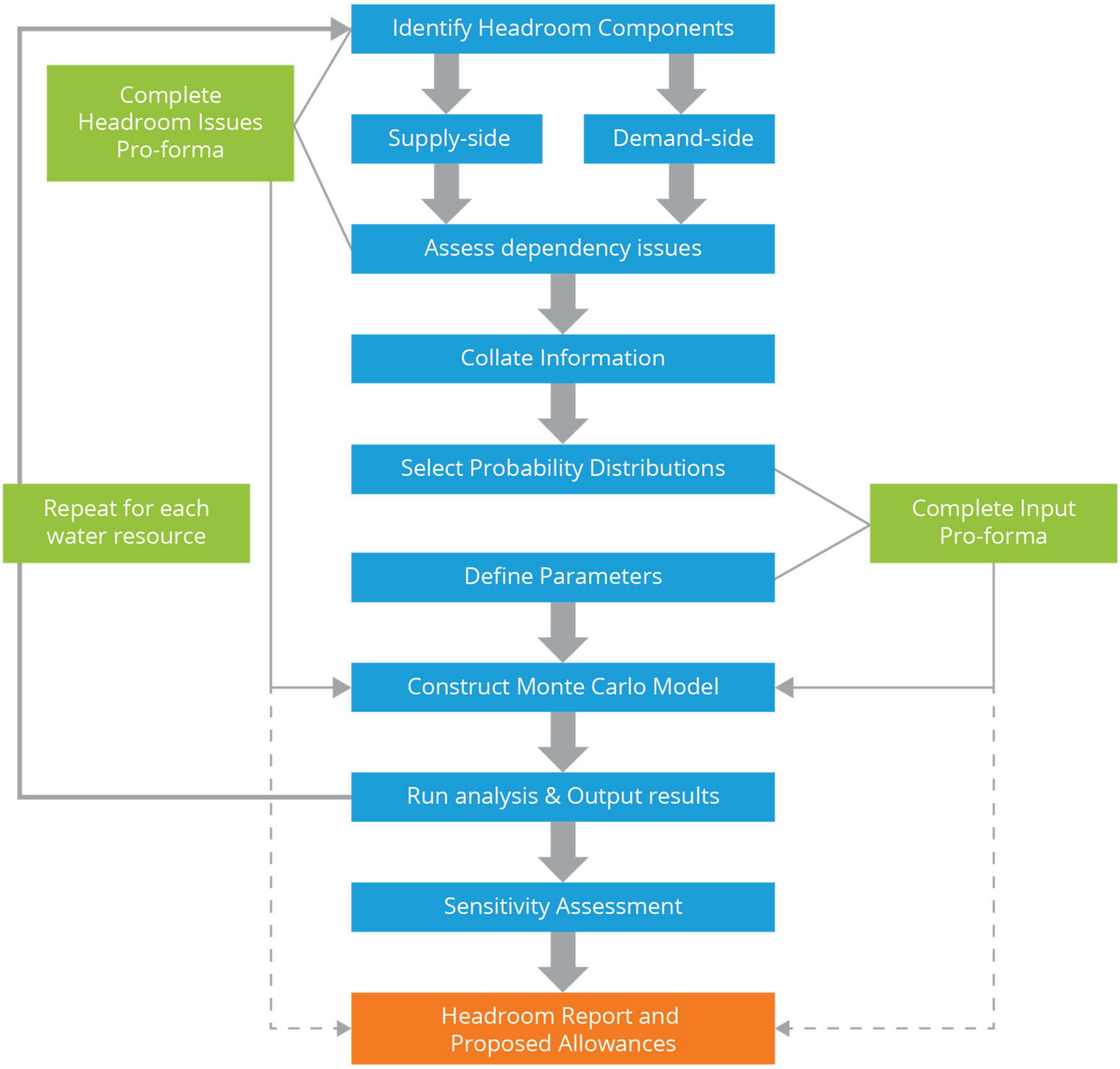



Figure 4.6 - Overview of Headroom Calculation Methodology for the Plan

(*Adapted from Figure 1.3 in The UKWIR Improved Methodology for Assessing Headroom 2002)*

Whilst the required data was obtained to apply the UKWIR methodology to the GDA WRZ, at present there is insufficient data to apply this methodology across public water supplies nationally. Outside of the GDA, best available information from similar WRZ types in the UK has been used as surrogate data.

A review of the UK has identified that water utilities' average headroom percentages vary between 3% and 8%. However, in some of the smaller, rural areas, headroom can be over 15% where there is greater uncertainty due to limited data.

Our WRZs generally experience a greater level of uncertainty in comparison to typical UK water utilities because we have fewer years of asset data available. We are continuously working on improving understanding of our asset base to reduce our level of uncertainty and achieve a better understanding of our headroom requirements.

Table 4.13 shows the headroom figures we used for the various WRZs. Headroom factors are applied to the Supply Demand Balance for each Weather Event Planning Scenarios described in section 2.3.2, in order to derive the Total Demand.

Table 4.13 - NWRP headroom allowance

| WRZ | Headroom Allowance | Comment |
|---|---|---|
| GDA | 8% | Based on UKWIR methodology as Figure 4.4 |
| Large zones (10–100Ml/d) | 10% | Large urban centres not significantly different to GDA |
| Medium zones (1–10Ml/d) | 15% | Mostly WRZs with small number of sources or lots of small sources leading to significant uncertainty |
| Small zones (<1Ml/d) | 20% | Mostly small, isolated rural WRZs, where uncertainty is a large percentage but a small quantity |

More details on the uncertainties that headroom allows for and a description of how headroom is calculated can be found in Appendix I.

## 4.5 Step 4: Calculate Total Demand Forecast

Total demand is the sum of the components of water use plus headroom for each Weather Event Planning Scenario. This represents the amount of water we need to have available for supply to meet the needs of our customers allowing for our operational use, apparent losses and leakage.

## 4.6 Step 5: Calculate Peaking Factors

In Steps 1 to 4 we calculate total demand during normal conditions (the NYAA) including the impacts of climate change on demand. We also calculate total demand for the different Weather Event Planning Scenarios (described in section 2.3.2). Ideally, calculations would be based on historical data for water use during these scenarios to derive peaking factors that describe the scale of the increase in total demand for each scenario. These factors are then applied to normal year total demand.

However, country-wide reliable historical data is not presently available for all WRZs. Therefore, we have used data from other water utilities with similar characteristics and checked this against best available data for our supplies. This data has been used to derive peaking factors depending on the size of the WRZ. For the DYAA and DYCP scenarios we multiply the peaking factor by the annual climate change factor and this is applied to total demand.

The peaking factors we have calculated for 2019 are outlined in Table 4.14.

Table 4.14 - Peaking factors for WRZs during summer and winter planning scenarios

| Size of WRZ | DYAA | Summer planning scenario (DYCP) | Winter planning scenario (WCP) |
|---|---|---|---|
| Small WRZ (up to 1 Ml/d) | 2% | 20% | 50% |
| Medium WRZ (up to 10 Ml/d) | 2% | 20% | 40% |
| Large WRZ (up to 100 Ml/d) | 2% | 20% | 30% |
| GDA (> 100 Ml/d) | 2% | 13% | 20% |

Tables 4.15, 4.16 and 4.17 show the impact of applying these factors to the total demand for each WRZ.

Table 4.15 - DYAA Total Demand

| WRZ | 2019 (Ml/d) | 2024 (Ml/d) | 2034 (Ml/d) | 2044 (Ml/d) |
|---|---|---|---|---|
| GDA WRZ | 630 | 654 | 659 | 699 |
| Cork City WRZ | 148 | 151 | 161 | 172 |
| Galway City WRZ | 84 | 85 | 90 | 94 |
| Limerick City WRZ | 50 | 51 | 55 | 59 |
| South Louth & East Meath WRZ | 38 | 40 | 41 | 43 |
| All other WRZs | 1,010 | 1,017 | 1,046 | 1,074 |
| **Total (all 539 WRZs)** | **1,960** | **1,997** | **2,052** | **2,141** |

Table 4.16 - DYCP Total Demand

| WRZ | 2019 (Ml/d) | 2024 (Ml/d) | 2034 (Ml/d) | 2044 (Ml/d) |
|---|---|---|---|---|
| GDA WRZ | 697 | 723 | 729 | 774 |
| Cork City WRZ | 174 | 178 | 190 | 203 |
| Galway City WRZ | 99 | 100 | 106 | 111 |
| Limerick City WRZ | 59 | 60 | 65 | 70 |
| South Louth & East Meath WRZ | 45 | 47 | 49 | 51 |
| All other WRZs | 1,192 | 1,200 | 1,235 | 1,268 |
| **Total (all 539 WRZs)** | **2,266** | **2,308** | **2,373** | **2,476** |

Table 4.17 - WCP Total Demand

| WRZ | 2019 (Ml/d) | 2024 (Ml/d) | 2034 (Ml/d) | 2044 (Ml/d) |
|---|---|---|---|---|
| GDA WRZ | 742 | 769 | 773 | 819 |
| Cork City WRZ | 188 | 192 | 205 | 218 |
| Galway City WRZ | 107 | 108 | 114 | 120 |
| Limerick City WRZ | 63 | 65 | 70 | 76 |

| WRZ | 2019 (Ml/d) | 2024 (Ml/d) | 2034 (Ml/d) | 2044 (Ml/d) |
|---|---|---|---|---|
| South Louth & East Meath WRZ | 49 | 50 | 52 | 54 |
| All other WRZs | 1,359 | 1,367 | 1,402 | 1,437 |
| **Total (all 539 WRZs)** | **2,508** | **2,551** | **2,617** | **2,724** |

### 4.6.1 Tourist demand

Some WRZs including those located by the coast will experience influx of tourists particularly during summer months. This can result in elevated water demands. In cases where the holiday population is high relative to the resident population these demand peaks may be very pronounced during hot, dry weather periods in the summer holidays.

Reports published by Bord Fáilte and Fáilte Ireland have been examined. However, they only provide generalised information about the location of tourist sites. They identify that major cities and towns receive the largest numbers of tourist visitors. These areas are usually supplied from large WRZs where the extra demands are small relative to the baseline demand.

At early development stages of our draft Framework Plan, variations in monthly distribution input for each WRZ were investigated to identify whether WRZs with the largest peaks in demand were tourist destinations. However, based on available data the findings were inconclusive. Therefore, whilst it is recognised that tourism may significantly affect peak demand in some WRZs, no reliable means of identifying this or quantifying the effects was found. It is likely that some of this demand is covered by the peaking factors we use for scenario planning in the draft Framework Plan. This is a factor of uncertainty in the demand forecasts and is currently covered by the headroom allowance rather than being allowed for separately.

## 4.7 Summary

In this section we have explained how we calculate the total demand for water which includes the needs of our customers, our own operations and losses due to leakage.  It also includes a ‘headroom allowance’ to allow for potential variations in our calculations.

More details on the potential variation that headroom allows for and a description of how headroom is calculated can be found in Appendix I. The Demand methodology described in this Chapter has been incorporated into our draft Framework Plan and the associated Supply Demand Balance Calculations for each water supply can be found in Appendix L.

5

# Identify the Need - Barrier Assessment

# 5 Key Points

**In this Chapter we will:**

- **Outline Water Quality Risk and Need across our existing asset base;**
- **Describe the Barrier Assessment Process; and**
- **Summarise our Critical Maintenance Process.**

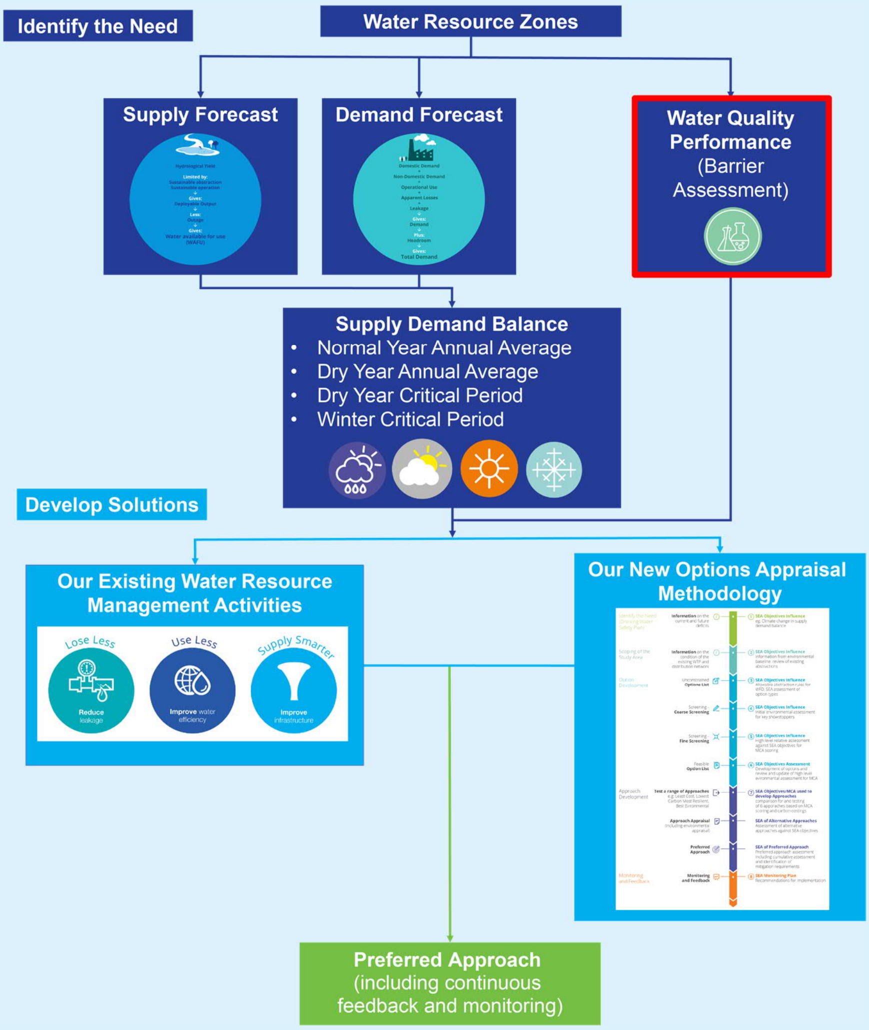



Figure 5.1 - NWRP Process – Barrier Assessment Water Quality and Reliability

## 5.1 Introduction

Irish Water has a statutory obligation to produce safe drinking water that complies with regulatory standards, and this is overseen by the Environmental Protection Agency. Irish Water has put in place the necessary structures to support sampling, testing and reporting from source to tap and puts in place the necessary actions should a risk to the safety of a supply be identified from our monitoring programmes.

We are now going further and looking to ensure that public water supplies are also secure and sustainable. This requires us to identify and appropriately manage risk to our water supplies. Risk is the possibility of an adverse event occurring (e.g. *Cryptosporidium* contamination of the source, failure of a dosing pump) that could impact on our ability to provide safe water. Risk cannot be eliminated, but by quantifying, categorising, and managing risk, we are taking a proactive approach to ensuring our supplies are safe, secure and sustainable. Our risk management approach is based on the World Health Organisation's Drinking Water Safety Plan (DWSP) approach.

The DWSP approach involves assessing a comprehensive range of hazardous events that could potentially occur in a drinking water supply from source to tap. These assessments are then used to inform the required operational, maintenance, or capital interventions that will manage / mitigate the likelihood of these hazardous events from occurring. These hazard assessments from the DWSPs are converted into "identified need" within the draft Framework Plan.

In this Chapter, we provide an overview of Irish Water's current Drinking Water Safety Plan approach to risk assessment in more detail and show how the live hazard assessments from the DWSP feed into this and future cycles of the National Water Resources Plan (Figure 5.1).

## 5.2 Drinking Water Regulation

The current European Union (Drinking Water) Regulations 2014 was transposed into Irish law by S.I. 122 of 2014 and amended by S.I. 464 of 2017 to give effect to the Drinking Water Directive (Council Directive 98/83/EC of 3 November 1998). The Regulations set the standards that drinking water supplies must meet to safeguard public health. These standards set out the water parameters to be tested, how often they are to be tested for, and the acceptable limits for each water quality parameter.

> The European Union (Drinking Water Regulations) 2014, transposed into Irish law by S.I. 122 of 2014 as amended set the standards that water supplied to the public must adhere to.

The EU is currently reviewing the Drinking Water Directive (the parent EU Directive of Ireland's Drinking Water Regulations). It is expected that this new recast Directive will be adopted by the European Union in 2020 and transposed into Irish Law by 2022.

## 5.3 Upcoming Legislative Context

On the 1st February 2018, the Commission submitted its recast proposal for a Directive of the European Parliament and of the Council on the quality of water intended for human consumption, more commonly referred to as the Drinking Water Directive (DWD). The overarching objective of the recast proposal was to ensure a high level of protection of the environment and of human health from the adverse effects of contaminated drinking water. Current timelines for this recast suggest December 2020 for formal ratification followed by December 2022 for national transposition and entry into Irish law. The recast DWD proposes a risk-based approach to the supply of safe and secure drinking water.
The risk-based approach comprises three elements:

1. Catchment – catchment area up to abstraction point (or zone of contribution in the case of groundwater)
2. Supply system – from abstraction point to point of supply; and

3. Domestic system – from point of supply to tap.

The first risk assessment and risk management of elements are to be completed within six years of transposition of the DWD into the statute book. Thereafter, it is to be reviewed at regular intervals no longer than six years. For catchment and domestic supply, member states are required to ensure that risk assessment and risk management is performed. For the supply system, member states are to ensure that risk assessment and risk management is performed by the Water Authority. This approach is effectively illustrated in Figure 5.2.

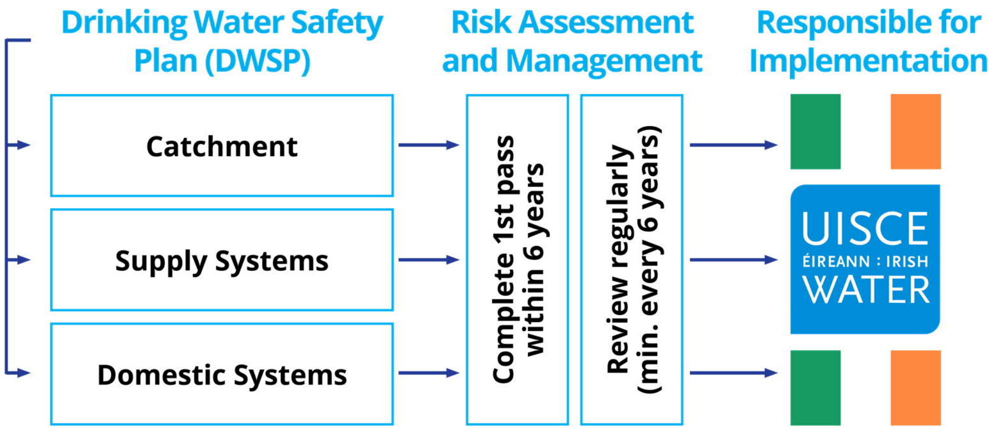



Figure 5.2 – Illustration of how IW's DWSP approach will meet the proposed DWD Recast requirements

Under this revised Directive, it is proposed to update quality standards for water intended for human consumption and to introduce minimum hygiene requirements for materials in contact with drinking water (e.g. pipes, taps). A watch-list mechanism is also proposed to allow for the monitoring of substances or compounds of public or scientific concern to health, such as endocrine disruptors, pharmaceuticals and microplastics. Furthermore, the draft DWD proposes that EU Members ensure the safety of a drinking water supply through the comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. Greater transparency of water quality information for customers is also proposed.

Parameters in the Drinking Water Regulations are grouped into three categories, 'Microbiological', 'Chemical' and 'Indicator', and summarised as follows:

### 5.3.1 Microbiological

This category refers to the two main types of bacteria that pose a risk to public health if present in drinking water – *E.coli* and Enterococci. These bacteria usually end up in raw water sources (i.e. rivers, lakes, springs, etc.) following contamination by human and/or animal faeces. Monitoring of our public water supplies for *E.coli* and Enterococci is essential to verify the water is safe to drink, and that the disinfection process is working correctly.

### 5.3.2 Chemical

Water is an excellent solvent and most source waters contain mineral concentrations derived from the underlying catchment geology and runoff from land. Chemicals and metals are tested in drinking water to determine if they are present and, if so, are they within acceptable limits.
Chemical parameters that are present in drinking water can be caused by a number of different issues. These include chemicals dissolving into water from pipes and chemicals carrying over from the treatment

process. They can also be due to chemical reactions occurring between different materials in the water or even runoff from the environment.
Some chemicals, such as metals, occur naturally in the environment and some are essential for life and are available naturally in our food. Others, such as lead and mercury, can have negative effects on health. Copper is an example of a metal that is essential in our diet but is toxic at high concentrations. Furthermore, metals such as lead, copper, and nickel can dissolve into drinking water from the supply pipe connecting your property to the public mains and from pipes and fittings within the plumbing systems domestic or non-domestic properties.

### 5.3.3 Indicator

This parameter group includes all other tests not including 'Microbiological' or 'Chemical' parameters, (e.g. total organic carbon, colour and turbidity). Testing for these 'Indicator' parameters is required to monitor if there is a potential problem with the source, treatment process, or distribution network of a water supply that requires investigation, or that may point to a more serious problem requiring remedial operational and/or maintenance action.

### 5.3.4 Cryptosporidium

*Cryptosporidium* is a protozoan, i.e. a very small single celled organism. It is pathogenic, meaning it can cause infection, disease or illness in other living things, but it is also parasitic, meaning it lives off other living things. Whilst *Cryptosporidium* is not specifically named in the Drinking Water Regulations, public water supplies must be free from parasites. Irish Water therefore monitors our water supplies for the presence of *Cryptosporidium*, where the risk of finding it is highest.

The European Union (Drinking Water Regulations) 2014, transposed into Irish law by S.I. 122 of 2014 set the standards that water supplied to the public must adhere to.

## 5.4 Monitoring of Our Existing Supplies

Irish Water monitors all public water supplies in accordance with the requirements of the European Drinking Water Regulations and the results of these tests are reported to the EPA (Irish Water's environmental regulator). Irish Water publishes the results from the regulatory monitoring programme on its website at www.water.ie/waterquality.  This website provides information on the Drinking Water regulatory standards and allows users of public water schemes to check the results for their water supply by using their home address and/or Eircode.

If a drinking water sample shows a result above a specified water quality standard, Irish Water reports it immediately (where applicable) to the EPA. If there is a concern about a possible health risk, we also consult the Health Service Executive (HSE). If a water sample has a result above a regulatory limit, this does not automatically mean there is an immediate risk to health. Therefore, Irish Water undertakes a water quality risk assessment and discusses this risk assessment with the HSE as part of a consultative process. If the consultation concludes that the risk to public health is of such significance that the affected consumers must be notified immediately, Irish Water takes prompt action to do so.

The EPA, as regulator, supervises the investigation Irish Water undertakes following notification of water quality failures, including the effectiveness and timeliness of corrective and preventative actions. The EPA has a hierarchy of further enforcement actions available to them, including undertaking an Audit, placing the supply on the Remedial Action List (RAL), or imposing a Direction.

The EPA updates and publishes their Remedial Action List every three months and can be viewed at **www.epa.ie/water/dw/ral**.

The EPA also publishes its annual review of the quality of drinking water in public water supplies for the previous year. Box 5.1 includes an excerpt from the EPA's latest published Drinking Water Quality in Public Supplies 2019 Report Table 5.1, setting out the current status of our supplies with respect to compliance with Microbiological, Chemical and Indicator parameters in the Regulations.

**Box 5.1 Water Quality in 2019**

Water quality across each of the three parameter categories has remained consistent since Irish Water became responsible for public water supplies in 2014.

Table 5.1 - Overall percentage compliance of samples taken for public water supplies

| Parameter Categories | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| Microbiological (%) | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |
| Chemical (%) | 99.4 | 99.4 | 99.5 | 99.6 | 99.6 | 99.6 |
| Indicator (%) | 99.3 | 99.1 | 99.8 | 98.9 | 98.8 | 99.1 |

## 5.5 Risk Assessment of Our Existing Supplies – The Drinking Water Safety Plan Approach

As can be seen in Box 5.1, in general our supplies show good compliance with the Regulations, and most compliance trends have improved over time.

In line with the requirements of the Drinking Water Regulations, Irish Water take samples from the point of compliance, which is the customer tap. While compliance sampling is robust and is necessary to monitor regulatory compliance, it is retrospective in nature (i.e. a lagging indicator) and does not assess all of the wider risks in our water supplies. Irish Water requires a methodology that allows us to proactively assess risk in our water supplies from "source to tap" as a way to identify and prevent possible future non-compliance, rather than react to a non-compliance after it has occurred.

The Drinking Water Safety Plan (DWSP) approach, developed by the World Health Organisation and endorsed by the EPA, is best practice in terms of a 'source to tap' risk assessment for water supplies as outlined in Figure 5.3.

The DWSP approach aims to achieve the following:

- To provide a comprehensive risk assessment and risk management approach that encompasses all steps in water supply provision from catchment to consumer;

- A risk management strategy that influences a water utilities whole way of working towards the continuing supply of safe and secure water; and
- A source to tap risk assessment and risk management system to inform the effective controls or barriers required to consistently supply safe and sustainable drinking water.

The DWSP model critically and objectively determines the component risk associated with the source(s), treatment processes, process controls, alarm and plant shutdown settings, and finally the robustness of these processes. It also allows for consideration of occurrences that fall outside of normal operating conditions e.g. weekend events, weather issues, failed monitors etc.

Risk scores from the DWSP assessment will be used to identify need, to develop operational or maintenance solutions, and to prioritise remedial works for supplies that pose potential a risk to public health. This process will drive improvements in the provision of consistently safe and secure drinking water nationally. The DWSP approach involves assessing hazards that can occur in a drinking water supply from source to tap, assessing the Barriers that are in place to mitigate against these risks and guiding the management plans, operational monitoring and surveillance required for each supply (summarised in Figure 5.3).

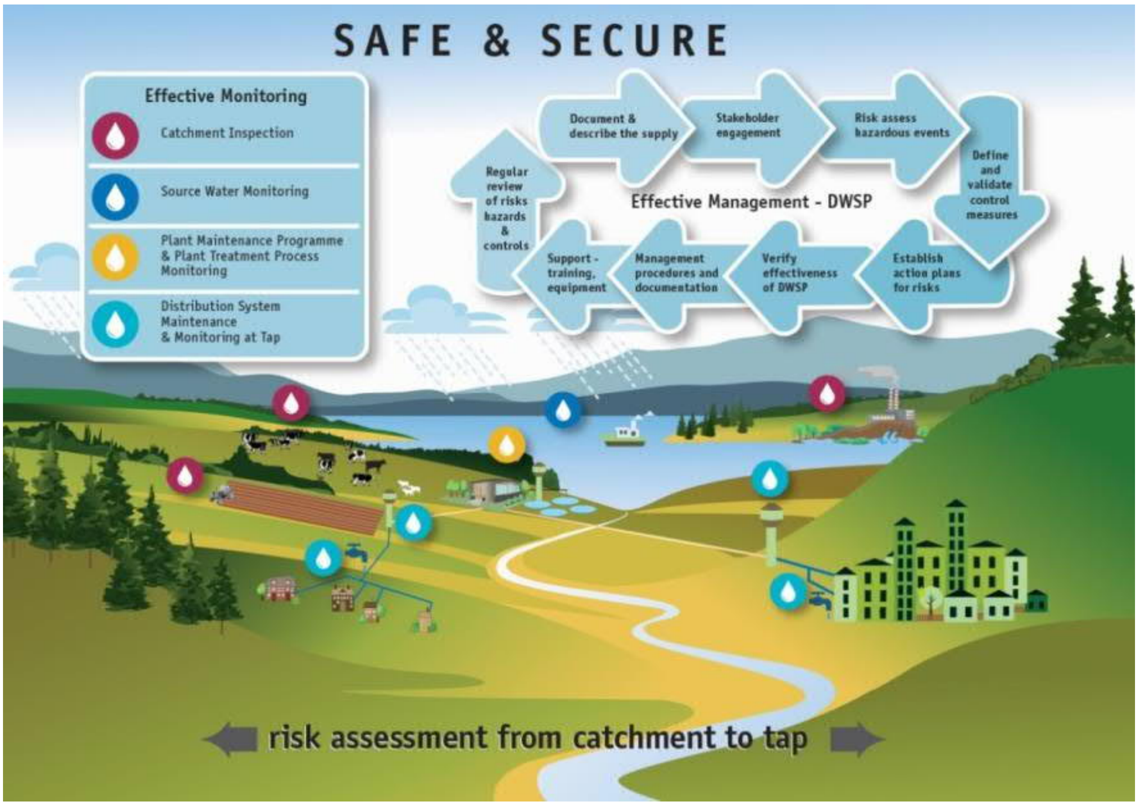



Figure 5.3 - An overview of the DWSP approach, as provided by the EPA

Hazards are biological, chemical, physical or radiological sources that have the potential to cause contamination of a drinking water source; and Hazardous Events are considered incidents or situations that can lead to the presence of a hazard (e.g. the failure of a slurry lagoon allowing cattle waste to flow into a river). Risk is interpreted as the likelihood of identified hazards causing harm in exposed populations in a specified time frame; and Risk Assessment is the measure of magnitude of harm and / or the consequences of a hazard reaching a drinking water source.

To realise Irish Water's objective in providing a safe and wholesome water supply to our customers, Irish Water has identified 174 potential hazards (also referred to a hazardous events) that may pose a risk in our ability to produce safe and secure drinking water.

Table 5.2 shows the number of potential hazards associated with the various stages (1-6) involved in a water supply.

Irish Water has developed a set of specifically customised methodologies for the assessment of risk for each hazard as opposed to a rigid singular process. Where available, data is used to determine risk via predictive modelling and, where appropriate, bespoke failure-based review is also used to ascertain risk. In some cases, Irish Water uses a combination of the two.

Table 5.2 - Numbers and grouping of DWSP Hazardous Events across the 6 categories of water supply

| Core list of hazards | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | General Catchment | Surface water catchment | Groundwater catchment | Intake | Storage | Line | Other | CFC | Filtration | Disinfection | Residuals | Design | Membrane filtration | Network | Service reservoir | Premises | System | Training |
| Source | 22 | 12 | 3 | | | | | | | | | | | | | | | |
| Raw water | | | | 9 | 6 | 3 | | | | | | | | | | | | |
| Treatment | | | | | | | 22 | 21 | 16 | 14 | 6 | 5 | 2 | | | | | |
| Distribution | | | | | | | | | | | | | | 22 | 9 | | | |
| Consumer | | | | | | | | | | | | | | | | 3 | | |
| Management | | | | | | | | | | | | | | | | | 3 | 1 |

As part of the DWSP approach, Irish Water is developing scientifically robust datasets to assign risk. For the ‘source’ component of DWSPs, a greater emphasis will be placed on the source-pathway-receptor concept for contaminant delivery and utilisation of existing national scale catchment related datasets published by the EPA and Geological Survey Ireland.

For the ‘treatment’ and ‘distribution’ component of DWSPs, Irish Water are utilising the well-established *‘Failure Mode Effect Analysis’* which provides a step-by-step approach for identifying all possible failure modes that can result in a hazardous event.

Once identified, we assess risk against the existing controls (Barriers), which we have in place for source protection or within our water treatment plants and networks. This Barrier Assessment process highlights where there is a deficit in these controls or treatment process elements. The process is not static, but rather ‘living’ in that it will continuously be open to review and receive regular updates and upgrades as requirements evolve.

## 5.6 The Barrier Approach to Safe and Secure Drinking Water

Irish Water’s multi barrier approach, in terms of water treatment, is summarised in Figure 5.4. The multi barrier approach takes a source to tap approach by seeking to reduce the level of contamination entering water sources, applying robust multiple treatment barriers at the water treatment plants based on source risk assessment, and having appropriate temporal and spatially distributed monitoring programmes at each stage of the source to tap process to validate performance. Barrier components consist of any actions, processes, procedures, standards or assets (treatment plants, water mains, pumping stations etc.) put in place across the entire system, from catchment to tap, to achieve water of sufficient quality and quantity. The Barrier standards should be able to sufficiently address the potential hazards identified in the DWSP assessments. Currently, there are eight key Barriers, and associated control measures (set out in Figure 5.4).

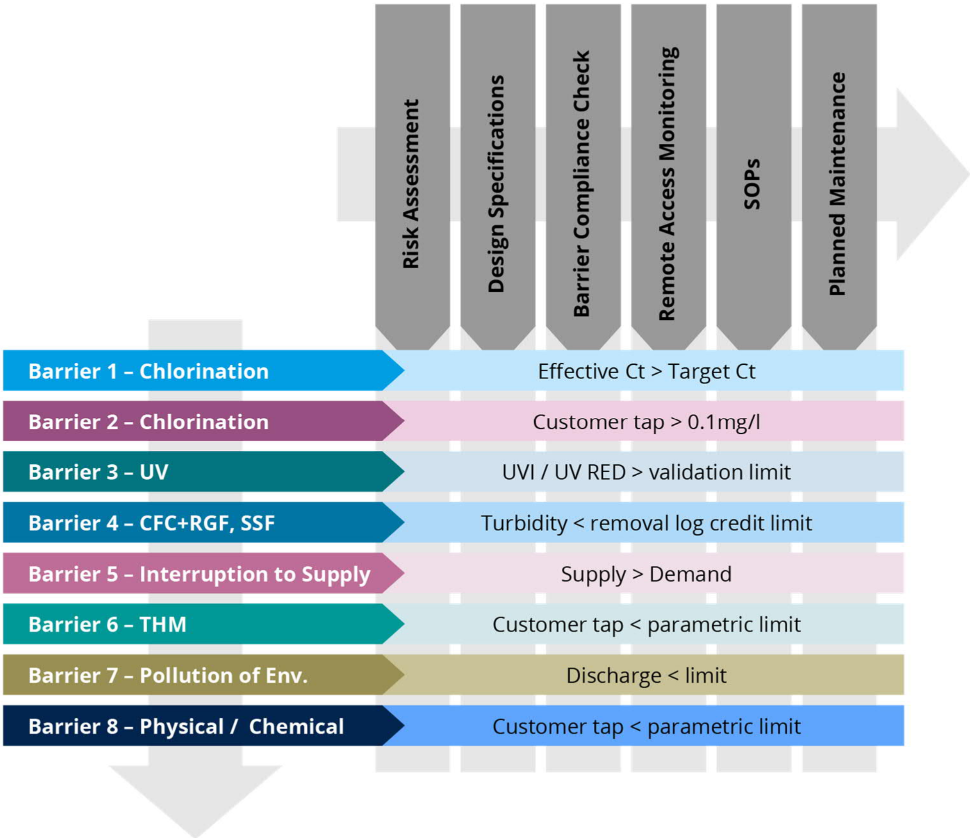



Figure 5.4 - Irish Water's Barriers for achieving Safe & Secure Drinking Water

The eight barriers and eight sub-barriers are:

**Barrier 1:** Inactivation of bacteria and viruses, as determined from a calculation of the chlorine contact time (generally referred to as 'Ct').

**Barrier 2:** Maintenance of a microbiological barrier in the distribution network

**Barrier 3:** Inactivation of protozoa (i.e. *Cryptosporidium* and *Giardia*) by UV radiation with reference to a determination of the *Cryptosporidium* risk score

**Barrier 4:** Removal of protozoa (i.e. *Cryptosporidium* and *Giardia*) by coagulation, flocculation and clarification (CFC) and filtration, slow sand filtration or membrane filtration with reference to a determination of the *Cryptosporidium* risk score

**Barrier 5:** Prevention of supply interruptions

**Barrier 6:** Prevention of the formation of trihalomethanes (THMs)

**Barrier 7:** Prevention of pollution of the environment

**Barrier 8:** Minimising the level of other physical / chemical parameters such as:

a. Lead
b. Pesticides
c. Nitrates
d. Aluminium
e. Iron
f. Manganese
g. Taste and odour
h. Others

Of these, the first five barriers (Barriers 1 – 5) are the most critical, as failure of one or more of these could present an immediate health risk or loss of water supply to our customers.

The Barriers and their control measures are aligned with water quality requirements to achieve a safe and secure water supply and are further detailed in Appendix J.

Where the existing barriers are not sufficient to address potential hazards, the component and severity of the associated failure mode is identified within a DWSP and this identified need will require an associated mitigation in the form of either an operational intervention or a capital investment in our asset base.

The relationship between the DWSP, the Barrier Assessment and the National Water Resources Plan is summarised in Figure 5.5.

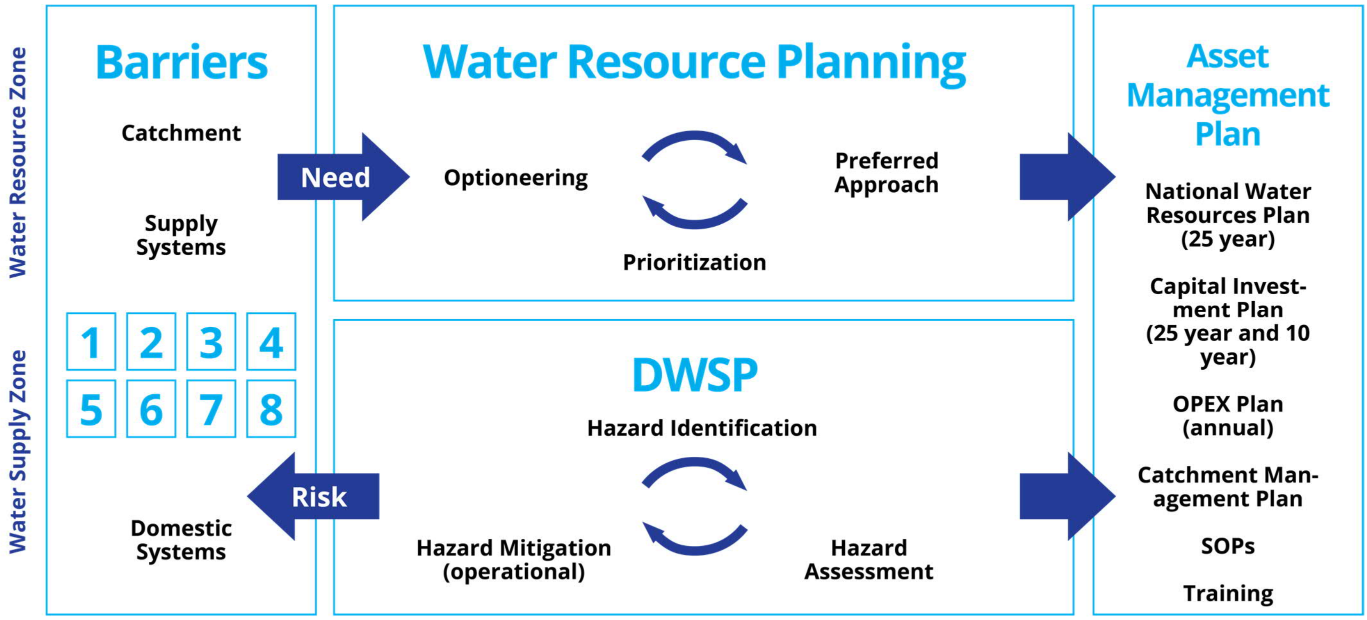



Figure 5.5 - Relationship between the DWSP, the Barrier Assessment and the National Water Resources Plan

The proposed Recast DWD breaks the water supply scheme into 3 parts: catchment, supply systems and domestic systems. Requirements for risk assessment and risk management vary across the three component parts. The eight barriers considered within this plan relate to supply systems. When the recast DWR is enacted, further/alternative barriers will be developed for catchment and domestic systems.

## 5.7 Interim Barrier Assessment Review

In the enduring model, as shown in in Figure 5.6, the hazard assessments completed as part of the DWSPs will be used as the base data for the Barrier Assessments, which will in turn inform water quality driven need within our NWRP.

However, as Irish Water currently operates 539 individual water supplies, and each site specific DWSP requires 174 individual assessments, it will likely take many years to fully complete the DWSP assessments across our entire water supply asset base.

In order to understand potential water quality driven need, for the purposes of the draft Framework Plan, we have evaluated on an interim basis the capability of our existing Barriers to meet the stringent asset standards we wish to achieve. We are undertaking this by applying a risk hierarchy based on lagging and (some) leading analysis. This Interim Barrier Assessment has allowed us to identify need for the purposes of the Framework Plan which will in turn be used to inform the Preferred Approaches (capital interventions and associated level of investment) required within the Regional Water Resources Plans.

Whilst this interim approach provides a data-based analysis of need within water resource zones, it does not fully evaluate the risk associated with the individual elements related to a supply. Therefore, while the interim Barrier Assessment is sufficient at a Plan level to understand potential solution types and capital investment need within the catchment and for our treatment assets, the more granular DWSP hazard assessments are required to fully understand and manage the component (failure modes) of risk.

Within the draft Framework Plan, we represent the Interim Barrier Assessment for each Water Resource Zone as per the graphic shown Figure 5.6. The “speedometer” chart illustrates the scale of investment (or intervention) we need to plan for in order to meet our stringent asset capability standards. We have used a scale of 1 to 5, where 1 indicates that little intervention or investment is required and 5 indicates that significant intervention may be required to meet capability standards.

By transforming our asset base to achieve these standards over the future capital investment cycles, we will ensure that we are “best in class” in terms of safe, secure, reliable, and sustainable water supplies.

As the Drinking Water Safety Plans are completed for each of the individual supplies, the Interim Barrier Assessments will be updated to include any additional information available, as per the monitoring and feedback process described in Chapter 8.

However, it should be noted that the “quality need” identified through the Barrier Assessment is **not** an indicator of compliance with the Drinking Water Regulations. It is an assessment of the need to invest in areas of our asset base (human and structural) through resource planning, to ensure that we can address potential risks or emerging risks to our supplies.

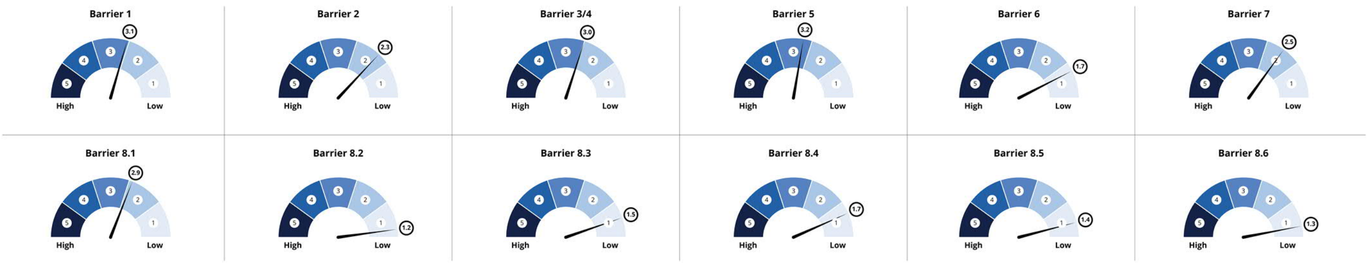



Figure 5.6- Speedometer type Barrier Status Analysis

## 5.8 Managing Risk in Drinking Water Supplies

Our individual water sources have different raw water characteristics. Some of our abstractions are situated in relatively secure upland catchments or are from well protected groundwater sources. Others abstract from lower down in catchments or from poorly protected groundwater sources which are more vulnerable to contamination from human or agricultural activities. Therefore, the Barrier, or indeed combination of Barriers is specific to each supply.

## 5.9 Managing Risk in Drinking Water Abstraction Catchments

Irish Water has been working with a range of stakeholders in recent years to develop action plans for managing risks within catchments such as pesticides. As part of the development of the DWSP approach, Irish Water will continue to work in collaboration with relevant bodies in order to develop drinking water catchment action plans.

The drinking water catchment action plans will include the identification of the main risks to raw water quality, the actions required to address those risks and the relevant geographical areas where those actions should be focused. Those responsible for actions will be identified and target dates for implementation will be established through existing and new working groups or structures.

In Chapter 7 we have summarised some of the catchment and risk management activities that are ongoing at present.

## 5.10 Future Asset Planning Across our Existing Supplies

As summarised in Section 5.1, Irish Water's regulated sampling results for 2019 shows a high degree of compliance at our customer's taps.

However, in many cases, the controls and Barriers that we currently have in place may be insufficient to address the potential hazardous events that could occur at these supplies. As a result, we are developing programmes to install the required equipment and controls at all of our water supply sites, on a prioritised basis.

These programmes include the **Disinfection Programme** the **Source Protection Programme** and the **Pesticides Pilot Projects** described previously. These initiatives (specifically for works at the abstraction site and borehole upgrades) are currently funded and being delivered as part of our regulated Capital Investment Plan 2020-2024.

However, due to the condition of our existing asset base and the large number of sites to be addressed, it may take several investment cycles before we have the appropriate risk controls in place across all our supplies.

Due to the range of treatment Barrier issues across our asset base, we must consider addressing these water quality issues as part of water resources planning, alongside supply demand balance issues.

As regulatory non-compliance drives capital investment requirements in our existing asset base, we must ensure to limit investment in supplies / sites that have long term viability issues. However, we must also balance this with immediate public health risk and ensure any short-term interventions to reduce / manage such risk are implemented *en route* to establishing permanent long-term sustainable supplies.

Our long-term approach will increasingly include catchment management for drinking water source protection in partnership with key stakeholders. Catchment management can take many years to yield a benefit but is a sustainable solution by preventing contaminants entering the watercourses in the first place rather than putting in end of pipe treatment solutions.

This approach to managing the risk to our drinking water sources is in accordance with Article 7(3) of the Water Framework Directive, which specifically requires countries to protect drinking water sources: "*Member States shall ensure the necessary protection for the bodies of water identified with the aim of avoiding deterioration in their quality in order to reduce the level of purification treatment required in the production of drinking water*." Irish Water's approach will be to collaborate with all relevant stakeholders who seek to deliver a common goal of protecting drinking water source, to understand risks in the catchment and reduce these risks.

In order to appropriately consider water quality issues as part of the Options Assessment Methodology within the Regional Water Resources Plans, in any supplies that have Interim Barrier Assessment scores of 3 and above, the Deployable Output from these water treatment plants is reduced to zero. This will drive upgrade or alternative source solutions for these supplies within the Regional Water Resources Plans.

## 5.11 Reliability – Capital Maintenance and Critical Assets

To ensure the ongoing security and reliability of our treatment and water distribution assets, we need to ensure that they are appropriately maintained. Capital Maintenance is defined as the replacement or refurbishment of existing capital assets to provide continuing service to the customer and to protect the environment in accordance with current regulatory obligations.

Maintenance includes the following activities:

- The refurbishment of an existing asset;
- The replacement of an existing asset with a similar asset;
- The replacement of an existing asset with an asset of different type or design, that is fit for purpose; and
- The reconfiguration of the system to provide the required service by another means.

Irish Water has processes in place to ensure the appropriate delivery of maintenance works including:

- A Working Group to monitor the delivery of works;
- A comprehensive approvals process for requests;
- Alignment of funding requests with Irish Water Service Measures;
- Capture of estimates of expected efficiencies resulting from the replacement or refurbishment of an asset; and
- Monthly reporting summarising of works delivered.

This Asset Management approach is best practice to maintain serviceability (the capacity to maintain desired level of service) through the normal life cycle of an asset. This approach manages risk, protects assets from accelerated deterioration and reduces whole life cost by extending asset life.

Across our water supplies, we also have a subset of assets known as critical assets. In a water supply, critical assets are the single points of failure that have the potential to significantly impact on our ability to provide water to our customers. Critical assets include abstraction points, large water treatment plants, and our bulk transfer or trunk mains (including any pumping stations associated with these). As a failure of one of these assets would result in a large-scale interruption to supply, they need to be maintained at a higher condition and performance grade and should be subject to more stringent maintenance programmes than non-critical assets. However, as these assets can be in continuous use, maintenance programmes can be difficult to implement.

At water treatment plants we can design for additional capacity in the form of an outage allowance, which allows us to carry out planned and emergency maintenance or upgrades. However, trunk mains need to be taken out of service to allow for maintenance and repairs. As these mains are often running continuously at or close to full capacity, it can be difficult to take them out of service for the length of time required for appropriate maintenance unless we have sufficient reserves of treated water in storage. In addition, trunk mains can be extremely expensive to repair and replace.

As critical assets have the potential to significantly impact our ability to supply water to our customers, we consider the capital maintenance requirements of these asset classes within our resource planning process. This means we include this aspect in the Needs Assessment workshops with our Local Authority partners, drawing on operational experience and referring to operating performance data.

Impacts on water supply due to critical asset failure are assessed as part of Barrier 5 – Interruptions to Supply. As part of this barrier, we examine our assets for 'source to tap' security, including treated water storage requirements to mitigate against supply interruptions.

## 5.12 Summary

In this section we have outlined the Drinking Water Safety Plan and Barrier Assessment approaches that we will use to manage potential risks and emerging risks to our water supplies. We have also summarised how these processes interface with Irish Water's resource planning and capital investment planning processes.

For the purposes of this cycle of the National Water Resources Plan, we have used an Interim Barrier Assessment to identify water quality and reliability driven need for the purposes of the Framework Plan.

As Part of Phase 2 of the NWRP, we will develop Preferred Approaches (solutions) to address this identified need as part of the Regional Water Resources Plans.

The European Union (Drinking Water Regulations) set out the water parameters to be tested, how often and the acceptable limits to ensure public health

# 6

# Summarise the Need - Supply Demand Balance & Barrier Risk Scores

# 6 Key Points

**In this Chapter of the draft Framework Plan we:**

- **Summarise the results of the Supply Demand Balance Assessment and the Barrier Performance Assessment**

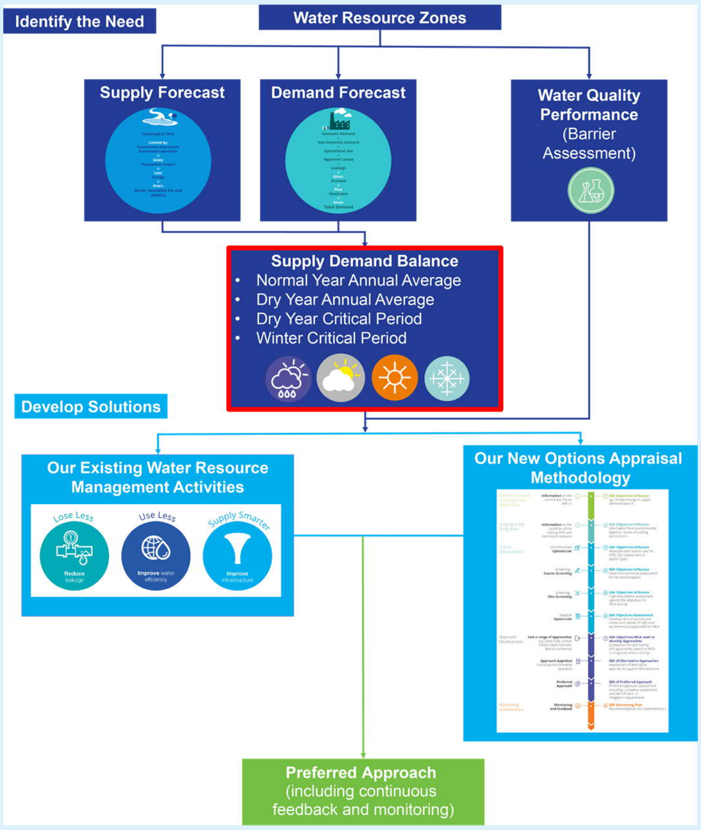



Figure 6.1 – NWRP Plan Process- Supply Demand Balance

## 6.1 Introduction

In Chapters 3 and 4 of the draft Framework Plan, we identified how we assess our baseline supplies and the demand for water in each of our Water Resources Zones. We also summarised how we forecast our supplies and future demand for water across the 25-year horizon of our Plan.

In Chapter 5 we identified how we assess the risks to our water supplies from the hazards that may affect them and the existing barriers and controls that are in place to mitigate these risks. Chapters 4, 5 and 6 broadly describe our current water supplies in terms of:

- The **Water Quantity** that we can supply;
- The **Water Quality** that we can supply; and
- The **Reliability** of our asset base to maintain supply.

These three aspects of our supplies need to be managed and planned for collectively to ensure that interventions to resolve one area of risk do not adversely impact on another (Figure 6.1). We must also consider whether our water supplies are sustainable and, if not, how we can ensure that the short, medium and long term plans we put in place will be sustainable in the future.

## 6.2 Summary Results Water Quantity – Supply Demand Balance

To identify need in terms of the current and future ability of our water supplies to meet demand and to support growth and economic development, we compare our supply calculations against our demand forecasts to derive the Supply Demand Balance (SDB). This is shown graphically in Figure 6.2.

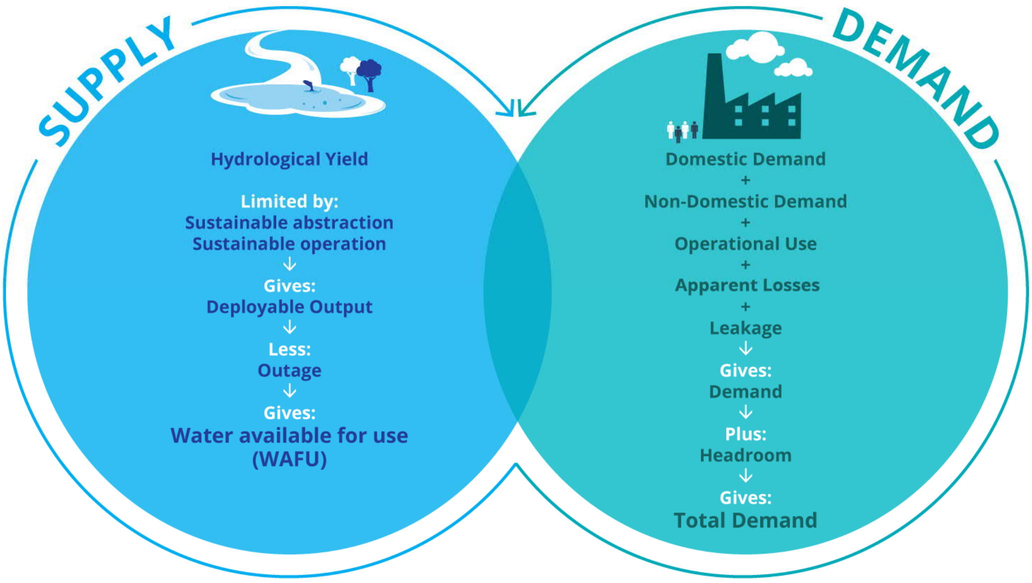



Figure 6.2 – The Supply Demand Balance

The SDB calculation compares the WAFU (i.e. the amount of water we can supply) to the Total Demand for water. Where the WAFU is less than the Total Demand, this is known as a deficit (or need) meaning there would be a risk maintaining supplies to our customers.

Both the WAFU and Total Demand change for different weather conditions. As we identified in Chapter 2, an uninterrupted water supply is essential for public health, so we must ensure that our water supplies can withstand variations in climatic conditions. Four iterations of the SDB calculations were completed for each WRZ, to cover Weather Event Planning Scenarios:

- Normal Conditions (Normal Year Annual Average – NYAA);
- Dry Years (Dry Year Annual Average – DYAA);

- Drought Periods (Dry Year Critical Period – DYCP); and
- Winter Freeze Thaw Conditions (Winter Critical Period – WCP).

Further details of the Weather Planning Scenarios are provided in Chapter 2.

Our SDB calculations have been adjusted to include the following assumptions:

- All Irish Water plans and projects that are planned to be completed by 2021 are delivered;
- Target leakage savings to the end of 2020 and which have secured funding, are delivered;
- The baseline SDB for the GDA WRZ includes the SELL glide path (as described in Chapter 5 and Appendix H); and
- The baseline SDB for the other WRZs does not include the applicable SELL. We calculated the SELL nationally, however, the glide path to achieve SELL cannot be included until we have further information on the delivery mechanisms. The leakage saving may also have to be concentrated into specific areas depending on the outcomes of abstraction legislation, to support growth and economic development, or used within the Preferred Approach for the WRZs.

The SDB Calculations do not consider any projects or interventions that will be delivered after 2021, as one of the purposes of the NWRP is to assess and then identify the most appropriate interventions.

SDB Calculations have been developed for our 539 WRZs. The calculations cover the period from 2019 to 2044 to correspond with our 25-year NWRP - Framework Plan and Regional Water Resources Plans.

The SDB calculations for each WRZ are included in Appendix L. For ease of review, these have been categorised by Region and County.

A national summary of our SDB calculations is provided in the sections below.

## 6.2.1 National Summary

### 6.2.1.1 Baseline and Future Supply

Figure 6.3 shows our calculation for the WAFU nationally for our Weather Event Planning Scenarios from 2019 to 2044. A summary of this information is also provided in Table 6.1.

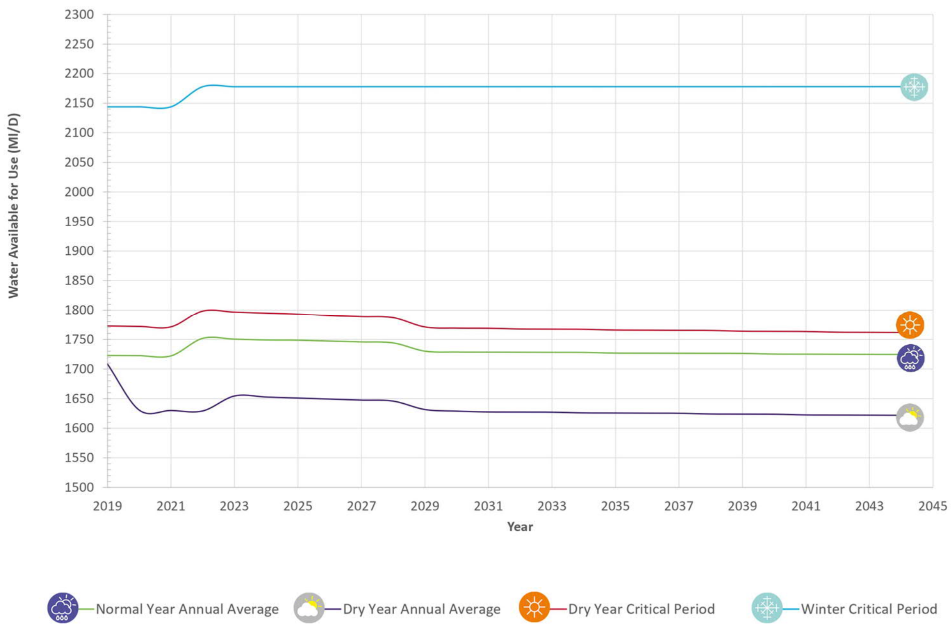



Figure 6.3 - National Summary of WAFU, 2019 to 2044

Table 6.1 - Change in WAFU, 2019 to 2044

| Weather Planning Scenario | WAFU Megaliter (Ml/d) | | Change in WAFU from 2019 to 2044 | |
|---|---|---|---|---|
| | 2019 | 2044 | Total (Ml/d) | (%) |
| NYAA | 1,723 | 1,725 | 2 ⬆ | 0 |
| DYAA | 1,708 | 1,622 | -86 ⬇ | -5⬇ |
| DYCP | 1,773 | 1,762 | -12 ⬇ | -1 ⬇ |
| WCP | 2,139 | 2,173 | +34 ⬆ | +2 ⬆ |

⬆ = Increased in WAFU

⬇ = Decrease in WAFU

Further detail on the calculation of baseline WAFU and forecast supply can be found in Chapter 3. Figure 6.4 illustrates the Limiting Factor for the WAFU produced at our water treatment plants

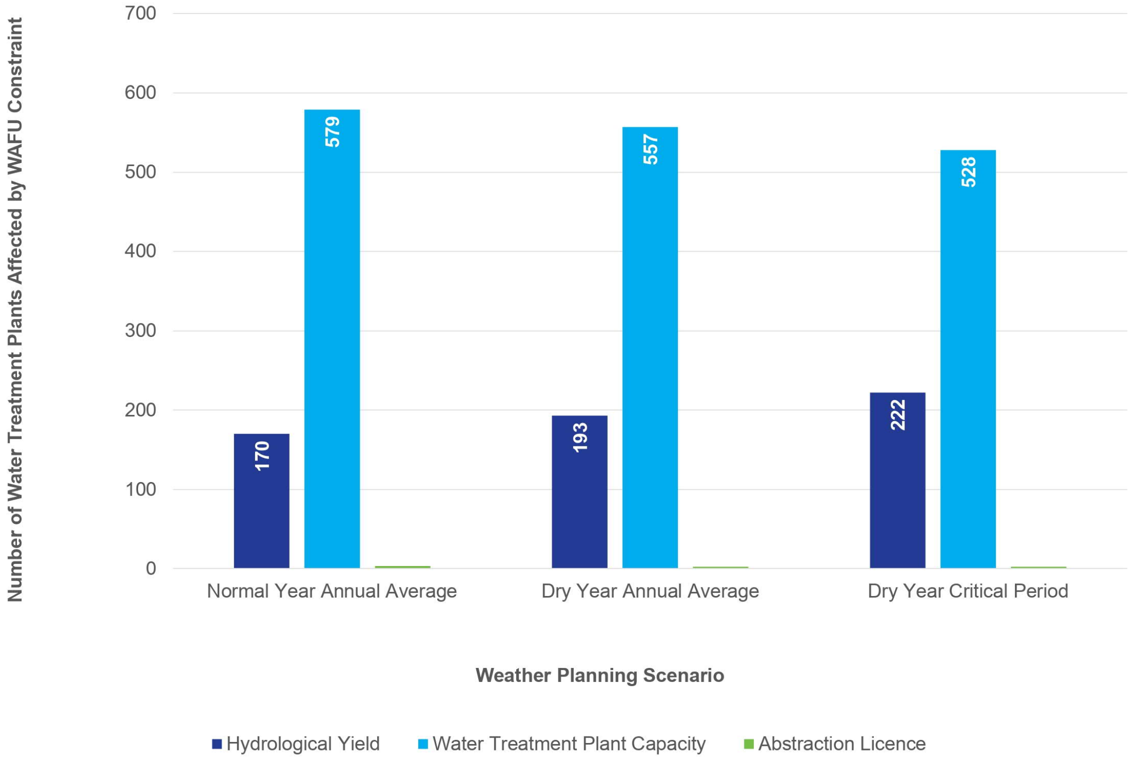



Figure 6.4 - Limiting Factor for the WAFU produced at our water treatment plants

Our current forecast for the WAFU does not include the pending abstraction legislation. The new regulatory regime, which is required to meet the requirements of the WFD (2000/60/EC), will inevitably result in modifications to the way that we currently abstract from our individual water sources. However, as our water supplies have evolved based on these existing water sources, it will take numerous investment cycles before we have an integrated supply system that is truly environmentally sustainable.

The effects of the future abstraction legislation are likely to be wide ranging, such that it is not possible to assess them fully at this stage, with a more detailed site by site assessment required, when the legislation is published in its final form.

Figure 6.5 shows the potential long-term impact on the WAFU under a WFD compliant new abstraction regime. As can be seen, our available water supplies could reduce from 1,723 MLD to 1,478MLD in a normal year as outlined in Appendix L.

This will represent one of the key challenges for Irish Water over the coming years. It also has broader implications that need to be considered in relation to the growth and economic wellbeing of the country.

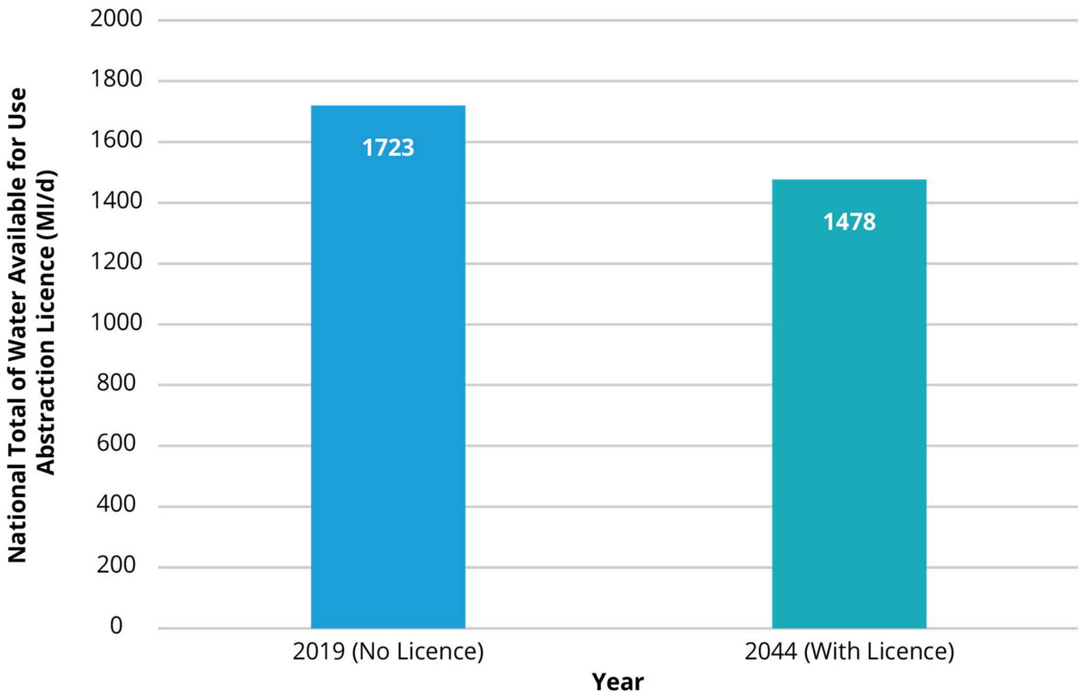



Figure 6.5– Potential Impact of Abstraction Legislation on WAFU, 2019 to 2044

### 6.2.1.2 Baseline and Future Demand

Figure 6.6 and Table 6.2 show the Total Demand (i.e. with headroom) for water from our supply networks. Presently, in a Normal Year, the Total Demand is 1,924Ml/d and in a Dry Average Year is 1,960Ml/d.

Our requirements for water in a drought or severe winter period can increase the Total Demand by up to 30%. For the DYCP (drought), the current Total Demand is 2,266Ml/d. The Total Demand is higher still for the WCP at 2,508Ml/d, due to the effect of pipe bursts.

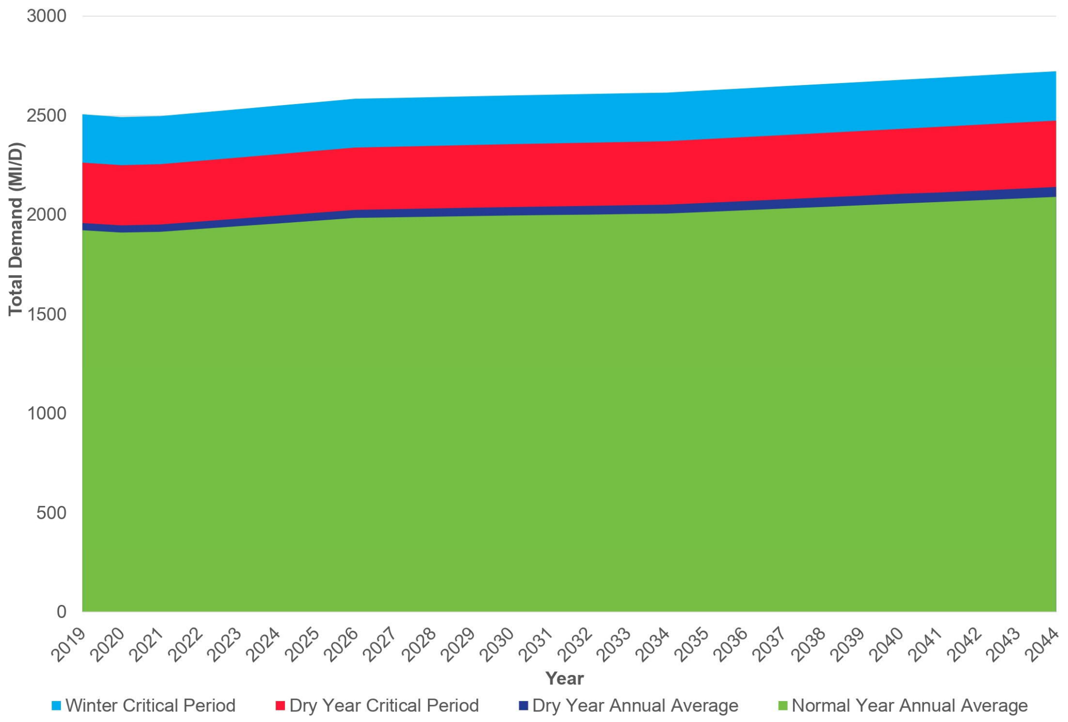



Figure 6.6 – National Summary of Total Demand, 2019 to 2044

Table 6.2 – National Summary of Total Demand

| Weather Planning Scenario | Total Demand (Ml/d) | | Change | |
|---|---|---|---|---|
| | 2019 | 2044 | Total (Ml/d) | (%) |
| NYAA | 1,924 | 2,091 | 168↑ | 9%↑ |
| DYAA | 1,960 | 2,141 | 182↑ | 9%↑ |
| DYCP | 2,266 | 2,476 | 211↑ | 9%↑ |
| WCP | 2,508 | 2,724 | 215↑ | 9%↑ |

↓ = Reduced Demand

↑ = Increased Demand

Figure 6.6 and Table 6.2 also show that although our population is forecast to grow by over 20% by 2044 along with significant economic growth, Total Demand is only forecast to increase by around 10% across the different Weather Planning Scenarios.

This comparatively small increase in Total Demand is attributed to:

- The ambitious leakage reduction targets we have set ourselves as a country; and
- The fact that significant high-water demand growth is confined within a small number of WRZs, which mitigates the effect of such increases, when using national averages.

### Supply Demand Balance

We combine our baseline and forecast calculations for supply and demand over the next 25 years, to understand the deficits (need) in the SDB that we will need to address. For the purposes of this summary, we have presented this information as:

- The national net surplus or deficit across our Weather Planning Scenarios; and
- The number of WRZs that would be in deficit i.e. where there would be a risk of disruption to our customers.

### Net Surplus & Deficit

Figure 6.7 and Table 6.3 show the national summary of the net surplus or deficit across our Weather Planning Scenarios for 2019 and 2044.

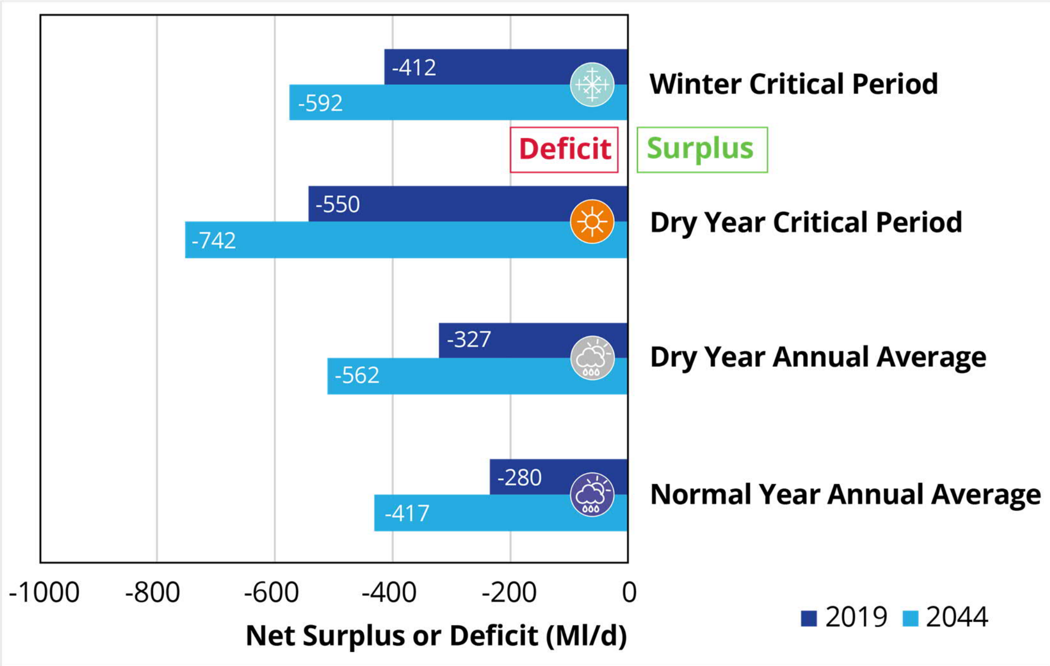



Figure 6.7 – National Summary of the SDB for 2019 to 2044

Table 6.3 – National SDB Summary

| Weather Planning Scenario | SDB (Ml/d) | | Change | |
|---|---|---|---|---|
| | 2019 | 2044 | Total (Ml/d) | (%) |
| NYAA | -280 | -417 | 137 ⇑ | 91% ⇑ |
| DYAA | -327 | -562 | 236 ⇑ | 60% ⇑ |
| DYCP | -550 | -742 | 192 ⇑ | 39% ⇑ |
| WCP | -412 | -591 | 180 ⇑ | 51% ⇑ |

⇑ = Increased Deficit[7]

At present, Total Demand exceeds the Water Available for all Weather Event Planning Scenarios.

The largest deficit in the SDB is for the DYCP, with a net deficit nationally of 550Ml/d. This is because raw water sources are impacted during extreme warm periods such as drought which typically coincides with increases in demand.

The net deficit nationally for the WCP is 412Ml/d. There are normally no restrictions to the amount of water we can abstract during the WCP. This deficit is predominantly driven by the ability of our water

[7] The national deficit is not equal to the total WAFU – Demand as this would assume all WRZ's are interconnected. The national deficit is the sum of all the individual deficits per WRZ.

treatment plants and distribution networks to cater for the increased demand during this Weather Event Planning Scenario.

By 2044, our SDB deficit will increase across all Weather Planning Scenarios.  This is primarily due to a growth in demand, combined with a forecast reduction in water availability due to climate change.

The SDB does not include the impacts of the pending abstraction regulations and reform.  When implemented, these new Regulations will have the potential to significantly increase the deficits by reducing the amount of water, which we can abstract from our sources.

### WRZ Impacts

Figures 6.8 to 6.11 show the number of Water Resources Zones which are currently in surplus or deficit across our four Weather Event Planning Scenarios.  These figures show:

- During the NYAA Planning Scenario, 311 (58%) of our WRZs are in deficit whilst 228 (42%) are in surplus;
- During the DYAA Planning Scenario, 323 (60%) of our WRZs are in deficit whilst 216 (40%) are in surplus;
- During the DYCP Planning Scenario, 355 (66%) of our WRZs are in deficit whilst 184 (34%) are in surplus; and
- During the WCP Planning Scenario, 362 (67%) of our WRZs are in deficit whilst 117 (33%) are in surplus.

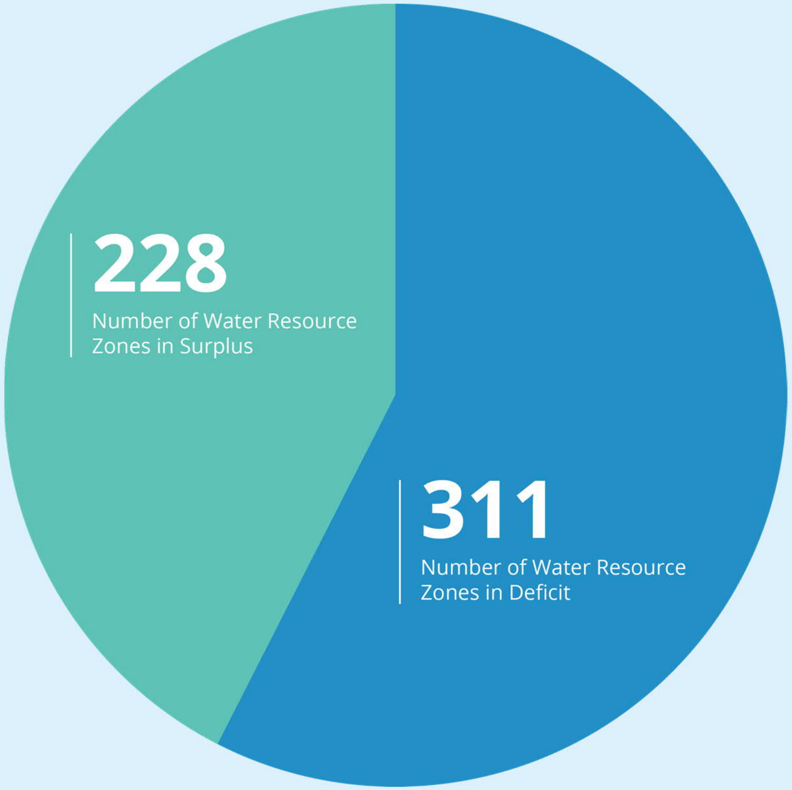



Figure 6.8 – Numbers of WRZs in Surplus or Deficit in 2019 for the NYAA Planning Scenario

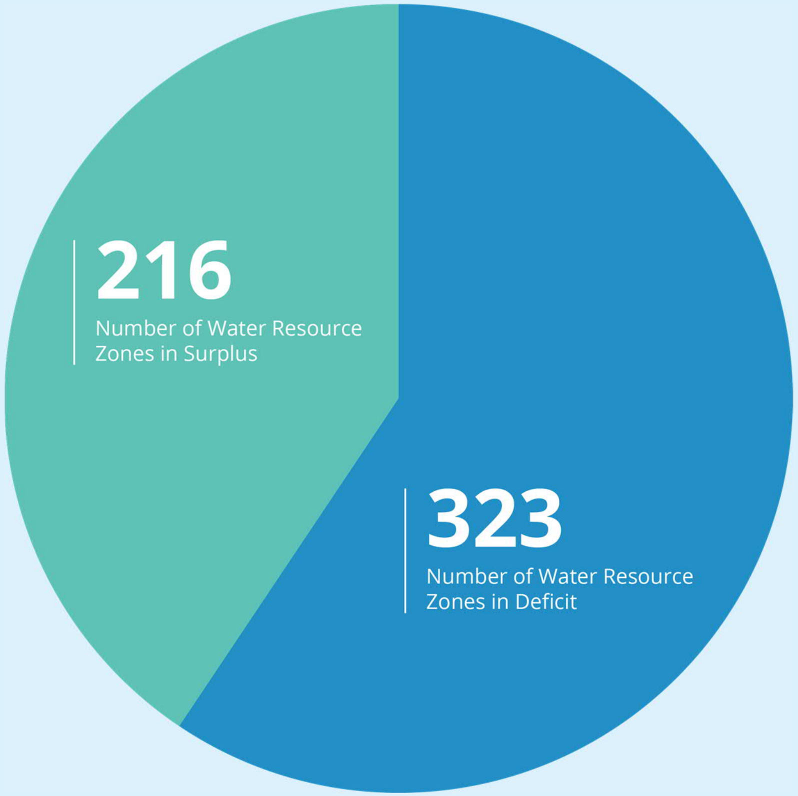



Figure 6.9 – Numbers of WRZs in Surplus or Deficit in 2019 for the DYAA Planning Scenario

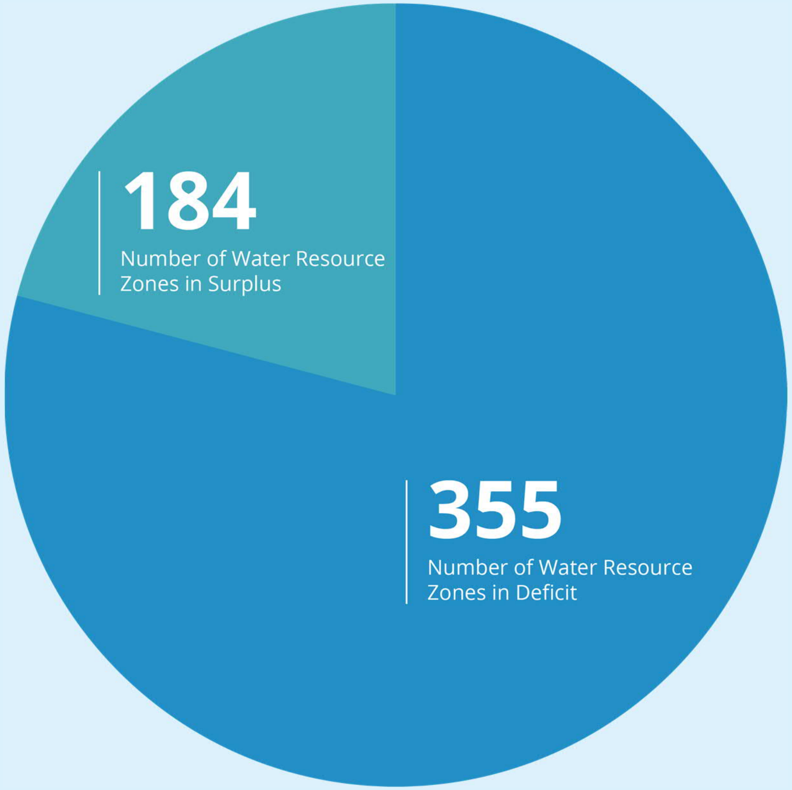



Figure 6.10 – Numbers of WRZs in Surplus or Deficit in 2019 for the DYCP Planning Scenario

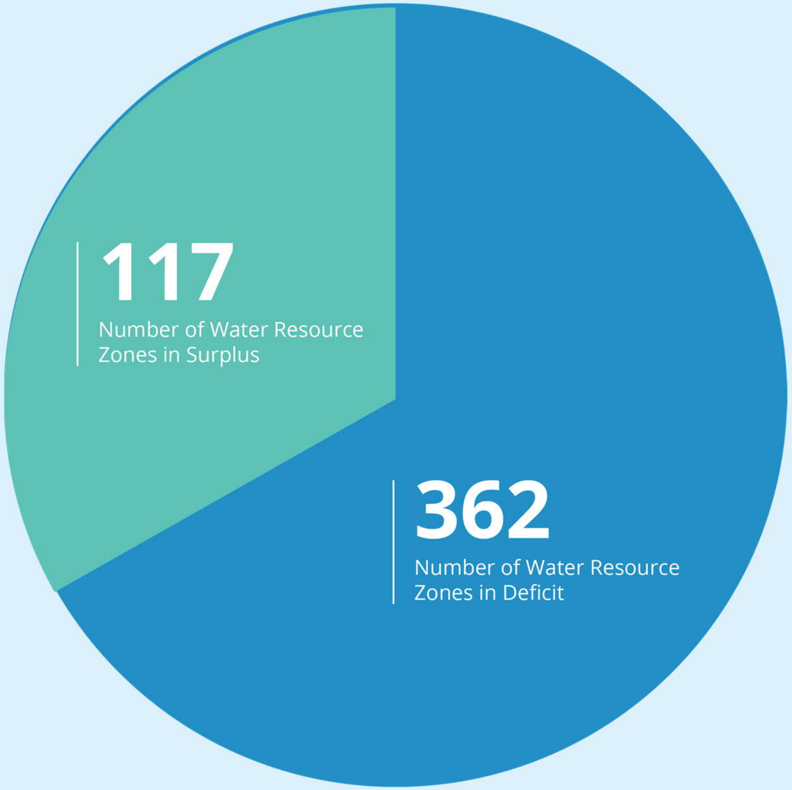



Figure 6.11 – Numbers of WRZs in Surplus or Deficit in 2019 for the WCP Planning Scenario

Figure 6.12 and Table 6.4 highlight that between 2019 and 2044 there will be an increase in the number of WRZs in deficit. The largest change occurs for the DYCP and DYAA Planning Scenarios with 27 and 30 more WRZs respectively in deficit.

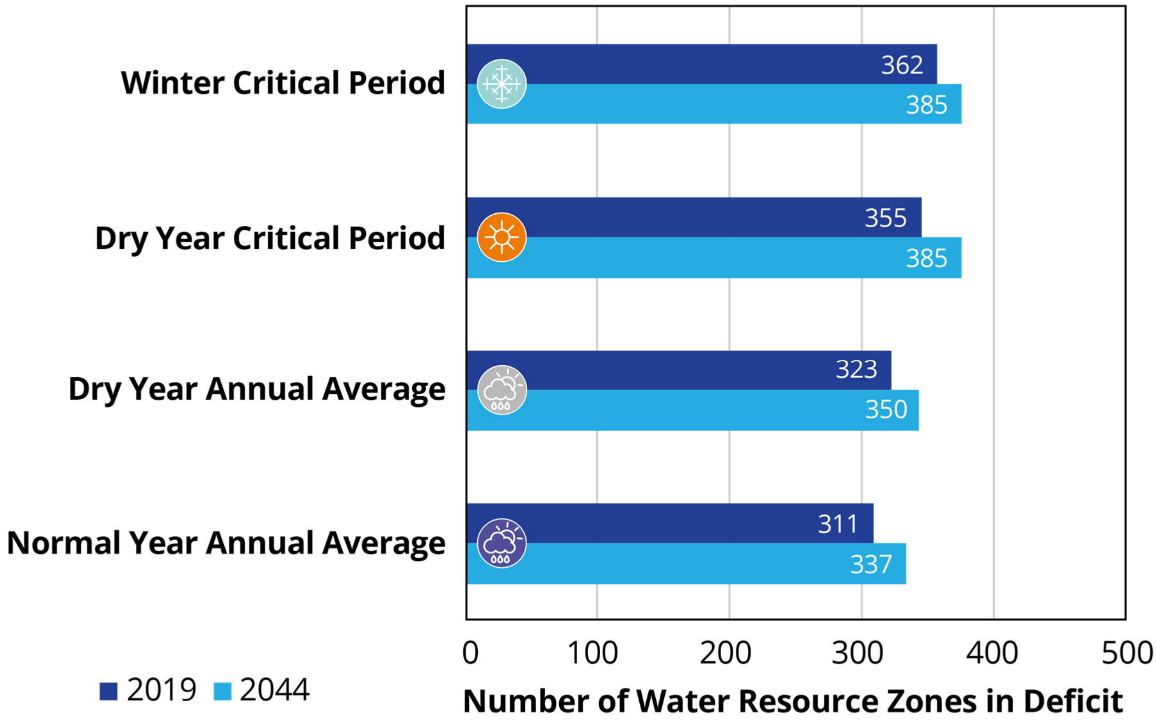



Figure 6.12 – Number of Water Resources on Deficit 2019 - 2044

Table 6.4 – Number of WRZs in Deficit in 2019 and 2044

| Planning Scenario | Number of WRZs in Deficit | | Change from 2019 to 2044 | |
|---|---|---|---|---|
| | 2019 | 2044 | Count | (%) |
| NYAA | 307 | 332 | 25 | 8% |
| DYAA | 317 | 343 | 26 | 8% |
| DYCP | 421 | 438 | 17 | 4% |
| WCP | 356 | 376 | 20 | 6% |

Based on this analysis, it is clear that our baseline position is challenging, and that many of our supplies currently experience significant SDB deficits particularly during dry periods. However, Ireland has good natural water resources and when these issues are addressed through capital investment, the SDB will stabilise over time. We do not anticipate a significant increase in the overall SDB deficit nationally over the timeframe of the Plan, due to planned investment and leakage reduction. However, the SDB may increase significantly within certain Water Resource Zones, and abstraction legislation may impact on others.

The current position reflects the condition and performance of our existing asset base particularly in relation to WAFU constraints.

### 6.2.2 How we are presenting the SDB information

The SDB calculation for each WRZ is provided in Appendix L. Figure 6.13 gives further details of the information provided for each WRZ.

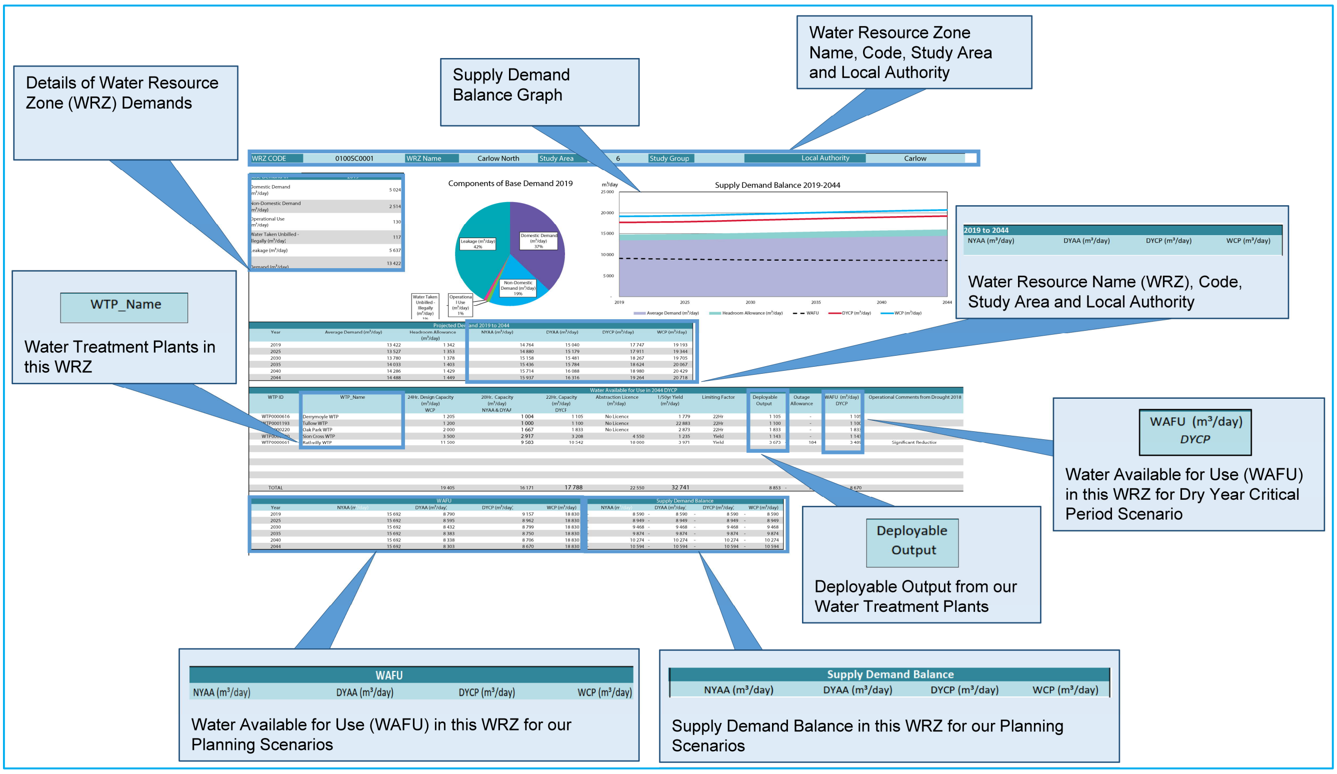



Figure 6.13 – WRZ SDB Information

#### 6.2.2.1 SDB Summary

The key findings from our SDB calculations are as follows:

- The WAFU from our existing supplies is not sufficient to balance the current demand for water, across all weather event planning scenarios whilst ensuring the correct levels of service to our customers;
- This situation will deteriorate over time, because of climate change, leading to an increased frequency of prolonged droughts lowering river and lake levels;
- Changes to legislation and the regulatory process around abstractions has the potential to significantly impact water availability at our existing supplies;
- Although population and economic growth are forecast the Supply Demand Balance deficit is not expected to increase significantly at a national level, although there may be some WRZs with significant demand increase;
- 58% of our WRZs are in deficit at present and do not provide the correct reliability to our customers in normal conditions based on the standards for reliability and Level of Service that we have set in this draft Framework Plan.  This increases to 67% of resource zones in winter conditions and 79% in drought conditions.

The SDB assessments show considerable vulnerability across the public water supply both now and into the future, if no course of action is taken. This vulnerability has the potential to limit socio-economic development and cause real losses to customers at times.

However, whilst the purpose of this draft Framework Plan is to identify the methodology that will be used to develop short, medium and long-term solutions to address the risks to our supplies (in terms of quantity, quality and reliability), it should be noted that we have a range of interventions in train. These include critical maintenance investments, leakage reduction, new supply interventions, and operational interventions, which will help deliver more from our existing asset base.

## 6.3 Quality and Reliability

### 6.3.1 Quality and Reliability – Summary Results

In Chapter 5, we described how Irish Water monitors water quality in line with the requirements of the Drinking Water Regulations, and how drinking water compliance across public water supplies has remained high.

We also detailed how Irish Water is adopting the Drinking Water Safety Plan (DWSP) approach to managing risk, in order to ensure that our water supplies are also secure, sustainable and reliable. Under this approach we have commenced the process of assessing our supplies against an identified list of hazardous events, in accordance with the World Health Organisation's DWSP approach. This hazard assessment process allows us to understand current and future risks across our supplies from source abstraction to the consumer tap, which is the point of compliance in the Drinking Water Regulations.

We also described how Irish Water assesses the capability of our current water supply asset base to deal with existing and future potential risks. This is called the Barrier Assessment, and it allows Irish Water to:

- Understand the scale of potential "Quality and Reliability" need and the associated long-term investments we will need to plan for in order to meet the asset capability standards that we have set for ourselves, and
- Transform our asset base over time through the NWRP and the future capital investment cycles

Although we have commenced the process for completion of the DWSPs, they will likely take a number of years to complete across all of our water supplies. Therefore, for the purposes of this Framework Plan, and the subsequent Regional Water Resources Plans we have used an Interim Barrier Assessment, as described in Chapter 5. These Barrier Assessments will be continually updated as we complete the DWSP hazard assessments over the coming years.

### 6.3.2 Water Security – The Barrier Approach to Asset Management

While we continue to make progress in the development of the DWSPs for all of our supplies, Irish Water has used an Interim Barrier Assessment to identify "Water Quality and Reliability" need for the purposes of the draft Framework Plan.

The Barrier Assessment is not a measure of compliance with the Drinking Water Regulations, however it is an assessment of our existing asset capability to meet the standards we have set for ourselves as a business. Meeting these asset standards will ensure that our asset base transforms over time, and that all of our supplies evolve to become secure, reliable and sustainable. The function of the Interim Barrier Assessment within this iteration of the NWRP is to allow Irish Water to understand the scale of the transformation required across our entire water supply asset base in the short, medium and long term.

It also allows us to plan for the transformation of the asset base through the Regional Water Resources Plans and the future capital investment cycles.

In the following paragraphs, we provide a summary of Interim Barrier Assessment across our supplies, under the individual Barrier headings. The scale of 1 to 5 indicates the level of transformation and investment required across our existing asset base to achieve the stringent asset capability standards we have set for our supplies under this category.

The Pie Charts below represents our 539 Water Resource zones and the portion of these that of these that fall in to the 1 to 5 scale categories. This simple representation does not indicate the size of the supplies, which vary considerably across the country. The information for water resource zone will be included within the Regional Water Resources Plans, as part of Phase 2 of the NWRP.

As shown in Figures 6.14 to 6.20, the barrier assessments under all eight categories indicate that there is some investment required across our water resource zones to ensure that our assets are **secure**, **reliable** and **sustainable**, both now and in the future.

The average asset capability and scale of transformation and investment required is contextualised using the “speedometer diagrams” under each category.

#### 6.3.2.1 Barrier 1 - Ensuring Primary Disinfection

We verify compliance with the Drinking Water Regulations by sampling and testing the stipulated parameters in accordance with the required sampling frequency. Our regulatory compliance for microbiological standards was 99.9% in 2019. Therefore, our water supplies are considered to be **safe.** Figure 6.14 summarises the performance of our water resource zones in relation to Barrier 1.

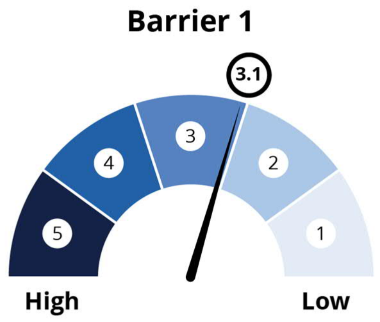



Figure 6.14 – Barrier 1 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

#### 6.3.2.2 Barrier 2 – Ensuring Secondary Disinfection

Figure 6.15 summarises the asset capability of the distribution networks within our water resource zones to meet the asset standards Irish Water has set in relation to Barrier 2.

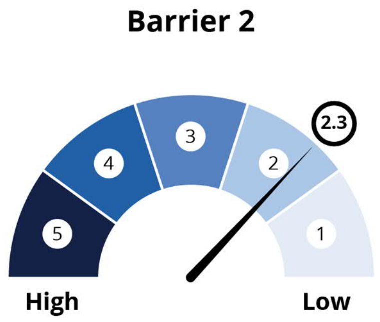



Figure 6.15 – Barrier 2 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

#### 6.3.2.3 Barrier 3 and 4 - Ensuring Physical removal and/or inactivation of Protozoa

Figure 6.16 summarises the performance of our water resource zones in relation to Barrier 3 & 4 performance. Two assessments have been undertaken on Barriers 3 & 4 to reflect the two risk assessment methodologies (simple assessment and SCRAM) currently being undertaken by Irish Water (See Chapter 5 and Appendix J).

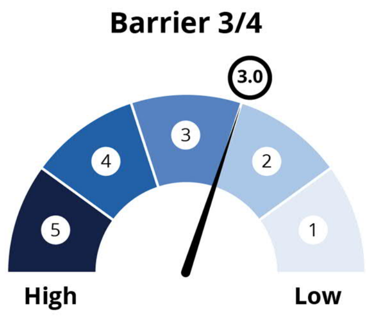



Figure 6.16 – Barrier 3&4 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

### 6.3.2.4 Barrier 5 - Ensuring security and continuity of supply

Barrier 5 conformity includes our ongoing risk assessment and management of the following range of water supply and distribution issues:

- The Supply Demand Balance (see Chapters 4, 5 and 6.3 above),
- The management of treatment process alarms and their effect on downstream water storage supplying our distribution networks,
- The management of risks associated with critical infrastructural assets, such as abstraction works, large water treatment plants, pumping stations and trunk mains used for bulk transfer of water, as discussed in Chapter 6.4; and
- The management of distribution network resilience encompassing reduction of leakage and the adequacy of storage to manage short term operational interruptions to the treatment and pumping of drinking water

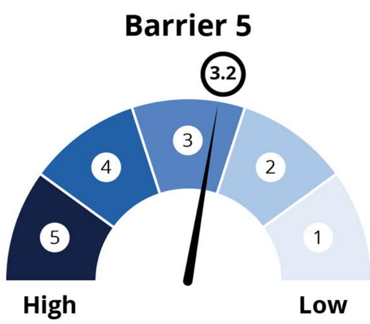



Figure 6.17 – Barrier 5 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

### 6.3.2.5 Barrier 6 – Minimising THM formation potential

Figure 6.18 summarises the asset capability of our water sources, water treatment plants and distribution networks to meet the standards Irish Water has set in relation to Barrier 6.

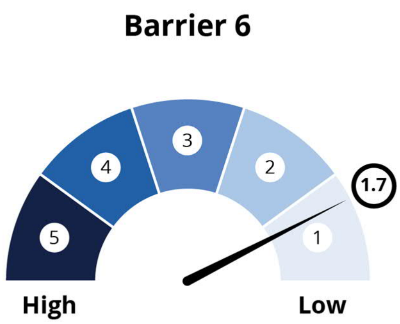



Figure 6.18 – Barrier 6 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

### 6.3.2.6 Barrier 7 Minimising discharges to the receiving environment

Figure 6.19 summarises the performance of our Water Resource Zones in relation to Barrier 7 performance.

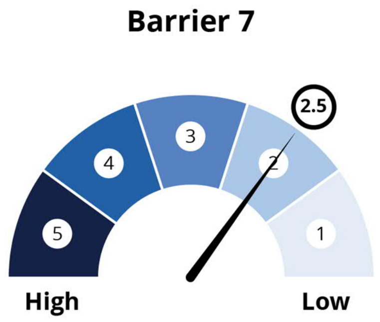



Figure 6.19 – Barrier 7 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

### 6.3.2.7 Barrier 8 - Minimising presence of Chemical and Physical Parameters

Figure 6.20 summarises the performance of our Water Resource Zones in relation to Barrier 8 performance. Barrier 8 includes a number of physical and chemical parameters. As can be seen, the barrier assessment under this category indicates that there is some investment required across our asset base.

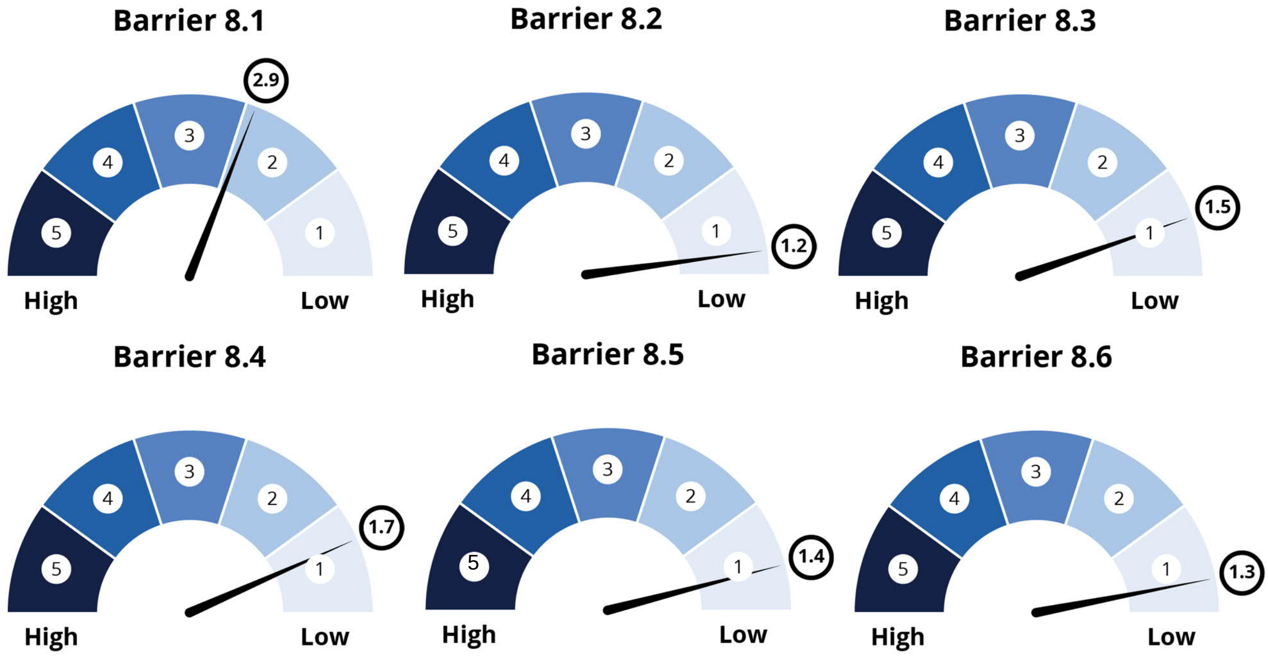



Figure 6.20 – Barrier 8 Average Asset Capability: Scale of Transformation and Investment Required (High to Low)

## 6.4 Summary

In this section, we have summarised at a national scale the potential asset capability issues across all our supplies when compared to the asset standards that we strive to achieve, in the short medium and long term.

In this iteration of the National Water Resources Plan, the information from the Supply Demand Balance and the Interim Barrier Assessment, will form the basis of “Identified Need”, and will be brought through to the Regional Water Resources Plans (RWRPs) as part of Phase 2 of the NWRP.

Development of Preferred Approaches (solutions) for each supply, to address identified need as part of RWRPs will allow Irish Water to strategically plan for the transformation of our asset base over future investment cycles, and will ensure that our supplies are safe, **secure, reliable and sustainable**. It will also allow us to understand the overall scale of investment required to transform our asset base.

# 7 Develop Solutions - Our Approach

# 7 Key Points

**In this Chapter we will:**

- **Outline our 'three-pillar' approach to managing supply and demand; and**
- **Discuss our existing Resource Planning Activities.**

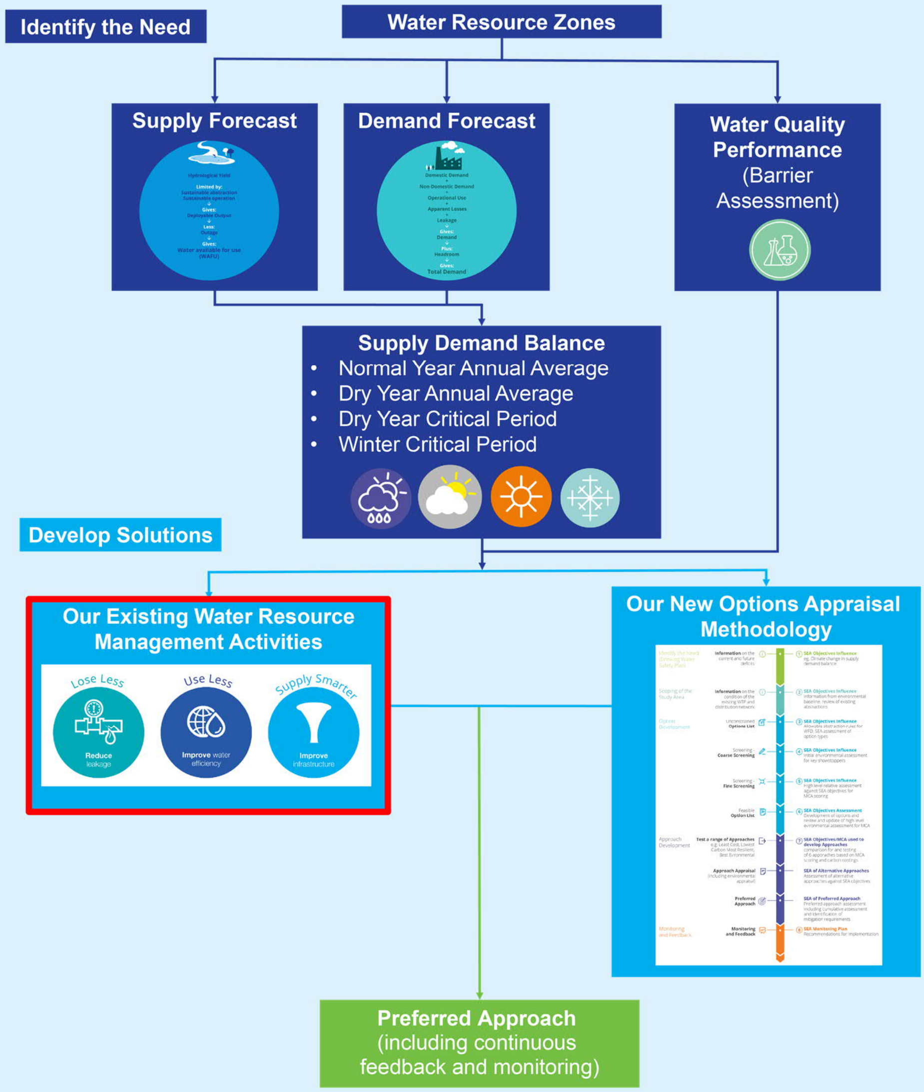



Figure 7.1 – NWRP Process – Our Existing Water Resource Management Activities

## 7.1 Introduction

Irish Water faces significant challenges in terms of the quantity, quality reliability and sustainability of the public supplies across the country. Primary risks identified with over 50% of our supplies include, insufficient water available for supply, water quality/compliance, and insufficient Levels of Service to meet our customers' requirements.

We must ensure that our water supplies become more sustainable over time, therefore we need to ensure that solutions to our supply issues consider the broader environment within which we operate. This means:

- Where feasible we must cater for increased growth requirements in the first instance by driving an aggressive leakage reduction programme combined with strong promotion of water conservation measures in homes and businesses, as we cannot continue to abstract more and more water from sensitive sources to meet this demand; and

- We fully adhere to the WHO principle that the starting point for good clean drinking water is source protection, rather than relying on ever more complex and costly treatment. We will achieve this by developing and implementing DWSPs across all our supplies.

In developing appropriate interventions in a sustainable manner, we have compiled the range of available solutions into three pillars; lose less, use less and supply smarter.


**Lose Less:** reducing water lost through leakage and improving the efficiency of our distribution networks

**Use Less:** reducing water use through efficiency measures

**Supply Smarter:** improving the quality, resilience and security of our supply through infrastructure improvements, operational improvements and developing new sustainable sources of water

Together these pillars will enable us to optimise our capital and operational interventions to achieve the best outcomes and react to emerging issues (Figure 7.1).

## 7.2 The Three Pillars

In this Section we describe the "three pillars" in more detail.

### Lose Less

Leakage is the loss of water from the distribution network. This includes fractures and bursts, smaller holes and pinholes in pipe walls, leakage at joints, leakage at service connections and leakage at valves and other fittings and overflows at storage reservoirs. Only a tiny proportion of leaks within our distribution networks come to the surface as visible leaks.

Most water leakage is absorbed into the ground or escapes into sewers and drains, so cannot be seen at ground level. The **Lose Less** pillar includes the actions which will improve our understanding of leakage, ways to reduce it and the tools required to help us to find and fix leaks.

### Use Less

There is potential for us all to use less water in our everyday lives, and for businesses to save money by using water more efficiently. Irish Water is committed to developing and testing new initiatives to inform policy and enable customers to become more efficient in their water use.

The **Use Less** pillar focuses on activities to help us to understand water use habits, influence behaviour, encourage change and to promote the use of water efficient devices and appliances.

Figure 7.2 - Option types

### Supply Smarter

Our water supply network consists of 1,090 individual sources. The **Supply Smarter** pillar includes actions to proactively engage in the protection our natural water resources, improve the performance and resilience of existing supplies, improve interconnectivity within our supply networks, increase the amount of water available for use, improve compliance, address the environmental impacts of existing abstractions and mitigate the impacts of climate change. We also support this through asset maintenance, operations and by delivering process optimisation and training.

The key option types for infrastructure improvements under the **Supply Smarter** pillar are listed in Figure 7.2.

## 7.3 Our Current Actions

Irish Water is already implementing measures across our three pillars of **Lose Less**, **Use Less** and **Supply Smarter** to maintain and improve the LoS to our customers.  This section outlines the measures we are already taking and how we have accounted for them in this draft Framework Plan.

### 7.3.1 Lose Less: Leakage Reduction

Activity to reduce leakage from the public distribution network was historically undertaken by Local Authorities and is now managed by Irish Water.  As our water mains network ages, leakage will increase if we do not continue to invest in fixing leaks. We focus on finding and fixing the leaks which account for most of the water lost from our supply network.

Our supply network is built from a variety of pipe materials of different ages and quality control during construction.  Good network and water-use information, expert knowledge, specialist equipment and rigorous management is therefore required to reduce and control leakage.

Example of an aged pipe

To reduce leakage, Irish Water has committed to a planned and proactive campaign of high intensity leak detection and repair, reinforced by pressure management and replacement of mains which are prone to frequent bursts. To be effective, the effort must be sustained with new leaks detected and addressed promptly through active leakage control.

We recognise that our current leakage levels are unacceptably high, and we are working hard to reduce the amount of treated water lost within our distribution networks. We have developed and are implementing our National Leakage Reduction Programme which includes:

- Establishing over 4,500 district meter areas to enable us to identify faults;
- Establishing our Find and Fix activities to deliver active leakage control;
- Undertaking large-scale water mains replacements;
- Valve and control replacement;
- Implementing pressure management controls; and
- Delivering the 'First Fix Free' initiative to address leaks on pipes, within the boundary where the customer has responsibility.

Our National Leakage Reduction Programme targets a net saving of 50 million litres per day by the end of 2021, which we have included in our Supply-Demand Balance forecasts. In order to achieve this net saving, we must achieve a gross saving estimated at 166 million litres per day, when account is taken of the Natural Rate of Rise of Leakage. In line with best practice, our long-term objective will be to reduce leakage nationally to SELL. We have summarised our SELL in Chapter 5 of this draft Framework Plan with further details provided in Appendix H.

We know that this target presents a major challenge, but we are committed to meeting it. Within this draft Framework Plan, our initial objective is to achieve Sustainable Economic Levels of Leakage in the Greater Dublin Area where the current need is the greatest.


An image from our recent national water conservation campaign

### 7.3.2 Use Less: Water Conservation & Stewardship

Successfully encouraging water conservation requires continued commitment to a long-term behavioural change campaign that educates and informs the end user about their individual water consumption along with the challenges faced in providing a sustainable treated water supply. This requires investment and ongoing research.

In many countries water conservation activities are also aligned to economic incentives or other means of encouraging a reduction in water use. Research commissioned by Irish Water has shown that the broad perception among the general public is that we have an abundant water supply and that the need for water conservation is confined only to periods of extreme dry weather, as we have seen in recent years. We also know that low understanding of personal individual consumption, combined with high levels of leakage within the water supply network, and the misconception that Irish Water is not addressing the significant and complex leakage challenge, are further barriers to behavioural change.

Many stakeholders have a role in educating the public about the importance of water conservation and Irish Water has an ongoing active programme of promoting water conservation in schools, businesses and communities. Our current activities include supporting the Green Schools Programme, water conservation public information campaigns and our certified Water Stewardship Programme.

#### 7.3.2.1 Green Schools

Since 2014, Irish Water has supported An Taisce's Green Schools Programme which provides a highly effective ongoing environmental education for primary and secondary schools. In 2018 the Green Schools programme, which is in its 6th year of the Water Theme, saved over 389 million litres of water, the equivalent of over 450 million cups of coffee, thanks to participation in this programme.

#### 7.3.2.2 Water Conservation Public Information Campaigns

Irish Water conducted a number of Public Information Campaigns on Water Conservation, between 2018 and 2020, summarised as follows:

**Drought 2018:** During the drought of 2018 Irish Water undertook an extensive national and local integrated public awareness campaign to educate the public about their personal water use. This initiative combined media, advertising and online information campaigns, with stakeholder and customer engagement to focus on the daily estimated water consumption, with a view to encouraging simple steps to reduce it.

Daily water demand, especially in the Greater Dublin area reduced significantly during the period of the campaign (July and August) and while it is difficult to directly attribute this reduction in demand solely to the campaign, the widespread media coverage and associated advertising across all channels, along with direct engagement with large water users was very likely to have positively impacted behaviour and encouraged water conservation. Research undertaken after the campaign confirmed that household water users thought more about their individual use based on the campaign. However, the research also highlighted that their perception was that the extent of the drought may have been exaggerated.

**Water Conservation and Leakage Reduction 2019:** In 2019 the focus of Irish Water's public information campaign was broadened to inform the public and stakeholders about the work we are doing to reduce leakage. As with the drought campaign in 2018, the approach to water conservation and leakage messaging was integrated across multiple channels including; national and regional media engagement, advertising, social media, website and direct stakeholder engagement with business, communities, local authorities and elected representatives.

The return was reasonably effective, given the low understanding of the challenge of reducing leakage prior to the campaign. Post campaign research showed that understanding of key messages and stakeholder understanding improved. The campaign results underlined the need for continued activity ongoing investment in awareness campaigns on key issues.

**Drought Spring 2020:** In 2020, due to an historically dry spring, some of our more vulnerable supplies started to come under stress. Therefore, a public information campaign on water conservation needed to begin earlier than in previous years. During this same period the impact of changed water use due to Covid-19 was also significant, with an increase in domestic water consumption due to increased home hygiene and hand washing. As a result, Irish Water's water conservation messaging had to take account of critical public health messaging related to hand washing in particular, while still encouraging households to reduce non-essential use at the time a National Water Conservation Order was being imposed.

As in previous years an integrated campaign approach was adopted to maximise the impact. Direct dedicated stakeholder engagement was also undertaken with key stakeholders including An Fóram Uisce, the Irish Water National Stakeholder Forum and each Local Authority through the Local Government Management Agency. Local Authorities across the country supported and amplified the water conservation campaign by sharing key campaign messages and collateral on their own online channels broadening the reach and impact of the campaign messages.

While media coverage and stakeholder feedback on water conservation messaging was positive, it is difficult to accurately quantify the direct impact of the 2020 water conservation campaign given the wider context of the Covid-19 pandemic and its impact on personal behaviour, including water use.

Water conservation public information campaigns continue to be an important part of Irish Water's overall communications approach and they will require continued sustained research, investment and stakeholder engagement. Due to limitations in data, we have not quantified the savings from these activities within our demand forecasts. As we develop our understanding of how we can influence water use behaviour in Ireland and how to accurately quantify the water saving benefits we will update our demand forecasts.

We continuously review all relevant available data to develop our understanding of customer behaviours and household water usage. Further studies will be required to improve our understanding of the extent to which water conservation can influence the SDB.

Irish Water will continue to actively promote water conservation in schools, businesses and communities through activities including:

- National and Local Media Campaigns
- Targeted Sectoral campaigns
- Green Schools
- Water Stewardship Scheme
- First Fix Free Scheme

Recent government policy has also allowed for the introduction of the Household Water Conservation Charge or Excess Use Charges to highlight high usage to our customers.  This may also encourage further uptake of our First Fix Free Scheme, where customer side leakage is the main cause of excessive use.

More detail of our current activities can be found in section Chapter 4 and on our website: https://www.water.ie/conservation/.

Box 7.1 provides specific details on our Water Stewardship scheme which aims to support Irish businesses in reducing their water use.

**Box 7.1 – Water Stewardship Programme**

In partnership with Lean & Green Skillnet and Central Solutions, we have launched our Water Stewardship programme.  This programme is open to business customers seeking to reduce water consumption and operating costs while protecting the environment.

Stewardship takes a holistic approach to safeguarding our water supplies. This is a step further than water conservation which typically focuses on water efficiency and reducing water consumption, as it also supports and educates our business customers on quality and environmental impact to become Custodians of Water.

Participating businesses prepare a Water Charter capturing the business case for action, their site's current state, water saving opportunities and an agreed action plan.  Successful businesses receive Certification that is accredited by International Water Stewardship Standards (EWS/AWS), and supports meeting corporate sustainability commitments including for Ireland's pioneering food and sustainability programme, Origin Green (sponsored by Bord Bia). In addition, it is fully supported by the EPA, SEAI, IDA, Enterprise Ireland, IBEC, Chambers Ireland, and BIM.

The leading-edge initiative in water stewardship is the first of its kind globally and funded by Irish Water & Skillnet (Department of Education and Skills).

We have set up a new connections management system to ensure sufficient control of new connections to our water supplies. This allows us to facilitate new developments whilst ensuring that there are no reductions to Levels of Service across our existing customer base. We work with developers and large non-domestic water users who require significant volumes of water to understand their actual needs, including details such total annual and daily demand and timing of peak demands. This allows us to control and set efficiency stipulations within new connection agreements, including reduced peak water requirements.

Methods for driving down demand from large water users such as data centres includes limiting peak flows to the development and ensuring the developer provides adequate storage to manage needs during periods of peak demand.

### 7.3.3 Supply Smarter: Capital Investment and Improved Operations

We are currently implementing an investment programme in our water supply infrastructure which includes water treatment plant upgrades to improve the LoS we can provide to our customers.

We have numerous water supply improvement projects and programmes in progress, to improve both the quality and quantity of drinking water. Findings of the yield and demand assessments (in Chapters 4, 5 and 6) are being fed into our current projects to ensure we are delivering the most appropriate solutions.

We publish details of planned, live and recently completed projects on our website. For more information please visit www.water.ie

**Box 7.2 – Impact of the Plan on In-Flight Projects**

Ireland's first ever National Water Resources Plan has been under development since 2017. As our draft Framework Plan has evolved there has been a requirement to continue to design and deliver projects within our capital investment plans, particularly in relation to critical water quality issues with potential to impact on human health (e.g. for projects required to remove 'boil water' notices). This section sets how the Plan will apply to projects identified in Irish Water's RC3 Capital Investment Plan 2020 to 2024, which we call "in-flight projects".

At present Irish Water has commenced implementing its regulated Capital Investment Plan "RC3", which runs from 2020 to 2024. As a general rule the Regional Water Resources Plans will apply the methodology adopted in the Framework Plan to all in-flight projects, other than those that have planning permission as at the date of adoption of the Framework Plan.

To mitigate against any potential sustainability or capacity issues with new assets as they are designed and delivered, we have applied the Supply Demand Balance standards set out in the draft Framework Plan to water resource zones with "in-flights projects" in them. These projects were initiated before the Preferred Approach Methodology set out in the draft Framework Plan was developed and refined. Once this draft Framework plan has been subjected to public consultation and after it has been adopted, we will apply the Supply Demand Balance and Preferred Approach Methodology in the adopted plan to all water resource zones with these in-flight projects in them, unless there are exceptional circumstances for not doing so.

For the next regulated investment cycle "RC 4", the preferred approaches identified in the adopted Regional Water Resources Plans will normally be used to form the basis of all water supply projects in the investment plan.

#### Source Protection and Catchment Management Activities

Catchment Management and source protection approaches, in partnership with key stakeholders, are an essential and increasingly important component in ensuring the security and sustainability of our water supplies. This type of approach to managing risks to our drinking water sources is in accordance with Article 7(3) of the Water Framework Directive.

Irish Water is actively involved in pilot source protection projects in Ireland to trial catchment scale interventions to reduce the risk of peptides causing exceedances in water supplies. The two key projects are described below:

**A. Source to Tap Project:** is a cross-border partnership project that focuses on the River Erne and the River Derg catchments which cross the border between Ireland and Northern Ireland. Irish Water is a project partner on this project which is funded by INTERREG and match-funding has been provided by the Department of Agriculture, Environment and Rural Affairs in Northern Ireland and the DHPLG in Ireland. The project began in 2017 and will continue until 2021.

It aims to develop sustainable, catchment-scale solutions for the protection of rivers and lakes, which are the main sources of our shared drinking water. Source to Tap also delivers a learning and outreach programme targeted at informing and empowering the public about their role in protecting our clean and healthy freshwater environment. An Agricultural Land Incentive Scheme is being delivered focused on changing land management practices for the protection of our water.

**B) Pilot Drinking Water Source Protection Project:** as committed to under the River Basin Management Plan (RBMP). Irish Water is coordinating a pilot drinking water source protection project to "*trial innovative monitoring and management strategies aimed at reducing the risk of pesticide contamination of drinking waters*". Catchment management interventions to be undertaken as part of the project will involve a combination of behavioural-change initiatives and promotion of the sustainable use of pesticides. Scoping, consultation and planning of the project began in 2019 and is continuing in 2020.

As part of Irish Water's Water Services Strategic Plan (WSSP) we are developing a pesticide strategy for our drinking water sources. The strategy will cover our collaboration with stakeholders in order to assess and manage the risk of pesticides in the catchment. It will serve as an interim strategy whilst the pilot projects are ongoing, and we develop our long-term approach for catchment management for drinking water source protection. A summary of activities to date is included in Box 7.3.

Irish Water also engages with other key stakeholders such as the National Water Forum, An Fórum Uisce, the Local Authority Water Programme (LAWPRO), the EPA Catchment Science Team and the National Parks and Wildlife Service (NPWS).

**Box 7.3 Managing the risk of pesticides in catchments is an area that key stakeholders, including Irish Water, have advanced through national and local groups over the past number of years, summarised as follows:**

Pesticides have widespread use nationally across multiple sectors, including agriculture, horticulture, forestry, transport, local authorities, recreation, and domestic users. Pesticides can runoff into water bodies and therefore make their way into raw water sources. Irish Water is a key stakeholder within the catchment area, but it has no legal role or powers to enforce, control and limit the use of pesticides within the catchment. Their use is regulated by the Department of Agriculture, Food, and the Marine (DAFM).

Since 2015, Irish Water has been an active member of the National Pesticides and Drinking Water Action Group (NPDWAG). The NPDWAG is chaired by DAFM and was formed to provide a coordinated and collaborative approach to prevent the ongoing prevalence of pesticides in catchments used for the abstraction of drinking water. Members include Teagasc, the IFA, ICMSA, APHA and local authorities among others. When made aware of a pesticide exceedance, all group participants engage with their own network of staff and stakeholders to raise awareness on the issue in the area relevant to the supply and its catchment. Irish Water highlights priority catchments to members of the NPDWAG for escalation of collaborative efforts.

In 2019 the Pesticide Action Procedure (PAP) was prepared by Irish Water. The PAP ensures a standardised response to all drinking water failures and outlines how Irish Water endeavors to ensure compliance with the pesticide parametric values in the Drinking Water Regulations. It does this by notifying the EPA, HSE, and DAFM of pesticide failures, undertaking monthly pesticide monitoring of the supply and engaging and working collaboratively with key stakeholders of the NPDWAG.

When persistent exceedances occur at a supply a local sub-group of the NPDWAG called a Catchment Focus Group is established to identify synergies and coordinate efforts via multiple activities which support the return to compliance such as catchment risk characterisation and monitoring, awareness raising and advice and training.


NPDWAG Catchment Focus Group

### 7.3.4 Cross Pillar Action: Data Acquisition and Improvement Projects

The methods used to develop this draft Plan have been adapted from best practice, particularly from the UK, where a regulated form of resource planning has been in place for over 25 years. In the UK, the datasets and business intelligence systems used to collate and interpret data have evolved over time to meet the requirements of resources planning. As we are in the initial stages of resources planning on a national scale we are working to develop and implement a best practice approach to data and information management. In the interim we have had to rely on best available data, surrogate data and trends from neighbouring jurisdictions in developing this draft Framework Plan. Whilst we have identified the data improvements required to support best practice in future and invested in systems to manage it, it will take time to build the databases from operational information.

Information improvements will include additional data to reduce uncertainty in our SDB calculations. This will support our Options Assessment Methodology and inform future policies. Data improvement projects are already being progressed, such as the rollout of the National Telemetry Programme and the Leakage Management System.

In some instances, it may be that adapting an existing method to suit Irish data might be preferable to trying to develop Irish datasets. The applicability of approaches used elsewhere will be considered during our programme of data acquisition and improvement.

#### 7.3.4.1 Supply side data improvements

##### Surface Water Yield Assessments

The Surface Water Yield estimates used in the draft Framework Plan are desktop calculations. For strategic and sensitive sites or where significant infrastructure investment is planned under the **Supply Smarter** pillar, actual field measurement will be required to confirm the estimated yields. Flow and water level data were collected at 140 abstractions during low flow conditions in summer 2018 and these have been extremely useful in defining yields. However more site-specific data will permit improved understanding of abstraction during all weather conditions over time. Surface Water Yield is a key component of the SDB.

We will continue to work with the EPA to further develop a targeted flow gauging programme to increase the confidence in our yield estimates.

##### Climate Change Impacts

As part of our commitment to building resilience in our water supply system, we have recently completed the Climate Sensitive Catchments Project with the Irish Climate Analysis and Research Unit (ICARUS) in Maynooth University. This project has identified the catchments in Ireland which are most sensitive to climate change and has developed and applied an innovative assessment methodology considering water resources and drought propensity.

The traditional methodology to identify catchments vulnerable to climate change considers a ‘top down’ approach, applying information about large-scale climate change trends to small areas. This can result in inaccurate forecasting for catchments because it does not take area-specific information into account.

The Climate Sensitive Catchments Project has taken a ‘bottom up’ approach, building catchment specific data catalogues, identifying stressors and vulnerabilities in each catchment. This will improve the effectiveness of our resource planning activities and allow us to develop a more resilient water service.

The project output identifies those catchments most sensitive to climate change including an assessment of their sensitivity to drought. It considers water quantity and temperature change impacts both on flow regimes and to water quality.

The next step in order to use this data, is the development of an application process for the research outputs into our Hydrological Yield assessments. As this work is happening in parallel with this draft

Framework Plan, we intend to use the findings in our next reiteration of the Plan. We will seek to bring the findings from the Climate Sensitive Catchments Project into our SDB calculations as we update them over the coming years, as set out in Chapter 8 Monitoring and Feedback Loops.

#### Environmental Impacts

The Second Cycle RBMP identified approximately 250 water bodies sensitive to increased abstractions. We will work with the relevant organisations to scope and conduct the required investigations to determine the degree of sensitivity of these water bodies to abstractions. This may lead to abstraction reductions at some sites, potentially increasing a Supply Demand deficit. We will use the outcomes from these assessments when we apply the Options Assessment Methodology and we will update the SDB calculation following the process set out in Chapter 8.

### 7.3.4.2 Demand side data improvements

#### Planning for Future Developments

Our demand forecasts include projections set out in the NPF 2040 and information from the subsequent Regional Assemblies. These demand growth forecasts, although high level, are based on government policy and are therefore appropriate for the 25-year Plan. As we roll out our Regional Water Resources Plans in phase 2, we will work with our Local Authority partners to refine short-term demand projections based on committed development and local area plans where available. We will also update the SDB calculation following the process set out in Chapter 8.

#### Non-Domestic Demand

Over the coming years we will analyse non-domestic consumption based on usage trends within different industry sectors and by geographic area to develop statistical models to forecast future non-domestic consumption. This will require the collection of additional data on non-domestic use, which will be further enabled by the meter replacement programme currently in progress.

#### Water Efficiency

We expect water efficiency will play a significant role in managing future demand (under our **Use Less** pillar) and we need to better understand the likely effectiveness of potential efficiency measures. Internationally there is a growing body of evidence to support and understand efficiency measures which we need to translate to an Irish context.

We will undertake a series of pilot studies considering UK and international estimates of water efficiency savings and their applicability to Ireland which will be factored into the next iteration of the National Water Resources Plan.

### 7.3.4.3 Hazard assessments as part of the development of Drinking Water Safety Plans

In order to improve our water supplies and to ensure that they can address potential hazards at present and in the future, we set standards for each of our supplies that we will strive to achieve over time through the regulated capital investment plans. The standards we need to achieve at each supply are the Barriers required to address the potential hazardous events as assessed during the development of the Drinking Water Safety Plans for each water supply. Over time DWSP assessments will further define Barrier integrity, however, it will take a number of years to complete the DWSPs for all supplies. At present DWSPs for 27 WSZs have been substantially completed with approximately 2,500 hazards reviewed. As further DWSPs are completed, the information in the barrier assessments will be updated in accordance with the feedback and monitoring process set out in Chapter 8.

## 7.4 Summary

In this section we have outlined the activities we are already undertaking under our three-pillar approach to Lose Less, Use Less and Supply Smarter, to reduce the Supply Demand deficits across the public water supply.

In the next Chapter we outline a new Options Assessment Methodology that we will use to identify solutions in the Regional Water Resources Plans to reduce and manage deficits across our supplies over the next 25 years.

# 8 Develop Solutions - Our New Options Methodology

# 8 Key Points

**The purpose of resource planning is to identify need and then to develop solutions to address this need across our asset base over the coming years. In this Chapter we summarise the Options Appraisal Methodology we will use within our National Water Resources Plan. This involves:**

- **Identifying all possible solutions for each WRZ by the application of the options assessment methodology in this draft Framework Plan;**
- **Screening out all options that are not feasible;**
- **Developing outline designs for feasible options; and**
- **Through Multi Criteria and whole life cost analysis, developing feasible options and Preferred Approaches for each WRZ in the short, medium and long term.**

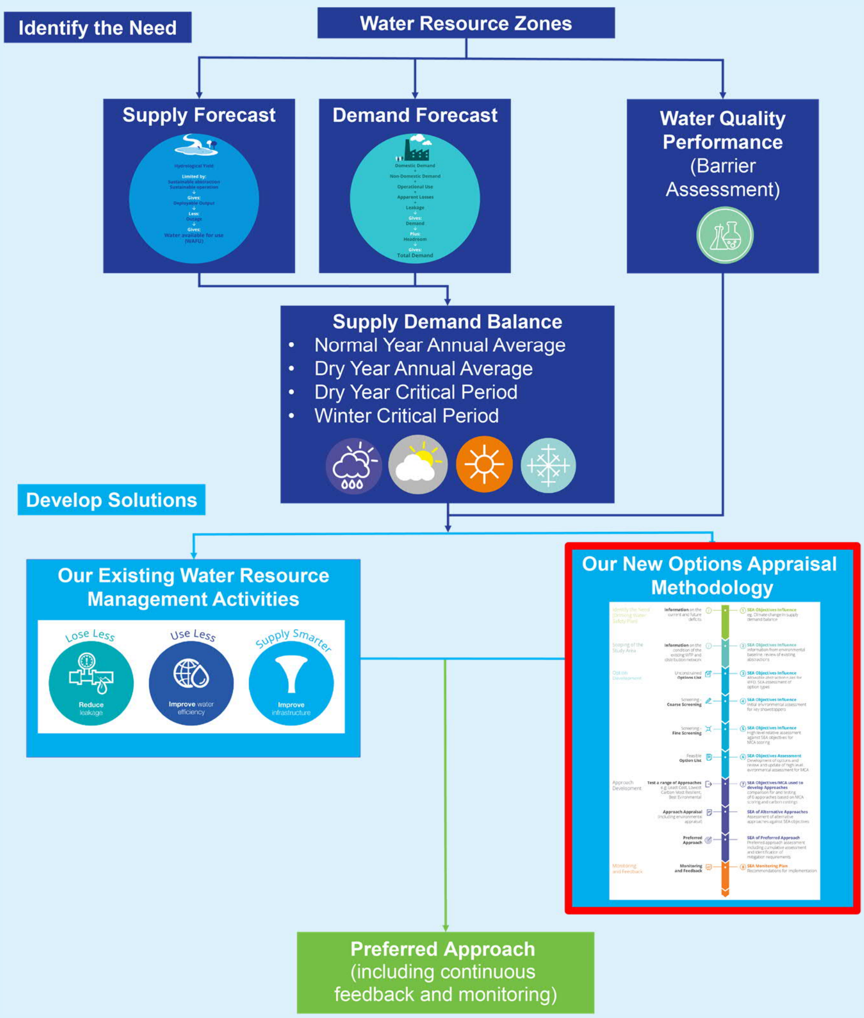



Figure 8.1 – NWRP Process – New Options Appraisal Methodology

## 8.1 Introduction

The primary purpose of a Water Resources Plan is to identify need and develop plan level solutions that will ensure appropriate water quality, quantity and reliability for each WRZ. This involves developing a Preferred Approach for each Water Resource Zone (WRZ) (Figure 8.1).

The Preferred Approach is the optimal Plan level solution to address an identified need within a WRZ, when all potential options have been assessed in a uniform way relative to each other. A Preferred Approach can be a single solution or combination of solutions (for example, a new water source combined with leakage savings), and can address need in a single WRZ or across multiple WRZs (for example a solution that addresses a local need or a larger solution that addresses multiple supplies).

Plan level preferred approaches are initially developed to a level of detail that allows us to complete outline design and costing. The preferred approaches identified by our Plan will then be prioritized and, if funded through a regulated Capital Investment Plan, taken forward to detailed design and planning, thus maintaining alignment with the Plan objectives.

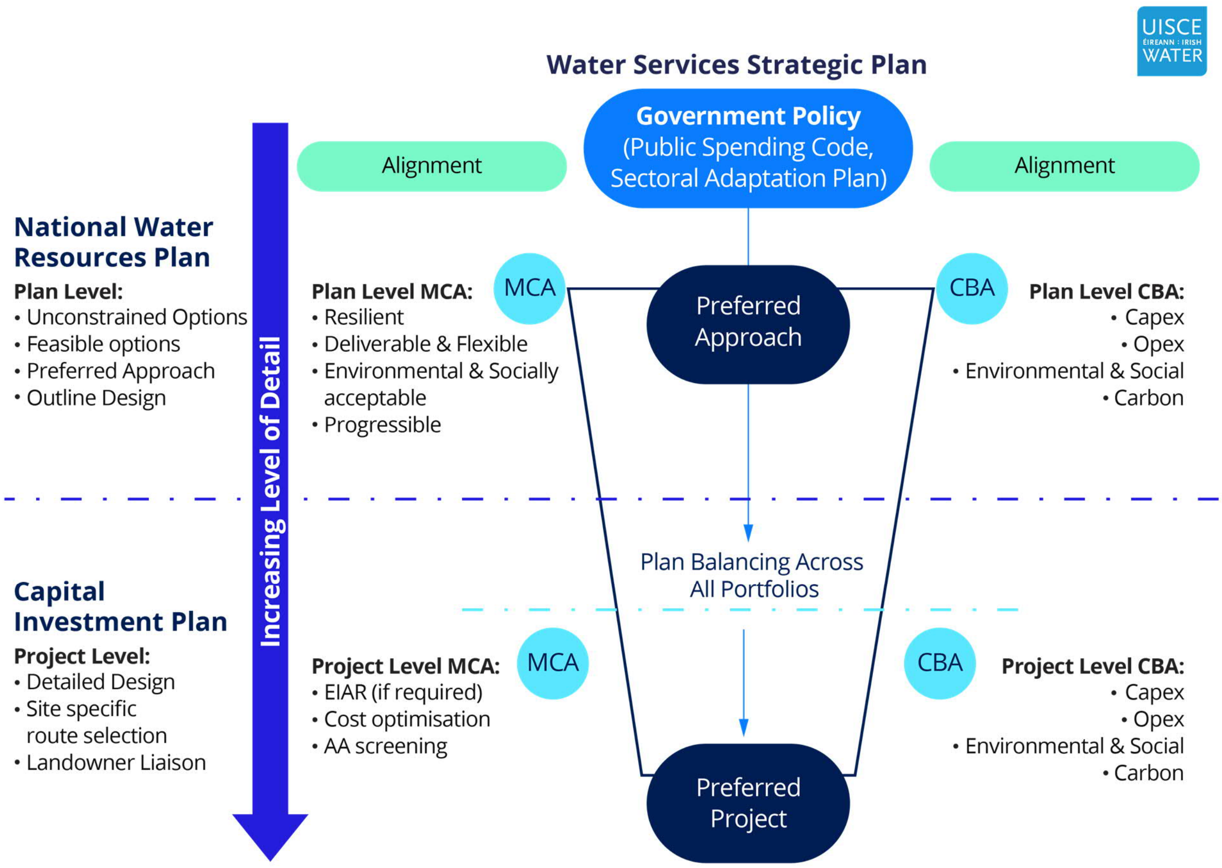



Figure 8.2 – Plan to project alignment

However, as this is the first National Water Resources Plan that Irish Water has prepared it has been determined that a phased approach should be adopted. In this draft Framework Plan (Phase 1), the issues and need have been explained and assessed, and an Options Assessment Methodology is described in this Chapter.

Once this draft Framework Plan has been finalised, the options assessment methodology will be applied to each WRZ in the Regional Water Resources Plans and possible solutions identified and consulted on (Phase 2).

The solutions must reduce risk to our water supplies in the short, medium and long term. Each solution or Preferred Approach must consider the longer-term objectives of Irish Water, as set out in our Water Services Strategic Plan, other national policy objectives and the need to transform our existing asset base. We must comply with the Irish Government's Public Spending Code and ensure alignment with DHPLG Sectoral Adaptation Plan for Water and Water Quality. The process of project & programme evolution is described in Figure 8.2.

## 8.2 New Options Assessment Methodology – Criteria

Since the establishment of Irish Water, there have been two regulated investment cycles completed, and a third is ongoing (Revenue Control 3). The first two cycles were focussed on closing out projects that were carried over from the DPHLG Water Services Investment Plan, with some degree of re-scoping, while also introducing for the first time a range of asset maintenance programmes in priority areas (Health & Safety, disinfection upgrade, mains replacement & leakage management).

In terms of water supply, the key focus of this regulated investment cycle Revenue Control 3 (2020-2024) is to address critical drinking water compliance and chronic leakage issues.

The National Water Resources Plan will inform future investment cycles by enabling risk-based prioritisation of capital investment, allowing us to address need across the entire water supply asset base. In order to align with the requirements of our regulators and Public Spending Code, the process must be transparent, robust and subject to established governance. This will ensure alignment is maintained between the objectives of the National Water Resources Plan and the development and delivery of projects and programmes.

Our methodology to identify approaches within the Plan aligns with the seven standard steps set out in the Department of Public Expenditure and Reform guidance document "*Public Spending Code: A Guide to Evaluating, Planning and Managing Current Expenditure*". The key stages of the Options Assessment Methodology process are illustrated in Figure 8.3 and summarised below.

a) Identify the Need based on the SDB (Chapters 3, 4 & 5) and/or DWSP Barrier Assessment (Chapters 5 & 6) and scope the study Areas (Phase 2: Regional Water Resources Plans)

b) Option Development: Unconstrained Options Coarse Screening and Fine Screening through Multi Criteria Assessment (Options Assessment and scoring against the key criteria to verify Option Feasibility and understand key risks and constraints)

c) Feasible Option List: Option costing encompassing Direct and Indirect Costs including Environmental and Social Costing;

d) Test a Range of Approaches: Analyse the main feasible options;

e) Approach Appraisal: based on risk

f) Preferred Approach – the combination of options that present the best value approach to resolve need at Plan level.

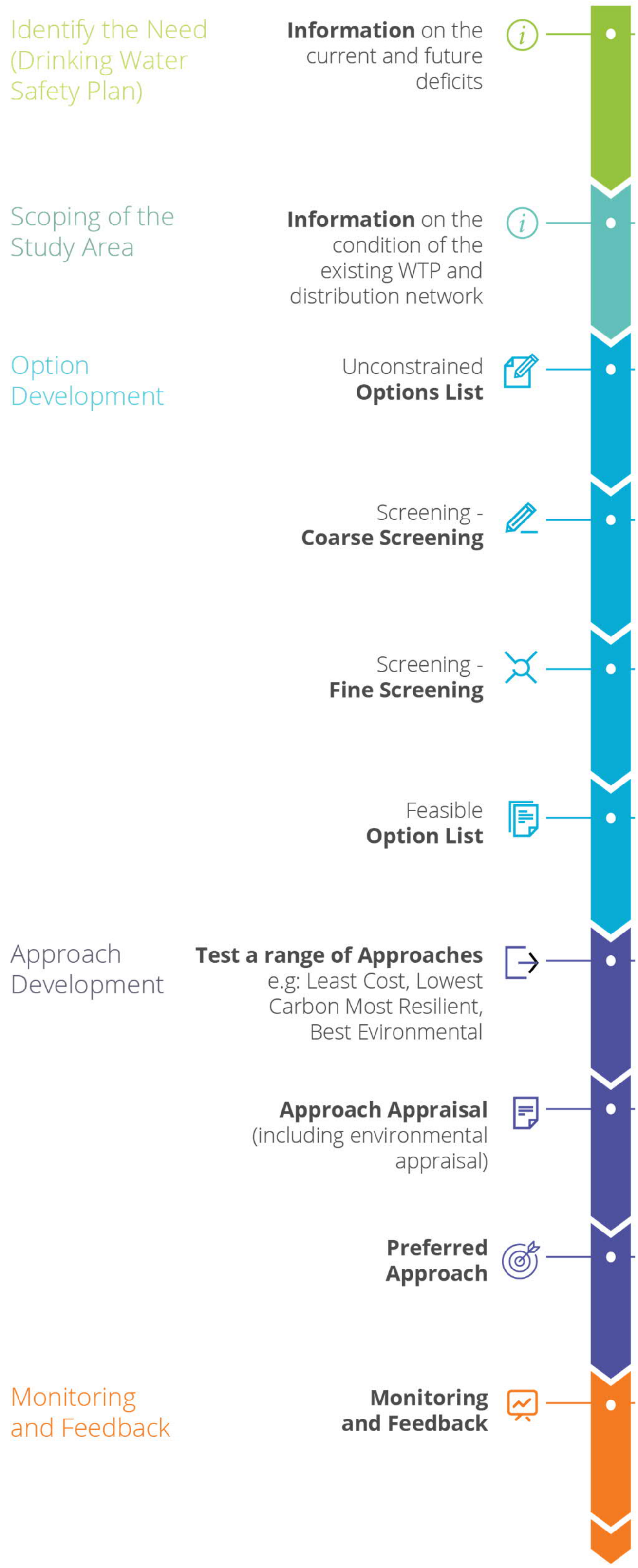



Figure 8.3 – Option Development Process

Table 8.1 shows how at a Plan level they correspond to the seven standard steps in the Public Spending Code.

Table 8.1 – Comparison between Public Expenditure and Reform Guidance and our Methodology

| Department of Public Expenditure and Reform Guidance Standard Steps | Corresponding Step(s) in our Methodology | Framework Plan Section |
|---|---|---|
| 1. Define the Objective | a) Identify the Need & Scoping the Study Area | 4, 5, 6 & 7 |
| 2. Explore options taking account of constraints | b) Option Development: Unconstrained Options & Coarse Screening | 9.3.3 – 9.3.4 |
| 3.Quantify the costs of Viable options and specify sources of funding | c) Feasible Option List: Plan Level Option Costing encompassing Direct & Indirect Costs (including environmental & social costs) | 9.3.6 |
| 4. Analyse the main options | d) Test Range of Approaches | 9.3.7.1 |
| 5. Identify the risks associated with each viable option | c) Multi Criteria Assessment | 9.3.5 |
| 6. Decide on a preferred option | e) Approach Appraisal | 9.3.7.2 |
| 7. Make a recommendation to the Approving Authority | f) Preferred Approach (Those that are prioritized are advanced through the regulated Capital Investment Plans) | 9.3.7.3 |

This Chapter describes the Option Development Process (methodology) we will use to develop a preferred approach to address in each WRZ need.  It sets how we will test a range of options (in isolation and combination) against a range of criteria which reflect the objectives of the NWRP and its associated Strategic Environmental Assessment.

Our proposed options assessment methodology is based around the following five criteria:

- Resilience;
- Deliverability and Flexibility;
- Progressibility;
- Sustainability (Environmental and Social Impacts); and
- Cost.

### 8.2.1 Resilience

A resilient water resource is one with enough capacity to mitigate the impacts to water supply when operational issues occur. These issues include:

- Unplanned outages;
- Low flows or flooding exacerbated by climate change; and
- Regulatory changes.

A resilient system is also one which does not commit us to long term operational risks, high carbon and energy intensive projects.

The key constituents of the resilience criterion are shown in Figure 8.4.

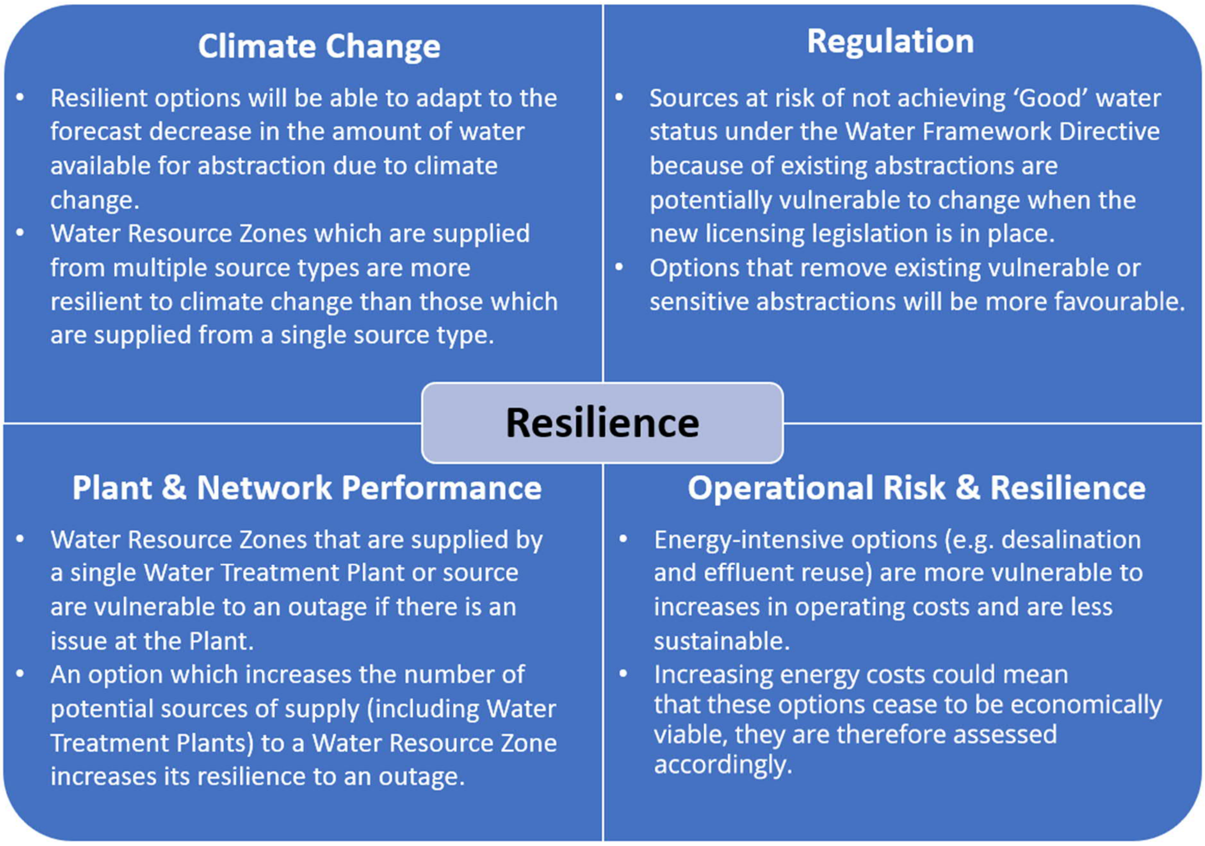



Figure 8.4 – Components of the Resilience Criterion

### 8.2.2 Deliverability and Flexibility

It is important that the options we promote to address a need can be implemented or constructed safely within required timeframes and are flexible to allow for future adaptation as water availability or demand changes. It includes the following two main sub-criteria:

- **Deliverability** – considers the practicality of building or implementing an option or options; and
- **Flexibility** – considers how adaptable an option will be to future changes in demand and the environment.

Further details of the Deliverability and Flexibility Criterion are provided in Figure 8.5.

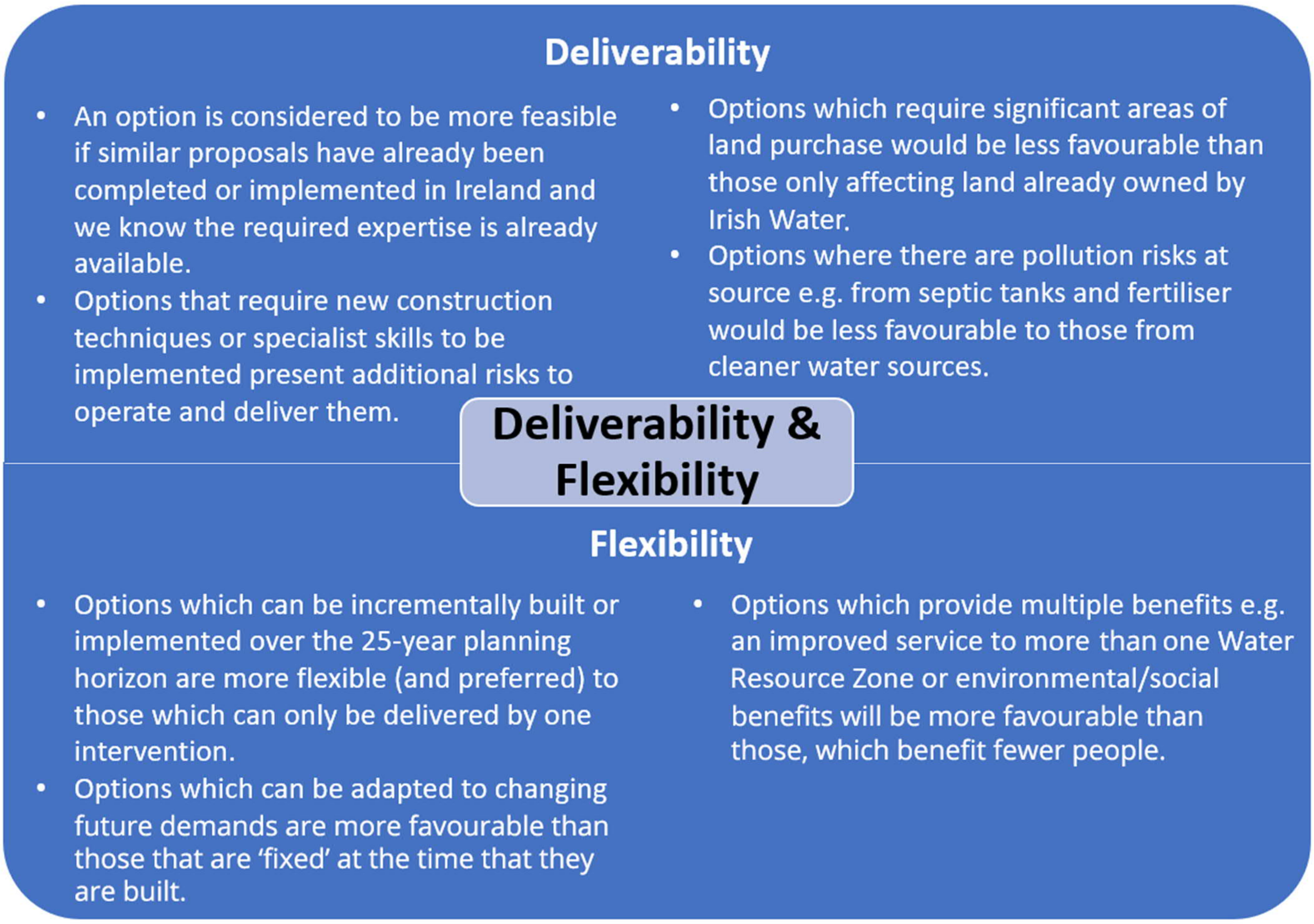



Figure 8.5 – Components of the Deliverability and Flexibility Criterion

### 8.2.3 Progressibility

Within resource planning, it is important that the options proposed to address need satisfy strategic, national and local planning objectives.

This criterion is to help us understand the relative difference between options, and how progressible different options may be. The purpose of this criterion is not to eliminate options, but to give maximum consideration to the potential challenges that might be encountered, should they be progressed. This also allows us to factor into our plan level delivery timeframes, complex consent submissions. Figure 8.6 shows the main component of this criterion:  Planning Considerations


Figure 8.6 – Components of the Progressibility Criterion

### 8.2.4 Sustainability (Environmental and Social Impacts)

The Sustainability (Environmental and Social impacts) scoring criteria are based on the objectives defined for the SEA. AA is also integrated into the environmental assessment process. Aligning the Options Assessment process with the SEA allows the environmental assessment to be integral to and influence the assessment and eventual selection of the Preferred Approaches. This ensures that options which have a likely unacceptable environmental and social impact, particularly in relation to European and National designated sites are discounted at coarse screening.

The criteria under these objectives which the options are assessed against are:

- Population, economy, tourism and recreation, and human health;
- Water environment;
- Biodiversity (including flora and fauna);
- Material assets;
- Landscape;
- Climate change;
- Cultural heritage; and
- Geology and soils.

### 8.2.5 Cost

When comparing the costs of different options at a Plan level, it is important that all costs i.e. the total investment costs and monetised environmental and social impact costs are considered. Figure 8.7 shows how options appraisal approach in the NWRP considers costing.

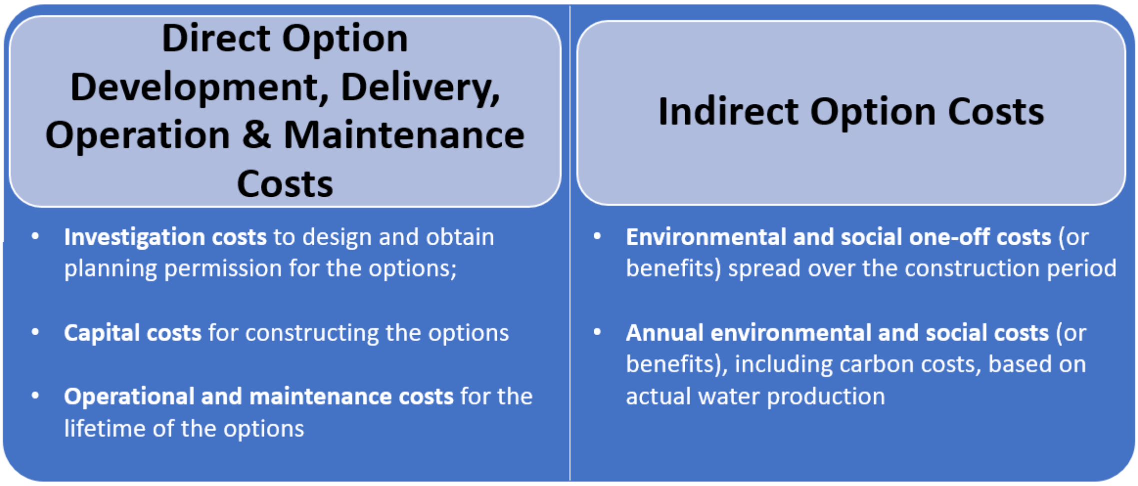



Figure 8.7 – Components of the Costing Criterion

During the assessment process, no option will be discounted on the basis of cost alone at the initial Option screening stages. This ensures that due consideration is given to all selection criteria.

Therefore, an Option with the lowest Direct Cost will not necessarily be chosen. Indirect Option Costs (Environmental and Social Costs) also influence the selection of Options. Further detail on Environmental Costing is included in Appendix M.

## 8.3 A New Options Assessment Methodology

As outlined in Figure 8.8, there are 8 key stages in the New Options Assessment Methodology.

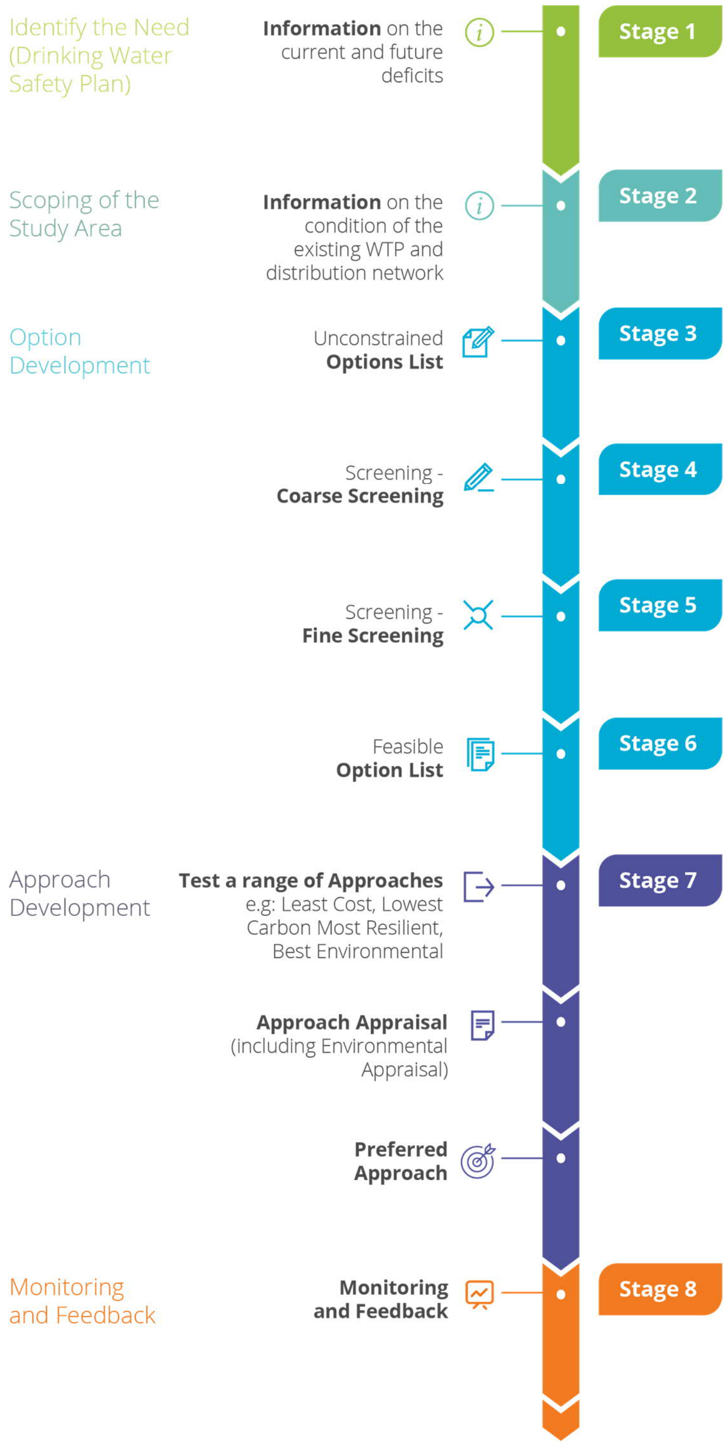



Figure 8.8 – Option Assessment Methodology

### 8.3.1 Stage 1: Identify the Need

The process starts with the Needs Identification Process (both quantity and quality), as described in Chapters 3 to 6 of this draft Framework Plan. This provides context for the Options Assessment Methodology and informs the scale of the solutions required.

### 8.3.2 Stage 2: Scoping of the Study Area

In order to manage the roll-out of the Options Assessment Methodology and the delivery of the Regional Water Resource Plans, we have split the public water supply into the four Group Areas shown in Figure 8.9.

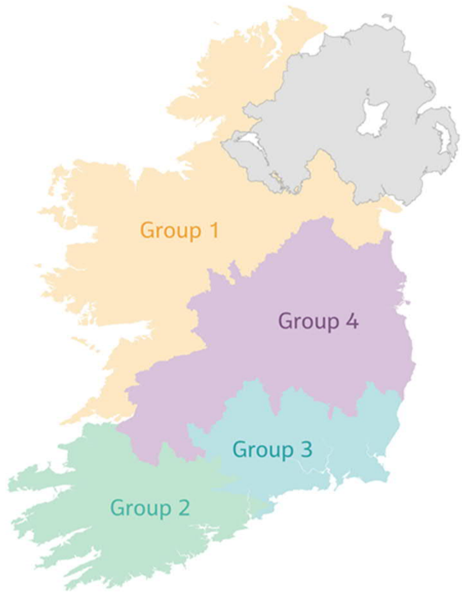



Figure 8.9 – Regional Groups

These regional groups are further subdivided into Study Areas which are clusters of Water Resource Zones termed Study Areas. Grouping WRZs into Study Areas means that:

- Options can be developed that address multiple problematic supplies, which allows for consideration of efficient regional solutions to resolve local needs in more than one supply
- Broader strategic decisions are made when looking at multiple WRZs

The Study Area boundaries are based on WFD catchments and WRZ location and type (urban and rural). Further details on grouping WRZs into study areas are provided below.

#### 8.3.2.1 Urban Areas

Urban WRZs are defined as those that comprise major settlements as defined by the National Planning Framework, Regional Assemblies and Local Authorities. The raw water sources used to supply these areas are identified and if neighbouring WRZs also abstract from the same water bodies, they are included in the Study Area. This allows us to assess cumulative impact on water bodies and ensures that all abstractions from the one source are coordinated. For example, if there are multiple abstractions from the same river supplying different WRZs, the combined effect of these abstractions might be missed if they were considered on a single WRZ basis.

#### 8.3.2.2 Rural Areas

In rural areas we strive to develop geographical groups of small WRZs to form Study Areas. This approach allows us to consider regional solutions for these water supplies. The geographical groups can be within an individual county or cross multiple county boundaries.

#### 8.3.2.3 Identify Needs for the Study Area

Data is gathered for each individual study area including, but not limited to:

- The **Water Quality** that can be supplied;
- The **Water Quantity** that can be supplied;
- The **Sustainability** of our sources or infrastructure; and
- The **Reliability** of our assets.

A detailed programme of consultation and Workshops is then conducted with Local Authority operators and stakeholders, to ensure a full and comprehensive understanding of need across the given Study Area. Further details on the data queries considered at these workshops at each study area are summarised in Table 8.2.

Table 8.2 – Data gathering activities during consultation

| | |
|---|---|
| **Water Quality** | What is the performance and condition of our existing WTPs?<br>Are our WTPs at risk of not treating water to the required quality standards?<br>Are there any distribution network challenges contributing to water quality issues? |
| **Water Quantity** | What is the quantity of water that our WTPs and networks currently provide?<br>Can the output from our WTPs be increased without affecting water quality?<br>Is the condition of our WTPs or network affecting the quantity of water we can supply? |
| **Sustainability** | Is a source sustainable for the long term or is there a risk our abstraction will be reduced by future legislation?<br>Are our WTPs sustainable or are they too costly and/or risky to operate and maintain?<br>Is the WTP sustainable in terms of energy use and carbon and climate change visibility? |
| **Reliability** | Are any critical assets at risk of failure which could impact supplies?<br>Is asset performance reliable or are quality outputs variable? |

This allows us to include any essential maintenance or refurbishment work required within a WRZ to be considered at the Options Stage. If a water treatment plant in the study area is coming to the end of its operating life and will require a complete refurbishment within the next 10 years, the capital cost of this needs to be considered in the proposed Options. The methodology also assumes that we will continue to invest in Capital Maintenance in order to ensure that viable plants are maintained at full serviceability. These requirements are identified through the Asset Management Process underpinning the Capital Maintenance Investment.

At this stage we also consider the reliability and environmental impact of our existing abstractions. This will allow us to identify sites where capacity required is not likely to be reliably available. This will also allow us to identify situations where we must reduce or remove our existing abstractions within the coming years.

### 8.3.3 Stage 3: Option Development: Unconstrained Options List

The SDB and the Barrier Assessment inform the type and scale of options that we must consider. These Options will be taken from the generic water resource types that are shown in Figure 8.10 and Table 8.3. Sub-variants of each Option type are also considered.

Whilst Options are considered individually, an approach to meet identified need may be provided from a combination of these Options. For example, to meet a deficit of 10 million litres per day, the Preferred Approach could be achieved by increasing an abstraction from an existing source by 6 million litres per day, reducing leakage by 3 million litres per day and reducing consumption through demand management measures by 1 million litres per day (aligned with our Three Pillar approach).

An "Unconstrained Options" list is developed from our Generic Option types.

The Unconstrained Options constitute all of the **possible solutions**, which either fully or partly resolve a water supply deficit, regardless of any cost, environmental or social constraints. In developing the Unconstrained List, we identify options that are applicable to meet the needs of the study area. This includes:

- A review of any options identified by Irish Water that have not been committed to in the current Investment Plan;
- A review of options previously considered by Local Authorities;
- A review of options identified in other strategy documents, approaches and projects; and


Figure 8.10 – Option Types

- Ideas generated at Workshops with regional operational staff drawing on their knowledge and experience of the supply system and the geographical area.

We do not generally include Options that we know will not be practicable to implement or suitable to address need.

The Unconstrained Options list can include solutions at a WRZ, Study Area, Regional Group Area or even National level.

Table 8.3 – Option types

| NWRP category | NWRP sub-category | Summary |
|---|---|---|
| **Lose Less** | | |
| Leakage Reduction | | Reducing leakage from our network is a priority for Irish Water. This can involve a range of measures for actively detecting and repairing leaks such as the installation of meters to better identify customer leakage activity and advanced monitoring tools and techniques to better identify leaks.<br>Leakage reduction will focus on Active Leakage Control, targeted replacement of ageing pipes, pressure management to minimise fluctuations and excessive pressures, providing more constant pressures to our customers whilst reducing bursts and the application of different leak repair approaches to minimise cost and disruption. |
| **Use Less** | | |
| Water Efficiency | Education & Awareness | Educational awareness campaigns and partnerships to raise awareness of water shortages and encourage water conservation and efficiency. |
| | Water Efficiency Measures | Use of water efficient products and processes in new and refurbished housing developments and working with building standards to ensure that water efficiency measures are included in standards and regulations as mandatory. Encouraging take up of water efficiency measures by domestic and non-domestic customers such as more efficient appliances, repair of leaking toilets, use of water audits.<br>Actively pursue business customers and industry for partnerships that involve water efficiency goals.<br>Investigate how to use water within Irish Water's existing assets more efficiently through improved treatment processes and recycling of effluent water for appropriate uses. |
| | Recycling and Reuse | The recycling of treated wastewater or grey water provides a critical supplementary water source for non-potable activities therefore alleviating stress on primary water sources. Grey water refers to the water used in baths, sinks, washing machines, and other kitchen appliances. In periods of drought, when potable water is in short supply, grey water can be a potential alternative water source for activities such as agricultural and landscape irrigation, industrial process, and toilet flushing. |
| | Metering | Domestic water metering can build a better understanding of water use and network pressures to improve water efficiency and therefore water security and identify leaks.<br>Water meters with advanced analytics to undertake flow balances across the network can allow Irish Water to gain a better understanding of the whole network from the abstraction point to the customers |

| NWRP category | NWRP sub-category | Summary |
|---|---|---|
| **Supply Smarter – resource supply options** | | |
| Surface Water | Surface Water Abstraction | Increasing the abstraction at an existing river or lake source or developing a new river or lake source from which water can be sustainably abstracted. These options would be subject to an abstraction licence. |
| Groundwater | Groundwater Abstraction | Increasing the abstraction at an existing groundwater source or developing a new groundwater source from which water can be sustainably abstracted. These options would be subject to an abstraction licence. |
| | Aquifer Storage Recovery | Storage of treated or raw water in suitable aquifers. During times of plentiful water supply, excess water withdrawn from a river, lake or another groundwater source is injected and stored within an aquifer. This supplementary stored water can be extracted from the aquifer during periods of dry weather and/or increased demand when the primary supply sources are running low. This requires aquifers with suitable characteristics to be available as the risks of losses can be high. |
| Reservoirs | Storage Reservoirs | Provision of storage reservoirs which can be filled with untreated water abstracted during high flow conditions from surface waters to be drawn on during low flow periods or to provide additional resilience during droughts as a back-up supply source. |
| Catchment Management | Catchment management for ground or surface water sources | Activities such as agriculture, forestry, industry and waste management all have an impact on the retention of water in the catchment and the quality of the water within rivers and lakes. Pollutants in the water can lead to ecological deterioration, increased flood risk and can also create issues for water treatment. There may be scope for changes to land management through working in partnership with landowners, farmers and regulators to develop agreements and share information and resources to provide long term improvements with wide benefits including water suitable for supply from surface or groundwaters. |
| Effluent Reuse | Effluent Reuse | Recycling of wastewater effluent from treatment plants can produce a new supply source from wastewater which is otherwise discharged to rivers or the sea. This involves treating wastewater to a sufficiently high standard to meet supply standards relevant for the intended use for example for agricultural/horticulture/industry or for release to rivers to compensate for an abstraction upstream. |
| Desalination | Desalination:<br>Coastal or Brackish | This involves the process of removing salt and other minerals from seawater or brackish water from river estuaries to make it suitable for human consumption and/or industrial use. The level of treatment required is related to the salt concentration of the water and variability of raw water characteristics. |
| Water Transfers | Transfers | Water transfer is the physical movement of water from one area to another usually via pipelines. These generally refer to the transfer of treated water and can vary considerably in scale in terms of size and length from local transfers from one WRZ to another, to regional transfers and inter-utility transfers (from Northern Ireland Water). |

| NWRP category | NWRP sub-category | Summary |
|---|---|---|
| | Tankering | Delivery of treated water to customers via road tanker to alleviate temporary short-term water shortages in certain localised situations. |
| Network Improvements | Network Improvements (general) | Network improvement involves works such as upgrade, replacement or operational improvements. They are undertaken to facilitate better water distribution and avoid network limitations. Therefore, strategic network reinforcement improving connections between different sources and customer supply can significantly improve security and resilience. |
| | Service Reservoir Expansion | Service reservoirs store treated water. They are used to balance out the steady supply of treated water they receive from WTPs and the fluctuating variations in customer demand during a 24-hour period. They can also be used to store a backup supply in low flow events but for a limited period of time. |
| WTPs | WTP Expansion/ Rationalisation | Expansion of existing WTPs to facilitate the treatment of a higher volume of water. This option would be considered in combination with an increase of a surface water or ground water abstraction or the provision of a new surface water our ground water source. Expansion of existing WTPs may be carried out as part of a rationalisation process which involves the merging of WTPs. Rationalisation is carried out to reduce water supply costs, take a malfunctioning WTP out of service or to cease abstraction from an unsustainable source. |
| | WTP Process Losses | For every litre of untreated water extracted from a source and fed through a WTP to the supply distribution network, a small fraction of the water will be lost from the system as a result of the treatment losses. Generally, WTPs are designed to recover, treat and recycle as much of the waste stream as economically feasible. However, there can be opportunities to improve efficiency through the upgrading and installation of more complex treatment processes to reduce these process losses and therefore increase the WAFU. |

### 8.3.4 Stage 4: Coarse Screening

The Unconstrained Options list is refined using a Coarse Screening assessment, which enables us to rule out any non-viable options. The remaining options, known as "Constrained Options" can then be carried forward for more detailed Multi Criteria Assessment at the Fine Screening Stage.

The Coarse Screening assessment uses the criteria listed in Table 8.4, with Options scored against a red, amber or green traffic light system shown in Table 8.5.

Any Option which scores "red" against a question has a fundamental issue that would be difficult to mitigate and is discounted on the basis that it is unlikely to ever be delivered.

An amber rating across any of the coarse screening criteria will not rule out an option, however, it will highlight that this option may require mitigation. For example, a surface water abstraction from a source which is designated as a European site will obtain an amber rating (assuming that it meets the allowable abstraction limit) against the Deliverability and Flexibility criterion and Sustainability (Environmental and Social Impacts) criterion. However, such an Option will most likely require mitigation which will take time to develop. Therefore, we must allow for consideration of the likely environmental site assessments and studies that will need to be carried out within the Plan level costing for an Option.

A 'Rejected Options Register' is produced to record and explain all Options that are screened out on the basis of a red rating.

Table 8.4 – Unconstrained Options Assessment criteria

| Criteria | Unconstrained Option Assessment questions | | Assessment Score |
|---|---|---|---|
| Resilience | Q1 | Does the Option address the supply-demand problem? | Yes / Maybe / No |
| Deliverability and Flexibility | Q2 | Is the Option technically feasible? | Yes / Maybe/ No |
| | Q3 | Can the risks and uncertainties associated with the Option be mitigated to avoid failure of the Option? | Yes / Maybe / No |
| Sustainability (Environmental and | Q4 | Can the impacts on known high level environmental constraints including at internationally designated sites be avoided? | Yes / Maybe / No |

Table 8.5 – Red, Amber and Green decision matrix

| RAG matrix | Red | Amber | Green |
|---|---|---|---|
| Resilience | Does not address the supply-demand problem at all. | May address part of the supply-demand problem (with due consideration on the size of the deficit). | Fully addresses the supply-demand problem. |
| Deliverability & Flexibility | Option is not technically feasible. Associated risks and uncertainties are unacceptable and will result in a failure of the option. | There are some risks and uncertainties associated with the Option but are not considered to be insurmountable at this stage. | Option is technically feasible. There are no associated risks or uncertainties which are unacceptable. |
| Sustainability (Environmental and Social Impacts) | Likely unacceptable impacts on European designated sites or WFD objectives* which cannot be avoided through design or mitigation.<br>***** Options that cannot meet sustainable abstraction limits are removed/red rating | There are some impacts identified. However, they are not considered to be prohibitive at this stage due to the potential for improved design and/or mitigation. | No major issues or sensitivities identified at this stage. |

### 8.3.5 Stage 5: Fine Screening

Fine screening involves an analysis of the Constrained Options against a range of detailed assessment criteria, through a process known as Multi Criteria Assessment (MCA). The objective of the MCA and the fine screening process is to determine the potential benefits and impacts of the Options across a range of key criteria. It involves dividing the decision into smaller, more understandable parts and analysing each part before integrating those parts to produce a meaningful assessment.

The MCA process allows a combination of issues to be considered together. This can help indicate if one Option will be more: cost effective, environmentally acceptable, promotable, resilient or feasible when compared to other Options. This process requires a more detailed analysis of the Options and their potential benefits and impacts against the key criteria. This allows us to highlight issues with Options which were considered to be feasible at the coarse screening stage but on further review are not considered viable.

The MCA methodology has been tailored to provide a structured and transparent approach to inform the decision-making process and to remove subjectivity, as far as reasonably possible. It also recognises that both monetary and non-monetary objectives may influence decisions.

The MCA approach applies a common set of questions to determine the relative merits of each option across the key criteria. The questions are developed by dividing the criteria from the coarse screening stage into detailed sub-criteria against which options can be assessed. Table 8.6 lists the criteria, sub-criteria and questions that are applied at the Fine Screening Stage.

Table 8.6 – Fine Screening Questions

| MCA criteria | Sub-criteria | Fine screening questions |
|---|---|---|
| Resilience | Outages | Is there vulnerability due to failure/outages caused by, for example, flooding, pollution, damage, freeze-thaw, loss of power supply?<br>Is there provision of additional resilience (from new Option) to outage events at existing sources? |
| | Financial uncertainty | Is there vulnerability due to increasing energy or commodity prices? |
| | Regulatory changes | Is there vulnerability to future regulatory and legislation changes including changes to environmental legislation? |
| | Climate change | Is there improved resilience for Irish Water due to climate change and / or drought conditions? |
| Feasibility and Deliverability | Flexibility | Are there benefits due to short lead in time to deliver the Option?<br>Is there phased or incremental delivery of the Option?<br>Is it possible to adapt the option once delivered, to meet any future changes?<br>Are there benefits due to a short ramp-up time for the Option to deliver potable water into supply? |
| | Deliverability | Is there experience in delivering similar solutions (technology or construction methodology known to Irish Water)?<br>Is there deliverability uncertainty due to land ownership or suitable land availability?<br>Are there construction uncertainties due to land stability or contamination risk? |

| MCA criteria | Sub-criteria | Fine screening questions |
| --- | --- | --- |
| | | Is there dependency on existing assets for successful delivery?<br>Are there any major issues with the Safety, Health and Welfare at Work (Construction) Regulations, 2013 that could change the scope or put at risk the successful delivery of the option?<br>Is the required technology tried and tested with Operations Department?<br>Is there quality and confidence of design information? |
| Progressibility | Sustainability | Are there any major local planning issues that could change the scope or put at risk the successful delivery of the Option?<br>Are there any major issues with regulatory consents or permissions that could change the scope or put at risk the successful delivery of the Option? |
| | Synergies | Are there synergies with other WRZs, other water companies on the island of Ireland, in the UK, or third parties? |
| Sustainability (Environmental and Social Impacts) | Population, health, economy & recreation | Will the Option impact public health and quality of life, during construction?<br>Will the Option impact public health and quality of life, during operation?<br>What is the impact on recreational amenities? |
| | Water environment: quality & resources | Would the option or associated construction activities affect WFD Status of water body, in terms of quantity and quality for surface water?<br>Would the option or associated construction activities affect WFD Status of water body, in terms of quantity and quality for groundwater?<br>Would the option or associated construction activities affect WFD Status of water body, in terms of hydro morphology?<br>Would this Option reduce pressure on water environment through water savings?<br>Is there a potential for this option to increase flood risk – e.g. increase base flow or result in loss of flood plain?<br>Will Navigation be affected? |
| | Biodiversity, flora and fauna | Is there potential to result in adverse effects on the integrity of a European site?<br>Is there potential to impact on an Annex species outside European designated areas?<br>Is there potential to impact on National designated sites?<br>Is there potential to impact on Biodiversity in all other areas?<br>Is there a risk of spreading Invasive Non-Native Species (INNS)? |
| | Material assets | Will the Option make effective use of existing assets?<br>Will this Option conflict with critical infrastructure, or does the option conflict with existing business, planned land use or valuable agricultural land? |

| MCA criteria | Sub-criteria | Fine screening questions |
|---|---|---|
| | Landscape and visual amenity | Could this Option impact the landscape character areas, townscape character areas or important views (detract or improve)? |
| | Climate change | What is the level of construction and operational carbon emissions associated with the Option (tonnes)? |
| | Cultural heritage and archaeology | Does this option avoid direct damage to, or detract from the setting of, designated cultural heritage assets, or does this contribute to protecting them? |
| | Geology and soils | Would any designated or non-designated geological features, valuable soils, or contaminated land sites be affected? |

Each Option is subject to an objective assessment with uniform scoring criteria, based on best publicly available datasets. Options are scored using a seven-point Likert scale, from -3 to 3, as set out in Appendix N.

The environmental MCA criteria are linked to the SEA objectives developed from the SEA Scoping Report through consultation with environmental stakeholders. Some criteria/screening questions may be more relevant to some Options types than others, and where a criteria or sub-criteria is not relevant it is simply considered as “not-applicable” (N/A) and is discounted in the overall appraisal of the Option. Where criteria are found not to be relevant for comparing between Options within a particular study area, they can be put aside to focus the assessment.

Appropriate Assessment has been integrated into the Options Assessment Methodology in particular through the MCA/ fine screening assessment questions and scoring for the European sites (biodiversity) question (see Best AA approach, Table 8.6)

The screening process provides MCA scores for each of the Feasible Options which then pass through to the Approach Appraisal stage for further consideration.

Where there are a very large number of Options covering a range of Option types, fine screening can be used to identify poorly performing options. These can be removed or placed on a reserve list for future consideration should they be required.  Options that passed through the constrained options stage might also be removed at fine screening if a more detailed assessment shows them to be unsuitable.  Any Options which are discounted at this stage are recorded on the Rejected Options Register. Better performing Options are taken forward for further consideration in the feasible list. This method can be appropriate for large WRZs or study areas.

Only Options identified as clearly not feasible, unsustainable or unacceptable will be removed. Where Options perform poorly against specific sub-criteria, the potential for design or mitigation to address effects will be considered. If there is any doubt as to whether a particular Option should be classified as feasible or not, then that Option will be carried forward to the feasible list with risks identified.

### 8.3.6 Stage 6: Feasible Options List – Option Costing

The output of the Fine Screening stage is called the Feasible Options List.  A Plan Level outline design and estimated cost is developed for each option on the list.  “Whole life” construction and operation costs are based on Irish Water’s PCT (Project Costing Template) to ensure alignment with Irish Water’s investment processes.

It should be noted that assessments at this stage are desk based and plan level assessments. Environmental impacts and costing of projects are further reviewed at project level where alternatives will need to be considered as part of the Environmental Impact Assessment process in the usual way. No statutory consent or funding consent is conferred by inclusion of any option in the Regional Water

Resources Plan. Any projects that are progressed following identification as Preferred Approaches in the Regional Plans, will require individual environmental assessments in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions).

As the Plan level costing is intended to be a comparative assessment between Option types, we do not include detailed project level costing for “In-Flight Projects”. This is to ensure that the Framework Plan methodology is uniformly applied in the development of the Preferred Approach.

### 8.3.7 Stage 7: Approach Development

#### 8.3.7.1 Test a Range of Approaches

The purpose of the Regional Water Resources Plans will be to examine all potential Options that could be used to address identified need and then to eliminate those that are not feasible or that have identifiable environmental issues (at a desktop level).

After fine screening the remaining Feasible Options are assessed against a specified number of Approaches. We test the Options against six approaches which were selected to align the NWRP with all relevant Government Policy. The six approaches are summarised in Table 8.7 and discussed in further detail.

Table 8.7 – Range of Approaches to Test Feasible Options

| Approaches Tested | Description | Policy Driver |
|---|---|---|
| Least Cost | Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social and Carbon Costs | Public Spending Code |
| Best Appropriate Assessment (Best AA) | Lowest score against the European Sites (Biodiversity) sub-criteria question:<br><br>Score = 0 equates to no likely significant effects (LSEs). If, in our opinion, these 0 scoring options meet the deficit/ plan objectives, they are automatically picked as the Preferred Approach.<br><br>Score = -1 or -2 equates to LSEs that can be addressed with general/standard mitigation measures.<br><br>Score = -3 equates to LSEs that may be difficult to mitigate. Options scoring -3 are assessed and given alternative scoring options identified where possible. | Habitats Directive |
| Quickest Delivery | Based on an estimate of the time taken to bring an option into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening<br><br>This is particularly relevant where an option might be required to address an urgent Public Health issue. | Statutory Obligations under the Water Supply Act 2007 and Drinking Water Regulations |
| Best SEA Environmental | This is the option or combination of options with the highest total score across the 19 No. SEA MCA sub-criteria questions | SEA Directive and WFD |
| Most Resilient | This is the option or combination of options with the highest total score against the resilience criteria. | National Adaptation Plan |
| Lowest Carbon | This is the option or combination of options with the lowest embodied and operational carbon cost | Sectoral Adaptation Plan |

### Least Cost Approach

The Least Cost Approach is determined using a Net Present Value assessment tool which establishes the Option or combination of Options with the lowest comparative Net Present Value cost encompassing: Environmental and Social Costs, Carbon Costs, Capital Costs and Operational Costs. We consider this approach to allow our plan level assessments to align with the requirements of the Public Spending Code and the National Adaptation Framework.

### Best Appropriate Assessment (Best AA) Approach

The Best AA approach gives maximum consideration to the Options with no potential for impacts on European Designated (no Likely Significant Effects or LSEs) sites or Options with LSEs that can be addressed with general/standard mitigation measures at the project level. It puts avoidance of impacts on European sites at the forefront taking account of the fact that Options with a high likelihood of significant effects which could lead to adverse effects on a European Site have already been removed at Coarse Screening stage.

### Quickest Delivery Approach

The quickest delivery is based on the estimated time for an option to be brought into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening. This approach allows us to potentially optimise the Preferred Approach by minimising the time taken for an Option to be become operational. This could be appropriate in a WRZ with a critical water quality issue that might impact on public health, as this approach would identify the Option that could potentially be delivered in the shortest possible timeframe.

As the NWRP does not confer funding or statutory consent for any project, and on a national basis the Needs across 539 WRZs must be prioritised, we would be unlikely to modify an approach based on Quickest Delivery, unless there is a critical driver.

### Best Environmental Approach

The Best SEA Environmental Approach is the Option or combination of Options performing best overall across the 19 SEA objective-based MCA environmental criteria, assessed as part of the Fine Screening assessment described in Section 8.3.5. Positive and negative scores are summed separately. The purpose of this approach is to ensure that the SEA objectives to minimise potential impact are considered through the Options Assessment and Approach Selection process. For each Option or combination of Options, we assess the MCA scoring in detail across all SEA assessment criteria, using the sum of positive scores as well as the sum of negative scores. We also review the scoring against individual criteria to identify where assessment reflects important differences between Options focusing on potential operational or long-term effects. This ensures that we can review the relative merits of each Option.

### Most Resilient Approach

The Most Resilient Approach is the Option or combination of Options with the highest scores from the four MCA screening questions relating to Resilience criteria. This approach is aligned to the NWRP objective to ensure a safe and secure water supply in the short, medium and long term.

### Lowest Carbon Approach

The Lowest Carbon Approach is the Option or combination of Options with the lowest embodied and operational carbon costs. This approach is aligned with Irish Water's carbon reduction policies and the NAP in relation to climate change.

### 8.3.7.2 Approach Assessment Ranking

Depending on the complexity and size of the WRZ or Study Area, the best performing Feasible Options for each of the six approaches are determined using either:

• EBSD (Economics of Balancing Supply and Demand) Lite; or

• EBSD Model

#### EBSD Lite

The Preferred Options to meet the need for each of the six Approaches (Least Cost, Best AA, Lowest Carbon etc.) are derived by ranking the Options in order of lowest to highest total NPV cost and with regard to their applicable MCA scores for the six Approaches.

This approach is generally better suited to smaller WRZs and Study Areas, as it allows for a simple comparison of individual Options where the entire need can be met from single Options. Where the assessment is required to consider a range of different and more complex combinations of Options to meet a need, then the more detailed, full EBSD analysis is required.

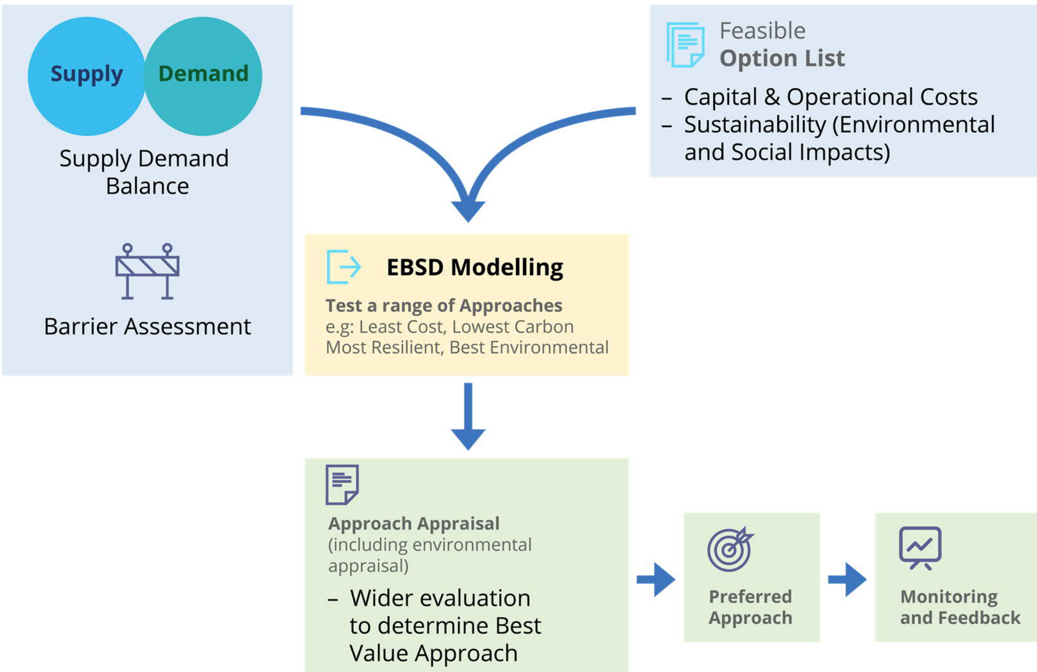



Figure 8.11 – EBSD Model Approach

#### EBSD Model

The full EBSD Model evaluates the range of potential Approaches comprising single or different combinations of options for a WRZ to reflect the key criteria used in the Fine Screening stage namely: resilience; deliverability and flexibility; progressibility; sustainability (environmental and social impacts) and cost. The full EBSD Model then produces an optimised programme of investment to meet the needs of a WRZ over a defined planning period (25 years in this Plan).

The model does this by evaluating the Fine Screening criteria and determining:

• **Which** Options should be selected;

• **When** the Option should be implemented; and

• **What** utilisation should be made of the Option within the planning period.

For each of the six Approaches (Least Cost, Best AA, Lowest Carbon etc.), Irish Water use the EBSD Model to derive an optimum combination of Options to address the future need based on the MCA scores.

The Approach development process is designed to determine the Best Value approach to meet the need and this is then identified as the Preferred Approach. Best value is identified as the approach that provides the best performance overall, balancing across the range of NWRP and SEA objectives.

The input data and structure of the EBSD model is shown in Figure 8.11.

#### 8.3.7.3 Approach Appraisal

We then compare the Options identified for each of the six Approaches (Least Cost, Best AA, Lowest Carbon etc.) against each other to come up with a Preferred Approach that meets the objectives of the Plan and aligns with all relevant Government Policy.

The Approach Appraisal process involves:

- Identify the Option or combination of Options that best conform with each of the six Approach descriptions, for example, the Option or combination of Options that would be classified as the Least Carbon Approach, Least Cost, Best AA etc.
- Assessing the Approaches against each other, following the 8-step process set out in Figure 8.8 in order to develop a Preferred Approach for each WRZ.
- Ensuring an alternative Option that can meet the plan objectives is available for any Option that has an identified "-3 Biodiversity" in relation to the European Sites sub-criteria question.
- Identifying interim measures that might be required in a WRZs to meet a potential immediate need.

The eight step Preferred Approach Development Process is summarised in Figure 8.8. The following principles will be used to ensure its consistent application in developing Phase 2 of the NWRP:

- If an Option is identified that meets the Objectives of the Plan and is assessed as having no potential impact on a European Site (zero or neutral score based on desktop assessment), it is automatically adopted as the Preferred Approach at WRZ level.
- As all our Feasible Options have all passed the coarse and fine screening process, The Least Cost Option is used as Step 1 in the development of the Preferred Approach.
- The Preferred Approach must meet the Objectives of the Plan (i.e. to address the identified need).
- Although the Preferred Approach development process starts with the Least Cost approach, it must give the highest consideration to Environmental Legislation and Government Policy on climate change adaptation and public expenditure.
- We also consider at this stage any project level information available for In-Flight Projects to sense check them against the Preferred Approach. For example, detailed project level costings might reveal that an In-Flight Project identified as a Preferred Approach is more expensive than the plan level estimates, or the progress already made for an In-Flight Project is less than a Preferred Approach that is not an In-Flight Project.
- The Preferred Approach at a Plan level does not confer any consent to develop a project, nor does it preclude other options being considered subsequently at the project Level.

#### 8.3.7.4 Preferred Approach

The Preferred Approach to address the need for each WRZ is identified using the Approach Assessment Process set out in Figure 8.12. When we compare the various approaches as part of this process we are looking to identify where the approaches provide significantly better performance for some outcomes without incurring significantly worse performance against other outcomes.

During the development of the draft Framework Plan we have attempted to define this as a rules based exercise but given the complexity of the considerations this always gave compromised solutions.

We have decided to maintain this as an exercise in professional judgement from the teams involved, which is recorded as a narrative at each stage, in order to reflect the considerations of the intricacies of the approaches.

This Approach Development Process will be conducted via workshops involving technical experts working on the Regional Water Resources Plans, including Engineers, Ecologists and Environmental Scientists. The decision-making process and outcomes will be documented for each Water Resource Zone.

The Approach Development process repeated at the Study Area, and Regional Group Area levels in order to develop the four Regional Water Resources Plans.

| | |
|---|---|
| **STEP 0** Best AA | If there is an option that meets the Objectives of the Plan, and is assessed as having no potential impact on a European Site (based on desktop assessment), it is automatically adopted as the Preferred Approach |
| **STEP 1** Least Cost | Compare Least Cost against **best AA** Approach, and consider again at Step 6 |
| **STEP 2** Quickest Delivery | Compare Least Cost against Quickest Delivery Approach and develop Modified Approach if appropriate |
| **STEP 3** Best Environmental | Compare Least Cost or Modified Approach against Best Environmental, and modify approach **if appropriate** |
| **STEP 4** Most Resilient | Compare Least Cost or Modified Approach against Most Resilient |
| **STEP 5** Least Carbon | Compare Least Cost or Modified Approach against **Lowest** Carbon |
| **STEP 6** Approach Comparison | Compare output from Steps 1 to 5 against:<br>• SEA required outcomes • Sectoral Adaptation Outcomes<br>• **Best AA outcomes** • Public Expenditure Code Outcomes |
| **STEP 7** Preferred Approach | Select Preferred Approach based on steps 0 to 6 |

Figure 8.12 – Approach Assessment Process[8]

[8] Least cost includes environmental and social costs.

#### 8.3.7.5 Sensitivity Analysis

Our supply demand forecast has been developed using the best available information and the application of best practice methods where we have the data to do so. We have identified areas where we will focus improvements in data to improve the certainty of our forecasts. However, all long-term forecasts are subject to uncertainty.

Therefore, we will incorporate a sensitivity analysis check in our Approach Assessment Process to allow us to test the sensitivity of the Preferred Approach to a range of futures which could alter the Supply Demand Balance and impact on Need (Table 8.8). This will ensure that our decision making is robust and that the approaches developed are adaptable.

In reality, a combination of these scenarios may occur together. For example, we may find growth in demand is lower and we achieve greater leakage reductions at the same time as the abstraction licensing regime limits our water availability. In this case reductions in demand would offset some of the increasing deficit due to abstraction sustainability reductions.

Should an outcome of the Sensitivity Assessment find that a preferred option will not be resilient or adaptable to changing future scenarios, we reassess it against the options identified for the six approaches during the Approach Appraisal phase and consider if an alternative should be progressed.

As data and models improve over time Irish Water will incorporate a more extensive approach to sensitivity analysis in the shape of Adaptive Planning. Adaptive Planning provides the flexibility to respond to uncertainty when it occurs (e.g. climate change impact increases).

#### 8.3.7.6 Interim Solutions

Based on the scale of need across all our Water Resources zones, it is likely to take numerous investment cycles, before we can address all issues across existing water supplies. Therefore, smaller, localised upgrades may be required on an interim basis to secure priority need in existing supplies until the Preferred Approach can be delivered.

Any projects considered within the interim approach will only be progressed on the basis of urgent or priority need (such as Remedial Action List) to address critical water quality risk and supply reliability until such time as long term and permanent solutions can be delivered. In these cases, they would be considered to be required irrespective of the medium or long term SDB requirements and would be regarded as efficient use of budget.

The NWRP does not confer funding availability or statutory consent on any interim solution. If an interim option is deemed necessary, funding approval in addition to all applicable consents would need to be obtained for it to progress.

Table 8.8 – Summary of our Sensitivity Assessment (non-exhaustive list)

| Uncertainty Factor | Likelihood | Impact on SDB | Impact on deficit | Discussion |
|---|---|---|---|---|
| New abstraction legislation introducing sustainability limits on quantities to be abstracted | High (as our current abstractions are large compared to the water bodies from which they abstract) | Reduction in DO | Larger SDB deficit. | Although the likelihood of this scenario is high based on a desktop assessment of our existing abstractions, potential impacts may be mitigated against by optimising our operations on a more environmentally sustainable basis across the range of supplies. |
| Climate change impacts on supplies are greater than anticipated | Moderate (central climate change estimate used) | Reduction in water availability at certain times of the year | Larger SDB deficit. | Although the likelihood of this scenario is moderate based climate change allowances made in this Plan, potential impacts may be mitigated against by optimising our operations on a more environmentally sustainable basis across the range of supplies. |
| Domestic demand is lower than expected and/or<br>Non-domestic demand is lower than expected. | Low/Moderate (growth has been based on policy) | Growth in demand is lower than forecast. | Smaller SDB deficit | The SDB deficit is driven by many factors including limitations in existing supplies, the reliability of the overall supply and assumptions on demand growth. If demand does not growth as significantly as we forecast there will still be a supply demand deficit in many WRZs. The required intervention to resolve the deficit may be smaller. |
| We achieve good levels of effectiveness and efficiency in reducing leakage | Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction) | Leakage reduces to below SELL within the period of the plan | Smaller SDB deficit | Irish Water will strive to be progressive in our leakage reduction plans. However, due to the supply and reliability issues we have this will not negate the need for other interventions to address the supply demand deficits. |
| Ability to reduce leakage in accordance with targets, due to, lengths of networks, access to assets, need to maintain and budget constraints. | Moderate (the distribution network is extensive) | Leakage does not reduce to SELL within the period of the plan | Larger SDB deficit | Due to the length and condition of our networks, we could potentially fail to achieve leakage targets in the timeframes set out. However, as Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage reductions as opposed to accepting lower targets. |

### 8.3.8 Stage 8: Monitoring and Feedback into Plan

The Public Water Supply in Ireland is a live asset base and is subject to continuous change. New assets such as water treatment plants, storage reservoirs, trunk and distribution mains are continuously developed and upgraded. Knowledge and data relating to our assets is improving and operational procedures are being standardised.

External factors can also influence the performance of our water supplies, including:

- Changes in legislation and policy that impact the way we operate our asset base or our interface with the natural environment
- Reductions in water supply availability due to climate disruption and environmental impacts
- Growth in demand for water for domestic and non-domestic use
- Funding availability and requirements to improve Levels of Service to water users

All of these factors influence need in terms of Quality, Quantity, Sustainability and Reliability; therefore, the Supply Demand Balance and Barrier Scores in the Plan represent a snapshot in time of live metrics.

Similarly, the development of Preferred Approaches as part of the forthcoming Regional Plans is influenced by evolving scientific data, understanding, and policy change in relation to the natural environment.

Irish Water must be able to continuously adapt to these changes, which may be minor or material in nature. As part of the implementation of the Framework Plan, we are committed to the implementation of the SEA recommendations and Monitoring Plan. The Framework Plan commits to undertaking continuous monitoring and ensuring that there is a feedback mechanism within the Framework Plan and Regional Plans. The Regional Plans will be subject to formal review every five years; however, this continuous monitoring process will ensure that material amendments are assessed for significant impacts on the environment.

#### 8.3.8.1 Monitoring and Feedback Process

The monitoring and feedback process involves:

- Identifying the internal and external factors that may impact the Plan, mapping the areas of the plan that they will influence;
- Updating needs identification by updating the Supply Demand Balance, Drinking Water Safety Plans and Barrier scores to reflect these changes;
- Assessing the impact of these changes on the Plan and Preferred Approaches Developed within the Regional Resource Plans and;
- Updating the Need in the Regional Plans where the changes are deemed to be material.

In certain circumstances, monitoring and feedback will identify the need for a variation of the NWRP - Framework Plan or a Regional Water Resources Plan. Where a variation is required, Irish Water will screen the change for SEA and AA in accordance with legal obligations.

As part of the screening, Irish Water will consult with the EPA and relevant Government Departments as required by Article 9(5) of the EC (Assessment of Certain Plans and Programmes) Regulations 2004 (SI 435/2004). If, following screening, Irish Water determines that the change is likely to have significant effects on the environment it will carry out SEA before adopting the change. Irish Water will also carry out an AA if it determines, following screening, that the change is not directly connected with or necessary to the management of any European site and Irish Water cannot, on the basis of objective scientific information, exclude that the change, individually or in combination with other plans and projects, will have a significant effect on European sites, as required by Article 42(6) of the EC (Birds and Natural Habitats Regulations) 2011 (SI 477/2011).

### Indicative List of Factors

Tables 8.9 and 8.10 provide an indicative but non-exhaustive list of internal and external factors that may influence the Framework Plan with potential knock on effects on the four Regional Plans*. From the tables it can be seen that the Framework is largely ring-fenced once adopted, however, changes in Need have the potential to modify the Regional Plans.  This table is intended to anticipate such changes to inform the design of the NWRP - Framework Plan, but Irish Water will review and screen for SEA and AA any changes as they arise and may determine that they are material where the table considers them to be minor and vice versa on the basis of the full information then available.

* Non-exhaustive list. Irish Water will review any changes, consultation feedback and identify whether they are material and update the plans where necessary

Table 8.9 – Factors that may influence the Framework Plan

| Framework Plan | Area of Plan | Likelihood | Predicted Impact | Likely Action |
|---|---|---|---|---|
| Legislation or new Guidelines on Water Resources Planning by Irish Water's Financial or Environmental Regulator: At present there is no regulatory framework or guidelines for water resources planning in Ireland. Should regulations or guidelines come into effect within the time frame of the plan, the framework may need to be modified to reflect this | Methodology | Low/<br>Moderate | Material | If material - Variation on Plan |
| Legislation and Regulations on the Abstraction of Water from the natural environment: At present the Irish Government is developing new legislation on abstraction of water from the natural environment, aligned with the Water Framework Directive. This legislation and subsequent regulations on abstraction may have the potential to alter the volumes of water we currently abstract at existing sites and the volumes of water we can abstract from new supplies | Need | High | Minor in terms of the methodologies used in draft Framework Plan (as we have accounted for this change both in our sustainability assessments for existing supplies, and ensure that all new options prepared as part of the plan conform to conservative abstraction rules) | Update SDB and assess impact on preferred approaches in the Regional Strategic Resources Plans. If material, this will not change the framework but can potentially impact the subsequent Regional Plans. |
| Sustainability: The 3rd Cycle of the River Basin Management Plan is currently underway. Identification of significant pressures in water bodies relating to hydromorphology, land use planning, agriculture, siltation and hazardous chemicals, have the potential to influence need in our water supplies<br>Any outcomes from the SEA Statement and monitoring plan. | Need | High | Minor (as we have accounted for potential changes within other risk-based approach to our supplies | Update SDB, DWSP and Barrier Scores and assess impact on preferred approaches in the Regional Plans |
| Leakage and Network Performance: Leakage reduction is a core activity within our plan, however, leakage is dynamic and naturally increases over time as assets deteriorate. Therefore, reducing leakage is a function of continuous reduction and maintaining established leakage savings. Across a large distribution network, there can be uncertainty amount | Need | Moderate | Minor (we have included sensitivity assessments of leakage performance as part of the Preferred approach Development process) | Update SDB and assess impact on preferred approaches in the Regional Plans |

| Framework Plan | Area of Plan | Likelihood | Predicted Impact | Likely Action |
|---|---|---|---|---|
| achieving target leakage reductions within the required timeframes, but also the potential for exceeding targets. This has the potential to modify our demand forecasts within the Plan. | | | | |
| Domestic Demand Growth: The Irish Water Forward Planning team interfaces directly with the Regional Assemblies and the Local Authority Planning Departments during the preparation of the regional growth strategies and the County Development Plans. As these strategies and plans are completed, the information at settlement level will become more granular and has the potential to modify demand within the supplies. | National Water Resources Framework Plan - Need | Low/Moderate | Minor (we have continuously updated our demand figures, based on feedback from the Regional Assemblies and established interface with the Local Authority Planning and Development Sections | Update SDB, DWSP and Barrier Scores and assess impact on preferred approaches in the Regional Plans |
| Non-Domestic Demand Growth: Ireland has a significant and established manufacturing base across high water use sectors such as Pharmaceutical, Agri Food, Manufacturing and Hospitality. Irish water engages with key stakeholders such as the IDA and Local Authority Planners. However, it can be difficult to fully anticipate growth in high water use sectors. | National Water Resources Framework Plan - Need | Low/Moderate | Minor (we have continuously updated our demand figures, based on feedback from the Local Authority Planning and Development Sections and via the Pre-Connection Enquiry process within our Connection Developer Services function. | Update SDB and assess impact on preferred approaches in the Regional Plans |
| Data Improvements: Irish Water's data and intelligence systems are being continuously updated. These improvements will allow us to further develop our understanding of existing supplies, components of demand and supply specific peaking factors, outage allowances and headroom. Similarly, through catchment initiatives, monitoring of our treatment plants and distribution networks as part of the rollout of the Drinking Water Safety Plans, our understanding of Water Quality and Reliability issues is continuously improving. | National Water Resources Framework Plan - Need | Low/Moderate | Minor (we have continuously updated SDB and Barrier scores as new information becomes available) | Update SDB and assess impact on preferred approaches in the Regional Plans |

Table 8.10 - Factors that may influence the Regional Water Resource Plans

| Regional Water Resource Plans (4 no.) | Area of Plan | Likelihood | Predicted Impact | Likely Action |
|---|---|---|---|---|
| Updated Need: This could impact the Preferred Approach outcomes within the Regional Plans | Need | Low/ Moderate | Minor/ Potentially Material (in development of feasible options for each water resource zone we use conservative estimates of potential new supply availability as set out in Chapter 4) | Ensure feasible options are based on conservative estimates. Engage with Environmental Regulator on Preferred Approaches within each regional plan. If Preferred approach is altered on a regional basis, and the Preferred Approach is to be delivered within the timeframe of the Plan, this will require variation on Plan |
| Improvements in available scientific and environmental datasets: This could impact the Preferred Approach outcomes within the Regional Plans | Preferred Approach Development | High | Minor/ Potentially Material (we use best available data to screen options as part of the SEA/AA processes) | Assess impact on Preferred Approach. If Preferred approach is altered on a regional basis, and the Preferred Approach is to be delivered within the timeframe of the Plan, this will require variation on Plan |

* Non-exhaustive list. Irish Water will review any changes, including feedback from consultation and identify whether they are material and update the plan where necessary

Figure 8.13 shows the feedback process in relation to the Plan in terms of monitoring, impact assessment, feedback loop and actions. While Tables 8.9 and 8.10 show the frequency of these steps.

As can be seen material changes in either the Framework Plan or the Regional Strategic Resource Plans will result in variations to the Plan, however, minor changes can be incorporated into the plan process.

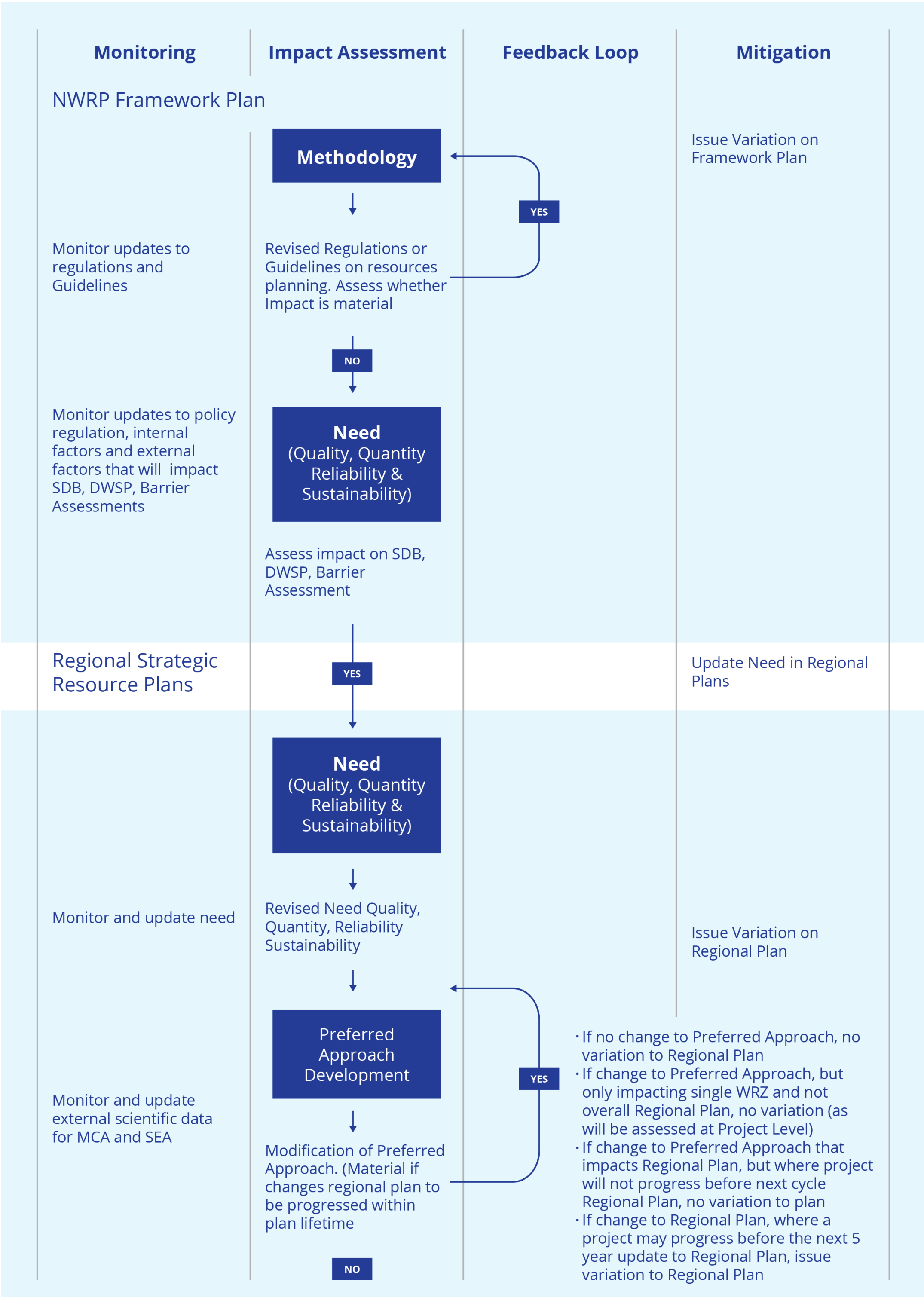



Figure 8.13 - Feedback Loop - Framework Plan

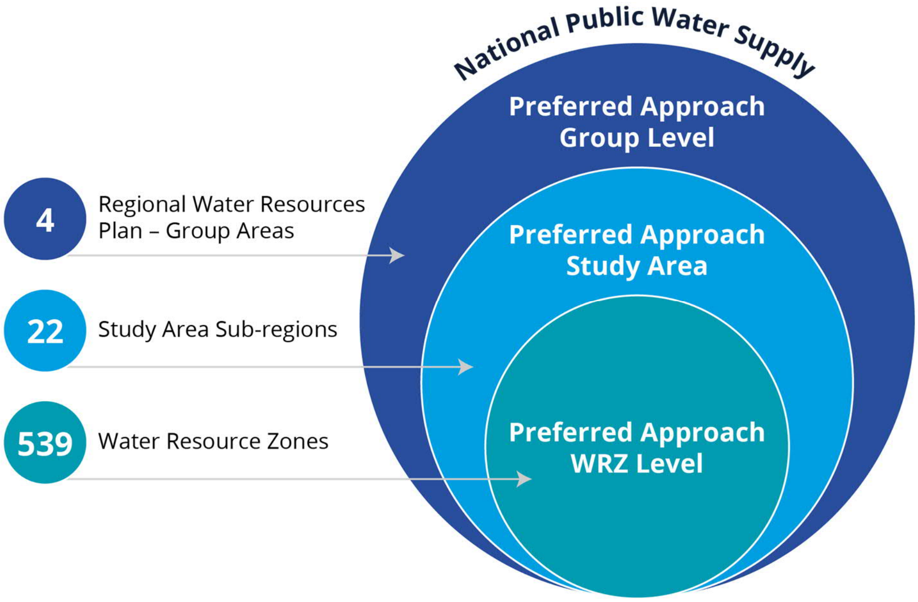



Figure 8.14 - NWRP Spatial Scale of Assessment

We apply a defined process to develop the Preferred Approach at the three spatial scales shown in Figure 8.14:

1. Assess the Feasible Options to develop a Preferred Approach for each WRZ. This would be expected to result in small local Options that can resolve need solely within all or part of the WRZ.
2. Assess the Feasible Options to see whether any Regional Options are available to meet the need across multiple WRZs.  This stage can yield a modified Preferred Approach at the Study Area Level.
3. We then assess the Feasible Options at the Regional Group Area level to see if there are any Options that can be applied across the entire Region and, if appropriate, adjust our Preferred Approach accordingly.
4. The final stage is to assess any inter-regional options and potential cumulative or in combination effects and determine if any adjustment is required. (This will be addressed sequentially in each of the RWRP Plans in turn).

### 8.3.8.2 SEA and AA of Preferred Approaches

Following identification of the Preferred Approaches as part of the Regional Water Resources Plans (including the SEA and AA requirements considered throughout the Approach Development), SEA and AA assessments will be undertaken of the Preferred Approaches. This will include cumulative and in combination assessments. The assessments will feed back into the process where additional significant effects are identified and mitigation to address cumulative and in combination effects will be included in the overall recommendations.

The SEA Statement from the Framework Plan and AA Determination for the adopted Framework Plan, as well as any mitigation and monitoring recommendations identified, will also be taken into account in the Regional Plans. As part of the implementation of the Framework Plan, we are committed to the implementation of the SEA recommendations and Monitoring Plan.  The NIS report forms the output of the AA process.

## 8.4 Summary

In this section we have described our proposed methodology to develop the Preferred Approach or Approaches to resolve water resource needs across our supplies.

This Options Assessment and Preferred Approach Development Methodology described in this Framework Plan will be applied to all of the WRZs in the four Regional Water Resources Plans, once it has been adopted by Irish Water.

# 9 What Happens Next

# 9 Key Points

**In this Chapter we will provide:**

- **A summary of the draft Framework Plan**
- **An outline of our next steps to implement our three-pillar approach and new Options Assessment Methodology to improve the LoS we are able to provide for our customers**

## 9.1 Summary of the Draft Framework Plan

This draft Framework Plan describes the process that Irish Water will use to transform our asset base and move towards a sustainable, secure, reliable and sustainable drinking water supply for everyone over the next 25 years.

It describes the baseline performance of our existing asset base including:

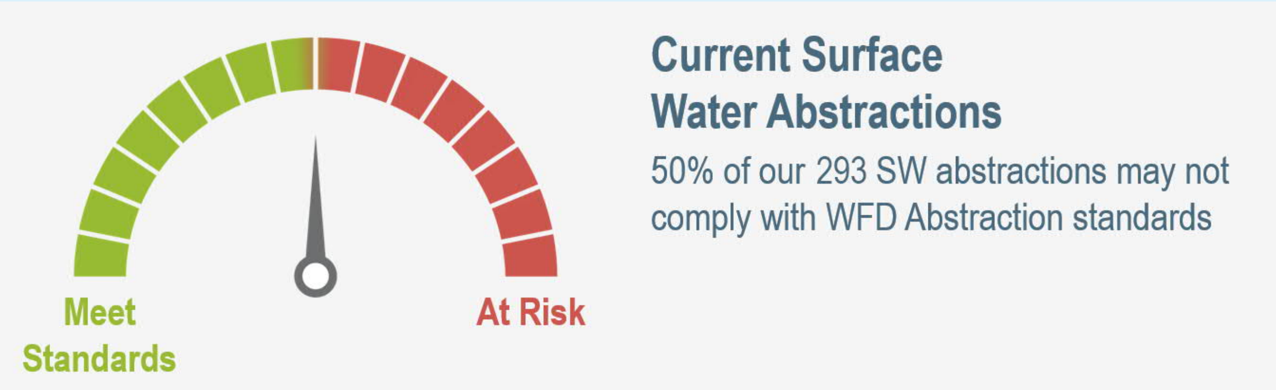
- Current Levels of Service:
- Issues with single source supplies
- Performance issues during extreme whether events such as storms, drought period and freeze-thaw events
- Asset Performance in terms of the standards we have set for risk to water quality
- Asset Performance including high leakage
- Potential sustainability issues with our supply sources
- Funding Constraints

### Box 9.1

At a national level we currently have a Dry Year Critical Peak demand of 2,266 Million litres per day with a corresponding supply available of 1,773 Ml/d. This gives a deficit of 493Ml/d.

If there is no change to current water efficiency or reductions in leakage, by 2044 we forecast a demand of 2,308Ml/d and a supply yield that falls to 1,762 Ml/d because of climate change. This will result in a deficit of 546Ml/d.

The available supplies will reduce further when abstraction licensing regime is introduced as some of our sites may not comply with WFD Abstraction Standards.



### 9.1.1 Identify the Need

We have detailed the methods we use to estimate quantity need through the Supply Demand Balance assessment (Figure 9.1). A Supply Demand Balance Forecast has been developed for each of our 539 Water Resource Zones, for four Weather Event Planning Scenarios, including Normal Year Annual Average, Dry Year Annual Average, Dry Year Critical Period and Winter Critical Period. The supply demand balance is forecast over a 25-year period from 2019 to 2044.

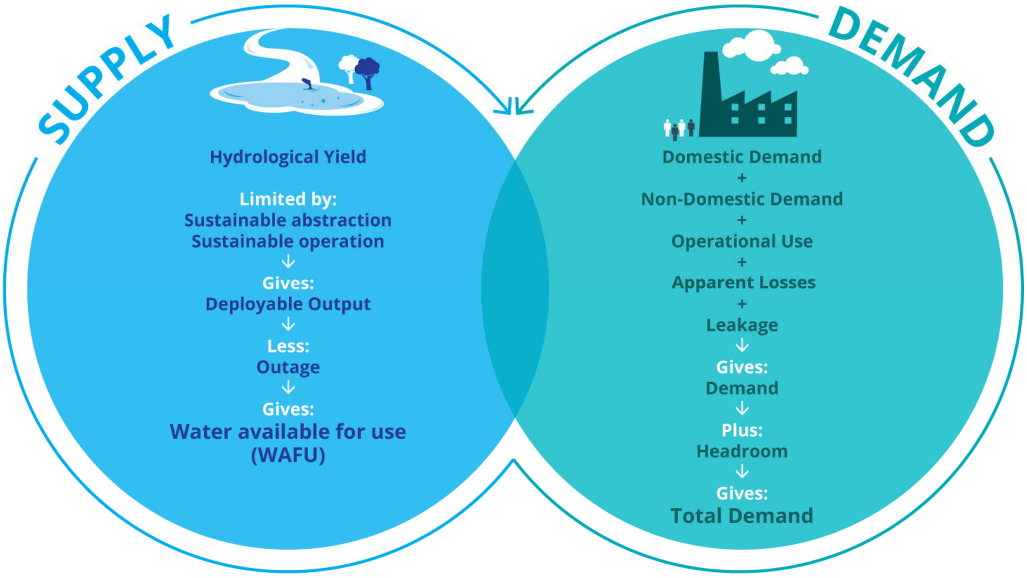
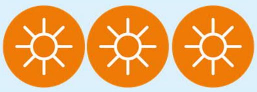



Figure 9.1 - Supply-Demand Balance

Our SDB calculations estimate that over 58% of our WRZs are at risk of being in deficit during a normal year. A deficit means that the quantity of water we can supply is exceeded by the total Demand for water. In these circumstances there is a risk of disruption to the service we provide for our customers.

During the Dry Year Critical Peak (equivalent to a summer drought), 66% of our WRZs are currently in deficit.



### 9.1.2 Identify the Need: Quality and Reliability

We have detailed the methods we use to estimate risk to water quality and reliability using the Drinking Water Safety Plans and the Barrier Assessments across all of our supplies (Figure 9.2).

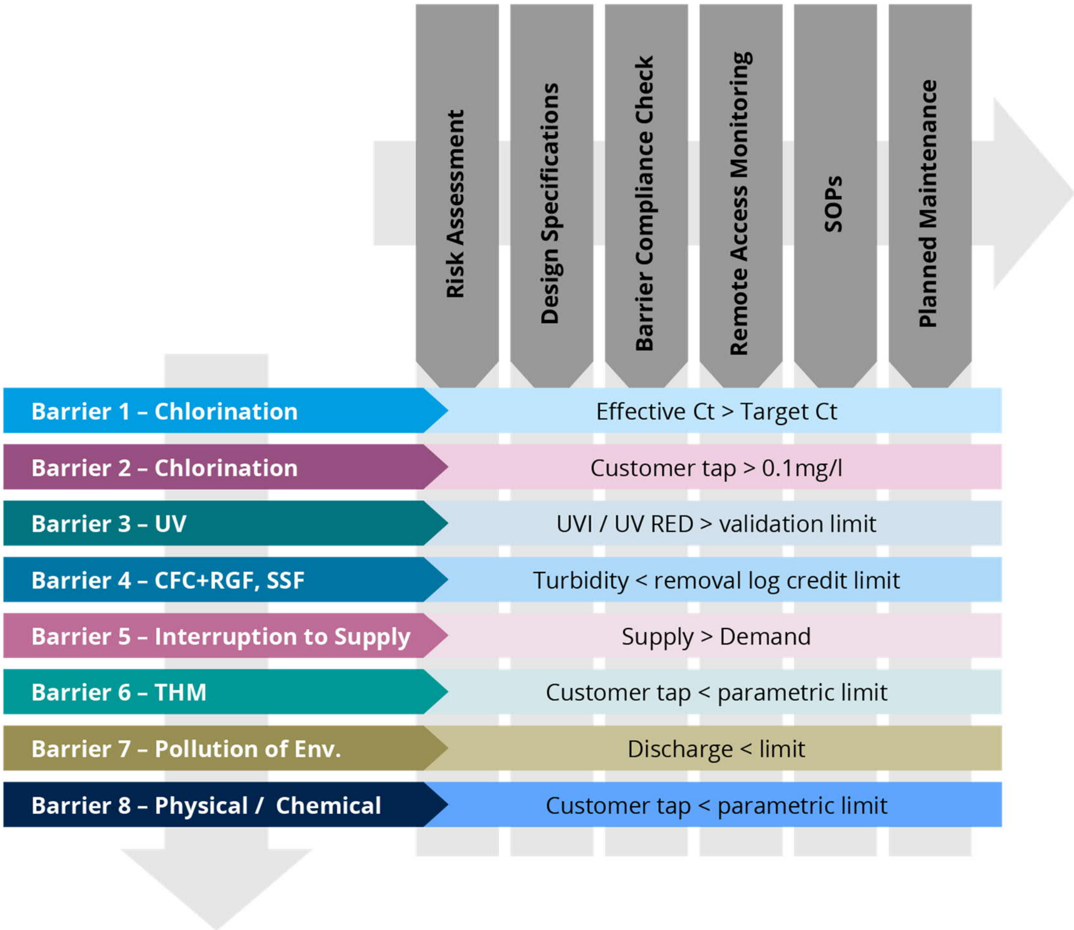



Figure 9.2 - Irish Water's Barriers for achieving Safe & Secure Drinking Water

Our Barrier Assessment of Water Resource Zones summarised in Chapter 6, shows that in some cases our current asset capability does not meet the standards we have set for ourselves. Therefore, significant asset transformation and capital investment may be required over the coming regulated investment cycles, to ensure that our supplies are secure and address risks to water quality.

### 9.1.3 Identifying appropriate solutions: Our Three Pillar Approach

Our draft Framework Plan is based on the best currently available data. It has detailed the SDB, Barrier Assessment approaches and identified need across all of our Water Resources Zones. Within this draft Plan we have developed the methodology we will use to reduce or eliminate identified needs and bring greater resilience to the water supply network over future investment plans.

We have described our Three Pillar Approach to developing solutions based around Lose Less, Use Less and Smarter Supply which encompass both our current and future activities.

**Lose Less:** reducing water lost to the system through leakage

**Use Less:** reducing water use through efficiency measures

**Supply Smarter:** improving the resilience and security of our supply through infrastructure improvements.


We will implement the three-pillar approach through our current and future activities to deliver a minimum of 1 in 50 year Level of Service to all our customers and ensure the sustainability and reliability of all assets.

## 9.2 Options Assessment Methodology and Preferred Approach Development

The objective of the National Water Resources Plan is to incrementally improve our supply networks to provide safe, secure, reliable and sustainable sources of supply for our customers. To achieve this we must ensure that our supplies are based on:

- Consideration of Government Policy, Sectoral Adaptation Plans and the Circular Economy
- Sustainable water sources that do not impact on the environment and are resilient to climate change
- The required number and variety of water sources in each supply to allow us maintain supply continuity across a range of weather events
- Appropriate catchment protection activities and water treatment facilities that ensure compliance with Drinking Water Regulations in all weather conditions
- Innovation, new technologies and Ecosystem Services where possible
- Ability to address current and future deficits with the flexibility to manage inevitable unpredictable events.
- Reliable and interconnected distribution networks that provide the required Levels of Service to our customers
- Careful Operational Management and continued investment in capital maintenance
- Efficient and low energy networks with the continued emphasis on leakage reduction
- The principles of Water Conservation and reducing demand

In order to ensure that we achieve the objectives of our plan and that we transform the existing national public water supply, we have developed an Options Assessment and Preferred Approach methodology shown in Figure 9.3.

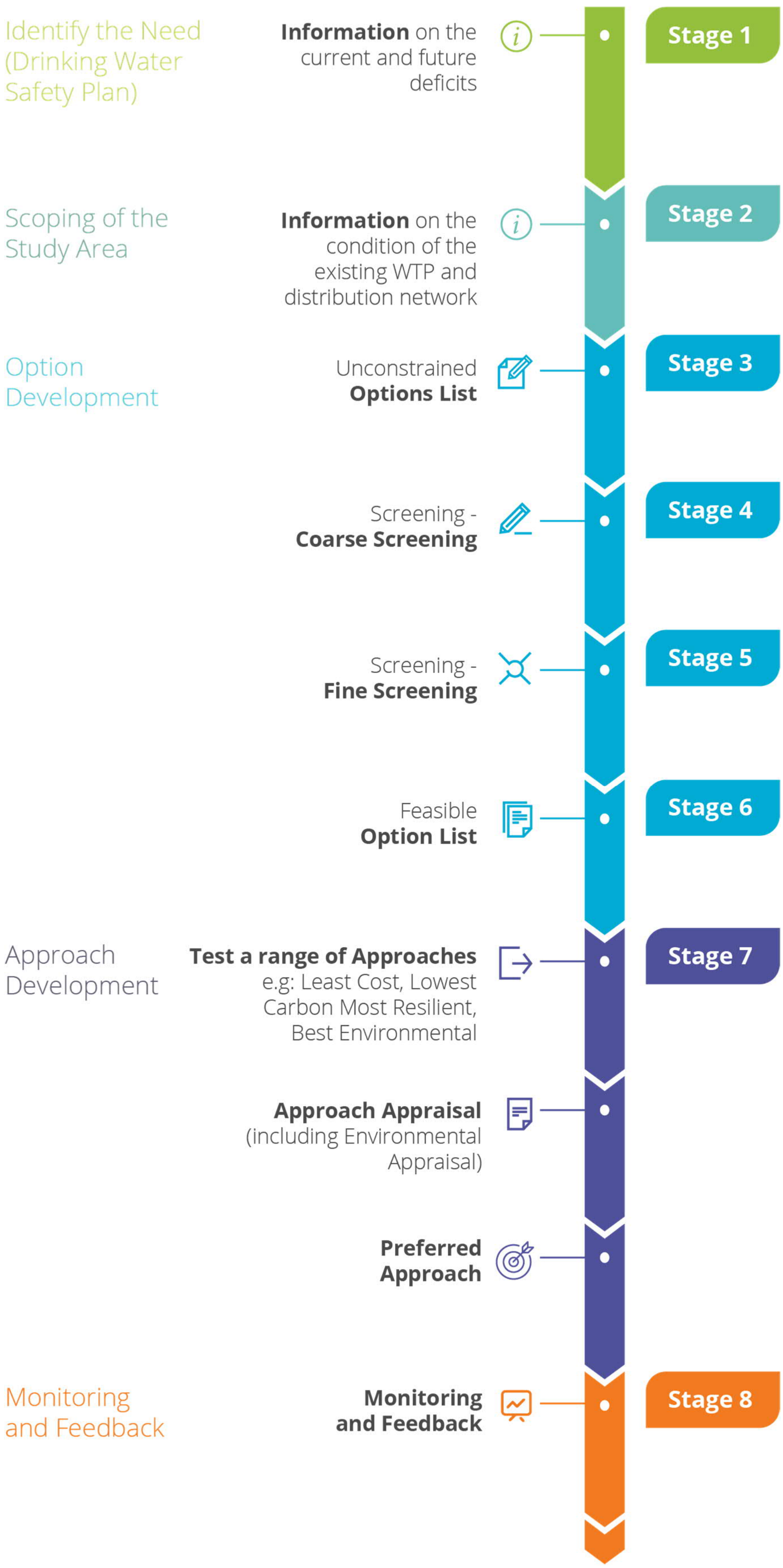



Figure 9.3 - Options Assessment and Preferred Approach Methodology

### 9.2.1 Delivery of the National Water Resources Plan

As this is our first National Water Resources Plan, within this draft Framework Plan we have described how it has been split into two distinct Phases, summarised as follows:

#### 9.2.1.1 Phase 1: National Water Resources Plan – Framework Plan (This Consultation)

Phase 1 of the draft Plan will include:

- The methodology we will use to develop our plan including:
    - How we assess quantity need through the Supply Demand Balance
    - How we assess quality and reliability need through the Barrier Assessment
    - How we address Sustainability by ensuring that all new options for water supply must be based on conservative approaches to protecting water sources
    - Our Options Assessment Process
    - Our Preferred Approach Development Process
- An assessment of Need across our asset base in terms of Quality, Quantity, Reliability and Sustainability for all of our supplies nationally.
- A sample Case Study of the draft Framework Plan methodology applied to a number of Water Resource Zones (including sample environmental review information) will also be provided as supporting material for the Phase 1 consultation. However, this is for illustrative purposes only and does not form part of the consultation during this Phase.

Once the Framework Plan has been adopted, the options assessment and preferred approach methodology will be applied to all of our current water supplies within Phase 2 of our National Water Resources Plan, where we will develop the Regional Water Resources Plans.

#### 9.2.1.2 Phase 2: Four Regional Water Resource Plans

In order to manage the delivery of Phase 2, the public water supply will be divided into the four Regional Groups shown in Figure 9.4.

We will then:

- Apply the Framework Methodology to the Regional Group Areas of Water Supplies
- Develop Plan Level Preferred Approaches (solutions) for all water supplies within these group areas.

The Regional Water Resource Plans (RWRPs) will be referred to as follows:

- Regional Water Resource Plan: North West (Group Area 1)
- Regional Water Resource Plan: South West (Group Area 2)
- Regional Water Resource Plan: South East (Group Area 3)
- Regional Water Resource Plan: Eastern and Midlands (Group Area 4)

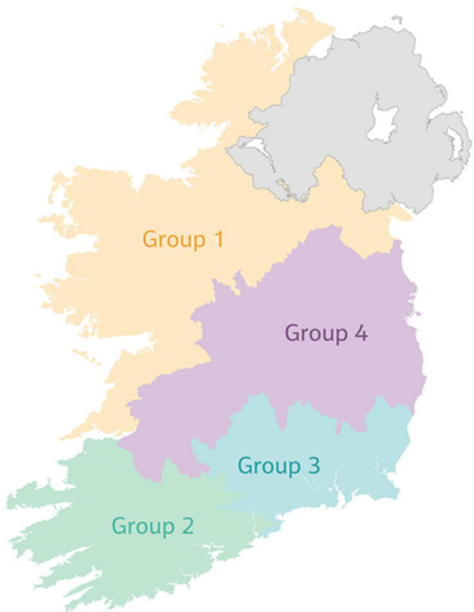



Figure 9.4 - Regional Water Resources Plan – Group Areas

In this consultation we are asking for feedback on the draft Framework plan, as highlighted in Figure 9.5.

## National Water Resources Plan (The Plan)

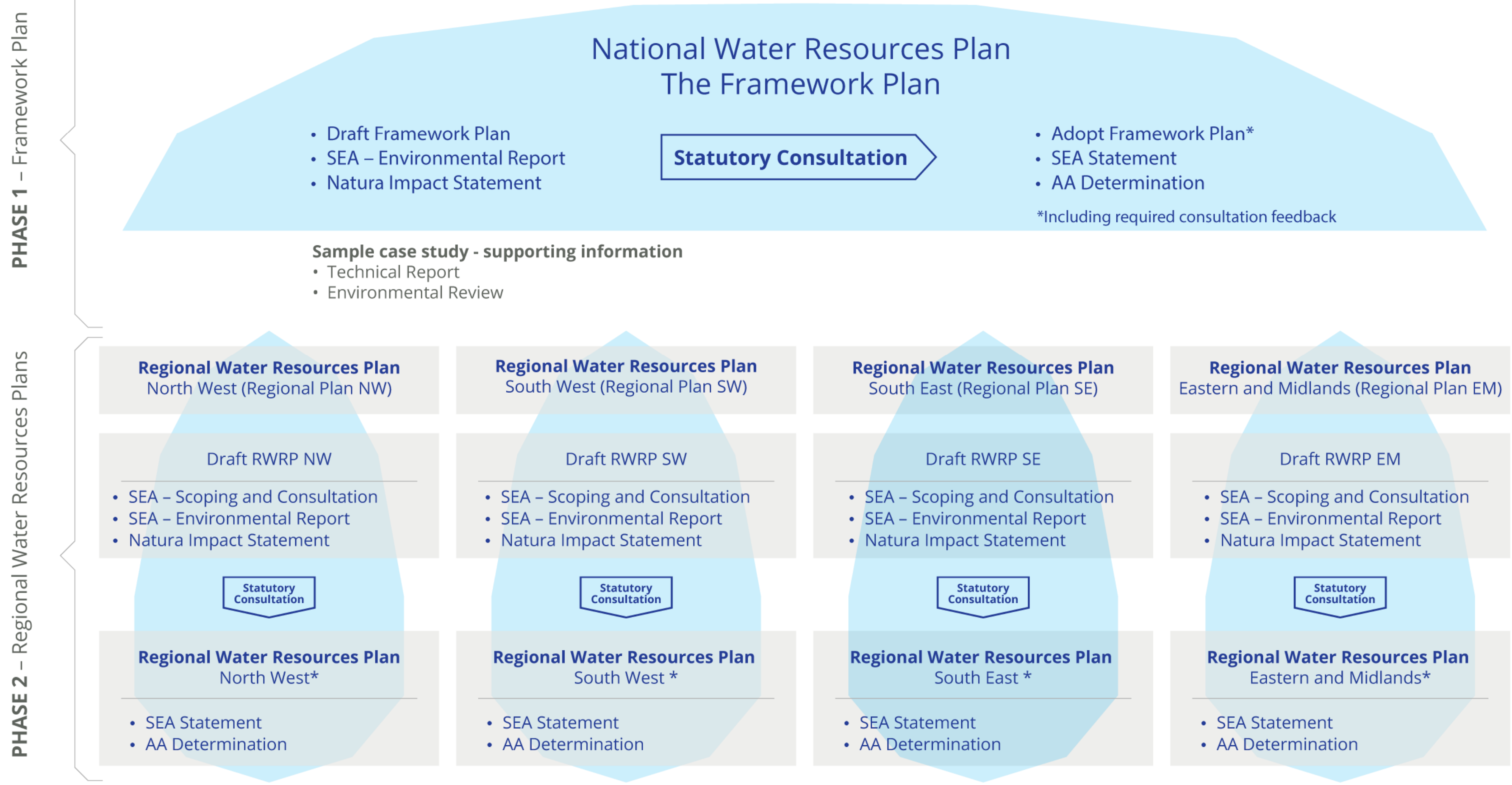



Figure 9.5 – Key elements of the NWRP and the Phased Consultations

Subsequent to the adoption of the Framework Plan, Irish Water will develop and consult on the four Regional Water Resource plans, as summarised in Figure 9.5.

## 9.3 Tracking our Progress

Irish Water will establish clear metrics in conjunction with the regulators to monitor our progress delivering a more sustainable and robust supply system. Key metrics will be the number of customers receiving target Level of Service (LoS), and the number of unsustainable abstractions identified through the RBMP process. The first of these measures will be identified through the Security of Supply measure being developed in conjunction with the CRU. The second will be through abstraction activities identified alongside the EPA.

The objective will be to deliver a minimum of 1 in 50 LoS to all customers and remove all unsustainable abstractions. Both will require considerable investment and time to implement. Periodic targets will be established through the NWRP.

## 9.4 What Happens Next

We are consulting on this draft Framework Plan during the period December 2020 to January 2021 and would like to hear your views. All feedback received will be reviewed by the NWRP team and our responses will be published.

Following the consultation, we will publish a final version of the Framework Plan.

We will then commence Phase 2 of the Plan, the Drafting and Consultation for the Regional Water Resources Plans. As part of this Phase we will apply the Options Assessment and Preferred Approach methodology set out in the adopted Framework Plan to each water supply. This will allow us to develop a nationwide programme of short, medium- and long-term options that we will present for consultation within the Regional Plans. The Regional Plans once adopted will be used to inform future regulated capital investment plans and operational plans.

Consultation on Phase 2 of the NWRP, the Regional Water Resources Plans, including corresponding SEA Environmental Reports and Natura Impact Statements will be undertaken during 2021 (subject to adoption of the Framework Plan).

## Glossary of Acronyms and Terms

| Term | Description |
|---|---|
| AA | Appropriate Assessment |
| ALC | Active Leakage Control |
| BIM | Bord Iascaigh Mhara |
| BWN | Boil Water Notice |
| CER | Commission for Energy Regulation |
| CFC | Coagulation/Flocculation/Clarification |
| CRU | Commission for Regulation of Utilities |
| CSL | Customer Side Leakage |
| CSO | Central Statistics Office |
| DAFM | Department of Agriculture, Food and the Marine |
| DO | Deployable Output |
| DHLGH | Department of Housing, Local Government and Heritage |
| DHPLG | Department of Housing, Planning and Local Government |
| DMA | District Metered Area(s) |
| DWD | Drinking Water Directive |
| DWR | Drinking Water Regulations |
| DWSP | Drinking Water Safety Plan |
| DYAA | Dry Year Annual Average |
| DYCP | Dry Year Critical Period |
| EBSD | Economics of Balancing Supply and Demand |
| EPA | Environmental Protection Agency |
| FDC | Flow Duration Curve |
| GDA | Greater Dublin Area |
| GSI | Geological Survey Ireland |
| Headroom | Headroom is the term given to a buffer in the SDB. It accounts for the uncertainty with data and the assumptions used in the supply and demand estimates and forecasts. |
| HSE | Health Services Executive |
| IBEC | Irish Business and Employers Confederation |
| ICARUS | Irish Climate Analysis and Research Unit |
| IDA | Industrial Development Authority Ireland |

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| INTERREG | Series of European Regional Co-Operation Programmes |
| LAWPRO | Local Authority Waters Programme |
| LMS | Leakage Management System |
| LoS | Level of Service |
| MCA | Multi-Criteria Analysis |
| MCW | Marginal Cost of Water |
| Ml/d | Mega litres per day |
| MSSA | Midlands Strategic Study Area |
| MUR | Meter Under Registration |
| NAP | National Adaptation Plan |
| NCCAF | National Climate Change Adaptation Framework |
| NIS | Natura Impact Statement |
| NOM | Natural Organic Matter |
| NPDWAG | National Pesticides and Drinking Water Action Group |
| NPF | National Planning Framework |
| NPV | Net Present Value |
| NPWS | National Parks and Wildlife Service |
| NRR | Natural Rate of Rise of Leakage |
| NWRP | National Water Resources Plan |
| NYAA | Normal Year Annual Average |
| OFWAT | Economic Regulator of the Water Sector in England and Wales |
| PAP | Pesticide Action Procedure |
| PCC | Per Capita Consumption |
| PCT | Project Costing Template |
| PHC | Per Household Consumption |
| Progressibility | Criterion to assess relative difference between options, and how progressible different options may be |
| RAL | Remedial Action List |
| Raw Water Quality | The chemical characteristics or quality of the water in the river/lake/groundwater source before it is treated. |
| RBMP | River Basin Management Plan |
| RSES | Regional Spatial and Economic Strategy |
| RWRP | Regional Water Resources Plan |

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| SDB | Supply Demand Balance |
| SEA | Strategic Environmental Assessment |
| SEAI | Sustainable Energy Authority of Ireland |
| SELL | Sustainable Economic Level of Leakage |
| SLA | Service Level Agreement |
| Tankering | Delivery of water supplies by water tanker |
| THM | Trihalomethane |
| TOC | Total Organic Carbon |
| TTHM | Total Trihalomethane |
| UARL | Unavoidable Annual Real Losses |
| UKWIR | UK Water Industry Research Ltd |
| WAFU | Water Available For Use |
| WCP | Winter Critical Period |
| WFD | Water Framework Directive |
| WHO | World Health Organisation |
| WRc | Water Research Centre Ltd., UK |
| WRZ | Water Resources Zone |
| WSPS | Water Services Policy Statement |
| WSSP | Water Services Strategic Plan |
| WSZ | Water Supply Zone |
| WTP | Water Treatment Plant |
| ZOC | Zone of Contribution |