Winter 2023

Regional Water Resources Plan South East

Irish Water's 25 Year Plan for Our Water Assets

Tionscadal Éireann
Project Ireland
2040

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 applicable policy.

Baseline data included in the RWRP-SE has been incorporated from numerous sources including but not limited to; National Planning Framework, Central Statistics Office, Regional Spatial and Economic Strategies, Local Authority data sets, Regional Assembly data sets and Irish Water data sets. Data sources will be detailed in the relevant sections of the RWRP-SE. 2019 was selected as the base year to align with the planning period (2019-2025) of the NWRP.

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1 Planning Context

1.1 Introduction

Water is part of our everyday lives. It is essential to everything we do. Ireland's existing public water supply was built gradually over the last 150 years, often responding to local needs by developing nearby small water supplies. As a result, we have a fragmented supply system. In addition to this, as a result of historic underinvestment, many of Uisce Éireann's treatment facilities, pumps and water main networks within these supplies are in poor condition compared to standards in most European countries. The poor condition of many of our current water supplies means that some of our customers receive a low Level of Service (LoS) resulting in the issuing of intermittent Boil Water Notices or other interruptions. If no action is taken, population growth, continued aging of our water supply infrastructure and climate change will lead to further deterioration in this situation over time. To improve the Levels of Service we provide to our customers we must plan ahead. Uisce Éireann's first National Water Resources Plan (NWRP) outlines how we can do this. The NWRP is a 25-year strategy (2019 to 2044) which will identify how we will provide a safe, sustainable, secure and reliable water supply to our customers for now and into the future while safeguarding the environment.

The **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. A 1 in 50 LoS means that customers would only expect to experience a supply failure, on average, once every 50 years, or there would be a 2% chance of experiencing a supply failure in any given year.

The first phase in the development of the NWRP was the preparation of the NWRP - Framework Plan (the Framework Plan), which was adopted in May 2021 following Strategic Environmental Assessment (SEA), Appropriate Assessment (AA) and extensive public consultation. The Framework Plan sets out the methodologies developed to identify need and find solutions to address need across all of Uisce Éireann supplies.

The second phase of the NWRP involves the production of four Regional Water Resources Plans (RWRPs) that assess Need and propose a Preferred Approach (i.e., solutions to the identified need) for each of the 539 water supplies that make up the national public water supply. The outputs of the four RWRPs will be combined for prioritisation and progression through the future cycles of capital investment planning.

The NWRP will comprise of the Framework Plan and four RWRPs which together will be treated as a unified Plan. The relevant regional groupings will have no ongoing application in future cycles.

Three (3) regional plans, the RWRP for the Eastern and Midlands region, the RWRP for the South West region and the RWRP for the North West region have been finalised and adopted. The RWRP for the South East region is the final region. The Framework Plan, Regional Plans and supporting documentation are available at https://www.water.ie/projects/strategic-plans/national-water-resources/.

The RWRP-SE aims to ensure secure safe, reliable and sustainable drinking water supplies in the South East Region for the next 25 years. It identifies baseline issues with the existing water supplies, in terms of Quality, Quantity, Reliability and Sustainability. The plan also assesses factors that will influence our water supplies into the future, including, growth and economic development, changing legislation and climate change. The RWRP-SE considers opportunities for our water supplies, and the solutions for each supply, using the methodology set out in the Framework Plan. Feedback from the consultation on the Eastern and Midlands dRWRP South West dRWRP and North West dRWRP has been incorporated into the RWRP-SE.

1.2 Who We Are

Uisce Éireann assumed statutory responsibility for the provision of public water services and management of water and wastewater investment for Ireland on the 1st January 2014.

Its' role is to ensure that all our customers and communities 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.

Uisce Éireann is regulated by the following:

- The economic regulator, the Commission for Regulation of Utilities (CRU), who is charged with protecting the interests of the customer. The CRU also approves appropriate funding to enable Uisce Éireann to deliver the required services to specified standards in an efficient manner.
- The environmental regulator, the Environmental Protection Agency (EPA), who sets standards and enforces compliance with EU and National Legislation for drinking water supply and wastewater discharge to water bodies. The EPA liaises with the Health Service Executive in matters of public health.

All projects developed by Uisce Éireann are subject to the planning and regulatory processes.

1.3 Water Supply in the South East Region

There are 143 Water Treatment Plants (WTPs) in the South East Region, which collectively serve over 369,237 people (or 18% of the population of Ireland), via approximately 6,321 kilometres of distribution network. The size of these WTPs varies, with the largest two in the region producing on average 47% of the water supplied and the remaining 141 producing on average about 53% or 85 Ml/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 the supply in 50 years).

This RWRP-SE will summarise key issues that impact the Quality, Sustainability and Reliability of our existing water supplies, in this region, including:

- Levels of Service
- Treatment Capacity;
- Water Quality;
- Network Performance;
- Abstractions potentially at risk of exceeding sustainable abstraction thresholds and;
- Constrained Funding.

In addition, we also face key challenges over the coming years, which have the potential to exacerbate the current problems in the region, including:

- A growing population;
- A changing climate;
- Changes in land use and emerging contaminants;
- Legislative changes; and
- An Environment in Need.

Addressing these challenges as part of the overall NWRP, ensures that future infrastructure development is proportionate to the identified Need and is Sustainable, Reliable and Resilient.

1.4 Development of the National Water Resources Plan

Uisce Éireann's NWRP is the first such Plan for the entire public water supply in Ireland.

The NWRP will:

- Enable Uisce Éireann to address Need 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.

In addition to this we anticipate that the RWRP-SE will achieve the following:

- Facilitate integration of government policy and legislation into our outcomes planning;
- Support balanced regional development, as outlined in the National Planning Framework (NPF) and the supporting Regional Spatial and Economic Strategies (RSESs), by assessing water supply Needs across our growing communities;
- Improve the security of our supplies in terms of both Quality and Quantity;
- Improve the environmental Sustainability of our supplies, and ensure that we can adapt to the impacts of climate change;
- Facilitate improvement in the Reliability of our supplies, resulting in less frequent interruptions to supplies and boil water notices; and
- Allow Uisce Éireann to have a strategic approach to planning our supplies in terms of improving biodiversity and reducing carbon.

The structure of the NWRP is set out in Figure 1.1.

Phase 1 – NWRP-Framework Plan

The NWRP-Framework Plan includes:

- A description of the methodology for Water Resources Planning:
    - How we assess Quantity Need through the Supply Demand Balance (SDB)
    - 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 each of our 539 public water supplies nationally in terms of:
    - **Water Quantity** that Uisce Éireann can provide;
    - **Water Quality** that Uisce Éireann can provide; and
    - **Performance and operational efficiency** of Uisce Éireann's Asset Base.

The Framework Plan and Consultation Two Report is available online at https://www.water.ie/projects/strategic-plans/national-water-resources/

Figure 1.1 Components of the National Water Resources Plan

The Framework Plan associated SEA Statement, AA Determination and the Consultation Two Report demonstrate, based on submissions made, how environmental considerations have shaped and helped in the development of the RWRPs.

Phase 2 – Four Regional Water Resources Plans

Progress on each of the Regional Water Resources Plans (RWRPs) is as follows:

- The draft Regional Water Resources Plan-Eastern and Midlands dRWRP-EM (Group Area 4) underwent consultation and was adopted in September 2022 after incorporating consultation feedback.
- Consultation on the draft RWRP-SW (Group Area 2) was undertaken in June/August 2022, and after incorporating consultation feedback, it was adopted in February 2023.
- Consultation on the draft RWRP-NW (Group Area 1) was conducted from November 2022 to February 2023 and after incorporating consultation feedback, it was adopted in July 2023.
- The RWRP-SE Regional Water Resources Plan: South East (RWRP-SE) (Group Area 3) is the fourth and final Regional Plan. Consultation concluded in October 2023, and it is expected to be adopted in December 2023.

Figure 1.2 Regional Areas of the NWRP

The four regions are shown in Figure 1.2. The regional boundaries are only relevant for the development of the first NWRP and have been identified as the most appropriate way to allow Uisce Éireann to identify Preferred Approaches (water supply solutions) in an efficient and timely manner. Once the first NWRP has been finalised, while it is comprised of the Framework Plan and four Regional Water Resources Plans, together they will be treated as a unified Plan. The relevant regional groupings will have no ongoing application. Where Local Authority areas have been split, Uisce Éireann will engage with the relevant Local Authorities following the finalisation of the RWRPs, on the outcomes for all water supplies in their areas.

The boundaries of the regional groups were determined based on the following criteria:

1. **Uisce Éireann Operational Regions (North and West, Eastern and Midlands, and Southern Region):** To allow us to optimise the staffing resources during the roll out of the four RWRPs.
2. **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.
3. **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. In some cases, it was necessary to split the Local Authority areas to ensure alignment of the water supply delivery area, which can comprise an interconnected network supplying both urban and rural settlements. Where this is the case, we have aligned the overall growth with the RSES and the NPF projections by attributing the different growth rates to the proportion of the supply that is in the urban and rural settlements.
4. **Environmental Impact:** As far as possible, designated water body catchments (or at least sub-catchment areas), as delineated by the EPA under the River Basin Management Plan, have been used. This allows consideration of the WFD.

Each RWRP will identify deficiencies and Need across the water supplies within the region and develop plan level solutions to address these issues. The solutions will be identified in Uisce Éireann's planning and investment cycles. Their prioritisation will be based on criticality and risk.

The RWRPs are subject to SEA and AA. Each of the four draft RWRPs and associated environmental reports have their own public consultation phases.

The four RWRPs, along with their respective SEA Environmental Reports and Natura Impact Statement, have ensured that the cumulative impacts and in-combination effects of the other RWRPs are considered. The solutions have been developed to address those impacts to the fullest extent possible based on all available information.

1.5 RWRP-SE

The RWRP-SE and supporting material consist of the following documents:

- **RWRP-SE**

  The RWRP-SE presents an overview of the South East Region with respect to population, development and the natural environment and identifies specific challenges within the region. It summarises progress to date, the Options considered, and the Preferred Approach identified at WRZ, Study Area (SA) and Regional Scale.

- **Study Area Technical Reports**

  As the South East has been divided into three (3) Study Areas (SAs) (as described in more detail in Section 1.7), a detailed Technical Report is provided for each SA describing the solution types at SA level and providing a summary of the detailed Option and Approach Development Process and resulting outcomes for each SA. The SA Technical Reports are provided as appendices to the RWRP-SE document.

- **SEA Environmental Report (SEA)**

  Uisce Éireann has prepared a SEA Environmental Report to identify and evaluate likely significant effects of the RWRP-SE and identify potential mitigation measures, in accordance with the requirements of the European Union SEA Directive and associated Irish regulations (outlined in more detail below)[1]. It considers alternatives to the approach for the RWRP-SE and aims to identify potential interactions with other plans and programmes, including the potential for cumulative effects. The SEA provides the methodology for integrating SEA and AA requirements throughout the development of the RWRP-SE; and provides mitigation and implementation recommendations for the RWRP-SE and a monitoring plan.

- **Environmental Reviews**

  The Study Area Environmental Reviews form part of the SEA Environmental Report for the RWRP-SE. The Environmental Review applies the SEA objectives and environmental assessment methodology set out in the Framework Plan. The Environmental Review summarises the environmental assessment undertaken for each Study Area (K-M) within the South East Region for the Options and Approaches considered and as outlined in the SA Technical Reports.

- **Natura Impact Statement**

  A Natura Impact Statement (NIS) has been prepared to support the AA of the RWRP-SE. Screening for AA of the RWRP-SE assessed whether, on the basis of objective scientific information, the RWRP-SE individually or in-combination with other plans or projects, is likely to have a significant effect on a European site. The relevant information to assist in informing the AA determination by Uisce Éireann is documented in this NIS (noting that Uisce Éireann's ultimate AA determination will also take into account wider factors, including feedback received through consultation).

1.6 Scoping and Screening for South East Region

Consultation on the SEA Scoping Report for the RWRP-SE was held from 22nd November 2022 to 20th December 2022. The SEA Scoping Report was provided to certain environmental authorities as specified in the SEA Regulations, for the purposes of initial consultation on the scoping of the SEA for the South East Region.

The feedback obtained has been considered and reflected in the RWRP-SE and associated SEA Environmental Report and Natura Impact Statement.

1.7 Study Areas

The South East Region has been divided into three (3) Study Areas (SAs), as shown in Figure 1.3. The Study Area boundaries were determined based on factors such as:

- Groundwater body boundaries;
- Surface water sub-catchments;
- Geographical features;
- WRZ boundaries;
- Local Authority functional areas; and
- Appropriate size for an efficient reporting structure.

A detailed Technical Report on each SA provides context on the SA in terms of water Quality, Quantity, supply Reliability, Sustainability and a Needs summary. Each SA Technical Report outlines the solution types identified for the area and applies the Option and Approach Development process, which was adopted in the Framework Plan. At the end of this process, a Preferred Approach is identified to meet the Need in the WRZ, SA and Region. Each Preferred Approach will be subject to a sensitivity analysis to help predict how it will perform against future anticipated developments. It will take multiple investment cycles to deliver all of the solutions identified in the NWRP and, in certain circumstances, capital maintenance projects may need to progress in the interim until all of the Preferred Approaches are delivered. These interim solutions will help manage and sustain Ireland's public water supply.

It should be noted that assessments, solutions and Preferred Approaches at this stage are at a plan level. Environmental impacts and costing of projects are further reviewed at project level. No statutory consent or funding consent is conferred by inclusion in the RWRP-SE. Any projects that are progressed following the NWRP will require individual environmental assessments, including Environmental Impact Assessment (as required) and screening for Appropriate Assessment, in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

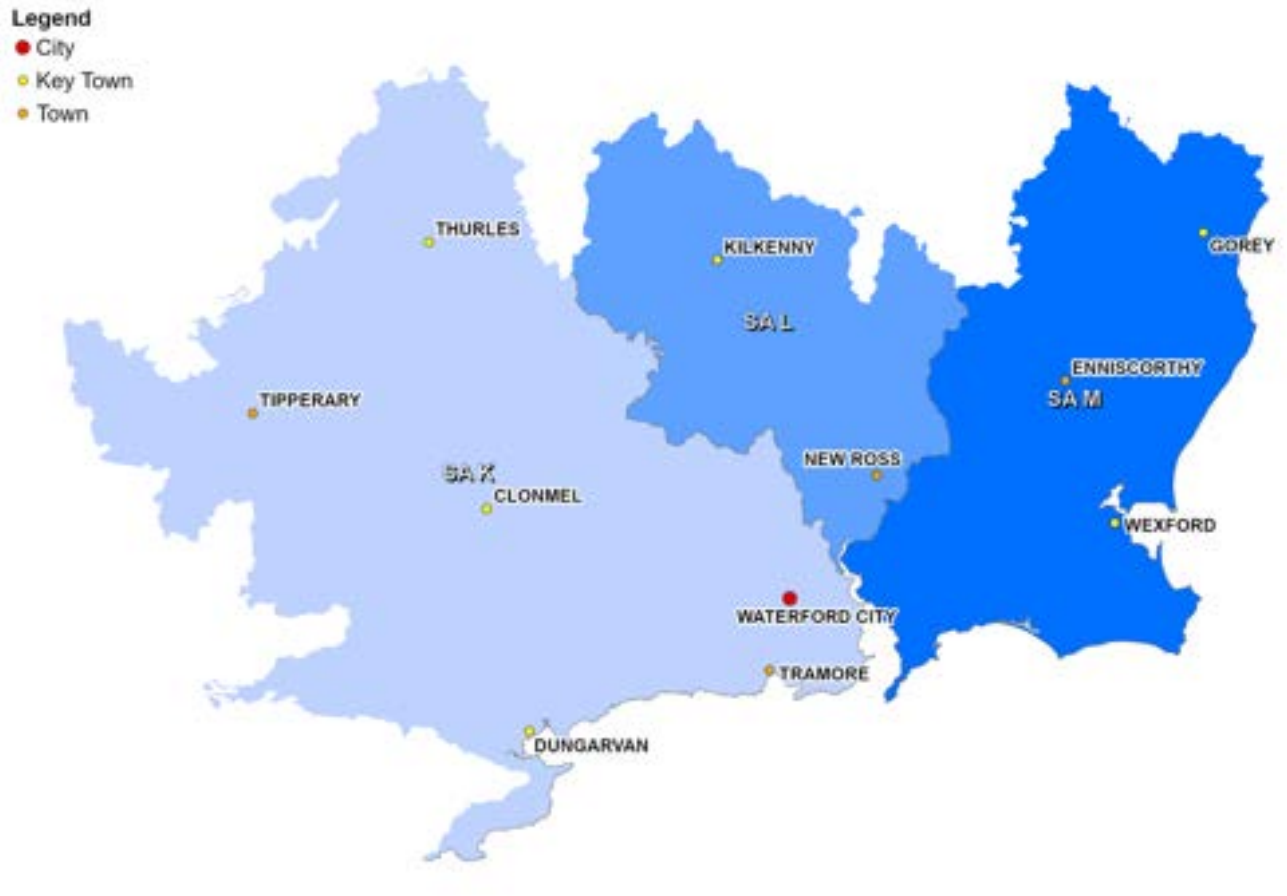


Figure 1.3 Study Areas of the South East Region

1.8 Overview of RWRP-SE

The RWRP-SE presents an overview of the Options and Preferred Approach Outcome for the South East Region. It consists of ten individual sections, of which this is the first.

Section 2 explores the context of current and forecast population growth, economic development and tourism and recreation within the South East Region. The region's natural resources, including surface water and groundwater, are profiled as well as the considerations of WFD ecological status and risk. An overview of the designated sites within the South East Region is presented. Opportunities for protection, restoration and enhancement are also outlined. Specific challenges for the South East Region are discussed including rainfall patterns and drought and flood risk. The infrastructure supporting South East Region supply is summarised along with a consideration of the impact of climate change on future water availability.

Section 3 of the RWRP-SE explores the specific issues relating to water Quantity and Quality at the regional scale. Supply Demand Balance calculations have been developed for the 111 WRZs within the South East Region covering the 25-year planning period from 2019 to 2044. Water Quality, Supply Reliability and Sustainability are also assessed at regional scale.

Uisce Éireann is committed to continuous improvement to our water supply network. Throughout the development of the Framework Plan and the RWRP-SE we have continued working on a range of existing projects, in-flight projects and identifying additional work required through the scoping process of the RWRP-SE. Each of these projects has aimed to address issues surrounding water Quality and or supply Reliability. **Section 4 and 5** of the RWRP-SE describe ongoing work and solutions to Need for the South East Region.

Sustainability remains at the core of Uisce Éireann's approach to developing appropriate solutions to meet future water demand. **Section 6** presents our Option Development Process for the South East Region. Feasible Options for the region are presented here.

A Preferred Approach is the Feasible Option or combination of Feasible Options that provide the optimum solution to address Needs. **Section 7** presents the Preferred Approaches at WRZ and SA Level, which are able to meet the water Quality and Quantity needs of the SAs within the South East Region. We also describe the 'Interim Solutions' we have identified to address the short-term needs within our Region; and test the Sensitivity of the Preferred Approaches to changes in climate change, abstraction limits, leakage targets and growth projections.

The Regional Preferred Approach, which is the optimal combination of Options that resolve the overall Deficit in the South East Region, is presented in **Section 8.**

Section 9 provides an overview of Monitoring and Feedback into the Plan and

Section 10 summarises the overall conclusions of the RWRP-SE.

1.9 Strategic Environmental Assessment and Appropriate Assessment

The RWRP-SE will be subject to SEA and AA in accordance with applicable European legislation and associated Irish implementing legislation.

The SEA Directive outlines the requirements for environmental assessments for all plans and programmes prepared by relevant authorities. The SEA Directive was transposed in Ireland under the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004, SI 435/2004, as amended (the SEA Regulations). The SEA process is integral to the development of the NWRP as a whole, and ensures the environment is considered in our approach. The SEA objectives identified at the scoping stage of the SEA process for the NWRP are used for assessing the beneficial and adverse impacts on the environment at all stages of the Options and Approach Development Process. The Options and Approach Development Process enables the selection of our preferred water resources solutions. The SEA objectives are described fully in the SEA Statement accompanying the Framework Plan.

The SEA Environmental Report that accompanies the RWRP-SE outlines the likely environmental effects and potential benefits of implementing the Plan. It is subject to public consultation in accordance with the SEA Directive and SEA Regulations. Recommendations from the SEA, following consultation, including the SEA monitoring plan and environmental action plan, will be taken forward as part of the implementation of the RWRP-SE.

A screening for Appropriate Assessment has been completed in relation to the RWRP-SE to assess, in view of best scientific knowledge and in view of the conservation objectives of relevant European sites, if the RWRP-SE, individually or in combination with other plans or projects is likely to have a significant effect on any relevant European site(s), i.e. Special Areas of Conservation (SAC) and Special Protection Areas (SPA). A summary of the screening for AA of the drRWRP-SE concluded that there was potential for Likely Significant Effects (LSEs) therefore AA of the RWRP-SE was required. A Natura Impact Statement (NIS) has been prepared to support the Appropriate Assessment of the RWRP-SE and accompanies this version of the RWRP-SE.

1.10 Summary of Policy

The key policies feeding into our NWRP and Regional Resources Plans are:

- Water Services Policy Statement (WSPS);
- Project Ireland 2040 – National Planning Framework (NPF);

- Regional Spatial and Economic Strategies (RSES);
- Water Framework Directive (WFD) & River Basin Management Plan (RBMP) for Ireland;
- National Adaptation Plan (NAP) & Adaptation Plan for Water Quality and Water Services Infrastructure;
- Recast Drinking Water Directive (DWD);
- Climate Action Plan (CAP);
- Climate Action and Low Carbon Development Act 2015 (as amended 2021); and
- Ireland's United Nations (UN) Sustainable Development Goals, specifically Goal 6 - Clean Water and Sanitation[2].

Under the Water Services (No. 2) Act 2013, Uisce Éireann is required to prepare a Water Services Strategic Plan (WSSP) setting out the company's objectives for the provision of water services in the Irish State, over a 25-year period. The WSSP identified the need for a National Water Resources Plan to be developed in order to meet its objectives.

Further details on the Policy feeding into the NWRP is outlined in Chapter 1 of the Framework Plan.

1.11 Stakeholder Engagement and Consultation on the RWRP

Public consultation is a key element in ensuring members of the public and all interested parties have the chance to be part of the development of the NWRP. As noted, the NWRP is being delivered in two distinct Phases, this will assist public and stakeholder engagement as it will allow the information to be presented in a more manageable format (as outlined in Figure 1.1). The environmental authorities have been engaged on numerous occasions throughout the development of the RWRP-SE. These are stakeholders who have a key role in shaping or informing the development of the NWRP and RWRPs. Pre-consultation workshops for key statutory stakeholders facilitated by Jacobs and supported by relevant Uisce Éireann personnel as appropriate are a key part of the consultation process on the RWRP-SE and associated environmental reports. Targeted consultation with such bodies ensures all available data relevant to the RWRP-SE is gathered as early as possible in the process. In addition, it will help to ensure that concerns and queries that may have been raised can be addressed in a timely manner.

1.12 Baseline Data

Baseline data included in the RWRP-SE has been incorporated from numerous sources including but not limited to; National Planning Framework, Central Statistics Office, Regional Spatial and Economic Strategies, Local Authority data sets, Regional Assembly data sets and Uisce Éireann data sets. Data sources are detailed in the relevant sections of the RWRP-SE. 2019 was selected as the base year to align with the planning period (2019-2025) of the NWRP.

The public water supply in Ireland is a live asset base and is subject to continuous change. Therefore, numerical figures presented within the RWRP-SE are the best estimates available at the time of publishing and may be subject to change. Data incorporated into the Supply Demand Balance (SDB) comes from Uisce Éireann's internal databases as well as data and assumptions from the above sources which includes the impacts of climate change. Where assumptions or estimates have been included within the SDB Uisce Éireann have taken a conservative approach. While Uisce Éireann is confident that uncertainties associated with assumptions/limited data sets have been addressed appropriately, we recognise that further improvements can be gained by improving the data that is available to us for modelling. Uisce Éireann have a firm commitment to update the SDB as datasets are updated and more data becomes available to them (see Section 9 for further details).

In addition, we recognise that data relating to population forecasts, economic trends and tourism are based on information gathered before the Covid 19 pandemic. Therefore, trends and patterns may need to be revised as enough data and information is available to understand the long-term impact of the pandemic. Key considerations will be potential changes to demographics in relation to commercial and office settings, changes in hospitality and tourism impacts. Uisce Éireann will incorporate any future changes as outlined in the monitoring and feedback process summarised in chapter 8 of the Framework Plan. One of the benefits of a more interconnected water supply network will be the flexibility to adapt to changing growth patterns.

1.13 Summary

In this section of the RWRP-SE we have:

- Introduced the Regional Plan as a key component of the NWRP.
- Outlined the context for the NWRP and its relationship to other Uisce Éireann Strategies, government policy and legislation.
- Outlined specific challenges for Water Supply in Ireland.
- Provided an overview of the development of the NWRP, which is being undertaken across two distinct phases.
- Summarised the structure and focus of the RWRP-SE.
- Provided an overview of the consultation roadmap.

1.14 References

1. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment; transposed in Ireland under SI 435/2004 - European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004
2. Central Statistics Office. (2023). Ireland's UN SDGs - Report on Indicators for Goal 6 Clean Water and Sanitation: Overview – SDG 6 Clean Water and Sanitation. [Online]. Available from: https://www.cso.ie/en/releasesandpublications/ep/p-sdg6/irelandsunsdgs2019-reportonindicatorsforgoal6cleanwaterandsanitation/overview-sdg6cleanwaterandsanitation/.

2 South East Region

2.1 Introduction

In this section we introduce the South East Region and describe the:

- Regional location in the national context;
- Projected population growth and economic development and how this is considered in our water resources planning approach;
- Natural water resources and the environmental status of our groundwater and surface water bodies; and
- Our water supply systems and the impacts of drought and climate change.

2.1.1 Regional Overview

Figure 2.1 shows the location of the South East Region for the purpose of the Regional Water Resource Plan (RWRP-SE). To deliver our RWRP-SE, we have subdivided the region into smaller management units to enable us to manage the process of identifying potential water supply solutions (Options) and the selection of our Preferred Approach to resolve our water supply and water quality deficits. These smaller units are referred to as Study Areas (SAs). Three (3) SAs have been defined in the South East Region. The Study Area boundaries are based on Water Framework Directive (WFD) catchments and Water Resource Zones (WRZs), which represent an area where supply and demand are largely self-contained. This is further explained in Section 1.4.

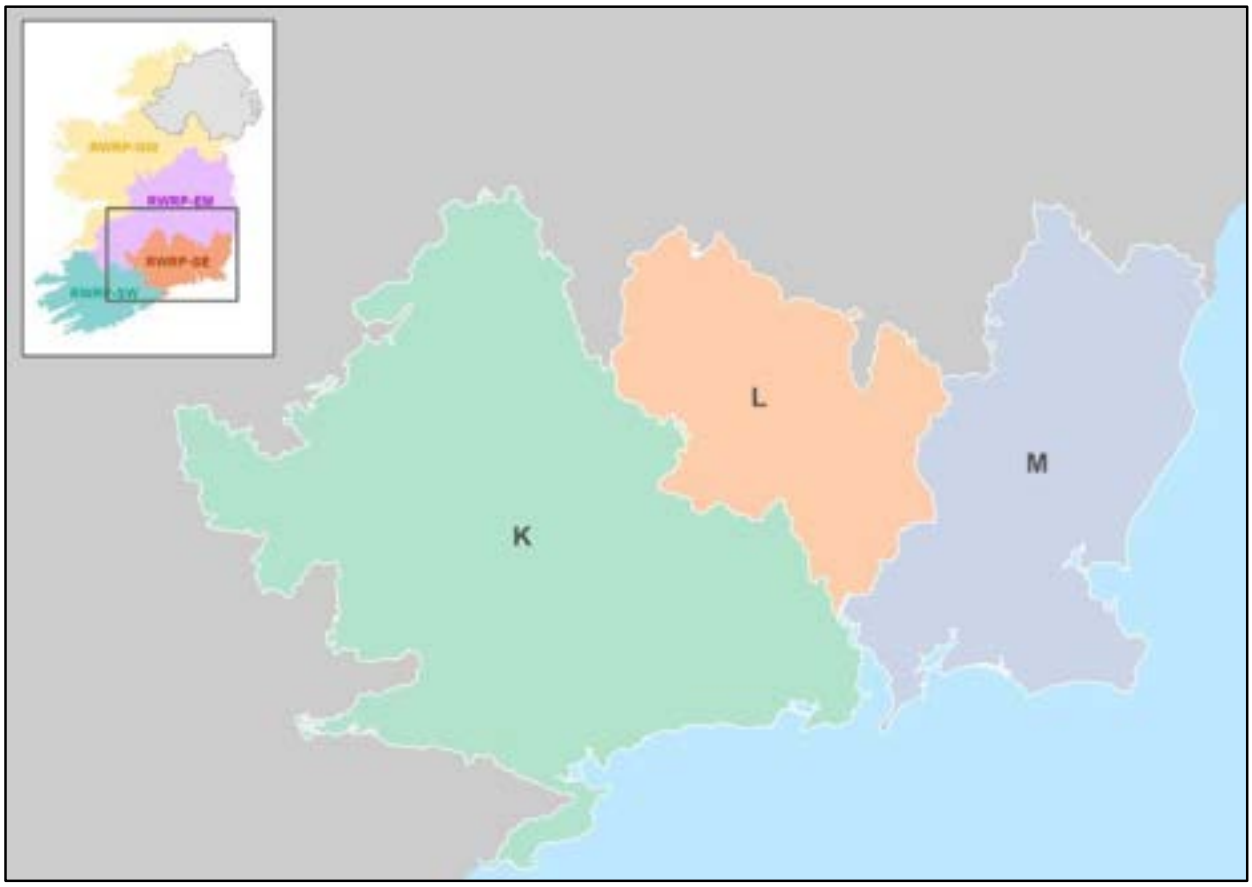


Figure 2.1 Location of the South East Region

The South East Region includes nine (9) counties: Limerick, Tipperary, Waterford, Kilkenny, Laois, Cork, Carlow, Wicklow and Wexford. It covers approximately 9,200 square kilometres (representing about 13% of the Republic of Ireland) and extends from the south-east coast, south of Arklow, towards Youghal, Mitchelstown and Limerick in the west. Waterford City is the largest settlement, comprising 14% of the regional population. It is situated on the estuary, Waterford Harbour, which receives flows from the three (3) major rivers draining the region – the Barrow, Nore and Suir.

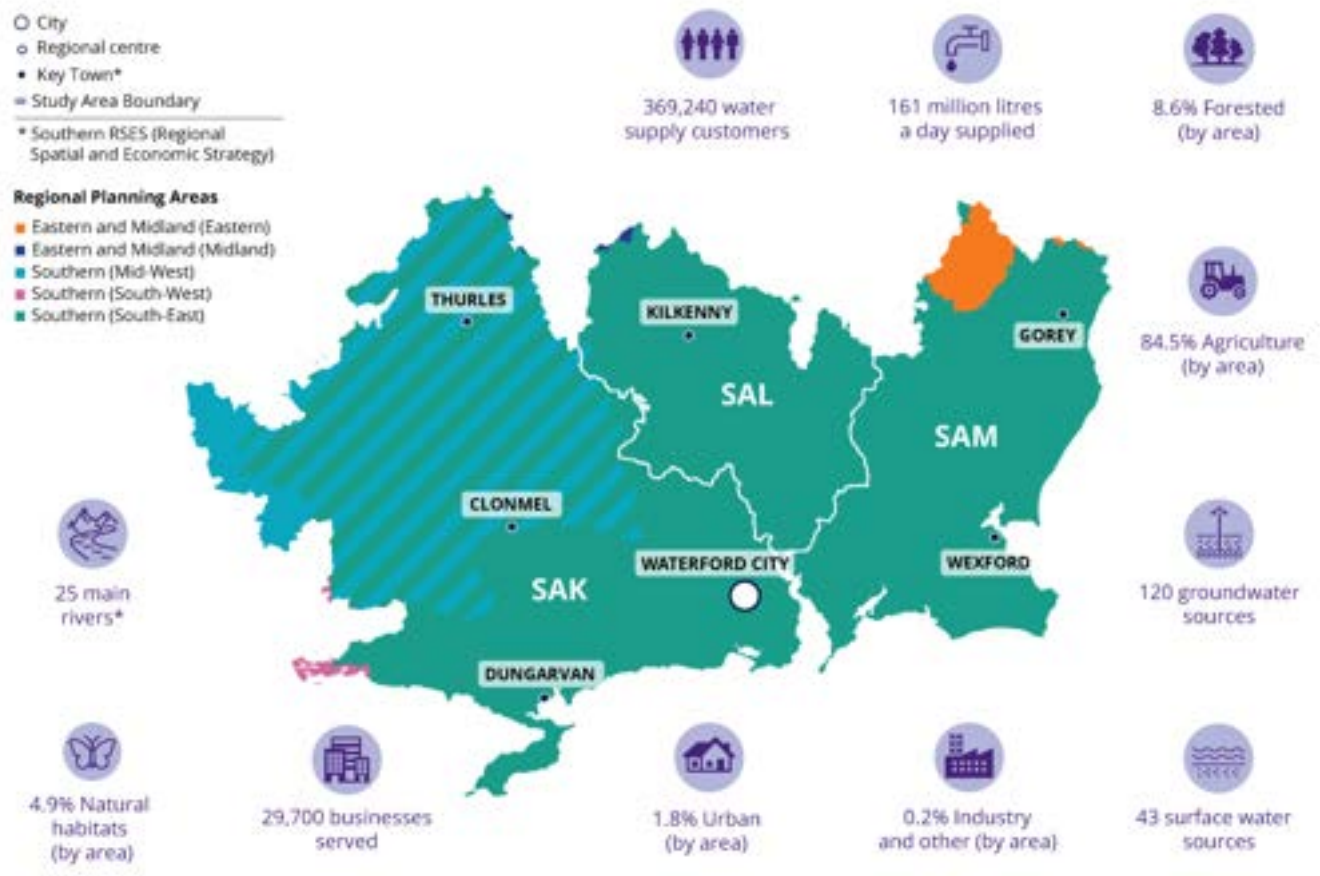
The predominant land use is agriculture, representing 84.5% of the total land area[1]. Natural habitats and forested areas comprise 4.9% and 8.6% of the land area, respectively. Urban areas cover just 1.8% of the region with industry and other minor land use categories making up the remaining 0.2%. The highest population density is in the east and includes Waterford City and the surrounding area. Uisce Éireann supplies around 161 million litres of water per day to a population of 369,240 people and 29,700 businesses in the South East Region. This represents 9% of our total supply nationally.

2.1.2 Study Areas in the RWRP-SE

The three (3) SAs making up the South East Region, and the cities, Key Towns and principal settlements (population greater than 10,000) located within them, are shown in Figure 2.2. Table 2.1 gives the area of each SA and lists the principal settlements.

There is one City, Waterford City, identified in the Southern Region Regional Spatial and Economic Strategy (RSES) and six (6) Key Towns including Kilkenny, Wexford, Thurles, Gorey, Clonmel and Dungarvan. The Key Town of Dungarven includes the satellite town of Ballinroad.

The Key Towns represent settlements that "will play a significant role in strengthening the urban structure of the Region. This is based on their strategic location and influence"[2]. It is envisaged that local authorities will plan for significant growth in these towns. Kilkenny City is the largest of the Key Towns, with a population of approximately 26,510.



*Main rivers include those classified as Stream Order 5 or higher

Figure 2.2 Study Areas of the South East Region and Key Regional Statistics

Table 2.1 Study Areas of the South East Region

Study Area	Description
SAK	SAK total area is approximately 5,060 km^2 and lies within the counties of Limerick, Tipperary, Waterford City, Waterford, Kilkenny, Laois, Cork, and Wexford*, The principal settlements (with a population of over 10,000) within SAK are Waterford City, Clonmel, Dungarvan (includes the satellite town of Ballinroad) and Tramore (CSO, 2016).
SAL	SAL total area is approximately 1,700 km^2 and lies within the counties of Tipperary, Carlow, Kilkenny, Laois, and Wexford. The principal settlement (with a population of over 10,000) within SAL is Kilkenny (CSO, 2016).
SAM	SAM total area is approximately 2,240 km^2 and lies within the counties of Carlow, Wexford, and Wicklow. The principal settlements (with a population of over 10,000) within SAM are Wexford, and Enniscorthy (CSO, 2016).

The population within the South East Region is served by 111 independent water supply systems defined by WRZs. Fifty-eight (58%) of the regional population is in SAK (Kilkenny, Limerick) which comprises Waterford City, whilst a further 27% of the region's population is located in SAM (Carlow, Wexford, Wicklow), and 14% of the region's population is located in SAL (Kilkenny, Carlow, Wexford) Table 2.2 gives the population served by Uisce Éireann and the number of WRZs in each Study Area.

Table 2.2 Study Area Population and Number of WRZs

SA No.	SA Name	Counties in SA	Total Population Served* (2019)	% of Regional Population	No. of WRZS
SAK	Waterford and South Tipperary	Limerick, Tipperary, Waterford, Kilkenny, Laois, Wexford and Cork	214,980	58	75
SAL	Kilkenny	Tipperary, Carlow, Kilkenny, Laois, Wexford	53,620	15	10
SAM	Wexford and Wicklow	Carlow, Wexford, Wicklow	100,640	27	26
RWRP-SE Area Total			369,240	100	111

* Population numbers are rounded to the nearest 10.

2.2 Growth and Development

2.2.1 Current Population

The South East Region has a population of 369,240 (9% of the national population), with 53,500 people (14% of the regional population and 1% of Ireland's population) located within Waterford City[3]. There are seven (7) settlements with a population of over 10,000 people. These are listed in Table 2.1 above. There are a further four (4) settlements with a population of over 5,000[2] including Gorey, New Ross, Thurles and Carrick-on-Suir. Eighteen percent (18%) of the region's population live in settlements of less than 5,000[2]. Figure 2.3 shows the population density across the region, highlighting smaller population centres and illustrating how much of the region is sparsely populated, resulting in the need for numerous small independent water supply systems.

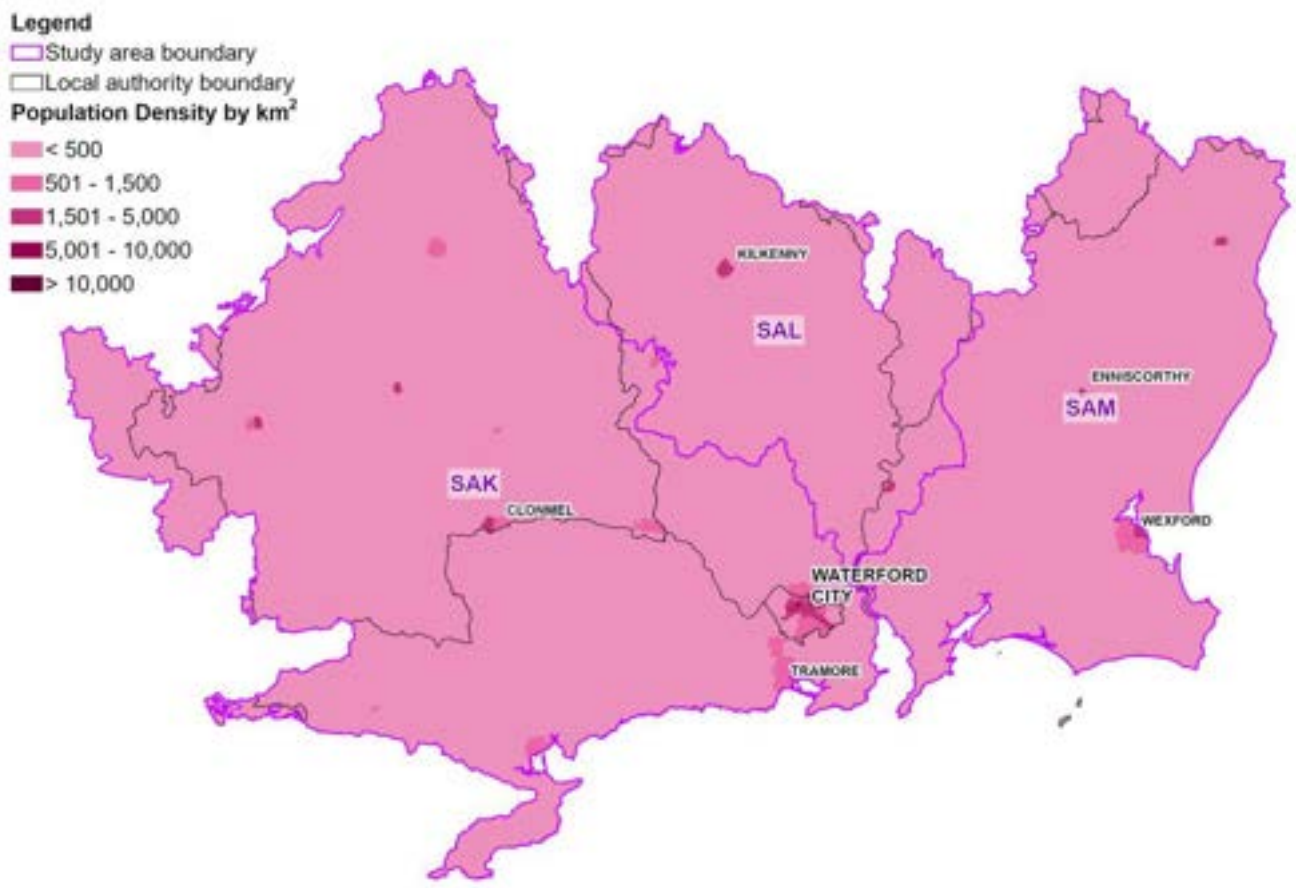


Figure 2.3 Population Density[3]

2.2.2 Growth and Economic Development Policies

Uisce Éireann's National Water Resources Plan (NWRP), which will comprise this RWRP-SE and the three (3) other regional water resource plans (Eastern and Midlands, South West and North West), is being developed to ensure water infrastructure can support the proposed growth policies at national, regional and county level. Supporting the National Policy Objectives (NPOs) and Regional Policy Objectives (RPOs) within the National Planning Framework (NPF)[4] and Regional Spatial and Economic Strategies (RSESs) is central to our NWRP.

The National Planning Framework (NPF) is the overarching policy setting out priorities for growth and development at national level over a 25-year period to 2040. A key objective is balancing development across three (3) Planning Regions, with 50% of future growth and development concentrated in the Eastern and Midland Planning Region and the other 50% directed towards the Northern and Western Region and the Southern Region.

The national objectives are then set out at regional level in the RSESs. There are three (3) regional assemblies – East/Midland Region, Southern Region, North West Region – which published RSESs for their respective regions in 2020. The RSES is a 12-year regional plan (2019-2031) which primarily aims to support the delivery of the programme for change set out in Project Ireland 2040, the National Planning Framework (NPF) and the National Development Plan 2018-27(NDP)[5].

At county level the regional policy is implemented through County/City Development Plans (CDPs), Local Area Plans (LAPs) and Metropolitan Strategic Plans (MASPs). The County Development Plan sets out the priorities within each local authority area for development over a 6-year timeframe.

The Office of the Planning Regulator (OPR) evaluates, assesses, and makes observations on the RSESs, CDPs and LAPs (including growth projections) to ensure they are in accordance with planning policy. The interaction between the planning system and Uisce Éireann's plans and programmes is summarised in Figure 2.4 below.

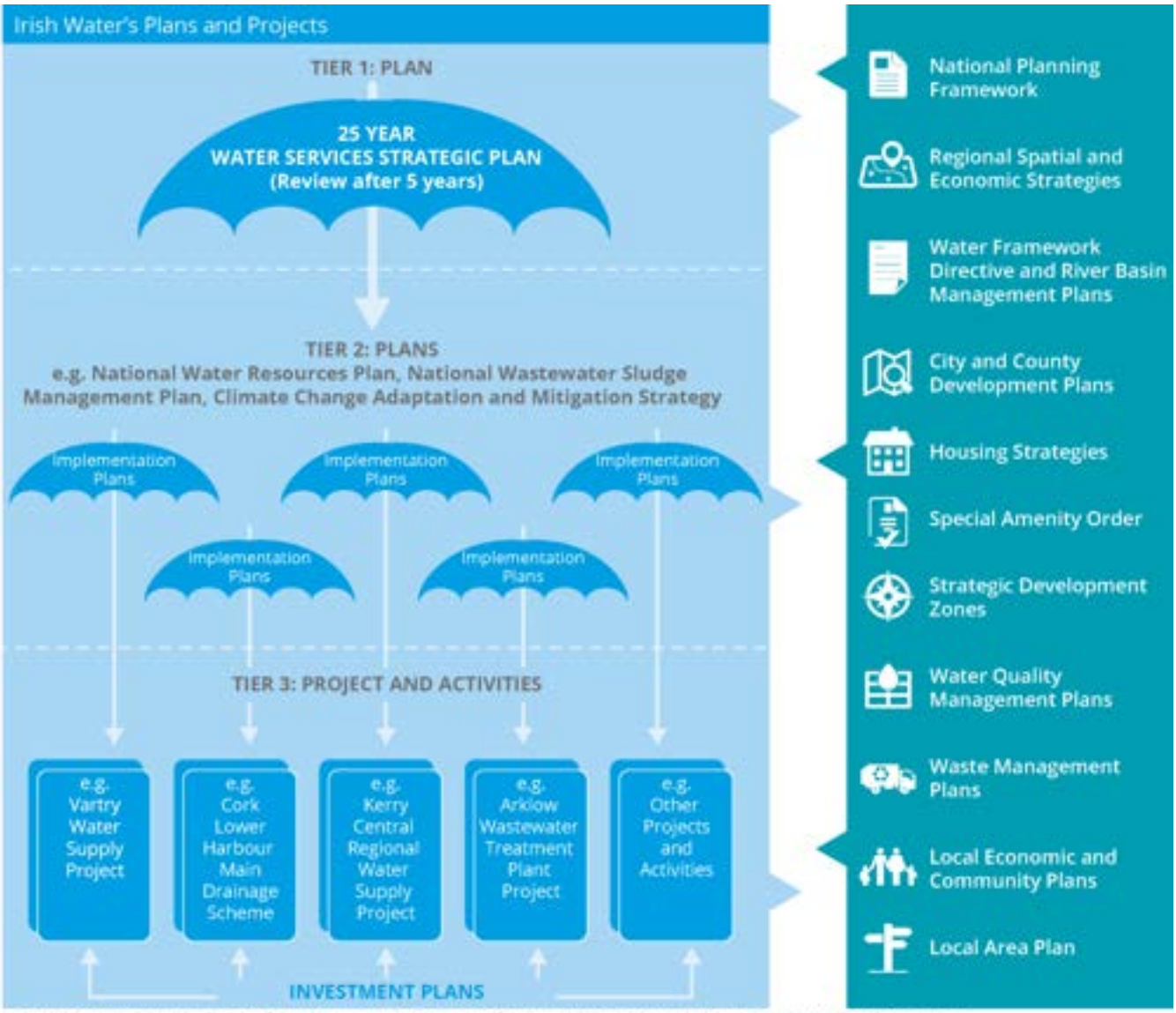


Figure 2.4 Interaction between the Planning System and Uisce Éireann's Plans and Programs

Uisce Éireann continually engages and interacts with the relevant public bodies in the planning process at all levels: national, regional and county level. Uisce Éireann is committed to taking account of national, regional and local spatial planning policy when developing investment planning (including the NWRP process) within technical, environmental, and budgetary constraints (and taking into account our sustainability policy).

The National Planning Framework recognises that "investment in water services infrastructure is critical to the implementation of the National Development Plan". Uisce Éireann's NWRP has been developed to ensure that water infrastructure can support the proposed growth policies at all three planning levels. The RWRP-SE falls within the region of the Southern Regional Assembly.

2.2.3 Population Forecasts in the RWRP-SE

Growth projections used within our RWRP-SE are based on best available data from the NPF and RSESs at the time of compiling the plan. The growth projections for the cities were taken from the NPF and RSESs, and projections for the Regional Growth Centres and Key Towns were taken from the RSESs. For all other areas, the growth projections were taken from the NPF.

In addition, we recognise the ongoing work between the Regional Assemblies and the Local Authorities over the course of the development of the Local Authority County / City Development Plans and the MASPs. As these plans are finalised, Uisce Éireann will incorporate the increasingly refined growth rates into our demand forecasts – see Section 2.2.3.1 for further details. The demand forecasts are used in our Supply Demand Balance calculations to determine future water supply deficits in the region.

The projected population used in our demand forecasts for WRZs at our regional planning Study Area level is shown in Table 2.3.

Table 2.3 Study Area Population Growth (2019 to 2044)

SA No.	SA Name	Total Population* (Source: CSO, 2016[2] and IW population projections)		Change in Population
		2019	2044	%
SAK	Waterford and South Tipperary	214,980	279,370	30
SAL	Kilkenny	53,620	66,400	24
SAM	Wexford and Wicklow	100,640	127,710	27
	TOTAL	**369,240**	**473,480**	**28**

* Population values are rounded to the nearest 10

The overall regional population growth is 28% from 2019 to 2044. All study areas in the South East Region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016.

SAK (County Kilkenny, Limerick, Tipperary and Waterford) has the highest projected growth rate at 30%, which is driven by the East Waterford Water Supply Scheme WRZ and Clonmel and Environs WRZ 2044 forecast growth of 44% and 47% respectively.

The population growth at a WRZ level is presented in Figure 2.5. The figure shows the higher growth rate projections of Waterford City and surrounds as well as Tramore and surrounding areas. It should be noted that settlements and associated growth rates are not exactly aligned with the existing water supply asset base, as our water supplies can serve large areas covering urban and rural settlements through an interconnected asset base. Where this is the case, we have attributed the differing growth rates in proportion to the supply that is in the urban and rural settlements. This ensures that the overall growth is aligned with the NPF (and LAPs, where applicable).

A summary of the population growth rates that we have assumed for the settlements in the RWRP-SE is presented in Section 3, which explains the demand forecast projections across the South East Region.

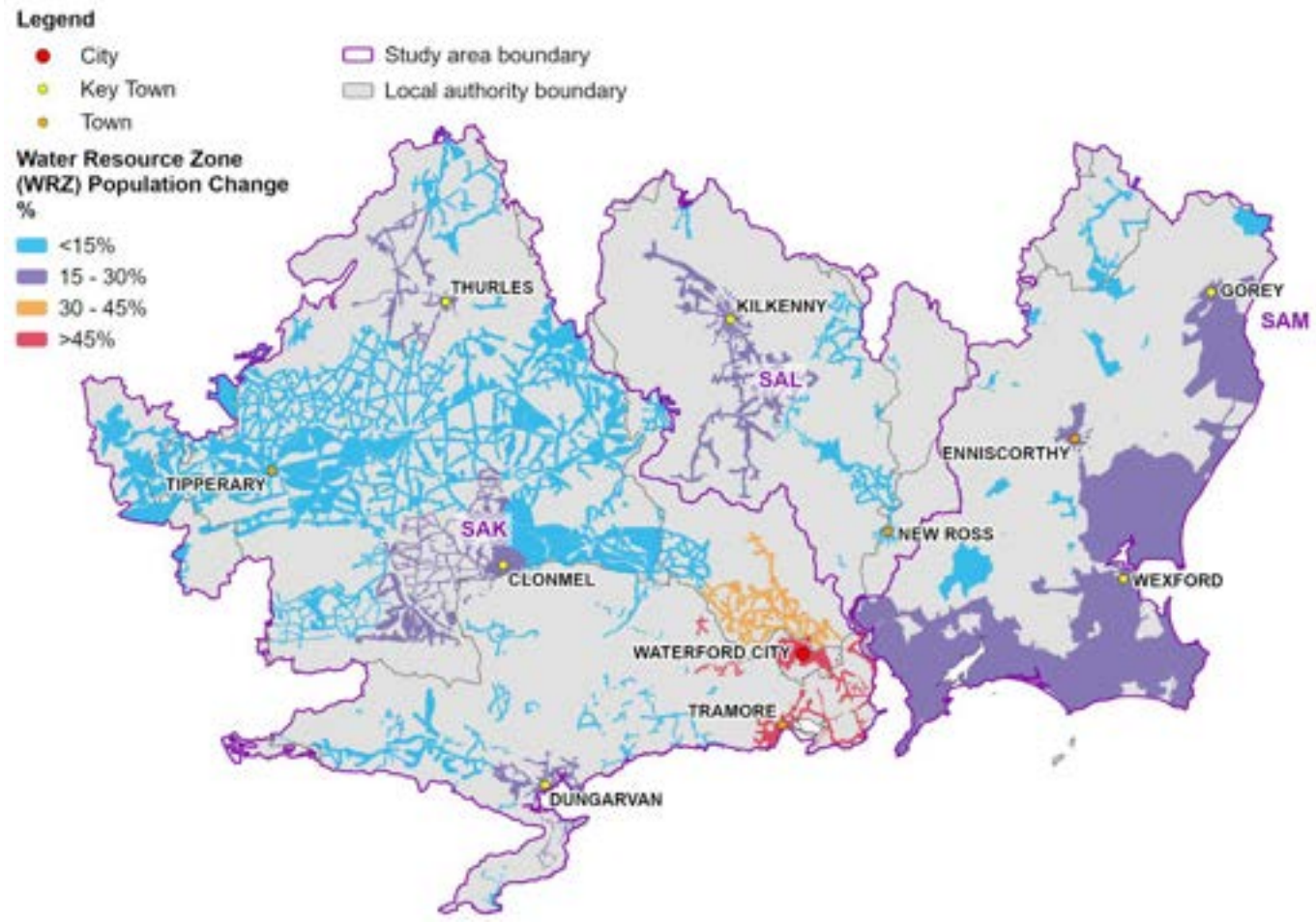


Figure 2.5 Percentage Change in Population (2019 to 2044) for WRZ's in the South East Region

2.2.3.1 Future Updates to Growth Projections

We recognise the ongoing work between the Regional Assemblies, the Office of the Planning Regulator and the local authorities over the course of the development of the Local Authority County/City Development Plans and the Waterford Metropolitan Area Strategic Plan (MASP). As these plans are finalised, Uisce Éireann will incorporate the increasingly refined growth rates into our demand forecasts. Uisce Éireann is also collaborating with Central Statistics Office (CSO) to update the 2022 Census population data for Uisce Éireann's planning boundaries. The Supply Demand Balance will be updated once the 2022 Census population update is completed. Any new census data and information will be incorporated on an iterative basis through the monitoring and feedback process set out in section 8.3.8 of the Framework Plan.

Uisce Éireann has developed a 10-year capacity register based on the Supply Demand Balance (SDB) to provide Local Authorities with an indication of settlements that have potential capacity constraints. These will be made available for use in Development Plans. This process will involve an ongoing feedback loop between the resources planning process and the forward planning processes in Uisce Éireann, the Regional Assemblies and the Local Authorities. This will allow Uisce Éireann to respond to growth and development needs and prioritise water supply investment in collaboration with Local Authorities and with reference to the County/City Development Plans, LAPS and MASPs.

The methods for forecasting water demand utilising the population projections are detailed in the NWRP Framework Plan Section 4. Projections of water demand and the resulting challenges for the South East Region are set out in Section 3 of this Plan.

2.2.3.2 Non-Domestic Growth

Within the RSES and the NPF there are also projections of non-domestic growth. The precise nature of the business activity created to drive non-domestic growth can have a significant impact on water demand as non-domestic water demand varies enormously from sector to sector and property to property. Therefore, an allowance has been made for non-domestic growth in towns and cities identified as strong growth areas in Project 2040[4]. For other areas it has been assumed that there will be no significant increase in non-domestic demand. This approach and the assumptions made are described in Section 4.3.2.3 of the Framework Plan. We will review policy and trends in relation to this over the coming years and refine our forecasts as per the monitoring and feedback process set out in Section 8.3.8 of the Framework Plan and Chapter 9 of this Plan.

2.2.4 Tourism and Recreation

Tourism has an important role in the core baseline area, particularly in rural locations, with the National Planning Framework (NPF) [4] stating that tourism is a key aspect of rural job creation now and in the future. The majority of the core baseline area encompasses Ireland's Ancient East, and slightly extends into Ireland's Hidden Heartlands on its Northern side, and the new Dublin tourism brand on its Western side, three (3) of Fáilte Ireland's tourism programmes in the country. Ireland's Ancient East is part of a tourism development strategy that covers the South, East and part of the Midlands, and places emphasis on the importance of historic sites in the area[6]. Hidden Heartlands is located in the Mid-West, focussing on rural communities[7] and the new Dublin tourism brand which is "the first Dublin-dedicated tourism campaign in many years" and seeks to change perceptions of Dublin "from a weak and one-dimensional image to that of a city pulsing with life"[8].

Key tourist attractions located within the region are described below[9]:

- The county of Carlow (SAL and M) is the second smallest and the third least populous of Ireland's 32 traditional counties. It is known for its rich store of historical and archaeological artifacts from pagan sites such as the Brownshill Dolmen and for its ecclesiastical settlements, many of which are of national significance[10];
- The county of Cork (SAK) contains internationally recognised Camden Fort Meagher, and it has been described as "Ireland's Maritime Haven", with emphasis placed on the cultural and historical attractions many of which located along the coastal environments[11];
- The county of Kilkenny (SAK and L) is known as the "Cultural County" and has rich historical roots and is famous for its medieval buildings and castles[12].
- The county of Laois (SAK and L) has been described as an "outdoor enthusiasts paradise" with emphasis also placed on the county's cultural and historical attractions[13].
- The county of Limerick (SAK) includes Limerick City, the first city of culture, and emphasises the importance of sports in its touristic appeal[14];
- The county of Tipperary (SAK and L) has been described as the "farming heartland of Ireland" with emphasis also placed on the county's cultural and historical attractions[15];
- Waterford City (SAK) is the oldest city in Ireland, and it is said to be the perfect blend of ancient and modern[16].
- The county of Waterford (SAK) is home to the stunning 25km County Waterford's Copper Coast, and an UNESCO Global Geopark which offers winding trails for walking, driving, and cycling[16];
- The county of Wexford (SAK, L and M) is known as 'The Sunny Southeast'. Alongside being a Viking town, it offers coasts and beaches, and is said to be one of the best places to see puffins in the wild[17];

- The county of Wicklow (SAM) has been described as “the garden of Ireland”, containing Ireland’s largest national park (Wicklow National Park) and emphasising outdoor recreation as a key asset for the area[18].

Ireland’s natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport. Key natural heritage and outdoor recreation attractions[19] within the core baseline area include:

- Study Area K: Comeragh Mountains, Capel Island and Knockadoon Head Nature Reserve,
- Study Area L: Ballykeeffe Wood Nature Reserve, Kyledohir Wood Nature Reserve, Garryricken Woods Nature Reserve, Kilkenny Castle
- Study Area M: Ballyteigue Burrow Nature Reserve, The Raven Nature Reserve, Wexford Wildfowl Reserve, Loftus Hall, Irish national Heritage Park

Rivers, loughs and coastal areas across the core baseline area also all make an important contribution to tourism and recreational opportunities and support important fisheries.

Rivers and coastal areas across the region make an important contribution to tourism and recreational opportunities and support important fisheries. For example, the River Barrow, which is the second longest river in Ireland (after the River Shannon) is known as an area of natural beauty and hosts many sporting activities and recreation events[20]. The River Nore, which joins the River Barrow about 20 km upstream of the Waterford Harbour estuary, is one of the best salmon rivers in Ireland[20]. The River Suir also joins the Barrow and is one of Ireland’s important brown trout fisheries[21].

In planning our water resource infrastructure, we consider the increase in water demands resulting from the influx of tourists, particularly during summer months when local demand is elevated. In cases where the holiday population is high relative to the resident population the demand peaks may be pronounced during hot, dry weather periods in the summer season. We have accounted for the impact of tourism in our water demand forecasts. This is further explained in Section 3.2.6

2.2.5 Impact of the Covid-19 Pandemic

We recognise that data relating to population forecasts, economic trends and tourism are based on information gathered before the Covid-19 pandemic. Therefore, trends and patterns may need to be revised as enough data and information is available to understand the long-term impact of the pandemic. Key considerations will include potential changes to demographics in relation to commercial and office settings, changes in hospitality and tourism impacts. Uisce Éireann will incorporate any future changes as outlined in the monitoring and feedback process summarised in Chapter 8 of the Framework Plan. One of the benefits of a more interconnected water supply network will be the flexibility to adapt to changing growth patterns.

2.3 Natural Resources

A sustainable supply of clean water to support our growing communities depends on our understanding and protection of natural resources. At a fundamental level this includes the catchment that feeds surface water and groundwater bodies and the extent of ecosystem services that these waterbodies provide. Improving sustainability is at the heart of our plans and the NWRP assessment methodology incorporates Strategic Environmental Assessment (SEA) objectives into the decision-making process. This includes taking account of cumulative impacts within catchments. As noted in Section 2.2, examples of waterbodies that provide environmental, social and cultural values for communities in the South East Region include the River Barrow, River Suir and the River Nore, collectively known as The Three Sisters. The rivers drain a large part of southern Ireland, and flow through Counties Tipperary, Carlow, Kilkenny,

Wexford and Waterford. The rivers join to form the Waterford Harbour estuary, east of the city of Waterford. The River Barrow is the longest of the three (3) rivers, and the second longest river in Ireland. It is considered one of Ireland's most scenic waterways.

Our freshwater systems support the provision of drinking water needs, livestock and firefighting as well as other uses including industry, irrigation, and recreation and amenities. In our planning, Uisce Éireann recognises that in addition to anthropogenic uses, our freshwater resources also need to sustain habitats that rely on the quality, flows and volumes within these systems. We endeavour to protect aquatic environment/habitat by maintaining water quality, physical habitats, hydrological processes, flow regimes and broader biological diversity.

In the following sections we describe the features of our natural environment that impact water quality and describe the sensitivities of the riverine ecology to changes in the flow regime. This is an important consideration for understanding the impact of abstractions and hydromorphological modifications (such as large-scale damming and channelisation). We account for these impacts by limiting new abstractions to sustainable flow thresholds. This is discussed further is Section 2.3.7. We describe the environmental status of our surface water bodies and ground water systems in Section 2.3.5 and Section 2.3.6.

2.3.1 Geology

Understanding the geology of our catchments is vital to the provision of clean, secure and sustainable water supplies. Geology is responsible for shaping mountain ranges, defining river network systems and determining their character, i.e., slope and erosivity. The geology in the environment can impact the quality and quantity of water in the area through differences in drainage, chemical composition, filtration and resultant land use. The water supply can be heavily impacted by the type of aquifer in the area, as they impact the system's ability to store and transmit groundwater. The resultant land use can have a detrimental impact on water quality.

The bedrock geological maps developed by the Geological Society of Ireland (GSI) are the foundation maps upon which groundwater protection and vulnerability maps have been constructed and upon which Water Framework Directive (WFD) groundwater bodies and monitoring programmes have been established by the Environment Protection Agency (EPA). In general, the topography and its associated geological deposits can be broadly split into topographic highs and lowland valleys. Considering the extent of glaciation during the last ice age the Irish landscape can be considered a glacial one. Bedrock outcrop often prevails in the mountainous areas, while the remainder of Ireland's bedrock is generally overlain by glacial material or glacially influenced materials (river alluvium, peat or coastal deposits).

The oldest geology of the South East Region, comprising greywacke sandstones, slatey mudstones, shales and quartzites, were deposited during the Cambrian Period, 541 – 485 million years ago (mya). These represent 5% of the geology of the South East Region, consisting of highly complex metamorphic rocks. There is a very minor representation of Precambrian rocks, representing just 1%. Most of them originated as sedimentary rocks such as limestones (which became marbles), sandstones (which became quartzites or psammites) and mudstones (which became schists or pelites). There are large swathes of Cambrian Metasediments stretching from Tramore in Waterford northeast to Ballygarrett at the coast in Wexford.

The Ordovician and Silurian Periods, when present day northwest and southeast Ireland, lay along the margins of separate continental masses and divided roughly along the Shannon Estuary, represents the second largest proportion (32%) of the South East Region's bedrock geology. During the closure of the Iapetus Ocean, the subduction of oceanic crust was responsible for the formation of a volcanic island arc. These volcanic rocks were erupted and intruded into the Silurian marine sedimentary sequences, which include greywackes, mudstones, lavas and tuffs. These form an extensive band which stretches from Wexford in the northeast to Stradbally on the coast of Waterford.

Broadly speaking the geology of the Munster Basin, consists of east-west trending anticlines (sandstone ridges) and synclines (limestone valleys). The Late Devonian period (c. 370 mya) was a period characterised by river deposition in a sub-equatorial arid environment. The rocks are collectively known as Old Red Sandstone (ORS) and consist mainly of coarse and fine sandstones, siltstones, shales, and conglomerates. They make up around 14% of the bedrock geology in the South East Region. These non-marine sediments can form depths of up to 6 km in places. They are resistant to erosion and often form rugged terrain of the more upland areas. Most notable are the Knockmealdown Mountains located on the borders of Tipperary and Waterford. They are predominantly overlain by quaternary sediments of Till and raised Peat in the more upland areas.

Most of the bedrock geology of the South East Region (34%) falls into the Lower Carboniferous period (350 mya), which consists of a mixture of sandstone, limestone and shale, and these represent the transition from terrestrial to marine depositional conditions. During the transgression of the warm, shallow sea limestones, sediments derived from the breakdown and disintegration of calcareous shells of invertebrate animals were deposited. They are present in the lower lying areas across large areas of Tipperary and Kilkenny and to a smaller extent southeast Wexford. The Upper Carboniferous (325 mya) is represented by 6% of the South East Region, dominated by deep water shales in the lower Namurian sequence, while the upper portions are generally sandstones and siltstones. These appear as a small occurrence in northern Tipperary and Kilkenny.

2.3.2 Groundwater Aquifers

The geology of our catchments is vital to the quantity and quality of water which we can abstract. The quantity of water which can be abstracted from a groundwater source is impacted by the depth, porosity and connectivity of the target geological formation/layer. Geological horizons such as clay and igneous rocks have limited porosity and are therefore low yielding (poor aquifers) whilst geological formations such as chalk and limestone are associated with higher porosities and can yield substantial quantities of water (good aquifers). For water to move through an aquifer the internal voids and fractures must be connected. The porosity and degree of fracturing and interconnectivity therefore impacts not just the available quantity of water but also the level of recharge of the groundwater body. This in turn impacts the potential sustainable abstraction rate.

About 34% of the water supply for the South East Region is abstracted from underground aquifers, either from boreholes, springs or infiltration galleries. Groundwater abstractions make up 120 of our 163 supply sources are groundwater sources representing an important source of supply serving independent settlements within the region. The major aquifers in the South East Region are shown in Figure 2.6.

Geological Survey Ireland has classified and mapped nine (9) aquifer categories across the country. The broad criteria used to determine aquifer categories include hydrogeological data, the presence of large springs, geology and stream density. The categories describe both resource potential/value (Regionally important, Locally important, or Poor) and groundwater flow type (through fissures, karst conduits or intergranular porosity):

- Regionally important bedrock aquifers are defined as those that can service public water supplies or that have excellent yields (>400 cubic meters per day (m^3/day)). The aquifer area is >25 km^2 and flow is predominantly though fractures, fissures and joints.
- Locally important bedrock aquifers are defined as those that can service more local public water supplies/group schemes or that have good yields (100-400 m^3/day). Flow is predominantly though fractures, fissures and joints.
- Poor bedrock aquifers are defined as those that can service small abstractions (domestic supplies/small group schemes) or that have moderate-low yields (<100 m^3/day). Flow is predominantly though a limited and poorly-connected network of fractures, fissures and joints.

Additionally, GSI usefully grouped and summarised the aquifer categories into high-level groupings that succinctly describe the broad types:

- Sand/gravel;
- Karstic;
- Productive fissured bedrock; and
- Poorly productive bedrock.

Sand and gravel aquifers are classed as an aquifer if the deposit is highly permeable, more than 10 m thick and greater than one square kilometre in areal extent. The thickness is more often used than the more relevant saturated thickness as the data for this is often not available.

These general types of aquifers can be considered as groundwater systems that have similar properties with a good indication of resource, extent and risk. Table 1.2 in Appendix C of the Framework Plan describes the nine (9) aquifer categories in detail.

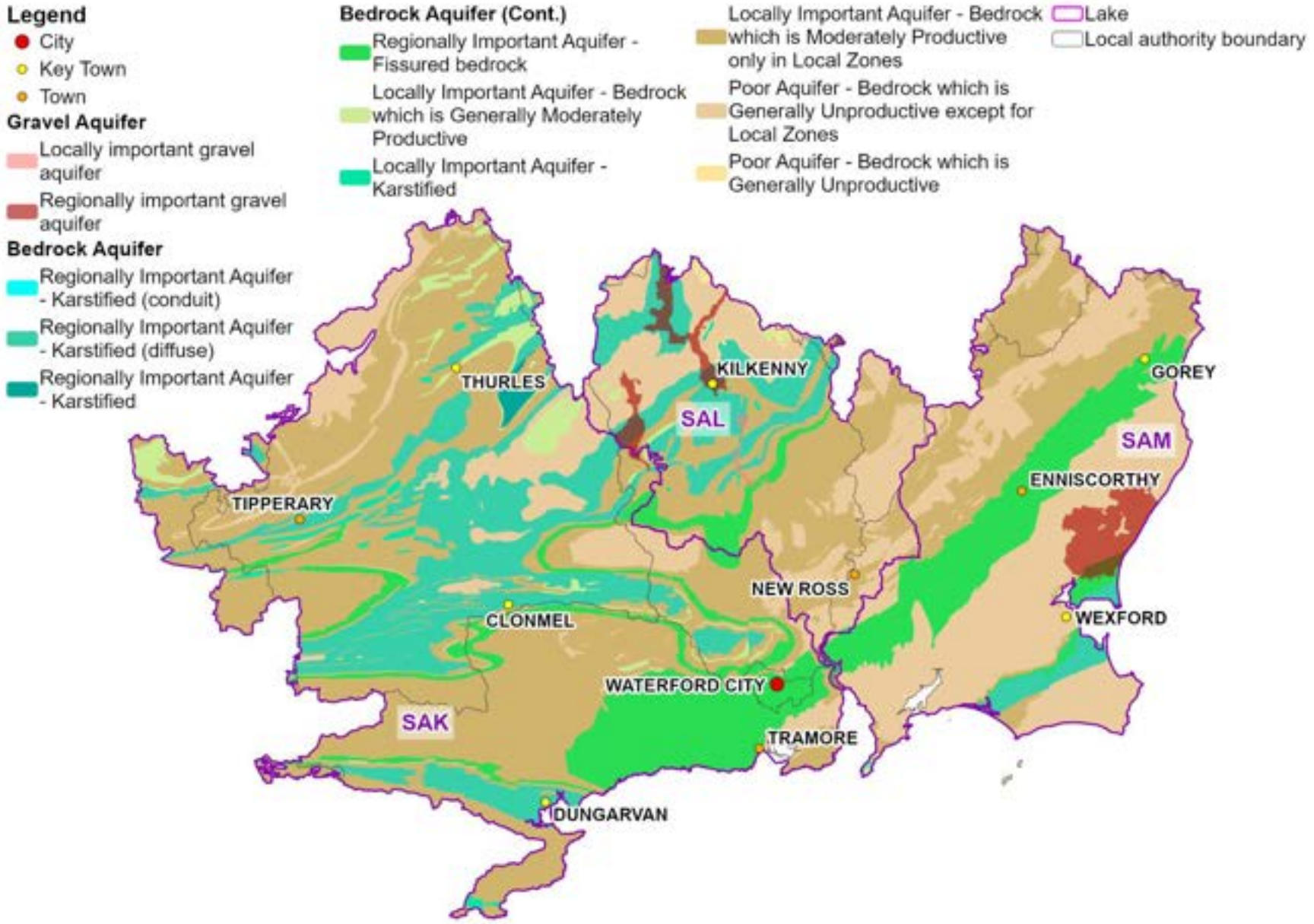


Figure 2.6 Spatial Extent of Major Aquifers in the South East Region

The predominant aquifer type of the South East Region is made up of poorly productive bedrock (70%), followed by productive fissured (22%), sand and gravel (5%) and karstic aquifers (3%).

The Old Red Sandstone (ORS) are predominantly made up of **poorly productive bedrock.** The aquifer is generally devoid of intergranular permeability, with groundwater flow occurring predominantly through fractures and faults. Most groundwater flow occurs in the top 15-20 metres of the aquifer, with levels generally mirroring topography. Deeper flows along fault zones or connected fractures are encountered however, which can provide much higher yields. Significant flows can be found at springs issuing from bedding planes marking a change in lithology. Much of western and central Waterford, as well as parts of western Tipperary, is characterised by a larger proportion of ORS bedrock resulting in lower groundwater potential in this part of the region. The Cambrian rocks, mostly seen in southeast Wexford, generally show low aquifer potential but are occasionally capable of supplying group schemes and small commercial interests.

Groundwater flow in the **productive fissured aquifers** largely takes place along fractures and faults. Where extensive faulting occurs, the aquifer permeability is likely to be increased. Additional fracturing may also be associated with the faulting. An extensive body of productive fissured bedrock, made up primarily of volcanics, stretches from Wexford in the northeast to Stradbally on the coast of Waterford. The most productive yields are sourced from the well-developed fissures in the felsic Rhyolites and Andesites. Lower permeabilities and yields do occur in these however, with intrusive rocks (dykes and sills) forming a barrier to groundwater flow. There are some productive wellfields in this formation, such as Gorey in Wexford which has in the past supplied upwards of 7,000 cubic metres per day (m^3/day). The potential for productive wells becomes less frequent in County Waterford due to the greater proportion of intrusive rocks. Although covering a less extensive area than the Ordovician Volcanics, the Devonian Kiltorcan Sandstones form a Regionally Important Fissured aquifer and can be found along the base of the Galtee Mountains, while also extends in a narrow band through Waterford, Tipperary to Kilkenny. This type of bedrock has shown to be able to provide good yields (about 700 m^3/day at Cappoquin), where permeability depends on fractures and fissures. The cleaner sandstones are likely to have a denser network of fracturing and fracture permeability in the shalier sandstones.

The differing spatial extents and permeabilities of **sand/gravel aquifers** results in a variable development potential. They act as areas for groundwater filtration owing to the intergranular flow mechanics, which offers good protection against microbial contamination. There are a number of regionally important sand and gravel aquifers (Rg) throughout the region, with the main ones occurring in Kilkenny (Nore Valley and Kilmanagh Gravels) and the Screen Hill Gravels in Wexford. Those in valley settings will likely receive significant rejected recharge from valley sides. The sand/gravel deposits, when overlying areas of bedrock aquifers, can improve the overall flow and storage to the aquifer and also protect against pollution. Conversely, groundwater from the dolomite bedrock can feed into the gravel under certain conditions.

There are extensive swathes of **regionally important karst aquifer** (diffuse Rk^d) in some areas, particularly in southern Tipperary stretching north-eastwards into Kilkenny and southeast Wexford. The distribution of permeability and yield is more homogenous where the development of karst has resulted in a more diffuse network of flow pathways. This provides a slightly more reliable flow regime than conduit (Rk^c) dominated aquifers, however these karstic environments are still prone to pollution from point sources such as septic tanks, disposal sites and land spreading. A number of large abstractions take place from these pure bedded limestones, namely Fardystown (supplies c. 9,500 m^3/day) in Wexford and Mullenbawn spring (650 – 2,200 m^3/day) in South Tipperary. Dolomitisation of the limestone results in an increase in porosity and permeability and is most notable in central Kilkenny where a band of bedrock extends to the northeast, while also being present in parts of north Tipperary. Optimum well yields from the dolomite aquifer will be obtained from boreholes drilled into one of the many fault zones and penetrate at least 50-100 metres of the aquifer. Previous groundwater exploration in the area of Bennetsbridge, Kilkenny showed the productive limestone zones to be relatively localised

and associated with areas olomitizationion. It should be noted that extensive weathering associated with olomitizationion can lead to problems when drilling.

2.3.3 Surface Water Systems

Relative to other European countries, Ireland has twice the EU average of lake coverage (12,000 lakes covering ~2% land area)[22]. In the South East Region however, there are only 11 lakes, covering 0.01% of the region's land area (less than 1 km^2). The three (3) largest lakes are Lough Knockaderry, Lough Belle and Lough Ballyshunnock.

The larger known rivers within the region include the Barrow, Suir, Nore, Slaney, Aherlow and Tar; however, they represent only a fraction of the extensive 8,830 km network currently mapped by the EPA in the South East Region. The Barrow River is the second-longest river in Ireland (after the Shannon River) and the Suir the third longest river. Along with the Nore River, the Barrow and the Suir Rivers are known as the Three Sisters. Their combined catchment areas are 9,207 km^2.

Surface water makes up 66% of the water we supply to our customers in the South East Region and comprises 43 of our 163 supply sources. The surface water river systems are shown in Figure 2.7 and described below for each Study Area.

SAL is split between the River Barrow and the River Nore catchments. The Barrow rises in the Slieve Bloom Mountains in County Laois, flowing a distance south before crossing into SAL at Muine Bheag, turning tidal at Saint Mullins, being joined by the Nore at Ringwood before flowing through New Ross into the Suir Estuary at Cheekpoint. The Nore rises at on the slopes of Borrisnoe Mountain in County Tipperary, flowing south east into SAL around Durrow, traveling through Kilkenny City, turning tidal at Inistioge, before its confluence with the Barrow. Both rivers are designated as part of the large River Barrow and River Nore Special Area of Conservation (SAC).

Most of SAK is within the large River Suir catchment, with small parts of the Study Area crossing into the coastal Colligan-Mahon catchment and the River Blackwater catchment. The River Suir is one the largest rivers in Ireland, with a total catchment area of 3,542 km^2, rising on the slopes of the Devil's Bit Mountain before draining large parts of County Tipperary as it flows south through wide karstified limestone plains. The Suir then turns sharply east to form the border with County Waterford, flowing through Clonmel before turning tidal at Carrick-on-Suir, joining the Nore and Barrow Rivers east of Waterford City, before finally entering the sea at Waterford Harbour. The River Suir is designated as the Lower River Suir Special Area of Conservation (SAC), and one of its tributaries, the Clodiagh River (Portlaw), is also designated for *Margaritifera* (Freshwater Pearl Mussel) SAC catchment.

Most of SAM is within the large River Slaney & Wexford Harbour catchment, whilst elsewhere the Study Area crosses into the small catchments of the Ballyteigue-Bannow catchment in the south, and the River Owenavorragh catchment in the north east. The River Slaney rises on Lugnaquillia Mountain, draining the western Wicklow Mountains as it flows south, crossing into SAM at Bunclody, continuing south across central County Wexford, becoming tidal at Enniscorthy before entering Wexford Harbour at Wexford Town. The Slaney has a total catchment area of 1,980 km^2 and is designated as the Slaney River Valley Special Area of Conservation (SAC). In comparison, the Ballyteigue-Bannow and Owenavorragh catchments are much smaller coastal catchments characterised by several short rivers flowing to sea.

Figure 2.7 Rivers of the South East Region

2.3.3.1 River Typologies

The riverine ecology of many of our river systems is considered highly sensitive to changes in flow and water level. The parameters identified to reflect this sensitivity include geology, gradient and altitude. There are eight (8) typologies for water resources standards for rivers that are defined based on these parameters[23]. The river water bodies in the South East Region comprise five (5) of the eight (8) typologies, as shown in Figure 2.8. The dominant river typology is represented by B1 – Hard limestone and sandstone; low-medium altitude; low-medium slope. This makes up 73% of the river systems in the region.

The most sensitive rivers are those within the C2 and D2 categories which are representative of headwaters, low nutrient, low pH and salmonid spawning and nursery areas. The salmonid spawning and nursery areas are particularly sensitive to low flows and impounding structures. These categories combined make up 26% of the river systems in the region.

The method by which waters of a similar ecological sensitivity are grouped into types for the Water Framework Directive, is referred to as a **typology**. For example, a river may be assigned to types based on altitude and alkalinity.

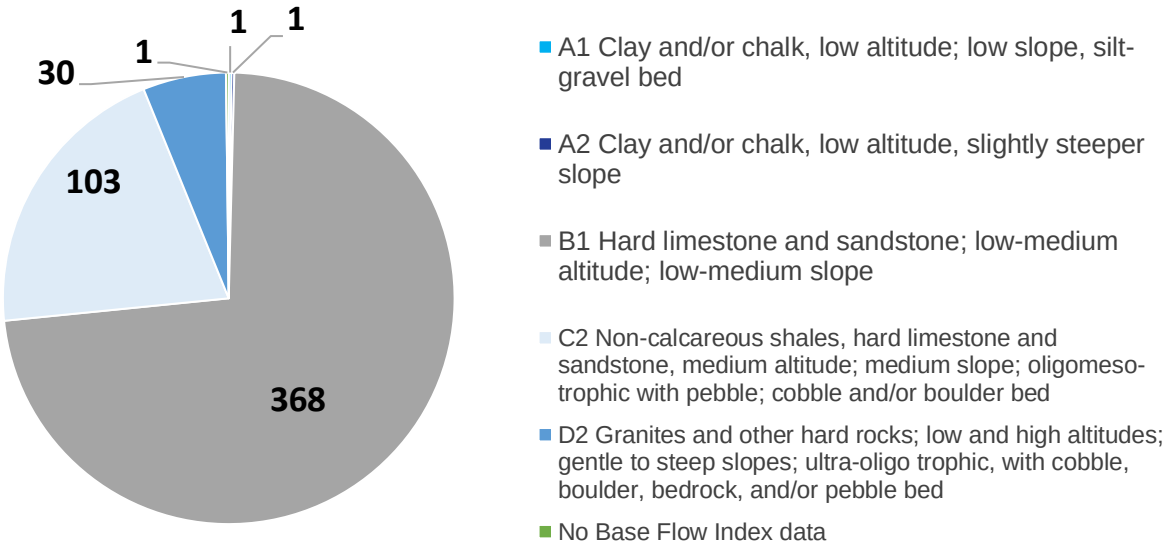


Figure 2.8 Main River Typologies in the South East Region

2.3.4 Groundwater – Surface Water Interaction

Surface water and groundwater interactions are important when considering the quantity of groundwater that can be abstracted, identifying options to support increased water demands and managing the water quality we supply. Interaction between surface water and groundwater can impact groundwater recharge rates, and therefore sustainable abstraction rates, as well as water quality through interactions with sources of pollution.

The degree of karstification is a large factor in controlling groundwater and surface water interaction. This is of importance in Groundwater Bodies (GWB) with protected ecosystems. In these karstified environments any surface water contaminants can be easily transported to groundwater and vice versa. Groundwater and surface water are more closely linked at certain karst features such as springs and swallow holes. Karst formations form regionally important aquifers in some areas of the South East Region, particularly in southern Tipperary and towards the north-east into Kilkenny and south east towards Wexford. Where the karst appears close to the surface, stream density is often low and sinking streams are activated. This can be seen where areas of thicker subsoil meet an area with karst bedrock at or close to the surface. Under certain circumstances, the River Nore, which flows south east through County Tipperary, receives relatively high baseflows from the underlying karst aquifer.

2.3.5 WFD 'Ecological Status' of Waterbodies

Our water planning approach, as set out in the Framework Plan, is developed to meet the environmental objectives of the European Union WFD (Directive 2000/60/EC) and the EPA's River Basin Management Plan (RBMP) (a requirement under the WFD). The WFD contains a standard European approach for managing waterbodies in our natural environment from abstraction to final discharge; while the RBMP outlines the WFD objectives for Ireland. It is underpinned by the following statement, "Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such"[24]. Ireland's United Nations Sustainable Development Goal 6 - Clean Water and Sanitation[25], is underpinned by the WFD. Progress in meeting the 2030 target to improve water quality is measured against the proportion of bodies of water with good ambient water quality.

The EPA coordinate WFD implementation in Ireland and carry out monitoring, assessment and setting of objectives for waterbody status nationally. Under the WFD, waterbodies are assigned an ecological status. The categories of ecological status are described in Box 2.1.

In accordance with the WFD, Uisce Éireann must ensure that all waterbodies achieve 'Good' status by 2027. In addition, under the legislation, any modification to a WFD waterbody should not lead to deterioration in either the overall status or any of the quality elements.

Uisce Éireann considers the ecological status through the requirements for abstraction licences and discharge permits. The ecological status impacts drinking water quality and Uisce Éireann work to support the ecological status of waterbodies through our catchment-based management programmes.

Box 2.1 – Water Framework Directive (WFD) River Basin Management Plan Ecological Status Categories

Surface water bodies are classified according to their **ecological status** which is assessed by the abundance of aquatic flora and fish fauna. The biology of a waterbody is supported by the chemistry (including general physio-chemical measurements and chemical pollutants), the hydrology (flow and water levels) and the morphology (physical structure). Hydromorphological quality is only used during the assessment of high ecological status waterbodies. The ecological status shows the influence of pressures (e.g., pollution and habitat degradation) and a good ecological status is defined as 'a slight variation from undisturbed conditions.'

The classification scheme for ecological status for surface water includes five (5) categories: High, Good, Moderate, Poor and Bad. 'High status' means no or very low human pressure, 'Good status' means a 'slight' deviation from this condition, Moderate means a 'moderate' deviation whilst a Poor or Bad status recognises that the waterbody has been affected by an altered habitat and/or is polluted. The ecological status assigned for surface water bodies is determined by the status of the poorest quality element.

Overall status of groundwater bodies is assigned based on the combined chemical (the quality of groundwater) and quantitative element status. Groundwater chemical status is measured by concentrations of pollutants and changes in electrical conductivity in the groundwater body. Groundwater levels are used as one of the measures of quantitative status. Groundwater bodies are classified as either 'good' or 'poor' status.

2.3.5.1 Surface Water

The RBMP considers the actions Ireland will take to improve water quality and achieve "Good" ecological status in surface water bodies (rivers, lakes, estuaries and coastal waters) by 2027. In doing so it influences from where, in what quantities and under what conditions we can abstract water for public water supply. It also sets the legislative framework within which any new abstractions Uisce Éireann develop must conform.

The status of the South East region's surface water bodies, classified using data from 2016 - 2021, is depicted in Figure 2.9. Across Ireland there has been a decline in water quality over the last three WFD assessment cycles. The most recent water quality assessment cycle (2016 – 2021)[26] reports that the number estuaries and coastal waters in satisfactory condition has declined by almost 16% and 10% respectively. There has also been a one percent (1%) and three percent (3%) decline of monitored lakes in satisfactory condition. There are 20 WFD river water bodies that are determined to be of high ecological status. These are mostly within Study Area K (SAK), including tributaries of the Blackwater Estuary, and rivers in the Colligan-Mahon catchment and Suir catchment. Surface water bodies classified as bad status include the Kings River near Kilkenny River and the Upper Suir estuary in SAK.

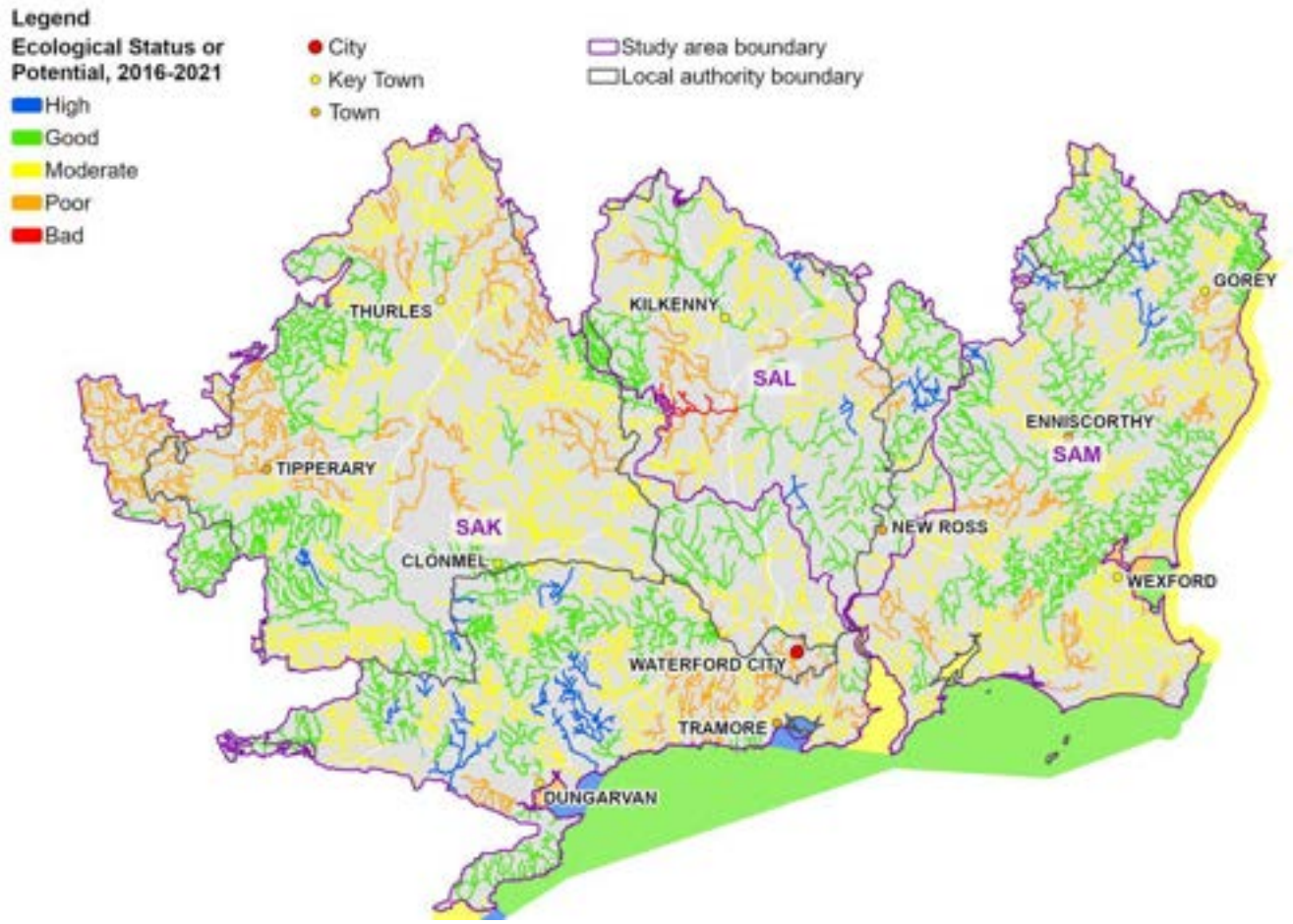


Figure 2.9 WFD 'Ecological Status' of Surface Water Bodies (2016-2021).

2.3.5.2 Groundwater

The bedrock geological maps developed by the Geological Survey Ireland (GSI) are the foundation maps upon which groundwater protection and vulnerability maps have been constructed and upon which Water Framework Directive (WFD) groundwater bodies and monitoring programmes have been established by the EPA.

The South East Region has 94 groundwater bodies (GWBs). GWBs are classified by the EPA as either 'good' or 'poor' status depending on the outcome of five (5) chemical tests and four quantitative tests. The failing of even one of these tests determines a 'poor' status for that waterbody. There are 10 GWBs in the South East Region that are currently at 'poor' Chemical Status[27]. These include Durrow, Athy-Bagnetlstown Gravels, Stoneyford Gravels, three (3) Waste Facility GWBs, and four (4) Industrial Facility GWBs. The remaining 84 GWBs in the region are currently at 'good' overall WFD status. The status of the South East region's groundwater bodies is shown in Figure 2.10.

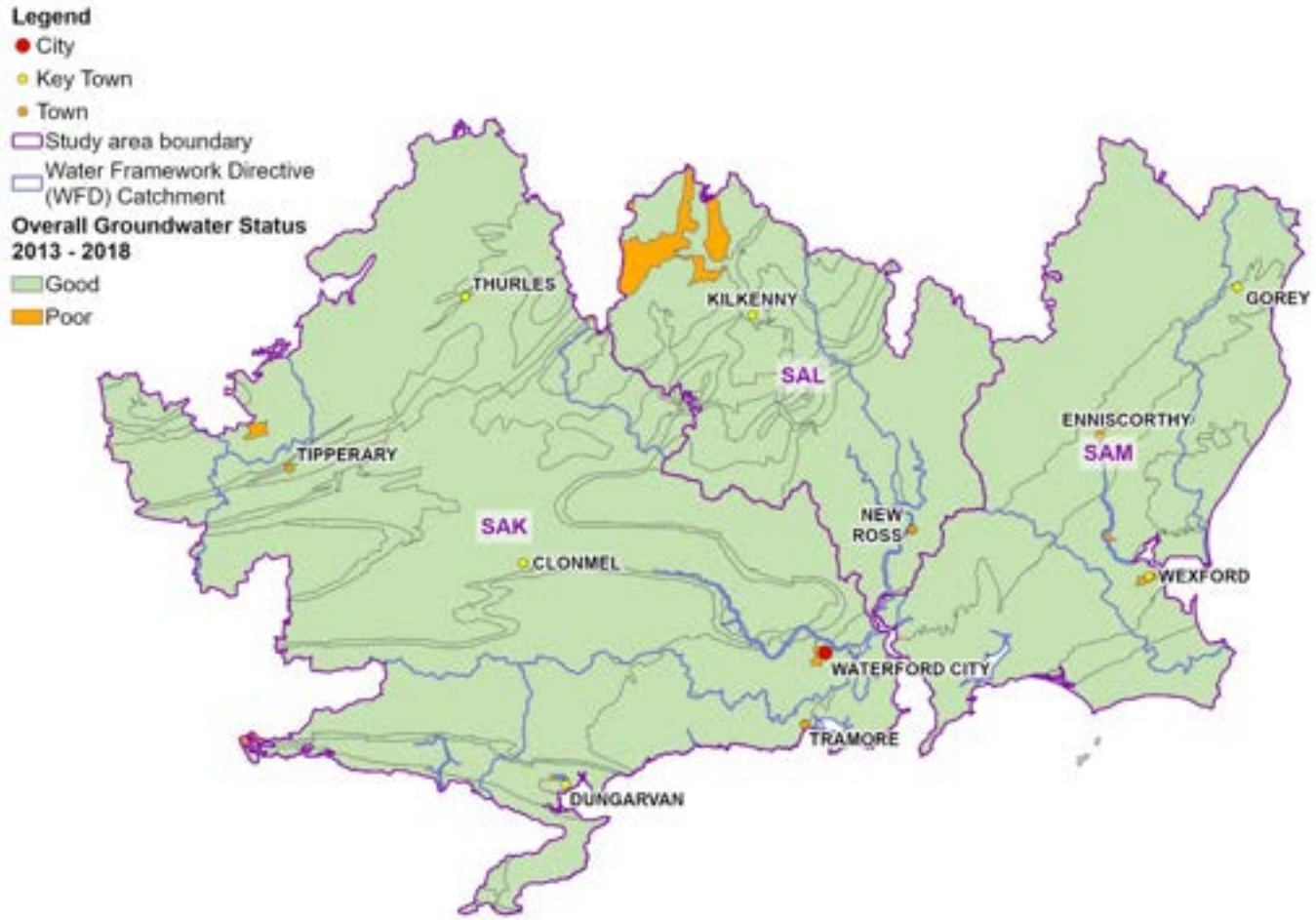


Figure 2.10 WFD Groundwater Body 'Ecological Status' (2016-2021)

Table 2.4 summarises the surface water and groundwater body classification for each Study Area. Across the region, 41% of surface water bodies (SWBs) are at 'High' or 'Good' status, while 17% SWBs are classified as below Moderate Status.

Forty-two percent (42%) of the 464 river water bodies (RWBs) in the region are classified as 'High' or 'Good' status. Forty percent (40%) of the RWBs are classified as 'Moderate condition' whilst 18% are classified as 'Poor' condition and one (the Kings River near Kilkenny) is assessed as 'Bad' Status.

Table 2.4 Water Body WFD 'Ecological Status' for each Study Area [27-31]

Study Areas	No. of WFD Catchment areas	Number of Surface Water Bodies in the region			Number of Groundwater bodies in the region	Number of Waterbodies Rated Below Moderate (SW) or poor (GW)	
		Rivers	Transitional and Coastal	Lakes		Surface Water	Groundwater
SAK	6	254	13	9	64	60	5
SAL	2	83	4	0	14	12	3
SAM	5	131	15	2	16	18	3
Regional Total	**11**	**464**	**30**	**11**	**94**	**88**	**10**

*Some water bodies fall within more than one Study Area. For this reason, the sum of the number of water bodies in each Study Area will be greater than the regional total.

2.3.6 WFD 'Risk Status' of Water Bodies and Associated Pressures

2.3.6.1 Surface Water

Risk assessment data produced to support Cycle 3 of the RBMP identifies water bodies at risk of failing WFD objectives or at risk of deteriorating from their current status due to a number of pressures.

The 2016 – 2021 WFD[31] Risk associated with river water bodies in the South East Region indicates that currently 46% (212 out of 464) of river water bodies in the region are 'At Risk', 29% (133) are 'Not at Risk', and 25% (119) are 'Under Review'. Four (4) out of 11 Lake Water Bodies (LWBs) are 'At Risk', five (5) are 'Not at Risk' and two (2) are 'Under Review'. This is represented in Figure 2.11.

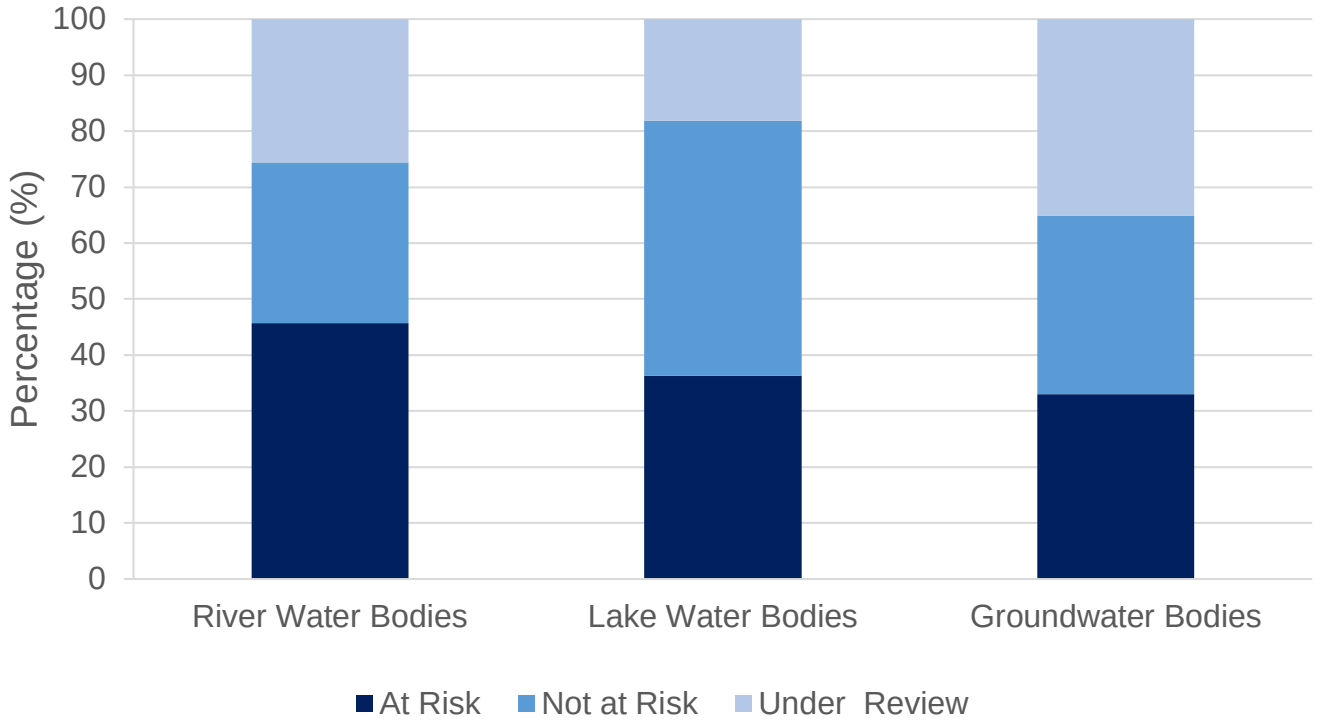


Figure 2.11 The 2016 – 2021 WFD Risk associated with River, Lake and Groundwater Bodies in the South East Region

Figure 2.12 presents the Surface Water Bodies (SWBs) 'At Risk' of not achieving the environmental objectives according to the pressures resulting from human activities. Surface Water Bodies that are 'At Risk', may be at risk due to one pressure or as a result of a combination of multiple pressures. For this reason, the sum of SWBs presented across the pressure categories exceeds the total number of SWBs reported as 'At Risk'. Of the SWBs 'At Risk' the predominant pressure associated with them is agriculture.

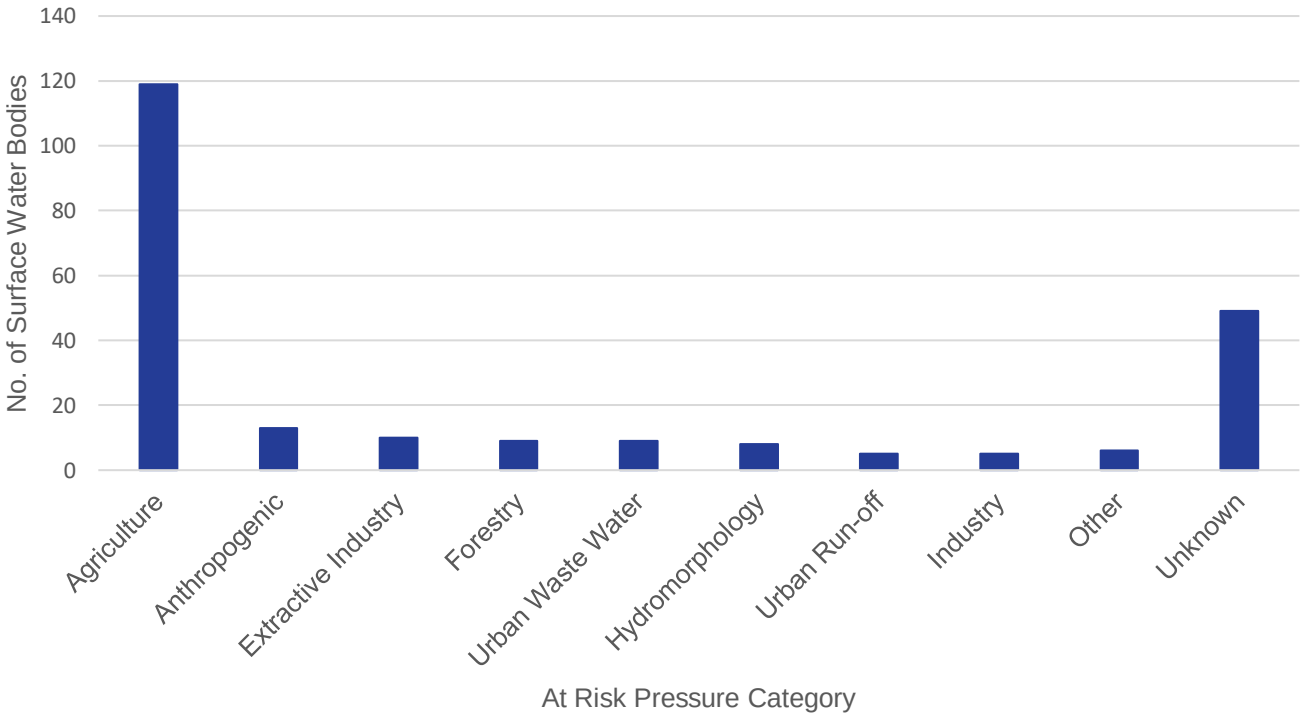


Figure 2.12 Number of Surface Water Bodies with Associated 'At Risk' Pressure Category[32]

2.3.6.2 Groundwater

The 2016– 2021 WFD Risk associated with the Ground Water Bodies (GWB) in the South West Region indicates that currently 33% (31 out of 94) GWBs are 'At Risk', 32% (30) are 'Not at Risk' and 35% (33) GWBs are 'Under Review'. (Figure 2.11).

Of the GWBs 'At Risk' the predominant pressure associated with them is agriculture, followed by industry (Figure 2.13).

The sustainable management of groundwater abstraction is challenging due to the large number of small abstractions in the region. Numerous smaller abstractions are necessary as the regions' hydrogeological conditions (as described in section 2.3.2) do not support the development of large abstractions. Uisce Éireann are committed to active participation in collaborative multiagency working forums, to draw on the expertise of stakeholder agencies with subject experts, for optimum management of Ireland's water resources.

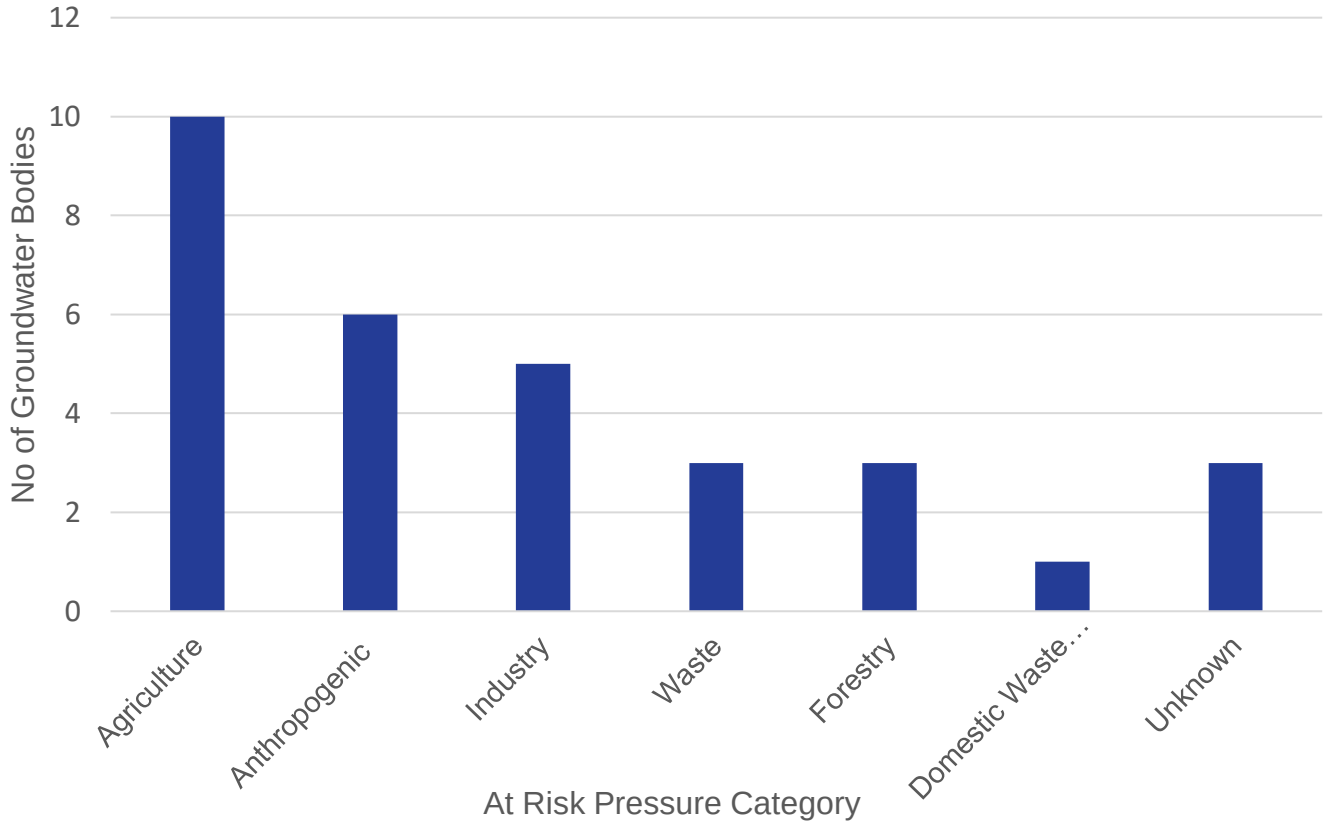


Figure 2.13 Number of Groundwater Bodies with Associated 'At Risk' Pressure Category[31]

2.3.7 Abstraction Pressures

In December 2022 the Water Environment (Abstractions and Associated Impoundments) Act (the "Abstractions Act")[33] was published, however it had not yet commenced. The Abstractions Act will align abstraction licensing with the requirements of the Water Framework Directive. The Abstractions Act has not yet commenced and the associated regulations and guidelines, which will further detail the types of assessment and national methodology to be used, are not yet in place. Whilst the regulations and guidelines for the new abstraction regime are being developed, we are assessing existing abstractions to identify surface water sites that may exceed future abstraction thresholds. We have taken a precautionary approach based on our current understanding of how proposed abstraction legislation might be applied. This assessment suggests that certain schemes may be subject to reductions in

abstraction under the new legislation; however, this will ultimately be determined by the EPA based on the project level information before them.

The assessment is based on the technical guidance from the United Kingdom Technical Advisory Group (UKTAG) to identify sites potentially at risk from abstraction. UKTAG comprises the Environment Agency, Natural Resources Wales, Scottish Environmental Protection Agency and Northern Ireland Environment Agency. The application of this guidance is explained in Appendix C and Appendix G of the Framework Plan.

The UKTAG standards[34] for alteration to river flows (hydrological alteration), permit a degree of modification from natural conditions. The standards are defined as an allowable percentage variation from natural flows. For “Good” ecological status watercourses, the allowable percentage variation from natural flows depends on river typology, season and flow rate. More restrictive limits apply between April and October compared to the period between November and March. The standards for “High” ecological status water bodies are defined as a lower allowable percentage variation from natural flows compared to “Good” ecological status water bodies.

The standards are only a supporting element of the overall ecological status indicator, and the EPA will utilise its own assessment methodology, which will have the benefit of containing more detailed project information and analysis. The assessment of potential future abstractions is used in this Plan as a conservative guide/indicator of abstractions that might be at risk. As further data becomes available, and more specific Irish standards are developed, Uisce Éireann will update the NWRP as appropriate using the monitoring and feedback process set out in Section 9 of this Plan.

The UKTAG method for determining the allowable abstraction for lakes requires detailed bathymetry and water level data. As this data is not widely available in Ireland, the methodology set out in a 2009 report by the Dublin City Council[35] was used to estimate the potential ecological limit of abstraction at lakes. This method sets the threshold for abstraction from lake sources at 10% of the Q50 of the rivers flowing into the lake.

A summary map showing the degree of modification of natural flows which may be permitted during periods of low flows is shown in Figure 2.14 for the South East Region.

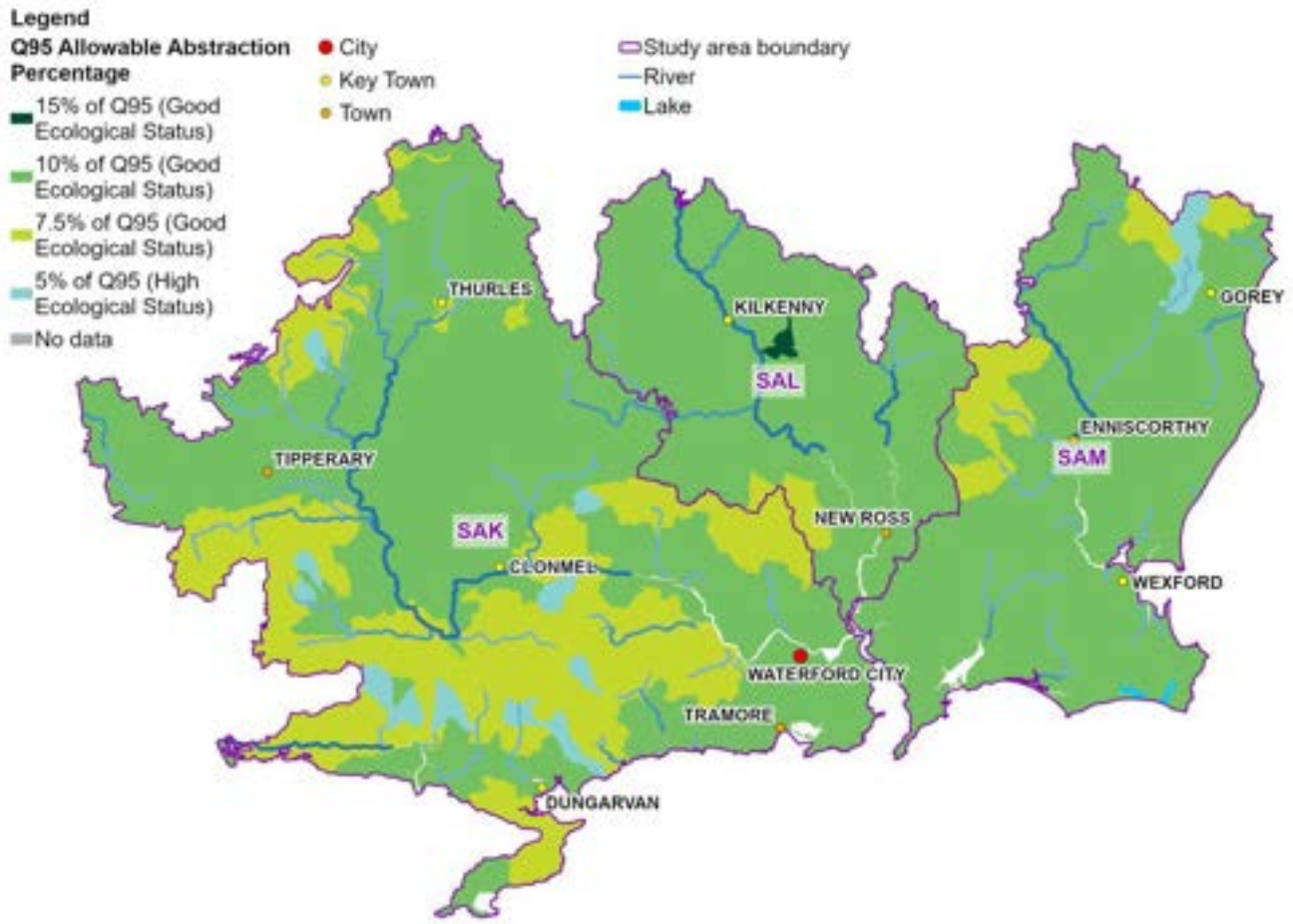


Figure 2.14 Percentage of natural flow at Q95 that can be abstracted to meet 'Good' Status

This assessment suggests that certain schemes may be subject to reductions in abstraction under the new legislation; however, this will ultimately be determined by the EPA based on the project level information before them. We have determined there are 35 out of 43 surface water abstraction sites that may not meet sustainability guidelines during dry weather flows – 22 in SAK, four (4) in SAL, and nine (9) in SAM. These sites are represented in Figure 2.15 and are listed in the respective Study Area Technical Reports (Appendix 1 - 3). A small number of the abstractions are from surface water bodies with a High WFD status, as shown in Figure 2.15. The allowable abstraction from these sites is more restrictive. Further detailed site investigations will be required to confirm the impacts of existing abstractions. Section 3.5 presents the estimated volume of abstraction reductions which may be implemented in the future to meet allowable abstraction thresholds.

As Uisce Éireann does not have full visibility of the future regulatory regime and has not progressed through the licensing process on a site-by-site basis, we have not included the estimated sustainable abstraction within the SDB calculations. Instead, we use the hydrological yield, water treatment capacity and bulk transfer limitations in our calculation of supply availability. We use the sustainable abstraction assessment to assess the sensitivity of the Preferred Approaches (solutions) that it develops as part of the NWRP.

Therefore, the RWRP-SE assumes that existing abstractions can continue on a transitional basis, subject to the regulatory requirements which will be outlined in the future regulatory regime.

For these existing 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 SDB will be updated, and solutions will be delivered through the future cycles of RBMPs and/or Regional Water Resources Plans.

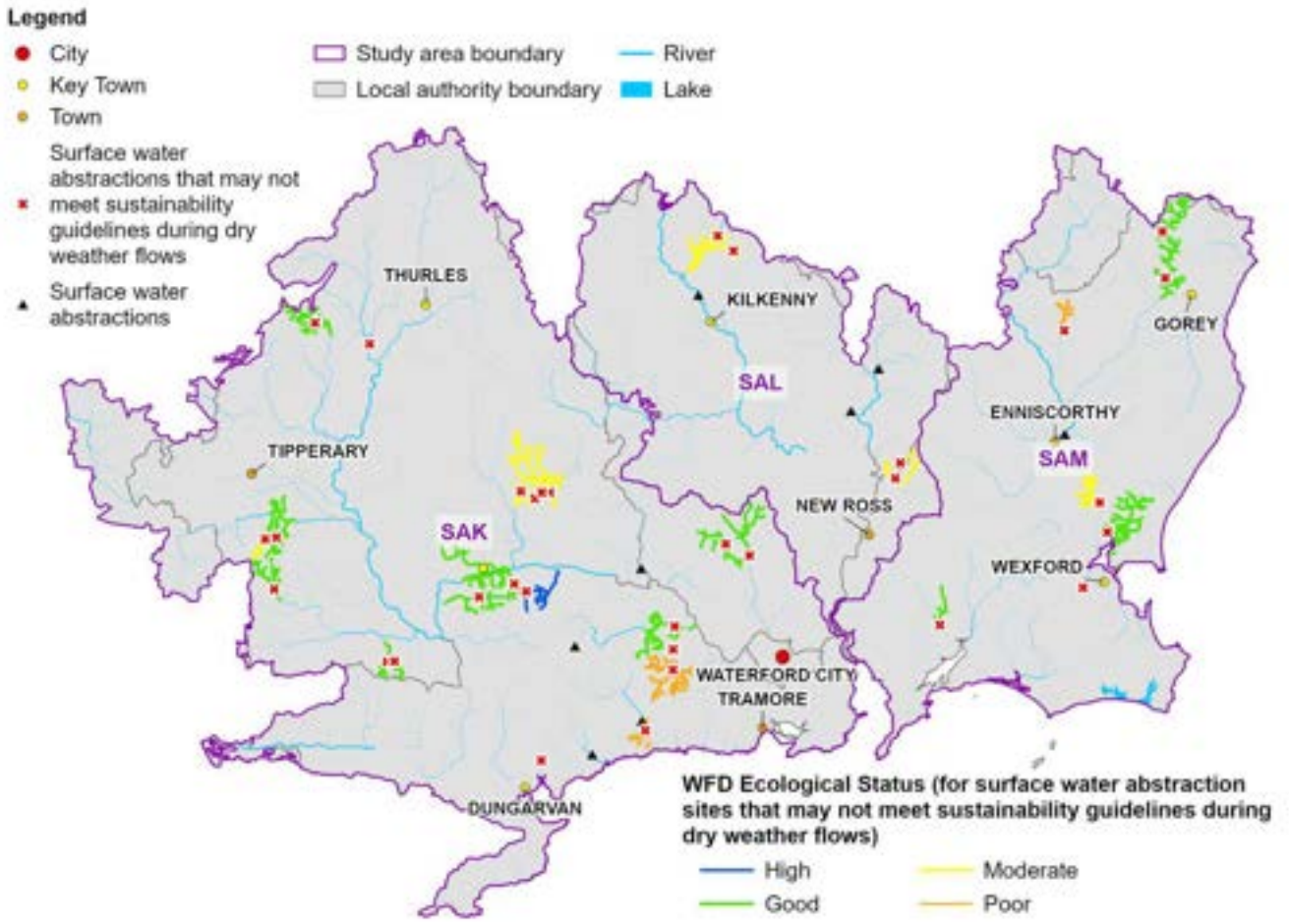


Figure 2.15 Surface Water Abstraction Sites that may not meet sustainability guidelines during dry weather flows

Groundwater abstractions will also need to conform to the proposed new abstraction licencing regime. These abstractions will be assessed in two ways:

- Impacts on the groundwater bodies from which they abstract; and
- Impact of the groundwater abstraction on the base flow in surface waterbodies.

On an interim basis, Uisce Éireann has developed an initial assessment based on the best available information. Over the coming years, Uisce Éireann will work with the environmental regulator (the EPA) and the Geological Survey of Ireland (GSI), to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources (informed by data gathered as part of GSI's ongoing Groundwater 3D project).

2.3.8 Designated Sites in the RWRP South East Region

Our habitats and species are protected under the Habitats Directive[36]. The habitats and species that are designated to afford protection are listed in the: Habitats Directive and the Birds Directive (2009/147/EC), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

Water abstractions from both groundwater and surface water have been identified as being a potential threat to some habitats and species listed in the Annexes to the Habitats Directive. As discussed in

Section 2.3.7, sustainable abstraction limits have been assessed for new water abstractions, which will ensure the protection of these Annexed species and habitats. A full list of water dependent species and their sensitivities to sedimentation and changes to flow regime is provided in Appendix C of the Natural Impact Statement (NIS) on the Framework Plan.

European, national and local designated sites within the core baseline area (South East region) include 14 Special Protected Areas (SPAs), 33 Special Areas of Conservation (SACs), 5 sites designated as Wetlands of International Importance (Ramsar sites),1 Natural Heritage Area, 8 nature reserves and 135 proposed Natural Heritage Areas (NPWS, 2019) (Table 2.5 and Figure 2.16). There are a further 2 marine SACs and 2 marine SPAs that are not within the core baseline area but are hydrologically linked to it. These sites are Blackwater Bank SAC, Long Bank SAC, Saltee Islands SPA, and Keeragh Islands SPA. The protected sites with the greatest coverage in the South East Region and are described in Box 2.2 below.

Table 2.5 Total Number of Designated Sites in the RWRP-SE*

Designated Sites	Number of Sites
Special Protection Areas (SPAs)	14
Special Areas of Conservation (SACs)	33
National Heritage Areas (NHA)	1
Ramsar Sites	5
Nature Reserves	8
Proposed Natural Heritage Areas (pNHA)	135

* Note, some SACs or SPAs may fall within more than one Study Area.

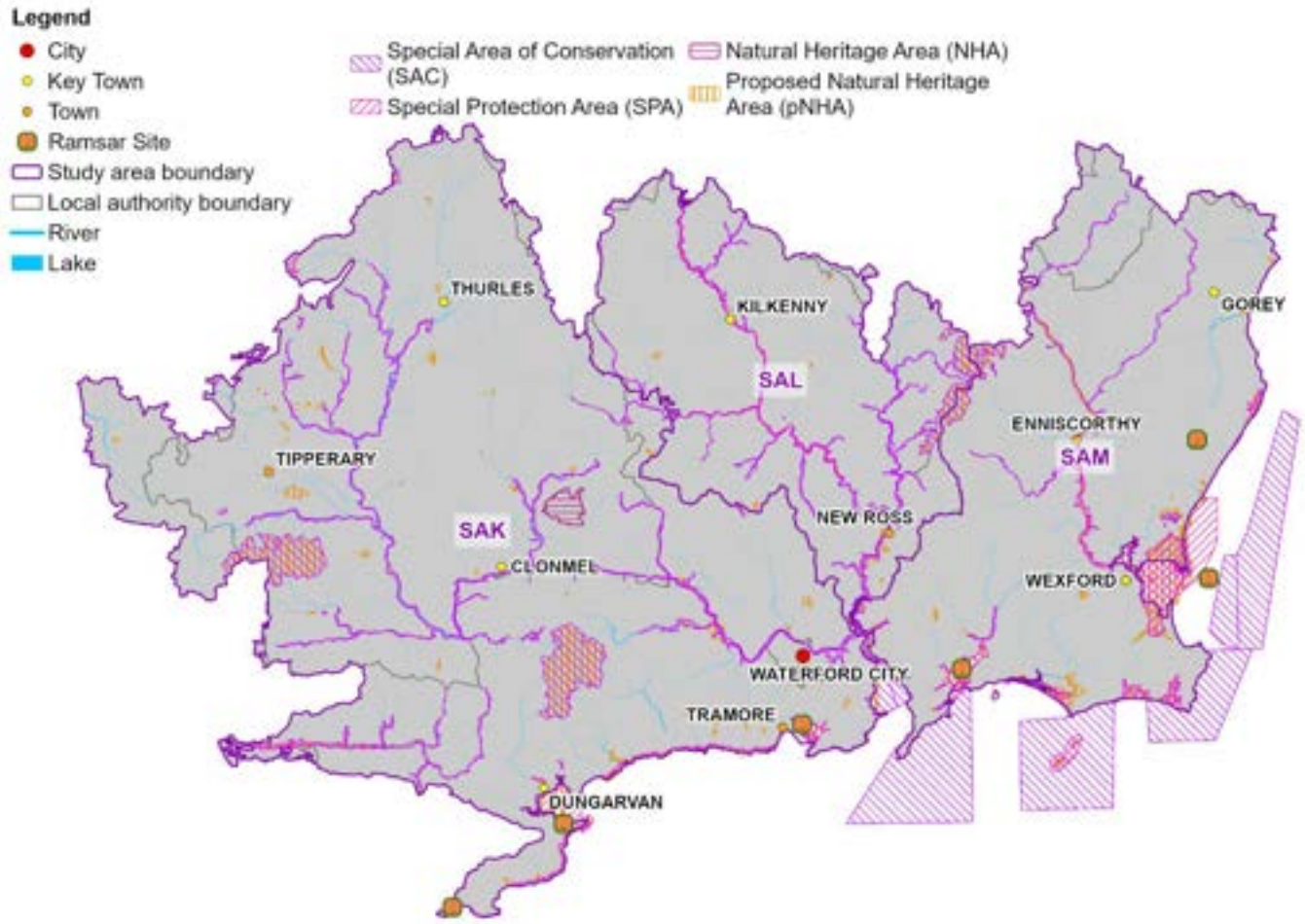


Figure 2.16 Designated Sites in the South East Region

Box 2.2 – Protected sites with the greatest coverage

Slievefelim to Silvermines Mountains SPA

A very large area covering 20,100 hectares, the site is an extensive upland site located in Counties Tipperary and Limerick. Much of the site is over 200 m in altitude and underlain mainly by sandstones of Silurian age. Several important rivers rise within the site. The site consists of a variety of upland habitats, though approximately half is afforested. Roughly one-quarter of the site is unplanted blanket bog and heath, with both wet and dry heath present. The remainder of the site is mostly rough grassland used for hill farming. This varies in composition and includes some wet areas with rushes and some areas subject to scrub encroachment. Some stands of deciduous woodland also occur, especially within the river valleys. The site is of ornithological importance because it provides excellent nesting and foraging habitat for breeding Hen Harrier and is one of the top sites in the country for the species. The presence of three (3) species, Hen Harrier, Merlin and Peregrine, which are listed on Annex I of the E.U. Birds Directive is of note.

Wexford Harbour and Slobs SPA

A large area covering 6,000 hectares focused on Wexford Harbour. Wexford Harbour is the lowermost part of the estuary of the River Slaney, which drains much of the south-east region. The site includes the natural estuarine habitats of Wexford Harbour, the reclaimed polders known as the North and South 'Slobs', and the tidal section of the River Slaney. Shallow marine water is a principal habitat, but at low tide extensive areas of intertidal flats are exposed. The flats support a rich macroinvertebrate fauna, with salt marshes fringing the intertidal flats. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands, which form part of this SPA. The site is of international importance for several species of waterbirds and is one of the top three (3) sites in the country for numbers and diversity of wintering birds. The combination of estuarine habitats, including shallow waters for grebes, diving duck and seaduck, and the farmland with freshwater drainage channels, provides optimum feeding and roost areas for a wide range of species. It is one of the two most important sites in the world for Greenland White-fronted Goose. The site is an important centre for research, education and tourism. Wexford Wildfowl Reserve is a Ramsar Convention site, a Biogenetic Reserve and a Statutory Nature Reserve. Parts of the Wexford Harbour and Slobs SPA are also designated as Wildfowl Sanctuaries.

The Raven SPA

A large coastal area of 4,200 hectares. The Raven SPA extends from north of Rosslare Point to Blackwater Harbour on the coast of Co. Wexford. The seaward boundary extends approximately 4.5 km from the shoreline to encompass areas of shallow water utilised by species of special conservation interest. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for various species. Of critical significance, is the principal night roost for the internationally important Wexford Harbour population of Greenland White-fronted Goose. Various other waterfowl species are also attracted to the site during winter for feeding and roosting. The shallow waters are particularly suitable for divers, grebes and sea duck, and nationally important populations of Red-throated Diver and Common Scoter occur, with Common Scoter population representing over 17% the total across Ireland. Nationally important populations of many birds are present here. Birds nest on the shingle and sandy beaches or on offshore sandbanks. Five (5) wintering species that regularly occur are listed on Annex I of the E.U. Birds Directive, i.e., Red-throated Diver, Great Northern Diver, Greenland White-fronted Goose, Golden Plover and Bar-tailed Godwit. Little Tern also breed within the site, area listed on Annex I of this directive. Raven Point is a statutory Nature Reserve and a Ramsar Convention.

2.3.9 Opportunities for Protection, Restoration and Enhancement

Uisce Éireann's long-term approach to protecting drinking water sources, and therefore our natural resources, will be the increasing implementation of catchment management for drinking water source protection. This will be achieved in partnership with key stakeholders. Our approach is in accordance with Article 7(3) of the Water Framework Directive and has the joint benefit of protecting our water habitats and managing the risk to our drinking water sources.

In 2019, the Irish Government declared a National Climate Change and Biodiversity Emergency to highlight the significant concerns around Ireland's biodiversity and recognizing the urgency to act on these interconnected global crises. Uisce Éireann recognizes the need to urgently increase and accelerate efforts to halt the decline of biodiversity. We are committed to ensuring that we build and manage our infrastructure responsibly so that our ecosystems are protected, and where possible enhanced.

Biodiversity protection is a key part of Uisce Éireann's Biodiversity and Sustainability Policies. The overall aim of Uisce Éireann's Biodiversity Policy is that in association with the provision of water and wastewater services, biodiversity and the natural environment are conserved, protected and where practical enhanced through our responsible stewardship, sustainable water services and strong partnerships. Uisce Éireann launched our Biodiversity Action Plan (BAP)[37] in 2021 to deliver on this aim.

One of the key objectives of the BAP is the promotion of nature-based solutions (NBS) for water protection and wastewater treatment, which have considerable potential to deliver biodiversity. Nature-based solutions are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems, natural features and characteristics of waterbodies using natural means and processes[38]. The main functions are to improve water quality, reduce flood risk, and create habitats. Nature-based solutions have many additional benefits that include reduction in energy usage, carbon sequestration, and amenity use for local communities. They include a broad range of measures such as: wetlands, basins and ponds, reedbeds, buffer strips and hedges and forest riparian buffers. Some examples of NBS being utilised by Uisce Éireann in the South East Region include:

- The Dunhill Integrated Constructed Wetland located in County Waterford. We are working with Waterford City and County Council and the local community to progress final works. The wetland is responsible for the treatment of all the wastewater from Dunhill village.
- Working in partnership with catchment stakeholders to support initiatives such as native tree planting and bog rehabilitation, which also help to protect and restore source waters.

Examples of our catchment management activities are described in Box 2.3.

Identifying opportunities for the incorporation of NBS and catchment management activities within our abstraction catchments will continue to be encouraged and promoted through the NWRP.

Box 2.3 – Source Protection and Catchment Management Activities

Uisce Éireann is actively involved in pilot source protection projects in Ireland to trial catchment scale interventions to reduce the risk of pesticides 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. Uisce Éireann is a project partner on this project which is funded by INTERREG (European Regional Development Fund) with match-funding having been provided by the Department of Agriculture, Environment and Rural Affairs (DAERA) in Northern Ireland and the Department of Housing, Local Government and Heritage (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). Uisce Éireann 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. Our key stakeholders in catchment management include the National Pesticides and Drinking Water Action Group (NPDWAG), the National Water Forum (An Fórum Uisce), the Local Authority Water Programme (LAWPRO), Geological Survey Ireland (GSI), Department of Housing, Local Government and Heritage (DHLGH), Department of Agriculture, Food and the Marine, National Federation of Group Water Schemes, Inland Fisheries Ireland, the EPA Catchment Science Team and the National Parks and Wildlife Service (NPWS).

2.4 Water Supply

2.4.1 Rainfall

Rainfall is the key climatic variable that affects the availability of water resources. Understanding the variability across the South East Region and the impact that climate change may have on rainfall patterns is important to planning our water infrastructure.

The rainfall across Ireland is varied. Figure 2.17 shows that the South East Region includes only a few locations that are within the highest rainfall categories. The region is mostly composed of lower rainfall levels. The west of the region extending across the Counties of Tipperary and Waterford, in the Knockmealdown Mountain range, typically experiences the highest rainfall with average rainfall levels of up to 2000 mm. The far east of the region including the Wexford coast, and Waterford City experience the driest conditions across both the region and Ireland with an average annual rainfall of less than 1000 mm.

The comparison with population density (also shown in Figure 2.17) highlights that Waterford City, Tramore and Kilkenny - areas which have the greatest population density - are situated in areas of lower rainfall, meaning water resources in these areas are more likely to become stressed. Most of the region is located within moderate levels of rainfall.

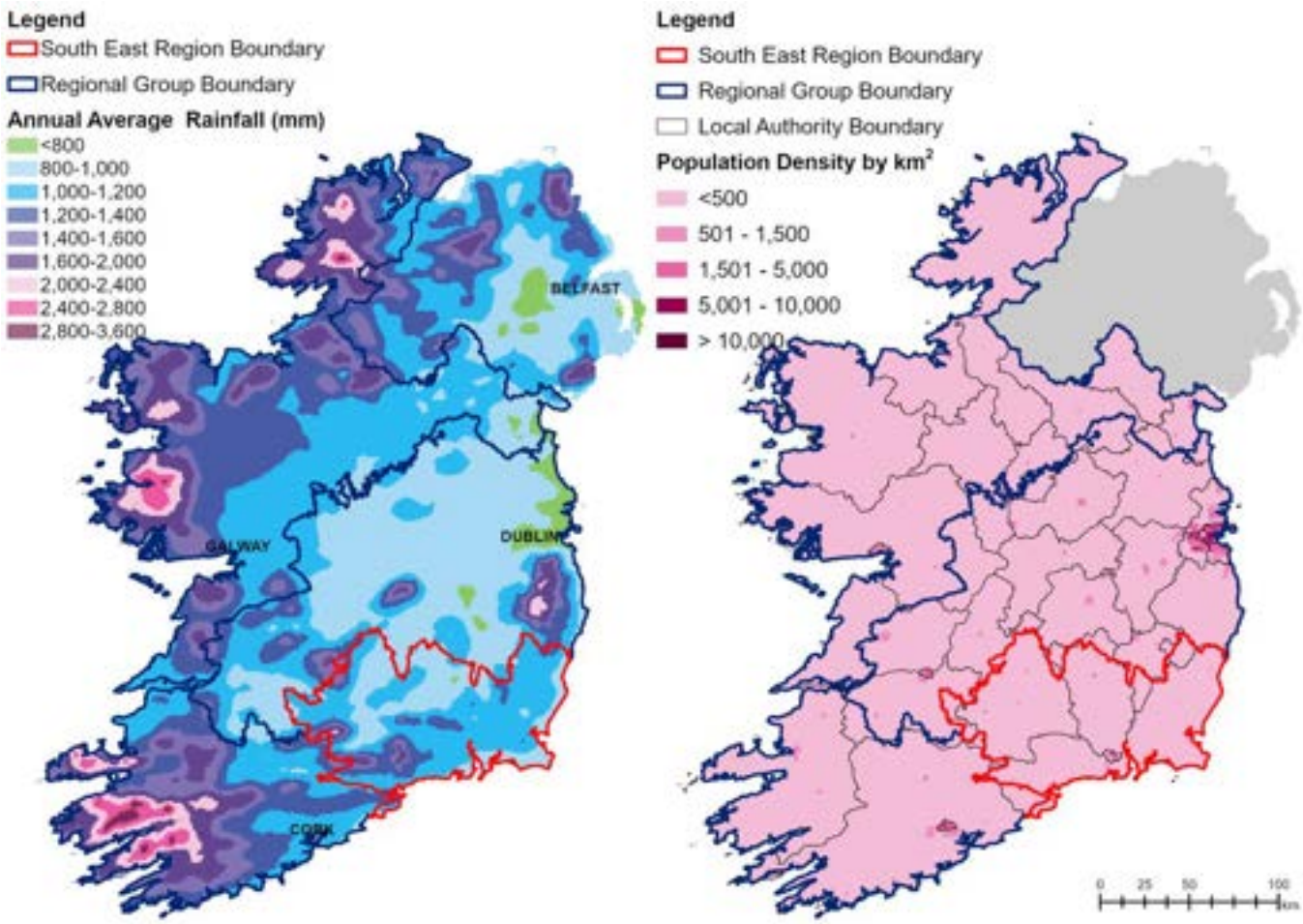


Figure 2.17 Rainfall across Ireland[39] compared with Population Density

Seasonal and annual variability of rainfall is an important consideration in water supply planning. The variability in time and magnitude will determine infrastructure requirements. For example, water reservoirs are required to store water captured during high flow periods, to supply customers during periods of low flow.

Across the South East Region, the variability in seasonal rainfall is slightly lower in the north than the east (Figure 2.18). In the eastern part of the region near Rosslare, monthly average rainfall across the year has a range of 59 mm, varying from 50 mm in May to 109 mm in October. The north of the region near Kilkenny shows reduced seasonal variability, with a range of 40 mm between the minimum average monthly rainfall in July of 55 mm and the maximum average monthly rainfall in October of 95 mm. Climate change is likely to increase the within year variability, with wetter winters and drier springs and summers[39]. This is further discussed in Section 2.4.5.

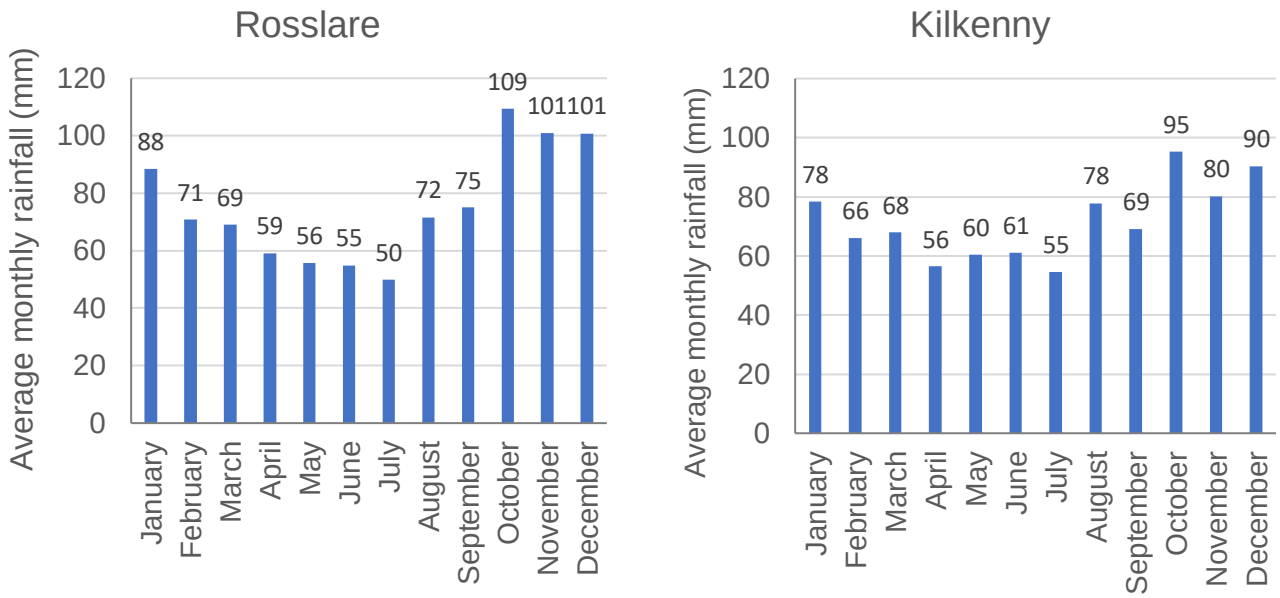


Figure 2.18 Monthly Rainfall Variability – 1981 to 2010[39]

2.4.2 Drought

Droughts occur when a period of lower-than-average rainfall causes a shortage of water. The shortage of water affects both the natural environment and sectors such as agriculture and water supply to our customers. The duration, timing and intensity of a drought can vary considerably, and these factors combine to affect different sectors in different ways. Although Ireland is considered to be a country with high rainfall, the country does experience drought events. Figure 2.19 shows there were 15 years of severe drought periods since records began in 1850 that would affect our key supplies.

The drought events experienced in 2018 and 2020, and more recently in 2022, although severe, were short in duration and are therefore not registered when compared to historical droughts. Despite this, the late spring and early summer of 2018 saw some of the lowest rainfall totals on record leading to drought conditions. In 2022, most annual rainfall totals across the country were below their 1981-2010 long-term average. Whilst these drought events were not defined as 'severe' based on historical records (due to the short duration) they were still substantial enough to impact our water supply availability. Low rainfall levels resulted in low river flows and stress to water supplies. Customers experienced reductions in water pressure and some temporary loss of supplies, principally because of a lack of capacity in our existing infrastructure. Demand for water was also higher than normal during this period, driven by high temperatures. Several supplies in the South East Region were severely impacted (Table 2.6). Sandbagging of groundwater sources and some rivers was required to maintain groundwater levels. In-stream pumping and water tankering was used to maintain supplies to customers and night-time restrictions were implemented in some areas to reduce demand.

As climate change continues droughts are expected to become more frequent[40]. Combined with the requirements of the Water Framework Directive (WFD) to reduce unsustainable abstractions (Section 2.3.5), there is a clear identified need to invest in sustainable water supply solutions to secure reliable supplies across the region.

Valuable learning on strategic and tactical drought management was gained during the 2018 drought period, which helped to improve our response during drought conditions experienced in the Spring of 2020 and the recent drought of 2022. Actions taken during the 2018 drought event and key lessons learnt are outlined in Box 2.5. Further information regarding our drought management approach is given in Appendix E of our Framework Plan.

Table 2.6 Drought impact during recent dry periods

Study Area	Drought impact
SAK	During 2018, in-stream damming was required at the surface water abstraction for Ballylaneen WTP. Unplanned outages of a few hours' duration occurred at Fews WTP as the source was unable to meet peak demand. Night-time restrictions were issued for Fews and Ballymacarbry WRZs to ensure supply to customers could be maintained. Tankering and night-t-time restrictions were also introduced in 2022 dry period to protect supplies in Kilcash and Coalbrook.
SAL	Several raw water sources experienced issues during the 2018 drought. Water levels dropped significantly at the river abstraction source to Borris WTP, as well as at Radestown WTP source, which serves Kilkenny City WRZ. During the 2020 drought, the infiltration gallery serving Bennetsbridge WTP dried up, leaving boreholes as the only source. Bennetsbridge also experienced shortages during 2022 when measures were implemented to conserve water.
SAM	In 2018, in-stream damming was required at the surface water abstraction to Wexford Town (Newtown) WTP. In-stream sand-bagging was also required at the intake of Pallis for Creagh WTP as a precautionary measure due to falling levels in Bann River. Water levels dropped at Ballykale Borehole, which is serves Gorey WRZ. Water conservations measures were introduced during the 2022 dry period in Wexford Town, Bunclody, Killmallock (Sow Regional WRZ) and Taylorstown (South Regional WRZ).

As climate change continues, droughts are expected to become more frequent[40]. Combined with the requirements of the Water Framework Directive (WFD) to reduce unsustainable abstractions (Section 2.3.5), there is a clear identified need to invest in sustainable water supply solutions to secure reliable supplies across the region.

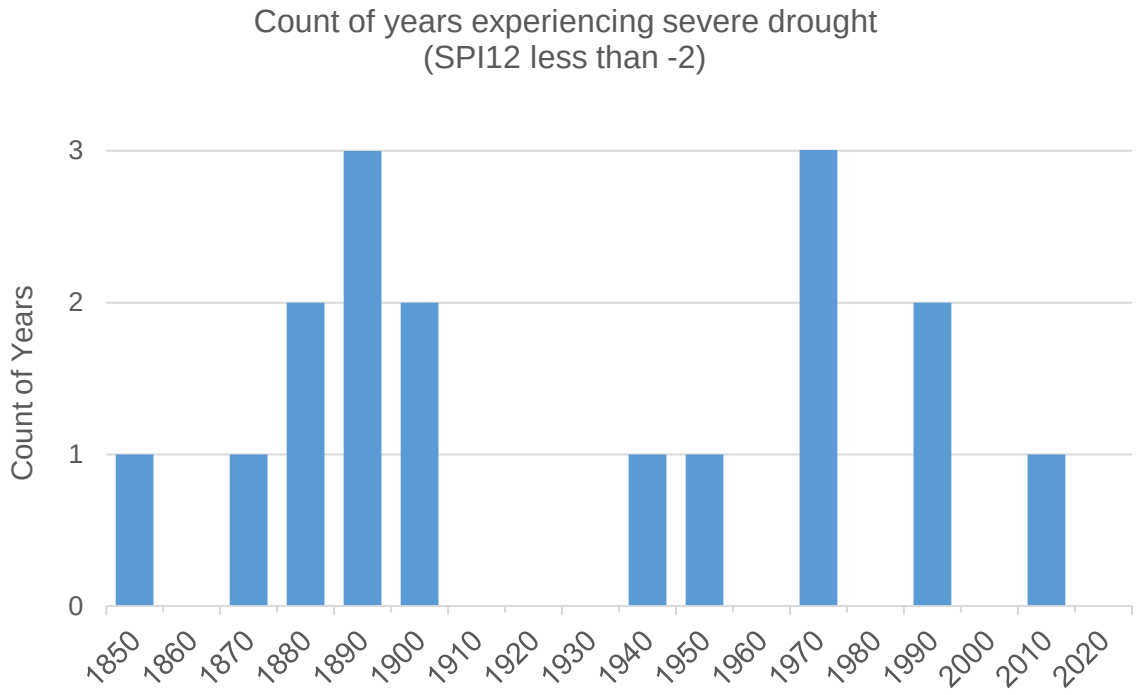


Figure 2.19 Number of Events of Severe Drought (The 12-month Standard Precipitation Index = -2)*

*The standardised Precipitation Index (SPI) is used to identify and classify meteorological drought, which is a period of abnormal rainfall deficit compared to long-term average conditions. An SPI that is less than or equal to -2.0 indicates extremely dry conditions.

Box 2.4 – 2018 Drought Experience

The late spring and early summer of 2018 saw some of the lowest rainfall totals on record, resulting in low river flows and stress to water supplies. Demand for water was also higher than normal during this period, driven by high temperatures.

In 2018, disruption to customers and environmental impacts were minimised as a result of emergency plans and activities carried out by Uisce Éireann and Local Authority operational staff, including:

- Convening a crisis management team;
- Tracking drought indicators and planning responses and activities;
- Optimising existing supplies;
- Tankering water to maintain storage levels;
- Commissioning back-up supplies;
- Controlling pressures in networks to improve water availability;
- Night-time restrictions in critical areas to conserve supplies;
- Communication campaigns to promote water conservation;
- Introduction of the first ever National Water Conservation Order;
- Working with stakeholders including the Department of Housing, Local Government and Heritage (DHPLG), National Federation of Group Water Schemes (NFGWS), EPA, Electricity Supply Board (ESB), Inland Fisheries Ireland (IFI), National Park and Wildlife Service (NPWS), Met Éireann;
- Providing alternative water supplies to customers (Bowsers, stand-pipes and bottled water), attention to critical customers, healthcare customers and vulnerable customers; and
- Engagement of our Key Account Managers with large customers.

Unfortunately, customers experienced some impacts, including reductions in water pressure and some temporary loss of supplies, principally as a result of a lack of capacity in our existing infrastructure.

A key learning from this recent drought experience was that we need to undertake further research and investigation to increase our understanding of the hydrology and hydrogeology relating to some of our water sources. We also identified the following improvements to our operational management:

- Site specific level and flow monitoring
- Live operational data
- Controls within some areas of our distribution networks to allow us to manage supplies more effectively.

2.4.3 Flood Risk

Climate projections over the next century indicate an increased likelihood of river and coastal flooding[40,41], particularly in the north and west of the country (Section 2.4.5). Increased flooding can cause pressure on drains and sewers and can affect water quality.

The Floods Directive (2007/60/EC) required member states to develop Flood Risk Management Plans for areas of existing and future potentially significant flood risk. The Floods Directive was transposed into Irish law by the EU (Assessment and Management of Flood Risks) Regulations 2010 and sets out the responsibilities of the Office of Public Works (OPW). The OPW has been implementing the Directive mainly through the Catchment Flood Risk Assessment and Management (CFRAM) Programme, through which 29 draft Flood Risk Management Plans have been developed. Approximately 300 Areas for Further Assessment have been established along with a range of measures to reduce or manage the

flood risk within each catchment. CFRAM mapping for all Areas for Further Assessment is available to view on the CFRAM website[42].

Figure 2.20 presents areas with high and medium probability of pluvial, fluvial, coastal flooding as well as historical groundwater flooding. The figure shows there is low probability of groundwater flooding within the South East Region; however, there are extensive areas of fluvial flooding in the upper reaches of the River Suir and Nore catchments as coastal flooding near Wexford, Kilmore and Waterford in SAM.

As well as considering surface water flooding, there are ongoing efforts to better understand the role of karst groundwater systems in flooding within the Flood Risk topic[43].

Guidelines for Planning Authorities on flood risk management (November 2009)[44,45] highlight that flooding of the water supply network (this includes pumping stations; electricity substations and water treatment works) can result in a loss of supply over large areas and magnify the effects of flooding beyond the immediate community directly affected. Uisce Éireann has considered the number of water treatment plants (WTPs) within areas of flood risk, where vulnerability to the effects of flooding need to be considered (Table 2.7). Nine (9) of the 143 WTPs in the region have a 10% chance of flooding in any year. These include:

- Hollyford WTP, Callan WTP, Lissava WTP, Stradbally WTP and Deelish WTP in SAK;
- Borris WTP in SAL; and
- Knockagreany WTP and Ballinellard WTP in SAM.

Callan WTP is the largest of these, serving a population of approximately 2,700.

There are no WTPs at risk of pluvial, coastal or groundwater flooding.

The WTPs that are known to be at risk of fluvial flooding are under review and where needed, protection measures will be considered for sites at risk. All new water supply options will be reviewed in terms of their risk from flooding, and this will be taken into account in the detailed siting and design to ensure improved flood risk resilience for the supply network.

Table 2.7 Total Number of WTPs at Risk of Flooding

Type of Flooding	Number of Water Treatment Plants at Risk of Flooding	
	1 in 10-year Flood Risk (10% Annual Exceedance Probability)	1 in 100-year Flood Risk (1% Annual Exceedance Probability)
Fluvial Flooding[44]	8	10
Pluvial Flooding[44]	0	0
Coastal Flooding[44]	0	0
Groundwater Flooding[44,46]	0*	0**

*Classification for Groundwater flooding recorded in database as 'High Probability'

** Classification for Groundwater flooding recorded in database as 'Medium Probability'

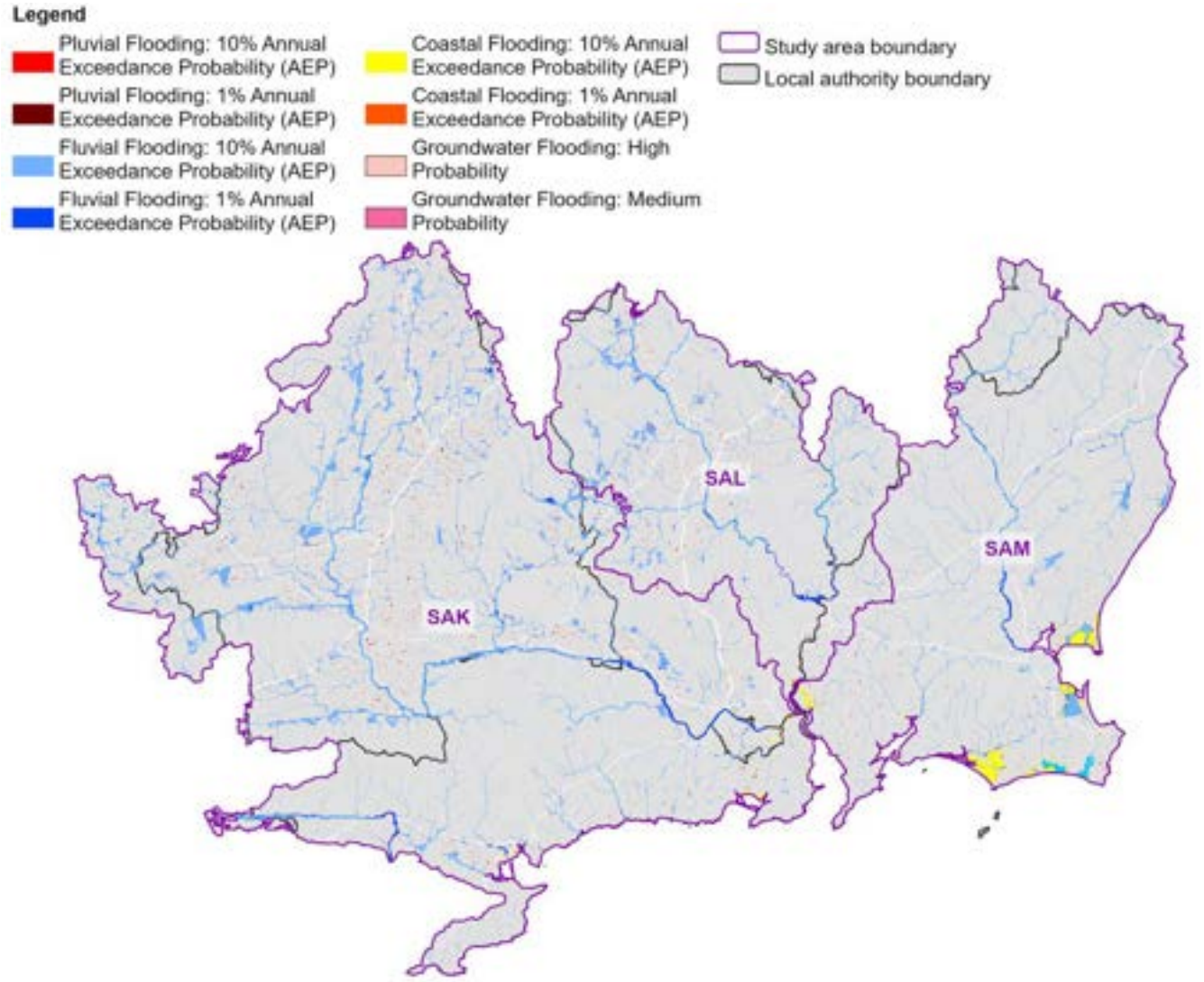


Figure 2.20 Surface Water and Groundwater Flooding

2.4.4 Water Supply Systems

The water supply systems across the South East Region draw from 163 sources (Table 2.8) and are treated in 143 Water Treatment Plants (WTPs). There are 43 surface water sources and 120 groundwater sources within the South East Region, with surface water sources supplying 66% of the total volume of water delivered to our customers either from rivers or lakes.

Around 60% of the water supplies to SAK come from surface water sources, with most of these from the River Suir system. The East Waterford WRZ in SAK is the largest WRZ in the region and has three (3) surface water abstractions feeding Adamstown WTP near Waterford City to deliver up to 58,000 m^3/day. The Water available for use (WAFU) from this system in a normal year represents approximately 23% of the regional WAFU. WAFU is further explained in Section 3.2.1 of this Plan.

The largest groundwater abstractions in the region supply Fardystown WRZ and Gorey WRZ in SAM near Wexford. These sources can deliver up to 12,000 m^3/day and 10,000 m^3/day, and approximately 10% of the regional WAFU in a normal year.

Table 2.8 Number of Water Sources in RWRP-SE

Study Area	No. of WRZS	No. of WTPS	Total Network Length* (km)	Water Sources		
				Total	Surface Water	Groundwater
SAK	75	99	4,010	110	26	84
SAL	10	13	1,205	16	7	9
SAM	26	31	3,120	37	10	27
TOTAL	**111**	**143**	**17,730**	**163**	**43**	**120**

* Network length values are rounded to the nearest 5km.

2.4.5 Climate Change

2.4.5.1 Potential Impact on Water Availability

Climate change will have significant effects on the availability of water at our sources in the future. Average annual temperatures for Ireland are expected to increase by 1.0 to 1.6 ^{o}C by the middle of this century (2041 – 2060) compared with the reference period (1981 – 2000). Warming will be enhanced at the extremes, with summer daytime and winter night-time temperatures projected to increase by 1.0 to 2.4^{o}C[47]. The projected increase in temperature will affect the amount, timing and intensity of local precipitation. In Ireland, this is expected to result in wetter winters but also drier springs and summers. Climate change simulations for Ireland show the precipitation in the autumn and winter months could increase by between 5% to 35%, while summer precipitation could decrease by a range of 0% to 30%. Under the medium to high carbon emissions scenarios dry periods are projected to increase in frequency, duration and/or magnitude from between 12% to 40% for the spring and summer months[49].

The historical analysis of average rainfall data undertaken by Murphy (2020)[49] confirms a continued trend of drier summers and wetter winters. The recent report, 'The Status of Ireland's Climate 2020'[41], published by the Environmental Protection Agency, Met Éireann and the Marine Institute, also confirms that Ireland's climate is warmer and wetter than it used to be. The study shows that there has been a 6% rise in precipitation over the past 30 years when compared to the previous three decades. While this corresponds to an observed increase in flows across most of the country, the report states there is an increase in potential drought conditions. This is the case especially in the east of the country, broadening the difference in how climate change is affecting Ireland's rivers in the east compared to the west.

The Climate Change Sectoral Adaptation Plan for Water Quality and Water Services Infrastructure[48], identifies the following key priority impacts of climate change for the water services infrastructure sector:

- Hot-weather related changes in demand.
- Increased drawdown in the autumn/winter for flood capacity, leading to resource issues in the following spring/summer.
- Reduced availability of water resources (surface and groundwater sources).

Uisce Éireann considers these impacts in our approach to supply forecasts when assessing the Supply Demand Balance across our planning period. Our assessment of the impact of climate change on the water resources of the South East Region is discussed in further detail in Section 3 of this Plan.

2.4.5.2 Further Work

Whilst there is recent work on potential climate effects on rainfall, there is less work on the projected impacts of climate change to river flow regimes across Ireland. There is also no Ireland-wide guidance available at present outlining the effects of future climate change on flows. Recognising this, we commissioned the Climate Sensitive Catchments Project to improve our understanding of how river flows may change due to climate change and how best to prepare for a hotter climate. The research characterised 206 river catchments into five (5) catchment sensitivity types as described in Box 2.5. For those located in the South East Region, most were characterised as types (a) and (d). Catchment type (a) are in the northern part of the region and are the least sensitive to changes in seasonality of wetter winters and drier summers due to high groundwater storages in these catchments. Catchment type (d) which cover areas in SAK lose more water due to evaporation and are mostly drier catchments.

Box 2.5 - Climate Sensitive Catchments Project

Project Partner: Maynooth University Irish Climate Analysis and Research Units (ICARUS)

The Climate Sensitive Catchments research project improved our understanding of how river flows may change due to climate change and how best to prepare for a hotter climate. This research concluded in April 2019.

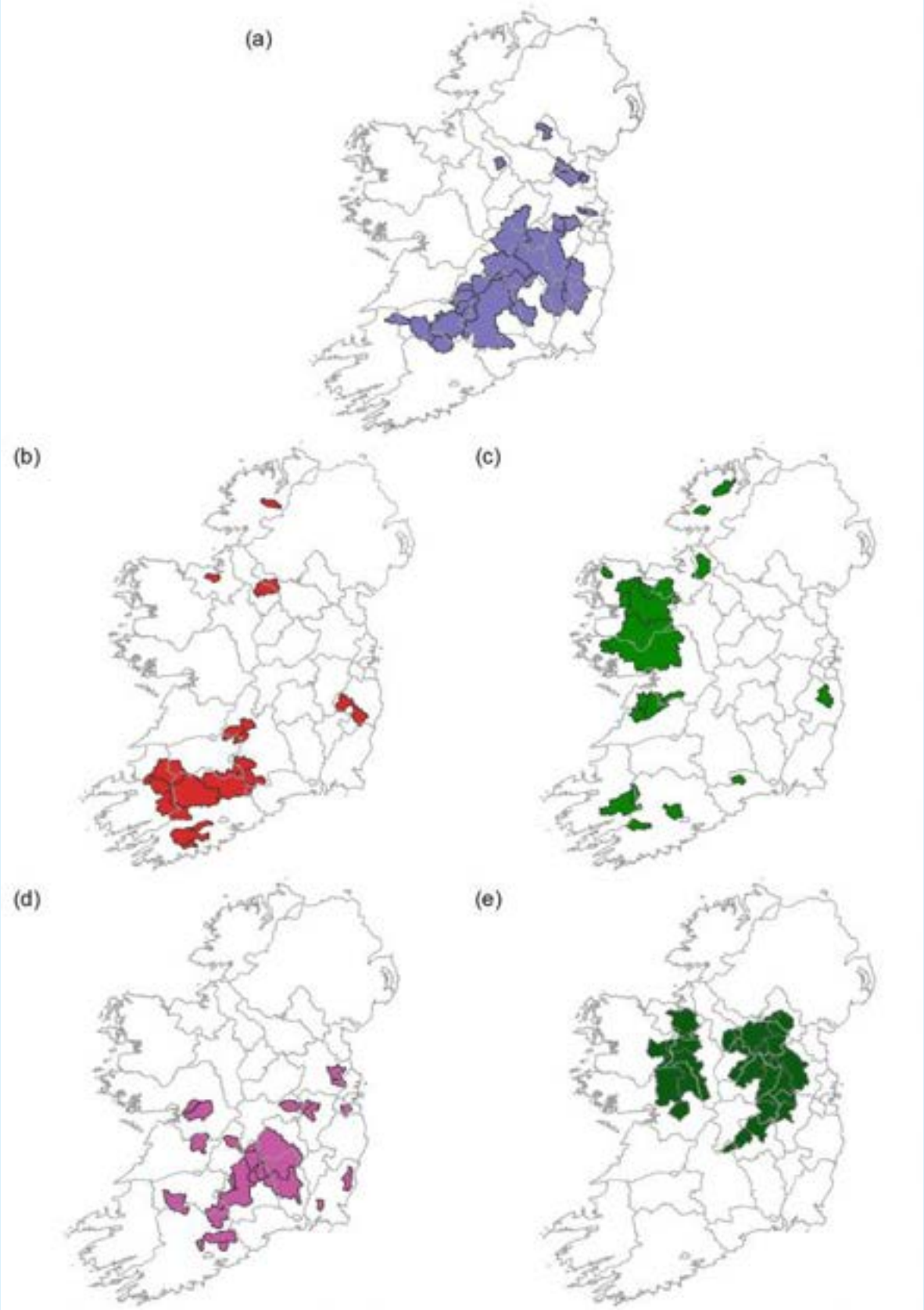
The traditional methodology to identify and assess catchments vulnerable to climate change takes a 'top down' approach, which applies information about large-scale climate change trends to small areas. This can result in inaccurate forecasting for catchments because it does not take area-specific information into consideration. This project applied a 'bottom up' methodology, which assessed how sensitive catchments are to climate change by building a catalogue of data specific to each catchment. This allowed us to identify the particular stressors and vulnerabilities in each area. By better assessing the sensitivity of catchments to climate change, we aim to increase the effectiveness of our national water management and to develop a more resilient water service.

The 206 river catchments included in this research were characterised into five (5) catchment sensitivity types (a) to (e) as illustrated below. The research concluded that catchment types (a) are the least sensitive to changes in seasonality of wetter winters and drier summers due to high groundwater storage in these catchments. Catchment types (b) and (c) have lower natural water storage and see the greatest decreases in flow due to wetter winters and drier summers. Catchment types (d) and (e) lose more water due to evaporation and are mostly drier catchments in the midlands and east. Catchment types (d) are most sensitive to changes in annual mean precipitation. When changes in seasonality and mean quantity are considered together, catchment type (d) is also the most sensitive and type (b) the least. Catchment type (e) experience less evaporative losses than (d) and while sensitive to changes in seasonality and mean quantity, are less sensitive to these changes than catchment type (d).

This research projected low flow allowances for each of the five (5) catchment sensitivity types. These low flow allowances provide resilience for lower river flows in the future due to climate change. The project concluded that in some instances an allowance for a 30% reduction in low flow would be insufficient to avoid future climate change impacts.

The findings of this research project will address the water quantity aspects of climate change, but because of changes either to temperature or flow regimes, changes in water quality will also have a bearing. In addition, climate change may result in land use changes which may compound the observed effects.

Box 2.5 continued- Climate Sensitive Catchments Project



2.4.5.3 Reducing Our Carbon Footprint

The impact of climate change will be felt by every individual, household, and community in Ireland and there is now a high level of awareness and understanding of this. There is therefore, an onus on us to mitigate the magnitude of long-term climate change by taking action to reduce Greenhouse Gas Emissions (GHG) emissions, and to increase the capacity of carbon sinks such as forests and wetlands. The European Green Deal frames Europe's response to these challenges. It is the new growth strategy that will lead the transformation in Europe to a climate-neutral, fair and prosperous society, with a modern, resource-efficient and competitive economy.

In line with EU ambition, Ireland commits to achieving a 51% reduction in Ireland's overall GHG emissions from 2021 to 2030, and to achieving net-zero emissions no later than 2050.

Section 15 of the Climate Action and Low Carbon Development Act 2015 (as amended in 2021)[50] sets a new "national climate objective" for Ireland, which provides that "The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy". The amended Act requires public authorities, including Uisce Éireann, so far as practicable, to perform their functions in a manner consistent with the furtherance of the national climate objective and the relevant national and sectoral plans and strategies to mitigate greenhouse gas emissions and adapt to the effects of climate change.

The Department of the Environment, Climate and Communications' Climate Action Plan 2023 (CAP)[51] commits to achieving a 51% reduction in overall greenhouse gas emissions by 2030 and reaching net zero carbon emissions by 2050. The aim is for more sustainable growth and to create a resilient, vibrant and sustainable country. The CAP defines a roadmap to this goal and initiates a set of policy actions to achieve this. A detailed sectoral roadmap has also been set out, which is designed to deliver a cumulative reduction in emissions, over the period 2021 to 2030. It includes targets for renewable energy to provide 80% of electricity by 2030 and sets targets for agriculture and forestry and improving land management to support carbon sequestration.

Uisce Éireann is committed to improving energy efficiency and reducing carbon emissions. In 2020, we achieved a 32% improvement in our energy efficiency performance, saving an equivalent of 95,000 tonnes of carbon. We are on track to meet our target of 33% energy efficiency improvement, putting us in a strong position to meet our new target of 50% by 2030.

Uisce Éireann is committed to reducing energy consumption through a range of energy initiatives, including asset replacement and the commencement of sustainable energy pilots at two wastewater treatment plants to install solar panels to generate renewable energy. We are also reviewing the potential to produce more renewable energy from on-site wind turbines.

Uisce Éireann have made significant progress on the journey to become a low carbon, energy efficient, sustainable water utility. Our strategy and energy management programme take a business wide approach with 36 Energy Action Plans and 255 discrete energy projects, including energy efficient design, innovation, energy retrofits, renewable energy, lighting and heating, energy audits and planning, process optimisation, staff awareness and training. An example of this is the provision of 230 Solar Panels at the new WTP in Thurles, see Box 2.6.

We have also developed and published a Biodiversity Action Plan (BAP)[37] in 2020. It will help us to conserve, enhance and work with the natural environment. Our approach will protect and enhance biodiversity at our sites whilst also providing additional benefits such as carbon sequestration and drinking water source protection. We have implemented Biodiversity Management Plans and Enhancement Measures for 85 sites nationally.

Measures taken in 2020 to reduce our Carbon Footprint include;

- Decarbonising our energy consumption including installation of solar renewable energy sources.
- Implementing an energy governance model, using an asset management approach aligned with ISO 5000.
- Implementing energy efficiency projects across our operations including pumping, aeration, renewables, lighting and heating.
- Roll out the water conservation awareness campaign.
- Preparing a climate change mitigation and adaptation strategy.

The NWRP approach to assessing and selecting solutions to meet our existing and future water supply challenges, is aligned with national policy objectives. For example, Carbon Costs and Operational Costs (including energy costs) are included in the development of the overall Net Present Value (NPV) of all options. Therefore, it is a key consideration in the determination of the Preferred Approach.

Further to this, one of the six (6) Approach Categories considered in the determination of the Preferred Approach is the Lowest Carbon Approach (Table 7.1, Section 7). The Lowest Carbon Approach is the Option or combination of Options with the lowest embodied and operational carbon cost.

At project development stage further considerations will be given to energy efficient design and the potential to reduce greenhouse gas emissions and improve energy efficiency of the project by the development of clean renewable energy on-site.

Box 2.6 - Thurles Renewable Energy Project

Uisce Éireann, working in partnership with Tipperary County Council, has recently completed a solar energy project at the new water treatment plant in Thurles Co. Tipperary. This project involved the installation of 230 solar panels at the recently constructed water treatment plant, generating clean, renewable energy for the plant. This project will generate 83,264 kWh (kilowatt hours) electricity per year, improve energy efficiency at the plant and reduce carbon emissions.

This project will:

- Reduce the plant's carbon footprint, which will equate to a 40 tonnes reduction in carbon emissions.
- Generate 83,264 kWh (kilowatt hours) per year of electricity, which is equivalent to the electricity required to power 20 houses per year.
- The generation of clean renewable energy will lead to a 10% reduction in imported electricity at the site.
- Reduce greenhouse gas emissions and improve energy efficiency at the plant.

2.5 Summary

In this section we have outlined the following key characteristics of the RWRP-SE:

Population and Growth

- Uisce Éireann supplies around 161 million litres of water per day to a population of 369,240 people (18% of the national population) and 29,700 businesses in the South East Region. Approximately 14% of the regional population is located within Waterford City.
- The overall regional population growth is 28% from 2019 to 2044. All Study Areas in the South East region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016. The Waterford and South Tipperary Study Area (SAK) has the highest projected growth rate at 30%, which is driven by the East Waterford Water Supply Scheme WRZ and Clonmel and Environs forecast growth of 44% and 47% respectively by 2044.

Natural Resources and Environmental Pressures

- There are only 11 lakes in the South East Region; however, the region is drained by an extensive network of rivers, including the Barrow (the second largest river in Ireland), the Suir (the third longest river in Ireland) and the Nore Rivers. Their combined catchment areas cover approximately 9,700 km^2.
- The riverine ecology of many of our river systems is considered highly sensitive to changes in flow and water level. The most sensitive rivers are those within the river typology categories that are representative of headwaters, low nutrient, low pH and salmonid spawning and nursery areas. The salmonid spawning and nursery areas are particularly sensitive to low flows and impounding structures. These categories combined make up 26% of the main river water bodies in the region. The dominant river typology is represented by hard limestone and sandstone, located at a low to medium altitude, with a low to medium slope.
- Across the region, 41% of surface water bodies (SWBs) are at ‘High’ or ‘Good’ status, while 17% are classified as below ‘Moderate’ status.
- Ten of the 94 groundwater bodies (GWBs) are currently at ‘poor’ Chemical Status. The remaining 84 GWBs are assessed at ‘good’ overall WFD status.
- The 2016 – 2021 WFD Cycle 3 assessed both GWBs and SWBs to determine which are currently considered to be at risk of failing WFD objectives or are at risk of deteriorating from their current status. Forty-six percent (46%) of our river water bodies, four (4) of the 11 lake water bodies, and 33% of our groundwater bodies are currently ‘At Risk’, with the predominant pressure being agriculture.
- In developing our Preferred Approach to securing future water supplies we have undertaken a desktop independent assessment to identify existing surface water sites where abstractions have the potential to exceed sustainable abstraction thresholds. We have identified 35 out of 43 surface water abstractions sites that we have assessed to be below target conditions. This was a conservative assessment based on plan level information. The EPA will be the authority to adjudicate with the benefit of more detailed project level information.
- There are 61 nationally and internationally designated sites listed in the South East Region and 135 proposed Natural Heritage Areas. Protected sites with the greatest coverage in the region include the:
    - Slievefelim to Silvermines Mountain SPA, an extensive upland site located in Counties Tipperary and Limerick;
    - Wexford Harbour and Slobs SPA, covering 6,000 hectares and focused on Wexford Harbour which forms the lowest part of the estuary of the River Slaney; and

- Raven SPA, a large coastal area of 4,200 hectares extending from north of Rosslare Point to Blackwater Harbour on the coast of Co. Wexford.

Water Resources and Existing Challenges

- Surface water abstractions make up 66% of the water delivered to customers in the South East region, with the remaining 34% being supplied from groundwater sources.
- The South East region includes only a few areas where average annual rainfall exceeds 2,000 mm. Most of the highest populated areas experience annual average rainfall less than 1,000 mm.
- Several raw water sources were impacted by the recent droughts in 2018, 2021 and 2022. Water levels in rivers dropped significantly for many supplies including to Kikenny City, Borris, Fews and Wexford Town.
- The availability of water is anticipated to change over the 25-year planning period due to climate change with water availability increasing during autumn/winter and decreasing during the summer. Precipitation responsible for the recharge of our groundwater and surface water sources could increase by 5-35% during the autumn and winter months decrease by 0-30% during the summer.

Environmental and Climate Change Initiatives

- Uisce Éireann is implementing Nature Based Solutions within the South East Region. This includes final works on the Dunhill Integrated Constructed Wetland Project located in County Waterford. Identifying opportunities for the incorporation of NBS and catchment management activities within our abstraction catchments, will continue to be encouraged and promoted through the NWRP.
- Key Sustainability objectives planned for 2022 include:
    - Developing and implementing a sustainability strategy aligned with the Government Climate Action Plan and UN Sustainable Development Goals.
    - Continuing the implementation of our sustainable energy strategy.
    - Implementing and communicating our climate change strategy.
    - Developing a carbon neutrality roadmap.
    - Continuing to decarbonise our energy consumption through energy efficiency improvement and renewable energy.
    - Improving energy efficiency by upgrading and replacing inefficient plant and processes.
    - Continuing to protect and enhance biodiversity on our assets.
    - Embedding energy efficiency design into our activities in collaboration with the Sustainable Energy Authority of Ireland (SEAI).
    - Implementation of a waste management strategy, with a particular focus on the circular economy.

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3 Regional Needs

3.1 Introduction

To plan for future water supplies it is necessary to assess public water supply requirements over our 25-year planning period. This assessment will identify whether there is likely to be a surplus or shortfall of available water; and whether our infrastructure can reliably deliver water supplies and ensure a risk-based approach to continuously meet water quality standards. The assessment will provide us with the baseline to make progress against our improvement goals including against Ireland's United Nations Sustainable Development Goal 6 - Clean Water and Sanitation[1]. This defines our current and future water supply needs and forms the first stage of our eight (8) stage process to develop our plan level Preferred Approach (PA) to delivering secure and safe water supplies. The process is referred to as our Options Assessment Methodology. The key stages of the process are illustrated in Figure 3.1 and summarised below.

a) Stage 1: Identify the 'Need' based on the Supply Demand Balance (SDB) and Drinking Water Safety Plan (DWSP) Interim Barrier Assessment (Section 3). The SDB calculates the difference between the water we have available in our supplies compared to the Demand for water. The DWSP Interim Barrier Assessment identifies water Quality and Reliability driven Need.

b) Stage 2: Scope the Study Areas to determine existing infrastructure deficiencies (Section 4).

c) Stage 3 to Stage 6: Option Development, involving the identification of a list of possible Options that are unconstrained by cost, feasibility or specific environmental requirements (Unconstrained Options List); and assessment of these Options through a two-stage screening process (Coarse Screening and Fine Screening) to produce a Feasible List of Options (Section 5).

d) Stage 7: Approach Development, which tests a range of Options and Option combinations to select the 'best value' solutions to address our Deficits. These are assessed against five (5) criteria (Resilience, Deliverability and Flexibility, Progressibility, Sustainability and Cost) reflecting the objectives of our National Water Resources Plan (NWRP) and associated Strategic Environmental Assessment (SEA). Stage 7 produces our plan level Preferred Approach at a Study Area spatial level (Section 7) and Regional spatial level (Section 8).

e) Stage 8: Monitoring and Feedback, where we identify how we will address gaps in data and information to improve the next iteration of our NWRP.

The process is described in further detail in Section 8 of our Framework Plan.

The **plan level Preferred Approach** is the combination of solutions that are assessed as the most effective in meeting the objectives of the National Water Resources Plan (NWRP). Section 6,7 and 8 of the RWRP-SE provide further details.

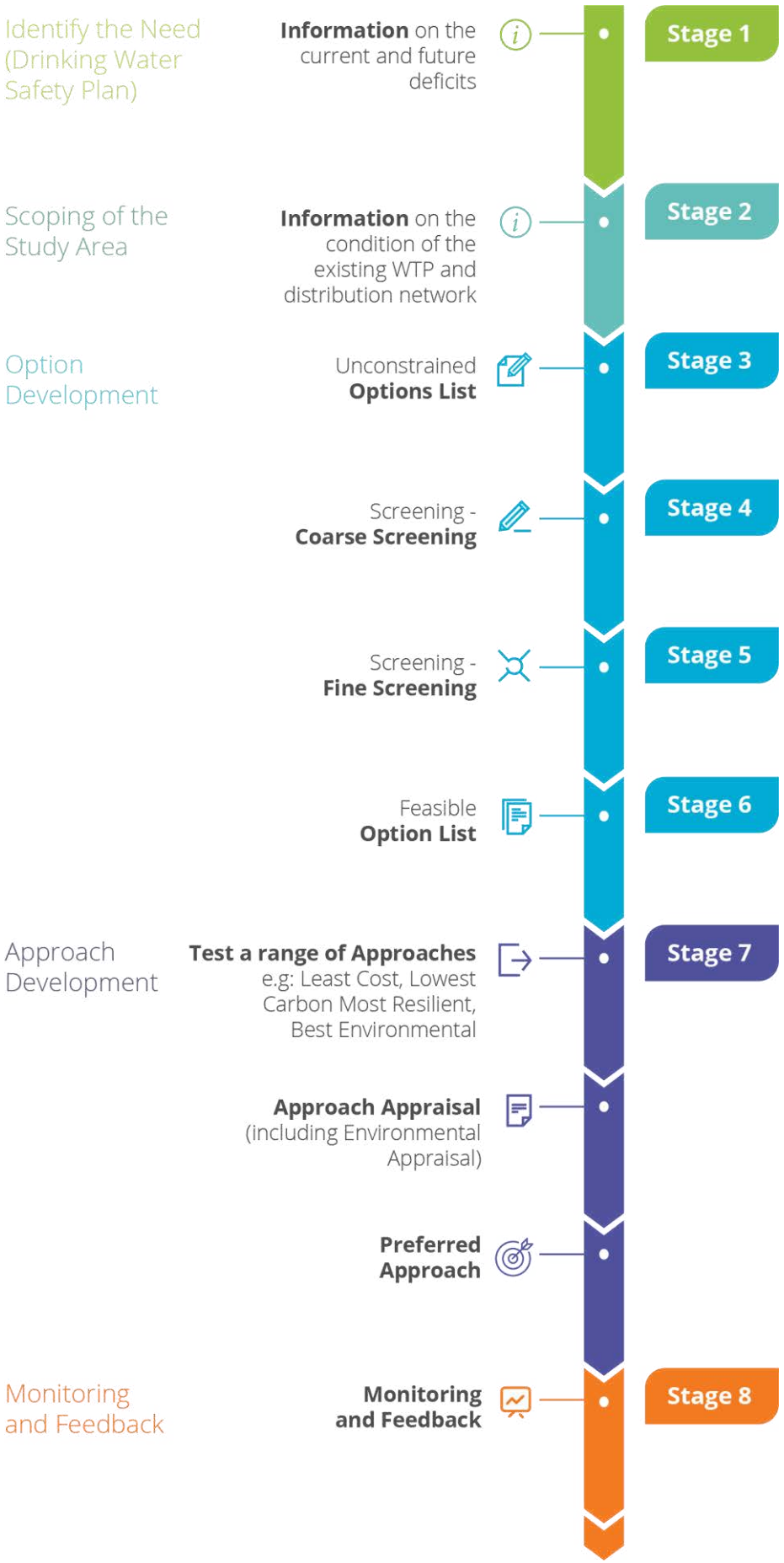

Figure 3.1 Options Assessment Methodology

In this section we present the outcomes of Stage One of our Options Assessment Methodology, describing the future Needs across the South East Region with respect to four (4) themes:

- **Water Quantity**, which is determined as the surplus or shortfall (Deficit) of available water supply over the 25-year planning period;
- **Water Quality**, which is assessed in relation to drinking water standards through the Interim Barrier Assessment which is built off the DWSPs;
- **Reliability** in relation to performance and operational efficiency of Uisce Éireann 's Asset Base; and
- **Sustainability** of our water resources to ensure we meet our statutory environmental obligations and secure future supplies under an uncertain climate.

The Needs assessment for the three (3) Regional Water Resources Plan South East (RWRP-SE) Study Areas is presented in the Study Area Technical Reports in Appendix 1 - 3. Figure 3.2 provides an overview of our approach to assess Need across our asset base in the context of our Options Assessment Process.

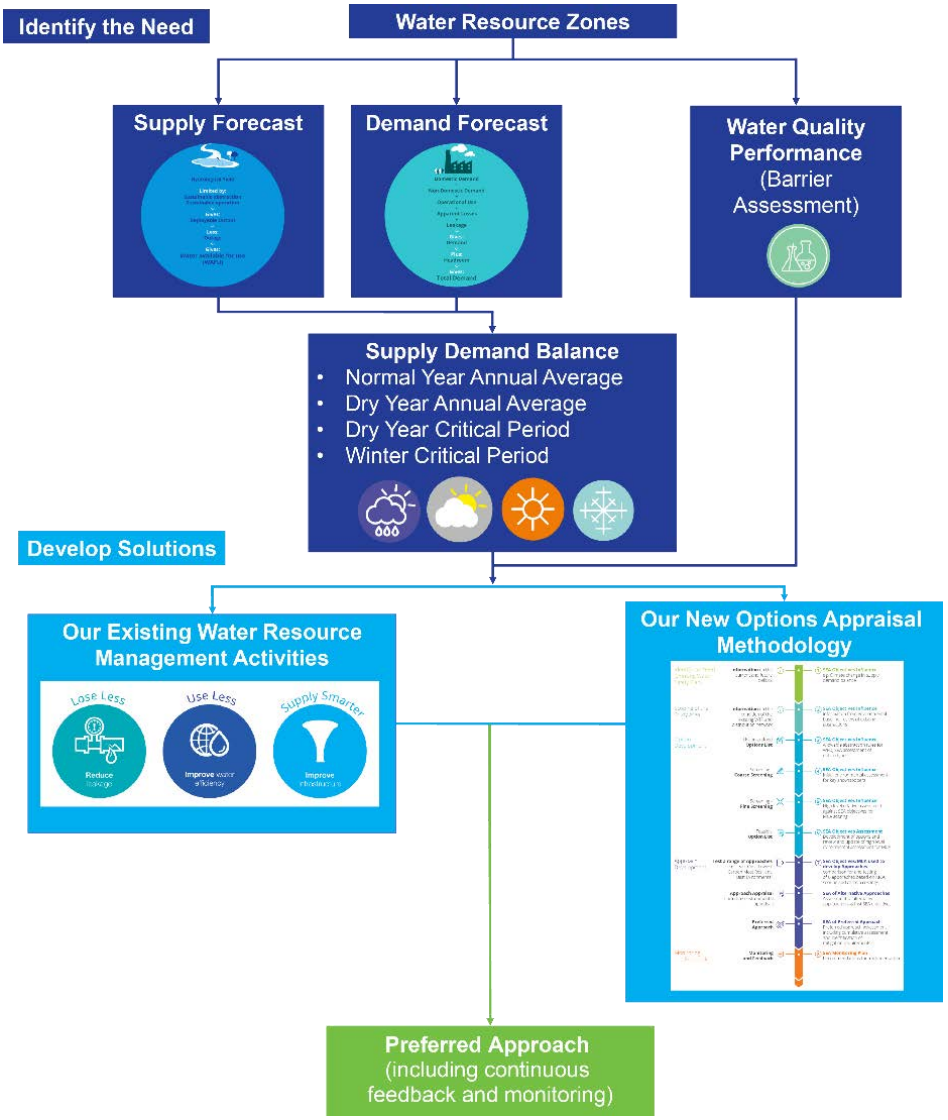

Figure 3.2 NWRP Options Assessment Process

3.2 Water Quantity

3.2.1 Introduction

The Supply Demand Balance (SDB) is the difference between the water we have available in our supplies compared to the demand for water. Figure 3.3 identifies the components of the SDB. In Section 3 and 4 of the Framework Plan, we outline how each of these components is calculated.

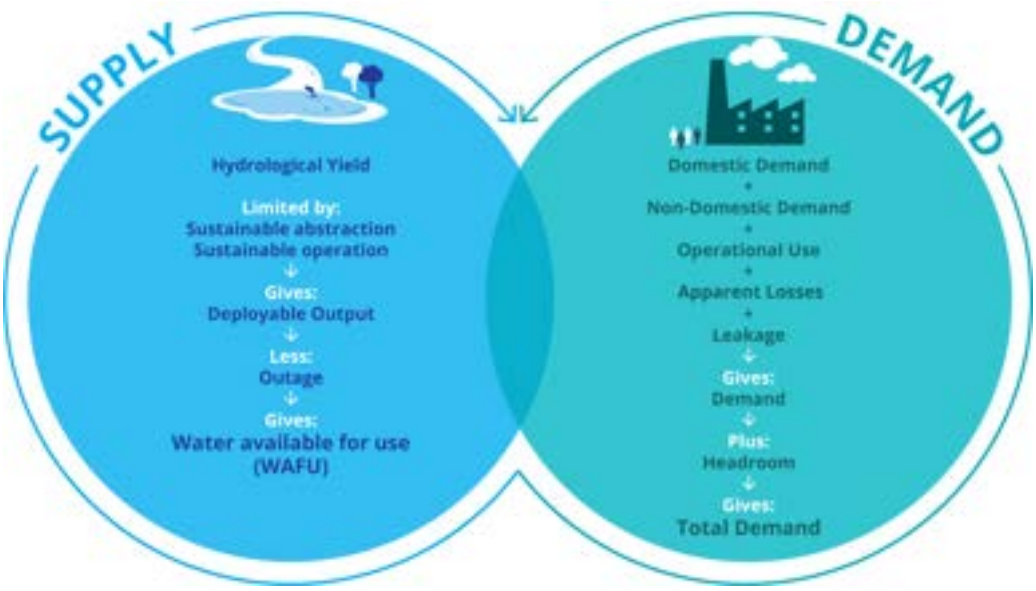

Figure 3.3 Components of the SDB

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 calculate the Water Available for Use (WAFU) for each Water Resource Zone (WRZ). As part of our supply forecasts, we must consider reducing supply availability due to the impact of climate change and the potential sustainability driven reductions in allowable abstraction from waterbodies.

Water Available for Use (WAFU) is the amount of water that can be supplied from a supply system taking into account infrastructure capacity constraints, treatment losses and planned and unplanned events that can reduce supplies.

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 SDB, 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.

3.2.1.1 Weather Event Planning Scenarios

The SDB calculations have been developed under four (4) Weather Event Planning Scenarios to ensure that the RWRP-SE supports the development of a resilient water supply system that limits the impacts of extreme events on our customers. The Weather Event Planning Scenarios include:

- 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).

Dry years and drought periods can reduce the available flows in rivers and groundwater recharge, which impacts the WAFU; while storms and cold weather events can disrupt services through asset damage such as water main bursts due to freeze-thaw conditions (periods of cold weather followed by a warming). This increases the water loss in the system, which increases the Total Demand. Consumptive demands may increase with warm weather events as customers increase outdoor water use.

The Framework Plan describes the Weather Event Planning Scenarios in further detail.

3.2.1.2 Level of Service (LoS)

In water resource planning, water supply systems are developed to provide a target Level of Service (LoS). The LoS refers to the Reliability of the supply that our customers can expect to receive. It is the frequency that our customers may experience an interruption to supply because of water availability issues, rather than a water Quality or a network incident.

The Reliability of meeting a LoS for water supply planning purposes is distinct from the day to day, or even hourly, operation of the distribution system. It is also not related to the Reliability associated with regulatory constraints such as required pressure or water Quality levels. Box 3.1 provides an explanation of the LoS as it relates to long-term water supply planning in Ireland.

The LoS we aim to provide our customers will have a significant impact on the level of investment needed. Typically, the greater the target LoS, the higher the amount of investment needed, as more resilient infrastructure is required. However, a lower LoS accepts a greater risk of implementing water restrictions that can have negative social, economic and environmental impacts.

Box 3.1 – Level of Service (LoS)

When planning for future water supply, it is necessary to strike a balance between investing in additional supply capacity now or deferring it for some future time. This will depend on the projected growth and other factors such as climate change, climate variability, environmental flow requirements and aging infrastructure. The uncertainty associated with many of these factors, in particular climate variability, introduces a risk that our customers will experience supply shortfalls during extreme weather conditions. Water supply systems are planned to provide a balance between investment and risk. This is defined as the Level of Service (LoS).

Level of Service (LoS) is expressed as a frequency or return period of supply failure. For example, if the LoS is stated as 1 in 50, as a consumer, you would only ever expect to experience a supply failure due to water availability, on average, once every 50 years. That is, there would be a 2% chance of experiencing a supply failure in any given year.

In Ireland, we define supply failure as the point at which reduced water availability requires the provision of emergency alternative supplies.

The current LoS across the RWRP-SE varies from one location to another, ranging from lower than 1 in 10 to greater than 1 in 50 during normal conditions (NYAA) (Figure 3.4). As summarised in Table 3.1, approximately 70% of the population connected to Uisce Éireann 's network receive our target LoS of >1 in 50 during normal conditions (NYAA). Approximately 30% of the population are therefore at risk of receiving a LoS lower than 1 in 50.

Table 3.1 NYAA Level of Service by WRZ and Population Served

LoS	Number of WRZs*	Population Served	% of Total Regional Population Served
>1 in 50	79	261,660	70.1%
>1 in 40	0	0	0.0%
>1 in 30	0	0	0.0%
>1 in 20	0	0	0.0%
>1 in 10	1	4,100	1.0%
<1 in 10	31	103,480	27.0%

* The Level of Service refers only to supplies currently operated by Uisce Éireann.

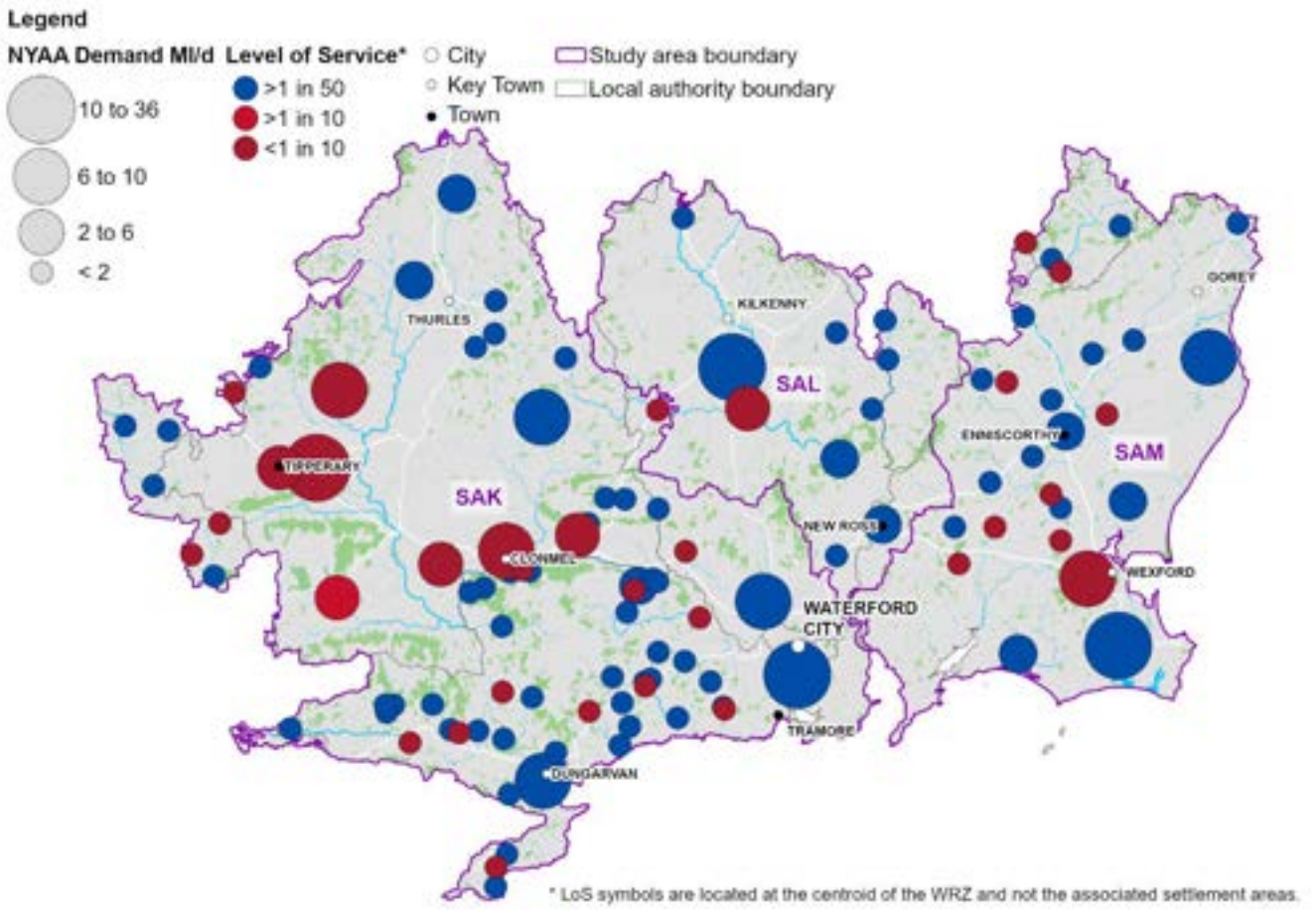

Figure 3.4 LoS for each WRZ for a Normal Year (NYAA)

In dry or severe winter conditions, some customers already experience interruptions to their supply despite considerable efforts and advancements by Uisce Éireann in partnership with Local Authorities. During a dry year critical period (DYCP) 69% of the region's population receive our target >1 in 50 LoS (Table 3.2 and Figure 3.5). Under this scenario approximately 41% of the region's population experience a LoS of <1 in 10.

Table 3.2 DYCP Level of Service by WRZ and Population Served

LoS	Number of WRZs	Population Served	% of Total Regional Population Served
>1 in 50	62	218,090	59.0%
>1 in 40	0	0	0.0%
>1 in 30	0	0	0.0%
>1 in 20	0	0	0.0%
>1 in 10	0	0	0.0%
<1 in 10	49	151,150	41.0

* The Level of Service refers only to supplies currently operated by Uisce Éireann.

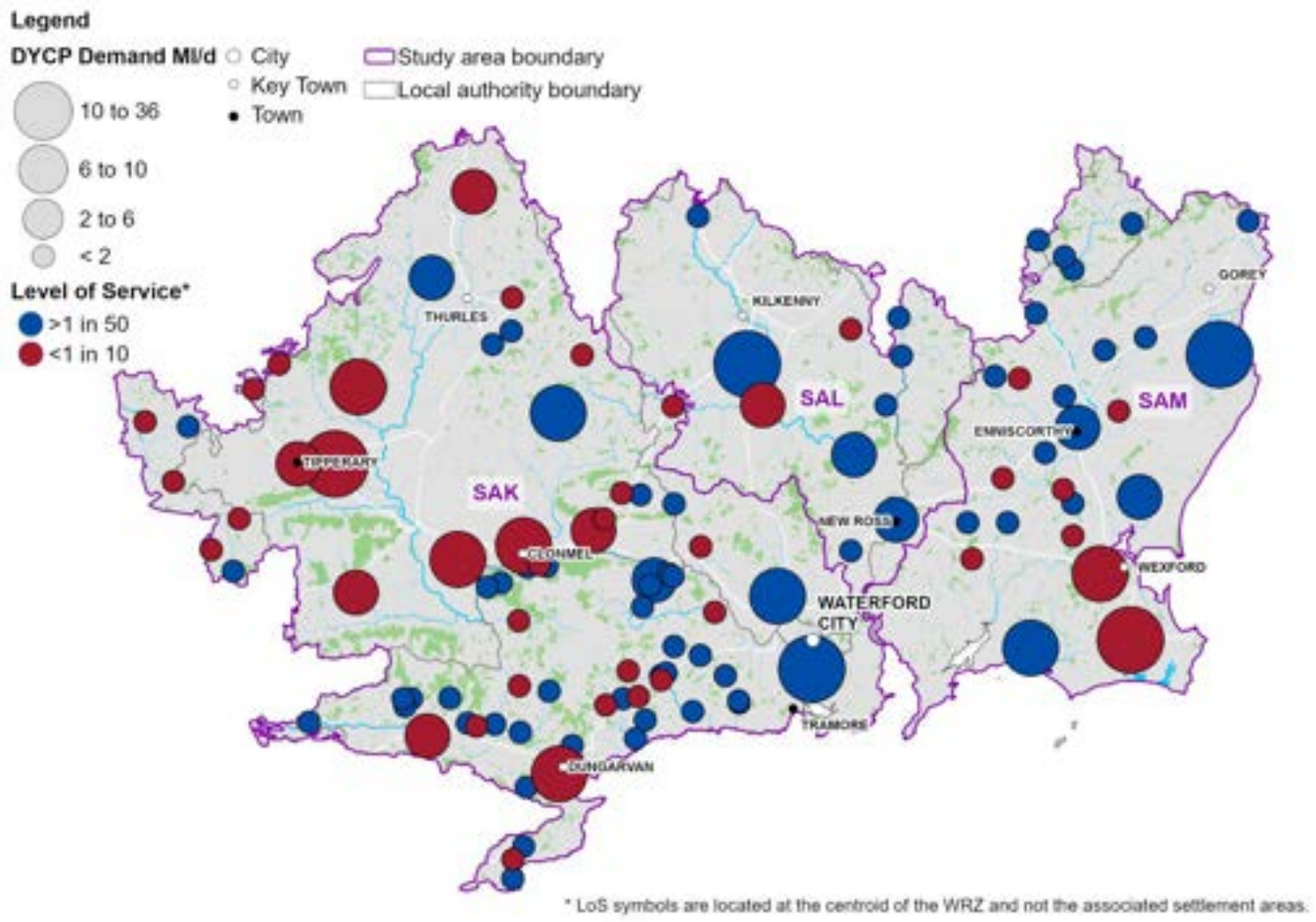

Figure 3.5 LoS for each WRZ for a Dry Year Critical Period (DYCP)

Our current LoS in Ireland is low compared to international norms. In the UK, the current LoS is generally over 1 in 100-year LoS (Appendix D of the Framework Plan). Given the current low LoS for some of our supply systems and the additional uncertainty in the future LoS due to the unknown impact of the new Abstraction Legislation, through this first iteration of the NWRP our aim is to provide a minimum supply Reliability of 1 in 50 to all of our customers. That is, there would be a 2% chance that customers will experience a supply failure in any given year due to low water availability. This will demonstrate progress towards Ireland Sustainable Development Goal 6 which aims to ensure that our customers have universal and equitable access to safe and affordable drinking water and reduce the number of people suffering from water scarcity. To achieve a higher LoS will take multiple investment cycles to realise and will not enable a uniform improvement to all our customers.

3.2.2 Current Water Supply

At present, we abstract more water from surface water sources (rivers and lakes) than from groundwater sources (boreholes and springs) for public water supply in the RWRP-SE. This is illustrated in Figure 3.6 which shows that we have 43 surface water sources and 120 groundwater sources. Our surface water sources provide 66% of our total supply, whilst groundwater sources provide only 34% 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. This limits the volumes available for abstraction and in some cases resilience during dry periods.

Figure 3.6 Water Supply Sources

The location of the existing surface water and groundwater abstraction points is shown in Figure 3.7. The figure shows that abstraction points in SAK and SAM are particularly clustered around population settlements as well as the more productive aquifers. In SAK abstraction points are notably clustered around Waterford City and Clonmel. In SAM abstraction points are notably clustered around Wexford, Gorey and Enniscorthy. In both cases the abstractions are clustered around the regionally important karstified and fissured bedrocks. Whilst there is a dominance of poorly productive bedrocks across Ireland a band of regionally important fissured bedrock is present in a north-east south-west band from Gorey in SAM across Waterford City, Tramore and to the north east of Dungarvan. A trend of boreholes can be seen in SAM following this aquifer. A notable cluster of boreholes can also be seen south of Wexford where there is a small area of this fissured bedrock along with an area of regionally important karstified bedrock. In SAK a number of spring sources can also be seen clustered around geological transitions. In SAL there are fewer boreholes reflecting a lower proportion of productive aquifers. Surface water abstractions are dominant located along the River Nore and the River Barrow.

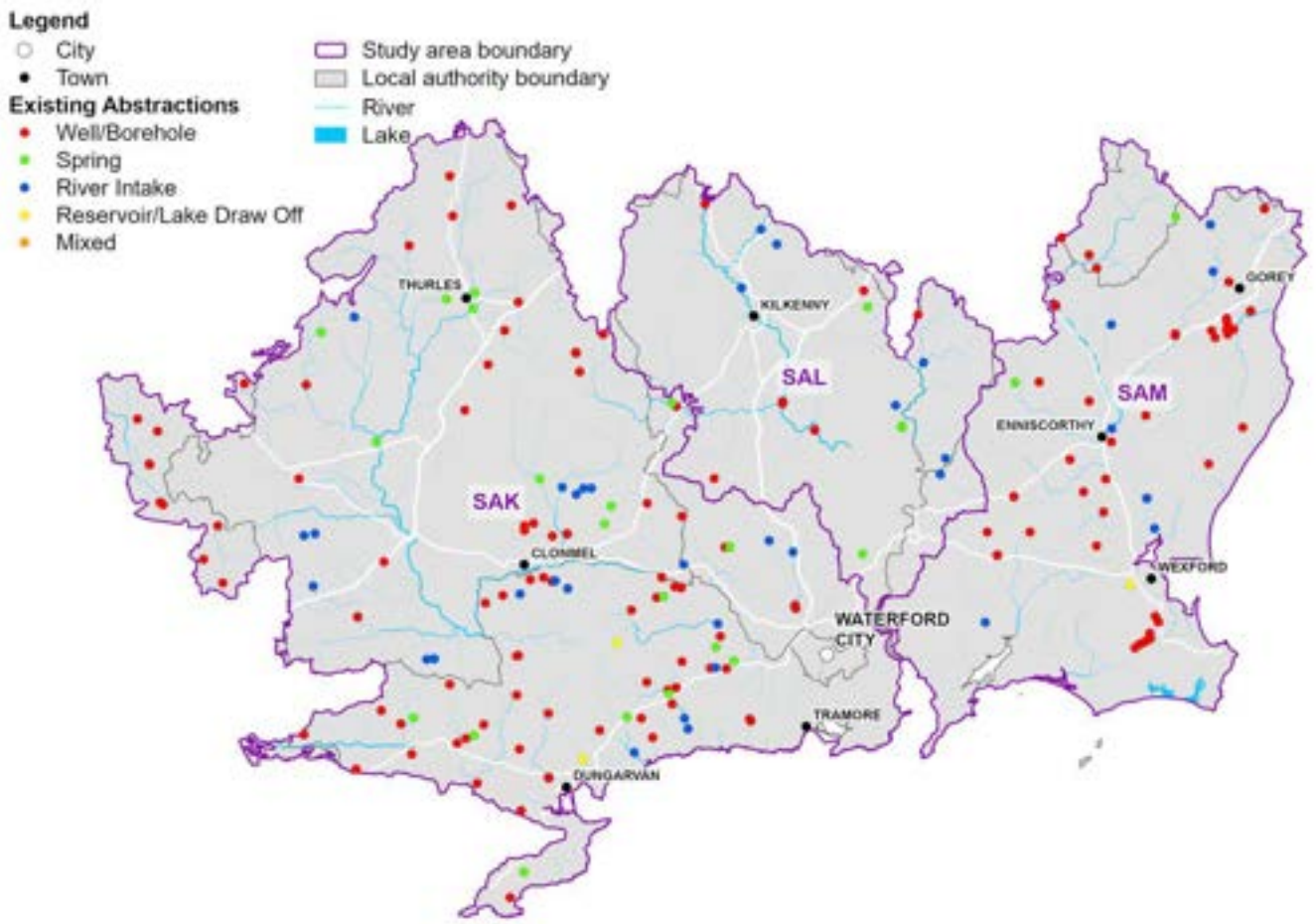

Figure 3.7 Existing Abstraction Locations in the South East Region

A comparison of surface water and groundwater sources across our Study Areas is shown in Table 3.3 and Figure 3.8. The pie charts show the proportion of each source type as a percentage of the total WAFU (Water Available for Use) for the NYAA (Normal Year Annual Average) planning scenario.

Each Study Area relies predominantly on surface water with SAK, SAL and SAM receiving 66%, 79% and 56% of their water resources from surface water sources respectively. Study Area L has the largest dominance on surface water due to its limited availability of productive bedrock.

In SAK the largest surface water abstractions are from the Clodagh River, Mahon River, Clonassy/Pollanasa River and the River Blackwater. The largest surface water abstractions from SAL include abstractions from the River Dinan, River Douglas and the River Nore (one of the largest rivers in Ireland). In SAM the largest surface water abstractions are from River Bann and River Sow.

Table 3.3 WAFU in 2019 for our Study Areas (NYAA)

SA No.	SA Name	NYAA WAFU					
		Groundwater		Surface Water		Total	
		(Ml/d)	(% of Region)	(Ml/d)	(% of Region)	(Ml/d)	(% of Region)
SAK	County Tipperary and Waterford	41.7	62.5	81.2	61.8	123	62.1%
SAL	County Kilkenny	7.0	10.5	27.0	20.5	34	17.2%
SAM	County Wexford	18.0	27.0	23.1	17.6	41	20.8%
	Total	**66.8**	**100%**	**131.3**	**100%**	**198.1**	**100%**

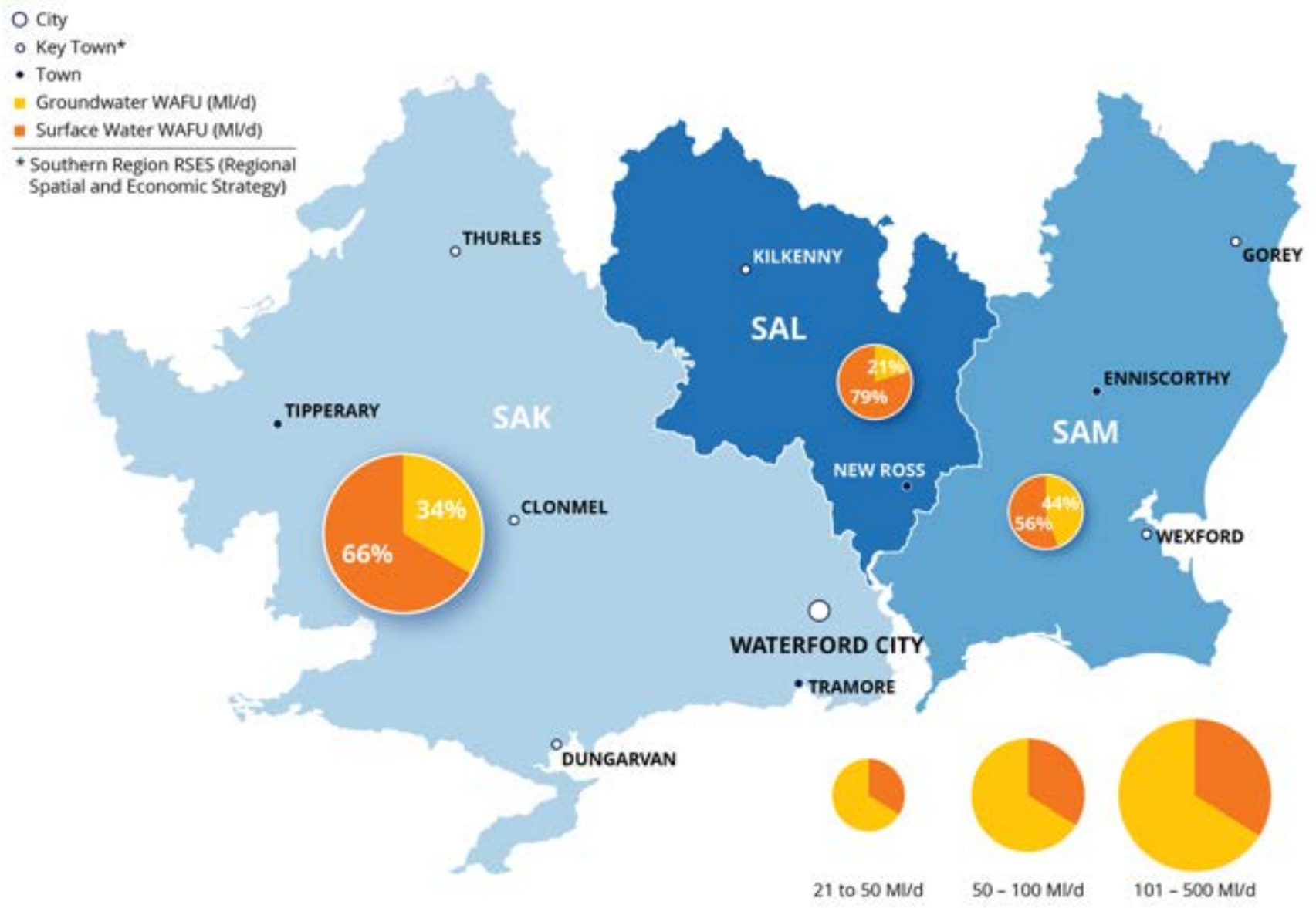

Figure 3.8 Comparison of Groundwater and Surface Water WAFU across the Study Areas for the NYAA

3.2.3 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 or groundwater body from which we abstract and the Level of Service we aim to provide.

Surface Water Sources

The quantity of water available from our surface water sources varies throughout the year. Less water is typically available from April to September. For example, the April to September average flow is approximately 27% of the annual average flow on the Glenakeefe River near Lismore. We assess the water available for abstraction from our direct river abstractions (referred to as the hydrological yield) using Flow Duration Curves (FDCs). A FDC describes the percentage of time that flow is likely to be equalled or exceeded. For example, the 95th percentile flow, denoted as Q95, is the flow equalled or exceeded 95% of the time. The Q95 would represent a low flow in the river, whereas the 5th percentile (or Q5 flow) would represent a high flow that is only equalled or exceeded 5% of the time.

As an example, the FDC for the Glenakeefe River and Sow River is shown in Figure 3.9. The shallower gradient of the curve for the Sow River compared to the Glenakeefe River suggests the flow at the Sow River is likely to have a greater contribution of baseflows that can sustain flows in dry periods.

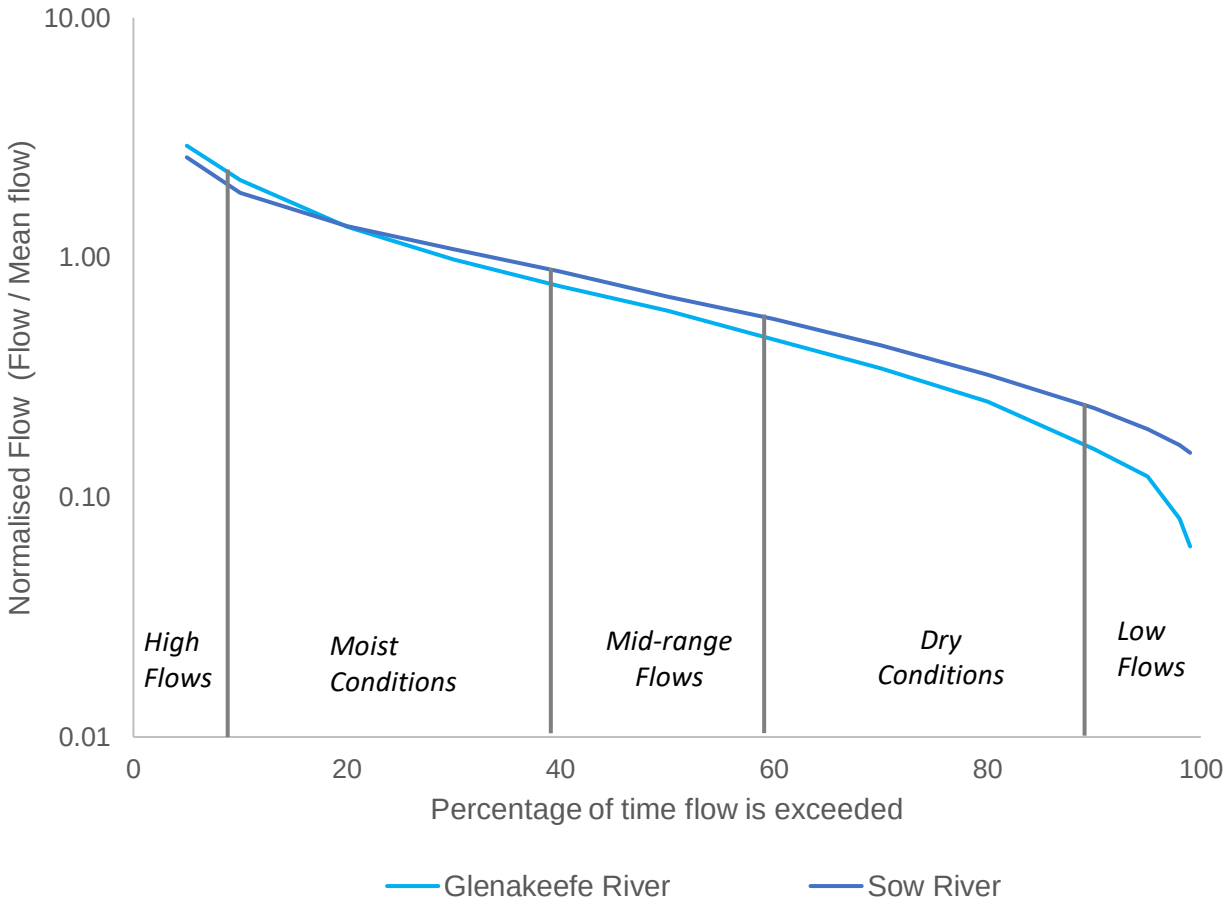

Figure 3.9 Hydrological Characteristics of the Glenakeefe River and Sow River

A similar approach is used to determine the hydrological yield for lakes and impounding reservoir sources, with the additional consideration of available water storage. The hydrological yield is calculated for a given source based on maintaining a 1 in 50 LoS. The method for calculating the hydrological yield from river and lake sources is summarised in our Framework Plan.

The hydrological yield across our surface water sources varies. Approximately 25% of the region's surface water sources are characterised by a yield of less than 1,000 m^3/d (1 Ml/d) whilst 58% of the region's surface water sources are characterised by a yield of less than 3,000 m^3/d (3 Ml/d). Only four (4) sources have a hydrological yield exceeding 10,000 m^3/d (10 Ml/d) (River Slaney, River Nore, Ballylaneen and Owenduff) with three (3) of these sources having a yield of less than 20,000 m^3/d (20 Ml/d). The highest yielding source which provides water to Enniscorthy has a hydrological yield of approximately 114,000 m^3/d (114 Ml/d) (River Slaney).

Groundwater Sources

The yield of our groundwater sources is largely dependent on the inherent hydrogeology. Approximately 87% of the South East Region's groundwater sources yield less than 1,500 m^3/d (1.5 Ml/d) as much of the region is underlain by poorly productive aquifers. Furthermore 40% of groundwater sources in the South East Region have a yield of less than 200 m^3/day (0.2 Ml/d). These sources serve small rural settlements. The highest yielding source is spring fed providing approximately 3.8 Ml/d and contributes to the supply for Fethard and Mullenbawn Regional Water Supply WRZ in SAK.

Appendix C of the Framework Plan provides further information on the aquifer categories and the expected yields across Ireland.

3.2.4 Current and Future WAFU

The WAFU is generally restricted by the capacity of the water supply assets, rather than the hydrological yield of the source. However, this can alter during dry periods when our river flows and groundwater sources are not replenished by rainfall. In some situations, the WAFU is restricted by the conditions of an abstraction licence. In the normal year (NYAA) planning scenario 31 of our 143 water treatment plants are restricted by the hydrological yield of the source. For the Dry Weather Planning Scenario (DYAA), the number of systems that are limited by the hydrological yield increases to 34. This increases further to 42 for the dry year critical period (DYCP). This is illustrated in Figure 3.10 which shows the number of sources that are limited by hydrological yield compared with sources that are limited by WTP (or distribution capacity) or abstraction licence constraints. During the winter critical period (when flows are high) the WAFU is constrained by the capacity of the water treatment plant. Further detail on the calculation of the baseline WAFU (current available supply) and forecast WAFU (reflecting reduced availability as a result of climate change and proposed changes to existing) can be found in Chapter 3 of our Framework Plan.

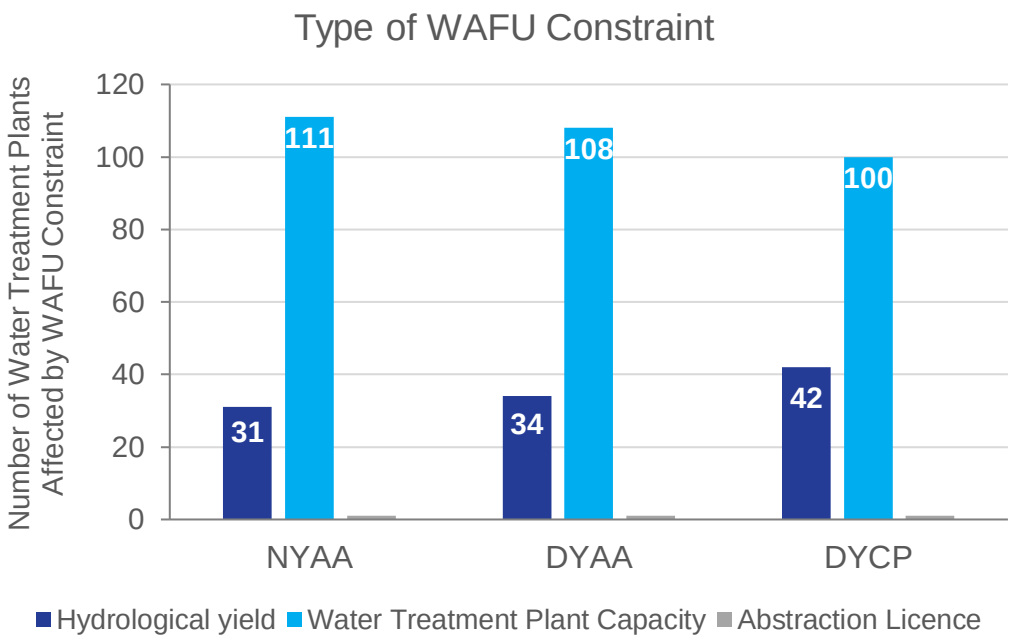

Figure 3.10 Limiting Factor of WAFU at our Water Treatment Plants

The change in estimated WAFU from the base year (2019) to the end of the planning period (2044) is summarised in Table 3.4 and shown in Figure 3.11.

Table 3.4 Change in WAFU, 2019 to 2044

Weather Planning Scenario	Estimated WAFU (Ml/d)		Estimated Change in WAFU (2019 to 2044)	
	2019	2044	Total (Ml/d)	%
NYAA	198.0	196.0	-2.0	-1.03%
DYAA	184.3	178.9	-5.4	-2.92
DYCP	193.2	187.8	-5.5	-2.82%
WCP	273.1	273.1	0.0	0%

= Increase in WAFU

= Decrease in WAFU

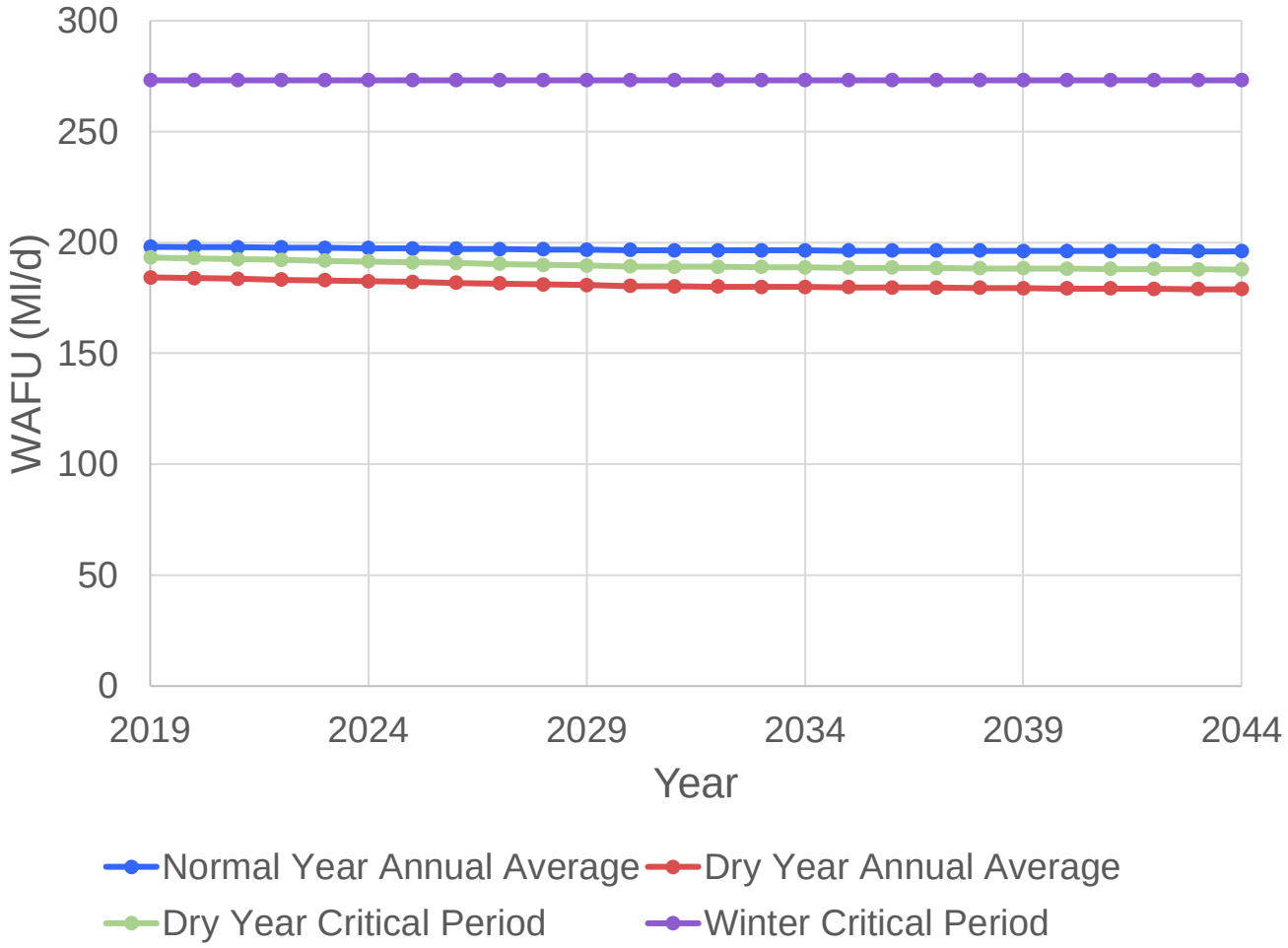

Figure 3.11 Regional Summary of WAFU, 2019 to 2044

Presently, for a normal year (NYAA) the maximum WAFU for the region is approximately **198 Ml/d.** (as shown in Figure 3.11). This will decrease by 2044 to **196 Ml/d** as a result of increasing demand and the impacts of climate change. Ongoing leakage management including active leakage control, pressure management and find and fix activities will increase WAFU during the current investment cycle negating some of the pressure associated with climate change and growth. Additionally, under our Leakage Reduction Programme we are investing in the public water network to meet target levels of leakage. Further details are provided in Section 4. As such there is a 1.03% decrease in WAFU over the 25-year planning period for the NYAA.

For a dry year (DYAA) the estimated maximum WAFU is estimated to be **184 Ml/d.** This reduces to an estimated **179 Ml/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.

For a drought period (DYCP) the estimated maximum WAFU is **193 Ml/d** reducing to an estimated **188 Ml/d** in 2044. Under drought conditions, water treatment plants are operated at a higher capacity to assist in meeting higher water demands due to increased outdoor usage, minimising the reduction in the WAFU.

3.2.4.1 Climate Change Impact

During the planning period for the NWRP, WAFU is forecast to reduce due to climate change. We have assumed a reduction of 12% by 2044 for river hydrological yields in a dry year and 4% for springs and surface water sources with storage, such as abstractions from loughs. For groundwater we have assumed a reduction of 1% over the planning period in line with projected changes in average precipitation, which drives groundwater recharge. Geological Survey Ireland (GSI) have embarked on a groundwater monitoring and modelling project that seeks to understand the impact of climate change on the groundwater resources in Ireland. It is envisaged that the findings of this project will inform and assist in iterative sustainable yield assessments and will help in the monitoring and understanding of operational data. The research will help us identify supplies which are potentially susceptible to reductions and enable Uisce Éireann to adapt our resource management[2].

Additional information on Uisce Éireann 's approach to considering the effects of future climate change is provided in Appendix F of our Framework Plan.

When improvements in the Level of Service (Reliability) have been accounted for, the overall regional reduction in WAFU due to climate change is estimated to be an additional **3 Ml/d and 4 Ml/d** under the DYAA and DYCP weather scenario respectively.

3.2.4.2 Sustainable Abstractions

As outlined at Section 3.7.2 of the Framework Plan, the Government is currently developing new legislation dealing with water abstractions. 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 Uisce Éireann currently abstract from its individual water sources. However, as this legislation is still being developed, Uisce Éireann do not have full visibility of the future regulatory regime and therefore cannot reliably include an estimation of sustainable abstraction within the SDB calculations. A more detailed site by site assessment will be required when the legislation is published in its final form.

Notwithstanding this, as discussed in Section 2 of this Plan, in the absence of legislative requirements, Uisce Éireann has proactively undertaken an independent conservative assessment of abstractions based on UKTAG standards to determine (i) the potential impact on our SDB and (ii) to identify possible alternative solutions to improve the sustainability of our abstractions. This assessment procedure is set out in Appendix C of the Framework Plan and is in line with a precautionary approach. Under the proposed regulatory regime, sustainable abstraction quantities will be adjudicated by the EPA, and therefore the assessment undertaken by Uisce Éireann is a conservative estimate only, the purpose of which is to help influence future planning.

Sustainable abstraction is dealt with in two ways as part of the NWRP:

- The desktop assessments for all new surface water and groundwater abstractions identified under the Preferred Approach for each Study Area (presented in Section 7) are developed based on conservative assessments to ensure that they are sustainable. These will be further assessed, including site level environmental assessments, should a Preferred Approach advance to project level.
- A Sensitivity Analysis is conducted for each WRZ, to allow us to stress test the sensitivity of the Preferred Approach against potential sustainability driven reductions to existing abstractions (again, taking a conservative and precautionary approach as to the level of reductions that may be required). This will ensure that our decision making is robust and the Preferred Approaches are adaptable and compatible with future potential regulatory regimes, in so far as this can be anticipated at this stage.

The SDB does not include the impacts of the pending abstraction regulations and reform. When implemented, this new legislation will have the potential to increase the Deficits by reducing the amount of water that we can abstract from some sources.

Under the proposed new Abstraction Legislation our available regional water supplies could reduce from an estimated 161 Ml/d to an estimated 114 Ml/d in a normal year, which represents a percentage decrease of 29%.

3.2.5 Current Demand

On average Uisce Éireann currently supply 161 Ml/d of water in a normal year (NYAA) to approximately 369,240 people in the South East Region. This represents the Distribution input which includes domestic and non-domestic consumption, operational use, apparent losses and leakage. In 2019 the public water supply served approximately 150,970 domestic and about 29,710 non-domestic properties in the region. A summary of Uisce Éireann 's customers and the volume supplied to meet domestic and non-domestic needs is provided in Table 3.5.

Table 3.5 Summary of Uisce Éireann's Demand in the South East Region

Item	Number in 2019
Total population served	369,240
Number of domestic properties served*	150,970
Number of non-domestic properties served*	29,714
Total quantity of water supplied	161 Ml/d (average)
Number of WRZs	111*

* Data derived from census data cross-referenced with Uisce Éireann demand and leakage management databases

Table 3.6 highlights how water is used across the varying sizes of WRZs in the South East Region. Out of 111 WRZs, 74 serve a population of less than 1000. In total these 74 WRZs account for just 5% of the population served by Uisce Éireann. In contrast, the largest WRZ, East Waterford Water Supply Scheme serves a population of 64,936 accounting for 18% of the total population served by Uisce Éireann and 17% of the total Demand. Medium WRZs, with a population of 5,000 to 25,000 account for the largest proportion of the population (57%) and 58% of the demand.

Table 3.6 Summary of Uisce Éireann's WRZ in the South East Region

WRZ category	Population served category	Number of WRZs in category	Population in 2019 (% of regional total)	Demand in 2019 (Ml/d) (% of total)
Very Large WRZ:	Over 100,000	0	0	0
Large WRZ:	25,000 to 100,000	2	East Waterford Supply Scheme 64,936 (18%)	East Waterford Supply Scheme 27,332 (17%)
			Kilkenny City 29,836 (8%)	Kilkenny City 10,224 (6%)
Medium WRZs	5,000 to 25,000	17	209,560 (57%)	94 (58%)
Small WRZs	1,000 to 5,000	18	47,858 (13%)	23 (14%)
Very Small WRZs	0 to 1,000	74	17,048 (5%)	7 (4%)

The main components of the demand for 2019 for the region are shown in Table 3.7 and Figure 3.12. These values were determined using data from our Leakage Management System (LMS) which draws together a range of live data including numbers of customers, metered customer usage and water put into supply.

Table 3.7 South East Regional Water Demand for 2019

Water balance component	Volume in 2019 (Ml/d)	% of total in 2019
Domestic consumption	52.1	32%
Non-domestic consumption	30.4	19%
Operational use	1.4	1%
Apparent Losses	0.7	0.4%
Leakage	76.2	47%
Distribution input (i.e. total water supplied)	160.8	100%

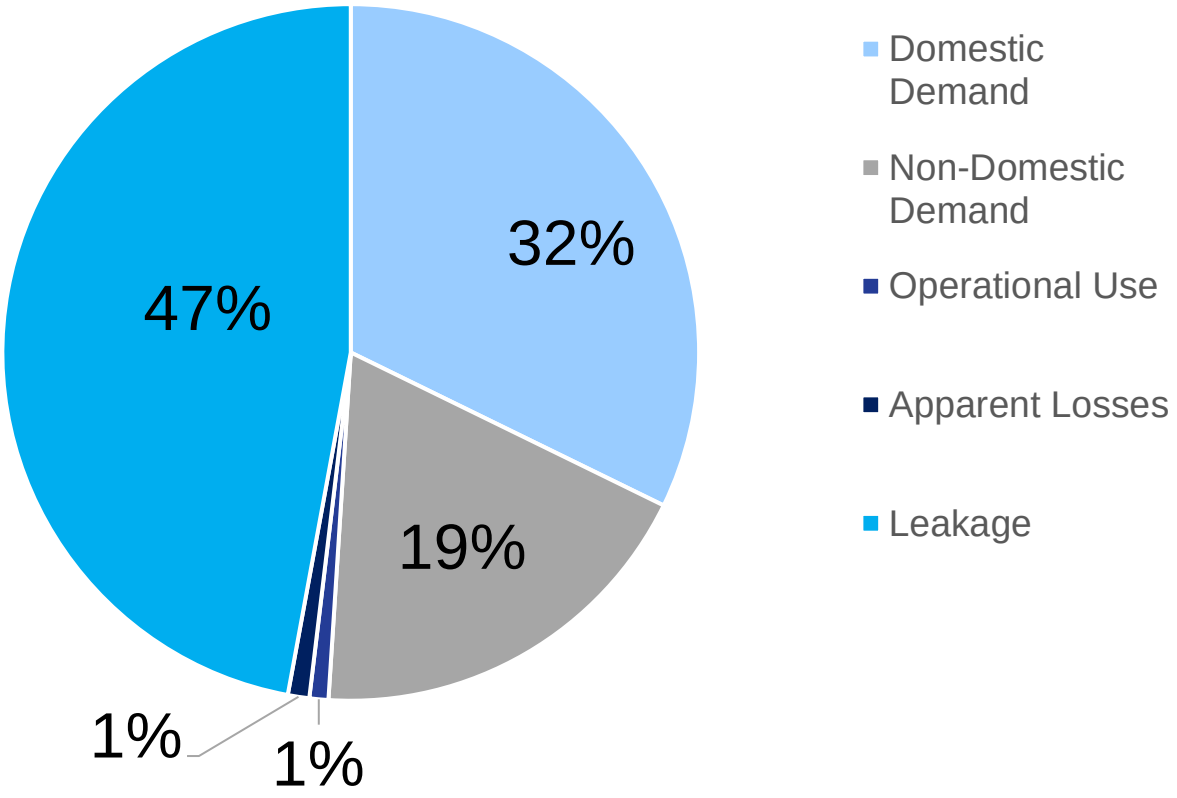

Figure 3.12 South East Region – Components of 2019 Demand

Leakage is currently estimated as the largest component of demand at 76.2 Ml/d. As explained in Chapter 4 of the Framework Plan, our reported leakage estimate to our economic regulator, the CRU, is reported as Distribution Network Leakage. However, due to the potential underestimation of Per Capita Consumption in non-metered households, which represent approximately 43% of properties, our Distribution Network Leakage may be overestimated, and in reality, is closer to a Total Leakage assessment.

Our approach to calculating the components of the Base Year Demand is describe in Chapter 4 of our Framework Plan.

Distribution Network Leakage is water losses across the public distribution network (excluding Customer Side Leakage (CSL)).

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).

3.2.6 Demand Forecast

Over the next 25-years:

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

The approach to calculating these components of the demand forecast is described in Chapter 4 of our Framework Plan and summarised in the following sections.

3.2.6.1 Population Growth

The estimated population in each WRZ is based on the 2016 Census data. The 2016 population is assigned to District Metering Areas (DMAs) by mapping the Central Statistics Office (CSO) data to DMA boundaries. Uisce Éireann is working with the CSO to map the 2022 Census population data to DMA boundaries. This updated data will be incorporated into our supply demand balance through the monitoring and feedback process outlined in section 8.3.8 of the Framework Plan.

As outlined in Section 4.3 of our Framework Plan, we have projected the 2016 population forward to 2019 to establish our base year populations. The growth projections were based on the draft National Planning Framework (NPF) and updated information from the Regional Spatial and Economic Strategies (RSES) and Local Authority Planning sections (where available). The growth projections from the NPF and RSES have also been used to forecast populations in each WRZ across our 25-year planning horizon. 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.

Target settlement populations have been informed by local, regional and national planning policy. As the City and County Development Plans are updated, Uisce Éireann will incorporate and take account of the growth rates set out in these Plans in our demand projection. Further details of the population forecasts are provided in Table 3.8.

Table 3.8 Population Growth Rate of Settlements in the South East Region based on Local, Regional and National Planning Policy

Settlement/type of settlement	Percentage population growth 2019 to 2044 (%)	Comment
Waterford city and suburbs**	52%	Growth from 55,209 2019 to 83,764 in 2044
East Waterford WRZ	46%	Growth from 69,294 in 2019 to 100,922 in 2044
Towns with population over 10,000 in 2016	On average 38%	Six settlements in the South East Region – Clonmel, Tramore, Kilkenny, Wexford, Enniscorthy, Dungarvan (includes the satellite town of Ballinroad).
Towns with population between 1,500 and 10,000 in 2016	On average 17%	19 settlements in the South East Region (excluding settlements connected to Waterford City)
Settlements with population <1,500 in 2016	On average 22%	15% growth assumed for all settlements with population <1,500

* The RSES growth rates were provided to 2040. We extended this rate of growth for the remaining four years of the Plan to determine the 2044 population.

** The population figure for Waterford City and surrounding area includes Waterford City as well as Kilmeaden, Tramore, Cheekpoint, Passage East and Dunmore East.

3.2.6.2 Domestic Demand Forecast

Domestic demand is calculated by multiplying the population forecast by the Per Capita Consumption (PCC). Factors that drive changes in the PCC can include occupancy rates and technology changes.

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, and so their uptake can off-set increases in consumption from lower occupancy rates.

Due to current data limitations in Ireland, data from the UK was used in our Framework Plan to assess potential changes to PCC for the period of the Framework 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 1 litre per person per day (l/p/d) by 2044, largely driven by reduced household occupancy rates.

On a conservative basis, for the purposes of the 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. Further details of our demand forecast and PCC assumptions are included in Chapter 4.2.2 of the Framework Plan.

The domestic consumption forecast is summarised in Table 3.9 for all areas served by Uisce Éireann in the RWRP-SE. The South East Region does not contain a 'Very Large' WRZ. There are two (2) Large WRZs in the South East Region, East Waterford Water Supply Scheme and Kilkenny City, which have been presented individually.

Table 3.9 Summary of Domestic Consumption Forecast by WRZ (Ml/d), NYAA

WRZ Size Category	2019	2024	2034	2044
Very Large WRZ	0	0	0	0
Large WRZ:				
– East Waterford Water Supply Scheme	10	11	13	14
– Kilkenny City	4	4	5	5
Medium WRZs	30	31	34	38
Small WRZs	7	7	7	8
Very Small WRZs	2	2	2	3
Total (111* WRZs)	52	55	61	67

*Note: Values may not sum exactly due to rounding

Based on forecast population growth it is estimated that domestic water demand will increase from 52 Ml/d (in 2019) to 67 Ml/d in 2044, for a normal year (NYAA). We are not allowing for any increase in PCC over the period of the Plan to account for uptake of water efficient appliances.

3.2.6.3 Non-Domestic Growth and Forecast Demand

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[3]. For other areas, it is assumed that there will be no significant increase in non-domestic demand, as shown in Table 3.10.

Table 3.10 Summary of Non-Domestic Consumption Forecast*

WRZ Size Category	2019	2024	2034	2044
Very Large WRZ	0	0	0	0
Large WRZ:				
– East Waterford Water Supply Scheme	4	4	4	5
– Kilkenny City	3	3	3	3
Medium WRZs	19	19	19	19
Small WRZs	4	4	4	4
Very Small WRZs	1	1	1	1
Total (111 WRZs)**	30	30	31	31

*Uisce Éireann is committed to the continuous improvement of data sets used within the SBD. These figures are based on the most recently available data.

**Note: Values may not sum exactly due to rounding

We have estimated the non-domestic water use for 2019 to be 30 Ml/d across the South East Region. This is projected to increase to 31 Ml/d by 2044.

We have considered the following data to derive an appropriate non-domestic demand forecast for Cork City:

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

We have taken an informed view that the significant expected increase in population for Waterford City and suburbs of 52% will also drive an increase in non-domestic demand. However, non-domestic growth trends are likely to be lower than the growth in domestic demand, as our non-domestic customers are incentivised to use less water through volumetric tariffs. For this reason, an estimated 10% growth in non-domestic demand is assumed for Waterford City over the 25-year planning period.

Rest of the South East Region

As in other jurisdictions, we have concluded that there will be no increase in non-domestic demand as the growth in non-domestic demand, outside of Regional Growth Cities, is assumed to be offset by water efficiency. However, Uisce Éireann continually assesses the potential for non-domestic activity through our interface with the Local Authority Planning Sections and the Connection Developer Services Function in Uisce Éireann. 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[4]), 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 of the Framework Plan, monitoring and feedback into the NWRP.

3.2.6.4 Operational Use

Operational use includes water used by Uisce Éireann 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.

3.2.6.5 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. However during our Framework Plan consultation period it was raised by a number of our Local Authority Water Services partners that this figure could be a gross underestimate of apparent losses. As we progress optimisation of our District Metered Area's we will refine data in relation to this.

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

3.2.6.6 Leakage

Uisce Éireann will take a three-step process to reduce leakage both nationally and within the South East Region. In summary this includes:

Step 1: Reaching Sustainable Economic Level of Leakage (SELL) by 2034 - The SELL concept is built on the principle that 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. SELL targets are presented and discussed further in Section 5.

Step 2: Go Beyond SELL - Uisce Éireann have set additional leakage targets with the objective of reducing leakage levels to 21% of total demand for larger WRZs (WRZs where demand is greater than 1,500 m^3/d)

Step 3: Appropriate Leakage Level (ALL) (Post 2034) – setting of further leakage reduction targets based on WRZ level and site-specific assessments which will require data which is not yet available to Uisce Éireann.

Further details of the targets and this process can be found in Section 5. Details of the SELL assessment process can be found in Appendix H of the Framework Plan. The SELL targets for the Eastern and Midlands Region, South West Region and North West Region have been summarised in Section 5 and are presented in the RWRP-EM, RWRP-SW and RWRP-NW.

The SELL target for the South East Region is 17 Ml/d. Of the 17 Ml/d of planned leakage reductions, 0.91 Ml/d have been incorporated into the SDB. Leakage reductions are applied to the SDB by reducing the Demand component of the calculation. For this reason, the future estimated Deficit will reduce as a lower Demand is subtracted from the available supply. It is acknowledged that if these leakage targets are not met then the solution (Preferred Approach) (Section 6-8) to the supply Deficit will not fully meet the Demand. For this reason, we are working to meet these targets now, in advance of the solution (Preferred Approach) reaching project stage.

The remaining 16.1 Ml/d of leakage reductions (required to achieve 17 Ml/d of SELL leakage reductions within the South East Region) are not incorporated into the SDB. Further leakage targets (Go Beyond SELL and ALL) have also not been incorporated into the SDB. Where leakage reductions have not been applied to the SDB any leakage reduction achieved will result in a reduction to the expected future Demand. In this scenario the solution (Preferred Approach) to the supply Deficit within each WRZ, Study Area or the Region may be capable of providing more water than is needed. In this scenario, this will enable us to modify the solution to reduce the quantity of water required to be delivered or if it coincides with greater than expected growth it will open up available water for this increased Demand.

3.2.6.7 Total Demand

Figure 3.13 and Table 3.11 show the Total Demand for water from our regional supply networks. Presently, in a Normal Year (NYAA), the Total Demand is 184 Ml/d and in an average Dry Year (DYAA) is 221 Ml/d.

Our requirements for water in a drought or severe winter period can increase the Total Demand by between 20% and 38%. For the DYCP (drought), the current Total Demand is 500 Ml/d. The Total Demand is higher still for the WCP at 561 Ml/d, due to the increase in pipe bursts resulting from freeze-thaw conditions.

Total Demand is forecast to increase by about 8.4% for all Weather Planning Scenarios despite the estimated overall regional population increase of 28%.

This comparatively small increase in Total Demand is attributed to the ambitious leakage reduction targets we have set ourselves.

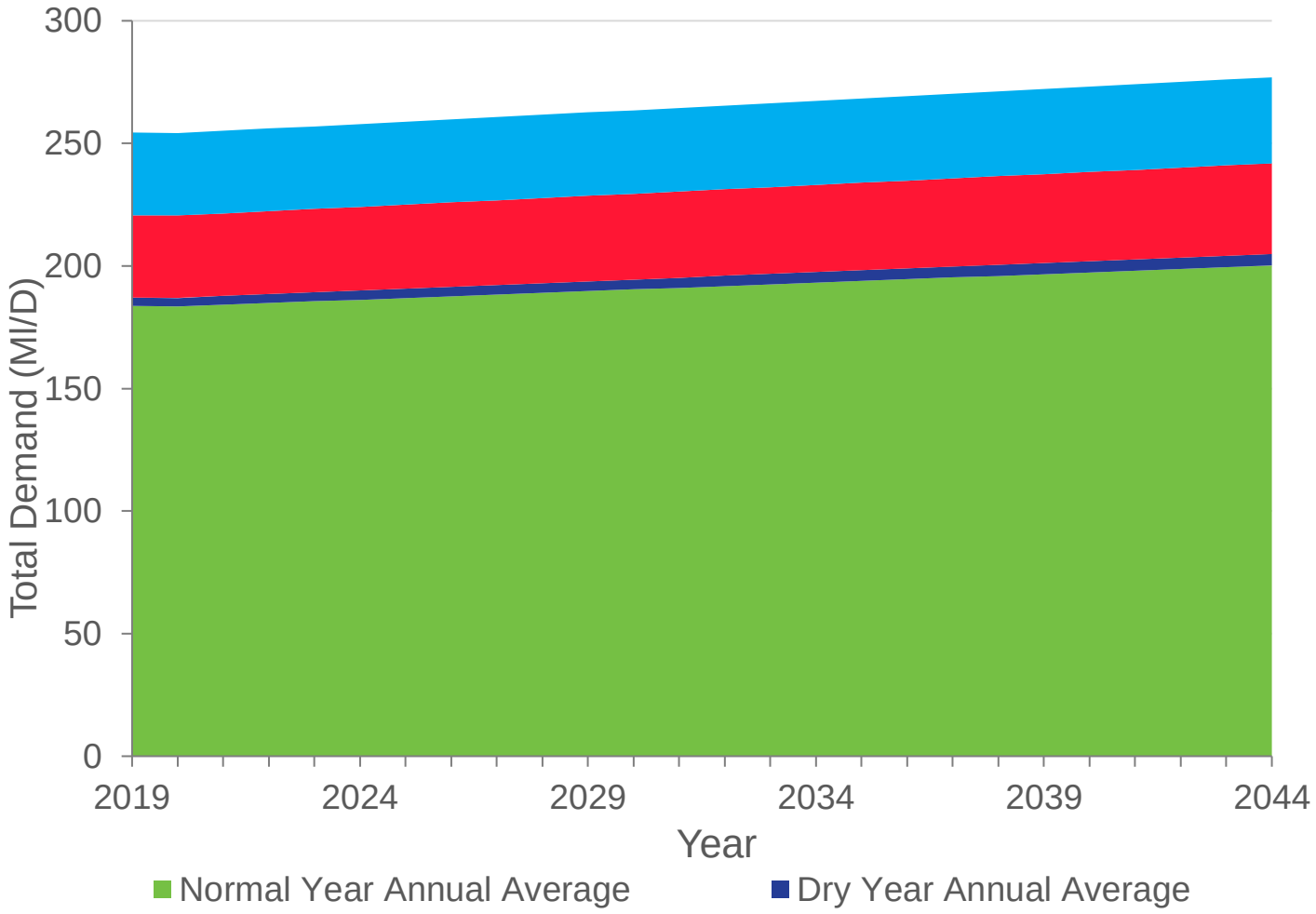

Figure 3.13 Regional Summary of Total Demand, 2019 to 2044

Table 3.11 Regional Summary of Total Demand

Weather Planning Scenario	Total Demand (Ml/d)		Change	
	2019	2044	Total (Ml/d)	(%)
NYAA	184	200	16	8.2%
DYAA	187	205	18	8.7%
DYCP	221	242	21	8.7%
WCP	254	277	23	8.1%

= Reduced Demand

= Increased Demand

3.2.7 Supply and Demand Balance

We combine our 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.

The South East Region has 111 WRZs, Supply Demand Balance (SDB) calculations have been developed for 111 WRZs in the RWRP-SE. The calculations cover the 25-year planning period from 2019 to 2044. The SDB calculations for each WRZ in the South East Region are included in Appendix L.

As explained in Section 3.2.3, potential reductions in our allowable abstractions may be required to meet environmental standards outlined in the Water Framework Directive. These reductions are not currently included in the calculation of the SDB; however, we have assessed the potential impact of the impending Abstraction Legislation in a Sensitivity Analysis of our Preferred Approaches. This is explained in more detail in Section 3.5 below.

For the purposes of the regional summary, we have presented this information as:

- The regional net Surplus or Deficit across the 111 WRZs for each Weather Planning Scenario; and
- The number of WRZs that would be in Deficit (i.e., where there would be a risk of supply disruption to our customers) compared with the number of WRZs in Surplus.

Net Surplus & Deficit

Figure 3.14 and Table 3.12 show the regional summary of the forecast net Surplus or Deficit across our Weather Planning Scenarios for 2019 and 2044. This volume is calculated by subtracting the Total Deficit from the Total Surplus volume across the WRZs.

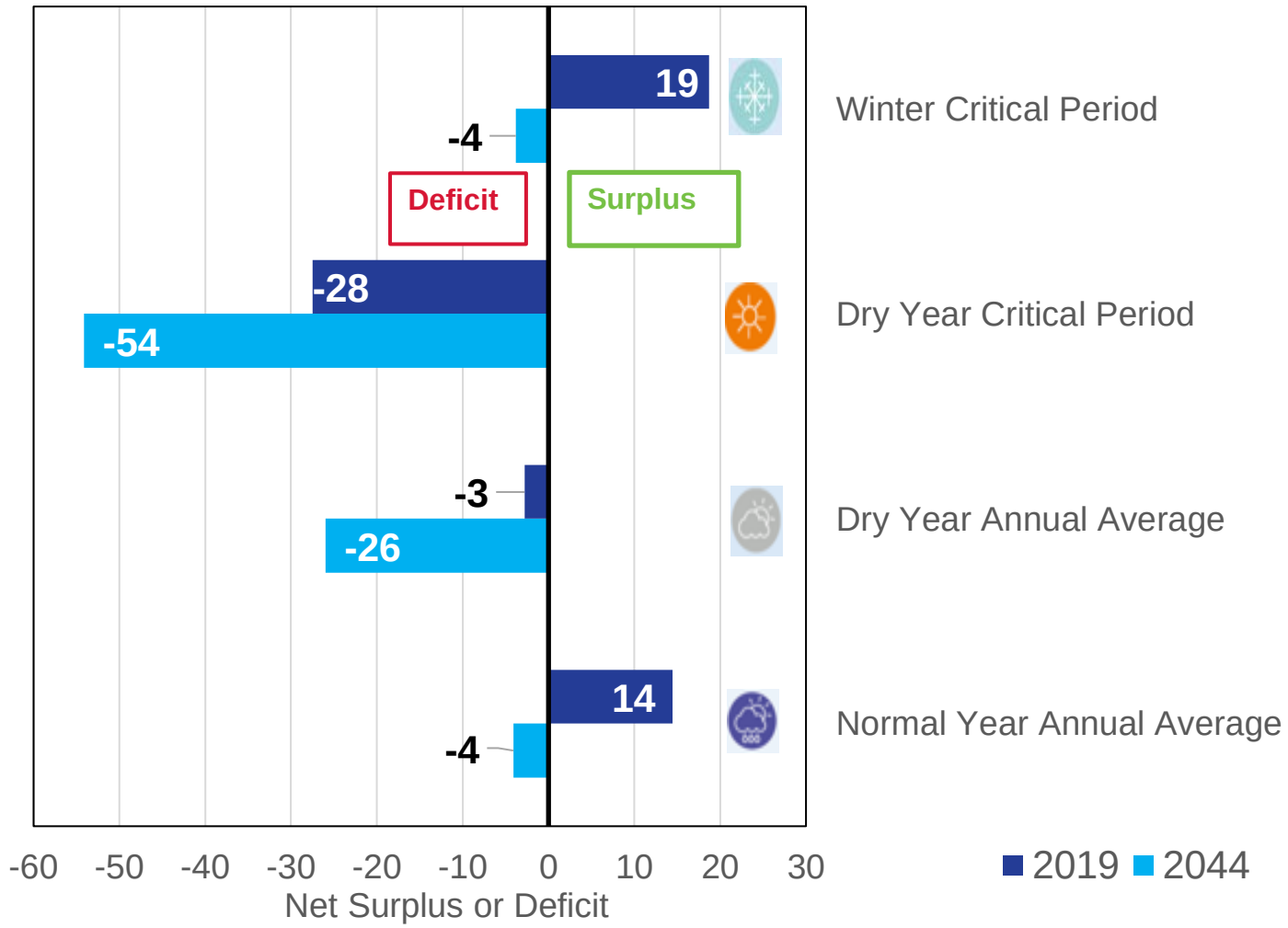

Figure 3.14 Regional Summary of the SDB for 2019 to 2044

At present, there are Deficits (i.e., Total Demand exceeds the WAFU) for the DYAA and DYCP Weather Event Planning Scenarios. The largest current net Deficit in the SDB (2019) is for the DYCP, with a net Deficit across the RWRP-SE estimated to be 28 Ml/d. The largest Deficit occurs under the DYCP scenario because raw water sources are impacted during the extreme warm periods such as drought which typically coincides with increases in Demand. At present these Deficits do not regularly translate to outages to our customers due to our responses, including emergency pressure reduction and management of supplies. During a normal year there is a net surplus of 14 Ml/d whilst there is a net surplus of 19 Ml/d in the WCP. By 2044 there are deficits for all Weather Event Planning Scenarios.

Table 3.12 Regional SDB Estimated Net Deficit Change from 2019 to 2044*

Weather Planning Scenario	Estimated Net SDB Deficit (Ml/d)		Estimated Change	
	2019	2044	Total (Ml/d)	(%)
NYAA	14	-4	-19 ↑	129% ↑
DYAA	-3	-26	-23 ↑	825% ↑
DYCP	-28	-54	-27 ↑	97% ↑
WCP	19	-4	-23 ↑	120% ↑

↑ = Increased Deficit

* The regional deficit is not equal to the total WAFU – Demand as this would assume all WRZs are interconnected. The regional deficit is the sum of all the individual deficits per WRZ.

The net Deficit regionally for the WCP is estimated to be 19 Ml/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 treatment plants and distribution networks to cater for the increased Demand driven by water main bursts and increased leakage resulting from the impact of freeze-thaw conditions on the water supply infrastructure.

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.

Figure 3.15 shows the Total Deficit and Surplus across the South East Region for each of the planning scenarios. Figures 3.16 to 3.19 show the number of Water Resources Zones which are currently in Surplus or Deficit across our four (4) Weather Event Planning Scenarios.

In a normal year (NYAA) there are 63 WRZs in deficit, with an estimated Total Deficit of 27 Ml/d. The 48 remaining WRZs are in surplus, with an estimated Total Surplus of 42 Ml/d. Between 2019 and 2044, in all planning scenarios the Deficit increases and the Surplus decreases.

In developing the Preferred Approach there may be an opportunity to interconnect WRZs in Deficit to WRZs which have Surplus water available. The Preferred Approach considers the applicability of these connections whilst also considering alternative solutions such as upgrading existing abstractions and or the development of new abstractions.

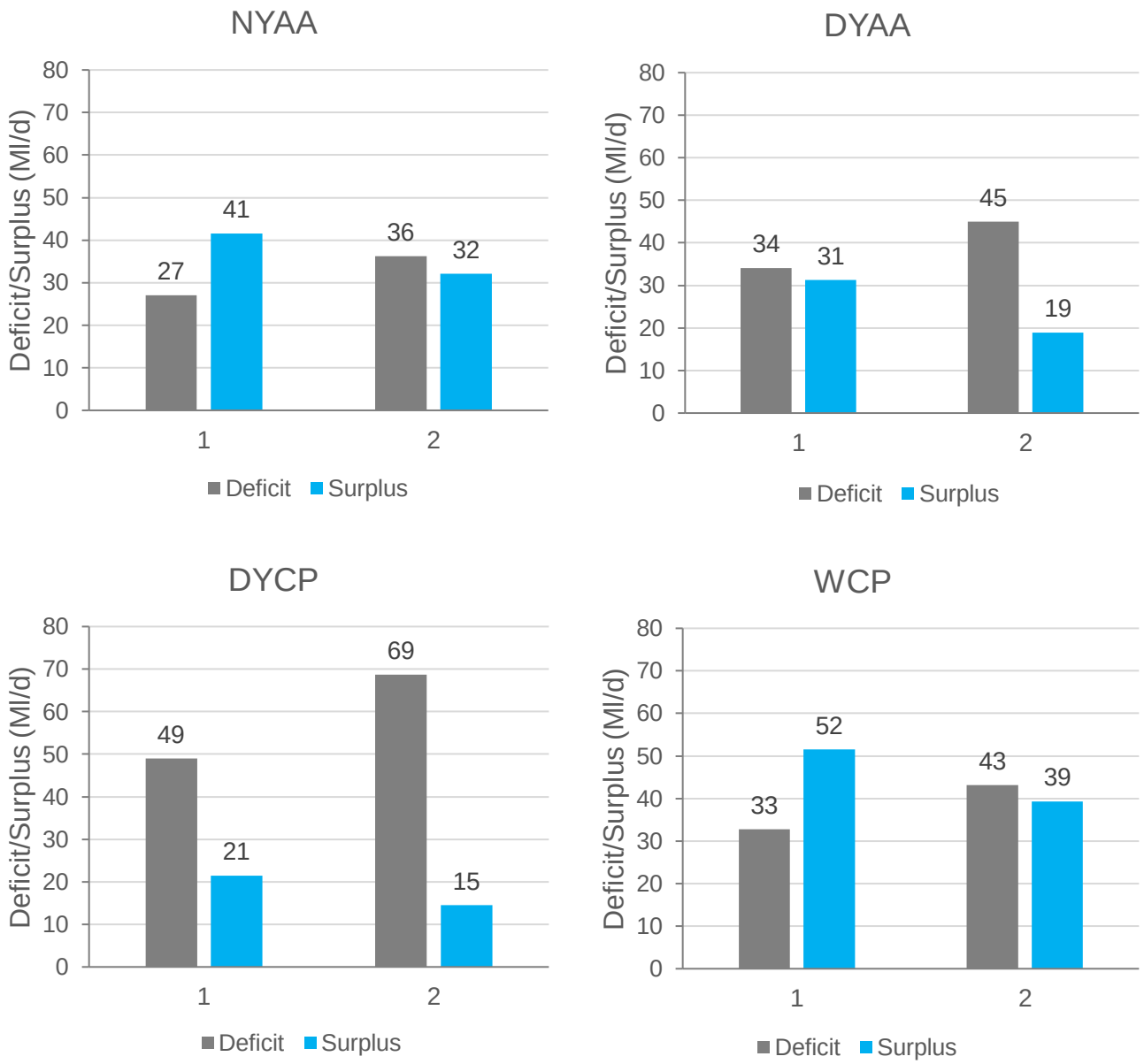

Figure 3.15 Total Estimated Deficit and Surplus across the South East Region

WRZ Impacts

Figures 3.16 to 3.19 show the number of Water Resource Zones which are currently in Surplus or Deficit across our four (4) Weather Event Planning Scenarios. These figures show:

- During the Normal Year Annual Average Planning Scenario, 63 (57%) of our WRZs, supplying approximately 193,261 customers, are in Deficit whilst 48 (43%) are in Surplus;
- During the Dry Year Annual Average Planning Scenario, 63 (57%) of our WRZs, supplying approximately 193,261 customers, are in Deficit whilst 48 (43%) are in Surplus;
- During the Dry Year Critical Period Planning Scenario, 71 (64%) of our WRZs, supplying approximately 211,997 customers, are in Deficit whilst 40 (36%) are in Surplus; and
- During the Winter Critical Period Planning Scenario, 63 (57%) of our WRZs, supplying approximately 159,842 customers, are in Deficit whilst 48 (43%) are in Surplus.

When a WRZ is in Deficit customers may receive a lower LoS due to a less resilient supply. For example, during a period of Deficit customers may experience lower water pressures.

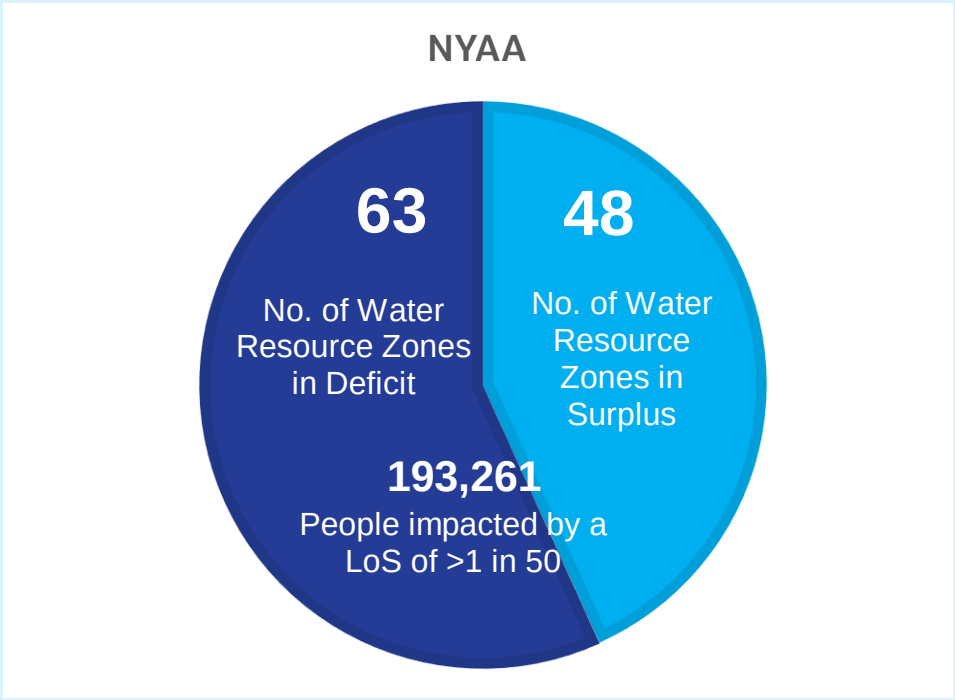

Figure 3.16 Number of WRZs in Surplus or Deficit in 2019 for the NYAA Planning Scenario

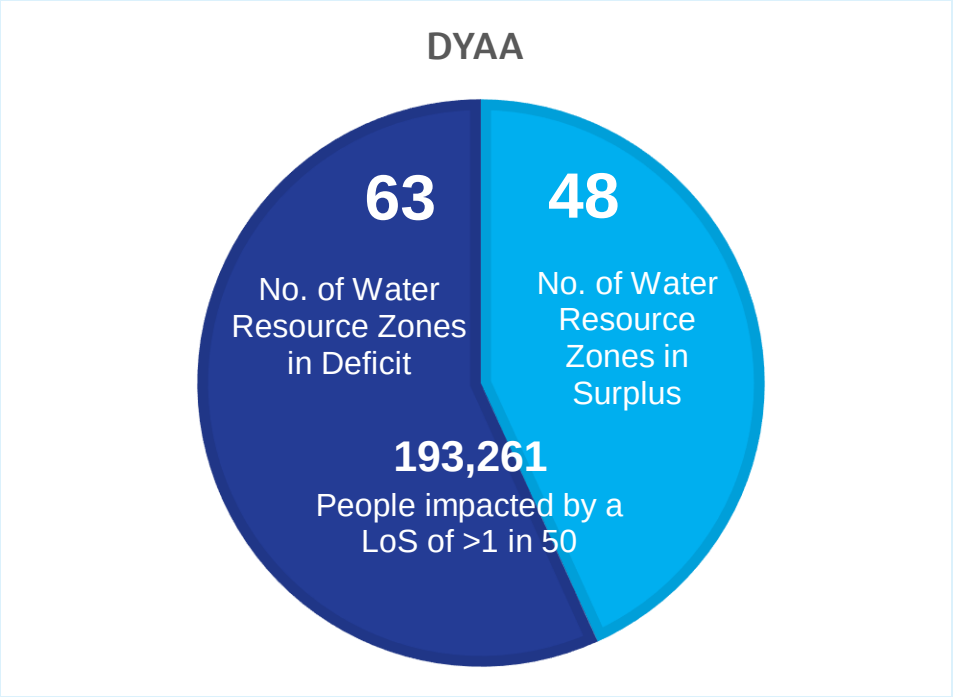

Figure 3.17 Number of WRZs in Surplus or Deficit in 2019 for the DYAA Planning Scenario

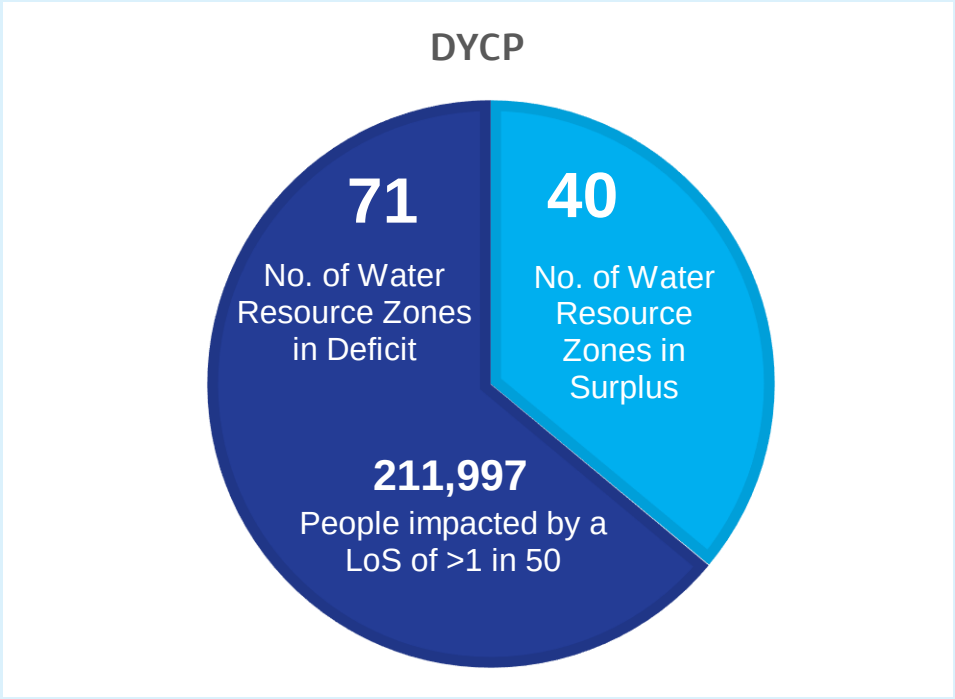

Figure 3.18 Number of WRZs in Surplus or Deficit in 2019 for the DYCP Planning Scenario

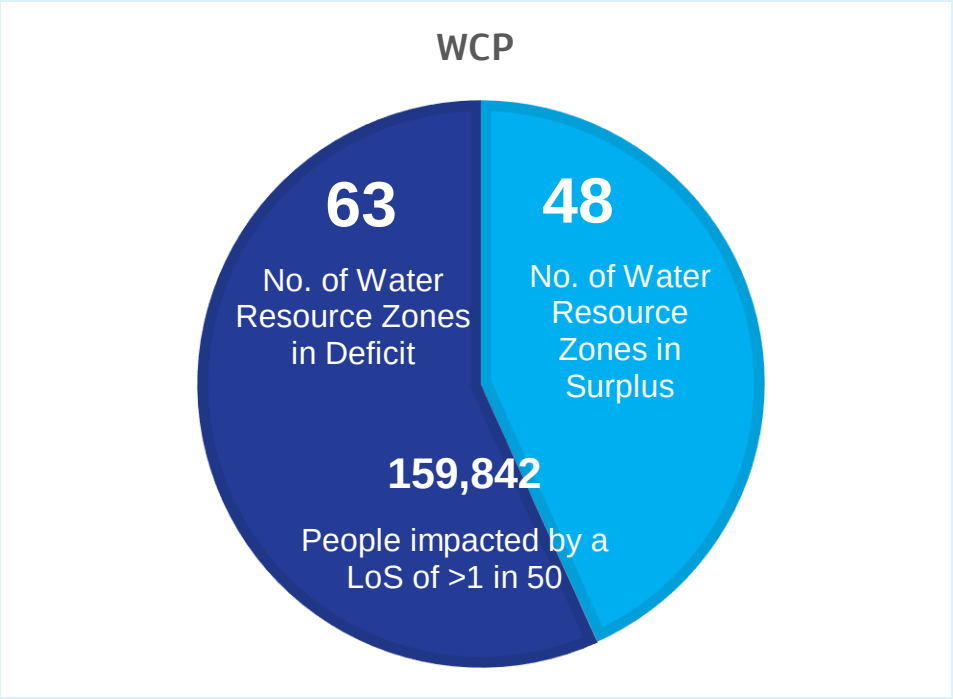

Figure 3.19 Number of WRZs in Surplus or Deficit in 2019 for the WCP Planning Scenario

Based on this analysis, it is clear that our baseline position is challenging, and that some of our supplies currently experience significant SDB Deficits, particularly during dry periods which leads to customers experiencing a lower LoS due to a less resilient supply. For example, during a period of Deficit customers may experience lower water pressures. The current position reflects the condition and performance of our existing asset base particularly in relation to WAFU constraints.

Figure 3.20 and Table 3.13 show that between 2019 and 2044 there will be an increase in the number of WRZs in Deficit.

However, despite the projected 28% increase in growth and the climate change impact, the number of WRZs in Deficit across the South East Region is only forecast to increase by 5 under the NYAA weather scenario and 7 in the DYAA weather scenario by 2044 representing an increase of 8 and 11% respectively. Our existing leakage reduction program, taking place over the next five years is helping to address current Deficits buffering against population growth and climate change.

The Deficits at a WRZ Level are presented in the Study Area Technical Reports (Appendix 1 - 3).

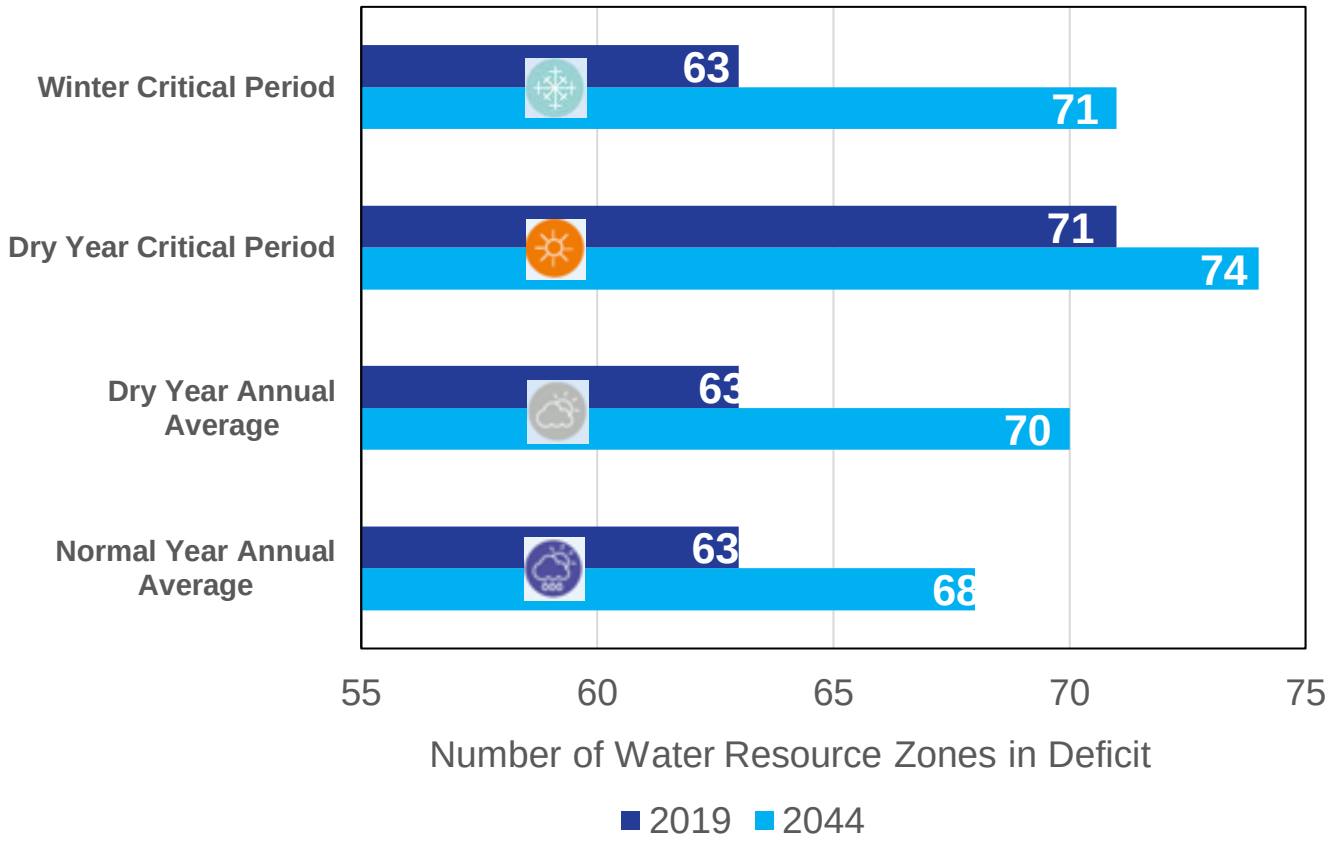

Figure 3.20 Number of WRZs in Deficit, 2019 to 2044

Table 3.13 Number of WRZs in Deficit and Change from 2019 to 2044

Weather Planning Scenario	Number of WRZs in Deficit		Change from 2019 to 2044	
	2019	2044	Count	(%)
NYAA	63	68	5	7.9%
DYAA	63	70	7	11.1%
DYCP	71	74	3	4.2%
WCP	63	71	8	12.7%

Study Area Water Quantity Needs

The Needs assessments completed for each Study Area are presented in the Study Area Technical Reports as Appendices 1 - 3.

The Deficits in 2019 and 2044 across the Study Areas for the DYCP are shown spatially in Figures 3.21 and Figure 3.22, respectively. This shows significant existing Deficits for Galtee Regional, Ardfinnan Regional and Clonmel and Environs in SAK. The largest deficit in SAL is seen in Bennetsbridge and Kilmaganny at 1 Ml/d whilst the largest deficit in SAM is seen in Wexford town at 4.4 Ml/d. By 2044 the largest deficit change is observed in the East Waterford Water Supply Scheme (SAK) where the WRZ moves from a surplus of 2.1 Ml/d in 2019 to a deficit of 7.5 Ml/d in 2044. Wexford Town (SAM), Clonmel and Environs (SAK), Kilkenny City (SAL) and South Kilkenny (SAK) all see a deficit increase of 1.2 to 2.3 Ml/d by 2044.

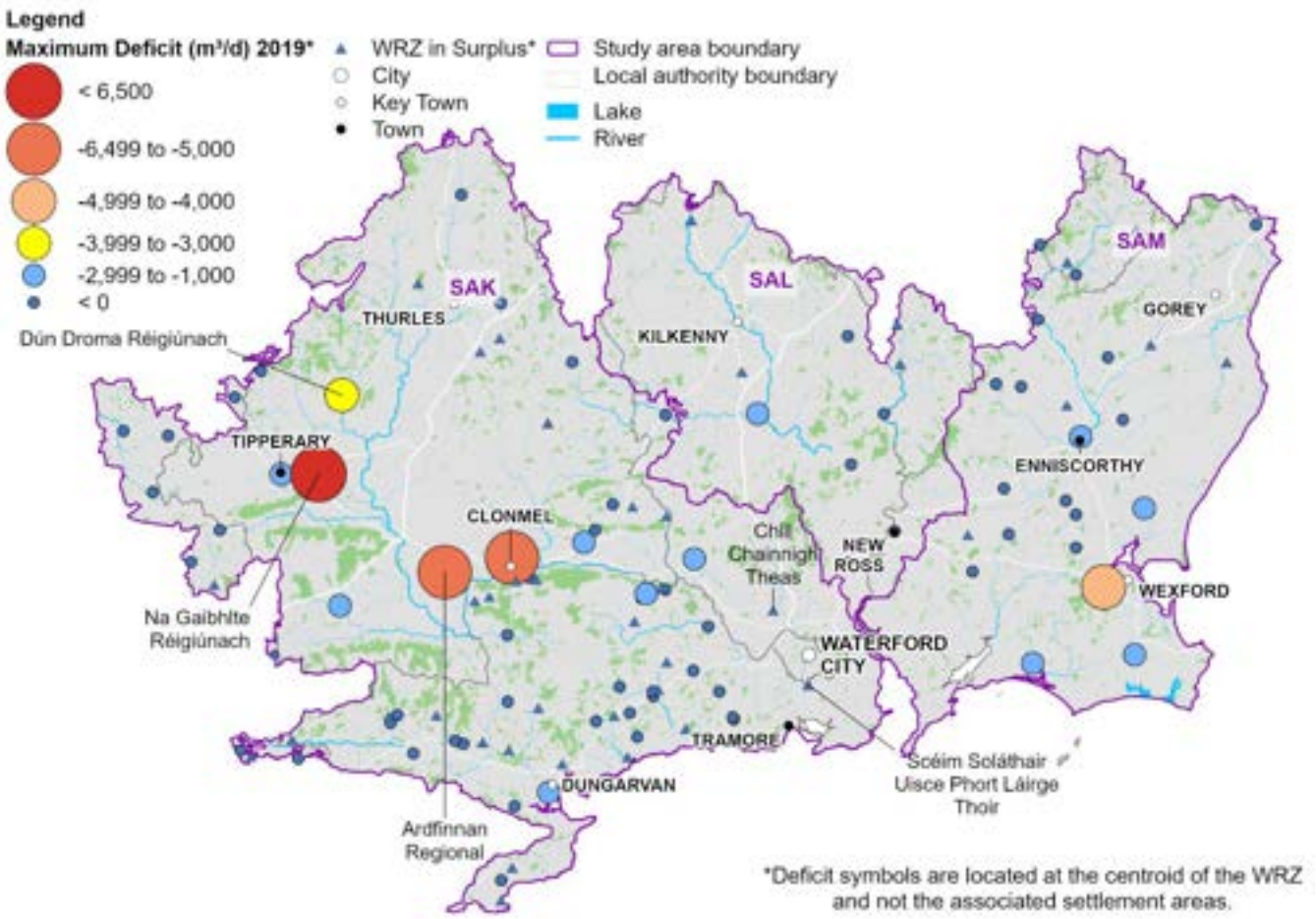

Figure 3.21 Deficit in 2019 across the South East Region (DYCP)

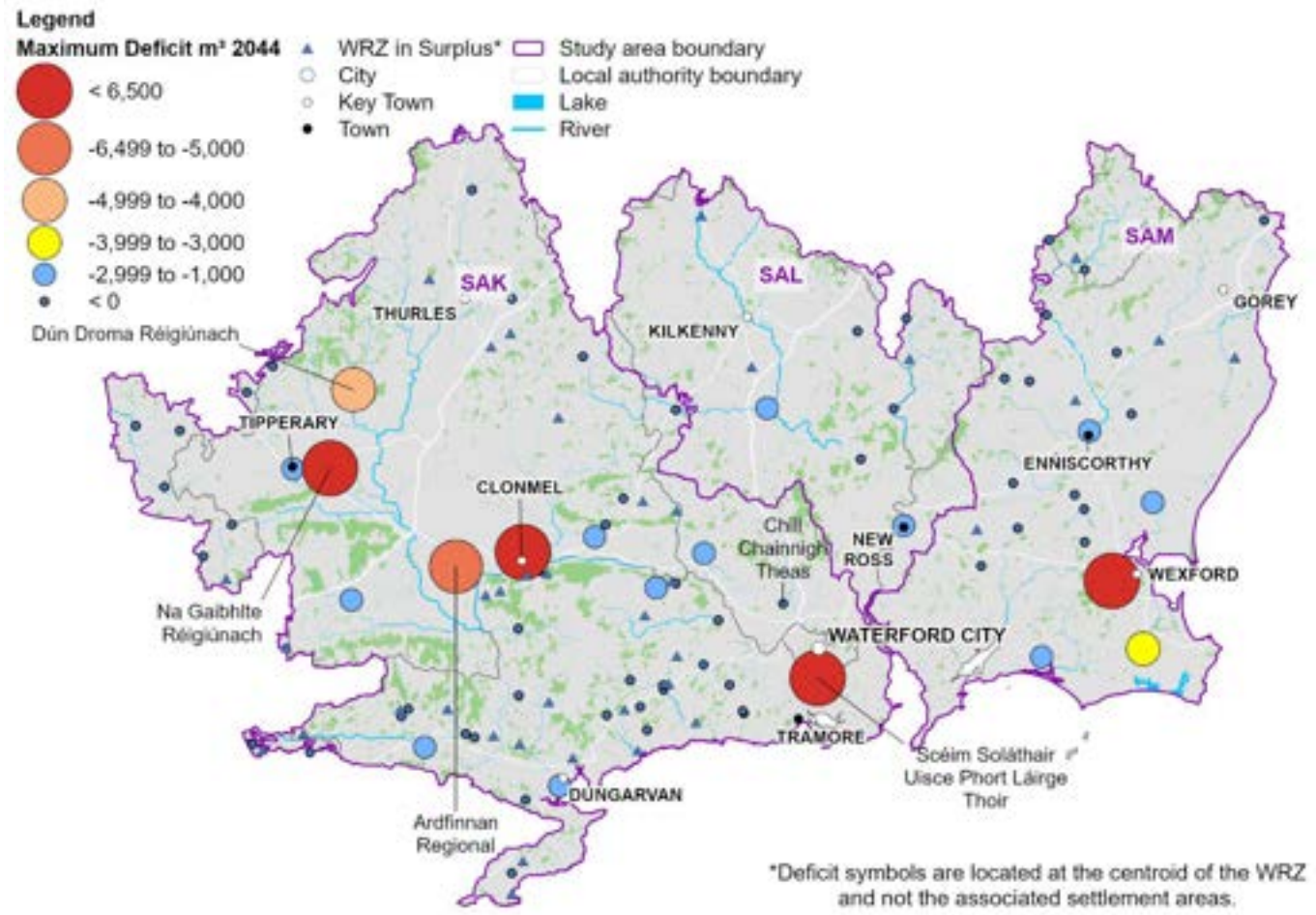

Figure 3.22 Deficit in 2044 across the South East Region (DYCP)

3.2.8 Summary

Key findings from our SDB calculations are as follows:

- 57% of our WRZs are in Deficit at present and do not provide adequate Reliability to our customers in normal conditions based on the 1 in 50 Level of Service that we have adopted for our NWRP.
- The WAFU from our existing supplies is not sufficient to balance the current Demand for water in a DYAA and DYCP. The highest estimated net Deficit occurs for the Dry Year Critical Period at 28 Ml/day. The Deficit for the DYAA is estimated to be 3 Ml/d for the Winter Critical Period. During the NYAA and the WCP there is a net surplus of 14 Ml/d and 19 Ml/d respectively. By 2044 there are net Deficits across all Weather Event Planning Scenarios.
- Total Demand is forecast to increase by about 8.4% for all Weather Planning Scenarios despite the estimated overall regional population increase of 28%. This comparatively small increase in Total Demand is attributed to the ambitious leakage reduction targets we have set ourselves; and
- By 2044, the net Deficit across the South East Region is forecast to increase by 23 Ml/d for the Dry Year Annual Average and 27 Ml/d fo the Dry Year Critical Period. By 2044 there are net deficits (rather than surpluses) under the Normal Year Annual Average and Winter Critical Period.
- The increase in Deficit is driven by population growth, and climate change.

- We have assessed the potential impact of impending Abstraction Legislation, which may reduce our allowable abstractions to meet environmental standards outlined in the WFD. The legislative changes could increase the SDB Deficit by an estimated 47 Ml/day under a Dry Year Critical Period scenario. We have completed a Sensitivity Analysis of our Preferred Approaches against the potential abstraction reductions to ensure they are robust and adaptable.

The key components of Deficit are represented in Figure 3.23 for the Dry Year Critical Period, the scenario with the largest Deficit due to the impact of extreme warm periods such as drought on our raw water sources.

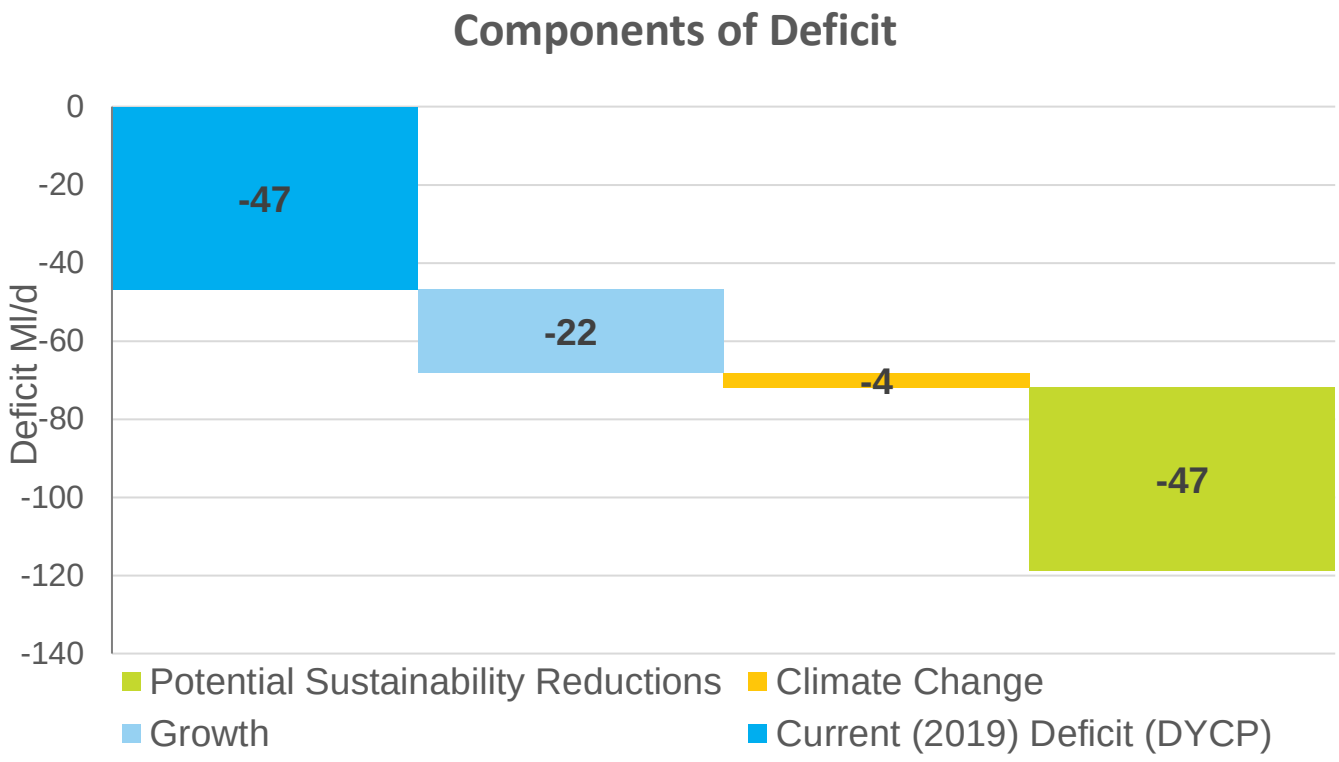

Figure 3.23 Pressures on Our Water Supply (DYCP)

3.3 Water Quality

This section summarises the current water Quality status of our supplies with respect to the Interim Barrier Assessment and risk-based Drinking Water Safety Plan (DWSP) approach.

Our Drinking Water Safety Plan (DWSP), described in Chapter 5 of our Framework Plan, will assess the risk that hazardous events could occur in our drinking water supply from source (catchment) to tap (consumer). This assessment informs the 'Need' for operational, maintenance or capital interventions to ensure a safe and reliable supply.

The methodologies for the DWSP approach are being developed following guidance of:

- World Health Organisation's Guidelines for Drinking Water Quality (2004).
- Water Safety Plan Manual (2009).
- Environmental Protection Agency's (EPA's) Drinking Water Advice Note No 8.
- Department of the Environment and Local Government, Environmental Protection Agency and Geological Survey of Ireland (GSI), 1999.

Furthermore, the measures and contaminants identified in the Recast Drinking Water Directive[5] (DWD) are being integrated into the development of DWSP methodologies. The overarching objective of the recast DWD is to ensure a high level of protection of the environment and of human health from the adverse effects of contaminated drinking water. Under the recast DWD, quality standards for water intended for human consumption have been updated, and minimum hygiene requirements for materials in contact with drinking water (e.g., pipes, taps) have been introduced.

The water resource zones in the South East Region are supplied with water from 143 water treatment plants, as shown in Figure 3.24.

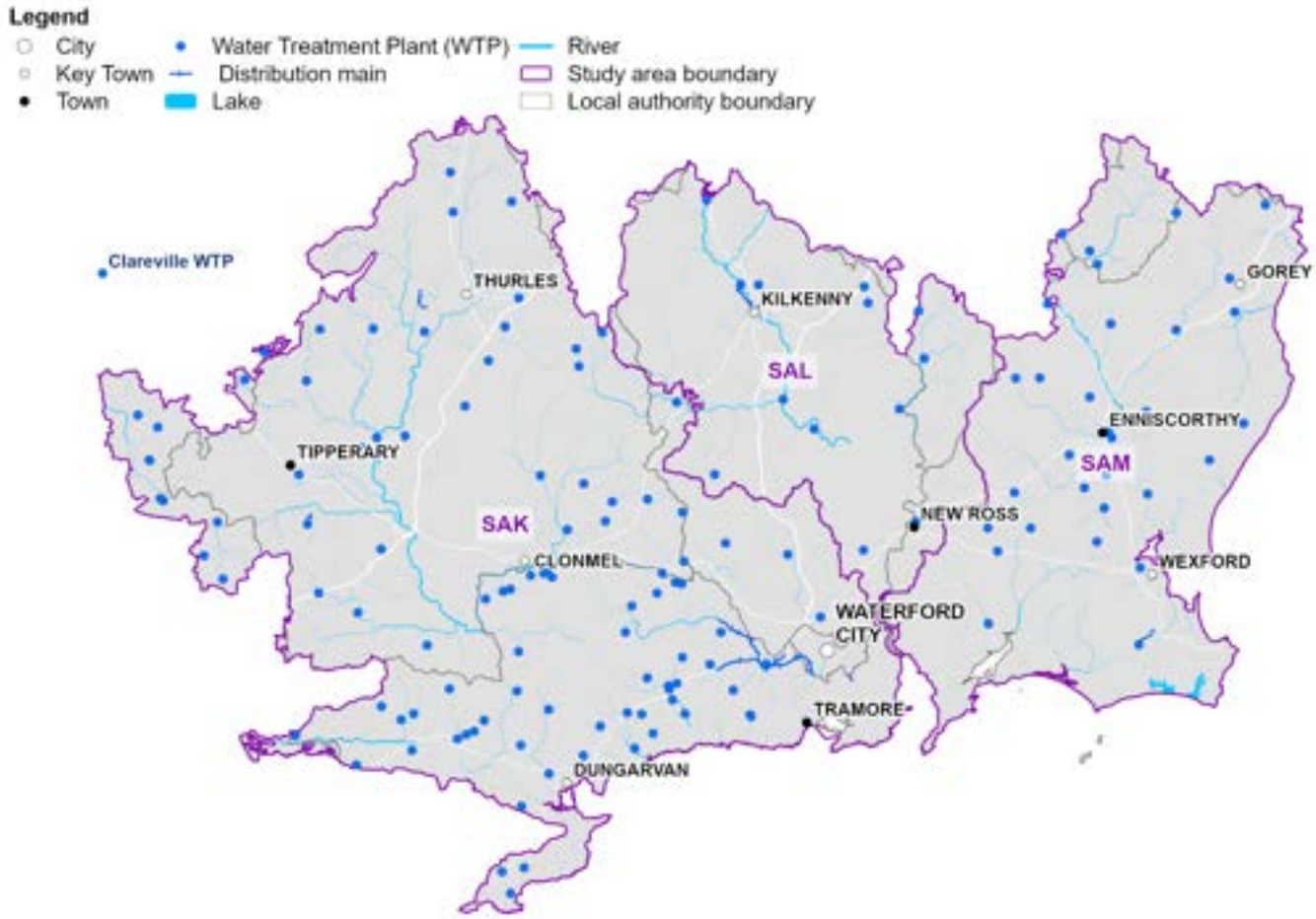

Figure 3.24 WTPs in the South East Region

The water treatment plants vary in size from 1 to 53,200 m^3/d (22-hour capacity), and by type of treatment process. The number of water treatment plants of each process type is outlined in Table 3.14.

Table 3.14 Types of Water Treatment Processes

Water Treatment Process	Number
Simple Disinfection	111
Filtration	10
CFC	22

3.3.1 Water Quality Compliance

Uisce Éireann monitors all public water supplies in accordance with the requirements of the European Drinking Water Regulations[6] and the Drinking Water Directive and the results of these tests are reported to the EPA (Uisce Éireann 's environmental regulator). Uisce Éireann publishes the results from the regulatory monitoring programme on its website at www.water.ie/waterquality. If a drinking water sample shows a result above a specified water quality standard, Uisce Éireann reports it immediately (where applicable) to the EPA.

The EPA, as the regulator, supervises the investigation Uisce Éireann 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 **RAL** is a register of public water supplies that are in need of corrective action, usually at a water treatment plant. The EPA requires Uisce Éireann to complete an action programme for each supply on the list. The list is updated every 3 months.

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

Box 3.2 includes an excerpt from the EPA's latest published Drinking Water Quality in Public Supplies 2022 Report, setting out the current status of our supplies with respect to compliance with Microbiological, Chemical and Indicator parameters in the Regulations.

Box 3.2 Water Quality in 2021

Water Quality across each of the three (3) parameter categories has shown good compliance since Uisce Éireann became responsible for public water supplies in 2014.

Overall percentage compliance of samples taken for public water supplies

Parameter Categories	2014	2015	2016	2017	2018	2019	2020	2021	2022
Microbiological (%)	99.9	99.9	99.9	99.9	99.9	99.9	100.0	100.0	100.0
Chemical (%)	99.4	99.4	99.5	99.6	99.6	99.6	99.7	99.6	99.6
Indicator (%)	99.3	99.1	99.8	98.9	98.8	99.1	99.0	99.2	99.1

As can be seen in Box 3.2, in general our supplies show good compliance with the Regulations, and most compliance trends have improved over time.

Despite improvements which have already been made, Table 3.15 shows that all the Study Areas have WTPs which are on the EPA RAL. Water Treatment Plants on the EPA remedial action list (RAL) present water quality issues related to the risk of THM formation, the presence of *Cryptosporidium* as a result of defective disinfection systems (see Box 4.1) the presence of aluminium and turbidity issues. Uisce Éireann are currently progressing corrective action for the WTPs listed on the RAL list in order to make progress against Ireland's United Nations (UN) Sustainable Development Goal 6 which aims to provide access to safe drinking water for all.

Table 3.15 Number of WTPs on the EPA Remedial Action List (RAL) or subject to EPA Direction

Study Area	Study Area Name	Number of WTPs on Remedial Action List (RAL)
SAK	Waterford and South Tipperary	9
SAL	Kilkenny	1
SAM	Wexford and Wicklow	3

3.3.2 Barrier Assessment – DWSP Approach

An Interim Barrier Assessment was undertaken as part of the development of our Framework Plan to identify "Water Quality and Reliability" need for the RWRPs. The assessment evaluates the risk against our existing controls (Barriers) which we have in place for either source protection or within our water treatment plants and networks. The interim approach is required while we progress in the development of DWSPs for all of our supplies. This is expected to take place over several years given the approach involves 143 individual assessments.

A **'Barrier'** consists 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 Interim Barrier Assessment allows us to identify water Quality driven Need for the purposes of the RWRP-SE and has in turn been used to inform the Preferred Approaches (capital interventions and associated level of investment) required within the RWRP-SE.

The Framework Plan describes eight (8) key barriers. These barriers should sufficiently address the potential hazards identified in the DWSPs (Appendix J of the Framework Plan). The interim approach evaluates all 143 WTPs within the South East Region based on four (4) of eight (8) critical barriers identified by Uisce Éireann:

- **Barrier 1**: Bacteria and Virus
- **Barrier 2.1**: Maintain chlorine residual in the network,
- **Barrier 3**: Effectiveness of the Protozoa removal processes
- **Barrier 6**: Prevention of the formation of trihalomethanes (THMs).

The barriers selected for assessment have been chosen based on existing data availability. Hazard assessments against the remaining critical barriers will be completed as our data and information systems improve and the site specific DWSPs are completed. For example, as the DWSPs 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 of our Framework Plan.

It should be noted that the "Quality Need" identified through the Barrier Assessment is **not** an indicator of non-compliance with the European Union (Drinking Water) Regulations 2023 but the ability to be able to provide our aimed LoS of 1 in 50 years. It is therefore an assessment or an indicator 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.

The source risk assessments currently in development align with the DWD Recast and will offer a leading/potential indicator of risk of contamination rather than a 'lagging' assessment at the customers tap. This will be approached using the source-pathway-receptor concept considering sources of contaminants in the catchment. These risk assessments will span existing contaminants in the short term, e.g., pesticides, *Cryptosporidium*, *E. coli* and natural organic matter, with a view to expanding to contaminants of emerging concern (microplastics, 'forever chemicals' and pathogenic and antimicrobial resistant bacteria).

3.3.3 Barrier Assessment – Summary

In this section we present a summary of the Interim Barrier Assessment for the WRZs in the RWRP-SE. The detailed assessments are presented in the Study Area Technical Reports (Appendix 1 - 3).

We have used colour coding to indicate the severity of the potential barrier deficit and the risk of the asset failing to achieve the required water quality standard. However, it should be noted that the table is not an indicator of non-compliance with the European Union (Drinking Water) Regulations 2023, as amended (Drinking Water Regulations), but an assessment of the asset capability standard compared with the asset standard as set out in Section 5.7 of the Framework Plan.

This assessment provides an indication of the level of investment (or intervention) we need to plan for to meet our stringent asset capability standards. The asset standard assessment is defined in Table 3.16. the colour coding indicates the severity of the potential risk of barrier failure.

Table 3.16 Asset Capability Score

Score	Uisce Éireann Asset Standard Assessment
●	Low Risk
●	Medium Risk
●	
●	High Risk

The Pie Charts in Figure 3.25 represents our 143 WTPs and the portion of these that fall into the 1 to 4 scale categories for each Barrier. A score of 1 indicates a low risk which represents a low priority for intervention. A score of 2 or 3 indicates a medium risk (medium-low or medium-high) whilst a score of 4 indicates a high risk and represents a high priority asset. Such assets are at a high risk of not meeting Uisce Éireann 's asset standard assessment rather than a risk of non-compliance with Drinking Water Regulations. This simple representation does not indicate the size of the supplies, which vary considerably across the Region. In summary,

Barrier 1: 55% of WTPs in the South East Region are considered to be at high risk of failing to achieve the required disinfection standard, while 25% are considered to be at medium risk of failing to achieve the required disinfection standard and 20% at a low risk.

Barrier 2.1: 67% of the water supply system has a low risk of issues associated with maintaining residual chlorine through the network; however, 24% are at high risk of failing to maintain the required residual.

Barrier 3: 59% of WTPs are considered to be at high risk of failing to effectively remove protozoa, while 22% are considered to be at a medium risk of failure, and 19% at a low risk of failure.

Barrier 6: 92% of the WTPs in the South East Region have a low risk of issues associated with removing THMs whilst just 1% are at high risk of failing to maintain the required levels of THMs. THMs can form when natural organic matter (NOM) is not sufficiently removed by Barrier 6, therefore, reacting with chlorine over time.

The barrier assessment results for each WTP are included in the Study Area Technical Reports in Appendix 1 – 3.

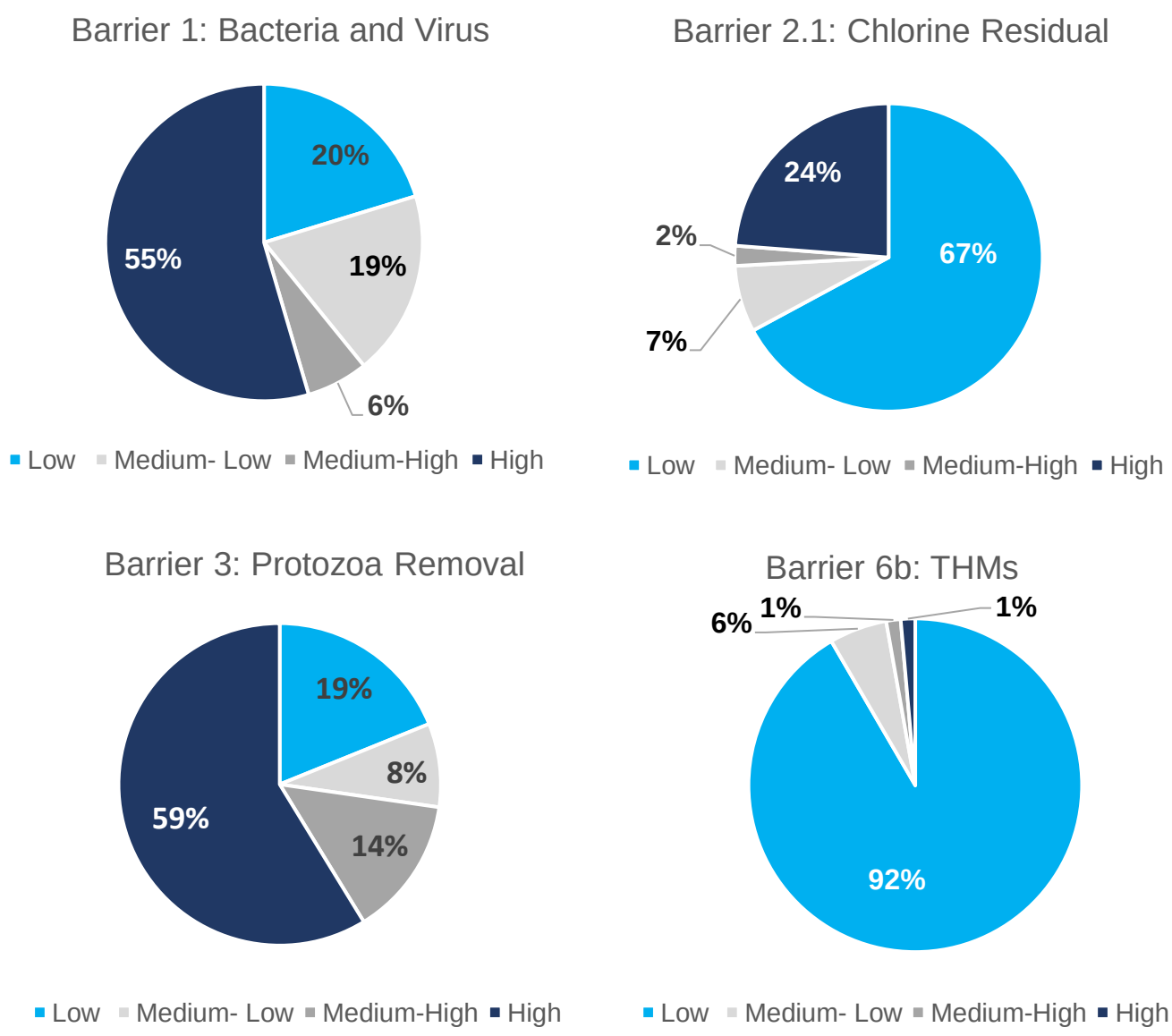

Figure 3.25 Proportion of WTPs in each Asset Capability category

Table 3.16 provides a breakdown of the number of WTPs in each SA that are assessed as high risk for each of the Barrier Types. A total of 115 out of the 143 treatment plants are considered high risk for one or more of the Barriers.

Across the South East Region Effectiveness of Protozoa removal processes (Barrier 3) is the largest risk (in terms of the number of WTPs impacted) impacting 59% of WTPs, whilst 55% of WTPs are 'at risk' from bacteria and viruses. Maintenance of chlorine residual (Barrier 2.1) is a risk for 24% of WTPs. THM formation (Barrier 6B) impacts 1% of the WTPs in the region.

Table 3.16 Number of WTPs in Study Areas assessed as 'High Risk' for each Barrier Type

Study Area	Study Area Name	Total Number of WTPs	Total No. of WTPs with a High Priority Barrier Score	Number of 'High Risk' WTPs			
				Barrier 1	Barrier 2.1	Barrier 3	Barrier 6
SAK	County Tipperary and Waterford	99	80	56	16	62	0
SAL	County Kilkenny	13	11	10	3	5	1
SAM	County Wexford	31	24	12	15	17	1
TOTAL		143	115	78	34	84	2

3.4 Water Supply Reliability

The benefit of having sufficient water supplies in terms of Quality and Quantity are negated if we cannot distribute the water we produce effectively around our networks. We also need sufficient treated water storage to enable us to respond to planned or unplanned outages on our trunk main and distribution networks.

In our Needs assessment we have identified a number of upgrades critical to ensure that we are able to deliver a reliable supply. Critical assets are the single point of failure that have the potential to significantly impact on our ability to provide water to our customers. They 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.

The critical infrastructure projects that have been identified across the South East Region are summarised in Section 4 and the Technical Reports for each Study Area that are included as Appendices (1-3) of our Regional Plan.

3.5 Water Supply Sustainability

A key objective of the NWRP is to improve the sustainability of the national water supply from its current baseline. This will include consideration of sustainable abstraction limits. The Water Framework Directive, and the associated River Basin Management Plan, is guiding the implementation of sustainable abstractions through the development of environmental standards. These standards will be defined under new legislation. To meet the sustainability objectives to be set out under the Abstraction legislation[7] some of our surface water and groundwater abstractions may need to be modified. Ireland's United Nations Sustainable Development Goal 6 - Clean Water and Sanitation[1], also requires us to ensure that abstractions are sustainable.

As the legislation is still being developed, we cannot reliably include an estimation of sustainable abstraction within the SDB calculations, so our forecast Deficits do not account for reductions in allowed abstractions as a result of legislative changes. However, as part of our Options Assessment Methodology (see Section 7 of this Plan) we include a Sensitivity Assessment to ensure we understand how the abstraction legislation could impact our Preferred Approaches and programmes for each WRZ.

This assessment applies a conservative approach in evaluating the potential impacts of the legislative changes on our surface water abstractions and ensuring selected Options would still be appropriate in the event that allowable abstraction quantities change to the extent that the future regime can be anticipated at this stage.

Our sustainable or allowable abstraction estimate is based on limiting abstraction to 5 – 15% of the Q95 low flow for river sources or 10% of Q50 inflow for lakes. This is based on applying the UKTAG guidance as modified for the Irish context as outlined in Section 2.3.7. This approach is described in Appendix C and G of our Framework Plan.

The potential change to the Deficit for each WRZ, as a result of these potential reductions in abstraction is described in the Sensitivity Assessment of the individual Study Area Technical Reports (Appendix 1-3) and is summarised in Table 3.17. the legislative changes could increase the SDB deficit by an estimated 47 Ml/d under a Dry Year Critical Period scenario. This change is for illustrative purposes only, and again is based on a conservative estimate of what a future regulatory regime may require. The actual reductions that may be needed in future will depend on the specific requirements of that legislation. Uisce Éireann will update the NWRP as appropriate to account for these requirements, once known, using the monitoring and feedback process set out in Section 9 of the RWRP-SE.

Groundwater abstractions will also need to conform to the proposed new abstraction licensing regime. At present the SDB does not account for changes to the abstraction licensing regime.

It is expected that as part of the proposed new abstraction licensing regime groundwater abstractions will be assessed in two ways:

- Impacts on the groundwater bodies from which they abstract; and
- Impact of the groundwater abstraction on the base flow in surface waterbodies.

As noted in Section 3.2.2 of our Framework Plan, Uisce Éireann does not currently have information to produce robust assessments of water availability from our existing groundwater. Over the coming years, Uisce Éireann will work with the EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources. In the interim, we have developed an initial assessment based on available information, included in Appendix C of the Framework Plan.

The multi-annual government funded GW3D project currently in progress[8] will provide more robust and refined scientific understanding and information on geodatabases. Specifically, the 'Groundwater resources assessment' component of this project will yield hydrogeological conceptual models at the catchment scale. These outputs will allow Uisce Éireann to work towards catchment-scale cumulative assessments in future iterations of the NWRP.

Table 3.17 Potential Change to the Deficit* based on the Potential Reductions to Abstractions (DYCP)

Study Area	Study Area Name	Number of SW Abstraction Sites		SW Abstraction Site Name (WRZ)	Potential Change to the Deficit (m^3/day)
		Assessed	Impacted		
SAK	County Tipperary and Waterford	26	22	1. Ahernes Glen Abstraction (Ardfinnan Regional) 2. Glenbreda Stream Abstraction (Ardfinnan Regional) 3. Glengarra River (Burncourt Ballylooby) 4. Boola River Intake (Clonmel & Environs) 5. Poulavanogue Abstraction 1 (Clonmel & Enviorns) 6. Poulavanogue Abstraction 2 (Clonmel & Enviorns) 7. Glenary Abstraction 2 (Clonmel & Environs) 8. Deelish Reservoir (Deelish/Ballinacourty/Kilnafrehan) 9. Multeen River Intake (Dundrum Regional) 10. Clodagh River (East Waterford Water Supply Scheme) 11. Ballyshonnock Impoundmnet (East Waterford Water Supply Scheme) 12. Mahon River Intake (East Waterford Water Supply Scheme) 13. Gurtnapisha (Fethard & Mullenbawn Regional Public Water Supply) 14. Walshbog (Fethard & Mullenbawn Regional Public Water Supply) 15. Cloran Stream (Fethard & Mullenbawn Regional Public Water Supply) 16. Anner River (Fethard & Mullenbawn Regional Public Water Supply) 17. College Stream Intake (Galtee Regional) 18. Muskry Stream (Galtee Regional) 19. Portlaw Springs (Portlaw) 20. Clonassy/Pollanasa River (South Kilkenny) 21. River Blackwater, Mullinavat (South Kilkenny) 22. River Clodiagh (Thurles/Borrisoleigh)	-39,400
SAL	County Kilkenny	7	2	1. River Pollmounty (New Ross) 2. Dranagh (New Ross)	-1,430
SAM	County Wexford	10	4	1. River Curralane (Ferns Regional) 2. Owenduff (South Regional) 3. River Sow- Wexfrod Town (Wexford town) 4. Coolree Intake (Wexford Town)	-5,940

Study Area	Study Area Name	Number of SW Abstraction Sites		SW Abstraction Site Name (WRZ)	Potential Change to the Deficit (m^3/day)
		Assessed	Impacted		
TOTAL REGION		**43**	**28**		**-46,770**

***** Based on potential changes to the projected 2044 Dry Year Critical Period (DYCP) scenario.

3.6 Summary

In this section we have described the water supply 'Needs' of the NWRP South East Region. We have determined the:

- Shortfalls in our supply to deliver **secure** supplies at a 1 in 50 Level of Service for our customers over the 25-year planning period;
- Water Quality deficiencies of our WTPs in delivering **safe** drinking water;
- Critical infrastructure improvements required to ensure **reliable** supplies; and
- Reductions in abstraction volumes to improve the **sustainability** of our water supply systems.

Water Quantity and Sustainability

Our Supply Demand Balance is under significant pressure:

- 57% of our WRZs are in Deficit at present and do not provide adequate reliability to our customers in normal conditions based on the 1 in 50 Level of Service that we have adopted for our NWRP.
- The WAFU from our existing supplies is not sufficient to balance the current demand for water, across all weather event planning scenarios. The highest net Deficit occurs for the Dry Year Critical Period at 28ML/day.
- Total Demand is forecast to increase by about 8% for all Weather Planning Scenarios despite the estimated overall regional population increase of 28%. This comparatively small increase in Total Demand is mostly attributed to the ambitious leakage reduction targets we have set ourselves
- By 2044, the net Deficit across the South East Region will increase by 129% in a normal year, 825% in a dry year (DYAA), 27% for the Dry Year Critical Period and 120% for the Winter Critical Period.
- The increasing Deficit is driven by a number of pressures. In a DYCP these include growth and climate change. The resulting increase in the SDB net Deficit is 27 Ml/day.
- Changes to legislation and the regulatory process around abstractions has the potential to increase the Deficit by a further 47 Ml/day under the DYCP.

Water Quality and Reliability

The risk to our drinking water quality of inadequate protection against key drinking water parameters (including bacteria and virus, protozoa and triahalomethanes) is high, with 115 out of the 143 water treatment plants assessed as high risk of not meeting for one or more of the water quality Barriers representing Uisce Éireann 's internal asset standards. As mentioned above these standards are not an

assessment of compliance with Drinking Water Quality Regulations but rather an internal conservative gauge to indicate where works are required.

Barrier 1: 55% of WTPs in the South East Region are classified as “high risk” of failing to achieve the required disinfection standard, while 25% are considered to be at “medium risk” of failing to achieve the required disinfection standard and 20% are at a low risk.

Barrier 2.1: 24% of the water supply system has “low risk” of issues associated with maintaining residual chlorine through the network; however, 67% has at “high risk” of failing to maintain the required residual.

Barrier 3: 59% of WTPs are classified as “high risk” of failing to effectively remove protozoa, while 22% are considered to be at a “medium risk” of failure.

Barrier 6: 92% of the WTPs in the South East Region have a “low risk” of issues associated with removing THMs. whilst 1% are at “high risk” of failing to maintain the required levels of THMs.

The Reliability of our water supply system is impacted by deficiencies in our WTPs and critical infrastructure. We have identified critical infrastructure projects which reflect the Reliability Needs across the South East Region as summarised in Section 4 and presented in the Technical Reports for each Study Area (Appendices 1-3). These will be incorporated into our Preferred Approach (solutions) to secure our supplies over the 25-year planning period.

Addressing the Need

The progress we have made so far to address our immediate needs is described in Section 4. This includes programmes to tackle water quality deficiencies, along with programmes such as the reservoir cleaning programmes, the network cleaning and repairing works and the national leakage reduction programme.

Our Options to address our future Needs are presented in Sections 5 and 6, while our Preferred Approaches at a Study Area Level are discussed in Section 7. Section 8 presents our Regional Approach.

3.7 References

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4 Current Status of Infrastructure

4.1 Introduction

Uisce Éireann are committed to continuous improvement to our water supply network. Throughout the development of the Framework Plan and the RWRP-SE there has been a requirement to continue to design and deliver projects, particularly in relation to critical water quality risks (which could have the potential to impact human health) and / or supply reliability issues. For example, this may include projects required to remove 'boil water' notices. These critical works are addressed through our critical infrastructure projects which are completed under our Capital Investment Plans. Critical projects and programmes to address potential public health issues are therefore on-going and are not impacted or delayed by the delivery of the NWRP.

Outside of the NWRP, Uisce Éireann's investment follows investment periods (known as Revenue Control periods) which set out how much Uisce Éireann can spend on projects and programmes for that period. These are subject to oversight by and approval of the Commission for Regulation of Utilities (CRU). Our first Capital Investment Plan covered the period 2014-2016 whilst the second Capital Investment Plan covered 2017 to 2019. We are currently carrying out work which was identified in our RC3 Capital Investment Plan 2020-2024.Throughout the development of the NWRP and RWRP-SE, Uisce Éireann have continued working on a range of existing critical infrastructure projects funded by Uisce Éireann's RC3 Capital Investment Plan and we continue to identify and complete further critical infrastructure projects.

Between January 2014 and December 2019 Uisce Éireann 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 (3) themes of Quality, Conservation and Future Proofing.

This section provides in-sight into the current status of the infrastructure within the South East Region, critical infrastructure work that has already been completed and critical infrastructure work that is currently ongoing.

4.2 National Investment Programmes

Uisce Éireann are committed to improving the quality of water received by our customers. In order to bring about improvements, we have identified critical water quality requirements nationally and are currently delivering a range of national programmes to address high risk water supplies.

National programmes being implemented to address asset reliability and water quality issues include:

- The **Source Protection Programme** which develops or upgrades groundwater sources.
- The **Reservoir Cleaning Programme** which involves inspections of reservoirs and the development of a prioritised works (cleaning/repair) schedule for implementation. The programme aims to reduce network water quality issues.
- The **Disinfection Programme** which consists of chlorination upgrades and/or UV installations/upgrades to help resolve network water quality issues.
- The **Lead Mitigation Programme** which is a pilot programme that involves the addition of orthophospate (a food additive) to the water to prevent lead in domestic pipes dissolving into drinking water. This programme will run in parallel to the Targeted Lead Services Replacement of all lead pipework on the public parts of the distribution system and the Government National Lead Strategy.
- **Trihalomethane (THMs) Reduction** works (Box 4.1).

Box 4.1 – Trihalomethanes

Trihalomethanes are a by-product that can be formed when we disinfect* water supplies that contain naturally occurring organic matter. Within the Drinking Water Regulations, the maximum permitted levels of THMs in drinking water is set at 100 µg/L. In 2017 the EU Commission issued a Letter of Formal Notice (Infringemennt No 2017/4007) in relation to compliance with the parametric values for Trihalomethanes (THMs). The Commission deemed that Ireland had not adopted the necessary measures to ensure compliance with the parametric values set out for THMs.

The Commission identified 74 of our public water supply zones affecting almost 500,000 people. Of the 74 supplies identified, Uisce Éireann has delivered solutions for 65 of these public water supplies and is working to address issues at the remaining 9 locations. The remaining 9 non-compliant supplies serve a combined population of almost 50,000. We hope to have addressed issues at these remaining supplies by the end of 2026. Identifying solutions to address non-compliance for THMs can be a complex process requiring various studies and assessments.

* It should be noted that the potential health risks associated with THMs are much lower than the risk of serious illness that could result from drinking water that has not been properly disinfected.

Through our National Disinfection Programme, we have upgraded a total of 255 Water Treatment Plants (WTPs). Under our National Lead Programme, we have replaced a total of 51,669 lead services (to the end of 2022), which represents a significant investment in protecting public health.

We are also targeting investment to improve water quality in order to lift Boil Water Notices (BWN). Since 2014 we have lifted 341 BWN's impacting over 2.1 million people of which over 41,000 of these people were on BWN's for a period of over a year. Through investment in water assets and infrastructure, the number of customers served by vulnerable water supplies (those on the EPA's Remedial Action (RAL) list) has reduced to its lowest ever level. Uisce Éireann has removed 115 public water schemes from the EPA's remedial action list (RAL) between 2014 and 2022 reducing the number of WTPs on the RAL.

These national programmes 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. For this reason, the development of our Preferred Approaches, presented in Section 7 and Section 8 of this Plan, consider these water quality issues alongside the supply demand balance issues. As explained in Section 2 of this Plan, our long-term approach will increasingly include catchment management for drinking water source protection in partnership with key stakeholders.

4.3 Progress in the South East Region

4.3.1 National Investment Programmes within the South East Region

The implementation status of national programmes across the South East Region is summarised in Table 4.1. One hundred and forty (140) of the 341 BWNs that have been lifted since 2013 were located in the South East Region benefitting approximately 300,000 customers. Currently there are approximately 650 customers on BWN in the South East Region.

Within the RWRP-SE there are currently 13 WTPs which are listed on the EPA's remedial action list.

Table 4.1 National Investment Programmes in the South East Region

Study Area	Source Protection Programme	Reservoir Cleaning Programme	Disinfection Programme (Completed upgrade works*)
SAK	Works progressing at 5 WTPs	Works progressing at 42 sites	Works complete at 39 sites Works progressing at 36 sites
SAL	Works progressing at 1 WTP	Works progressing at 7 sites	Works complete at 8 sites Works progressing at 5 sites
SAM	Works progressing at 3 WTP	Works progressing at 13 sites	Works complete at 23 sites Works progressing at 3 sites

*Any other requirements within the remaining supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the Regional Plan.

4.3.2 Identification of Critical Infrastructure Projects within the South East Region

Local critical infrastructure projects have and continue to be completed across the South East Region (in-flight projects). These include WTP upgrades to improve water quality, critical mains replacements to improve supply reliability, critical network upgrades, reservoir refurbishments, construction of new reservoirs and the installation of new boreholes. These works are important as the benefits of having sufficient water supplies in terms of Quality and Quantity are negated if we cannot distribute the water we produce effectively around our networks. We also need sufficient treated water storage to enable us to respond to planned or unplanned outages on our trunk main and distribution networks. It is likely that it may take 5-10 investment cycles before we address all issues with the existing water supplies. As a result of this, priority projects (such as those to remove sites from the RAL) have been identified.

Examples of critical infrastructure projects progressing in the South East Region include:

- Development of the existing Monroe well field to address the short-term needs of Clonmel Town. The first stage of this work, which involves testing and evaluating the existing source has been completed.
- Construction of Mountain Road pipeline and upgrade to Glenary water treatment plant. This project will transfer customer on Mountain Road onto the Glenary Water Supply Zone to increase supply resilience.
- Linguan water treatment plant upgrade development of production bores to improve resilience and address deficits in the supply to Carrick-on-Suir. This will include network upgrades to augment supplies to the Crotty's Lake water supply zone.

4.3.3 Completed Critical Infrastructure Projects

Uisce Éireann have been working across the nation since 2014 to support growth by constructing new water treatment plants, upgrading existing water treatment plans, laying new water mains and rehabilitating existing water mains. Major national strategic infrastructure water projects have also been progressed. Case studies of work completed in the South East Region include:

- The National Leakage Reduction Programme addressing leakage across the South East Region (Box 4.2).

- Water Treatment Plant upgrades as part of the National Disinfection Programme (Box 4.3)
- Kilkenny Regional Water Supply Scheme (Box 4.4)
- Clonmel Regional Water Supply Scheme (Box 4.5)
- Gorey Rural Public Water Supply (Box 4.6)
- Drinking Water Safety Plan – Burncourt Ballylooby Public Water Supply (Box 4.7)

It should be noted that some critical infrastructure projects have been progressed to support growth as part of our current regulated investment cycle. As such these measures do not improve Levels of Service, they prevent current levels from deteriorating further. Future need will be addressed through the Preferred Approaches discussed in Section 6 - 8.

Box 4.2 – National Leakage Reduction Programme

Everyday treated water in Ireland is lost through leaks before it reaches our taps. Leaks can be difficult to find because they happen in the vast and complex network of pipes below ground. Many of these pipes are now old and damaged and need to be repaired or replaced to improve our water quality and supply.

To reduce drinking water lost to leaks Uisce Éireann have implemented the National Leakage Reduction Programme (investing €800 million between 2020 and 2023) to provide a more reliable water supply. As part of the National Leakage Reduction Programme, we're working with Local Authorities across the country. This involves fixing or replacing old, damaged pipes and reducing high levels of leakage to provide a more reliable water supply.

Watermain replacement works have been carried out across the South East Region including:

- The replacement of approximately 300 meters of old cast iron water mains at Factory Road, Portlaw, Co Waterford. The works have been designed to alleviate water quality issues that have resulted in 'Boil Water Notices' for a small number of residents and businesses along Factory Road.
- The replacement of approximately 600 meters of high-density polyethylene (plastic) pipes in Carrick-On-suir, Co Tipperary. The works and resulting water network improvements will enable the decommissioning of problematic water mains in close proximity to the locations of works.
- The replacement of over 1,470 meters of problematic water mains at Abbey and Marlfield Roads, Clonmel, Co Tipperary. The works will also involve laying over 65 new water service connections from the public water main in the road to customers' property boundaries and connecting it to the customers' water supply. Where the existing service connections on the public side are lead these will be replaced as part of this improvement work.
- The replacement of approximately 500 meters of old cast iron water mains in Kilkenny City. The works will take place along Dean Street where 400m of new water main will be laid. The works will continue on Black Mill Street where a further 100m of problematic water main will be renewed. The works will also involve laying new water service connections from the public water main in the road to customers' property boundaries and connecting it to the customers' water supply. Where the existing service connections on the public side are lead these will be replaced as part of this improvement work.
- The replacement of approximately 450 metres of problematic water mains at Jerpoint Abbey, County Kilkenny to improve security of supply, reduce high levels of leakage and improve water quality.

As part of the National Leakage Reduction Programme Uisce Éireann have replaced ageing back yard water mains in Kilkenny City and Wexford Town through their Backyard Service Replacement which involves the replacement of ageing water mains which run to the rear of properties on older estates. These are usually shared connections which run through multiple properties making leaks hard to detect and repair. These connections are typically made of iron or lead and are a significant source of leakage and reduced levels of service due to their deteriorating conditions.

Similarly ongoing work under this scheme includes Tramore's Backyard Service Replacement. The works on Market Street Lane will involve the construction of approximately 30 metres of new public water main and provision of 5 new service connections for properties on Market Street Lane. These works will also remove lead services at the affected properties. The work will bring benefits of reduced leakage and higher levels of service (improved water pressures).

Box 4.2 – National Leakage Reduction Programme Continued

The National Leakage Reduction Programme provides various benefits including:

- A more reliable water supply
- Improved water quality
- Reduced levels of leakage
- Individual water connections

Due to the implementation of this programme, we are now saving 166 million litres of drinking water daily.

In 2018 the rate of leakage nationally was 46%, but our ongoing work has reduced this to 38%.

Box 4.3 – The National Disinfection Programme in the South East Region [1-3]

As part of the National Disinfection Programme Uisce Éireann have upgraded water treatment plants across Wexford, Waterford and Kilkenny. The programme works in two phases with the first being an assessment of the water treatment plant followed by the second phase which involved the completion of upgrade works. The works may include upgrades to chemical storage and dosing infrastructure, installation or replacement of ultraviolet disinfection systems, installation of monitoring systems and or installation of process alarms.

Box 4.4 –Kilkenny Regional Water Supply Scheme Outrath Reservoir[4]

Improvements have been completed to the Kilkenny Regional Water Supply Scheme in order to provide a minimum of 24 hours storage for the area supplied by the Outrath reservoir. The upgrades were required as during periods of high demand there was insufficient storage and pressure. The location of the pump station was also unsuitable. As part of the works additional storage was provided and the pump station was relocated to a suitable elevation. The works enabled increased water pressures, improved chlorine residuals for the townlands of Wallsough, Furzehouse and Kilferagh and increased resilience in periods of high demand. The works cost €1.5 million benefitting over 2000 customers.

Box 4.5– Clonmel Regional Water Supply Scheme[5]

The completion of the Clonmel Regional Water Supply Scheme has increased the security of the water supply for businesses and residents in North Clonmel. The scheme involved the construction of a 4,000 m^3 reservoir, associated control building, installation of a new booster pumping station and the construction of 4km of new water mains. The increased storage capacity benefits current residents and also supports future growth and economic development in the area.

Box 4.6– Gorey Rural Public Water Supply[6]

Upgrade works have been completed at Gorey Rural Public Water Supply which serves Gorey, Courtown, Riverchapel and the surrounding areas. The upgrade works involved the construction of a 8,000 m^3 capacity water treatment plant and a 7,500 m^3 storage reservoir. In addition both new and refurbished boreholes have been incorporated into the supply arrangements. Enhanced monitoring and control facilities have also been integrated. Together these have increased the security of the supply which has been relying on six (6) temporary water treatment plants. The works will also allow future growth in the area.

Box 4.7– Drinking Water Safety Plan Burncourt Ballylooby Public Water Supply (Burncourt Ballylooby Water Treatment Plant)

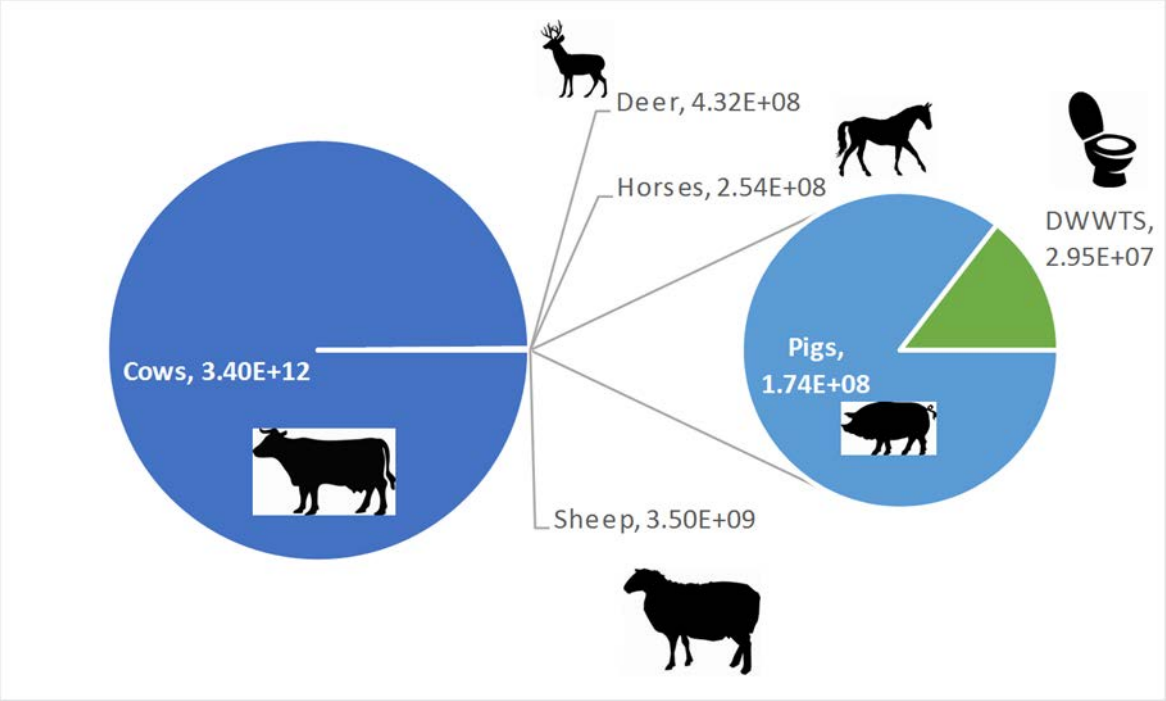
Following the detection of Cryptosporidium in the Burcourt Ballylooby PWS, Uisce Éireann applied the Drinking Water Safety Plan, Cryptosporidium Source Risk Assessment Methodology to understand the potential risk score to this supply and inform the appropriate treatment barrier.

Burncourt Ballylooby PWS receives water from two (2) boreholes. The Zone of Contribution (ZOC) has been delineated for the spring and is 123 hectares (ha). The ZOC draws from the Clonmel (IE_SE_G_040) Groundwater Body which is associated with a ‘Good’ status.

Box 4.7– Drinking Water Safety Plan Burncourt Ballylooby Public Water Supply (Burncourt Ballylooby Water Treatment Plant) Continued

Oocyst loads are calculated from livestock (cows, sheep and horses), pigs and deer and subtracted from an oocyst retention factor based on ZOC characteristics such as sub-surface nitrate susceptibility and potential of karst features within the ZOC. This ZOC has shown potential for karst features (+5) and the proportional area for sub-surface susceptibility has scored 3 (1 – low; 5 – high). The fraction of loading associated with this ZOC is 0.5.

The relative contribution of oocyst load by input type can be seen below:



The maximum observed Cryptosporidium oocyst concentration in the raw water is 1 oocyst m^{-3} which is much lower than the predicted of 84 oocysts per m^3. A sanitary survey has not been completed for this supply yet, therefore the Log requirement for this source presently is Log 3 (i.e., a 1000-fold reduction).

4.3.4 In-Flight Critical Infrastructure Projects

Some of the in-flight projects across the South East Region are presented in Table 4.2.

Uisce Éireann has commenced works to improve the security of water supply across Kilkenny City & Environs for over 28,000 people. Currently Kilkenny City & Environs is serviced by two (2) separate water treatment plants (WTPs) at Radestown and Troyswood. The existing Radestown WTP includes slow sand filtration followed by disinfection but it is unable to remove THM precursors and is currently on the EPA's Remedial Action (RAL) list. The existing Troyswood WTP also requires a significant upgrade to provide robust water treatment facilities. In addition, the raw water intake at Troyswood is inaccessible in periods of flooding. The existing WTPs also have inadequate capacity to cater for future growth in Kilkenny City & Environs[7]. The works will involve the upgrade of Troyswood WTP to increase capacity. A new 2.9 km watermain from Troyswood to the Radestown site will connect to the existing service reservoirs and enable the decommissioning of Radestown WTP. The upgrade will solve accessibility issues relating to the Troyswood intake pipe, improve flocculation and clarification, upgrade the sludge treatment facilities and provide a new UV treatment facility.

Uisce Éireann is currently tendering for works aimed at improving the quality and security of the water supply in Gowran Regional Water Supply Scheme[8]. The scheme supplies nine (9) housing estates, housing over 1,225 residents and non-domestic properties, which are currently utilising boreholes which have been subject to boil water notices.

Table 4.2 An Example of In-Flight Projects in the South East Region

In-Flight Project	Study Area	Progress
Troyswood Water Treatment Plant	SAL	In Progress
Gowran Regional Water Supply Scheme	SAL	In Tender

Upon progression with the NWRP and RWRP-SE, "In-flight" projects will be assessed against the Preferred Approaches identified and adapted as required. It should be noted that assessments and Preferred Approaches and solutions at this stage are at a Plan Level. The Preferred Approaches will have their own public consultations as part of the development of the RWRPs. These public consultations will take place throughout 2022.Environmental impacts and costing of projects are further reviewed at Project Level. No statutory consent or funding consent is conferred by inclusion in the RWRP-SE. Any projects that are progressed following this Plan will require individual environmental assessments, including Environmental Impact Assessment (as required) and screening for Appropriate Assessment, in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

4.4 Summary

In summary, there are asset reliability issues across the distribution network within the South East Region and works will be required over the coming years to address this need. An overview of the need across the area is provided in the Study Area Technical Reports (Appendix 1-3).

4.5 Conclusions

Uisce Éireann are committed to improving supply Reliability across the South East Region. This section provides in-sight into the work that has already been completed to improve our water network as well as ongoing and planned work. Critical projects and programmes to address potential public health issues are on-going and are not impacted or delayed by the delivery of the NWRP.

Between January 2014 and December 2019 Uisce Éireann 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 (3) themes of Quality, Conservation and Future Proofing.

Uisce Éireann are progressing National Programmes across all SAs to address asset Reliability and water Quality issues. They include the:

- Source Protection Programme – with works ongoing across the South East Region

- Reservoir Cleaning Programme – with work ongoing/planned in each of the region's SAs.
- Disinfection Programme – with work ongoing across the South East Region.
- Lead Mitigation Programme- planned across the South East Region in line with the Government National Lead Strategy.

Across the South East Region, works have been completed to address critical water Quality issues including the Kilkenny Regional Water Supply Scheme and Clonmel Regional Water Supply Scheme. Leakage is being addressed across all Study Areas through the National Leakage Reduction Programme. Distribution network repairs and upgrades are continuing across all Study Areas. These projects are of vital importance and are critical to meeting Ireland's growing water needs.

4.6 References

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5

Solutions-Our Approach

5.1 Introduction

Uisce Éireann faces significant challenges in terms of the Quantity, Quality, Reliability and Sustainability of the public supplies across the country.

Uisce Éireann 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:

- Continuous abstraction from source alone is not a sustainable approach to meet ever increasing demand in the long term. Therefore, 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; and
- Uisce Éireann fully adhere to the World Health Organisation (WHO) principle that the starting point for good clean drinking water is source protection, rather than relying on ever more complex and costly treatment for sources that are deteriorating due to inadequate protection. Uisce Éireann will achieve this by developing and implementing Drinking Water Safety Plans (DWSPs) across all of our supplies.

Sustainability must therefore be at the core of our approach to developing appropriate solutions to meet future water demand. Solutions should therefore fit into one of Uisce Éireann's three (3) pillars; Lose Less, Use Less and Supply Smarter as set out in the Framework Plan and summarised in Figure 5.1.

Lose Less – reducing water lost through leakage and improving the efficiency of our distribution networks;

Use Less – reducing water use through efficiency measures; and

Supply Smarter – improving the quality, resilience and security of our supply through infrastructure improvements, operational improvements and development of new sustainable sources of water.

Figure 5.1 Three Pillars to Address the Key Challenges

Together these pillars will enable us to optimise our capital and operational solutions to achieve the best outcomes and react to emerging issues.

5.2 Lose Less: Leakage Reduction

Leakage is the loss of water from the distribution network. Leakage can occur from fractures and bursts, smaller holes and pinholes in pipe walls, leakage at joints, valves, service connections and other fittings and as a result of 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. Activity to reduce leakage from the public distribution network was historically undertaken by Local Authorities and is now managed by Uisce Éireann. Our supply network is built from a variety of pipe materials of different ages and differing 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. As our water mains network ages, leakage will increase if we do not continue to invest in fixing leaks, leading to a Natural Rate of Leakage Rise (NRR).

In order to address leakage Uisce Éireann are committed to a National Leakage Reduction Programme which includes measures such as pressure management, active leakage control (ALC) and targeted water mains replacement. The National Leakage Reduction Programme incorporates advice from industry specialists and authors of the European Commission produced reference document 'Good Practices on Leakage Management WFD CIS WG PoM[1].

Our National Leakage Reduction Programme will be a major intervention to support growth over the timeframe of the National Water Resources Plan (NWRP). It aims to reduce our leakage through:

- Establishing over 4,500 district meter areas to enable us to monitor flows and identify areas of suspected high leakage;
- Establishing our Find and Fix activities to deliver active leakage control;
- Undertaking large-scale targeted 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 of domestic properties where the customer has responsibility.

As operational data and understanding of asset performance of our networks improves Uisce Éireann expect to be able to make further improvements.

In late 2018, Uisce Éireann developed a Leakage Management System (LMS) which will help us to assess leakage trends in a uniform way across our supplies and to manage active leakage control activities. We are continuing to embed the system and develop its calibration, but it is already (and will continue) helping us to understand leakage across our distribution networks. We are also looking at emerging acoustic technologies and intelligence systems to allow us to optimise our active leakage control activities, and non-destructive testing technology.

5.2.1 Three Step Leakage Reduction

Uisce Éireann will take a three-step process to reduce leakage both nationally and within the South East Region:

STEP 1: Sustainable Economic Level of Leakage

The SELL concept is built on the principle that 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. In other jurisdictions, the industry regulators for water supply set leakage reduction targets for the individual water utilities based on SELL, the Sustainable Economic Level of Leakage. As utilities have achieved or are approaching SELL, through progression along their leakage reduction glidepath, regulators are setting the challenge for some to go beyond SELL.

As this is Ireland's first NWRP, the target for leakage reduction has been set as SELL. Uisce Éireann aim to achieve the National SELL target by 2034, recognising that current leakage levels are unacceptably high. SELL targets will be continually reviewed through the five-year water resources planning cycles. As we progress towards SELL targets, Uisce Éireann will continually review and proactively target further leakage reductions.

Details of the SELL assessment process can be found in Appendix H of the Framework Plan. During the development of the Framework Plan separate SELL targets were developed for the Greater Dublin Area (GDA) and the rest of Ireland. These national SELL Targets are set out in Table 5.1.

STEP 2: Go Beyond SELL

Further to the initial SELL targets considered in the Framework Plan, Uisce Éireann has set additional leakage targets with the objective of reducing leakage levels to 21% of total demand for larger WRZs (WRZs where demand is greater than 1,500 m^3/d).

STEP 3: Appropriate Leakage Level (ALL)

As the 2034 SELL targets approach, Uisce Éireann's knowledge of the condition and responsiveness of our networks to leakage reduction activities will have improved and we will set further leakage reduction targets on the basis of Appropriate Level of Leakage (ALL) for each supply. This will require WRZ Level and site-specific assessments. These assessments will require data which is not yet available to Uisce Éireann and as such these targets will be developed approaching 2034.

5.2.1.1 Step 1: SELL Targets

Estimated leakage levels for 2019 and target SELL for 2034 are presented in Table 5.1.

In 2019 the national leakage level was 738 million litres per day (Ml/d). SELL targets aim to reduce this to 525 Ml/d by 2034 requiring a national leakage reduction of 213 Ml/d. The national leakage level target SELL will be met by leakage reductions nationally and across all WRZs. During the development of the Framework Plan, separate SELL targets were developed for the Greater Dublin Area (GDA) and the rest of Ireland (all non-GDA WRZs). The GDA is located in the Eastern and Midlands Region of the NWRP. Targets for the South East Region are included in the national leakage level for non-GDA WRZs. Table 5.1 compares the GDA WRZ and non-GDA WRZ leakage levels and SELL targets.

Table 5.1 Leakage Levels and Target SELL (Ml/d)

	Leakage Level (Ml/d)	Target SELL (Ml/d)	Leakage Reduction Required (Ml/d)
	2019	2034	
GDA leakage level	214	130	84
Leakage level for non-GDA WRZs (Nationally)	524	395	129
National leakage level	738	525	213

In 2019 the leakage level in the GDA was 214 Ml/d. In order to meet the 2034 GDA leakage target a leakage reduction of 84 Ml/d is required within the GDA (Table 5.1) as presented in the RWRP-EM.

The 2019 leakage level for non-GDA WRZs was 524 Ml/d. In order to meet the 2034 SELL target a leakage reduction of 129 Ml/d is required (Table 5.1). This reduction will be achieved across the four (4) NWRP regions (Table 5.2). A reduction of 22.5 Ml/d will be achieved within the non-GDA WRZs in the Eastern and Midlands Region (as presented in the RWRP-EM). A leakage reduction of 57 Ml/d, 32 Ml/d and 17 Ml/d will be achieved in the South West Region, North West Region and South East Region respectively.

5.2.1.2 Step 2: Beyond SELL

Further to the initial SELL targets considered in the Framework Plan, Uisce Éireann has set additional leakage targets with the objective of reducing leakage levels to 21% of total demand for larger WRZs (WRZs where demand is greater than 1,500m^3/d). These additional targets equate to a net leakage reduction of 42 Ml/d, 36.5 Ml/d, 70 Ml/d and 29 Ml/d across the Eastern and Midlands, South West, North West and South East Region respectively.

Together the SELL and Beyond SELL targets aim to reduce leakage nationally by 400 Ml/d by 2034.

Table 5.2 Leakage Levels and Target SELL Steps (Ml/d)

		National Leakage Reduction (Ml/d)				
		Non-GDA WRZs				
	GDA	Eastern and Midlands Region	South West Region	North West Region	South East Region	National Total
Step 1: SELL Target	84	22.5	57	32	17	213
Step 2: Beyond SELL	9	42	36.5	70	29	187
Total	**158**		**94**	**102**	**46**	**400**
Step 3: Post 2034 Appropriate Leakage Level	TBC Pending future data availability					

*Leakage Targets in GDA achieve 21% leakage in 2034.

5.2.1.3 Step 3: Appropriate Leakage Level (ALL)

As discussed above, as we approach the 2034 targets, our knowledge of the condition and responsiveness of our networks to leakage reduction activities will have improved and as we move towards 2034, we will set further leakage reduction targets on the basis of Appropriate Level of Leakage (ALL) for each supply. This will require WRZ Level and site-specific assessments. These assessments will require data which is not yet available to Uisce Éireann and as such, these targets will be developed as we move closer to 2034.

5.2.2 Leakage Targets and Demand Forecasting

Leakage targets are not automatically applied to the Supply Demand Balance (SDB) calculations. The SELL leakage target for the GDA has been prioritised, given the size of the supply demand deficit, and *is* incorporated into the SDB. Leakage outside of the GDA across all four (4) regions of the NWRP is prioritised on an annual basis as part of the National Leakage Reduction programme. This allows Uisce Éireann's leakage reduction programmes to be flexible and targeted, to meet specific emerging needs.

As set out in Section 4.3.3 of the Framework Plan leakage targets for 2019 were applied to priority supplies based on:

- Size of supply demand deficits
- Existing abstractions with sustainability issues
- Observed impacts during the 2018 drought

For the South East Region, 0.91 Ml/d of leakage targets have been applied to the SDB. These include:

- SAK – 0.35 Ml/d through net leakage reduction in Fethard & Mullenbawn Regional Public Water Supply, Galtee Regional and Tipperary Town Supply.
- SAL – 0.32 Ml/d through net leakage reduction in Kilkenny City.
- SAM – 0.24 Ml/d through net leakage reduction in Fardystown, Enniscorthy and Gorey.

This does not mean that only 0.91 Ml/d will be applied for the region between 2019 and 2034 but rather we committed to a figure for 2019 in the SDB and provided flexibility in where the remaining 16.1 Ml/d of leakage reduction (required to achieve 17 Ml/d of leakage reductions within the South East Region) will occur after that.

Leakage reductions are applied to the SDB by reducing the Demand component of the calculation. For this reason, the future estimated Deficit will reduce as a lower Demand is subtracted from the available supply. It is acknowledged that if these leakage targets are not met then the solution (Preferred Approach) will not fully meet the Demand and hence the Deficit will not be met. For this reason, we are working to meet these targets now, in advance of the Preferred Approach reaching project stage.

Where leakage reductions have not been incorporated into the SDB, any leakage reduction achieved will result in a reduction to the projected Demand. In this scenario the Preferred Approach within each WRZ, Study Area or the Region may be capable of providing more water than is needed. In this scenario, this will enable us to modify the Preferred Approach to reduce the quantity of water required to be delivered or if it coincides with greater than expected growth it will open up available water for this increased demand. For this reason, our leakage targets will be reviewed annually and will be subject to further modification. At project level, when we proceed to develop the Preferred Approach, we will review the SDB and subtract the target leakage reductions from the Deficit at this stage. This ensures that the Preferred Approaches are not oversized, or that the Needs are over emphasized.

In order to ensure that the Preferred Approaches which we develop (as described in Section 6-8) remain appropriate in the scenario of reduced leakage and static demand we have carried out a Sensitivity Analysis of our Preferred Approaches. This has allowed us to understand the impact of leakage reductions on the Preferred Approach and whether it would still be valid under a reduced leakage scenario. This process allows us to balance the delivery of the Preferred Approach between the Lose Less pillar (Section 5.2) and Supply Smarter pillar (Section 5.4). The Supply Smarter Options usually involve new or upgraded water sources and treatment plants. At project level these are delivered on a modular basis. For example, if we build a new water treatment plant (WTP) we assess the demand profile of that supply over 25 years and then deliver the capacity in modules to align with demand increase. Therefore, if we meet or exceed our leakage targets and the demand is less, we do not build the last modules of the new WTP, thus balancing supply with demand.

5.2.3 Challenges in Meeting Leakage Reduction Targets

While the optimum economic solution is to reduce leakage as quickly as possible and we aim to go above and beyond our SELL targets, there are a number of wider considerations that may impact delivery. These include:

- Data improvements which are necessary to improve visibility of active leakage control efficiency and key parameters such as background leakage;
- Existing and or future budget constraints;
- The availability of skilled and trained resources to undertake find and fix activity. It is not feasible to significantly increase the level of resource for a short duration. To do this would risk driving inefficiency into the leakage management process;

- There are planning constraints to consider in relation to shut offs when carrying out repairs, to maintain supply and pressure to customers;
- Repairs carry a social cost and impact particularly in relation to traffic delays, therefore spreading the impact over time manages this impact; and
- Technology and innovation improvements which are likely to improve active leakage control efficiency over time, and a number of trials in areas such as permanent acoustic sensors/smart networks, may offer more cost-effective solutions in the near future.

5.2.4 Leakage Reduction in the South East

Box 5.1 presents an example of the work being carried out to reduce leakage in the South East Region.

Box 5.1 – Leakage Reduction in the South East Region

The aim of our National Leakage Reduction Programme is to improve the water network and fix leaks across the country. This improves the reliability of supplies and delivers a more sustainable network. Uisce Éireann have been working in partnership with 31 of our Local Authority partners and our regional contractors Shareridge, to reduce leakage across our South East Region. Together we have identified key issues facing the water network across the region, in order to reduce leakage and secure supplies for future growth.

Problems identified in the region included high levels of dated and fragile infrastructure along with water mains that are prone to bursts.

To reduce leakage, it was identified that improvements needed to be made to critical water networks assets such as water mains, replacing old lead service connections and pressure reducing valves in addition to implementing other programmes such as Find & Fix, Frist Fix Free and a metering programme. The metering programme will help us to better understand the flow and distribution of water in our networks across the region and identify those areas with the highest leakage levels.

We are currently constructing new hydraulic network models on the following water supply schemes in the SE Region to further improve our understanding of the networks and to identify more opportunities for leakage reduction in those schemes:

- Kilkenny Water Supply Scheme
- East Waterford Water Supply Scheme (which includes Waterford City)
- Gorey Regional Water Supply and Gorey Urban Water Supply Scheme (Co. Wexford)
- South Regional Water Supply Scheme (Co. Wexford)
- Bunclody Water Supply Scheme (Co. Wexford)
- Clonmel Water Supply Scheme & Environs (Co. Tipperary)

Since 2020 under the Leakage Reduction Programme we have:

- Replaced approximately 170 km of old and underperforming watermains;
- Installed 15 new Pressure Reducing Valves (PRV's);
- Upgraded and repaired our existing stock of PRV's as part of a Planned Maintenance Programme, including optimization (in some cases via the provision of pressure controllers);
- Replaced old lead service connections causing water quality issues.

5.3 Use Less: Water Conservation

Uisce Éireann is committed to helping all of our customers to become more efficient in their water use. Research commissioned by Uisce Éireann 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 Uisce Éireann is not addressing the significant and complex leakage challenge, are further barriers to behavioural change. 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.

Reducing customer water use will not only reduce the pressure on the public water supply system but will also reduce carbon emissions associated with water treatment and supply. Research from the UK indicates that 6% of the UKs total greenhouse gas emissions are from household water supply and use and 90% of these emissions are from how water is used in the home. This equates to over 2.6 kg CO_2e per home per day. A 20% reduction in household water use could lead to a carbon emission reduction of up to 0.45 kg-Co_2 per property per day[2]. Reduction in water usage will also result in a reduction of wastewater discharged to the sewer network.

Uisce Éireann are committed to a behavioural change campaign that will educate and inform the end users about their individual water consumption and the challenges of providing a sustainable treated water supply in order to encourage water conservation. This will require investment and ongoing research.

5.3.1 Water Conservation Activities

Presently Uisce Éireann is actively promoting water conservation in schools, business and communities through activities including:

- National and Local Media Campaigns
- Targeted Sectoral campaigns
- Green Schools
- Water Stewardship Scheme (see Box 5.2)
- First Fix Free Scheme
- Development of an online water conservation application which will provide tips on how to conserve water in the home.

National and Local Media Campaigns

In addition to the broader water conservation programmes, such as the Green Schools and Water Stewardship schemes, Uisce Éireann promotes water conservation through national and local media campaigns during the year depending on the water demand, weather conditions, and available water. The campaigns raise awareness of the importance of saving water to cope with scarcity and protect the water environment. They include information on how the public can save water over both the immediate and longer term. For example, during periods of hot weather, customers are encouraged to minimise the amount of water used by avoiding power washing or cleaning the car and reusing water for the garden. We also have a water conservation webpage https://www.water.ie/conservation/ which provides details on why and how to conserve water.

Targeted Sectoral Campaigns

In 2021 the Water Forum commissioned research on a Framework for Improving Domestic Water Conservation in Ireland[3]. A key recommendation from this research is the provision of revised building regulations and fittings standard. Uisce Éireann is supportive of this recommendation as a measure to reduce water demand.

Uisce Éireann currently works with developers to determine if water efficiency measures could be taken, and the developer can reduce the projected required water demand. In August 2022, we launched a guide for the construction industry that sets out how builders and developers can achieve water conservation through measures such as innovative technology installations and rainwater harvesting systems. We ran Water Conservation Clinics, developed in partnership with the Construction Industry Federation (CIF), to offer training and guidance on how businesses can conserve water on site. Uisce Éireann is also exploring concepts for potential pilot projects with developers to determine if water efficiency measures could be implemented to reduce projected water demand. We will seek to reduce demand requirements from large new connection applications for domestic and non-domestic developments through the new connection application process.

Green Schools

Green Schools is an award programme for primary and secondary schools. It helps students to learn about the environment, including water conservation and efficiency. Uisce Éireann sponsors the water theme of the An Taisce Green Schools Programme which includes student-led Water Forums, Walk for Water events, Water Ambassador Support Sessions and poster competitions. More information on the Green-Schools programme can be found on our website at https://www.water.ie/about/programmes-sponsorships/green-schools/.

First Fix Free Scheme

The First Fix Free scheme aims to help reduce the amount of water wasted through leaks on customers' properties. The scheme offers a free investigation of potential leaks on external supply pipes and a free repair if a water leak is identified. The scheme is open to domestic or mixed-use customers with a predominant domestic water use. More information on the scheme can be found on our website at https://www.water.ie/help/leaks/first-fix-free/.

Conservation Calculator

The Conservation Calculator is a free tool that was developed in response to research, which showed that consumers want additional tools to assist them in conserving water. The tool will assist households to assess their water usage habits and find out how much water they are saving daily. It offers customers useful and practical tips on how to reduce water usage and track their progress. The Conservation Calculator is available at www.water.ie/calculator.

5.3.2 Domestic Metering Network

Uisce Éireann's Use Less pillar also involves investment in the domestic metering network. The existing network covers almost 60% of domestic units and has smart functionally, such as automatic drive-by reading, month-end readings, and continuous-flow (leak) alarms. This functionality will support the achievement of our water conservation ambition and has already been used in our 'First Fix Free' programme.

In 2018 Uisce Éireann carried out a pilot study of sub-metering of apartments, where smart meters were used with fixed radio communications. This trial was primarily to confirm that it is feasible to sub-meter apartment buildings and retrieve usage data. It has also demonstrated how water usage data can be made available to the occupants of the apartments. This work was funded by the CRU. The final report, "Pilot Technology Trials of Water Metering Systems for Multi-Unit Development", is available at https://www.water.ie/about/research-and-innovation/. Uisce Éireann are currently running a 'smart network' trial in the South Dublin Area.

5.3.3 Grey Water Recycling and Rainwater Harvesting

Grey water recycling and rainwater harvesting are private side measures that can potentially result in a reduction in demand (greywater) or a reduction in some peaking in dry conditions. Further research and innovation in these areas is required to improve the viability of these measures. The challenge for non-potable supplies such as grey water is the need to prevent contamination of drinking water supplies. A parallel network of pipeline would be required to separate domestic plumbing systems from non-potable supplies.

Due to the seasonality of rainfall in Ireland, a significant amount of storage would be required to ensure that rainwater harvesting is a viable option to address demand, particularly during dry periods. The space for the storage required to maintain supplies during dry weather would not be available at a typical domestic property. As outlined in Section 9.3 of the RWRP-NW, Uisce Éireann will work with our Innovation Team to review the potential for pilot studies to understand the benefits and outcomes for conservation measures such as rainwater harvesting and grey water reuse.

5.3.4 Water Savings

The ability to reduce Demand (based on technology, behaviour and metering) is uncertain and sensitive to the situational context and the awareness of Need. 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 at this time to assess 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. Over the coming years our ability to quantify the impact of these initiatives in terms of reduction in water use will improve as our data and intelligence systems become more refined.

In order to address water conservation Uisce Éireann has considered water conservation in our Domestic and Non-Domestic forecasts. Whilst Uisce Éireann recognises that occupancy rates are falling within households, which typically leads to an increase in demand, we have held our per-capita consumption rates as static across our supplies when calculating our future forecasts. This means that increased per capita consumption growth will need to be addressed though water efficiency. An allowance for non-domestic growth has been made for towns and cities identified as strong growth areas in Project 2040[4]. For other areas, it is assumed that there will be no significant increase in non-domestic demand. Where demand increases, Uisce Éireann will try to facilitate the growth via efficiency improvements and water conservation.Water Savings

Box 5.2 – Water Stewardship in the South East Region: Supporting the Business Community through Uisce Éireann's Water Stewardship Programme

Irish businesses use around 510 million litres of water every day. To put that in context, the city of Limerick requires about one-tenth of that at 51 million litres per day. Measures that support business to be more efficient and sustainable in how they use water make a real difference to safeguarding our national supply. Uisce Éireann is working closely with business stakeholder groups to raise awareness of our Water Stewardship Programme to support businesses to lower water consumption and reduce operating costs while protecting the environment. Small changes such as identifying water waste on site, setting a baseline for water use, raising awareness amongst staff and customers, or upgrading to water efficient devices can make a big difference to water efficiency and also to save money for businesses.

One of the programmes developed by Uisce Éireann is Certified Water Steward (CWS) training which is tailored to every size of business with a shorter small and medium-sized enterprise (SME) programme and more in-depth training for medium to large businesses. The programme is the first of its kind globally and accredited internationally by the European Water Stewardship (EWS) Standard. It has been made possible thanks to the funding from Uisce Éireann and Skillnet Ireland via the Department of Further and Higher Education, Research, Innovation and Science and it is a clear demonstration of Ireland's growing reputation and leadership actions on water stewardship and climate action.

Over 1000 new water conservation projects have been implemented by graduates to date and three (3) sites have progressed to EWS/AWS (Alliance for Water Stewardship) international water stewardship certification. Overall, 70% of businesses are introducing Annual Water Stewardship Targets as a result of the programme and 100% would recommend the training to other businesses.

What Green Credentials are on Offer to the South East Business Community?

We are offering three (3) different opportunities for businesses of all sizes to enhance their green credentials:

1. **Water Conservation Pledge**
    - We are inviting businesses to commit to making changes that will conserve water.
    - Businesses can share their pledge badge on social media to show they are taking action.
2. **Sustainable Water Partner Training**
    - Businesses are invited to take free online water stewardship training and learn about the importance of safeguarding this critical resource.
    - Businesses can share their new Sustainable Water Partner badge on marketing materials/social media and add it to their green credentials.
3. **Certified Stewardship Training**
    - Achieve international best practice certification. The programme is accredited by the EWS Standards.
    - Funded Programme by Uisce Éireann and the Lean & Green Skillnet with the support of Skillnet Ireland and the Department of Further and Higher Education, Research, Innovation and Science.
    - Save water and money. The programme will provide you with the knowledge and skills to reduce water consumption and operating costs at your site.
    - Protect the environment. You will learn the key principles of water stewardship and the actions required to improve your environmental performance.
    - The programme is the first of its kind globally and is fully supported by the EPA, Origin Green, Irish Business and Employees Confederation (Ibec), Chambers Ireland, Industrial Development Authority Ireland (IDA), (Sustainable Energy Authority of Ireland) SEAI, Bord Iascaigh Mhara (BIM) and Enterprise Ireland.
    - Origin Green accept our certification as part of their sustainability credential.

What does CWS Training deliver?

Module 1 - Introduction to water stewardship - the business case

Module 2 - Water mapping of your business

Module 3 - Water conservation and quick wins at your site

Module 4 - Developing a strategy and action plan

Optional workshops/webinars - Mentoring and support for the development of your Water Charter as well as providing peer to peer learning opportunities.

Develop a water charter for your site assessment - The charter will capture the business case for action, your site's water map, water saving opportunities and an agreed action plan. To achieve certification, participants will be expected to present this charter to senior management and get approval for implementation.

How has the water stewardship programme supported the South East Region?

Testimonials from our South East Certified Water Steward Graduates

	About	Benefits of CWS	Wins
Sulzer Pumps Ireland Ltd **Whitemill Industrial Estate** **Wexford Town**	Sulzer Pumps Ireland Ltd celebrates 50 years in Wexford next year. Employ approximately 270 team members. Sulzer Pumps Ireland Ltd design and manufacture a range of pumps, mixers, aerators and control monitoring equipment. The site is accredited to ISO 9001, ISO 14001 and ISO 45001.	Networking with other likeminded participants. High level of experiential learning from participation on the CWS programme. Highly Competent CWS tutors who presented both the theory and real world practical application of water stewardship. Knowledge to make a real difference on site in relation to water conservation and water sustainability.	Develop a bespoke on site water charter. Collaboration amongst key stakeholders in identifying and implementing on site water conservation initiatives. Empowerment to champion water conservation and water sustainability.

5.4 Supply Smarter

The **Supply Smarter** pillar actions to proactively engage in the protection of 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 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 5.2.

Figure 5.2 Option Types

As well as reducing leakage and improving water efficiency, we must develop our infrastructure to improve interconnectivity and storage, and create a more robust, smarter system. Our water supplies in some areas often come from small local rivers, which can have an environmental impact. We must therefore look at all of our water sources from rivers and lakes to groundwater so that we can reduce our reliance on these rivers. This will also allow us to take climate change into account.

All Options are considered at the 'Unconstrained' stage in the Option Development Process (Section 6) including technical assessment of transfers across Water Resource Zones (WRZs), and interactions with private Group Water Schemes, i.e., cumulative assessment of abstractions from the same source, and Options which consider connecting to Group Water Schemes.

Uisce Éireann's currently have 163 surface and groundwater sources located within the South East Region. Each source needs to be utilised, managed and maintained sustainably in order to protect the source for future use. There are also 143 WTPs in the South East Region. Development and growth over the years means that some WTPs are undersized, treating water in quantities far beyond what they were originally designed for and so investment is needed to upgrade these facilities.

As part of our **Supply Smarter** pillar we are currently carrying out the following activities:

- Capital Investment and Improved Operations
- Source Protection and Catchment Management Activities
- Data Acquisition and Improvement

We are currently implementing an investment programme in our water supply infrastructure which includes WTP upgrades to improve the Level of Service (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. We publish details of planned, live and recently completed projects on our website. For more information please visit www.water.ie.

Uisce Éireann recognises the importance of source protection in ensuring the security and sustainability of our water supplies and are currently working with key stakeholders to promote this concept. In recognition of the importance of multi-stakeholder engagement and collaboration in managing shared natural resources, Uisce Éireann are members of an expert group chaired by the Department of Housing Local Government and Heritage (DHLGH) to make recommendations to the Minister regarding a new approach to drinking water source protection as part of the transposition of the recast Drinking Water Directive. Other members of the group include the County and City Management Association (CCMA), the Local Authority Waters Programme (LAWPRO), the National Federation of Group Water Schemes (NFGWS), the Environmental Protection Agency (EPA), Geological Survey of Ireland (GSI), the Health Service Executive, the Department of Agriculture, Food and the Marine (DAFM), the Irish National

Accreditation Board (INAB), the National Standards Authority of Ireland (NSAI) and the Commission for Regulation of Utilities (CRU). Implementation of source protection measures will require further collaboration with several stakeholders including, riparian owners, industry groups, the agricultural and environmental sector forestry and Teagasc. These measures will complement existing ongoing works for example the works carried out by Teagasc under the Agricultural Sustainability and Advisory Programme (ASSAP) which looks to improve water quality through working with farmers.

Uisce Éireann are actively involved in source protection projects to trial catchment scale interventions for example to reduce the risk of pesticides causing exceedances in water supplies.

As Uisce Éireann are at the initial stages of resource planning we are relying on the best available data, surrogate data and trends from neighbouring jurisdictions in the development of the RWRP-SE SDB. We have identified the data improvements which will be required to support best practice in the future and have invested in systems to manage it. Overtime we will build on the existing database improving our understanding which will be fed into the SDB. Detailed explanations of our current data approaches and future plans can be found in the Framework Plan.

Uisce Éireann will also look at the waste produced from our WTPs (known as residual waste) to reduce the impact of this waste on the environment through the circular economy approach and nature-based solutions.

5.5 Summary

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

Across the South East Region Uisce Éireann are committed to:

- Carrying out ongoing leakage management including active leakage control, pressure management and find and fix activities to offset Natural Rate of Leakage Rise (NRR).
- Continuing household and business water conservation campaigns, initiatives and education programmes.
- Implementing legally enforceable Water Conservation Orders, as required, in drought periods in order to protect the environment and our public water supplies.

5.6 References

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6 Option Development

6.1 Introduction

In Section 3 of the Regional Water Resources Plan South East (RWRP-SE), we identified that 32 of our 111 water supplies in the South East Region do not provide an appropriate Level of Service (LoS) during dry conditions. The purpose of the RWRP-SE is to develop a Preferred Approach to improve the LoS across all water supplies within the region, accounting for increased demands, climate change impacts, and tighter drinking water and environmental standards.

Within the National Water Resources Plan (NWRP) Framework Plan Uisce Éireann has set the target **Level of Service** for the public water supply as being 1 in 50 years. This means the probability of a customer having a water supply outage should be less than 2% in any given year.

In this section, we summarise Stages 3 to 6 of the water resource planning process, known as the **Option Development Process.** The purpose of the Option Development Process is to investigate the full range of potential solutions that can address the identified Need of the WRZs within the region. The Option Development Process is underpinned by Ireland's United Nations (UN) Sustainable Development Goal 6[1] which aims to increase water efficiency, ensure abstractions are sustainable, address water scarcity and ensure an integrated water resources management approach. The potential Options we have considered include new groundwater and surface water sources, dams and impoundments, improvements to existing resources, water treatment plant (WTP) upgrades, interconnectivity of supplies, bulk treated water transfers, effluent reuse and desalination. During the Option Development Process, we consider all possible Options (Unconstrained Options), and then screen out those that are not feasible.

The Option Development Process involves:

- Developing a list of Unconstrained Options
- Coarse Screening, to remove Options that do not meet high-level assessment criteria
- Fine Screening, to produce a final Feasible Option list
- Feasible Option development (including whole life costing)

Before summarising the Option Development Process for the South East Region, we will firstly consider the scale and types of Options available.

6.1.1 Option Scale

During the Option Development Process, we review potential solutions at three (3) scales (Figure 6.1):

WRZ Level Options – We review each WRZ individually and assess Options that might address Need in that supply.

Study Area Level Options (Grouped Options) – We assess whether there are any larger Options that might be able to address the Need for multiple WRZs, generally within the same Study Area (SA); although in some circumstances the solution at this level may involve a transfer from outside the SA in which the relevant WRZs are located.

Regional Level - We assess the Feasible Options at the Regional Area level to see if there are any Options that can be applied across the entire region.

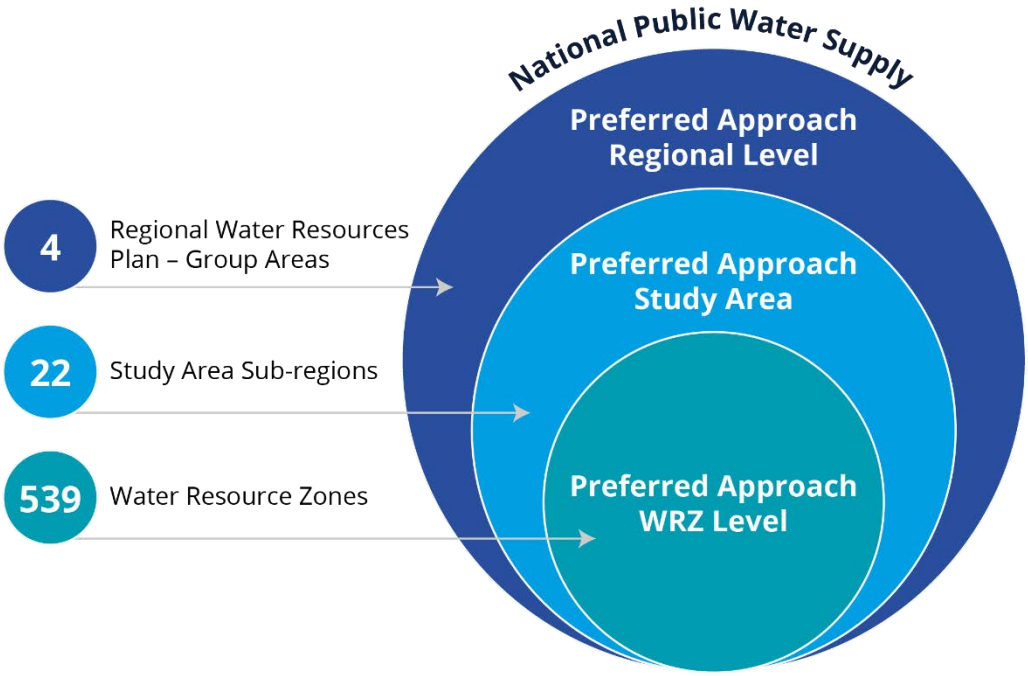


Figure 6.1 NWRP Spatial Scale of Assessment

WRZ Level Options - By reviewing each water supply individually, we can effectively examine Options that are local to each WRZ. For example, WRZ Level Options could include a new or upgraded groundwater or surface water source, an upgrade to an existing WTP or a transfer of water from a neighbouring water supply. This spatial scale is particularly useful for finding local solutions for small, isolated supplies. In areas where there is poor availability of raw water sources, finding a resilient and sustainable source can be difficult. In addition to this, for very small supplies, it is usually not feasible to develop Options that require small volumes of water to be transferred over a distance of five kilometres or more due to potential water quality issues generally associated with such transfers.

Feasible Options for larger WRZs can be identified when looking at a wider area. For example, it is possible to transfer 10 million litres per day (Ml/d) of water over a distance of 40-50 kilometres without encountering low velocity or water quality issues. For very large supplies (greater than 100 Ml/d) it is possible to transfer water over 200 kilometres. As these types of Options involve long lengths of transfer mains that traverse through the region, additional Option opportunities for smaller WRZs can be feasible in areas through which they pass.

Therefore, we assess the Study Areas that contain the largest WRZs first, in order to see if they generate Options that might provide potential solutions for smaller WRZs in their vicinity.

Figure 6.2 provides two examples of a WRZ spatial scale assessment and WRZ Option type:

- In SAK, the Preferred Approach at WRZ Level for Dundrum Regional WRZ is a new surface water abstraction from the River Suir; and
- In SAM, an increase in the existing surface water abstraction from the River Slaney is the Preferred WRZ Level Approach for Enniscorthy Town.

Study Area Level Options - The water supply in Ireland evolved in a piecemeal manner over time and compared to other EU countries Ireland has a large number of discrete small-scale local supplies. At Study Area Level, we review clusters or groups of these water supplies to see if there are Options that could resolve Need in more than one (1) WRZ.

Figure 6.3 presents Study Area Options as alternatives to the WRZ Options for Dundrum Regional WRZ and Enniscorthy Town. These involve:

- Supplying spare capacity from Thurles water supply system to five (5) neighbouring WRZs in deficit, including Dundrum Regional WRZ.
- Connecting Enniscorthy Town and 12 other WRZs in SAM to the Greater Dublin Area (GDA) via Rathvilly WTP in the Eastern and Midlands Region.

The benefits of larger SA Options (or Grouped Options) include:

1. Allowing Uisce Éireann to strategically assess the water supplies in a particular area and consider whether there are any larger Options that could address Need in more than one (1) WRZ.
2. Enabling transfers to groups of smaller WRZs. Taken individually, such small supplies and local sources may, depending on the circumstances, be vulnerable to pollution or may not be environmentally sustainable. Additionally, transfers into a single WRZ may not be feasible due to distance and age of water. Conversely, transfers into groups of WRZs, which collectively have a higher volumetric "Need", can potentially be a Feasible Option. Figure 6.3 provides an example of a SA spatial scale assessment and SA Option type.

At **Regional Level** we assess whether there are Options that can resolve Need for groups of WRZs across the Region.

The benefit of assessing a wider regional approach is that:

1. It allows us to strategically assess the most sustainable larger water sources across the region, and whether these can be used to improve resilience to the larger demand centres across the region.
2. The regional hubs can in turn supply some of the smaller neighbouring WRZs.
3. Sustainability and cost efficiency can be tested and optimised across the region.
4. It facilitates integrated planning across the key growth centres regionally (and ultimately) nationally.
5. As set out in the Framework Plan, the impact of uncertainty in our design assumptions - which is accounted for through a Headroom Allowance that is added to our estimated total demand - is reduced with large integrated WRZs. The interconnectivity facilitates demand being met from more than one (1) source therefore increasing resilience. This reduces the impact of the uncertainty associated with population growth assumptions and the corresponding impact on the demand component of our Supply Demand Balance (SDB). Similarly, peak demands are less pronounced across larger supplies. For this reason, if a number of smaller supplies (which have higher peaking) merge with larger supplies, we recalculate the supply demand balance for the new combined WRZ at project level. This ultimately reduces the design Need requirement and optimises the sizes of the WTPs.

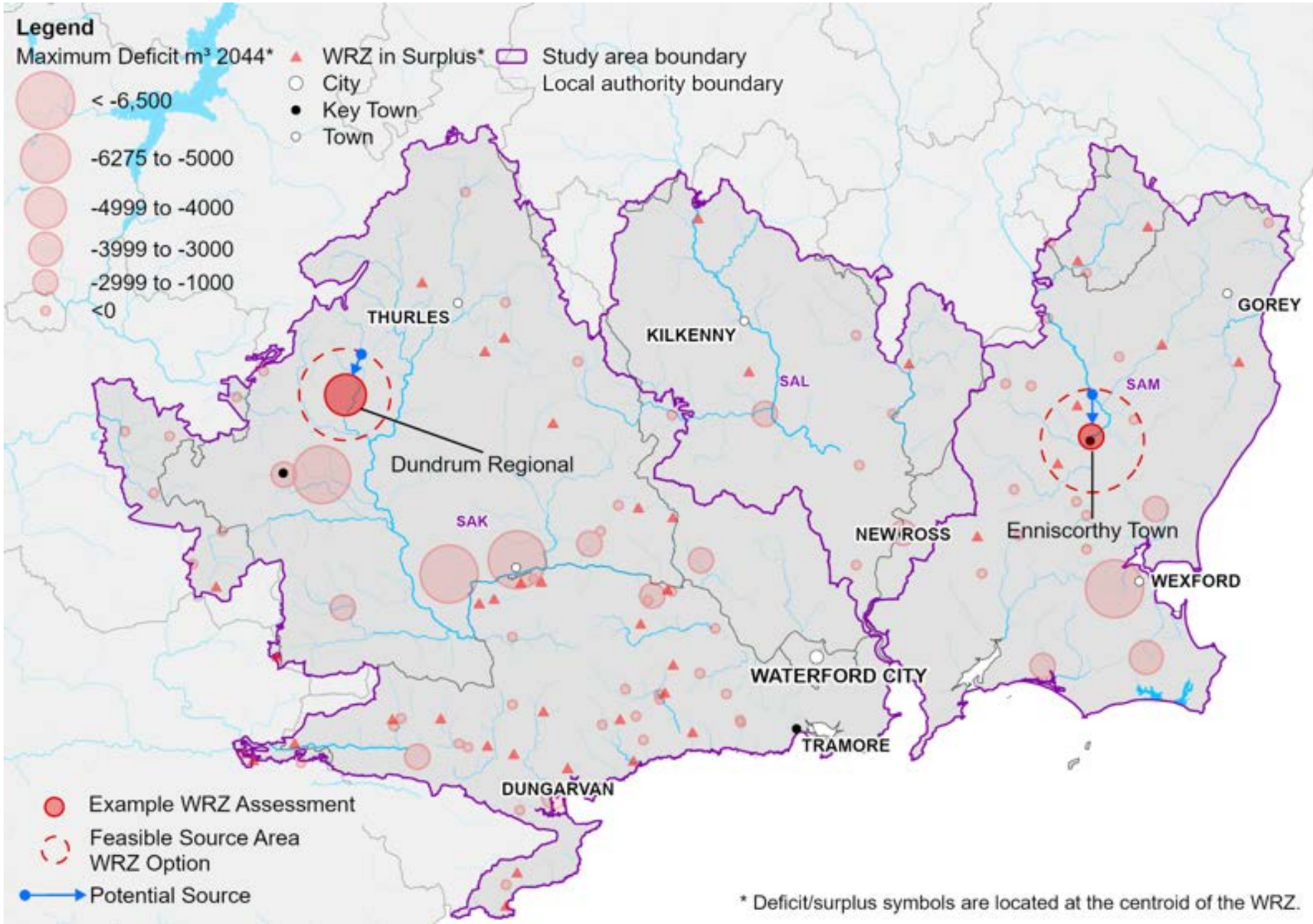
Assessment of Options at the three (3) spatial levels allows us to examine a wider plan for a more integrated water supply that will allow for a more sustainable, resilient and cost-effective water supply service.

For the South East Region, our Option Development Process determined there is no Feasible Option at the regional scale that connects WRZs across the three (3) Study Areas. Section 8 explains that the potential for regional interconnectivity is limited due to the cost and challenge associated with transporting small volumes of water over long distances.

While there are no feasible interconnections across study areas within the South East Region, the assessment has identified options that connect WRZs to study areas in the Eastern and Midland Region. These are:

- Connection of six (6) WRZs in SAK to Limerick Supply System in Study Area 8 (Limerick Clare).

- Rationalising Coolgreany Water Supply in SAM to the Arklow supply system in Study Area 1 (Mid Wicklow).
- Rationalising Ballingate Public Supply in SAM to the Tinahely supply system in Study Area 1 (Mid Wicklow).



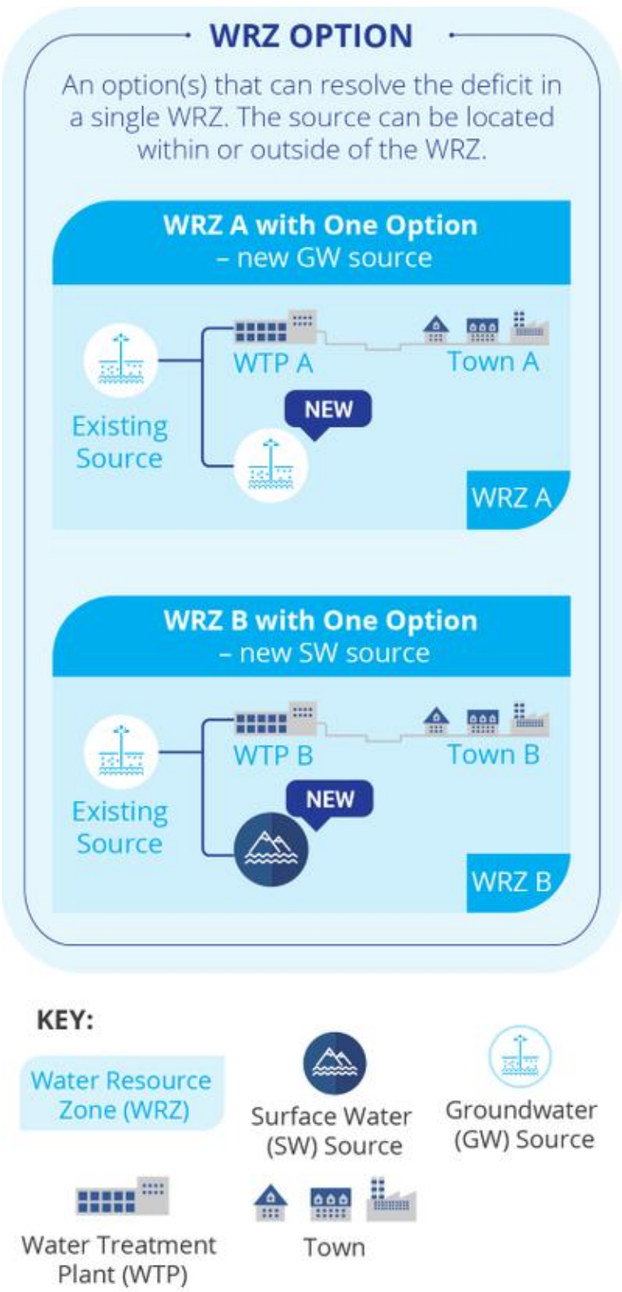
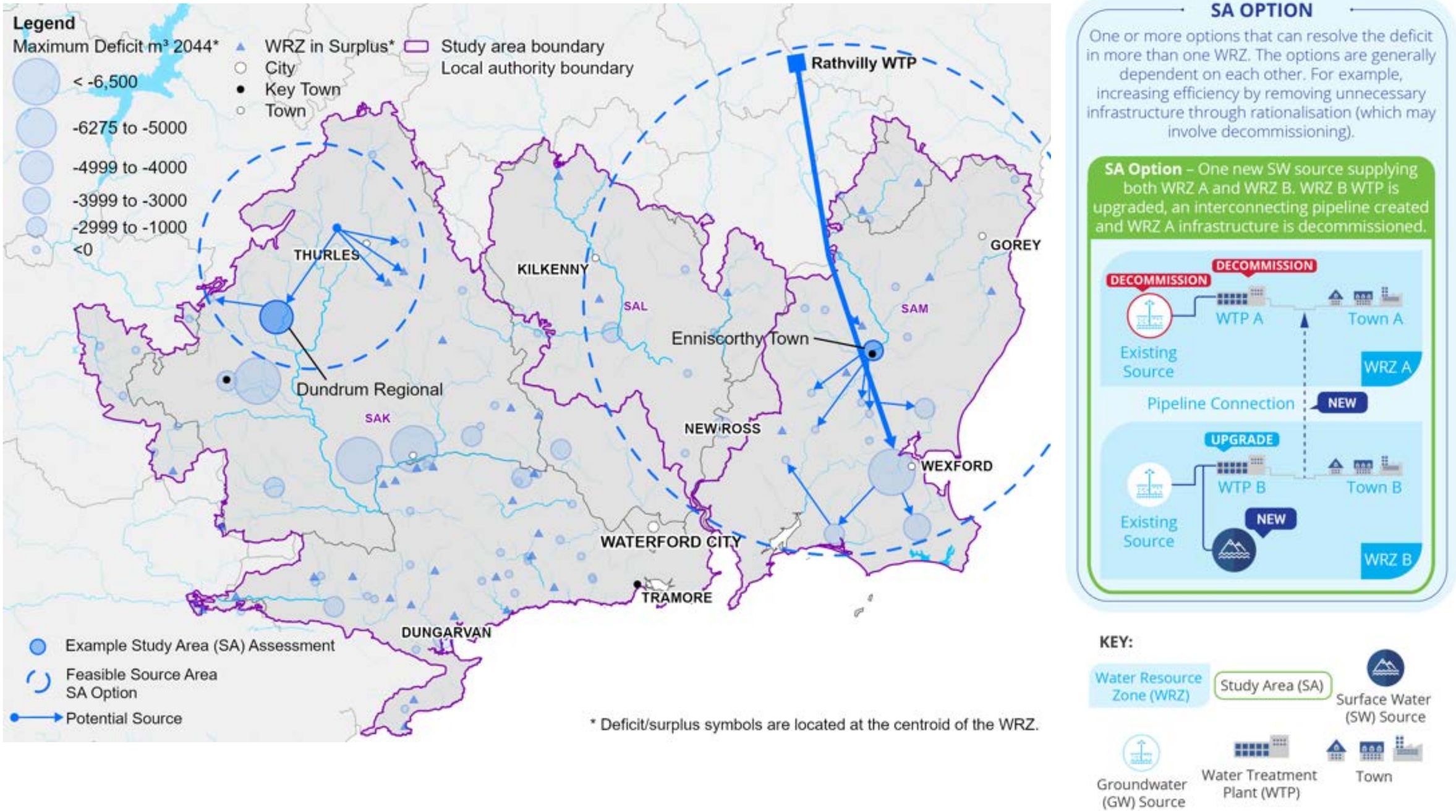


Figure 6.2 WRZ Level Assessment



SA OPTION

One or more options that can resolve the deficit in more than one WRZ. The options are generally dependent on each other. For example, increasing efficiency by removing unnecessary infrastructure through rationalisation (which may involve decommissioning).

SA Option – One new SW source supplying both WRZ A and WRZ B. WRZ B WTP is upgraded, an interconnecting pipeline created and WRZ A infrastructure is decommissioned.

Figure 6.3 Study Area (SA) Level Assessment

6.1.2 Option Development Process

The Supply Demand Balance (SDB) and Barrier Assessment outlined in Section 3 inform the type and scale of Options that Uisce Éireann must consider to address the Needs in each WRZ.

The main Option Types are shown in Figure 6.4.

Figure 6.4 Option Types

Nature-based solutions (NBS) and catchment measures will be considered as part of the Drinking Water Safety Plans (DWSPs), which aim to reduce risk to our supplies; and where possible, will be incorporated at project level (see Section 6.4). The DWSPs will include a comprehensive risk assessment of our supplies from water sources (catchment) to consumer (tap). Therefore, future iterations of the NWRP will include catchment Options based on information coming from the DWSP's. Further information on the development of our DWSPs is provided in Section 5.5 of the Framework Plan.

The purpose of our Option Development Process is to consider the widest practicable range of solutions to resolve identified Need within a given WRZ or Study Area. A suitable screening criterion is then applied to filter out any Options based on the five (5) screening criteria of Resilience, Deliverability, Progressibility, Sustainability (environmental and social impacts), and Cost.

The Options Assessment Screening Process involves the following:

- Developing a list of **Unconstrained Options** – the maximum possible list of unscreened Options for water supply, not limited by cost or feasibility;
- **Coarse Screening** – We filter the Unconstrained Options using a Coarse Screening assessment where we remove any Options that fail to meet desktop assessment criteria under: Resilience, Deliverability and Flexibility or Sustainability (Environmental and Social Impacts); and
- **Fine Screening** – We filter the remaining Options from the Coarse Screening exercise through a Fine Screening assessment, which includes 33 detailed questions related to environmental objectives identified for the Strategic Environmental Assessment (SEA) for the RWRP-SE (including biodiversity, the water environment and requirements under climate change adaptation) as well as Resilience, Deliverability and Progressibility. This produces the Feasible Option List.

It should be noted that Options are developed at a plan level. Environmental impacts and costing of projects are further reviewed at project level. No statutory consent or funding consent is conferred by inclusion in the NWRP. Any projects that are progressed following the NWRP will require individual environmental assessments, including, where appropriate, Environmental Impact Assessment and Appropriate Assessment, in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

6.1.3 Unconstrained Options

At the start of our screening process, we conduct a specialist desktop review of groundwater bodies and surface water catchments. This allows us to understand potential additional availability at existing water abstraction sites, or to identify any potential new water sources within a Study Area. This assessment is completed by a specialist team including groundwater professionals (hydrogeologists), surface water professionals (hydrologists), environmental scientists, ecologists and engineers.

An Unconstrained List of Options is developed by reviewing:

- Options identified by Uisce Éireann that have not been committed to in the current Investment Plan;
- Options previously considered by Local Authorities;

- Options identified in other strategy documents, approaches and projects (including those identified in pre-planning and in-flight projects); and
- Ideas generated at workshops with Uisce Éireann's Local Authority Water Services Partners, drawing on their knowledge and experience of the supply system and the geographical area.

As sustainability is at the heart of our NWRP, environmental and social assessment criteria are included at the earliest stages of the screening process. Some fundamental rules are applied even before screening begins to ensure the protection of the environment. For example, Uisce Éireann does not allow for any inter-catchment raw water transfers due to the high risk of transferring invasive non-native species (INNS) between catchments. We also consider Water Framework Directive (WFD) objectives through a sustainable abstraction risk review. This is based on UK Technical Advisory Group (UKTAG) WFD guidance[2] on baseflows. When Ireland specific standards come into place, we will update our environmental risk assessments as part of the next iteration of the NWRP. The application of these conservative abstraction standards to new Options ensures that any new or increased abstractions from rivers are likely to support conservation objectives for the most sensitive environmental sites. The SEA Environmental Report for the Framework Plan provides further detail of the risk assessment approach. The Natura Impact Statement (NIS) of the Framework Plan sets out the approach in relation to the Appropriate Assessment.

An **Appropriate Assessment** is an assessment of the potential adverse effects of a plan or project (in combination with other plans or projects) on Special Areas of Conservation (SAC) and Special Protection Areas (SPAs). These sites are protected by National and European Law.

The "Unconstrained Option List" therefore comprises solutions that either fully or partly resolve a water supply Deficit regardless of cost, and with only high-level environmental considerations. The detailed environmental constraints are assessed during the Coarse Screening (Stage 4) and Fine Screening (Stage 5) stages of the Option Development Process.

We identified **1,054 Unconstrained Options** for the RWRP-SE.

Figure 6.5 shows the number of Unconstrained Options by Option Type.

Thirty-one percent (31%) of the 1,054 Unconstrained Options identified for the RWRP-SE involve rationalisation, which refers to the merging of water supply systems and the subsequent decommissioning of the obsolete water infrastructure and associated abstractions. These Options may require a new or enhanced supply source - for example, a new or enhanced groundwater or surface water abstraction or a water transfer from another supply system. The upgrade and/or expansion of existing WTPs may be carried out as part of a rationalisation process.

Thirty percent (30%) are local groundwater abstractions and (17%) are local surface water abstractions. These are either an expansion of an existing abstraction site or the development of new sites to meet the Needs of WRZs within close proximity. These Unconstrained Options are usually combined with WTP capacity upgrades.

Water transfers make up 17% of Unconstrained Options. As with the rationalisation of supplies, many of these require an additional or upgraded source.

Four percent (4%) of the Unconstrained Options are WTP upgrades that have been identified for WRZs that are not in supply Deficit but require water quality improvements only.

The remaining one percent (1%) of the Unconstrained Options comprise:

- Desalination plants (for example, a small desalination plant in East Waterford to meet the estimated deficit of approximately 20,000 cubic metres per day in 2044.
- Conjunctive Use involving the combined use of surface and groundwater sources.
- Advanced Leakage Reduction additional to the reduction achieved through our national Leakage Reduction Programme (as outlined in Section 3.2.6.6 and 5.2 of the RWRP-SE), which aims to meet our Sustainable Economic Level of Leakage targets (SELL). The Advanced Leakage Reduction Options will go beyond the SELL targets and reduce the calculated SDB Deficit.

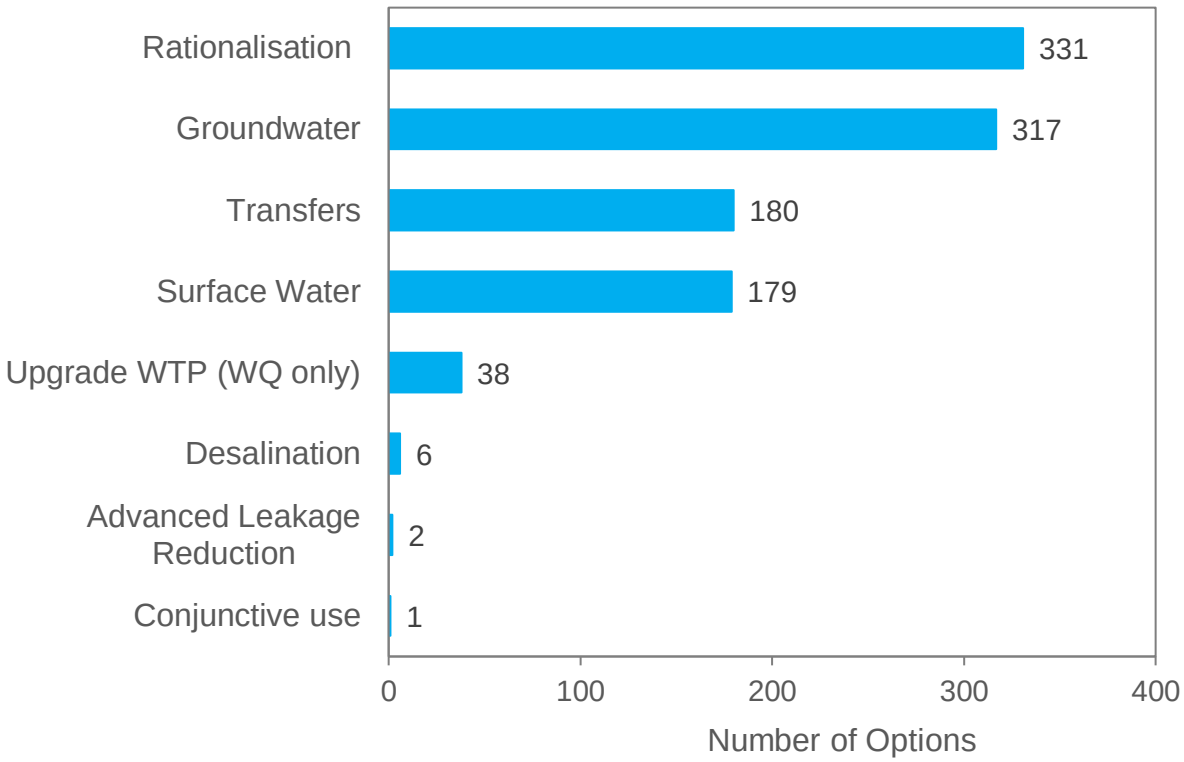


Figure 6.5 Unconstrained Option Types

6.2 Option Screening

Following the development of the Unconstrained Options List, a two-stage screening process (Coarse Screening and Fine Screening) is applied to the 1,054 Unconstrained Options to develop the 'Feasible Option List' for each Study Area.

6.2.1 Coarse Screening

The Coarse Screening process assesses the Options against the criteria outlined in Table 6.1. The process allows the assessment of the Unconstrained Options to eliminate any that will not be viable when assessed against the three (3) high-level criteria. The Options are assigned a red, amber and green rating according to the descriptions in Table 6.2.

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 Framework Plan Level costing for an Option.

Coarse screening allows us to better understand the scope of Options at a plan level, and factor this into plan level costing. The process is explained in Section 8.3.4 of the Framework Plan with details on the environmental screening presented in Chapter 9 of the SEA Environmental Report for the Framework Plan.

Table 6.1 '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 Social Impacts)	Q4	Can the impacts on known high level environmental constraints including at internationally designated sites be avoided?	Yes / Maybe / No

Table 6.2 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. * 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.

The total number of Options rejected and passed at Coarse Screening for each Study Area is shown in Figure 6.6 and outlined in the Rejection Register Summary in Annex B of the Study Area Technical Reports (Appendices 1 - 3).

There were **276 Options rejected for the Region** after being assessed against the Coarse Screening criteria of Resilience, Feasibility and Environment. The remaining 778 Options (of the 1,054 Unconstrained Options) are taken forward for Fine Screening. The Rejection Register Summary is outlined in Annex B of the Study Area Technical Reports (Appendices 1 - 3).

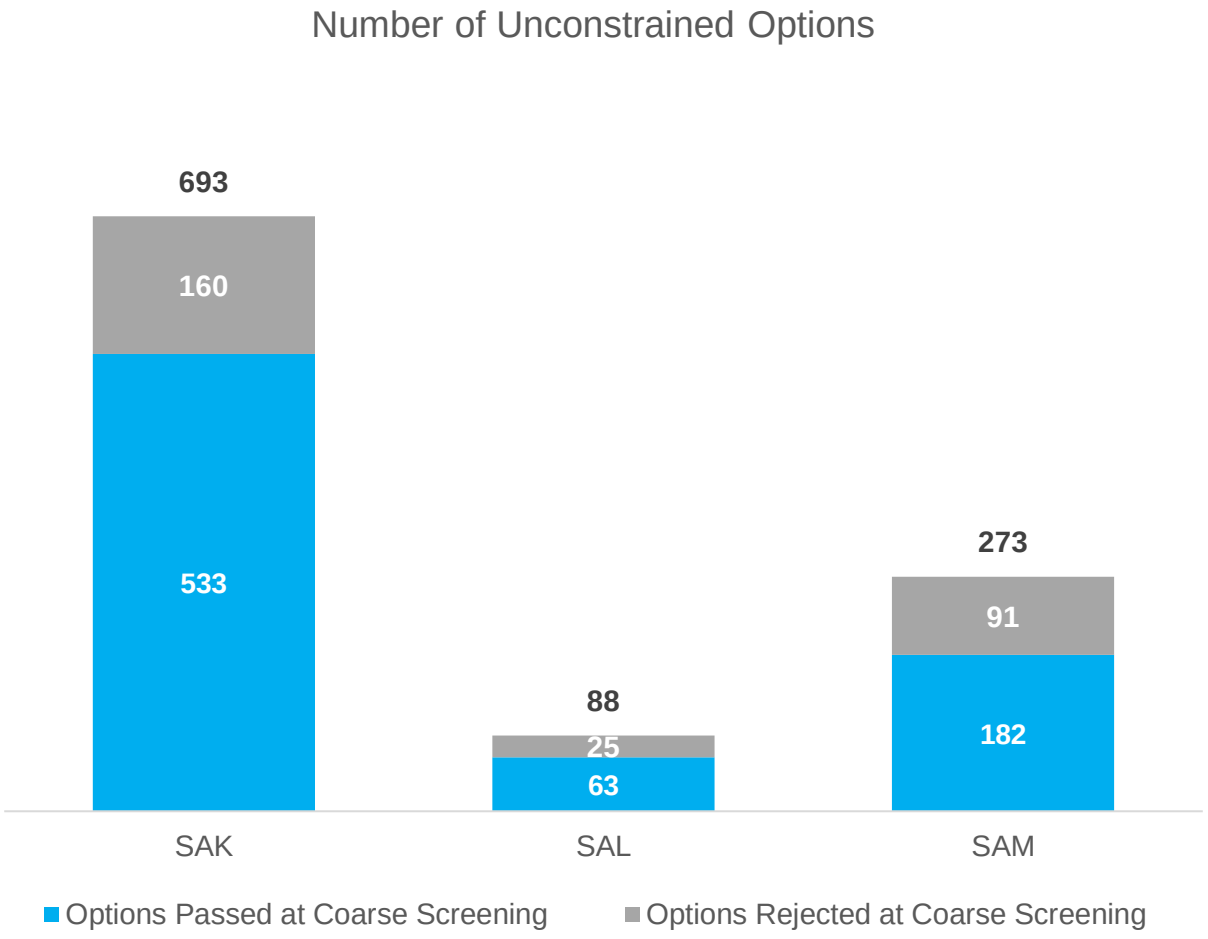


Figure 6.6 Coarse Screening Results

6.2.2 Fine Screening

Fine Screening involves a more detailed desktop assessment of the Options that have passed Coarse Screening, 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.

The MCA process allows a combination of issues to be considered together and allows us to assess the Options relative to each other. This can help indicate if one (1) 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.

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. It applies a common set of questions to determine the relative merits of each Option across the key criteria. Thirty-three questions are developed by dividing the criteria from the Coarse Screening stage into detailed sub-criteria against which Options can be assessed. The environmental MCA criteria are based on the SEA objectives from the SEA Scoping Report and have been consulted on with environmental stakeholders.

Habitats Directive considerations have been integrated into the Options Assessment Methodology at a number of points to ensure both robust assessment and protection are integrated into the NWRP. In particular, this is demonstrated through the MCA Fine Screening scoring for the European sites and biodiversity, and again, through consideration of mitigation measures to avoid adverse effects that have

been identified. Table 8.6 of the Framework Plan lists the criteria, sub-criteria and questions that are applied at the Fine Screening Stage and Section 8.3.5 describes the approach in further detail.

It should be noted that comparable projects which may have been rejected at Coarse or Fine Screening in one Study Area may, in some limited cases, be brought through as Feasible Options in another. This would only occur if there were no other Options available or the size or location of the projects differed to the extent that the project was deemed feasible. An example of this is where there are a very large number of Options passed at Coarse Screening stage within a particular Study Area. In this instance, Fine Screening is useful for identifying the poorer performing Options (on a relative basis), noting that these Options may not strictly speaking be "unfeasible". In these circumstances, Options identified as relatively poorer performing are removed or placed on a reserve list. The relatively better performing Options are then taken forward for further consideration in the "Feasible" list. Any Options which are discounted at this stage are recorded on the Rejected Options Register. This method can be appropriate for large WRZs or Study Areas where there are a large number of potential Options for resolving Need.

For more limited numbers of Options within any WRZ or Study Area, Fine Screening is best used as a check. This is considered an appropriate method where Options are likely to have been identified with some constraints. Only Options identified as clearly unfeasible, unsustainable or unviable are 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 is carried forward to the Feasible list with risks identified.

The general aim is to keep Options in for further consideration and to only remove Options where there is a clear justification for doing so and to avoid unnecessary further Option development and assessment work on unfeasible Options. Where there is uncertainty or potential for issues to be addressed through design or mitigation, Options are retained. This allows Uisce Éireann to consider the widest reasonable range of Options, and to ensure the best overall outcome is identified as the Preferred Approach.

There were no further Options rejected at the Fine Screening stage. Therefore, **798 Options were taken forward as Feasible Options.**

Table 6.3 summarises the number of Options selected at each stage of the screening process and the final number of Feasible Options for each Study Area.

Table 6.3 Number of Options at each Stage of the Screening Process

Study Area	Unconstrained Options	Feasible Options (following Coarse and Fine Screening)
SAK	693	533
SAL	88	63
SAM	273	182
TOTAL REGION	**1,054**	**778**

6.2.3 Rejection Summary

Details of the rejected Options and the justification for their rejection are outlined in Annex B of the Study Area Technical Reports (Appendices 1 - 3) for both Coarse Screening and Fine Screening. The rejection summary records the criteria against which the rejected Options were assessed. Box 6.1 provides an example of a rejection justification for an Option in SAK.

An Option is rejected if it fails against any one of the screening criteria. Some Options are screened out for multiple reasons. Table 6.4 shows the total number of Options rejected during the Coarse Screening and Fine Screening stages.

Table 6.4 Rejected Options Summary

Number of Options	Reason for Rejection
123	Resilience, Deliverability & Flexibility & Sustainability
108	Deliverability & Flexibility
1	Reliability & Sustainability
1	Resilience
43	Other reasons such as repeat Options or operational Options which did not provide additional supply.
276	**Total**

Box 6.1- Example Rejected Option

Option SAK-061 - Study Area K

Increase surface water abstraction from River Blackwater (Mullinavat) and upgrade the Mooncoin (Clanassy) WTP to supply the deficit for South Kilkenny Environs WRZ.

Rejection Reason:

The River Blackwater is a WFD good status waterbody at the point of abstraction. Abstracting the volume of water required to make this a Feasible Option is considered likely to result in the waterbody not achieving the WFD objectives and adverse effects on the River Suir Special Area of Conservation (SAC) downstream. Therefore, this Option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

6.3 Feasible Options

The Screening process produced **778 Feasible Options for the Region.** These Options or a combination of these Options are then appraised to select our Preferred Approach (solutions) to resolve the Deficit across the South East Region.

6.3.1 Feasible Option Types

Of the 778 Feasible Options, 211 of these are referred to as WRZ Options. These Options are only sufficient to resolve Need in a single WRZ in the vicinity of the source. The remaining 567 Options are Study Area Options which can resolve the Deficit in more than one (1) WRZ within a Study Area. This is summarised in Table 6.5 for each Study Area. A WRZ Option or SA Option may consist of individual or multiple projects that can meet the Deficit in a particular area. The NWRP identifies and, where suitable, groups these projects as Options to meet Need but the individual components of the relevant Option may be rolled out over multiple investment cycles or under different programmes. For instance, an Option could consist of a mixture of a Leakage Reduction Programme, Capital Maintenance Works, and WTP upgrades that, when all are complete, will ultimately address the Need. The benefit of the NWRP is to provide a holistic view of the different types of Options that can collectively resolve the identified Need.

Box 6.2 and Box 6.3 provide an example of a WRZ Option and SA Option, respectively.

Table 6.5 Number of Feasible WRZ and SA Options

Study Area	No. of WRZs	Number of Feasible Options	
		WRZ Option	SA Option
SAK	75	154	379
SAL	10	18	45
SAM	26	39	143
Total	111	211	567

Box 6.2 - Example of a WRZ Option

New and increased groundwater source and new WTP to address the deficit for Sow Regional WRZ

(Study Area M, Wexford and Wicklow)

WRZ: Sow Regional WRZ

Option Type:Groundwater source

The Sow Regional WRZ supply deficit will be met by two (2) WRZ options:

1) An upgrade to the existing Killmallock Bridge WTP, associated groundwater abstraction and pumps, and the construction of approximately 2km of new water mains; and
2) Development of a new groundwater abstraction, new WTP, new storage, new pump station and approximately 8km of new network.

Ballinellard WTP will be upgraded to improve water quality processing capability.

The locations and details of required mains, network upgrades and service reservoirs will be determined at project level.

Box 6.3 - Example of a Study Area Option

New surface water abstraction and rationalise nine (9) WRZs to the East Waterford Water Supply Scheme

(Study Area K, Wexford and South Tipperary)

WRZs: East Waterford Water Supply Scheme, Smoore, Faha, Fews, Dunhille-Cois Coille, Sunhill Ballinageeragh, Ballyogarty, Kilmacthomas, Scrahan, Kill/Ballylaneen

Option Type: Surface Water, rationalisation

This Option proposes to develop a new surface water abstraction from the River Suir upstream of Carrick-on-Suir, and pump raw water to Adamstown WTP, which serves Waterford City and the eastern parts of the county including Tramore and Dunmore East. The upgraded scheme will be expanded to serve eight (8) WRZs in the study area (listed above), enabling the decommissioning of ten existing water treatment plants. The option will include a new storage, new pumps and approximately 89km of new watermain.

The locations and details of any required mains, network upgrades and service reservoirs will be determined at project level.

Table 6.6 and Figure 6.7 compare the number of Feasible Options by Option Type for each Study Area. Options that involve an increased existing or new surface water or groundwater source make up 42% of the Feasible Options. Thirty-three percent (33%) of the Options involve rationalisation, where multiple WRZs are merged and redundant infrastructure is decommissioned; while transfers from WRZs within the same Study Area (without rationalisation) make about 19%. Where a WRZ is not in Deficit, it is only the water Quality Need that it is addressed through new or upgraded WTPs. This represents 5% of Feasible Options. The remaining one percent (1%) of Options include desalination and conjunctive use.

Table 6.6 Feasible Options by Option Type

Option Type	Study Area			
	SAK	SAL	SAM	Total
Rationalisation	212	20	28	260
Groundwater	164	23	42	229
Transfers	50	7	94	151
Surface Water	78	11	10	99
Upgrade WTP (WQ only)	27	2	7	36
Desalination	2	0	0	2
Conjunctive use	0	0	1	1
Total	**533**	**63**	**182**	**778**

**Upgraded WTPs refers to treatment plants where only water Quality improvements are proposed as the WRZ is not in Deficit.*

*** Conjunctive Use refers to Options that involve combined surface water and groundwater supplies.*

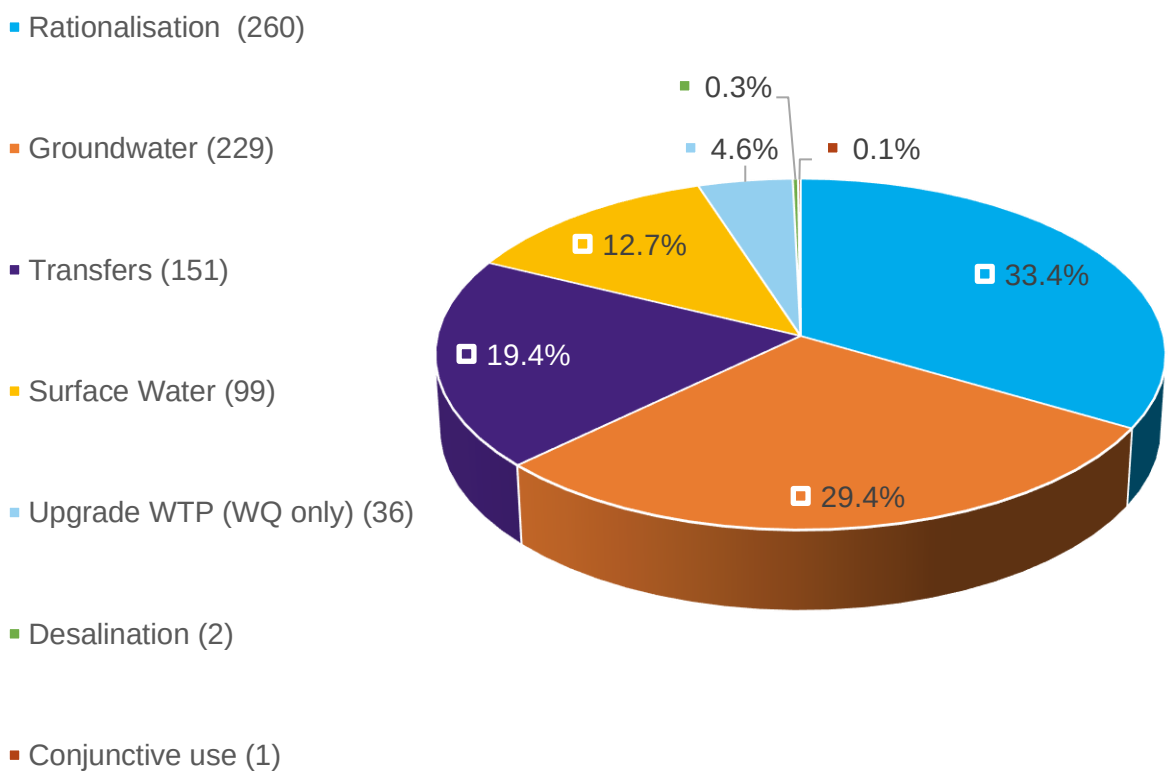


Figure 6.7 Feasible Option Types

6.3.2 Option Costing

An outline design and estimated cost is developed for each Feasible Option and summarised within Option dossiers. At this stage, designs, costings and environmental assessments are desk-based and plan level assessments. These aspects are further developed at project level

As the RWRP-SE level costing is intended to be a comparative assessment between Option types identified by the plan (independent of the existence of any “in-flight” projects), we do not include detailed project level costing for “In-Flight Projects” when identifying Preferred Approaches as we might only have this information for a few Feasible Options. This is to ensure that the methodology in this Framework Plan is uniformly applied in the development of Preferred Approaches.

Environmental and Social Valuation

In addition to the construction and operational cost estimates and qualitative environmental Options assessment, an environmental and social valuation of the Feasible Options is undertaken to provide monetised values to feed directly into the Approach Development Process, which is used to select the Preferred Approach.

While the SEA methodology is based primarily on qualitative assessments to consider if potential effects are likely to be significant, this is informed by quantitative information such as GIS based analysis. In addition, where possible the valuation of environmental and social costs and benefits (including carbon) are used to inform Options appraisal. This involves monetising societal impacts and benefits and is undertaken through a range of environmental economics tools, including natural capital accounting and ecosystems services assessment methodologies. These approaches are new and are still being developed but are likely to be increasingly used in the future.

The areas covered for the environmental and social costings are:

- Climate regulation – woodland;
- Traffic impacts – opportunity cost of time due to road congestion from roadworks;
- Food – crops and livestock; and
- Carbon emissions (calculated alongside the construction and operational costs for the Options).

The aim of the calculations is to capture and value significant residual impacts in relation to the categories examined for each Option. This can be especially valuable for providing information on combinations of Options. The categories that can be used depend on the Option and environmental information available to allow quantification metrics and valuation.

The approach for valuation of environmental and social costs and benefits aims to provide a framework for developing Natural Capital methodology in the future. This is described in Appendix E of the SEA Environmental Report. The costings complement the qualitative assessment undertaken through the SEA and are included as part of the Options assessment reported in the Study Area Technical Reports.

The Option costing information, and desk-based design and environmental assessments are used in the Approach Development Process described in Section 7.

6.4 Project Level Summary

As previously noted in this section, the Feasible Options are considered at plan level and the assessment of the Options are desktop-based. Any Options that are progressed following NWRP will be considered in more detail at project level. The following sections provide an overview of the project development process.

6.4.1 Data Review

The first step prior to the development of any solution will be to carry out a review of the data feeding into the project. The data that is reviewed at project level will include, but will not be limited to, the following:

- Supply Demand Balance – This will be updated at project level to align recent projected growth with actual growth, include new data on population growth and non-domestic growth. We will consider specific demand requirements of any Strategic Development Zone or Metropolitan Areas within the WRZ and incorporate improved information on water availability assessments and climate change impacts. At this stage we will also review assumptions relating to peaking and headroom factors and leakage targets, which are based on the size of WRZs. For example, if the Preferred Approach merges WRZs to form a larger interconnected WRZ, the benefits of increased resilience and supply security will allow for potential reduction in peaking and headroom factors. This will reduce the estimated demand and correspondingly, the Deficit. Similarly, changes to leakage targets will impact the Deficit and need to be considered. For example, if we build a new WTP we assess the demand profile of that supply over 25 years and then deliver the capacity in modules to align with demand increase. Therefore, if we meet or exceed our leakage targets and the demand is less, we do not build the last modules of the new WTP, thus balancing supply with demand.
- Water Quality – A review of the existing infrastructure impacted by the Preferred Approach will be carried out to identify any recent water Quality Need which should be included in the project. If Drinking Water Safety Plans have been completed, these will be reviewed to ensure the solution resolves any outstanding significant risks.
- Environmental baseline – A full review will be completed to reflect any changes in designations or waterbody status.

6.4.2 Project Development

In addition to refining the data feeding into the project, the scope and design of the project will be developed in parallel with a number of feasibility and environmental assessments and stakeholder engagement.

The Options will be developed to ensure all potential opportunities that can be afforded by the solution are realised. This might include an augmentation of the Option in line with our Biodiversity Action Plan[3] or Energy Efficiency Plan. For example, at plan level we would have assumed the yield required from a source needs to meet the customer demand with an allowance for process losses at the WTP. At project level, further to water quality assessments the process engineers may be able to design a plant with limited to no process losses. Such a design would reduce the overall environmental impact of the project. Another example of this would be the development of renewable energy as part of a project. At our newly developed Thurles WTP, 230 solar panels were included in the design.

Where we are looking to bring on new sources, the catchment assessment of the Drinking Water Safety Plans will be developed at the project level to ensure there is an understanding of all risks in the catchment feeding the new source. At this stage we will consider any nature-based solutions which could complement the Option. Such solutions could reduce the volume of chemicals required in the treatment process.

An example of a nature-based solution is the Dunhill Integrated Constructed Wetland located in County Waterford. We are working in partnership with Waterford City and County Council and the local community to progress final works. The wetland is responsible for the treatment of all the wastewater from Dunhill village.

In projects where the Preferred Approach includes the decommissioning of a WTP and associated abstractions, to reduce risk to our customers the existing abstractions and associated infrastructure will not be decommissioned until the commissioning phase of the new project is completed and an abstraction license for the new or existing alternative source has been obtained. Many of our existing abstractions are facilitated by the presence of structures such as a weir or dam and these can create obstacles for fish passage. When we decommission abstractions facilitated by structures the possibility of removing these structures will be considered. Many of these structures are not owned or operated by Uisce Éireann and as such, their removal will need to be considered in consultation with the relevant stakeholders.

6.4.3 Project Level Assessments

In parallel to the development of the project scope, design feasibility and environmental assessments will be required. The level of assessments required will depend on the size and scale of the solutions.

Assessments at project level will typically include:

- Hydrological and hydrogeological assessments of yield - These will include the collection of specific data. A critical aspect of the project level yield assessments will be to ensure that the development of a new source for water supply will not impact other existing sources or other water users. For example, if we are looking to develop a new groundwater source, we would need to determine that these sources do not impact any existing abstraction such as an existing Uisce Éireann or Group Water Scheme groundwater source or an existing abstraction required for industry or agricultural use. This would be assessed by installing water level monitors on existing boreholes that could be impacted by the new source for the duration of the pump testing.
- Environmental assessments, including an Appropriate Assessment (AA) screening, Environmental Impact Assessment (EIA) screening and WFD assessments - Outputs from the hydrological and hydrogeological assessments will be a key factor in the determination of the level of environmental

assessments required, as these will provide more information on the boundary of any potential environmental impacts. For example, pumping tests may indicate that the zone of contribution for an aquifer is larger than initially anticipated and confirm a link with a Special Area of Conservation (SAC). In such a scenario, any potential impact to the SAC will need to be considered as part of the environmental assessment for the project. Where the requirement for AA or EIA is identified, further site-specific environmental assessments will be required, and the scope of these works will need to be developed in consultation with the relevant stakeholders.

- Water Quality assessments - These will include the collection of samples of raw water from the proposed source to determine the required treatment process.
- Site selection and route selection assessments - While the indicative locations of infrastructure have been provided in the Plan, the actual routes and location of assets will need to be considered in more detail at project level. At this stage details of all existing infrastructure, including underground services, will be obtained. This, along with environmental constraints, and specific needs for any Metropolitan Areas or Strategic Development Zones will be considered in the determination of the preferred route/site.

Stakeholder engagement is also an important aspect to project development. The extent of engagement will be dependent on the size and scale of the project but will typically include environmental stakeholders, landowners, the general public, Local Authorities, and asset owners (Group Water Schemes, the Electricity Supply Board (ESB), Bord Gáis etc).

6.4.4 Next Steps

If at project level it is determined that a Preferred Approach is not feasible, consideration will be given to other Feasible Options outlined in the RWRP-SE. If there is a change to the Preferred Approach, but this impacts a single WRZ then there is no variation to the RWRP-SE; however, the change will be assessed at project level. This envisages a situation where refinements to a single project, or closely related project within a WRZ, will be considered within their own environmental assessments. The change would not have any systemic impacts on the wider RWRP-SE.

6.5 Summary

This section describes our approach to identifying and assessing Options to produce a Feasible Option List for the South East Region. Our approach involved:

- Identification of 1,054 Unconstrained Options through assessments undertaken by a specialist team and workshops with our Local Authority partners;
- Coarse screening, against the Resilience, Deliverability and Flexibility, and Sustainability criteria. At this stage 276 Options were rejected, and 778 Options passed to the Fine Screening stage;
- Fine screening, against 33 sub-criteria using a Multi-Criteria Assessment (MCA). Plan level environmental assessments were undertaken as part of the screening process. There were no further Options rejected at this stage. Therefore, the 778 Options passed at coarse screening were developed as Feasible Options.

The environmental MCA criteria are based on the SEA objectives from the SEA Scoping Report as consulted on with environmental stakeholders; and

Habitats Directive considerations have been integrated into the Options Assessment Methodology at a number of points to ensure both robust assessment and protection are integrated into the Plan.

The 778 Feasible Options consist of 211 WRZ Options that can meet local Needs only and 567 SA Options that can meet the Needs of multiple WRZs. They comprise a wide range of Option Types including:

- 328 (42%) local surface or groundwater Options
- 260 (33%) rationalisation Options; This consists of merging supply systems and decommissioning obsolete infrastructure, and is usually accompanied by increased or new groundwater and/or surface water abstraction/s;
- 151 (19%) transfer Options, usually accompanied by increased or new groundwater and/or surface water abstractions;
- 36 (5%) WTP upgrades for Water Quality for Study Areas not in Deficit; and
- 3 (1%) Options include desalination (2), and conjunctive use (1).

An outline design and estimated cost is developed for each Feasible Option. The Option costs include monetised values for environmental and social aspects and embodied and whole life carbon costs.

6.6 References

1. Central Statistics Office. (2023). Ireland's UN SDGs - Report on Indicators for Goal 6 Clean Water and Sanitation: Overview – SDG 6 Clean Water and Sanitation. [Online]. Available from: https://www.cso.ie/en/releasesandpublications/ep/p-sdg6/irelandsunsdgs2019-reportonindicatorsforgoal6cleanwaterandsanitation/overview-sdg6cleanwaterandsanitation/.
2. UK Technical Working Group (UKTAG). 2013. River flow for good ecological potential. Final Recommendations.
3. Irish Water. 2021. Biodiversity Action Plan. [Online]. Available from: https://www.water.ie/projects/national-projects/biodiversity/.

7 Preferred Approach – Study Area

7.1 Introduction

The purpose of this section of the RWRP-SE is to examine all potential Feasible Options that could be used to address the identified Need (both in terms of Quantity and Quality) across the 111 Water Resource Zones (WRZs) in the South East Region. The Approach Development Process, which is set out in Section 8.3.7 of the Framework Plan, seeks to identify the Preferred Approach for addressing Need at three (3) spatial Levels: individual WRZs, Study Area (SA) Level, and Regional Level (Figure 7.1). This process involves comparison of the Feasible Options at each level using defined criteria.

The Approach Development Process is undertaken sequentially for each WRZ and Study Area, before looking at approaches to address Need at a wider Regional Level. This Section will outline how the process is applied at WRZ and Study Area Level and Section 8 outlines the development of the Preferred Approach at Regional Level.

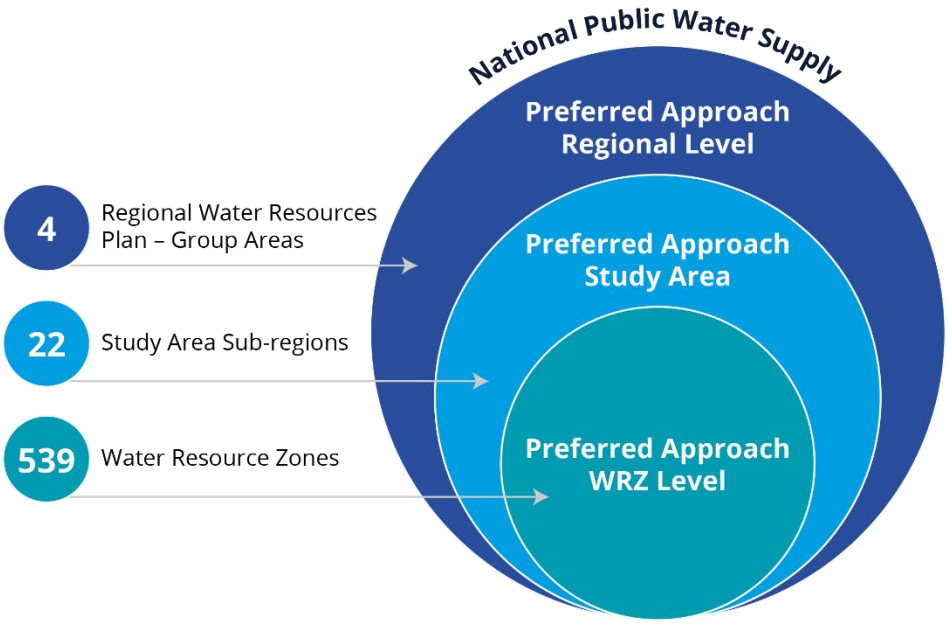


Figure 7.1 Spatial Level Assessment

The process we follow, which is based on a hierarchical view of the South East Region, allows us not only to resolve Need across the individual supplies, but also allows us to understand the potential for the strategic possibilities for collective water supply needs across the South East Region. This complete view means that each WRZ is no longer looked at in isolation (which was historically the case). It also enables the establishment of a wider plan that allows for the integration of WRZs, in circumstances where such integration is identified as the best outcome. This approach aligns with other jurisdictions that have fewer WRZs and will help deliver a more sustainable and cost-effective water supply service.

This section,

- Outlines the Approach Development Process we have implemented to determine the Study Area Preferred Approach (Section 7.2).
- Describes the Study Area Preferred Approach we have developed to address long term Need within the South East Region and compares this with the WRZ Level Approach (Section 7.3 and 7.4).
- Summarises the Preferred Approach for each Study Area (Section 7.5).
- Presents the 'Interim Solutions' we have identified to address the short-term Needs within the South East Region (Section 7.6).
- Details the outcomes of the Sensitivity Analysis of each of the Preferred Approaches to changes in climate change, abstraction limits, leakage targets and growth projections (Section 7.7).

7.2 Approach Development Process

7.2.1 Approach Categories

The Framework Plan establishes an Approach Development Process (Section 8.3.7) to compare various Options to address the Need within each WRZ and Study Area, and across the South East Region as a whole. This process is designed to identify the Option that meets estimated Deficits while providing the best overall outcomes when considered against a range of criteria based on policy objectives.

Specifically, the Approach Development Process assesses the Feasible Options under six (6) defined "Approach Categories". These categories are Least Cost, Best AA (Best Appropriate Assessment), Best Environmental, Most Resilient, Lowest Carbon and Quickest Delivery. These Approach Categories were selected to align the National Water Resources Plan (NWRP) with relevant Government Policy. The six (6) categories, along with the associated policy drivers, are summarised in Table 7.1 and explained in more detail below. We use these Approach Categories as a starting point to determine the best performing Option to meet the Deficit, relative to each Approach Category. For example, a “Least Carbon” approach would be the Option that would meet the Deficit and involve the least embodied and operational carbon load over the lifetime of the Option.

Table 7.1 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: 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. Score = -1 or -2 equates to LSEs that can be addressed with general/standard mitigation measures. Score = -3 equates to LSEs that may be harder to mitigate or require significant Project Level assessment.	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 This is particularly relevant where an Option might be required to address an urgent Public Health issue.	Statutory Obligations under the Water Supply Act and Drinking Water Regulations
Best SEA Environmental	This is the Option or combination of Options with the highest total score across the 19 No. Strategic Environmental Assessment (SEA) Multi-Criteria Assessment (MCA) sub-criteria questions.	SEA Directive and Water Framework Directive
Most Resilient	This is the Option or combination of Options with the highest total score against the four (4) resilience criteria. These include outages, financial uncertainty, regulatory changes, and climate change.	National Adaptation Plan and Climate Action Plan

Approaches Tested	Description	Policy Driver
Lowest Carbon	This is the Option or combination of Options with the lowest embodied and operational carbon cost	Climate Action Plan

Least Cost Approach

The Least Cost Approach is determined using an Uisce Éireann Net Present Value (NPV) assessment tool which establishes the Option with the lowest comparative NPV cost encompassing: Environmental and Social Costs, Carbon Costs, Capital Costs and Operational Costs. The NPV assessment tool utilises a strict set of requirements and is limited in the flexibility it offers. Therefore, where a number of Options provide similar NPV costs, so as to ensure that no such Options are excluded at this early stage by reference only to "least cost", Uisce Éireann has considered that all Options within a 5% NPV cost margin are, in principle, eligible to be identified as the "least cost" Option. This approach also recognises the desk-based nature of the NPV assessment, and the fact that these figures will change at project stage. To then determine the individual "least cost" Option in each case, Uisce Éireann has applied wider factors, including SEA and Habitats objectives, as part of its exercise of professional judgement (as explained in Section 8.3.7.4 in the Framework Plan). Further details of this approach are provided in Section 7.2.2. below. This approach also ensures that our plan level assessments align with the requirements of the Public Spending Code and the National Adaptation Framework[1].

Best Appropriate Assessment (Best AA) Approach

The Best AA approach gives maximum consideration to the Options with no potential for impacts on European Designated sites (no Likely Significant Effects or LSEs) or Options with LSEs that can be addressed with general/standard mitigation measures at the project level. This can equally be described as giving maximum consideration to the Option with the least impact on European Sites. This prioritises the avoidance of impacts on European Sites in the Option Assessment Process.

Options with high LSEs, which could lead to adverse effects on a European Site, will have already been removed at Coarse Screening stage.

Quickest Delivery Approach

The Quickest Delivery Approach 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 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 the identified Needs across the South East Region must be considered, 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 performing best overall across the 19 SEA objective-based Multi Criteria Assessment (MCA) environmental criteria, assessed as part of the Fine Screening assessment (described in Section 8.3.5 of the Framework Plan). Positive and negative scores

are summed separately. The purpose of this approach is to ensure that the SEA objectives to minimise potential impacts are considered through the Option Assessment and Approach Selection process. For each Option, we assess the MCA scoring in detail across all SEA assessment criteria, using the sum negative scores to indicate the potential for significant adverse effects and the sum positive to indicate the potential for beneficial effects. 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. When the combination with the lowest environmental score also scores any -3 score under the Best AA criteria, we review the other combinations to determine if there are any combinations with no -3-biodiversity score. The Best Environmental Option is the Combination with the best performing environmental score that has the least number of -3 scores against the best AA criteria.

Table 8.6 of the Framework Plan lists the criteria, sub-criteria and questions that are applied when completing the MCA assessment.

Most Resilient Approach

The Most Resilient Approach is the Option with the highest scores against four (4) resilience MCA screening criteria. These include outages, financial uncertainty, regulatory changes, and climate change. 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 with the lowest embodied and operational carbon costs. This approach is aligned with Uisce Éireann's carbon reduction policies and the National Adaptation Framework (NAF)[1] in relation to climate change.

7.2.2 Approach Ranking and Appraisal

The EBSD (Economics of Balancing Supply and Demand) method is applied to rank the Options in order of lowest to highest NPV cost and with regard to their applicable MCA scores for the six (6) Approach Categories. The EBSD method determines an optimum combination of Options to address the future Need, balancing across the range of NWRP and SEA objectives outlined above. Further detail on the EBSD method is outlined in Section 8.3.7 of the Framework Plan.

In some instances, Options may achieve similar, although not identical scores within an Approach Category. In these circumstances, to ensure that Options which perform better overall are not excluded from the Approach Development Process, Uisce Éireann takes a wider look at the combination to consider which of these comparable Options to categorise as the "Best" approach within each category. In particular, Uisce Éireann takes into account whether the Option or combination of Options meets the SEA and Habitats objectives outlined in the Framework Plan. This is an example of the exercise of professional judgement from the multi-disciplinary teams identified in Section 8.3.7.4 of the Framework Plan as being necessary.

We then compare the Option identified as the best performing within each of the six (6) Approach Categories (Least Cost, Best AA, Lowest Carbon etc.) against each other to come up with a Preferred Approach that meets the objectives of the Framework Plan and aligns with all relevant Government Policy. This comparison process is outlined in Figure 7.2. In this figure, the 'Modified Approach' refers to the Approach that is taken forward at Step 2 to Step 5. For example, at Step 2, if the Quickest Delivery Approach is determined to outperform the Least Cost Approach overall (when comparing the MCA scores of each Approach across the six categories), the Quickest Delivery Approach becomes the

'Modified Approach'. At Step 3, it is then the Quickest Delivery Approach (as the 'Modified Approach') that is compared against the Best Environmental Approach.

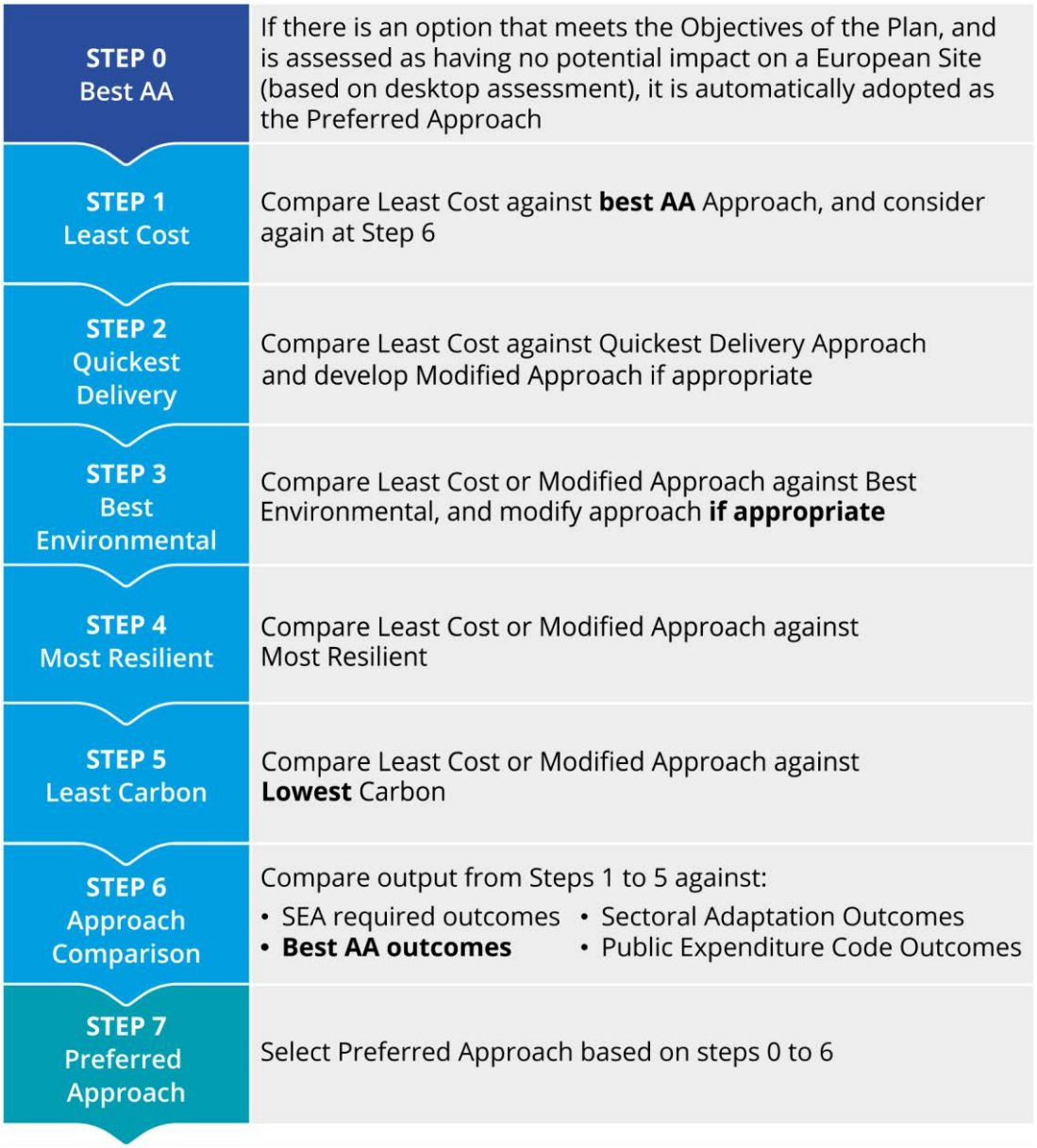


Figure 7.2 Seven (7)-Step Approach Development Process

This Approach Development Process is conducted via a combination of interactive workshops supported by a process of ongoing engagement and dialogue between the technical experts, including Engineers, Hydrologists and Hydrogeologists, Ecologists and Environmental Scientists working directly on the development of the Preferred Approach.

It should be noted that the identification of a 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. Assessments at this stage are desk-based and plan level assessments. No statutory consent or funding consent is conferred by inclusion of any Option in the NWRP. Any projects that are progressed following identification as a Preferred Approach in the Regional Plans, will require individual environmental assessments, including Environmental Impact Assessment and Appropriate Assessment (as required) in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

As explained in Section 6, the Option to resolve a Deficit can include a transfer of water from outside the WRZ or Study Area. The feasible source area will depend on the size of the demand centre. It is usually not feasible to develop Options that require small volumes of water to be transferred over a distance of five (5) kilometres or more, due to potential water quality issues associated with such transfers. The Approach Development Process contains three (3) tiers. We first start with WRZ Level and then apply the process sequentially to each Study Area and then the Region as follows:

Stage 1 – We assess the WRZ individually to develop an initial Preferred Approach, - WRZ Level Approach - for all of the supplies in the Study Area

Stage 2 – We assess whether there are any larger Options that might resolve Deficits across multiple WRZs. We then develop combinations of these Options (SA Combinations).

Stage 3 – We assess the SA Combinations and the WRZ Level Approach in order to determine the best performing combination across the six (6) Approach Categories. This is known as the Preferred Approach at SA Level.

We set out the process for identifying the Preferred Approach for WRZ and Study Area Level below, and Section 8 outlines how this is done at Regional Level.

7.2.3 Stage 1 – WRZ Level Approach

7.2.3.1 Test a Range of Approach Types - WRZ Level

The purpose of the NWRP is to examine all potential Options that could be used to resolve the Need within the WRZ (Unconstrained Options) and then to eliminate those that are not feasible or that have identifiable environmental issues at a desktop level (Option assessment and screening). This is set out in Section 6.

The remaining Feasible Options are categorised as Options that resolve the Need for one WRZ only ("WRZ Option"), and Options that resolve the Need for more than one WRZ ("Study Area Option").

To illustrate, Table 7.2 provides an overview of the number of feasible WRZ Options and Study Area Options for the 75 WRZs in Study Area K (SAK) in County Tipperary and Waterford.

Table 7.2 Study Area K – Option Types

Water Resource Zone	Option Type	
	WRZ Option	Study Area Option
Adramore/Kilrossanty	3	3
Aheeny	1	5
Anglesboro Water Supply	1	0
Ardfinnan Reginal	3	13
Ardmore	1	1
Ardmore Grange	2	2
Ballinvir	1	5
Balluguiry	2	2
Ballyknock	2	4
Ballylanders Water Supply	3	6
Ballymacarbry	2	0
Ballynoe/Melleray	1	0
Ballyogarty	2	6
Ballysaggart	1	4
Ballyshunnock	2	6
Boolavoonteen/Kilcooney/Touraneena	2	0
Burncourt Ballylooby	4	4
Callan PWS	3	3
Carrick-On-Suir	2	7
Carrigeen	1	2
Carrigmore	2	3
Carrignagower	1	5
Carrowgarriff	1	0
Clonmel & Environs	6	15
Coalbrook / Commons	1	3
Crehanagh	2	5
Deelish/Ballinacourty/Kilnafrehan	1	0

Water Resource Zone	Option Type	
	WRZ Option	Study Area Option
Dundrum Regional	7	5
Dungarvan	3	5
Dunhill	2	10
Dunhill Ballinageeragh	2	10
East Waterford Water Supply Scheme	5	19
Faha	2	2
Fethard & Mullenbawn Regional Public Water Supply	3	5
Fews	2	6
Galbally Water Supply	4	4
Galtee Regional	7	6
Garravoone	1	5
Garryahylish	1	1
Glenagad	1	4
Glengar	1	3
Graiguenageeha	1	4
Herbertstown	4	8
Horse & Jockey PWS	1	5
Inchinleamy	1	0
Kilbrien	1	0
Kilcash	1	7
Kil/Ballylaneen	1	5
Kilmacthomas	2	8
Kilmanahan	1	5
Kilteely	2	9
Knocklong / Hospital	3	10
Lacken	3	8
Liskealty	1	1

Water Resource Zone	Option Type	
	WRZ Option	Study Area Option
Lismore / Cappoquin / Ballyduff (LCB)	1	15
Littleton PWS	1	5
Lyrenaleara	1	0
Modeligo	1	0
Monatarrif	1	4
Moores Well	3	8
Piltown-Fiddown	1	2
Portlaw	2	6
Poulnagunoge (Waterford)	1	4
Rathgormack	1	4
Russelstown	1	5
Scrahan	1	6
Smoore	1	4
South Kilkenny	4	8
Stradbally	1	5
Templemore / Templetuohy	5	7
Templetney/Brackford Bridge PWS	4	15
Thurles / Borrisoleigh	2	10
Tipperary Town Supply	2	2
Tullohea	1	8
Two Mile Borris	2	4

Uisce Éireann's next step is to assess the Feasible WRZ Options for each WRZ and identify the best performing Option within each of the six (6) Approach Categories for the relevant WRZ. This is achieved by following the Seven (7)-Step Approach Development Process (Figure 7.2).

The Approach Development Process at WRZ Level is illustrated using the South Kilkenny & Environs WRZ in SAK. As can been seen from Table 7.2 above, there are four (4) feasible WRZ Options for South Kilkenny & Environs WRZ. We rank the four (4) WRZ Options against the six (6) Approach Categories using the EBSD tool. As set out in Table 7.3, Option SAK-060 performed poorly against all approach categories whilst option SAK-057 and SAK-282 were identified as the Best in only one approach category. Option SAK-648 was the Least Cost, Quickest Delivery, Best AA and Lowest Carbon option. It

was also comparable to SAK-057 in terms of resilience. This option was therefore identified as the Preferred Approach for South Kilkenny & Environs WRZ.

As previously mentioned, in some instances, Options may achieve similar, although not identical, scores within an Approach Category. As described in Section 7.2.2, where Options or combinations of Options achieve similar, although not identical scores under the six (6) approach types, Uisce Éireann takes a wider look at the comparable combinations/Options to consider which to categorise as the "Best" approach within each category. Therefore, prior to the Seven (7)-Step process, the Options that achieve similar scores for an approach category are compared to determine which approach should go forward as the 'Best' in that approach category.

Table 7.3 SAK, South Kilkenny WRZ - WRZ Options

WRZ Name	Feasible Options – South Kilkenny & Environs WRZ			Approach					
	No. of WRZ Options	Option Code	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA (Environmental)	Lowest Carbon	Most Resilient
South Kilkenny & Environs	4	SAK-057	Increase GW abstraction from existing BH's and upgrade Mullinabro WTP to supply deficit	-	-	-	-	-	✓
		SAK-060	New GW abstraction (productive fissured bedrock) and new WTP to supply deficit	-	-	-	-	-	-
		SAK-282	New wellfield and new WTP to supply deficit	-	-	-	✓	-	-
		SAK-648	Bring back Silverspring WTP to production and supply deficit	✓	✓	✓	-	✓	✓

7.2.3.2 Approach Appraisal - WRZ Level Approach

Once Uisce Éireann has identified the Option with the best outcomes within each of the Approach Categories, these Options are brought through to the Approach Development Process. As noted previously, this process allows us to compare the best ranked approaches within each category at WRZ Level relative to each other, to select the Option that provides the best overall solution for that WRZ. This process is demonstrated in Figure 7.3 for the South Kilkenny & Environs WRZ in SAK.

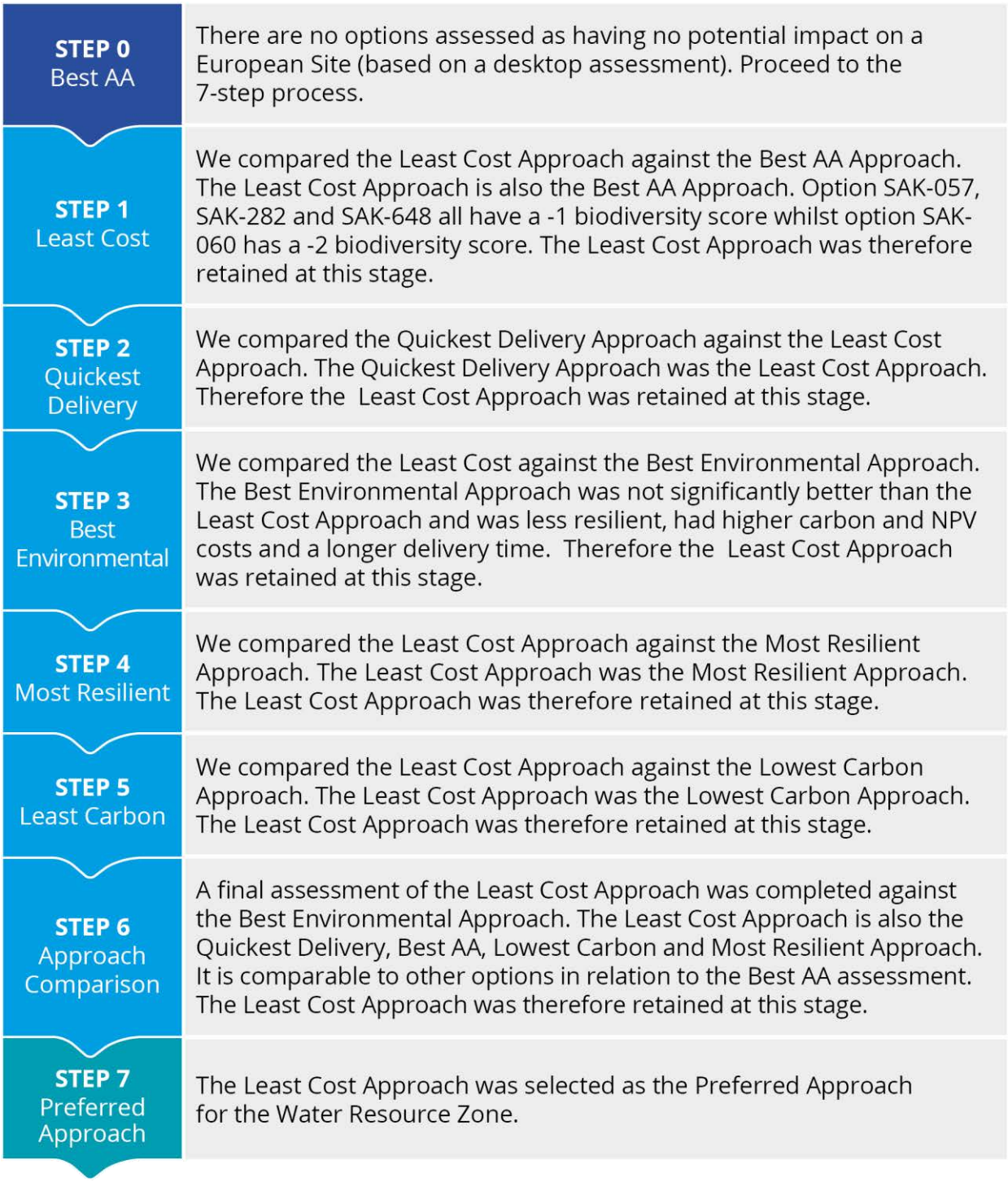


Figure 7.3 WRZ Level Preferred Approach Development – SAK, South Kilkenny & Environs WRZ

We follow this same process for the WRZs within each Study Area to establish the Preferred Approach for each WRZ across the three (3) Study Areas of the South East Region. The individual WRZ Preferred Approaches are combined and referred to as the **WRZ Level Approach**. This Stage 1 process is outlined in Figure 7.4.

Figure 7.4 Preferred Approach Development – Stage 1

The outcome of the Stage 1 process for SAK is summarised in Table 7.4. This shows the combination of the WRZ Preferred Approaches in the Study Area and their alignment with the six (6) Approach Categories, as determined by the application of the Seven (7)-Step process. Each of the 75 WRZs has a local Option available.

All study areas in the South East Region have a local WRZ option however nationally there may be no local WRZ Option available for some WRZs. For example, there are four (4) WRZs in Study Area A in the North West Region which do not have a feasible local Option. Such a scenario highlights the benefit of identifying Options at a broader Study Area Level (Section 7.2.4).

Even where a local Option is available for each WRZ, some of these Options may have the potential to meet the deficit of more than one WRZ. Combining WRZs into SA Option can be a good alternative to the local WRZ Option, as SA Options are likely to deliver cost efficiencies by supplying multiple WRZs. They also may provide wider environmental and social benefits through the rationalisation of infrastructure and abstraction points.

Table 7.4 SAK WRZ Level Approach –Assessment Outcome

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Adramone / Kilrossanty	SAK-450	Increase GW abstraction from Kilrossanty BH and upgrade Kilrossanty WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Ahenny	SAK-233	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit. Land acquisition required due to lack of space at the WTP site.	-	✓	✓	✓	✓	✓	✓	✓
Anglesboro Water Supply	SAK-055	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Ardfinnan Regional	SAK-156	New SW abstraction from River Tar and upgrade Goatenbridge WTP to supply deficit.	-	-	✓	-	-	✓	-	✓
Ardmore	SAK-392	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Ardmore Grange	SAK-625	Increase GW abstraction and upgrade WTP to supply deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Ballinvir	SAK-248	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Ballyguiry	SAK-472	Increase GW abstraction from Ballyguiry BH and upgrade Ballyguiry WTP to supply deficit.	-	✓	✓	✓	✓	✓	-	✓
Ballyknock	SAK-580	Increase GW abstraction from Ballyknock BH and upgrade Ballyknock WTP to supply deficit.	-	✓	✓	✓	-	✓	✓	✓
Ballylanders Water Supply	SAK-046	Increase GW abstraction at Ballylanders BH and upgrade Ballylanders Pump Station WTP to supply deficit.	-	✓	✓	-	-	-	✓	✓
Ballymacarbry	SAK-441	New GW abstraction (karstic) and new WTP to supply deficit.	-	✓	-	✓	✓	-	-	✓
Ballynoe / Melleray	SAK-386	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Ballyogarty	SAK-393	Increase GW abstraction from existing BH and upgrade Ballyogarty WTP to supply deficit.	-	✓	✓	✓	-	✓	✓	✓
Ballysaggart	SAK-420	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Ballyshunnock	SAK-481	Increase GW abstraction from BH and Ballyshunnock WTP to supply deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Boolavoonteen / Kilcooney / Touraneena	SAK-444	Increase GW abstraction from Touraneena BH and upgrade Touraneena WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Burncourt Ballylooby	SAK-211	Increase GW abstraction from no.2 BHs and upgrade Ballylooby Springs WTP to supply deficit.	-	✓	-	-	✓	✓	✓	✓
Callan PWS	SAK-077	Increase GW abstraction from existing spring and BH and upgrade Callan WTP to supply deficit.		✓	-	-	-	✓	-	✓
Carrick-On-Suir	SAK-202	New GW abstraction and new Linguan WTP to supply deficit.	-	✓	✓	-	✓	✓	-	✓
Carrigeen	SAK-548	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Carrigmore	SAK-123	Increase GW abstraction at Carrigmore BH and upgrade Carrigmore BH to supply deficit.	✓	✓	✓	✓	✓	✓	-	✓
Carrignagower	SAK-622	New GW abstraction and new WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Carrowgarriff	SAK-416	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Clonmel & Environs	SAK-140	New abstraction from the River Suir and new WTP at Barne (site identified)	-	✓	✓	✓	-	-	✓	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Coalbrook / Commons	SAK-247	New GW abstraction and new WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Crehanagh	SAK-585	Increase GW abstraction from Crehanagh BH and upgrade Crehanagh WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Deelish/Ballinacourty /Kilnafrehan	SAK-387	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Dundrum Regional	SAK-165	New SW abstraction from River Suir and new WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Dungarvan	SAK-461	Increase GW abstraction from no. 6 BH and upgrade Ballinamuck WTP to supply deficit.	-	✓	✓	✓	✓	-	✓	✓
Dunhill - Cois Coille	SAK-488	Increase GW abstraction from BH and upgrade Dunhill Cois Coille WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Dunhill Ballinageeragh	SAK-532	Increase GW abstraction from Dunhill BH and upgrade Dunhill Ballynageeragh WTP to supply deficit.	-	✓	✓	✓	-	✓	✓	✓
East Waterford Water Supply Scheme	SAK-260	New SW abstraction from River Suir upstream of Carrick-on-Suir. Pump raw water to Adamstown WTP and treat at Adamstown WTP to supply deficit.	-	✓	-	-	-	-	-	✓
Faha	SAK-499	Increase GW abstraction from Faha BH and upgrade Faha WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Fethard & Mullenbawn Regional Public Water Supply	SAK-225	Upgrade Fethard WTP for water quality improvements. WRZ is not in deficit.	-	✓	✓	-	✓	✓	-	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Fethard & Mullenbawn Regional Public Water Supply	SAK-219	Upgrade existing Dualla WTP for water quality improvements. The WRZ is not in deficit.	✓	-	✓	✓	-	-	-	✓
Fews	SAK-557	Increase GW abstraction from Fews BH and upgrade Fews WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Galbally Water Supply	SAK-038	Increase GW abstraction at Galbally BH and upgrade Galbally WTP to supply deficit.	-	✓	✓	✓	-	✓	-	✓
Galtee Regional	SAK-120	New SW abstraction from Aherlow river and upgrade Rossadrehid WTP to supply deficit.	-	✓	✓	-	-	-	-	✓
Garravoone	SAK-595	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Garryahylish	SAK-525	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Glenagad	SAK-568	Upgrade WTP for water quality improvements.	-	✓	✓	✓	✓	✓	✓	✓
Glengar	SAK-298	New GW abstraction and new WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Graiguenageeha	SAK-505	Increase GW abstraction from BH and upgrade Graiguenageeha WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Herbertstown	SAK-011	Increase GW abstraction at Herberstown Pump Station BH and upgrade Herbertstown WTP to supply deficit.	✓	✓	✓	✓	✓	✓	-	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Horse & Jockey PWS	SAK-089	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Inchinleamy	SAK-476	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Kilbrien	SAK-509	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Kilcash	SAK-250	New GW abstraction in karstic region and new WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Kill/Ballylaneen	SAK-601	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Kilmacthomas	SAK-428	Increase GW abstraction from Kilmacthomas School (spring) and upgrade Kilmacthomas WTP to supply deficit.	-	✓	✓	✓	✓	-	✓	✓
Kilmanahan	SAK-574	Upgrade WTP for water quality improvements.	-	✓	✓	✓	✓	✓	✓	✓
Kilteely	SAK-001	Increase GW abstraction at Kilteely BH and upgrade existing Kilteely WTP to supply deficit.	✓	✓	✓	✓	✓	✓	-	✓
Knocklong/ Hospital	SAK-029	Increase GW abstraction at Knocklong BH and upgrade Knocklong BH WTP to supply deficit.	✓	✓	✓	✓	✓	-	-	✓
Lacken	SAK-514	Increase GW abstraction from BH and upgrade Lacken WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Liskealty	SAK-478	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Lismore / Cappoquin / Ballyduff (LCB)	SAK-987	Increase GW abstraction from existing BH and upgrade LCB Lismore Deerpark WTP to partly supply deficit. New GW (commission 2018 TW) abstraction and upgrade Lismore Deerpark WTP to partly supply deficit.	-	✓	✓	✓	✓	✓	-	✓
Littleton PWS	SAK-113	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Lyrenaleara	SAK-569	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Modeligo	SAK-477	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Monatarrif	SAK-570	Increase existing GW abstraction and upgrade Monatarriff WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Moores Well	SAK-402	Increase GW abstraction from existing BH and upgrade Moore's Well WTP to supply deficit.	-	✓	✓	-	✓	✓	-	✓
Piltown-Fiddown	SAK-073	New GW and upgrade Jamestown WTP to supply deficit (progressing as project to address RAL).	-	✓	✓	✓	✓	✓	✓	✓
Portlaw	SAK-560	Increase GW abstraction from Portlaw BH and Portlaw spring and upgrade Portlaw WTP to partly supply deficit.	-	-	✓	✓	✓	✓	-	✓
Portlaw	SAK-618	New GW abstraction and new WTP to partly supply deficit.	-	✓	-	✓	-	-	✓	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Poulnagunoge (Waterford)	SAK-575	Increase GW abstraction from Poulavanogue BH and upgrade Poulavanogue WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Rathgormack	SAK-468	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Russelstown	SAK-498	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Scrahan	SAK-388	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Smoore	SAK-526	Increase GW abstraction from Smoor Beg BH and upgrade Smoorbeg WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
South Kilkenny	SAK-648	Bring back Silverspring WTP to production and supply deficit.	-	✓	✓	✓	-	✓	✓	✓
Stradbally	SAK-411	Upgrade existing WTP for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Templemore/Templetuohy	SAK-106	Rationalise Templetuohy to Templemore [rationalise to College Hill WTP]. Rationalisation within WRZ.	-	✓	-	-	✓	-	-	✓
Templetney/Brackford Bridge PWS	SAK-183	Increase GW abstraction from existing no.3 BHs and upgrade Templetney WTP to supply deficit.	-	-	✓	✓	✓	✓	-	✓
Thurles / Borrisoleigh	SAK-092	Upgrade existing WTPs for water quality improvements. The WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Tipperary Town Supply	SAK-180	New GW abstraction and new WTP to supply deficit.	-	✓	✓	✓	✓	-	✓	✓
Tullohea	SAK-237	New GW abstraction at Ninemilehouse and new WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Two Mile Borris	SAK-085	Increase GW abstraction from Two Mile Borris BH and upgrade Two Mile Borris WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓

7.2.4 Stage 2 – Study Area Combinations

As outlined in Section 6, there are three (3) types of Options considered within the NWRP:

- WRZ Option – Options that address Need in one WRZ only
- SA Option – Options that can address needs across multiple WRZs, generally within a Study Area
- Regional Option – Options that can address the needs in multiple WRZs across multiple Study Areas.

Accordingly, once the WRZ Level Preferred Approach for each of the individual WRZs has been identified, we determine whether there are alternative SA Options that can address need in more than one WRZ and replace the WRZ Options. Uisce Éireann then develops various combinations of Study Area Options and WRZ Options that can address the Deficit for the entire Study Area. These are called "SA Combinations". This Stage 2 process is summarised in Figure 7.5.

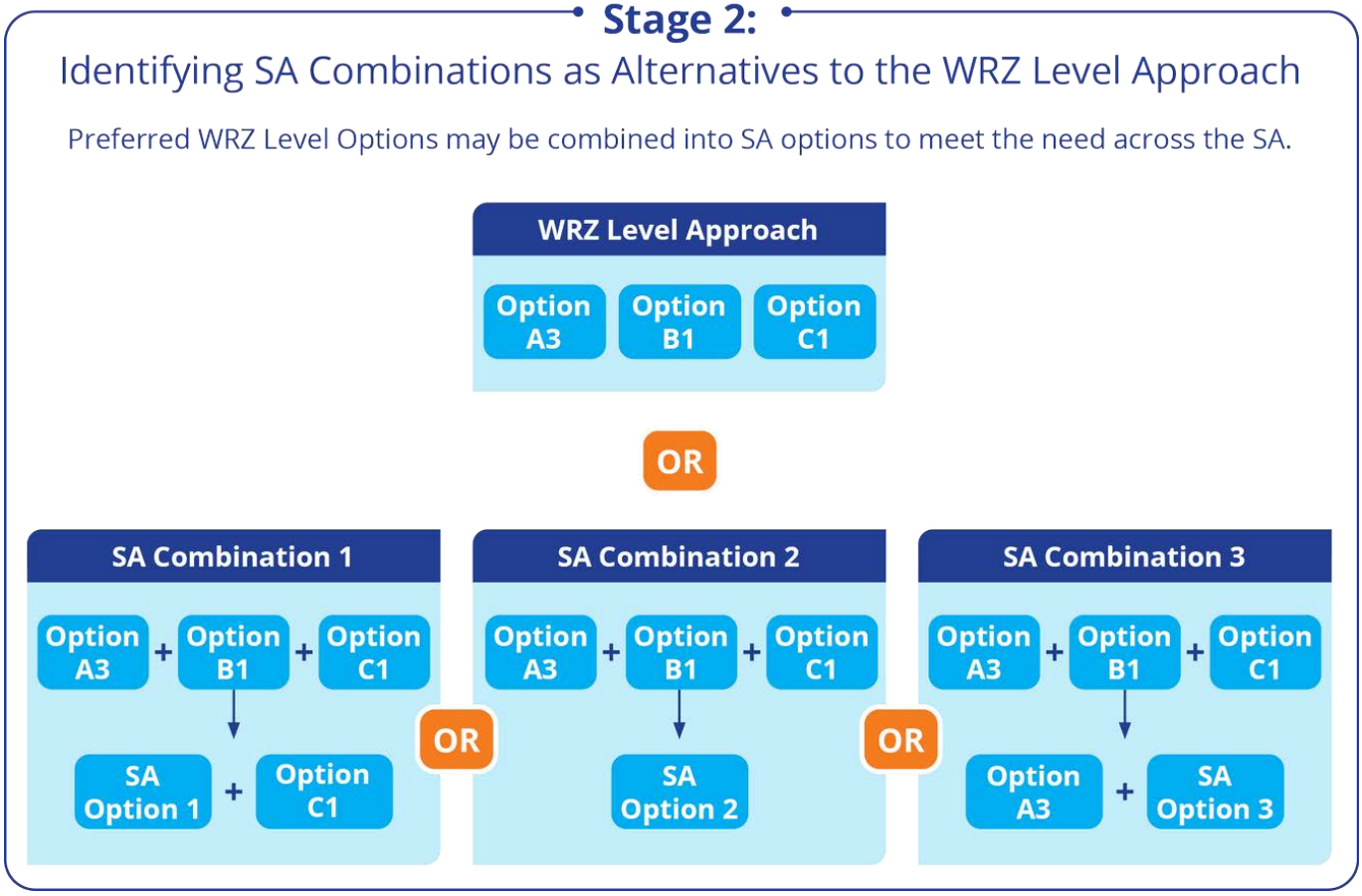


Figure 7.5 Preferred Approach Development – Stage 2

The WRZ Level Approach will form one of these combinations for assessment at the Study Area Level, if it can meet the full Deficit of the Study Area. Where this is not the case (that is, where feasible WRZ Options are not identified for all WRZs in the Study Area) the WRZ Level Approach is not included in the Seven (7) - Step Option Development Process.

In our example of SAK, twelve (12) SA Combinations were developed and taken through the Seven (7)-Step process to identify the 'Best' performing combination of Options across the six (6) Approach Categories. The combinations for SAK are summarised in Table 7.5.

Table 7.5 SAK SA Level Approach - Assessment Outcome

Key	WRZ Level Approach Option	O	SA Grouped Option	□

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 121, 149, 173, 175, 183, 185)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69,74,77,119,127,129,133,135,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187,190,191,192	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,78,129,142,15	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Adramone / Kilrossanty	O	O	O	O	O	O	□	O	O	□	O	O
Ahenny	O	O	□	□	O	O	O	O	□	O	□	O
Anglesboro Water Supply	O	O	O	O	O	O	O	O	O	O	O	O
Ardfinnan Regional	O	□	□	□	O	O	□	□	□	O	□	O
Ardmore	O	O	O	O	O	□	O	O	O	O	O	O
Ardmore Grange	O	O	□	O	O	□	□	O	O	O	O	O
Ballinvir	O	O	O	□	O	O	O	O	O	O	□	O
Ballyguiry	O	□	□	O	□	□	□	O	O	O	O	O
Ballyknock	O	O	O	□	O	O	O	□	□	O	O	O
Ballylanders Water Supply	O	□	O	□	□	□	O	□	□	O	O	O
Ballymacarbry	O	O	O	O	O	O	O	O	O	O	O	O
Ballynoe / Melleray	O	O	O	O	O	O	O	O	O	O	O	O

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 121, 149, 173, 175, 183, 185)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69,74,77,119,12 7,129,133,135,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187,190,191,192	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,78,129,142,15	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Ballyogarty	○	○	□	□	○	○	□	□	□	□	○	○
Ballysaggart	○	□	○	□	○	□	○	□	□	○	○	○
Ballyshunnock	○	○	○	○	○	○	○	○	□	○	○	○
Boolavoonteen / Kilcooney / Touraneena	○	○	○	○	○	○	○	○	○	○	○	○
Burncourt Ballylooby	○	□	○	○	○	○	□	○	□	○	○	○
Callan WS 1001	○	○	○	○	○	□	○	○	○	○	○	○
Carrick-On-Suir	○	□	□	□	□	□	○	□	□	○	○	○
Carrigeen	○	○	○	○	○	○	○	○	○	○	○	○
Carrigmore	○	○	○	□	□	□	□	□	○	○	○	○
Carrignagower	○	○	○	□	○	○	○	□	□	○	○	○
Carrowgarriff	○	○	○	○	○	○	○	○	○	○	○	○
Clonmel	○	□	□	□	□	□	□	□	□	○	□	○
Coalbrook / Commons	○	□	○	□	○	□	○	○	○	○	○	○
Crehanagh	○	○	○	□	○	□	□	□	□	○	○	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 121, 149, 173, 175, 183, 185)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69,74,77,119,12 7,129,133,135,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187,190,191,192	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,78,129,142,15	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Deelish /Ballinacourty	○	○	○	○	○	○	○	○	○	○	○	○
Dundrum Regional	○	□	○	□	□	□	□	□	□	○	○	□
Dungarvan	○	□	□	○	□	□	□	○	○	○	○	○
Dunhill - Cois Coille	○	○	○	□	○	□	○	□	□	□	○	○
Dunhill Ballinageeragh	○	○	○	□	○	□	○	□	□	□	○	○
East Waterford Water Supply Scheme	○	○	○	□	□	□	○	□	□	□	○	○
Faha	○	○	○	□	○	○	○	□	○	□	○	○
Fethard & Mullenbawn Regional Public Water Supply	○	○	○	□	○	□	○	○	○	○	○	○
Fews	○	○	○	□	○	□	□	□	○	□	○	○
Galbally Water Supply	○	○	□	□	□	□	○	□	□	○	○	○
Galtee Regional	○	□	□	○	□	□	□	□	□	○	○	○
Garravoone	○	○	○	□	○	□	□	□	□	○	○	○
Garryahylish	○	○	○	○	○	○	○	○	○	○	○	○
Glenagad	○	□	□	□	□	○	○	□	□	○	□	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 121, 149, 173, 175, 183, 185)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69,74,77,119,12 7,129,133,135,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187,190,191,192	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,78,129,142,15	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Glengar	○	□	○	□	□	○	□	○	□	○	○	□
Graiguenageeha	○	○	○	□	○	○	□	○	○	○	○	○
Herbertstown	○	□	□	□	□	□	□	□	□	○	○	○
Horse and Jockey	○	○	○	□	○	□	□	○	○	○	○	□
Inchinleamy	○	○	○	○	○	○	○	○	○	○	○	○
Kilbrien	○	○	○	○	○	○	○	○	○	○	○	○
Kilcash	○	□	○	□	○	□	○	○	□	○	□	○
Kill/Ballylaneen	○	○	○	□	○	○	○	□	○	□	○	○
Kilmacthomas	○	○	□	□	○	□	□	□	□	□	○	○
Kilmanahan	○	○	□	□	○	□	○	□	○	○	□	○
Kilteely	○	□	□	□	□	□	□	□	□	○	○	○
Knocklong/ Hospital	○	□	□	□	□	□	□	□	○	○	○	○
Lacken	○	□	○	□	○	□	○	□	○	○	○	○
Liskealty	○	○	□	○	○	○	□	○	○	○	○	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 121, 149, 173, 175, 183, 185)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69,74,77,119,12 7,129,133,135,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187,190,191,192	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,78,129,142,15	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Lismore / Cappoquin / Ballyduff (LCB)	○	○	○	□	○	○	○	□	○	○	○	○
Littleton	○	○	○	□	○	○	□	○	○	○	○	□
Lyreanearla	○	○	○	○	○	○	○	○	○	○	○	○
Modeligo	○	○	○	○	○	○	○	○	○	○	○	○
Monatarriff	○	□	○	□	○	□	○	□	□	○	○	○
Moores Well	○	□	○	□	○	□	○	□	○	○	○	○
Piltown-Fiddown	○	□	○	○	○	□	○	○	○	○	○	○
Portlaw	○	○	○	○	○	○	○	○	□	○	○	○
Poulavanogue (Waterford)	○	□	□	□	□	○	○	□	□	○	□	○
Rathgormack	○	○	○	□	○	○	○	□	□	○	○	○
Russelstown	○	○	□	□	○	□	○	□	○	○	□	○
Scrahan	○	○	○	□	○	○	□	□	○	□	○	○
Smoore	○	○	○	□	○	○	○	□	○	○	○	○
South Kilkenny Environs	○	○	□	○	□	□	○	○	○	○	○	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 121, 149, 173, 175, 183, 185)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69,74,77,119,12 7,129,133,135,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187,190,191,192	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,78,129,142,15	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Stradbally	○	○	○	□	○	○	□	○	○	○	○	○
Templemore/ Templetuohy	○	□	○	○	○	□	□	○	□	○	○	○
Templetney/ Brackford Bridge PWS	○	□	□	□	□	□	□	□	□	○	□	○
Thurles	○	□	○	□	○	□	□	○	□	○	○	□
Tipperary Town Supply	○	□	□	○	□	○	□	○	□	○	○	○
Tullohea	○	□	○	□	○	□	○	○	□	○	□	○
Two Mile Borris	○	○	○	□	○	○	□	○	○	○	○	□

Table 7.5 demonstrates the variety of SA Combinations for SAK. For example, SA Combination 7 contains six (6) Group Options - 38, 69,149, 173, 180 and 185:

- Group 149 resolves the need in ten (10) WRZs - East Waterford Supply Scheme, Ballyogarty, Stradbally, Kilmacthomas, Dunhill Cois Coille, Smoore, Dunhill Ballinageeragh, Fews, Kill/Ballylaneen and Scrahan.
- Group 180 resolves the need in eight (8) WRZs - Templetney/Brackford, Bridge PWS, Clonmel & Environs, Ardfinnan Regional, Russelstown, Kilmanahan, Glenagad and Poulavanogue (Waterford).
- Group 185c resolves the need in seven (7) WRZs - Carrigmore, Kilteely, Herberstown, Knocklong/Hospital, Ballylanders Water Supply, Galbally Water Supply and Limerick City.
- Group 173 resolves the need in six (6) WRZs - Ballysaggart, Monatarriff, Carrignagower, Lismore/Cappoquiin/Ballyduff (LCB), Lacken and Morreswell.
- Group 38 resolves the need in five (5) WRZs - Rathgormack, Ballyknock, Crehanagh, Garravoone and Carrick-On-Suir.
- Group 69 resolves the need in two (2) WRZs - Galtee Regional and Dundrum Regional.

The Need for the remaining WRZs in SA Combination 7 is resolved by the Preferred Approach at WRZ Level.

Even when we consider all permutations of Study Area Options to create the SA Combinations, there are some water supplies that will always require a WRZ Level Option. For example, in SAK Garryahylish, Inchinleamy, Kilbrien, Lyreanearla and Modeligo are always supplied by a WRZ Level Option. These WRZs are typically very small, isolated supplies serving a limited number of people. Due to the age of our water network and water quality issues associated with transferring small volumes of water over long distances, a local supply is a more suitable solution for these WRZs. In these cases, the emphasis of the NWRP is to ensure that the best possible resilient local sources are identified.

In Table 7.6 we show the number of SA Combinations identified for each Study Area in the South East Region.

Table 7.6 Number of SA Combinations for each Study Area

Number of SA Combinations		
SAK	**SAL**	**SAM**
12	26	41

7.2.5 Stage 3 – Study Area Level Preferred Approach

7.2.5.1 Test a Range of Approach Types – Study Area Level

As part of Stage 3, we compare the WRZ Level Approach (which is a combination of all the WRZ Level Options identified at WRZ level) and the SA Combinations developed in Stage 2. Where the WRZ Level Approach cannot meet the full need of the Study Area, it is excluded at this stage of comparison.

The purpose of this exercise is to ensure that the Preferred Approach selected at Study Area Level for each Study Area is the combination of Options that provide the best overall outcome when considered against the six (6) Approach Categories. To assist us in this exercise, we use the EBSD tool to rank the Study Area Combinations against the six (6) Approach Categories.

Table 7.7 shows an example of the output from the EBSD process for SAK. The presentation of the data in this way allows us to understand the relative benefits of each combination of Options.

Table 7.7 Stage 3 – EBSD Output for SAK (SA Combinations Assessment)

Ranked order (best to worst)	Best														Worst

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125, 141)	SA Combination 2 (SA Grouped Option 1, 9, 18, 40, 46, 153, 183, 190, 191 and 192)	SA Combination 3 (SA Grouped Option 37, 53, 149, 173, 175, 183, 185,195)	SA Combination 4 (SA Grouped Option 23,34,51,66,78,119,185b)	SA Combination 5 (SA Grouped Option 12,20,28,33,57,59,63,69, 74,77,119,127,129,133,1 35,140,141,187,193)	SA Combination 6 (SA Grouped Option 135,169,170,176,184,187 ,190,191,192,193)	SA Combination 7 (SA Grouped Option 38,69,149,173,180,185)	SA Combination 8 (SA Grouped Option 3,12,34,37,40,50,61,75,7 8,129,142,153,171,187,1 92)	SA Combination 9 (SA Grouped Option 149)	SA Combination 10 (SA Grouped Option 183)	SA Combination 11 (SA Grouped Option 175)
Least Cost				Best		Worst						
Quickest Delivery		Best		Worst								
Best AA biodiversity	9 -3 AA impacts	7 -3 AA impacts	9 -3 AA impacts	9 -3 AA impacts	7 -3 AA impacts	11 -3 AA impacts	7 -3 AA impacts	9 -3 AA impacts	7 -3 AA impacts	9 -3 AA impacts	8 -3 AA impacts	8 -3 AA impacts
Lowest Carbon					Best					Worst		
Most Resilient								Best				Worst
Best Environmental	Worst			Best								

The SA combinations outlined in Table 7.7 are assessed to determine the 'Best' performing combination in each Approach Category. These are summarised in Table 7.8.

Table 7.8 Best SA Combinations for SAK

Approach Categories	Best Performing Combination
Least Cost (LCo)	SA Combination 3 (SA Grouped Option 37, 53, 149, 173, 175, 183, 185 & 195)
Best Environmental (BE)	SA Combination 3 (SA Grouped Option 37, 53, 149, 173, 175, 183, 185 & 195)
Quickest Delivery (QD)	SA Combination 1 (SA Grouped Option 6, 7, 10, 20, 34, 47, 58, 66, 73, 77, 78, 119, 125 & 141)
Most Resilient (MR)	SA Combination 7 (SA Grouped Option 38, 69, 149, 173, 180, 185)
Lowest Carbon (LC)	SA Combination 4 (SA Grouped Option 23, 34, 51, 66, 78, 119, 185b)
Best AA (BA)	SA Combination 8 (SA Grouped Option 3, 12, 34, 37, 40, 50, 61, 75, 78, 129, 142, 153, 171, 187, 192)

7.2.5.2 Approach Appraisal – Study Area Level

We then compare the best performing Option or combinations of Options (listed in Table 7.8) within each of the six (6) Approach Categories using the Seven (7)-Step Process to establish the Preferred Approach at Study Area Level. As at WRZ Level, this process allows us to compare the best ranked approaches within each Approach Category at Study Area Level relative to each other, to select the combination of Options that provides the best overall solution for that Study Area. This process is conducted via a workshop, and the decision-making and outcomes are recorded for each supply.

As an illustration, we set out in Figure 7.6 how we applied this process to Study Area K.

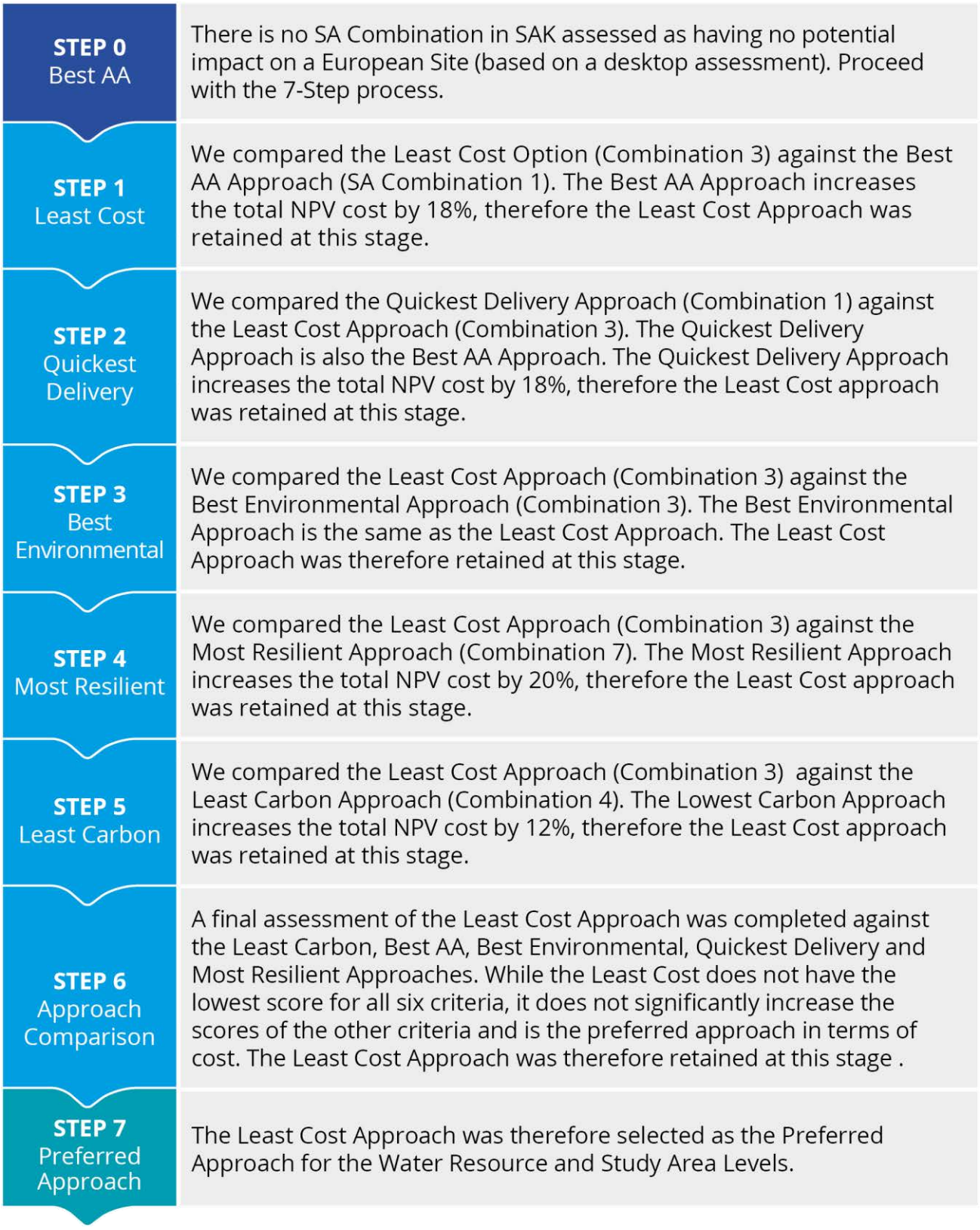


Figure 7.6 SA Level Preferred Approach Development – SAK

7.2.5.3 Selection of Preferred Approach – SA Level Approach

Table 7.9 summarises the comparison of the best performing SA combinations for SAK.

When we compare the five (5) best performing approaches against each other (representing the Stage 3 analysis for the selection of the Preferred Approach), their relative performance against categories they were not identified as 'best' in, may be different compared to their relative performance within the wider ranking against all the combinations, as presented in Table 7.7. Furthermore, in Table 7.7 the colour scale used to indicate the relative ranking of all combinations requires more gradations of colour to account for the large number of option combinations that can be assessed. Table 7.9 only contains five (5) different combinations and therefore the colours denoting relative performance between the 'Best Performing SA Combinations' for a particular Approach Type are different to the colour representing relative performance within the wider ranking. For example, for Combination 3, the Most Resilient Score is ranked last against the five (5) Best Performing SA Combinations; whereas it is ranked 7th amongst the 12 combinations in Table 7.7.

Table 7.9 suggests that SA Combination 1, 4 and 8 are the Best AA because they have the same number of -3 biodiversity scores (i.e., they each have six (6) -3 biodiversity scores). However, SA Combination 8 was selected as the Best AA approach overall, after comparing the number of -2 and -1 biodiversity scores.

Table 7.9 Summary of the MCA Scoring for the Best Performing SA Combinations – SAK

Category Criteria	SA Combination 1 (QD)	SA Combination 3 (LCo, BE)	SA Combination 4 (LC)	SA Combination 7 (MR)	SA Combination 8 (BA)
Least Cost Score	Worst	Best			
Quickest Delivery Score	Best	Worst			
Best AA Score	Seven -3 Biodiversity Scores	Nine -3 Biodiversity Scores	Seven -3 Biodiversity Scores	Nine -3 Biodiversity Scores	Seven -3 Biodiversity Scores
Lowest Carbon Score			Best	Worst	
Most Resilient Score				Best	Worst
Best Environmental Score		Best	Worst		

Key				
Ranked order (best to worst)				
Worst				Best

The outcome when we follow the Seven (7)-Step Process is that SA combination 3 is the Preferred Approach for SAK. SA Combination 3 has been selected through the 7-step process as the best performing approach overall across the different categories (Table 7.7). This combination of Feasible Options is the best long term water supply solution. In particular, the combination of Options performs well against the environmental criteria and cost.

The general Preferred Approach development process at Study Area Level (Stage 3) is summarised in Figure 7.7.

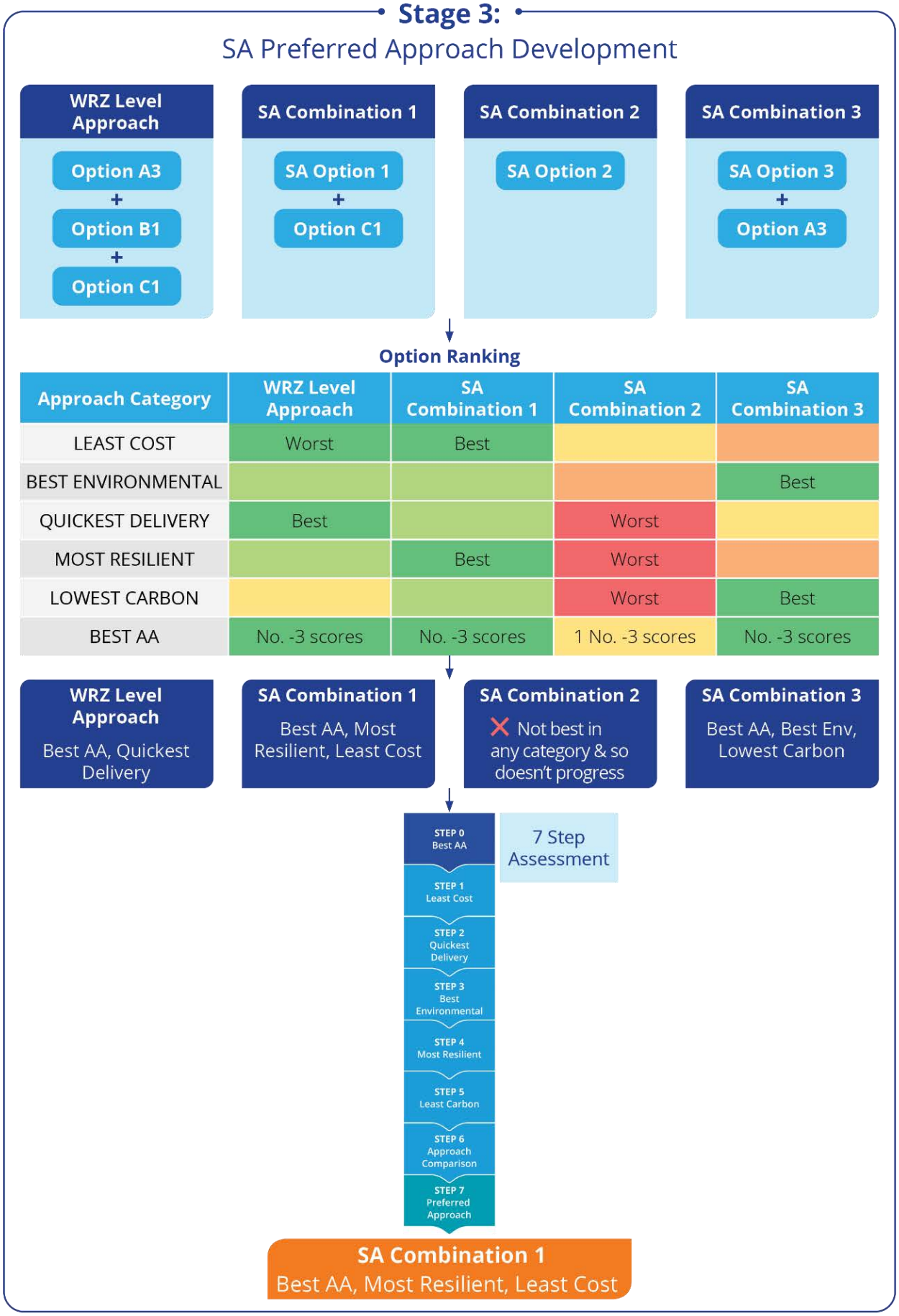


Figure 7.7 SA Preferred Approach Development – Stage 3

7.3 WRZ Level Approach and SA Preferred Approach

In this section, we compare the benefits of developing interconnected systems (under the SA Preferred Approach), with the option of continuing to supply existing WRZs independently (under the WRZ Level Approach).

One of the benefits of developing the Preferred Approach at Study Area Level is the ability to create an interconnected network and rationalise our infrastructure to provide a more resilient supply to our customers. In the following sections, we compare the combination of Options that make up the SA Preferred Approach with the WRZ Options that combine to form the WRZ Level Approach. The comparison considers the difference in the infrastructure components and total estimated cost provided by the Option. Additionally, the overall benefit of the SA Preferred Approach is described with reference to the NWRP objectives represented by the six (6) Approach Categories.

7.3.1 SA Preferred Approach Description

The Preferred Approach at Study Area Level comprises 15 SA Grouped Options across all three study areas that collectively supply 65 WRZs across the South East Region (Table 7.10). This creates an interconnected network and allows us to rationalise our infrastructure providing a more resilient supply to our customers. There is also the benefit of eventually moving away from some of our potentially unsustainable abstractions by reducing our abstraction points. Reviewing our supplies at a Study Area Level allows us to understand the regional sustainability of our abstractions.

Table 7.10 SA Preferred Approach

Study Area	Number of WRZs	SA Preferred Approach		Number of WRZs benefitting from a SA Grouped Option
		WRZ Option	SA Grouped Option	
SAK	75	27	8	49
SAL	10	3	3	7
SAM	26	18	4	9
Region Total	**111**	**48**	**15**	**65**

Table 7.11 and Table 7.12 compare the SA Preferred Approach with the WRZ Level Approach. The Option summary in Table 7.11 describes whether the supply Deficit will be met through new and/or increased groundwater (GW) and surface water (SW) abstractions, rationalisations (connection of water treatment plants (WTPs) and/or WRZs, which are usually accompanied by decommissioned abstractions and WTPs),or transfers from sources within or outside of the Study Area. The number of Options that only comprise a water quality upgrade to an existing WTP is also presented for those WRZs that are not in Deficit and therefore do not require a new or upgraded supply or transfer from another supply system.

Table 7.11 Comparison of Option Types

Study Area	WRZ Level Approach	SA Preferred Approach
SAK Waterford and South Tipperary	**75 WRZ Options*:** – 42 Options with increased/new GW abstractions. – 4 Options with new SW abstractions – 28 Options with a WTP upgrade (WQ only) – WRZs are not in deficit. – 1 Option involving 'within' WRZ supply rationalisation, decommissioning 1 WTP and abstraction. * Portlaw WRZ has 2 WRZ Options abstracting from 2 sources.	**27 WRZ Options*:** – 12 Options with increased/new GW abstractions. – 1 Option with a new SW abstraction. – 1 Option involving 'within WRZ supply rationalisation and an increased GW abstraction. – 12 Options involving a WTP upgrade (WQ only) - WRZs are not in deficit. **8 SA Grouped Options:** – 1 Option with a new SW abstraction, interconnecting 3 WRZs and rationalising 8 WRZs. – 1 Option with a new SW abstraction rationalising 9 WRZs to one source WRZ. – 2 Options with increased/new GW, rationalising 4 and 5 WRZs each. – 1 Option supplying spare capacity to neighbouring WRZs, interconnecting 1 WRZ and rationalising 4 WRZs. – 1 Option involving a cross study area supply from the Limerick Supply system in the Eastern and Midlands Region, rationalising 6 WRZs. – 2 Options with new/increased GW abstractions, interconnecting 2 WRZs and rationalising 2 WRZs to 1 source WRZ.

Study Area	WRZ Level Approach	SA Preferred Approach
SAL Kilkenny	**10 WRZ Options:** – 7 Options with increased/new GW abstractions. – 3 Options, upgrading or replacing existing WTPs to improve water quality – WRZs not in deficit.	**3 WRZ Options:** – 1 Option, increasing the existing GW abstraction. – 2 Options with new GW abstractions and new WTPs **3 SA Grouped Options:** – 1 Option improving water quality by upgrading an existing WTP and decommissioning an underperforming WTP. The WRZ is not in deficit. – 2 Options with new GW abstractions.
SAM Wexford and Wicklow	**26 WRZ Options*:** – 17 Options with increased/new GW abstractions. – 1 Option with an increased SW abstraction. – 1 Option interconnecting the WRZ to a neighbouring Group Water Scheme (GWS) to supply the deficit. – 1 Option involving 'within WRZ supply rationalisation to a new WTP – WRZ not in deficit. – 6 Options with a WTP upgrade (WQ only) – WRZs are not in deficit. * Sow Regional WRZ has 2 WRZ Options abstracting from 2 sources.	**18 WRZ Options*:** – 12 Options with increased/new GW abstractions. – 1 Option involving 'within WRZ supply rationalisation to a new WTP – WRZ not in deficit. – 5 Options with a WTP upgrade (WQ only) – WRZs are not in deficit. **4 SA Grouped Options:** – 1 Option increasing the existing SW abstraction and rationalising 4 WRZs to 1 source WRZ. – 1 Option developing a new GW abstraction and rationalising 1 WRZ. – 2 Options rationalising WRZs to Study Area 1 (Mid-Wicklow) in the Eastern and Midlands Region: Coolgreany WRZ to the Arklow WRZ and Ballingate WRZ to the Tinahely WRZ.

Table 7.12 details the infrastructure components associated with the Options identified for each Study Area. Overall, the SA Preferred Approach across the three (3) Study Areas of the South East Region requires 7 fewer new WTPs, 55 fewer WTP upgrades, and 37 fewer new or increased abstraction sources, compared to the WRZ Level Preferred Approach. The SA Grouped Options making up the SA Preferred Approach will also eventually result in the decommissioning of 55 more WTPs and the abandonment of 59 more abstractions, presenting the potential to deliver improved environmental outcomes, than if the abstractions were to remain local. The higher interconnectivity created by the SA Preferred Approach requires approximately 277 km more pipeline compared with the WRZ Level Approach and 9 additional water storages.

Full details of the SA Preferred Approach development are included in Technical Appendices 1-3.

Table 7.12 Infrastructure Component Summary

SA	Approach Type	Infrastructure Component						
		New Pipeline (km)	New WTPs	Upgrade WTPs *	New/ Upgraded Abstracts	Decomm. WTPs	Decomm. Abstracts	No. of Water Storage
SAK	SA Preferred Approach	300	6	53	22	46	48	42
	WRZ Level Approach	97	10	98	50	1	1	33
SAL	SA Preferred Approach	56	3	5	5	8	9	5
	WRZ Level Approach	21	5	8	7	5	4	8
SAM	SA Preferred Approach	99	4	22	15	9	9	14
	WRZ Level Approach	60	5	29	22	2	2	11
Total	SA Preferred Approach	455	13	80	42	63	66	61
	WRZ Level Approach	178	20	135	79	8	7	52
Difference between SA and WRZ Level Approach		**+277**	**-7**	**-55**	**-37**	**+55**	**+59**	**+9**

* Includes WTP upgrades for both Water Quality only (for those WRZs that are not in Deficit) and WTPs with capacity upgrades.

7.3.2 Assessment against the Six Approach Categories

Table 7.13 shows the Multi Criteria Assessment (MCA) ranking of the Preferred Approach at Study Area Level and the WRZ Level Approach for SAK, SAL and SAM. The ranking (colour coding) presented in Table 7.13 is relative to all SA Combinations identified for the Study Area.

A comparative description for each Study Area is presented in Table 7.14. Further justification for the selection of the SA Preferred Approach is set out in detail in the supporting Study Area Technical Reports (Appendix 1 - 3). The SEA South East Regional Environmental Report details the environmental assessment outcomes.

Table 7.13 Multi Criteria Assessment (MCA) Scores

Ranked order (best to worst)	Best													Worst

Study Area	Approach Type	Approach Category					
		Least Cost	Quickest Delivery	Best AA*	Lowest Carbon	Most Resilient	Best Env.
SAK	SA Preferred Approach	Best	Worst	9 No -3 scores			Best
	WRZ Level Approach**			9 No -3 Scores			Worst
SAL	SA Preferred Approach	Best	Worst	2 No. -3 Score	Best		
	WRZ Level Approach			1 No. -3 Score			Worst
SAM	SA Preferred Approach	Best**		1 No. -3 Scores			
	WRZ Level Approach			1 No. -3 Scores			

* A Best AA score of -3 equates to Likely Significant Effects (LSEs) that may be harder to mitigate or require significant project level assessment.

**The SAM Preferred Approach is within 5% of the Least Cost combination and is the Most Resilient, Best Environmental and is similar in carbon compared to the other 22 combinations that are within 5% of the Least Cost. Therefore, the SAM Preferred Approach was selected as the Least Cost Approach.

Table 7.14 SA Level Preferred Approach (PA) comparison with the WRZ Level Approach

Study Area	Comparative Assessment
SAK Waterford and South Tipperary	**The PA is the Least Cost and Best Environmental Approach.** The PA for SAK includes 8 SA Options and 27 WRZ Options compared with 75 WRZ Options for the WRZ Level Approach. Both approaches can meet the deficit across all WRZs in the study area. The PA decommissions 48 abstraction sources compared with 1 decommissioned abstraction under the WRZ Level Approach. The PA has the advantage of requiring 28 fewer new or increased abstractions and therefore has a lower impact on biodiversity and the water environment. The interconnected Options of the PA will require an estimated 203 km more pipeline than the WRZ Level Approach and will reduce the number of WRZs from 75 to 33. The PA has an estimated NPV cost that is 14% lower than WRZ Level Approach. The cost benefit is the result of lower operational costs associated with the number of WTPs to be decommissioned. The PA has 9 high-risk Options under the Appropriate Assessment that will require further assessment at project level to confirm mitigation opportunities. Six (6) of these involve abstractions that have the potential to impact the Lower River Suir SAC although these abstractions combined are expected to be within sustainable abstraction thresholds. The better environmental score for the PA is associated with the lower materials and waste impacts due to the rationalisation of assets. The PA is also likely to have a lower landscape

Study Area	Comparative Assessment
	impact as it requires fewer abstractions and WTPs. Benefits to the water environment are also achieved through the abandonment of 48 abstractions. Six (6) of these are surface water abstractions, of which four may not meet sustainability guidelines during dry weather flows. Cessation of abstractions from these sources are likely to improve water quality and benefit water dependent biodiversity, including aquatic ecology.
SAL Kilkenny	**The PA is the Least Cost and Lowest Carbon Approach.** The PA for SAL comprises 3 SA Options and 3 WRZ Options compared with 10 WRZ Options for the WRZ Level Approach. Both approaches can meet the deficit across all WRZs in the study area. The PA decommissions 9 abstraction sources compared with 4 decommissioned abstractions under the WRZ Level Approach. The PA has the advantage of requiring 2 less new or increased abstractions. Therefore, the PA has a lower impact on biodiversity and the water environment. The interconnected Options of the PA will require an estimated 35 km more pipeline than the WRZ Options and will reduce the number of WRZs from 10 to 6. The PA will require 3 fewer water storages. The PA has been selected as the Lowest Carbon and Least Cost Approach and ranks second highest against the Best Environmental Approach due to the reduced infrastructure requirements. The NPV cost is estimated to be 10% less than the WRZ Level Approach. This cost benefit is the result of lower capital expenditure due to fewer new/increased WTPs; as well as lower operational costs associated with the number of WTPs to be decommissioned. The PA has two high-risk Options that could impact on European, which will require further assessment at project level to confirm mitigation opportunities. The better environmental score for the PA is associated with the lower materials and waste impacts due to the rationalisation of assets. The PA is also likely to have a lower landscape impact as it requires fewer water storages and abstractions. Benefits to the water environment are achieved through the abandonment of 9 abstractions (2 of which are surface water abstractions that may not meet sustainability guidelines during dry weather flows). Cessation of abstractions from this surface water sources has potential to improve water quality and benefit water dependent biodiversity including aquatic ecology. The PA has a relatively long delivery timescale when compared with the other SA Combinations; however, the low score in this category is outweighed by the significant gains in overall environmental improvement, ranking highest for carbon. The SA Grouped Options of the PA merge WRZs through interconnections and rationalisation. This improves the resilience score of the PA compared with the independent local solutions that make up the WRZ Level Approach.
SAM Wexford and Wicklow	**The PA is the Least Cost Approach.** Development in many of the WRZs of Study Area M is currently constrained by capacity limitations in the existing supply system. The Preferred Approach for SAM has therefore been selected as the solution that is best able to address this short-term need across the study area. The PA for SAM includes 18 WRZ Options and 4 SA Options compared with 26 WRZ Options for the WRZ Level Approach. Both approaches can meet the deficit across all WRZs in the study area. The PA decommissions 7 additional abstractions and 7 additional WTPs compared to the WRZ level approach. It also has the advantage of requiring 7 fewer new or increased abstractions and

Study Area	Comparative Assessment
	1 less new WTP. The interconnection of WRZs requires 39 km of additional pipeline compared to the WRZ Level Approach. The PA has been selected as the Least Cost Approach; however, there is only a small difference compared with the WRZ Level Approach (1%). This is because the overall infrastructure requirements are similar - while the preferred approach has a longer length of pipeline and more water storages, it has 1 less new WTP and will have fewer operational WTPs. The PA has only 1 high-risk Option that could impact on European sites (which is the same as the WRZ Level Approach). This will require further assessment at project level to confirm mitigation opportunities. The PA provides benefits to the water environment through the abandonment of 9 abstractions, particularly as 1 of these abstractions may not meet sustainability guidelines during dry weather flows. Cessation of abstraction from this surface water source has potential to improve water quality and benefit water dependent biodiversity, including aquatic ecology. The PA scores higher against the environmental score as it as a reduced impact on landscape due to fewer operational WTPs, and it abandons 9 abstractions, one of which may not meet sustainability guidelines during dry weather flows. The Least Cost approach is the preferred approach which allows Uisce Éireann to meet the pressing shorter term needs in the study area by utilising new groundwater sources in the local area. Therefore, the Least Cost approach does not have the significant lead time associated with the Best AA, Lowest Carbon, Most Resilient and Best Environmental approach.

Appropriate Assessment (AA)

Study Area Combinations for all three study areas have -3 scores, indicating there are options with the potential for Likely Significant Effects (LSEs) on European Sites that cannot be ruled out without further detailed site level assessments. These options have been assessed as -3 either because the mitigation may be complex or there is uncertainty around potential impacts. However, with the mitigation proposed in the NIS, these have been assessed as being expected to have no adverse effects on site integrity (AESIs) at plan level.

The Preferred Approach for SAK has nine -3 biodiversity scores associated with the following options:

- Increase in abstraction from the existing spring and borehole to supply the Callan Public Water Supply (Option SAK-077) has the potential to impact Groundwater Dependent Terrestrial Ecosystems (GWDTEs) within the River Barrow and River Nore Special Area of Conservation (SAC). The works may also impact on Qualifying Interest (QI) species and habitats in this SAC, and on kingfisher in the River Nore SPA during construction;
- The new surface water abstraction from the Aherlow River (Option SAK-120) has the potential to impact the Lower River Suir SAC and the potential for pollution impacts during construction due to hydrological links and works within of near the SAC;
- Increased groundwater abstraction that is adjacent to the River Tar (Option SAK-211), which forms part of the Lower River Suir SAC, as well as other associated works, have the potential to impact the SAC during construction and operation, and may cause disturbance to birds within the Blackwater Callows SPA during construction;
- The new and increased groundwater abstractions in Portlaw (Options SAK-560 & SAK-618 combined) have the potential to impact the Lower River Suir SAC during operation, and the associated works may also impact this SAC during construction. The works may cause disturbance impacts to birds within the Tramore Back Strand SPA during construction;

- Increased abstraction at Mullinbawn springs (Option SAK-853), which is adjacent to the Clashawley River has the potential to impact the Lower River Suir SAC during operation, and other works within this option may also impact this SAC and the River Barrow and River Nore SAC during construction;
- The new surface water abstraction from the River Suir, upstream of Carrick-on-Suir, and the proposed pipeline (Option SAK-949) has the potential to impact the Lower River Suir SAC during both construction and operation, and the River Barrow and River Nore SAC may be impacted by pollution during construction due to hydrological links. Birds within Mid-Waterford Coast SPA, Tramore Back Strand SPA and Dungarvan Harbour SPA may be impacted during construction;
- The new and increased groundwater abstractions for Lismore/Cappoquin/Ballyduff WRZ (Group Option SAK-973) have the potential to impact the Blackwater River (Cork/Waterford) SAC during operation, and the associated works may also impact this SAC during construction. The works may cause disturbance impacts to the birds within the Blackwater Callows SPA, Dungarvan Harbour SPA, and Blackwater Estuary SPA during construction;
- The new surface water abstraction from the River Suir and proposed pipeline (Option SAK-983) has the potential to impact the Lower River Suir SAC during both construction and operation, and may cause disturbance to birds within the Blackwater Callows SPA during construction;
- The increased abstraction from the Shannon (Option SAK-985c) has the potential to exacerbate existing hydrological pressures from the hydropower station on the Lower River Shannon SAC during operation and may also impact on this SAC and the Lower River Suir SAC during construction. There may be construction impacts on the River Shannon and River Fergus Estuaries SPA.

The Preferred Approach for SAL has two -3 biodiversity scores:

- The new groundwater abstraction for Bennetsbridge (Option SAL-078) has the potential to impact the River Barrow and River Nore SAC, which contains several groundwater dependent Qualifying Interests (QIs), during operation. Some of the works are within or adjacent to this SAC leading to the potential for impacts during construction. The works may also impact on kingfisher in the River Nore SPA during construction;
- The new groundwater abstraction for Graiguenamanagh and Thomastown/Inistioge (Group Option SAL-521) has the potential to impact the River Barrow and River Nore SAC during operation, and other works associated with this option may cause impacts during construction. The works may also impact on kingfisher in the River Nore SPA during construction.

The Preferred Approach for SAM has one -3 biodiversity score associated with the new groundwater abstraction to supply Bunclody (Option SAM-036) as the Slaney River Valley SAC is in the Zone of Contribution (ZOC) and some of the construction works are within or adjacent to this SAC. The works may also cause disturbance to birds in the Wexford Harbour and Slobs SPA during construction.

There are Options with -1 and -2 scores across all three (3) Study Areas and as such there is the potential for Likely Significant Effects (LSEs). The potential for LSEs however is generally construction related impacts and it is considered that these LSEs will not result in Adverse Effects on Site Integrity (AESI) if mitigation is in place. A number of options (twelve options) across the three (3) Study Areas have 0 scores as they are not predicted to have impacts on any European Sites

SEA Objectives

The Preferred Approach for SAK is assessed as the Best Environmental approach. The environmental benefits include reduced long-term impact that is achieved through the decommissioning of water treatment plants and existing abstractions. The approach involves the lowest number of new WTPs, WTP upgrades, and new or upgraded abstractions and is therefore likely to have a high beneficial impact against landscape during operation as it also decommissions more WTPs compared with other

approaches. There are further benefits offers with fewer options that have high abstraction rate, which have the potential to be unsustainable in the long-term.

SAL is assessed as the Least Cost and Lowest Carbon approach. Although the Preferred Approach for SAL does not achieve the highest environmental score, its score is similar to the Best Environmental Approach. The Preferred Approach involves the lowest number of WTPs upgrades and has the highest number of decommissioned WTPs and abstractions. For this reason, it is likely to have some beneficial operational impacts against landscape and visual environmental categories. The SAL Preferred Approach scores lower than the Best Environmental approach as there is more construction required in urban areas and there is also greater potential for adverse impacts against biodiversity as it requires construction with the River Barrow SAC and River Nore SPA.

The Preferred Approach for SAM is assessed as the Least Cost approach and was considered the best performing approach overall. It achieves a lower score than the best environmental approach as it requires four more new WTPs and does not decommission as many existing WTPs. Consequently, there will be eleven more WTPs in operation. It also requires more upgraded and increased local groundwater abstractions. The Preferred Approach is selected in preference to the Best Environmental approach, inter alia, as it does not require the significant lead-time that is associated with the Best AA, Lowest Carbon, Most Resilient and Best Environmental approach. Surface water availability is also limited in the south-east of Ireland; therefore, the Least Cost approach is the preferred approach as it allows Uisce Éireann to meet the pressing shorter-term needs in the study area through utilising new groundwater sources in the local area. Groundwater investigations will be carried out to determine available yield in the area. If it is found that the groundwater sources cannot provide the required yield then the study area approach that was selected as the best Best AA, Lowest Carbon, Most Resilient and Best Environmental approach will be brought forward to supplement the groundwater supplies developed under the Preferred Approach. Further detail of this alternative approach is presented in Section 7.3.4.

Collectively, the Preferred Approach for the three study areas includes the eventual decommissioning of 63 WTPs and 66 abandoned abstractions, of which 11 of these are surface water sources. Seven (7) of the abandoned surface water abstractions are abstractions that may not meet sustainability guidelines under dry weather flows (as assessed by Uisce Éireann using the UKTAG guidelines)[2]. Cessation of abstractions from these surface water sources has potential to benefit ecology and support Water Framework Directive (WFD) objectives.

We have also determined that 31 of the 43 surface water abstractions will be maintained under the Preferred Approach. Twenty-eight (28) of these may not meet sustainability guidelines during dry weather flows. . While the plan level assessment has identified that these abstractions may not meet sustainability guidelines further project level assessments will need to be carried out in the context of applications for planning permission and/or abstraction licences under the new legislative regime. The Preferred Approach, however, does improve or avoid further deterioration at these sources by reducing existing abstractions or developing additional sources to support growth. Reduced abstractions have the potential to benefit aquatic ecology and contribute to the meeting of WFD objectives for these sources. Many of our existing abstractions will require a licence under the new abstraction legislation. Detailed environmental assessments will be submitted with these licence applications which will be assessed and adjudicated by the EPA. The SEA and AA set a framework for identifying mitigation and monitoring so that these can be part of the decision-making and inform Option design and development. This is further discussed in Section 9.

Least Carbon

Although the Preferred Approach for SAK may not yield the lowest carbon score, it presents as the best environmental combination of options, due to the benefits of decommissioning water treatment plants and mitigating unsustainable abstractions.

The Preferred Approach for SAL is the Lowest Carbon Approach. Compared with other SA combinations, it less new infrastructure such as WTPs and storages. This approach also involves decommissioning existing WTPs, resulting in reduced operational carbon requirements.

For SAM, the SA approach that include an interconnection to the Great Dublin Area resulted in the lowest carbon score. However, due to the extensive lead time required to make this option operational, it will not be available to address the immediate water supply deficit in the region. The Preferred Approach presents as the best alternative option to meet the short-term needs of the area.

There is noted to be scope for improving performance against SEA climate change carbon criteria significantly through energy efficient design and investigation of low carbon opportunities as identified as part of the process for developing future projects in the Environmental Action Plan in section 9. Also, further work on future operational modes will allow Uisce Éireann to optimise the interconnected supplies, to provide resilience and environmental benefit whilst balancing energy and carbon impacts.

7.3.3 Cost Comparison

Table 7.15 compares the cost difference for the SA Preferred Approach and the WRZ Level Approach for each Study Area. The Preferred Approach, which considers interconnected supply options, offers the Least Cost option across all three study areas (Figure 7.8). Comparing its estimated NPV to that of independent discrete water supply systems operated under the WRZ Level Approach, the Preferred Approach offers an 11 percent lower cost option.

The Preferred Approach for SAK and SAL incurs significantly lower costs compared to the WRZ Level Approach. This is in the most part attributed to lower operational expenses due to fewer treatment plants catering to identical demands.

For SAM, 22 SA combinations had a very similar ranking under the Least Cost category, within 5% of each other. The WRZ Level Approach was included amongst the 22 SA combinations. As set out in Section 7.2.1, where an Option or combination of Options provide similar NPV costs, to ensure that no Option is discounted by reference to only “Least Cost”, we compared the 22 SA combinations by applying the 7-step process. This approach recognises the desktop nature of the NPV plan level assessment.

When we compared the 22 SA Combinations against each other to identify which should go forward as the Least Cost approach, the SA Preferred Approach scored better in the Most Resilient and Best Environmental category and was comparable in score to the other combinations for the Lowest Carbon, Best AA and Quickest Delivery Criteria. The Preferred Approach was therefore selected as the Least Cost Approach.

Table 7.15 Cost Comparison

Cost Difference (%) SA Preferred Approach cf. WRZ Level Approach			
SAK	SAL	SAM	Region
-14% ↓	-10% ↓	-1% ↓	-11% ↓

↓ = Reduced cost

↑ = Increased cost

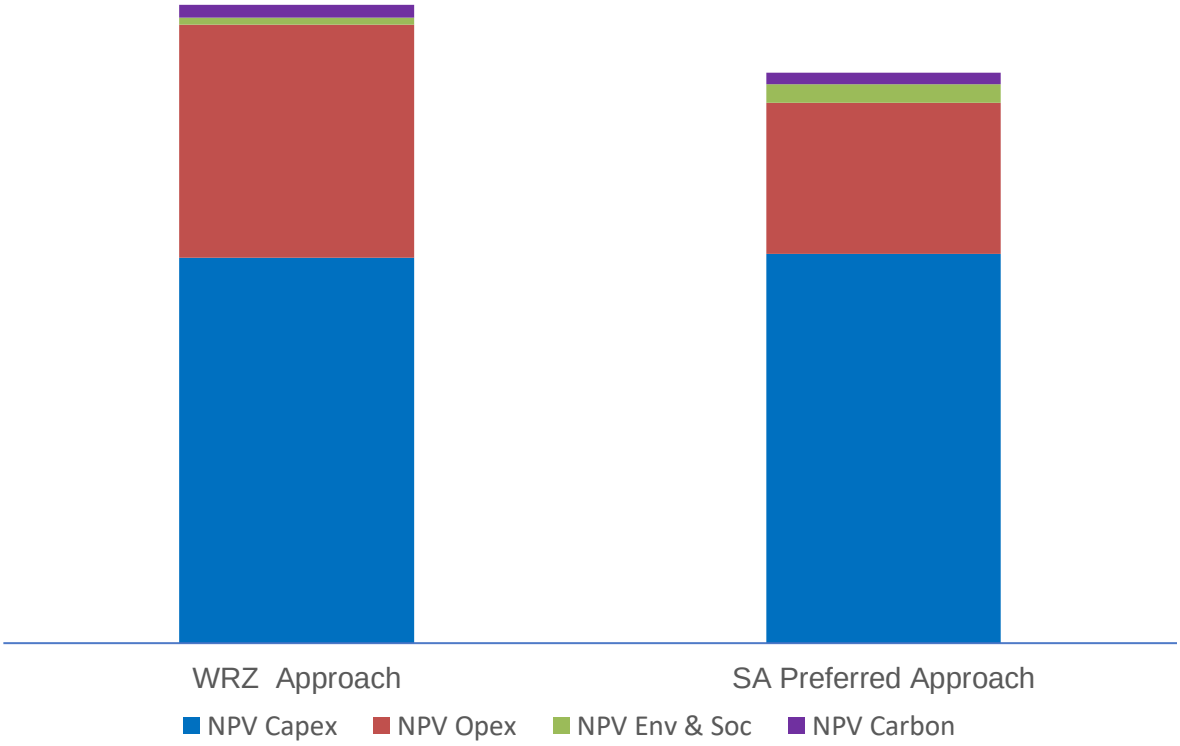


Figure 7.8 Regional NPV Costs for WRZ Level Approach and Study Area Preferred Approach

7.3.4 Alternative Study Area Approach for SAM

Development in many of the WRZs of Study Area M is currently constrained by capacity limitations in our existing supply system. Eleven (11) of the 26 WRZs in the study area have limited capacity. These are Enniscorthy, Bunclody, Sow Regional, Ferns Regional, New Ross, South Regional, Clonroche, Monageer, Woodview Drive, Bree and Carrigbyrne. . The SAM Preferred Approach has been selected as the solution that is best able to address this pressing need across the study area. The solution proposes to address almost 90% of the 2044 Deficit in the study area with increased or new groundwater abstractions that will serve 14 WRZs. An increased surface water abstraction from the River Slaney will address the critical need in the Enniscorthy Town WRZ and will also supply growth in Marshalstown, Glynn, Ballyhogue and Bree.

The available yield of the groundwater sources is based on a plan level assessment that relies on limited available information. Although the hydrogeological map of the study area (Figure 8.3) shows there are extensive swathes of productive fissured bedrock (Rf) stretching from Gorey in the north-east to Stradbally on the coast of Waterford, detailed project level investigations will be necessary to confirm the available yield.

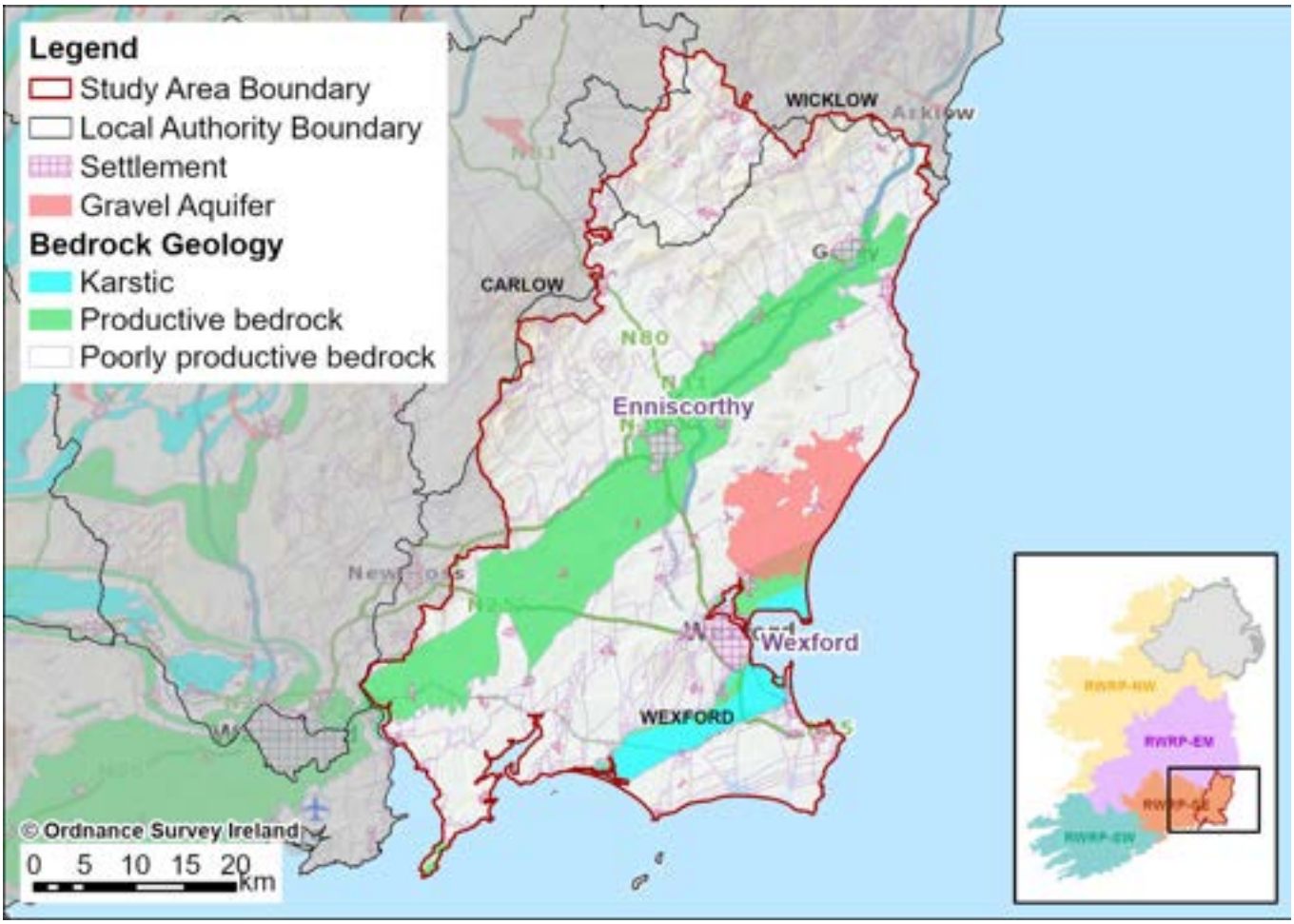


Figure 7.9 SAM Hydrogeology

If project level assessments indicate a lower-than-expected yield from groundwater sources, a higher volume supply source may be required to supplement the groundwater sources of the preferred approach and meet medium to longer term growth across the study area. The feasible option identified as the next best solution to address the study area Needs involves interconnecting 13 WRZs to the Greater Dublin Area in the Eastern and Midlands Region, via the Rathvilly WTP. This option will require new pumps, storages and approximately 140 km of new watermain. The option performed best against four of the best value assessment categories – Best AA (biodiversity), Best Environmental, Lowest Carbon and Most Resilient. This was associated with the benefits from the interconnection which decommissions seven (7) additional WTPs, abandons ten (10) additional abstractions and requires three (3) fewer new WTPs than the Preferred Approach.

Table 7.16 compares the options that would be different between the SAM Preferred Approach and the Alternative SAM Approach for each WRZ. Table 7.17 compares the infrastructure components for all the options within the two approaches.

Table 7.16 Comparison of SAM Study Area Approach

Connect to GDA No change

WRZ Name	Preferred Approach (Within SA groundwater supplies)	Alternative Approach (Cross-regional supply source)
Coolgreany	SAM-501 Rationalise to Arklow WRZ in the Eastern and Midlands Region. Increase GW abstraction.	
Gorey	SAM-198 Rationalise within WRZ. Upgrade 2 WTPs for water quality (WQ) improvements.	
Camolin	SAM-017 Upgrade existing WTP for WQ improvements.	
Ferns WS	SAM-029 New GW abstraction and New WTP	
Bunclody	SAM-036 New GW and upgrade WTP	SAM-581 Rationalise and supply from GDA via Rathvilly
Kilteely	SAM-044 Increase GW abstraction and upgrade WTP	
Ballindaggin	SAM-050 Increase GW abstraction and upgrade WTP	
Monagear	SAM-061 Increase GW and upgrade WTP	SAM-581 Rationalise and supply from GDA via Rathvilly
Davidstown	SAM-073 Upgrade existing WTP for WQ improvement	SAM-581 Rationalise and supply from GDA via Rathvilly
Clonroche	SAM-100 New GW and upgrade WTP	
Woodview Drive Adamstown	SAM-105 Increase GW and upgrade WTP	
Raheen	SAM-108 Upgrade existing WTP for WQ improvement	
Sow Regional	SAM-127 & SAM-207 New GW and new WTP	SAM-581 Rationalise and supply from GDA via Rathvilly
Ballynavortha Public Supply	SAM-141 Upgrade existing WTP for WQ improvement	
Coolboy Coolafancy Public Supply	SAM-144 Upgrade existing WTP for WQ improvement	
Raheengraney Public Supply	SAM-146 Upgrade existing WTP for WQ improvement	
Fardystown	SAM-148 New GW and upgrade WTP	SAM-581 Interconnect to GDA via Rathvilly WTP
Wexford Town	SAM-149 New GW and new WTP	SAM-581 Interconnect to GDA via Rathvilly WTP
Ballingate Public Supply	SAM-547 Rationalise Ballingate to Tinahely in the Eastern and Midlands Region	
Carrickbyrne	SAM-575 Rationalise to South Regional	SAM-581 Rationalise and supply from GDA via Rathvilly
South Regional	SAM-575 New GW and new WTP	SAM-581 Interconnect to GDA via Rathvilly WTP

WRZ Name	Preferred Approach (Within SA groundwater supplies)	Alternative Approach (Cross-regional supply source)
Marshalstown	SAM-576 Rationalise to Enniscorthy Town	SAM-581 Rationalise and supply from GDA via Rathvilly
Enniscorthy Town	SAM-576 Increase SW abstraction from River Slaney and upgrade WTP	SAM-581 Interconnect to GDA via Rathvilly
Bree	SAM-576 Rationalise to Enniscorthy Town	SAM-581 Rationalise and supply from GDA via Rathvilly
Ballyhogue	SAM-576 Rationalise to Enniscorthy Town	SAM-581 Rationalise and supply from GDA via Rathvilly
Glynn WS	SAM-576 Rationalise to Enniscorthy Town	SAM-581 Rationalise and supply from GDA via Rathvilly

Table 7.17 SAM Study Area Approach Component Summary

Infrastructure Summary	Preferred Approach (Within GW supply sources)	Alternative Approach (Cross-regional supply source)
New pipeline network (km)	99	157
New WTPs	4	1
Upgrade WTPs	22	15
New / upgraded abstractions	14	6
WTPs decommissioned	9	16
Abstractions abandoned	9	19
Raw Water Storage	0	0
Treated Water Storage	14	19

The Preferred Approach and the Alternative Approach are presented for comparison in Figure 7.10. The figure on the left shows the Study Area Preferred Approach. The options that would be different if the Alternative Approach was taken forward as the Preferred Approach are highlighted in white. The figure on the right shows the Alternative Approach. The WRZs that would benefit from the transfer of water from the GDA via Rathvilly are shaded pink. The blue highlighted options form part of both the Preferred Approach and Alternative Approach.

If project level assessments determine that the Rathvilly option will be required in addition to the new groundwater sources, the Preferred Approach and the Rathvilly option will be adapted to consider the future integration of the GDA source and avoid stranded assets when the GDA is brought online. For example, where a new WTP is proposed under the Preferred Approach that is not required for the Rathvilly Option, a temporary treatment option may be considered instead.

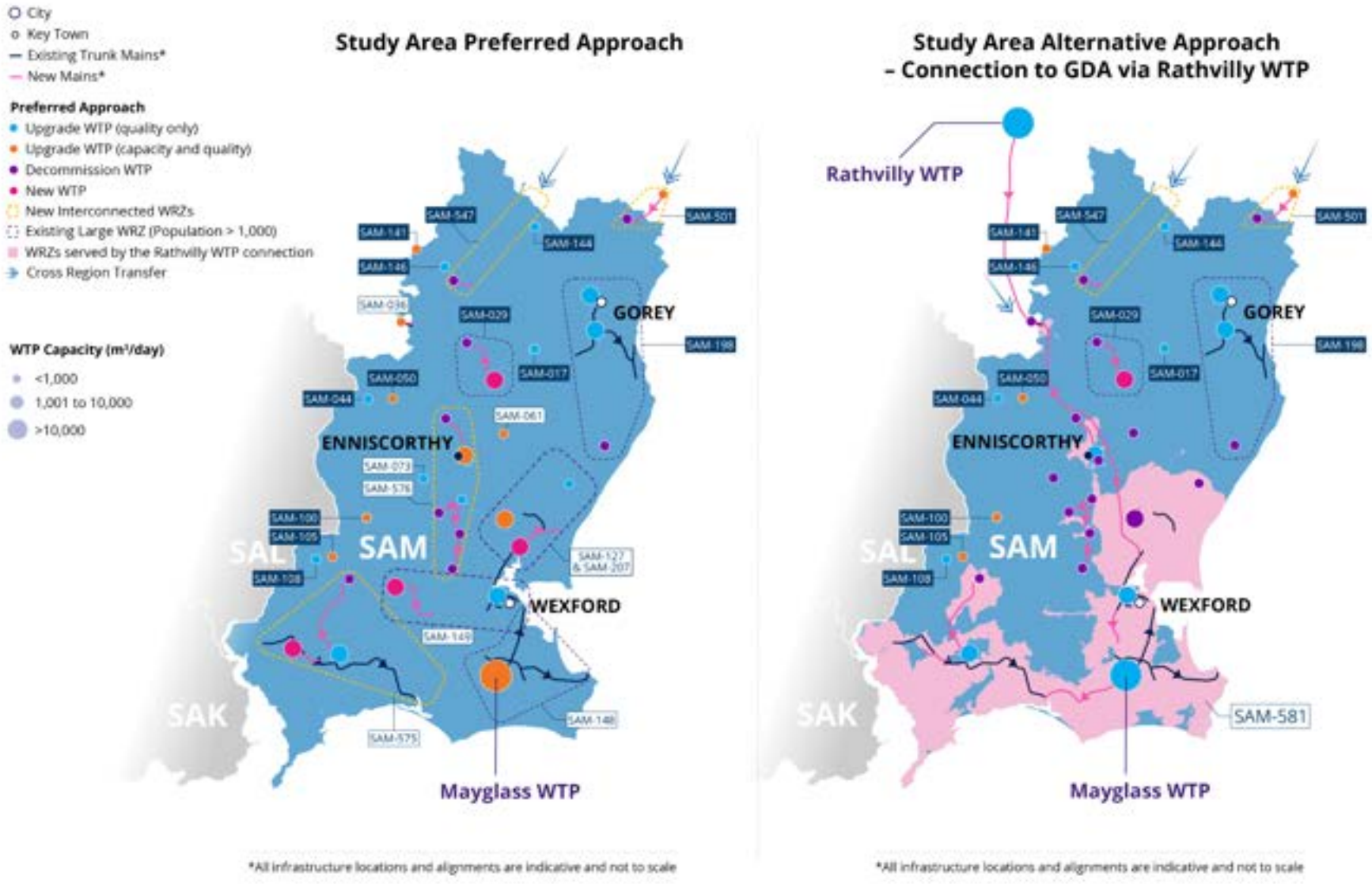


Figure 7.10 SAM Preferred and Alternative Approach

7.4 SA Preferred Approach

7.4.1 Water Supply Sources

The SA Preferred Approach for the three (3) Study Areas address the supply Deficit across all WRZs in the South East Region through:

- 28 Independent local WRZ sources - local surface water and groundwater sources;
- 12 Within Study Area (SA) interconnected supplies – benefitting 57 WRZs supplied from a new, ungraded or existing source within the Study Area;
- 3 Cross Regional interconnected supplies – benefitting 8 WRZs supplied from a new, upgraded or existing source outside the Region; and

For 18 WRZs that are not in deficit and therefore do not require a new or upgraded resource supply, the Preferred Approach includes a WTP water quality processing upgrade (WQ upgrade only). Table 7.18 lists the number of WRZs supplied by each source type, and the WRZs where a WTP upgrade (WQ only) is required.

Under the Preferred Approach 27 local groundwater supplies and one (1) local surface water supply contribute to meeting an estimated 27% and 9%, respectively, of the 2044 Deficit across the South East Region in a dry year. The supplies are mostly expansions of existing sources with some new abstractions.

The interconnection of supply systems reduces the number of WRZs in the region from 111 to 58. Sixty-three (63%) of the Deficit across the three (3) Study Areas is met by interconnecting and rationalising supplies. Across the South East Region, the SA Preferred Approach, once delivered, will eventually decommission 63 WTPs and abandon 66 abstractions. As mentioned previously, the reduction in the number of WTPs achieved through supply rationalisation is likely to have benefits of reduced landscape impact, and over the longer term will reduce operational costs. Furthermore, the abandonment of abstractions will deliver environmental benefits to the surface water and groundwater bodies. Resilience and Flexibility are also improved through larger, interconnected supplies.

Table 7.18 Preferred Approach Source Types

	Number of WRZs			
	SAK	SAL	SAM	Total
Local source (GW)	13	3	11	27
Local source (SW)	1	0	0	1
Within SA interconnection	43	7	7	57
Cross Region interconnection	6	0	2	8
WTP upgrade (WQ only)	12	0	6	18

The three (3) cross region interconnections supply 1% of the regional Deficit and benefit eight (8) WRZs interconnecting to supply systems in the Eastern and Midlands Region. These include:

- Rationalising six (6) WRZs in SAK to the Limerick Supply System in Study Area 8 (Limerick Clare). The water supply for Limerick comes from the River Shannon and is treated at Clareville WTP. The full demand for each connected WRZ will be met via the new interconnection.

- Rationalising Coolgreany Water Supply in SAM to the Arklow supply system in Study Area 1 (Mid Wicklow). The groundwater abstraction serving the Arklow supply system will be increased to meet the full demand of the Coolgreany WRZ.
- Rationalising Ballingate Public Supply in SAM to the Tinahely supply system in Study Area 1 (Mid Wicklow). The Tinahely supply can meet the full demand of the Ballingate WRZ without further upgrade.

The relative contribution of the types of sources that will address the 2044 supply Deficit is represented in Figure 7.11. Local groundwater sources supply almost 70% of deficit for both SAM and SAL, whereas interconnected supplies and associated increased or new surface water supplies meet almost 80% of the deficit across SAK.

The Option Development Process at the Study Area Level has not identified any large Regional Options that can connect and supply multiple WRZs across the three Study Areas of the South East Region. This is further discussed in Section 8, where we consider the Regional Preferred Approach.

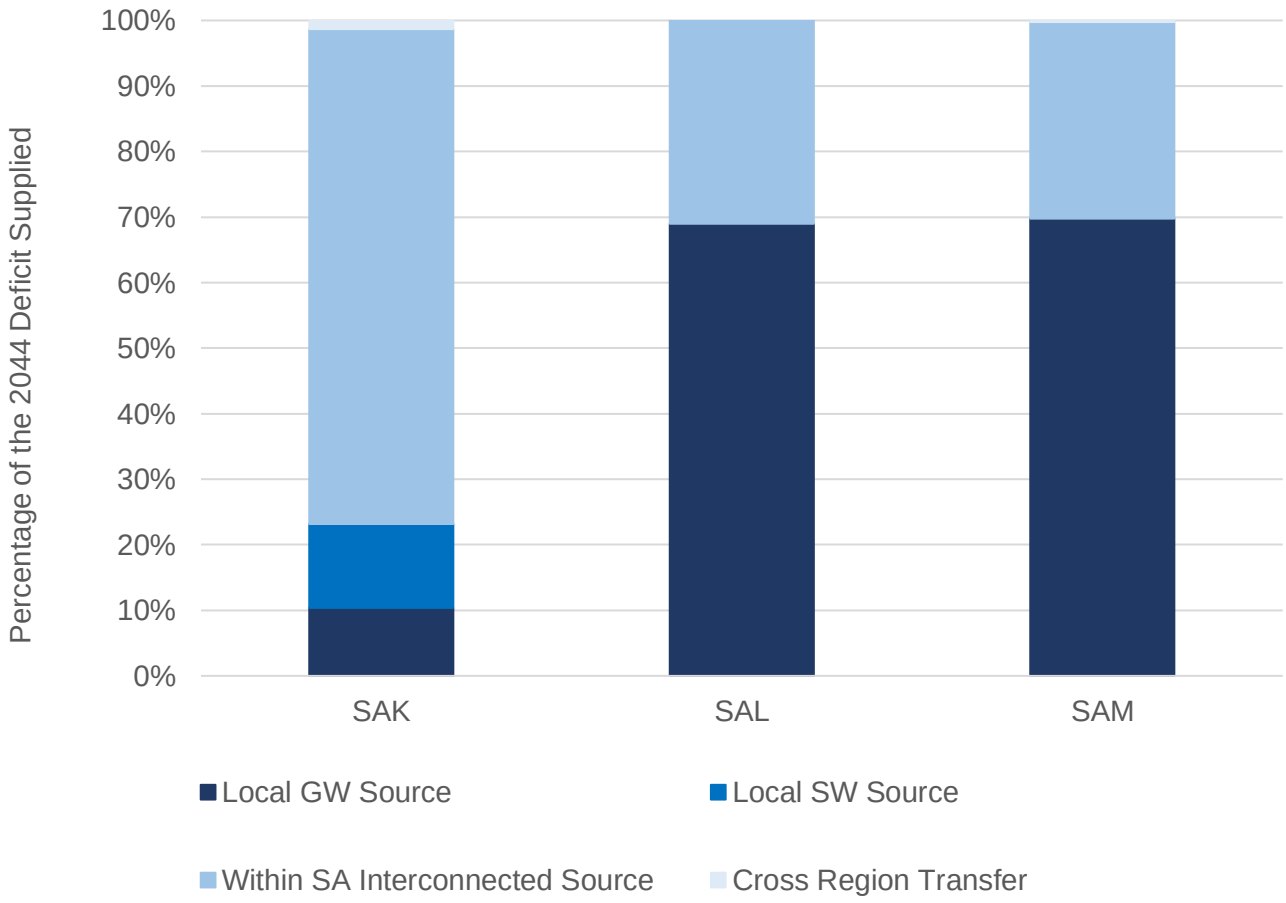


Figure 7.11 Preferred Approach Source Type – Percentage (%) of 2044 Deficit Supplied in a Dry Year

7.4.2 Existing Infrastructure

The existing WTPs and major interconnecting pipelines across the region are displayed in Figure 7.12. There are six (6) WTPs (out of 143 WTPs in the region) with a 22-hour design capacity of greater than 10,000 m^3/day (Table 7.19). The largest WTP is the East Waterford (Adamstown) WTP. This serves Waterford City and surrounds, which comprises a population of approximately 70,000 representing almost 20% of the regional population.

Table 7.19 Water Treatment Plant Capacities greater than 10,000 m^3/day

Water Treatment Plant	WRZ Name	Capacity* (m^3/day)
East Waterford (Adamstown) WTP	East Waterford Water Supply Scheme (SAK)	53,170
Troyswood WTP	Kilkenny City (SAL)	21,460
Mullinabro WTP	South Kilkenny Environs (SAK)	13,750
Rossadrehid WTP	Galtee Regional (SAK)	11,920
Mayglass WTP	Fardystown (SAM)	11,000
Thurles WTP	Thurles (SAK)	10,510

* 22 hr WTP Design Capacity

The SA Preferred Approach increases the security of supply through upgraded abstractions and treatment capacity. Safe supplies are achieved through improved treatment processing, and resilience is increased by interconnecting systems where this is feasible. These improvements are presented in Section 7.4.3 for WRZ Options and Section 7.4.4 for Grouped Study Area Options.

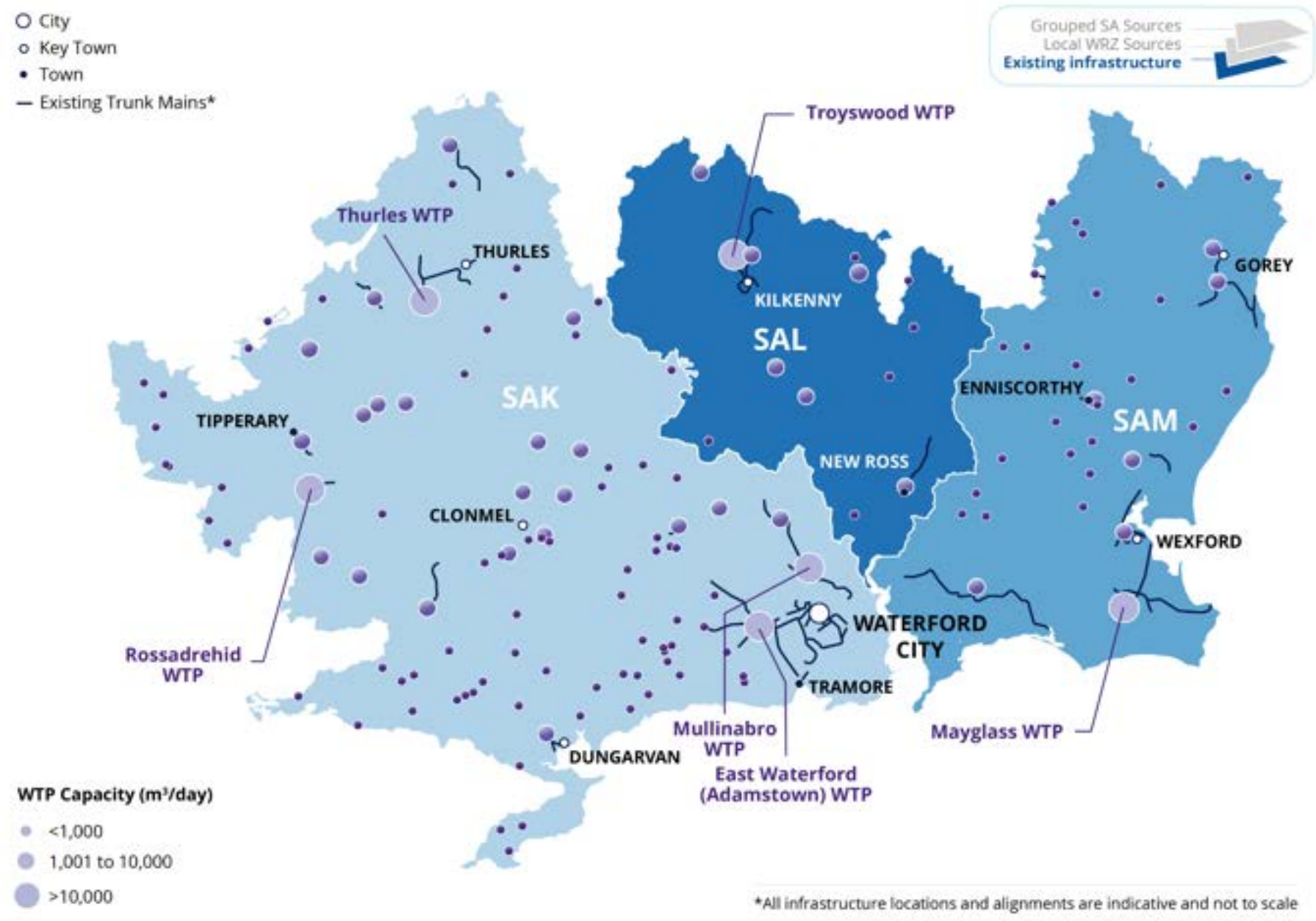


Figure 7.12 Existing Infrastructure

7.4.3 WRZ Options

Options that involve upgraded or new local WRZ sources are presented in Figure 7.13. The WRZ Options that will serve populations greater than one thousand are shown labelled in the figure and listed in Table 7.20.

Table 7.20 Water Treatment Plant Capacities greater than 10,000 m³/day

Option Number	WRZ Name	DYCP Demand 2044 (m3/d)	DYCP Deficit/Surplus 2044 (m3/d)	Population (2044)
SAK-073	Piltown-Fiddown	1,570	-1,190	3,820
SAK-077	Callan WS 1001	1,500	-510	3,140
SAK-120	Galtee Regional	12,820	-7,460	13,460
SAK-180	Tipperary Town Supply	3,590	-1,410	5,460
SAK-211	Burncourt Ballylooby	3,850	-1,330	2,060
SAK-560 & SAK-618	Portlaw	690	-410	1,860
SAK-648	South Kilkenny Environs	10,190	-400	8,040
SAL-073	New Ross	4,440	-1,140	9,270
SAL-078	Bennettsbridge & Kilmaganny	4,240	-1,470	6,430
SAM-029	Ferns WS	870	-270	1,960
SAM-127 & SAM-207	Sow Regional	4,970	-1,620	14,450
SAM-148	Fardystown	13,830	-3,380	18,890
SAM-149	Wexford Town	11,210	-6,400	31,920
SAM-198	Gorey	11,450	410	9,200

The WRZ options serving the largest populations in each study area are:

- SAK-120, Galtee WRZ – A new surface water abstraction from Aherlow River and an upgrade to the capacity of Rossadrehid WTP
- SAL-073, New Ross WRZ – A new groundwater abstraction located south of New Ross WRZ and a new WTP
- SAM-149, Wexford Town – A new groundwater wellfield at Adamstown and a new WTP.

Details of the smaller systems are provided in the Technical Appendices 1-3

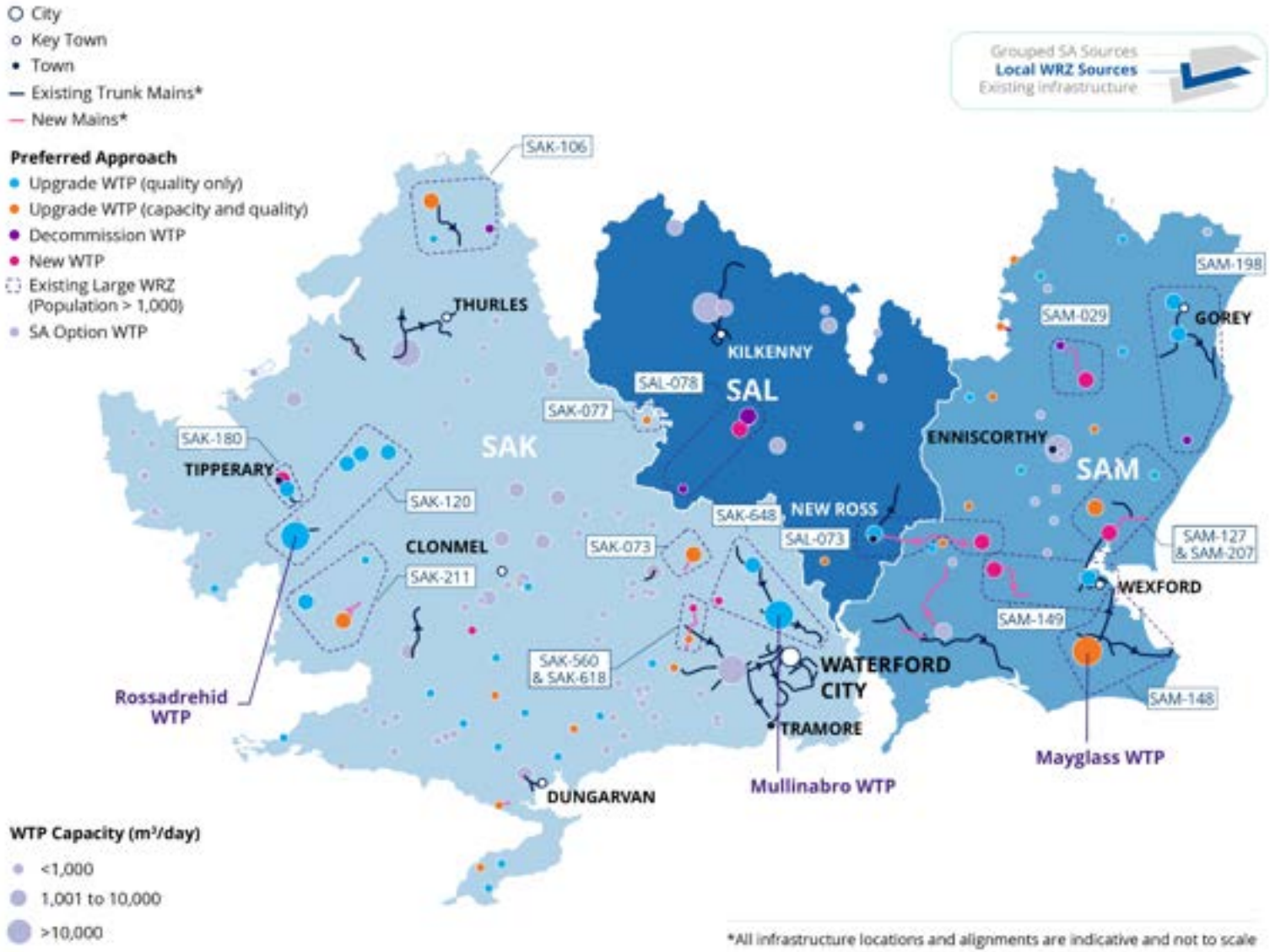


Figure 7.13 Preferred Approach – Local WRZ Sources

7.4.4 Study Area Grouped Options

The SA Grouped Options that will interconnect two or more WRZs, are displayed in Figure 7.14.

The two Grouped Options that will merge the largest number of WRZs are:

- Option SAK-949 proposes a new surface water abstraction from the River Suir, upstream of Carrick-on-Suir and will rationalise nine (9) WRZs to the East Waterford Supply system decommissioning ten (10) WTPs and associated abstractions.
- Option SAK-983 proposes a new surface water abstraction from the River Suir and new WTP at Barne. Ardfinnan Regional and Templetney/Brackford Bridge WRZs will be interconnected with Clonmel WRZ. Four (4) adjacent WRZs will be rationalised to Templetney/Brackford Bridge WRZ and a further four (4) WRZs will be rationalised to Clonmel. The rationalisation and interconnection of supplies will result in the decommissioning of 10 WTPS and associated abstractions.

These Options combined will meet 42% of the regional deficit in 2044 and serve a population of almost 97,000 representing about 30% of the 2044 regional population.

Table 7.21 lists the interconnected systems, including a list of the benefitting WRZs.

Table 7.21 Study Area Preferred Approach – SA Grouped Sources

Option number	Source WRZ	Benefitting WRZs	No. of WRZs	Trunk Main (km)	No. of Decomm. WTPs	DYCP Demand 2044 (m3/d)	DYCP Net Deficit 2044 (m3/d)	Population (2044)
SAK-837	Carrick-on-Suir	Ballyknock Carrick-on-Suir Crehanagh Garravoone Rathgormack	5	10	5	3,300	-1,420	3,030
SAK-853	Fethard and Mullenbawn Regional Public Water Supply (PWS)	Colabrook / Commons Fethard and Mullenbawn PWS	2	14	0	9,960	-430	2,300
SAK-949	East Waterford Supply Scheme	Ballyogarty Dunhill Ballinageeragh Dunhill – Cois Coille East Waterford Supply Scheme Faha Fews Kill/Ballylaneen Kilmacthomas Scrahan Smoore	10	69	10	43,890	-19,550	94,570
SAK-973	Lismore/Cappoquin/ Ballyduff	Ballysaggaart Carrignagower Lacken Lismore/Cappoquin/Ballyduff Monatarriff Moores Well	6	28	5	2,910	-1,060	360
SAK-975	Thurles	Dundrum Regional Glengar Horse and Jockey Littleton Thurles Two Miles Borris	6	31	4	16,550	-760	11,530

Option number	Source WRZ	Benefitting WRZs	No. of WRZs	Trunk Main (km)	No. of Decomm. WTPs	DYCP Demand 2044 (m3/d)	DYCP Net Deficit 2044 (m3/d)	Population (2044)
SAK-983	Clonmel	Ahenny Ardfinnan Regional Ballinver Clonmel Glenagad Kilcash Kilmanahan Poulavanogue (Waterford) Russeltown Templetney/Brackford Bridge PWS Tullohea	11	54	10	24,140	-14,650	23,090
SAK-985c	Limerick City (Eastern and Midlands Region)	Ballylanders Water Supply Carrigmore Galbally Water Supply Herbetstown Kiltely Knocklong/Hospital	6	58	9	3,160	-780	4,410
SAK-995	Dungarvan	Ddungarvan Graiguenageeha Stradbally	3	15	2	8,950	-1,740	15,890
SAL-511	Kilkenny	Ballyragget PWS Kilkenny City	2	10	2	15,190	8,080*	15,890
SAL-521	Thomastown/ Inistioge	Graiguenamanagh PWS Thomastown/Inistioge	2	13	1	3,460	1,000	3,560
SAL-526	Gowan-Goresbridge-Paulstown	Ballinkillen Borris Gowan-Goresbridge-Paulstown	3	15	3	1,440	40	3,320
SAM-501	Arklow (Eastern and Midlands Region)	Coolgreany	1	8	1	680	40	1,220
SAM-547	Tinahely (Eastern and Midlands Region)	Ballingate	1	3	1	5	2	10

Option number	Source WRZ	Benefitting WRZs	No. of WRZs	Trunk Main (km)	No. of Decomm. WTPs	DYCP Demand 2044 (m3/d)	DYCP Net Deficit 2044 (m3/d)	Population (2044)
SAM-575	South Regional	Carrigbyrne South Regional	2	18	1	8,280	2,860	13,550
SAM-576	Enniscorthy Town	Ballyhogue Bree Enniscorthy Town Glynn Water Supply Marchalstown	5	23	4	6,990	2,610	15,880

*Both merged water resource zones are in surplus. The interconnection of the two supply systems increases resilience and improves operational efficiency by decommission two WTPs.

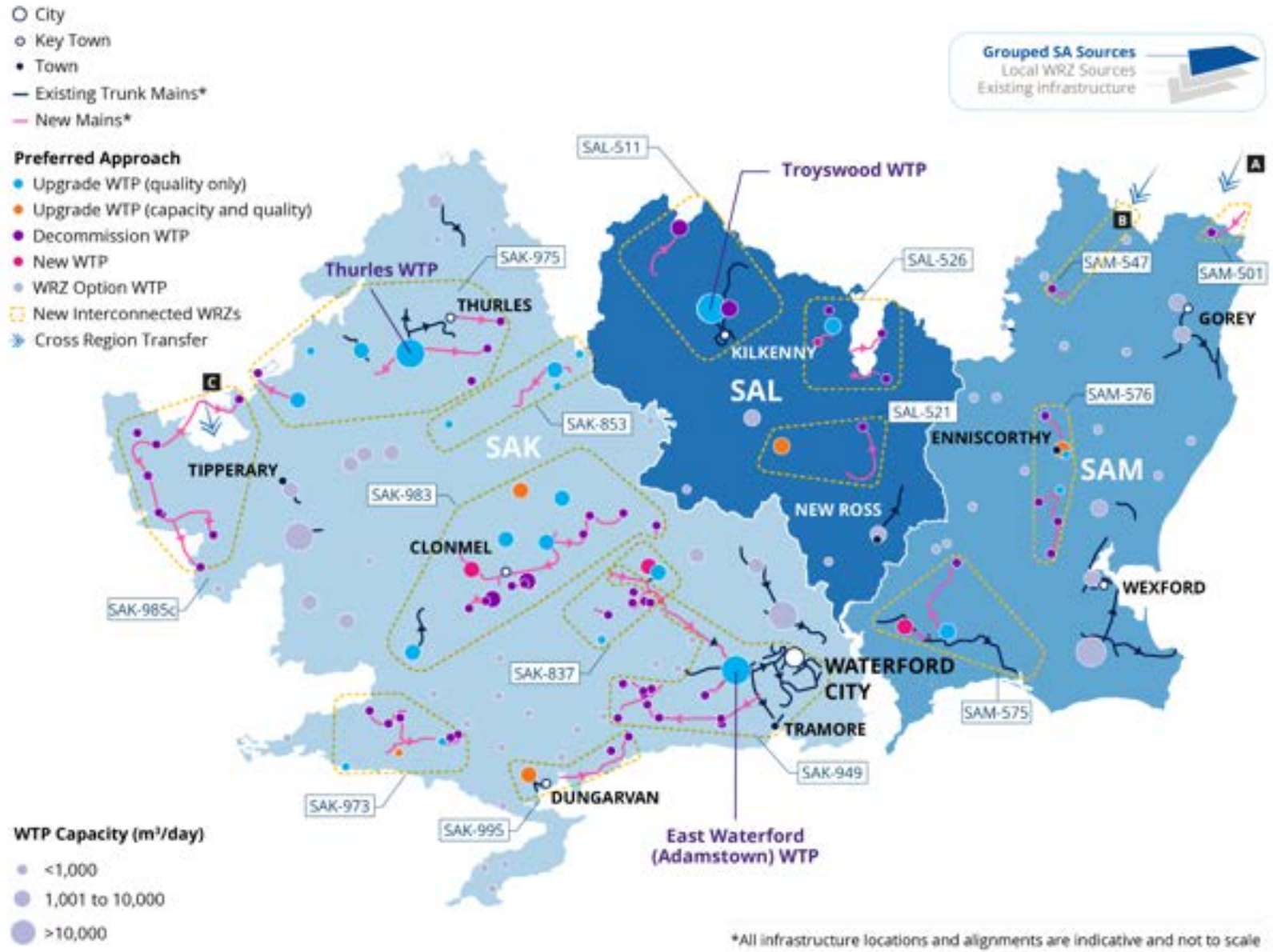


Figure 7.14 Preferred Approach –SA Grouped Sources

7.4.5 Addressing Leakage

Leakage reduction measures are a key component of the Preferred Approach to addressing Need across the South East Region. As outlined in Section 5.2, the measures aim to nationally reduce leakage by 400 million litres per day (Ml/d) by 2034. This will be achieved through the following contributions:

- 39.5 % within the Eastern and Midlands Region (representing 158 Ml/d)
- 23.5% within the South West Region (representing 94 Ml/day)
- 25.5% within the North West Region (representing 102 Ml/day)
- 11.5% within the South East Region (representing 46 Ml/day)

Leakage outside of the Greater Dublin Area WRZ (which is in the Eastern and Midlands Region) across all four regions of the NWRP, is prioritised on an annual basis as part of the National Leakage Reduction programme. This allows Uisce Éireann's leakage reduction programmes to be flexible and targeted, to meet specific emerging needs. For this reason, leakage targets are not automatically applied to the Supply Demand Balance (SDB) calculations.

As set out in Section 4.3.3 of the Framework Plan and Section 5.2.2 of this RWRP-SE, leakage targets for 2019 were applied to the SDB for priority supplies based on:

- supply demand deficit,
- existing abstractions with sustainability issues,
- and drought impacts.

For supplies within the South East region, specific leakage targets of 0.91 Ml/d were included in the SDB for 2019. Leakage targets for future years will be allocated to supplies to meet specific emerging needs and to meet the targets for the region.

Planned leakage targets (built into the SDB) across WRZs in the South East Region include the following reductions:

- SAK – 0.35 Ml/d through net leakage reduction in Fethard & Mullenbawn Regional Public Water Supply, Galtee Regional and Tipperary Town Supply.
- SAL – 0.32 Ml/d through net leakage reduction in Kilkenny City.
- SAM – 0.24 Ml/d through net leakage reduction in Fardystown, Enniscorthy and Gorey.

(Note: 1,000 m^3 per day is equivalent to 1 Ml/day).

This does not mean that only 0.91 Ml/d will be applied for the region between 2019 and 2034 but rather, we have committed to a target for 2019 in the SDB for specific supplies and we have provided flexibility to prioritise supplies for future leakage reduction.

Our current leakage targets are to reduce leakage in supply systems with demand greater than 1,500 m^3/day (1.5 Ml/d), to 21% of total demand by 2034. For the South East Region, this equates to a total leakage reduction of 46 Ml/d, which will reduce leakage to 24% of demand on average across the region.

Our leakage targets will be reviewed annually and will be subject to further modification. At project level, when we proceed to develop the Preferred Approach, we will review the SDB and subtract the target leakage reductions from the Deficit at this stage. This ensures that the Preferred Approaches are not oversized, or that the needs are not over emphasized.

The achievement of these additional leakage targets may mean that the supply volume delivered by the Preferred Approach would not be required in full. This will provide the opportunity to adapt the Preferred Approach, for example through changes in the delivery timeframe or modular designs. In the circumstance that higher than projected growth occurs, the additional leakage reductions would go towards balancing the additional demand generated through higher growth.

To ensure the Preferred Approach that we develop remains appropriate in the scenario of reduced leakage and static demand, we have carried out a sensitivity analysis of our Preferred Approach (Section

7.7). This has allowed us to understand the impact of leakage reductions on the proposed Preferred Approach and whether the Preferred Approach would still be valid under a reduced leakage scenario. This process allows us to balance the delivery of the Preferred Approach between the Lose Less pillar (Section 5.2) and Supply Smarter pillar (Section 5.4).

7.4.6 Addressing Water Quality

Uisce Éireann's Interim Barrier Assessment (described in our Framework Plan and summarised in Section 3.3.2 of this RWRP-SE) identifies Water Quality driven Need to inform the Preferred Approach development. The assessment determined that **115 of the 143 WTPs** in the Region have a high risk of not meeting one (1) or more of four (4) Uisce Éireann's Water Quality Barriers. However, these are internal Uisce Éireann assessments and in some cases our desktop assessments can over-estimate risk, particularly when there is little available data on the catchment characteristics of our raw water sources. As our "Source to Tap" Drinking Water Safety Plan (DWSP) assessments (which are a requirement under the Recast Drinking Water Directive (DWD)[3] and our national transposing legislation) are developed for each water supply, the barrier scores for all our supplies will be updated and become more reliable.

A **'Barrier'** consists of any actions, processes, procedures, standards or assets (WTPs, 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 four Barriers include: 1) Protection against bacteria and virus; 2) Maintain chlorine residuals in the network; 3) Protozoa removal processes; and 4) Prevention of the formation of trihalomethanes (THMS).

It should be noted that the assessment is not an indicator of non-compliance with the European Union (Drinking Water) Regulations 2023[4], but an assessment of the asset capability standard compared with the asset standard as set out in Section 5.7 of the Framework Plan. The assessment provides an indication 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.

The Preferred Approach for all study areas includes upgrades to water quality treatment efficiency for all WTPs that are not associated with an in-flight project (a project that is in progress). In-flight projects for the South East Region are described in Section 4. The WTP upgrades are designed to address the risks identified in Section 3.3.2 through improvements in filtration, coagulation and ultraviolet (UV) treatment. They do not include improvement measures that are related to actions required on WTPs that are subject to an Environmental Protection Agency (EPA) direction or are listed on the EPA Remedial Action List (as outlined in Table 3.15 of this RWRP-SE).

7.4.7 Environmental Sustainability

In December 2022 the Water Environment (Abstractions and Associated Impoundments) Act (the "Abstractions Act")[5] was published; however, it has not yet commenced. The Abstractions Act will align abstraction licensing with the requirements of the Water Framework Directive (WFD) (2000/60/EC), both for the specific abstraction and in combination with other activities. The Environmental Protection Agency (EPA) will determine the licences.

Whilst the regulations and guidelines for the new abstraction regime are being developed, we are assessing existing abstractions to identify surface water sites that may exceed future abstraction thresholds. We have taken a precautionary approach based on our current understanding of how proposed abstraction legislation might be applied. This assessment suggests that certain schemes may

be subject to reductions in abstraction under the new legislation; however, this will ultimately be determined by the EPA based on the project level information before them. This independent assessment of surface water abstractions is based on UKTAG standards to determine (i) the potential impact on our SDB and (ii) to identify possible alternative solutions to improve the sustainability of our abstractions. This assessment procedure is set out in Appendix C of the Framework Plan and is in line with a precautionary approach.

A sensitivity analysis (presented in Section 7.6) is conducted for each WRZ, to allow us to stress test the sensitivity of the Preferred Approach against potential sustainability driven reductions to existing abstractions (again, taking a conservative and precautionary approach as to the level of reductions that may be required). This will ensure that our decision making is robust, and the Preferred Approaches are adaptable and compatible with the future legislative framework for abstractions, in so far as this can be anticipated at this stage.

7.4.7.1 Surface Water Abstractions

Our assessment has identified 43 existing surface water sites where potential abstraction reductions may be required in the future under the future legislative framework for abstractions (which will ensure Ireland can meet its obligations under the WFD). Our assessment is based on conservative estimates of what a future regime may require). The 43 sites are shown in Figure 7.15 by symbols outlined in red. The WFD ecological status of the surface water waterbody is represented by the colour coded site identifier. The site names are listed in Table 7.22 against the corresponding site number that is displayed in Figure 7.15.

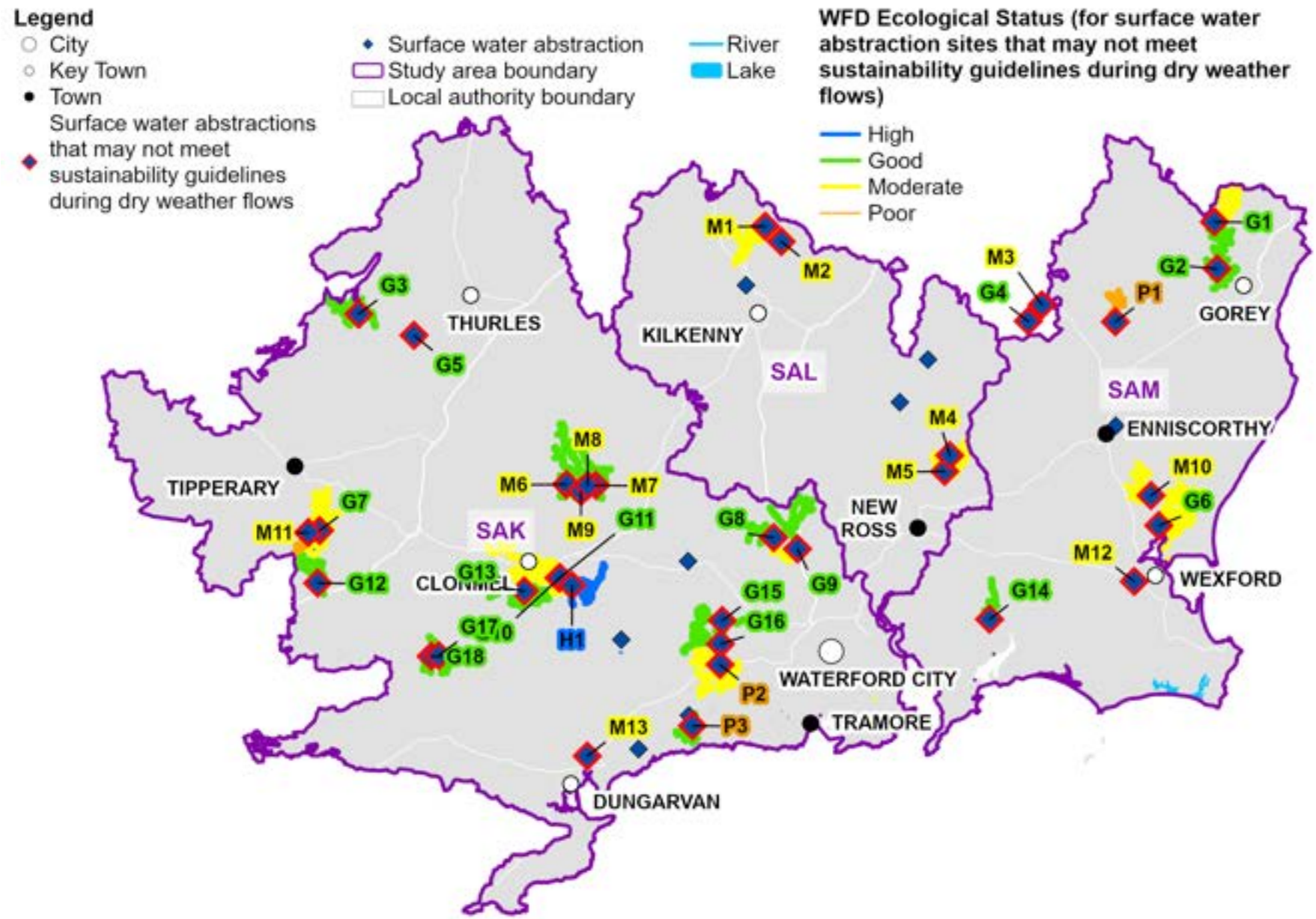


Figure 7.15 Existing Surface Water Abstractions

When developing our Preferred Approach, we considered solutions to improve the sustainability at the sites that were assessed to be potentially impacted by the new legislation.

Thirty-five (35) of the 43 surface water abstractions that have been identified as potentially exceeding sustainable abstraction thresholds are intended to be decommissioned as part of the Preferred Approach. These sites are shown in Figure 7.16, which presents the changes to surface water abstractions under the Preferred Approach development, including new abstractions and existing abstractions which will be maintained, upgraded or abandoned. The decommissioning of potentially unsustainable abstractions has the potential to improve the environmental outcomes at these sites and reduce the uncertainty posed by the future legislation.

The remaining 28 surface water abstractions that may not meet sustainability guidelines during dry weather flows, will be maintained under the Preferred Approach due to a lack of viable alternatives. The Preferred Approach, however, does improve or avoid further deterioration at these sources by reducing existing abstractions or developing additional sources to support growth.

The actual reductions that may be needed in future will depend on the specific requirements of the future legislation. Uisce Éireann will update the NWRP as appropriate to account for these requirements, once known, using the monitoring and feedback process set out in Section 9 of this Plan.

Table 7.22 Preferred Approach – Abstractions Potentially Exceeding Sustainable Abstraction Thresholds

Preferred Approach Outcome	Abstraction Sites	
	Decommission	Maintain
SAK Waterford and South Tipperary	H1 – Boola River Intake (Clonmel & Environs) G10 – Poulavanogue Abstraction 1 (Clonmel & Environs) G11 – Poulavanogue Abstraction 2 (Clonmel & Environs) G13 – Glenary Abstraction 2 (Clonmel & Environs)	G3 – Multeen River Intake (Dundrum Regional) G5 – River Clodiagh (Thurles/Borrisoleigh) G7 – Muskry Stream Intake (Galtee Regional) G8 – Clonassy / Pollanasa River (South Kilkenny) G9 – River Blackwater, Mullinavat (South Kilkenny) G12 – Glengarra River (Burncourt Ballylooby) G15 – Clodagh River (East Waterford Water Supply Scheme) G16 – Portlaw Springs (Portlaw) G17 – Ahernes Glen Abstraction (Ardfinnan Regional) G18 – Glenbreda Stream Abstraction (Ardfinnan Regional) M6 – Anner River (Fethard & Mullenbawn Regional Public Water Supply) M7 – Gurtnapisha (Fethard & Mullenbawn Regional Public Water Supply)

Preferred Approach Outcome	Abstraction Sites	
	Decommission	Maintain
		M8 – Cloran stream (Fethard & Mullenbawn Regional Public Water Supply) M9 – Walshbog (Fethard & Mullenbawn Regional Public Water Supply) M11 – College Stream Intake (Galtee Regional) M13 – Deelish Reservoir (Deelish/Ballinacourty/Kilnafrehan) P2 – Ballyshonock Impoundment (East Waterford Water Supply System) P3 – Mahon River Intake (East Waterford Water Supply Scheme)
SAL Kilkenny	M1 – River Dinan (Kilkenny City) M2 – River Douglas (Kilkenny City)	M4 – Dranagh (New Ross) M5 – River Pollmounty (New Ross)
SAM Wexford and Wicklow	P1 – River Currlane (Ferns Regional)	G1 – Bann River (Pallis Bridge) (Gorey) G2 – Bann River (Kilmichael pumping station) (Gorey) G6 – River Sow (Wexford Town) G14 – Owenduff (South regional) G4 – Craan Intake (Bunclody) M10 – River Sow (Sow Regional) M12 – Coolree Intake (Wexford Town) M3 – Barkers Creek (Bunclody)

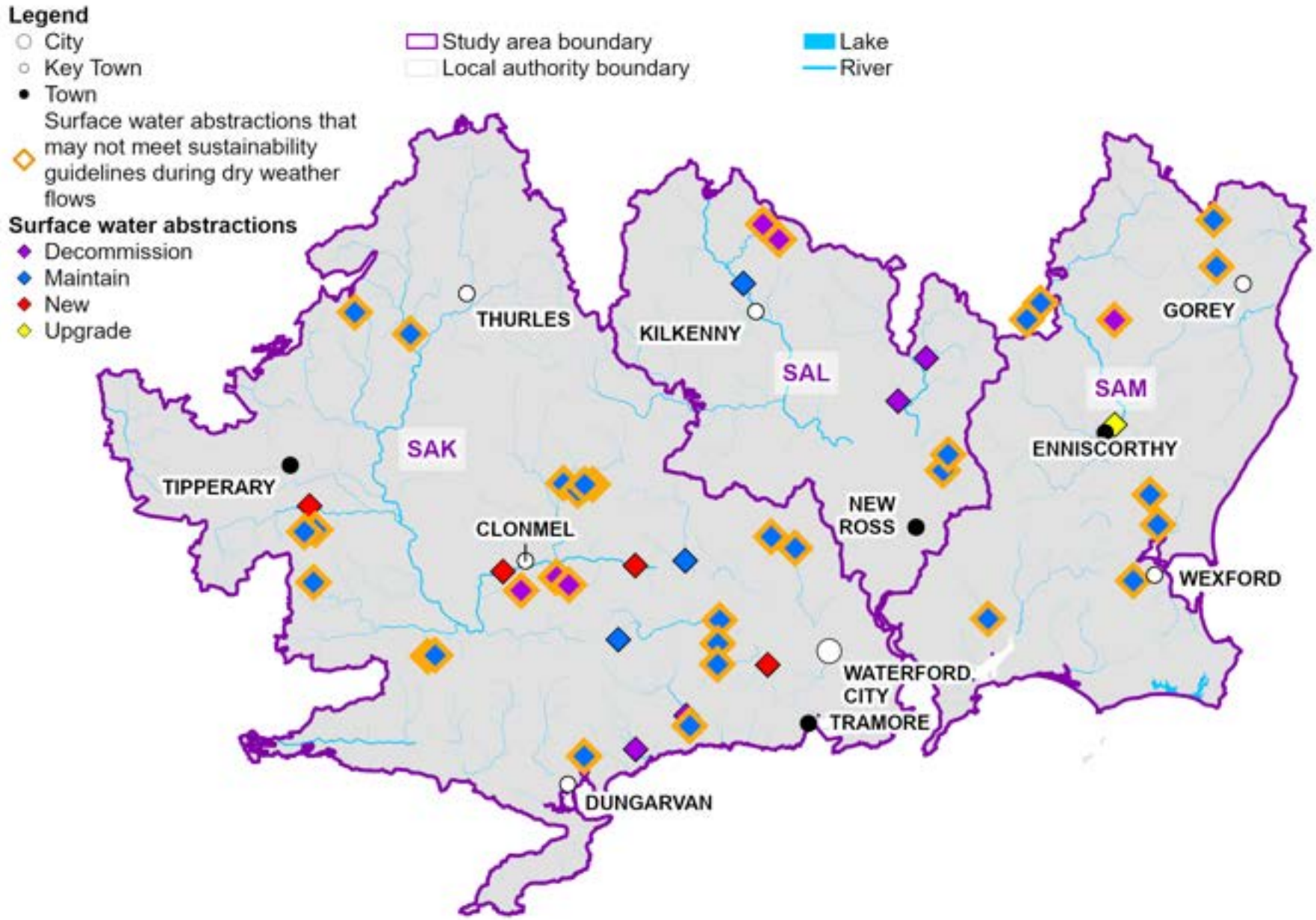


Figure 7.16 Preferred Approach – Surface Water Abstractions

7.4.7.2 Groundwater Abstractions

As explained in Section 3.2.2 of the Framework Plan, groundwater abstractions will need to conform to the proposed new abstraction licencing regime as well. Due to the limited long-term records on pumping and drawdown of water levels for many of our groundwater supplies, it is difficult to present robust desktop assessments of water availability for our existing groundwater abstractions. Until site-specific studies of groundwater availability are completed, Uisce Éireann have developed an initial assessment for existing abstractions based on best available information. Appendix C and Appendix G of the Framework Plan describes our approach to groundwater supply assessments and the regulatory and licencing constraints, respectively. Over the coming years, Uisce Éireann will work with the environmental regulator (the EPA) and the Geological Survey of Ireland (GSI), to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources. We are not in a position to estimate changes to the groundwater availability until better data is available.

Figure 7.17 presents our 120 groundwater sources with the SA Preferred Approach in place. If the SA Preferred Approach is delivered as proposed, abstractions from 55 groundwater sources will be decommissioned, there will be increased abstractions from 20 sources and 16 new groundwater sources will be developed.

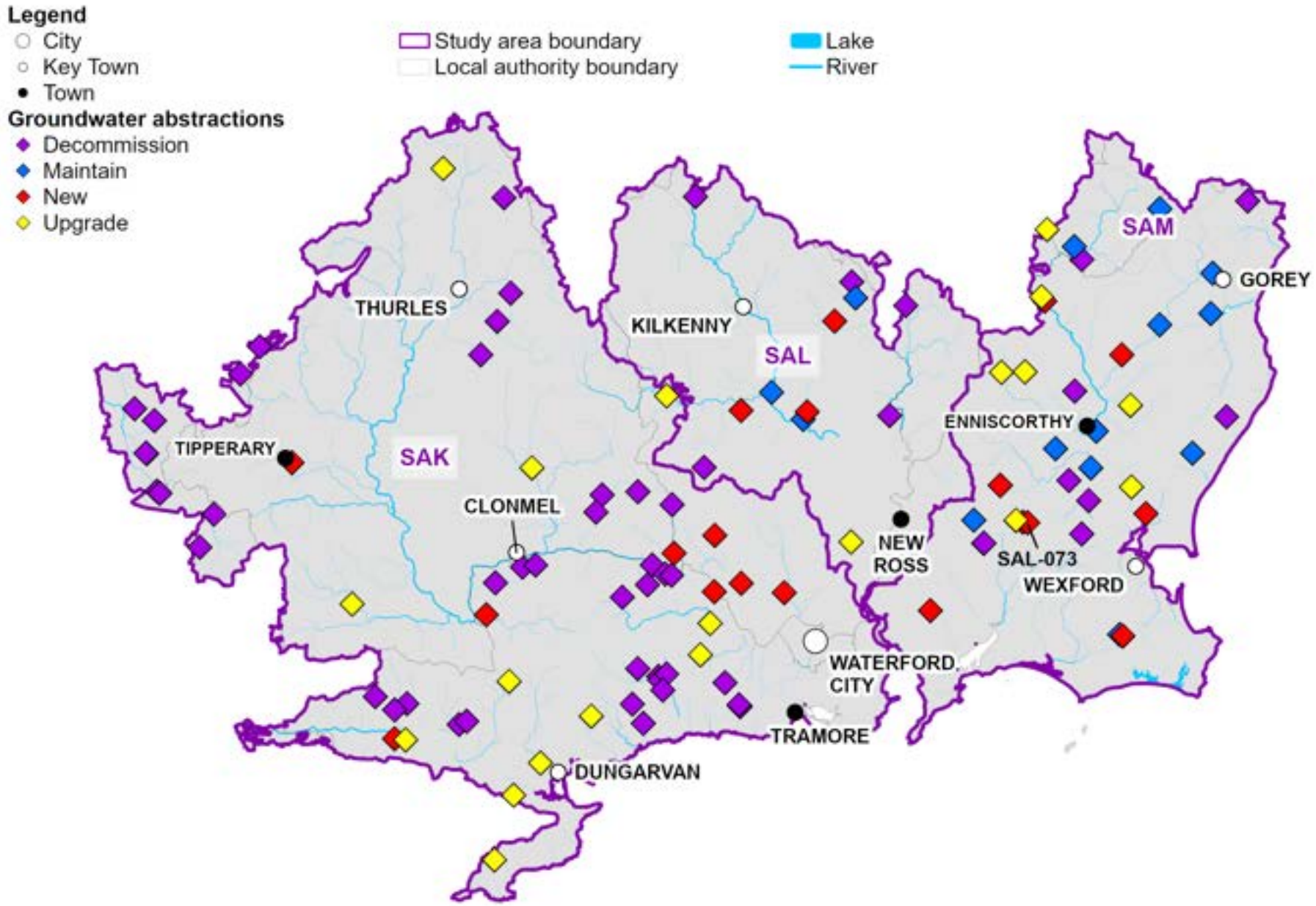


Figure 7.17 Preferred Approach – Groundwater Abstractions

7.5 SA Preferred Approach Summaries

The following sections provide a summary of the Preferred Approaches for each Study Area. Further details are contained in the Study Area Technical Reports in Appendices 1-3.

7.5.1 Study Area K – Waterford and South Tipperary

Study Area K – Waterford and South Tipperary	
No. of WRZs	SAK lies within the counties of Limerick, Tipperary, Waterford, Kilkenny, Laois, Cork and Wexford, covering an area of approximately 5,060 km^2. The population of the Study Area is approximately 214,980.
75	The principal settlements (with a population of over 10,000) are Waterford City, Clonmel, and Tramore.

Current Supply System					
WTPs	**No.**	**Water Source Type**	**No.**	**Supply Deficit**	**m^3/day**
Existing WTP	99	Groundwater	84	DYCP 2019	43,900
High Risk WTP	80	Surface Water	26	DYCP 2044	58,440

Preferred Approach Summary					
Number of WTPs	**No.**	**GW Abstractions**	**No.**	**SW Abstractions**	**No.**
Upgrade (WQ only)	40	Increase	12	Increase	0
Upgrade (Capacity & WQ)	13	Maintain	30	Maintain	20
Decommission	46	Decommission	42	Decommission	6
New	6	New	7	New	3

The Preferred Approach (PA) for SAK consists of 27 local WRZ Options and 8 SA Grouped Options that involve interconnections between one or more supplies, reducing the total number of WRZs from 75 to 33. The SA Grouped Options include:

- Two Options involving new surface water abstractions from the River Suir:
    - Option SAK-983 - Develops a new WTP at Barnes and interconnects Templetney / Brackford Bridge and Ardfinnan Regional WRZs to Clonmel WRZ. Tullahea, Kilcask, Ahenny and Ballinver WRZs are rationalised to Templetney / Brackford Bridge; and Russelstown, Glenagad, Poulavanogue (Waterford) and Kilmanahan are rationalised directly to Clonmel WRZ.
    - Option SAK-949 - Nine (9) WRZs are rationalised to the East Waterford Water Supply System - Ballyogarty, Kilmacthomas, Faha, Smoore, Fews, Kill/Ballylaneen, Scrahan, Dunhill - Cois Coille and Dunhill Ballinageeragh.
- Four Options with new and/or increased groundwater abstractions:
    - Option SAK-973 - Increased groundwater abstraction feeding Deerpark WTP and a new groundwater source to supply Cappoquin WTP. Four WRZs are rationalised to Lismore / Cappoquin / Ballyduff (LCB) WRZ - Ballysaggart, Monatariff, Lacken, Moore's Well, and Carrignagower.
    - Option SAK-837 - New groundwater abstraction and WTP to supply Carrick-on-Suir. Four WRZs are rationalised to Carrick-on-Suir - Rathgormack, Ballyknock, Crehanagh and Garravoone.
    - Option SAK-853 – Increased groundwater abstraction at Mullinbawn Springs and interconnect Coalbrook / Commons and Fethard & Mullenbawn and supply deficit from Fethard & Mullenbawn.
    - Option SAK-995 – Increased groundwater abstraction for Dungarvan WRZ and rationalise Graiguenageeha and Stradbally to Dungarvan WRZ.
- One Option (SAK-975) supplying spare capacity from Thurles to neighbouring WRZs in deficit. Three WRZs are rationalised directly to Thurles WRZs - Horse and Jockey, Littleton, and Two Mile Borris. Glengar WRZ is rationalized to Dundrum WRZs, which is then interconnected to Thurles.

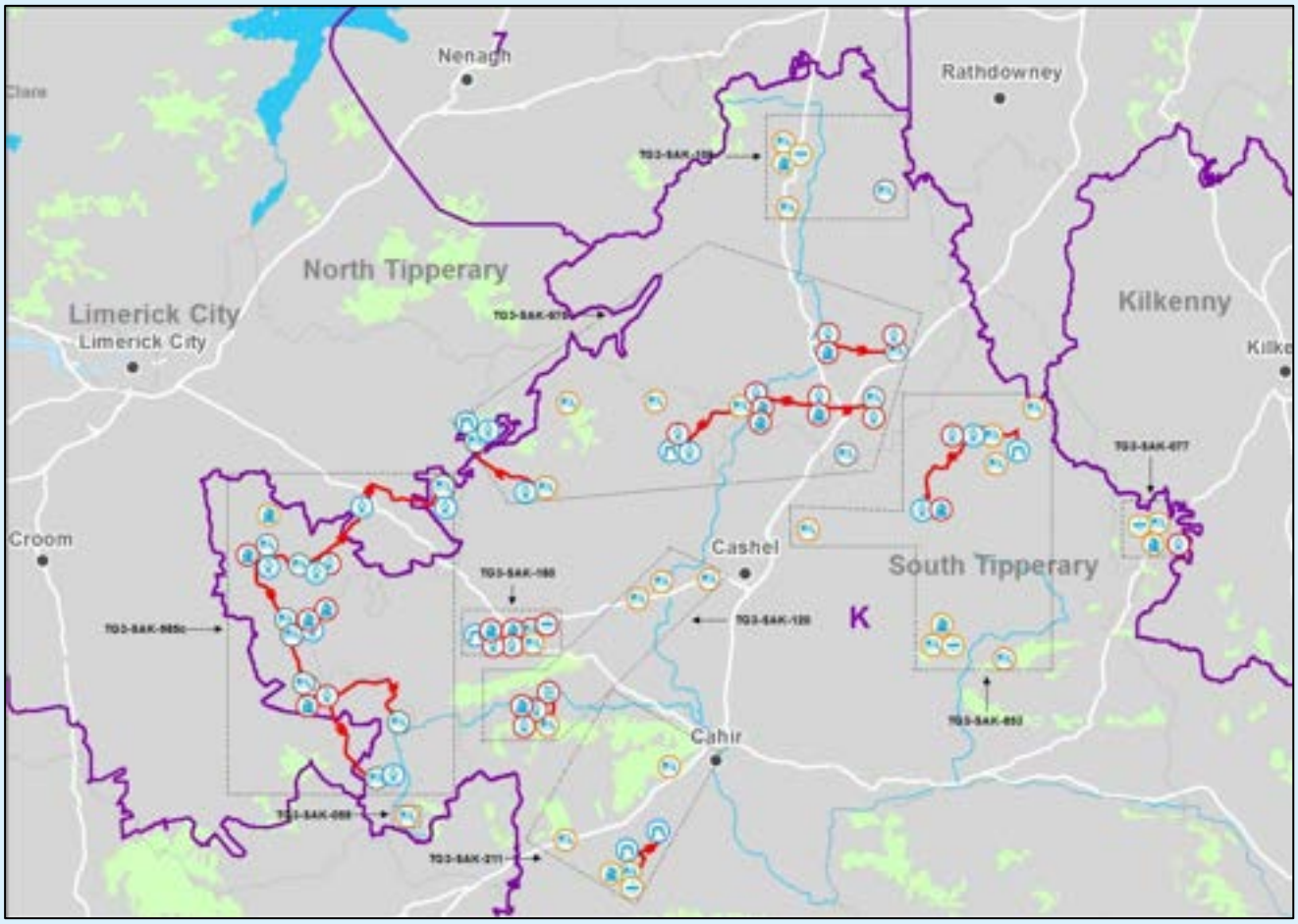
Study Area K – Waterford and South Tipperary

- One Option (SAK-985c) which rationalises 6 WRZs in SAK to the Limerick Supply System, which is located in the Eastern and Midlands Region.

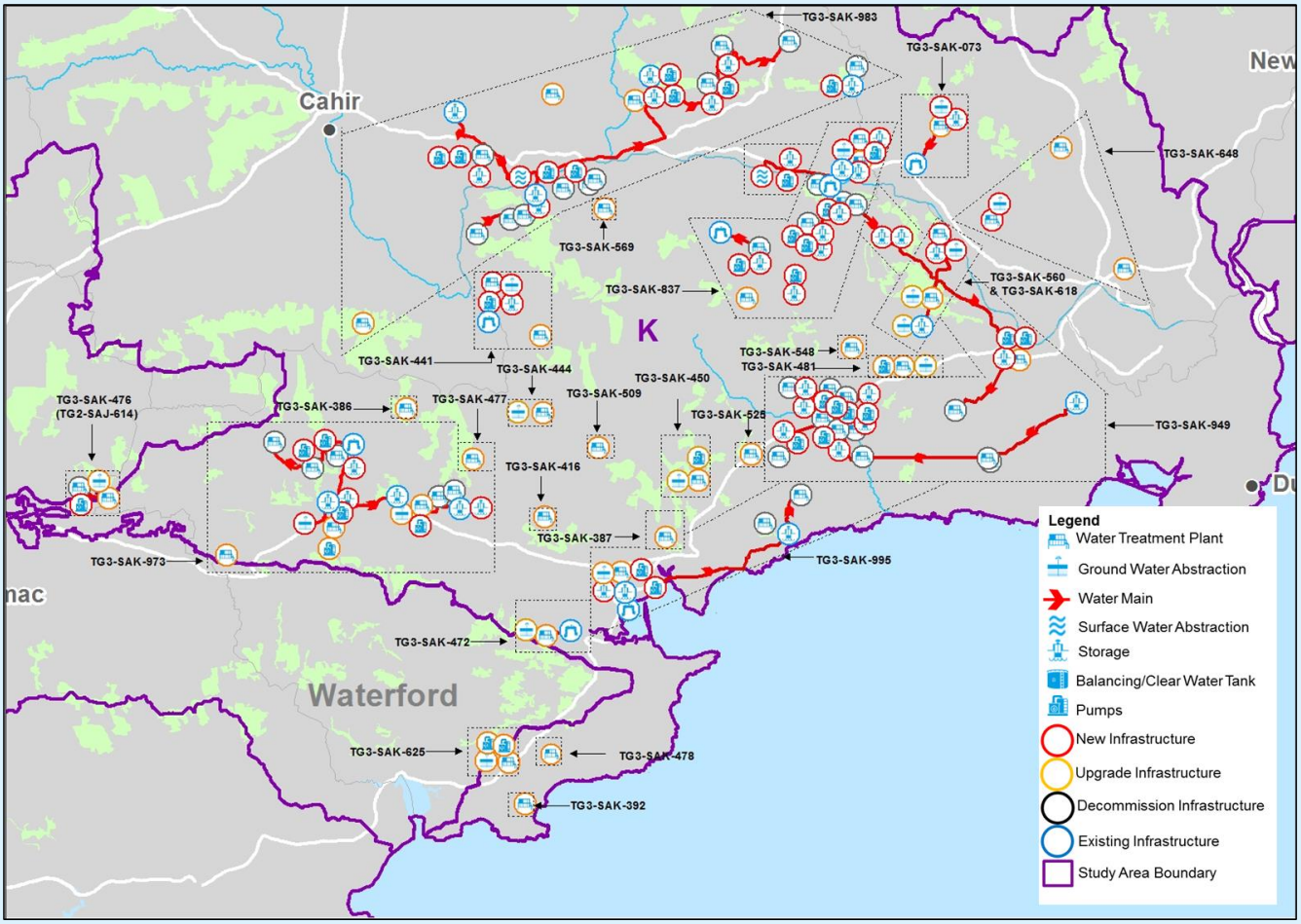
The Preferred Approach provides environmental benefits by decommissioning four existing surface water abstractions that may not meet sustainability guidelines – Boola River Intake, Poulavanogue Abstraction 1, Poulavanogue Abstraction 2 and Glenary Abstraction 2. All abstractions are currently part of the Clonmel WRZ supply system.

Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAK, planned leakage reduction programmes will reduce leakage by 350 m^3/day in Fethard & Mullenbawn regional PWS, Galtee Regional, and Tipperary Town WRZs. We have also committed to additional Leakage Targets of 36,233 m^3/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m^3/day.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.



Study Area K – Waterford and South Tipperary



TG1-SAX-00X are the Option Codes assigned to each Option. A description of each Option can be found in Table 5.9 of the Technical Appendices 1-3.

7.5.2 Study Area L – Kilkenny

Study Area L - Kilkenny	
No. of WRZs	SAL lies within the counties of Tipperary, Carlow, Kilkenny, Laois, and Wexford, covering an area of approximately 1,700 km^2. The population of the Study Area is approximately 53,620. The Principal Settlement (with a population of over 10,000) is Kilkenny.
10	

Current Supply System					
WTPs	**No.**	**Water Source Type**	**No.**	**Supply Deficit**	**m^3/day**
Existing WTP	13	Groundwater	9	DYCP 2019	2,820
High Risk WTP	11	Surface Water	7	DYCP 2044	3,840

Preferred Approach Summary					
Number of WTPs	**No.**	**GW Abstractions**	**No.**	**SW Abstractions**	**No.**
Upgrade (WQ only)	3	Increase	1	Increase	0
Upgrade (Capacity & WQ)	2	Maintain	3	Maintain	3
Decommission	8	Decommission	5	Decommission	4
New	3	New	4	New	0

The Preferred Approach (PA) for SAL consists of local WRZ Options for 3 of the 10 WRZs in the Study Area. The 7 other WRZs are supplied by 3 SA Grouped Options reducing the total number of WRZs from 10 to 6. The SA Grouped Options include:

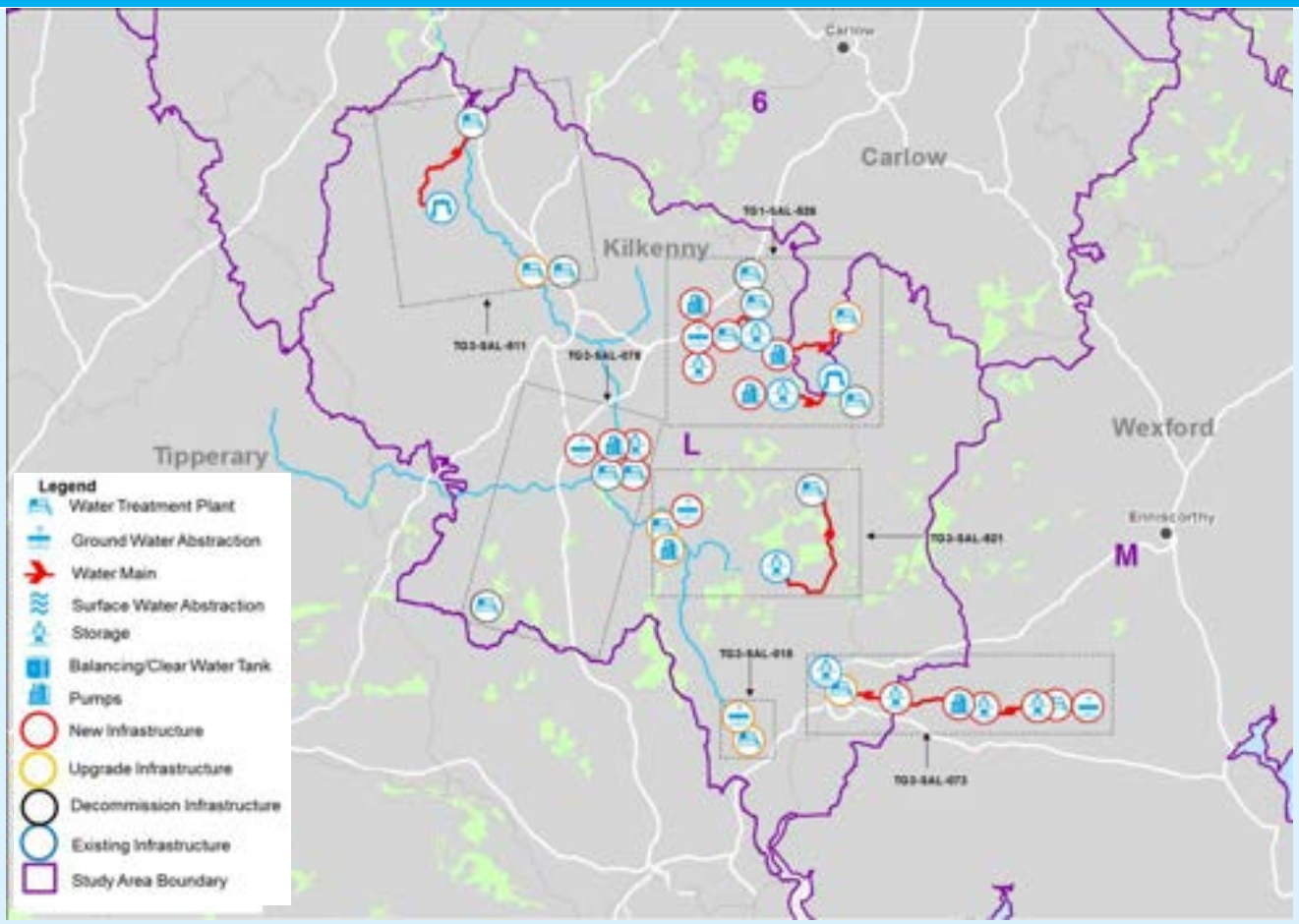
- Two Options rationalising WRZs and supplying the deficit with new groundwater abstractions:
  - Option SAL-526, rationalising Ballinkillen and Borris WRZs to Gowran-Goresbridge-Paulstown WRZ
  - Options SAL-521, rationalising Graiguenamanagh to Thomastown WRZ.
- One Option rationalising WRZs to increase resilience and achieve long-term operational savings:
  - Option SAL-511, upgrades Troyswood WTP to improve water quality performance and rationalise Ballyragged to Kilkenny City WRZ.

The Preferred Approach provides environmental benefits by decommissioning two existing surface water abstraction that may not meet sustainability guidelines – River Dinan and River Douglas, both currently supplying Kilkenny City.

Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAL, planned leakage reduction programmes will reduce leakage by 320 m^3/day in Kilkenny City WRZ. We have also committed to additional Leakage Targets of 3,830 m^3/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m^3/day.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.

Study Area L - Kilkenny



TG1-SAX-00X are the Option Codes assigned to each Option. A description of each Option can be found in Table 5.9 of the Technical Appendices 1-7.

7.5.3 Study Area M – Wexford and Wicklow

Study Area M – Wexford and Wicklow	
No. of WRZs	SAM lies within the counties of Carlow, Wexford, and Wicklow, covering an area of approximately 2,240 km^2. The population of the Study Area is approximately 100,640.
26	The Principal Settlements (with a population of over 10,000) are Wexford and Enniscorthy.

Current Supply System					
WTPs	**No.**	**Water Source Type**	**No.**	**Supply Deficit**	**m^3/day**
Existing WTP	31	Groundwater	27	DYCP 2019	13,770
High Risk WTP	24	Surface Water	10	DYCP 2044	18,220

Preferred Approach Summary					
Number of WTPs	**No.**	**GW Abstractions**	**No.**	**SW Abstractions**	**No.**
Upgrade (WQ only)	13	Increase	7	Increase	1
Upgrade (Capacity & WQ)	9	Maintain	12	Maintain	8
Decommission	9	Decommission	8	Decommission	1
New	4	New	7	New	0

The Preferred Approach (PA) for SAM consists of 18 local WRZ Options and 4 SA Grouped Options which reduce the total number of WRZs from 26 to 19. The SA Grouped Options are:

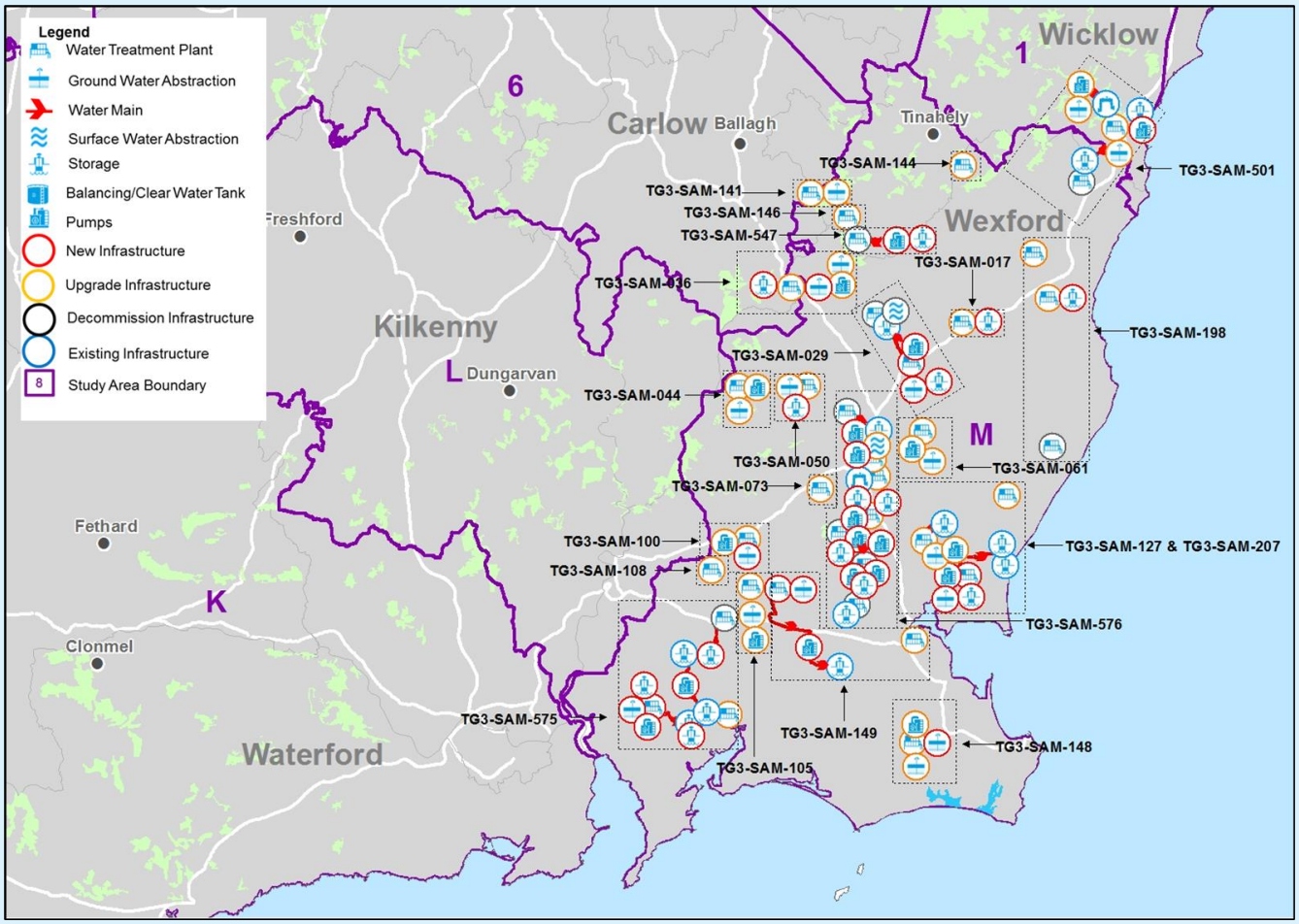
- Option SAM-576 – Increases the surface water abstraction from River Slaney to supply the deficit. Four WRZs are rationalised to Enniscorthy WRZ - Bree, Ballyhogue, Glynn and Marshalstown WRZs.
- Option SAM-575 – Develops a new groundwater source and rationalises Carrickbyrne to South Regional WRZ.
- Option SAM-501 - rationalises the Coolgreany WRZ to the Arklow WRZ (Study Area 1 – Eastern and Midland region).
- Option SAM-547 rationalises the Ballingate WRZ to the Tinahely WRZ (Study Area 1 – Eastern and Midland region).

The Preferred Approach provides environmental benefits by decommissioning one existing surface water abstraction that may not meet sustainability guidelines -River Currlane (Ferns Regional WRZ).

Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAC, planned leakage reduction programmes will reduce leakage by 240 m^3/day in Fardystown, Enniscorthy and Gorey WRZs. We have also committed to additional Leakage Targets of 5,240 m^3/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m^3/day.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.

Study Area M – Wexford and Wicklow



*TG1-SAX-00X are the Option Codes assigned to each Option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-7.

7.6 Interim Solutions

As outlined in Section 8.3.7.6 of the Framework Plan, the NWRP provides for an “interim solution” approach, which allows shorter term interventions to be identified and prioritised, when needed. The Preferred Approach for each WRZ, Study Area and Region will be delivered on a phased basis subject to budget and regulatory constraints. It will take many investment cycles to deliver the Preferred Approach across all WRZs, therefore, Uisce Éireann must have a means to continue delivering safe, secure and reliable water supplies (on a short to medium term basis) while we deliver our Preferred Approach.

On this basis, interim, short-term capital maintenance solutions have been identified for all WTPs and will be utilised when needed. These solutions will allow Uisce Éireann time to deliver the Preferred Approach, while at the same time, maintaining a sustainable water supply. These interim solutions are generally smaller in scale and rely on making best use of already existing infrastructure.

Examples of general interim measures for different water sources include the following:

- For groundwater sites, where the Preferred Approach requires that the existing WTP is to be maintained, the interim solution would typically provide for refurbishment of the existing boreholes or development of new boreholes and borehole pumps, and an upgrade of the treatment process in line with proposed growth predictions. This may require a staged upgrade of the WTP. For example, the interim solution would typically include an upgrade of the WTP to provide supply to existing customers with consideration given to a further required expansion of the WTP at a later date.
- For surface water sites, where the Preferred Approach requires that the existing WTP is to be maintained, the interim solution would typically involve the upgrade of the existing WTP in line with proposed growth predictions. Similar to groundwater sites this may require a staged upgrade of the WTP where the interim solution would typically include an upgrade of the WTP to provide supply to existing customers with consideration given to a further required expansion of the WTP at a later date.
- For groundwater and surface water sites where the Preferred Approach involves the decommissioning of the WTP by providing supply to the customers from another WTP within the WRZ or from another WRZ/Study Area/Region, the interim solution would involve the advancement of the rationalisation of the WTP, by provision of part supply or full supply if possible. If rationalisation is not feasible at that point in time due to dependencies on Study Area or Regional Option, containerised WTP upgrade solutions would be considered for the WTP. This involves the provision of a package WTP within a containerised unit. These package plants can be modified for use on other sites in the future and therefore are considered “no regrets” infrastructure investment.

A decision to progress any interim solution will be based on urgent or priority need to address water quality risk or supply reliability e.g., WTPs on the EPA Remedial Action List (RAL), drought issues or critical need. The RWRP-SE does not confer funding availability for any project and any interim measures will be subject to budget availability, relevant environmental assessment and other required consents in the normal way.

The interim solutions are for the purpose of maintaining continuity of supply and facilitating growth while we deliver the objective of the NWRP. However, it should be noted that the interim solutions will not improve the Level of Service. These solutions, in most cases, will only be used to allow time to deliver the longer-term solution. The interim solutions are determined in line with the Preferred Approach and as such, they are considered “no regrets” infrastructure investment.

7.6.1 Study Area K to Study Area M

The potential interim solutions for Study Areas K to M are summarised in Table 7.23 and described in the Technical Appendices 1 -3.

Table 7.23 Interim Solutions - Study Area K to Study Area M

	Number of Interim Solutions by Type		
Interim Solutions	**SAK**	**SAL**	**SAM**
Upgrade WTP to Uisce Éireann standards	11	2	5
Upgrade WTP to Uisce Éireann standards - potential site for containerised solution	4	6	0
Refurbish existing borehole(s) and upgrade WTP to Uisce Éireann standards - potential for a containerised solution	36	3	8
Refurbish existing borehole and upgrade WTP to Uisce Éireann standards	34	1	18
Refurbish existing spring abstractions and upgrade the WTP to Uisce Éireann standards	7	1	0
Refurbish existing spring abstraction & borehole, and upgrade WTP to Uisce Éireann standards	3	0	0
Refurbish existing spring and upgrade WTP to Uisce Éireann standards - potential site for a containerised solution	4	0	0
Total no. of solutions	99	13	31

Uisce Éireann 's Investment Plan 2020-2024 includes a number of programmes and projects targeted at providing for growth. One such programme is the Small Towns and Villages Growth Programme (STVGP) which will provide funding for Water and Wastewater Treatment Plant growth capacity in smaller settlements which are not otherwise provided for in the Capital Investment Plan 2020-2024. The STVGP is focused on supporting growth in areas already served by Uisce Éireann infrastructure where current or future capacity deficits have been identified. Uisce Éireann have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant County Development Plan. The interim solution for Galtee Regional (SAK), Adramone/Kilrossanty (SAK), Bennetsbridge & Kilmaganny (SAL), and Ballindaggin WRZ (SAM) will be considered under this programme.

7.7 Sensitivity Analysis

Our supply demand forecast has been developed using the best available information and application of best practice methods where we have data to do so. The uncertainty associated with our data is captured within our estimate of Headroom. The Headroom component is added to the Demand

component of the SDB. We have identified areas where we will focus improvements in data to improve the certainty of our forecasts. These are outlined in Section 9 of this RWRP-SE.

Future events that could alter the SDB and impact on Need, such as climate change and new abstraction legislation, introduce uncertainty to our long-term forecasts. For this reason, we undertake a Sensitivity Analysis that allows us to stress test our Preferred Approaches against a range of possible futures. This ensures that our decision making is robust and that the Preferred Approaches are adaptable.

We test our Preferred Approaches against future scenarios defined by five (5) uncertainty factors:

- Sustainability: New abstraction legislation introducing sustainability limits on quantities to be abstracted, increasing the SDB Deficit.
- Climate change: Climate change reduction in water availability at certain times of the year is greater than anticipated, increasing the SDB Deficit.
- Growth forecast: Growth in demand is lower than forecast, reducing the SDB Deficit.
- Leakage targets exceeded: We achieve better than expected levels of effectiveness and efficiency in reducing leakage, reducing the SDB Deficit.
- Leakage targets not met: Leakage does not reduce to target levels within the planning period, increasing the SDB Deficit.

We have not assessed against a scenario where growth is higher than forecast, as we consider the projections that we have used in our SDB calculation reflect an optimistic growth forecast. Furthermore, the scenario of higher than forecast growth would have the same impact as a scenario where Leakage targets are not met.

The uncertainty factors are tested independently. A combination of these scenarios may occur together. For example, we may find growth in demand is lower than forecast, and/or we achieve greater leakage reduction 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 arising due to abstraction sustainability reductions.

As data and models improve over time Uisce Éireann will incorporate a more extensive approach to sensitivity analysis in the form of Adaptive Planning. This will provide the flexibility to respond to uncertainty when it occurs.

Overall, our sensitivity assessment of the Interim Solutions and Preferred Approach indicates they are highly adaptable to a broad range of futures, and therefore represent ‘no regrets’ infrastructure

We describe the scenarios we have assessed in further detail in Chapter 8 of the Framework Plan. A summary of the outcomes of the analysis we have undertaken is given in Table 7.24. Further details can be found in the Study Area Technical Reports (Appendices 1-3).

Table 7.24 Sensitivity Analysis of the Study Area Preferred Approach

Sensitivity Criteria	Impact on the SA Preferred Approach		
	SAK	SAL	SAM
Sustainability Impact			
Status of surface water abstractions potentially impacted by new legislations with the Preferred Approach in place*	Decommission 4 Maintain 18	Decommission 2 Maintain 2	Decommission 1 Maintain 8
Likelihood	Moderate/High	Moderate/High	Moderate/High
Change in Deficit (m^3/day)	+39,400	+1,400	+6,000
Climate Change Impact			
Likelihood	High	High	High
Change in Deficit (m^3/day)	+7,600	+300	+700
Demand Growth Impacts			
Likelihood	Low/Moderate	Low/Moderate	Low/Moderate
Change in Deficit (m^3/day)	-5,950	-3,840	-18,520
Leakage Targets not met			
Likelihood	Low	Low	Low
Change in Deficit (m^3/day)	+350	+320	+240

Sensitivity Criteria	Impact on the SA Preferred Approach		
	SAK	SAL	SAM
Leakage Targets exceeded			
Likelihood	Moderate/High	Moderate/High	Moderate/High
Change in Deficit (m^3/day)	-36,230	-3,830	-5,240

= Reduced SDB Deficit

= Increased SDB Deficit

* Number of abstractions potentially impacted by new legislation that are proposed to be decommissioned in the Preferred Approach. Abstractions that will be potentially impacted by the new legislation are set out in Table 7.19. These impacts are based on conservative estimates of what a future regulatory regime may require. The actual reductions that may be needed in future will depend on the specific requirements of that legislation.

7.8 Summary

Our SA Preferred Approaches consist of a combination WRZ Options and SA Options that perform best against our criteria of Resilience, Deliverability and Flexibility and Sustainability. These solutions have been developed with input from technical and local experts through workshops involving the assessment of 778 Feasible Options.

Our SA Preferred Approaches:

- Consist of 63 Options comprising 48 WRZ Options and 15 Study Area (SA) Grouped Options. The SA Grouped Options supply more than one WRZ and generally rationalise supplies, with associated environmental benefits.
- Comprise 27 increased or new local groundwater supplies, and one (1) increased or new local surface water supplies that contribute to meeting an estimated 27% and 9% of the Deficit across the South East Region.
- Supply 63% of the regional Deficit by interconnecting and rationalising supplies. This is combined with upgraded or new groundwater or surface water sources. The interconnected systems benefit 57 WRZs.
- Supply approximately 1% of the regional Deficit through three (3) Cross Region Interconnections benefitting eight (8) WRZs. The largest cross regional supply connects six (6) WRZs to the Limerick Supply System in the Eastern and Midlands Region. The remaining two connect single WRZs to the Arklow supply system and the Tinahely Supply system in the Mid Wicklow area of the Eastern and Midlands Region.
- Upgrade all WTPs to be maintained under the Preferred Approach, to reduce water quality risks identified through our Barrier Assessments.
- Increase resilience by delivering solutions through interconnections and rationalisation and providing 61 more water storages.
- Improve sustainability outcomes by decommissioning 63 WTPs and abandoning 66 associated abstractions. This includes seven (7) surface water abstraction sites that have been assessed to be potentially impacted by future abstraction legislation. The assessment was based on a conservative estimate of what a future regulatory regime may require.
- Include 143 Interim Solutions to ensure shorter term Deficits are addressed to account for lead times in delivery of Options that will ultimately meet the Deficit across the 25-year planning period.
- Are adaptable to change across a range of future scenarios including climate change, growth projections, sustainability outcomes and changes in leakage targets.

7.9 References

1. Department of Communications, Climate Action and Environment. 2018. *National Adaptation Framework. Planning for a Climate Resilient Ireland*. [Online]. Available from: https://www.gov.ie/en/publication/fbe331-national-adaptation-framework/.
2. UK Technical Advisory Group (UKTAG). 2008.UK Environmental Standards and Condition (PHASE 1). Water Framework Directive.
3. EU Drinking Water Directive (Directive 2020/2184 of the European Parliament and of the Council on the quality of water intended for human consumption (recast).
4. European Union (Drinking Water) Regulations 2023. (S.I. No. 99/2023).
5. Water Environment (Abstractions and Associated Impoundments) Act 2022 [Online]. Available from: https://www.irishstatutebook.ie/eli/2022/act/48/enacted/en.

8 Preferred Approach - Regional

8.1 Introduction

As outlined in Section 1.9.4 of the Framework Plan and Section 1.4 of this document, given the large number of WRZs per capita of population, the National Water Resources Plan (NWRP) has been subdivided into 22 Study Areas (SAs) across four Regions.

These subdivisions are necessary and appropriate to make the Option development and assessment tasks manageable for both Uisce Éireann and the public/stakeholders during the consultation phase. Notwithstanding the sub-division, solutions are not constrained by distance i.e., WRZ, Study Area or Regional boundaries, but instead by the criteria of Resilience, Sustainability, Flexibility and Deliverability.

One of the key benefits of having a Regional Plan is that it allows us to consider options to address Need for each individual supply, and then to further assess whether the outcomes of the Plan can be improved by reviewing larger Study Area (SA) Options which serve multiple WRZs at Study Area Level; or even larger Regional Options that can be applied across the region.

Study Area and Regional Options in some cases perform better than local solutions, as they:

- Allow us to look at the resilient supplies across a wider area
- Provide opportunities to decommission problematic, unsustainable local sources
- Allow us to balance our overall regional abstraction in an improved way across multiple catchments, with improvements in sustainability
- Improve operational control by having fewer Water Treatment Plants (WTPs) to manage
- Provide more resilient WRZs that are less sensitive to peaks in demand during critical events.

In Section 7, we described the process applied to select the Study Area Level Preferred Approach. As part of this process, we assessed the Feasible Options to determine if any Study Area or Regional Options were available to meet the Need across multiple WRZs. While there were no regional options connecting WRZs across Study Area boundaries; inter-regional options were identified that connect WRZs to supply systems in adjacent regions.

As explained in Section 6, the Feasible Options are considered at Plan Level and are desk-based. The progression of the Preferred Approach is subject to project level assessments to confirm aspects such as the available source yield and environmental impacts. Where project level assessments identify challenges to the delivery of the Preferred Approach, alternative feasible options will be reassessed.

The Preferred Approach for Study Area M relies on the new and increased groundwater abstractions. The limited availability of data to support Plan Level yield assessments means the successful delivery of this Preferred Approach is less certain and an alternative option may be required.

In this section, we will:

- Explain the challenges to interconnecting supplies across the study areas of the South East Region;
- Provide an overview of the Regional Preferred Approach, outlining the benefits of supply rationalisation and interconnectivity achieved through our proposed SA Options;
- Present an alternative regional approach that involves an inter-regional transfer to meet the deficit in SAM.

8.2 Challenges to interconnecting supplies across the South East Region

Unlike the Eastern and Midlands Regional Water Resources Plan (RWRP-EM), our Option Development Process for the South East Region did not identify any Feasible Options with the potential, in terms of quantity and distribution of supply, for a large-scale interconnection of multiple WRZs across Study Area boundaries. The Study Area Preferred Approach does comprise interconnected supplies within the Study Area boundaries and in this way provides the benefit of resilience and improved environmental outcomes through the decommissioning of unsustainable sources and ageing infrastructure.

The South East Region has limited potential for regional interconnectivity due to the cost and challenge associated with transporting small volumes of water over long distances. Minimum main size requirements mean that treated water may be stored in the network for extended periods of time and hence there can be a significant time lag between when the water was treated and when the customer receives the water. Additional chlorine dosing may be required along the network to ensure water received by our customers meets the required water standards. Such arrangements can be complicated and costly for small supplies.

Additionally, almost two-thirds of the WRZs in the South East Region currently have a greater than two percent risk of experiencing a supply shortfall in a dry year, falling short of our target Level of Service. Options that require long lead times, like implementing large-scale interconnections, may not be the most effective solutions to address the pressing water shortages of these WRZs. Furthermore, there are limited surface water catchments within the region that can support large sustainable abstractions to supply multiple interconnected WRZs.

Across the South East Region, topography and the presence of environmentally sensitive sites, such as Special Protection Areas (SPAs) and Special Areas of Conservation (SAC), are not significant barriers to development across the study areas. Figure 8.1 shows there are very few SACs or SPAs that could potentially limit pipeline construction across the region. Although the Blackstairs SAC forms part of the boundary between SAL and SAM, there are no significant settlements nearby that would benefit from a connection across this route.

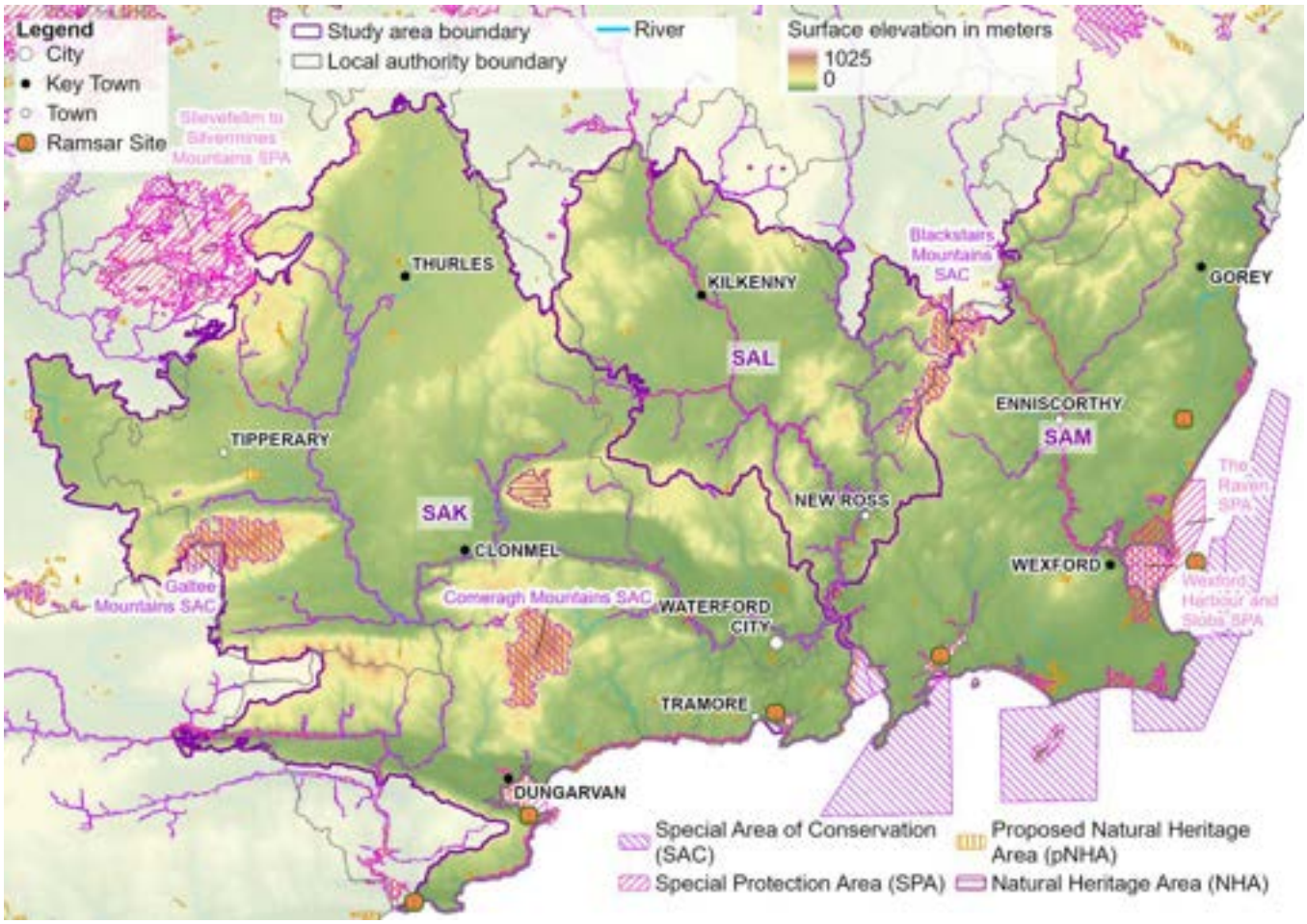


Figure 8.1 Designated sites in the South East Region

8.3 The Regional Preferred Approach

Due to the limitations described in Section 8.2, our Option Development Process for the South East Region did not identify any feasible options with the potential, in terms of quantity and distribution of supply, for a large-scale interconnection of multiple WRZs across the Study Area boundaries. For this reason, the SA Preferred Approach that is presented in Section 7 is assessed as the 'Best Value' solution to address the regional water supply Need. The Regional Preferred Approach is therefore the combination of the three Study Area Preferred Approaches for the South East Region.

8.3.1 Interconnected WRZs

Although the Preferred Approach for the South East Region does not involve a large-scale regional interconnected supply, the Preferred Approach does interconnect supplies within the Study Area boundaries. It therefore still provides the benefit of resilience and improved environmental outcomes, achieved through the decommissioning of unsustainable sources.

The interconnection of current supply systems within the region creates 12 new WRZs that incorporate 57 pre-existing WRZs. A further eight (8) WRZs will be connected to supply systems in the Eastern and Midlands Region.

The merging of WRZs reduce the total number of discrete water supply systems that Uisce Éireann will operate and maintain across the South East Region from 111 to 58.

Table 8.1 shows the number of new WRZs formed in the South East Region by merging a specific number of existing WRZs. For example, it shows that four (4) new WRZs are formed by merging two (2) WRZs each, hence replacing eight (8) existing WRZs. The table only refers to the new WRZs formed within the South East Region. It does not include the merged systems formed by interconnecting to water supply systems in the Eastern and Midlands Region, as the source supply is located outside of the South East Region.

Two (2) merged systems will interconnect ten or more WRZs. These are in Study Area K (Waterford and South Tipperary):

- **Clonmel WRZ** – Develops a new surface water abstraction from the River Suir that will supply 10 merged WRZs either through a direct connection to the Clonmel WRZ, or via connection to Templetney/Brackford Bridge WRZ. WTPs and associated abstractions will be decommissioned for eight connecting WRZs.
- **East Waterford Water Supply Scheme (WSS)** – Develops a new surface water abstraction from the River Suir, upstream of Carrick-on-Suir. The new abstraction will supply the forecast deficit in the East Waterford WSS, and an additional nine (9) WRZs that will be connected to the scheme. WTPs and associated abstractions will be decommissioned for nine connecting WRZs.

A further four (4) new WRZs are formed by merging five or six existing WRZs. Three (3) of these are also in SAK:

- **Lismore/Cappoquin/Ballyduff WRZ** - Increases groundwater abstraction from an existing borehole and commissions a new trial well. A New groundwater abstraction and upgrade in treatment capacity at LCM Cappoquin WTP is also proposed. WTPs and associated abstractions will be decommissioned for five connecting WRZs.
- **Thurles/Borrisoleigh:** Spare capacity from Thurles is supplied to five interconnecting WRZs. WTPs and associated abstractions will be decommissioned for four connecting WRZs.
- **Carrick-on-Suir:** Develops a new groundwater abstraction and new Linguan WTP. The new supply will address the deficit at four WRZs connecting to Carrick-on-Suir. The WTPs and associated abstractions will be decommissioned for all four connecting WRZs.

The fourth new WRZ is formed by merging five (5) WRZs with **Enniscorthy Town in Study Area M** (SAM). This involves an increased surface water abstraction from the River Slaney and upgraded WTP capacity. WTPs and associated abstractions of the four (4) WRZs connecting to Enniscorthy Town will be decommissioned.

The Preferred Approach also comprises 46 local, independent solutions to address the water quality and water supply needs of single WRZs. These are generally isolated rural settlements that are challenging to connect to adjacent supply systems due to the difficulties in transporting small volumes of water over long distances.

Table 8.1 Number of new WRZs formed (by Group Size)

Merged group size (Number of WRZs merged)	Number of New WRZs formed	Number of Existing WRZs replaced
Two	4	8
Three	2	6
Five	2	10
Six	2	12
Ten	1	10
Eleven	1	11
Total	**12**	**57**

Note: The table does not include the 8 WRZs that connect to the Eastern and Midlands region as the source supply systems are not located within the South East Region

8.3.2 Benefits of Interconnecting Supplies

In most cases, where WRZs are interconnected, one or more existing water supply systems are rationalised. The rationalisation of supply systems enables smaller and/or unsustainable sources to be decommissioned, delivering improved environmental outcomes and wider associated community benefits. The decommissioning of WTPs through rationalisation also delivers efficiencies through the reduced number of assets to operate and maintain. The Regional Preferred Approach proposes to decommission 66 sources and 63 WTPs. Supplies will only be decommissioned once a new source is connected and operational and abstraction licenses for the new or alternative supply have been obtained.

Larger interconnected water supply systems usually comprise multiple raw and/or treated water storages and WTPs. This provides operational flexibility and increased resilience by enabling supply to be delivered from other connected WTPs or storages during drought periods and at times of supply outage. Larger supply systems are therefore less sensitive to peaks in demand during critical events. For this reason, peaking factors (used to estimate design capacity) are lower for larger WRZs. Similarly, for larger WRZs, the uncertainty in the supply demand calculation reduces, as any potential changes in demand forecasts will have a relatively lower impact for a large WRZ compared with smaller WRZs. As a result, the headroom allowance we need to plan for is lower. The combination of reduced peaking effects and reduced headroom allowance means that the estimated supply volume that we need to provide a 1 in 50 Level of Service (LoS) to customers is lower. One of the key benefits of merging WRZs is this reduction in the design capacity resulting from the increased resilience of larger water supply systems.

Headroom is the term given to a buffer in the Supply Demand Balance (SDB). It accounts for the uncertainty with data and the assumptions used in the supply and demand estimates and forecasts.

The **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. A 1 in 50 LoS means that customers would only expect to experience a supply failure, on average, once every 50 years; or there would be a 2% chance of experiencing a supply failure in any given year.

Another benefit of larger interconnected systems is the increased efficiency and economies of scale in delivering leakage reduction measures compared with fragmented systems. As explained in Section 5 of this Plan, we have committed to leakage targets that reduce leakage levels to 21% of average demand for large WRZs where the demand is greater than 1,500 cubic metres per day (m^3/day).

Prior to the development of solutions at project level, the SDB will be updated to account for the changes in both the water available for use (resulting from the decommissioned sources), and the changes in demand (resulting from increased leakage targets and reduced headroom and peaking factors). The following section describes the approach that will be applied to re-calculate the SDB.

8.3.1.1 Re-calculation of the Supply Demand Balance (SDB) for Large Interconnected Supplies

As mentioned above, the Preferred Approach for SAK includes two large interconnected systems, each merging at least ten WRZs to form two (2) new WRZs: Clonmel WRZ and East Waterford WSS WRZ.

The formation of the proposed new Clonmel WRZ will involve merging 11 WRZs. Ardfinnan Regional and Templetney/Brackford Bridge WRZs will be interconnected with Clonmel WRZ. Four (4) adjacent WRZs will be rationalised to Templetney/Brackford Bridge WRZ and a further four (4) WRZs will be rationalised to Clonmel. The water available for use (WAFU) for these WRZs will therefore reduce to zero when the Preferred Approach is in place as the sources will be abandoned. The full demand for each WRZ will be supplied from the proposed new surface water abstraction from the River Suir. The sources and WTPs for Ardfinnan Regional and Templetney/Brackford Bridge WRZs will be maintained. Therefore, it is only the Deficit in these WRZs (rather than the full Demand) that will be met from the new and/or upgraded sources. Two of the three WTPs that currently serve the Clonmel WRZ will also be decommissioned. Only the WAFU from the Monroe WTP source will be maintained. Table 8.2 lists the additional supply that would be required from the new River Suir abstraction for each WRZ. The table shows the WAFU from the maintained WTPs will be 7.6 Ml/d; and the estimated WRZ 2044 DYCP demand will be 24.2 Ml/d. Therefore, the additional supply required from the new abstraction is estimated to be approximately 15.3 Ml/d, without considering the lower headroom allowance and higher leakage targets for larger interconnected systems.

Table 8.2 also lists the peaking and headroom factors that are applied in the SDB to calculate the demand for the existing discrete water supply systems. For the proposed integrated multi-source systems, the headroom factor will reduce to 10% across all WRZs and the peaking factor will remain at 20%. When leakage targets and the smaller headroom allowance is considered, the 2044 DYCP demand reduces from 24.2 ML/d to 8.9 Ml/d.

Similarly, the expansion of the East Waterford supply scheme to include a further nine (9) WRZs will decommission 10 WTPs and their associated abstractions. This will result in a Deficit of approximately 20.8 Ml/d that would need to be met from the new River Suir abstraction. Table 8.3 shows the WAFU from the maintained WTP will be 23.1 Ml/d; and the estimated WRZ demand will be 43.9 Ml/d. Therefore, the additional supply required from the new abstraction is estimated to be approximately 15.3 Ml/d, without considering the lower headroom allowance and higher leakage targets for larger interconnected

systems. When leakage targets and the smaller headroom allowance is considered, the 2044 DYCP demand reduces from 43.8 Ml/d to 32.7 Ml/d.

The supply demand balance for all interconnected systems will be reassessed at project level to confirm the abstraction that is required to meet the combined demand under the merged water supply system. Due to the higher leakage targets for large WRZs and the smaller headroom allowance, the recalculated abstraction volume at project level may be less than the Plan Level assessment.

Table 8.2 Supply Required for the new Clonmel WRZ

Current WRZ	2044 DYCP* Demand (m^3/day)	2044 DYCP* WAFU** from existing supplies (m^3/day)	Additional Supply Required (from New/Upgraded sources) (m^3/day)	Headroom (% of Average Demand)	DYCP* peaking factor (% of normal year average demand)
New surface water abstraction from the River Suir and new WTP at Barnes					
Ahenny	60	0	60	20%	20%
Ardfinnan Regional	7,420	1,190	6,230	15%	20%
Ballinvir	40	0	40	20%	20%
Clonmel	11,490	4,340	7,150	10%	20%
Tullohea	360	0	360	20%	20%
Kilcash	80	0	80	20%	20%
Templetney/ Brackford Bridge PWS	4,550	3,300	1,250	15%	20%
Glenagad	30	0	30	20%	20%
Russeltown	40	0	40	20%	20%
Poulavanogue (Waterford)	80	0	80	20%	20%
Kilmanahan	20	0	20	20%	20%
Total	**24,170**	**7,640**	**15,340**	-	-

*DYCP is the weather planning scenario that is used in our National Water Resources Plan (NWRP) to estimate the supply Deficit that the Plan must address. It represents the period within a dry year where demands can be significantly above average.

**WAFU (Water Available for Use) is the amount of water that can be supplied from a supply system, taking into account infrastructure capacity constraints, treatment losses and planned and unplanned events that can reduce supply. If the existing source will be decommissioned under the Preferred Approach, the WAFU from the existing source is zero.

Table 8.3 Supply Required for the new East Waterford Water Supply Scheme

Current WRZ	2044 DYCP* Demand (m^3/day)	2044 DYCP* WAFU* from existing supplies (m^3/day)	Additional Supply Required (from New/ Upgraded sources) (m^3/day)	Headroom (% of Average Demand)	DYCP* peaking factor (% of normal year average demand)
New surface water abstraction from the River Suir, upstream of Carrick-on-Suir					
East Waterford Scheme	42,660	23,100	19,560	10%	20%
Smoore	20	0	20	20%	20%
Faha	60	0	60	20%	20%
Fews	70	0	70	20%	20%
Dunhill-Cois Coille	30	0	30	20%	20%
Dunhill Ballinageeragh	10	0	10	20%	20%
Ballyogarty	370	0	370	20%	20%
Kilmacthomas	250	0	250	20%	20%
Scrahan	20	0	20	20%	20%
Kill/Ballylaneen	400	0	400	20%	20%
Total	**43,890**	**23,100**	**20,790**	-	-

*See footnotes for Table 8.2

8.3.3 Cross-regional transfers

The Regional Preferred Approach includes three (3) inter-regional transfer connecting to WRZs in the Eastern and Midlands Region, as detailed in Table 8.4. All three interconnections enable the decommissioning of connecting WRZ WTPs and abstraction sources.

The connection to Arklow WRZ requires a small increase in the groundwater surface water abstraction, representing. The new connected demand will represent about 10% of the total demand of the WRZ. The connection to Tinahely and Limerick City Environs will not require additional source upgrades.

For each inter-regional transfer, Table 8.4 lists the ‘Source’ and ‘Destination’ study area, the ‘parent’ WRZ (i.e., the WRZ which is to supply the other WRZ) and the rationalised WRZs (i.e., the WRZs which will be receiving a supply from the ‘parent’ WRZ). These transfers are shown in Figure 8.2 with the letter reference listed Table 8.4.

Table 8.4 Inter-regional Transfers

Source SA (Source Region)	'Parent' WRZ	Destination SA	Destination WRZ/s	2044 Transfer volume (m^3/day)	Figure 8.2 Reference
SA1 (Eastern and Midlands)	Arklow	SAM	Coolgreany	10	A
SA1 (Eastern and Midlands)	Tinahely	SAM	Ballingate	720	B
SA8 (Eastern and Midlands)	Limerick City Environs	SAK	Carrigmore, Kilteely, Herbetstown, Knocklong/Hospital, Ballylanders, Galbally	3,940	C

When assessing the Options at the Study Area level, the impact of the abstraction volume that is required to supply both the WRZs in the 'Source' Study Area and the WRZs in the 'Destination' Study Area, is considered in combination. As with all new and upgraded abstractions, the volume is limited to the estimated dry year sustainable abstraction threshold.

8.3.4 Cumulative Effects at Regional Level

At the Regional Level, cumulative effects need to be considered in relation to the combined effects from proposals in the three Study Areas of the South East Region and includes consideration of the transfers across Study Areas and inter-regional transfers.

For cumulative effects to occur, there needs to be an overlap of temporal periods in some way for the impacts and/or the effect. For example, two strategic-level schemes being constructed at the same time could result in cumulative traffic movements, while two schemes being operated together could result in a drawdown of groundwater levels. A precautionary approach has been taken for the cumulative effects assessment, which assumes that all Options could be constructed at the same time and then all Options would be operated at the same time.

The Strategic Environmental Assessment (SEA) Environmental Report prepared for the RWRP-SE assesses the cumulative effects of proposals across the three Study Areas related to:

- Biodiversity – for example, a cumulative loss or fragmentation of habitats or changes to a habitat quality through changes in water quality or groundwater levels;
- Water environment (surface water and ground water WFD status) – for example, changes to water quality due to multiple construction projects;
- People and health – for example, nuisance or physical health impacts caused by multiple construction works taking place at the same time;
- Landscape and visual – for example, if there are a number of Options located close together that could alter the landscape character or views;
- Cultural heritage – for example, if the same cultural heritage features are affected by above ground infrastructure in close proximity or the combined effect of loss to undesignated archaeological assets

or from combined impacts resulting in additional changes to water levels affecting archaeological resources; and

- Climate change – combined carbon emissions for the approach as a whole have been considered through the approach selection process. Combined effects on climate change adaptation are also considered including effects on biodiversity and the water environment (for example, changes to water quality due to multiple construction works taking place at the same time).

Sustainability analysis for groundwater and surface water abstractions has already taken account of combined effects from other Uisce Éireann abstractions within and across Study Area or region boundaries.

The components of Preferred Approaches most likely to lead to within-plan cumulative effects are the construction of pipelines and associated works, such as new WTPs and pumping stations. The Cross Region transfers are shorter in length than some of the within Study Area Options. Cumulative effects on landscape and visual amenity across Study Area Preferred Approaches and from pipeline construction of these cross transfers are therefore unlikely to be significant.

Further details of the cumulative assessment at regional level are provided in Section 9 of the SEA Environmental Report for the RWRP-SE, including the cumulative effects with other plans and programmes.

8.3.5 Transboundary Effects

The types of options and their location, proximity and pathways for environmental effects have been considered through the process in relation to possible environmental effects for the Northern Ireland environment including any shared groundwater and river catchments and the marine environment. For the combination of options included in the Regional Preferred Approach, no potential transboundary adverse environmental effects have been identified at the Study Area level or the regional level for the RWRP-SE.

8.3.6 Option Types and Component Summary

The Regional Preferred Approach provides a solution to address an estimated 2044 DYCP Deficit of 80 Ml/d. This is achieved through a combination of within Study Area interconnected supplies, local groundwater and surface water sources, and three interconnections to sources from an adjacent Study Area. It also includes WTP upgrades to reduce water quality risks identified through our barrier assessment.

Table 8.5 summarises the Option Type and the Deficit that will be supplied for the South East Region.

Table 8.5 Preferred Approach Option Types

Option Type	No. of Existing Benefitting WRZs	2044 DYCP Deficit Supplied (m^3/day)	Percentage of Regional Deficit Supplied (%)
Local source (GW)	27	21,420	70
Local source (SW)	1	7,460	<1%
Within SA interconnection	57	50,790	30
Inter-regional connection	8	820	<1%
WTP upgrade (WQ only)	18*	not applicable	not applicable

*This is the number of WTPs that will be upgraded for water Quality only. It does not include the existing WTPs that will be upgraded for both WQ and capacity, as these form part of the other Option Types.

When the Options within the Regional Preferred Approach are delivered, the number of WRZs across the South East Region will be reduced from 111 to 58 through the development of interconnected systems. Twelve (12) new WRZs will be formed, and 455 kilometres of trunk mains (>300 mm diameter) will be constructed to interconnect supply systems.

Table 8.6 summarises the changes to WTPs and abstractions with the Regional Preferred Approach in place. Figures 8.2 displays the WTPs and trunk mains that will form part of the Regional Preferred Approach; while Figure 8.3 shows the location of the surface water and groundwater sources.

Table 8.6 WTP and Abstraction Summary

Option Component	No. of Water Treatment Plants	No. of Surface Water Abstractions	No. of Groundwater Abstractions
New	13	3	16
Increased capacity	24	1	20
Maintained (WTP upgrade for quality only)	56	31	45
Decommissioned	63	11	55

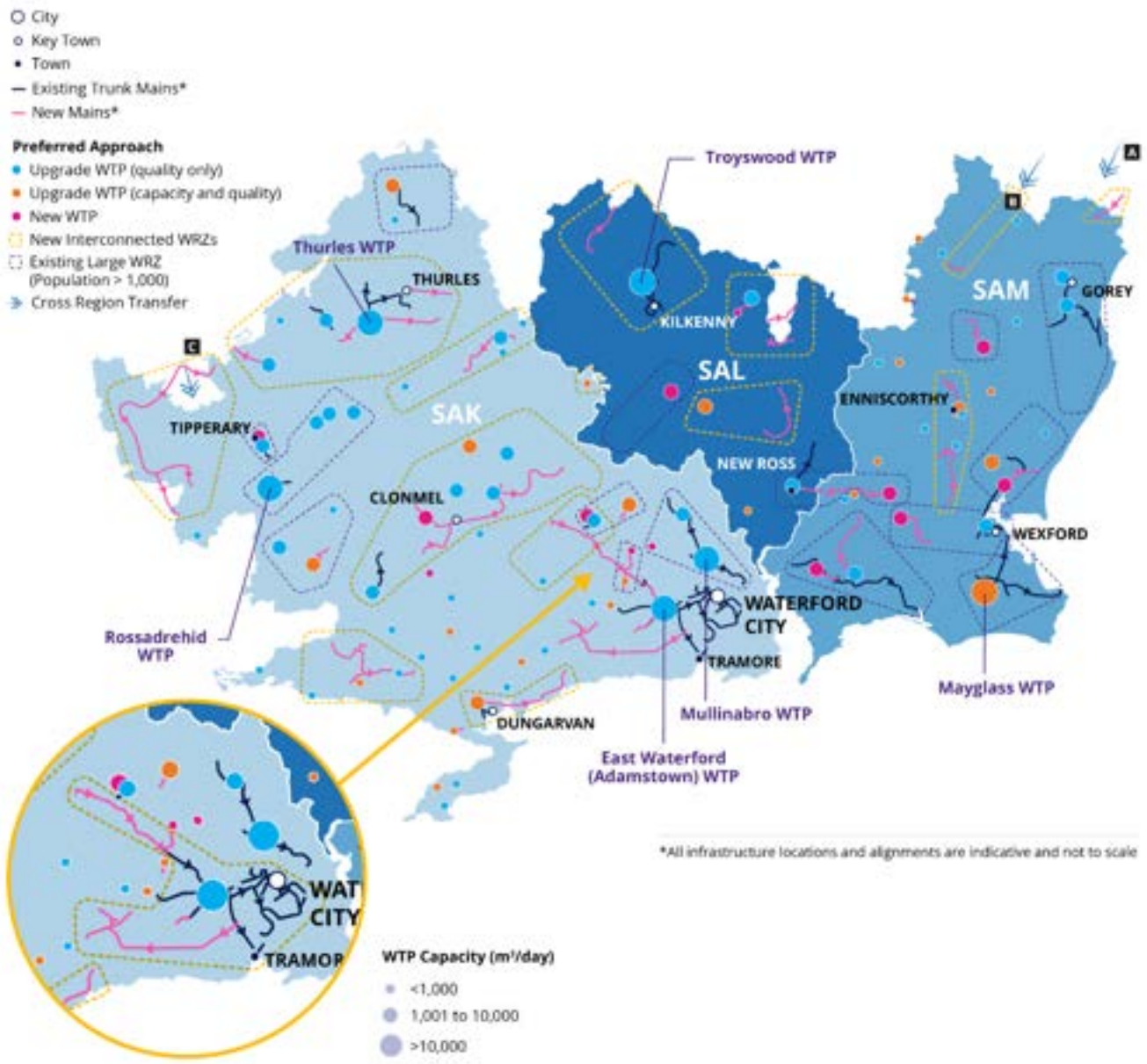


Figure 8.2 Regional Preferred Approach

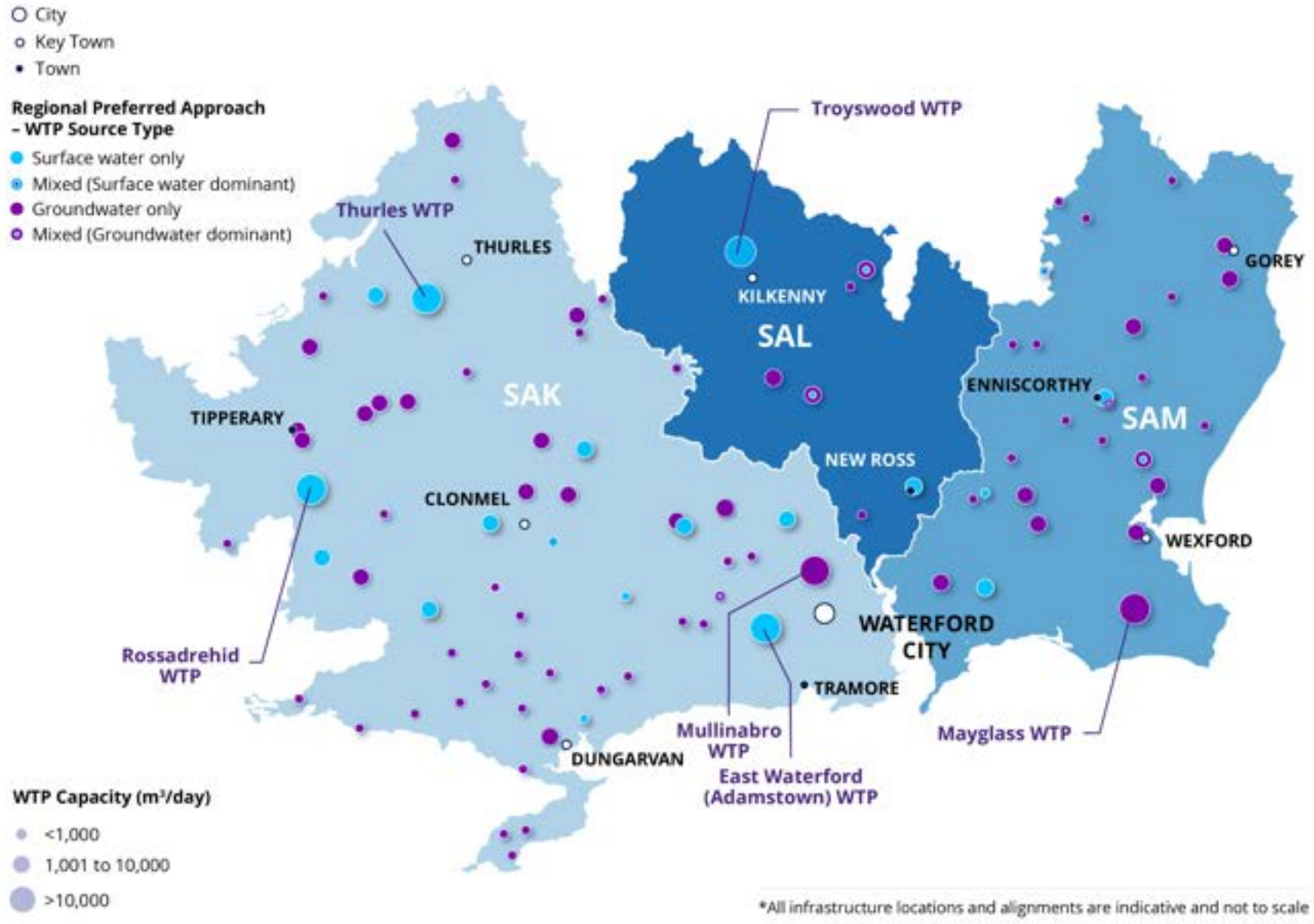


Figure 8.3 Regional Preferred Approach – Groundwater and Surface Water Supplies

8.4 Summary

The Regional Preferred Approach considers, at a Plan Level, what projects/solutions might work best to meet the overall Deficit in the South East Region. Taking a holistic view of the region presents opportunities to improve the sustainable management of our water resources and increase operational flexibility and resilience.

While some small Cross Study Area Transfers have been identified, the potential for a large feasible option with the capability to provide regional interconnectivity (across Study Area boundaries) is limited due to the cost and challenge associated with transporting small volumes of water over long distance. However, the Approach Development Process at Study Area Level, has identified interconnected supplies within the Study Area boundaries that will ultimately increase resilience and provide improved environmental outcomes. The interconnection of WRZs form 12 new WRZs, replacing 57 existing WRZs. This will reduce the total number of water supply systems that Uisce Éireann will operate and maintain across the region from 111 to 58.

The Regional Preferred Approach also comprises 48 local WRZ options to address the water quality and water supply needs of single WRZs

The benefits of delivering the Preferred Approach include:

- Improved environmental outcomes by decommissioning of inefficient infrastructure and abandoning abstractions including 11 surface water and 55 groundwater abstractions. This includes seven (7) surface water sources assessed by Uisce Éireann as not meeting sustainability guidelines during dry weather flows.
- Increased resilience through interconnected supplies. This includes the development of a new surface water abstractions from the River Suir to supply 10 WRZs connecting to the Clonmel system and nine (9) WRZS connecting to the East Waterford Supply scheme. Connection to the Limerick supply system in the Eastern and Midlands Region will also increase resilience to six (6) WRZs that are currently supplied by small local groundwater sources.
- A reduction in demand met through increased leakage targets and the lower headroom requirement of larger interconnected systems.
- Improved minimum Level of Service of 1 in 50 in drought and winter conditions across all WRZs in the South East Region, as well as increased resilience during normal and dry conditions.

The Options identified in the Regional Preferred Approach will be subject to their own planning and regulatory processes. As mentioned previously, the solutions identified in the NWRP will be delivered on a phased basis and will progress based on a risk-based prioritisation of capital investment, allowing Uisce Éireann to address Need accordingly. It will take a number of investment cycles to progress these projects and they may change in later iterations of the NWRP. Over time, the intention is to ensure the delivery of a more Sustainable, Resilient and cost-effective water supply service.

8.5 References

1. European Commission. 2000. *WFD Directive 2000/60/EC on establishing a framework for community action in the field of water policy*.
2. Water Environment (Abstractions and Associated Impoundments) Act, 2022. Available from: https://www.irishstatutebook.ie/eli/2022/act/48/enacted/en/html
3. UK Technical Advisory Group (UKTAG). 2008.UK Environmental Standards and Condition (PHASE 1). Water Framework Directive.

9 Ongoing Monitoring, Mitigation and Evolution

9.1 Introduction

While the National Water Resources Plan (NWRP) is a 25-year plan, it will be formally reviewed every five years. Baseline forecasts and data feeding into the NWRP will be reviewed annually.

Uisce Éireann will prepare a regionally-specific:

- Monitoring and Mitigation Plan for the Regional Water Resources Plan - South East (RWRP-SE), which will be based on the plan set out in Chapter 4 of the Strategic Environmental Assessment (SEA) Statement prepared in relation to the NWRP Framework Plan. The Monitoring Plan has been designed to provide a basis for the identification and continuous review of the positive, negative and cumulative impacts of the RWMP-NW, and it will form part of the SEA statement to be published with the final Regional Water Resources Plan for the South East. The Monitoring Plan is provided in two (2) parts to cover both plan level monitoring and project level monitoring. Indicators and targets to measure performance are set out in Chapter 4 of the Framework Plan SEA Statement.
- The Environmental Action Plan (EAP) is set out in Section 10 of the SEA Environmental Report for the RWRP-SE. This EAP will set out the recommendations of the SEA in relation to the RWRP-SE, and mitigation measures to take forward. Uisce Éireann's commitment to implement this monitoring and mitigation is set out in Section 8.3.8 of the NWRP Framework Plan.

The approach to monitoring takes account of the Environmental Protection Agency (EPA) guidance document 'The Tiering of Environmental Assessment – The influence of Strategic Environmental Assessment on Project-level Environmental Impact Assessment'[1].

9.2 Monitoring and Mitigation

The monitoring and mitigation process is presented in Figure 9.1 and in summary involves:

- Identifying the **internal and external factors** that may impact the NWRP and mapping the areas of the NWRP that they will influence;
- Updating **Needs identification** by updating the Supply Demand Balance (SDB), Drinking Water Safety Plans (DWSP) and Barrier Scores to reflect these changes; and
- Incorporating **feedback** from the **SEA mitigation actions and Monitoring Plan** set out in the SEA Statement prepared in relation to the NWRP Framework Plan.

The SEA assessment assumes the implementation of standard mitigation measures, such as operation of water sources in line with regulatory requirements and the use of good construction practice; and recommends further mitigation. Examples of standard measures expected to be embedded in the design and development of infrastructure options are listed in Appendix D of the SEA Environmental Report for the RWRP-SE. Appendix D identifies the mitigation measures that specifically respond to the significant environmental effects identified for each SEA topic in the three (3) Study Areas of the South East Region. Standard and specific mitigation measures identified include recommendations for further environmental assessment work to be undertaken at project stage (to further inform the development of suitable project specific mitigation measures), as well as mitigation to be implemented directly at project stage.

With respect to the NIS assessment, standard and option specific mitigation measures (see Sections 6.3.1 – 6.3.5 of the NIS) will be applied, unless project-level Appropriate Assessments (AAs) or project-specific environmental assessments demonstrate that they are: not required (i.e., the predicted effect will not occur), are not appropriate, or that alternative or additional measures are necessary or are more appropriate.

The EAP provided in Section 10 of the SEA Environmental Report for the RWRP-SE, summarises the actions and areas of further study identified in the SEA. The EAP provides a basis for tracking recommendations from the SEA during the NWRP implementation. The EAP considers the Options and Approach appraisal process as well as the integration of environmental considerations.

The Monitoring Plan is a requirement under the SEA regulations to provide a basis of identifying significant environmental effects during the implementation of the Plan. This is required to review the predicted impacts of the RWRP-SE, and the adequacy of the recommended mitigation measures so that additional mitigation can be applied, if required. Performance against the Monitoring Plan targets will also inform the next cycle NWRP and SEA process.

The proposed Monitoring Plan indicates a range of recommendations for the RWRP-SE including (but not limited to) the following topics:

- **Climate change**: mitigation through decarbonisation could include benchmarked reduced carbon emissions from construction, increased contribution of renewable/low carbon energy sources for existing and new schemes and improved energy efficiency of water services.
- **Catchment Management schemes** can be used for carbon offsetting, supporting biodiversity, and recreational objectives for population wellbeing.
- **Biodiversity, flora and fauna**: ensuring no adverse effects on the integrity of any European site and, where feasible, to seek to maintain and/or contribute to the site achieving Favourable Conservation Status. Further, ensuring protection of nationally designated sites and wider biodiversity.

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, as noted above, Uisce Éireann will screen the change for SEA and AA in accordance with its legal obligations.

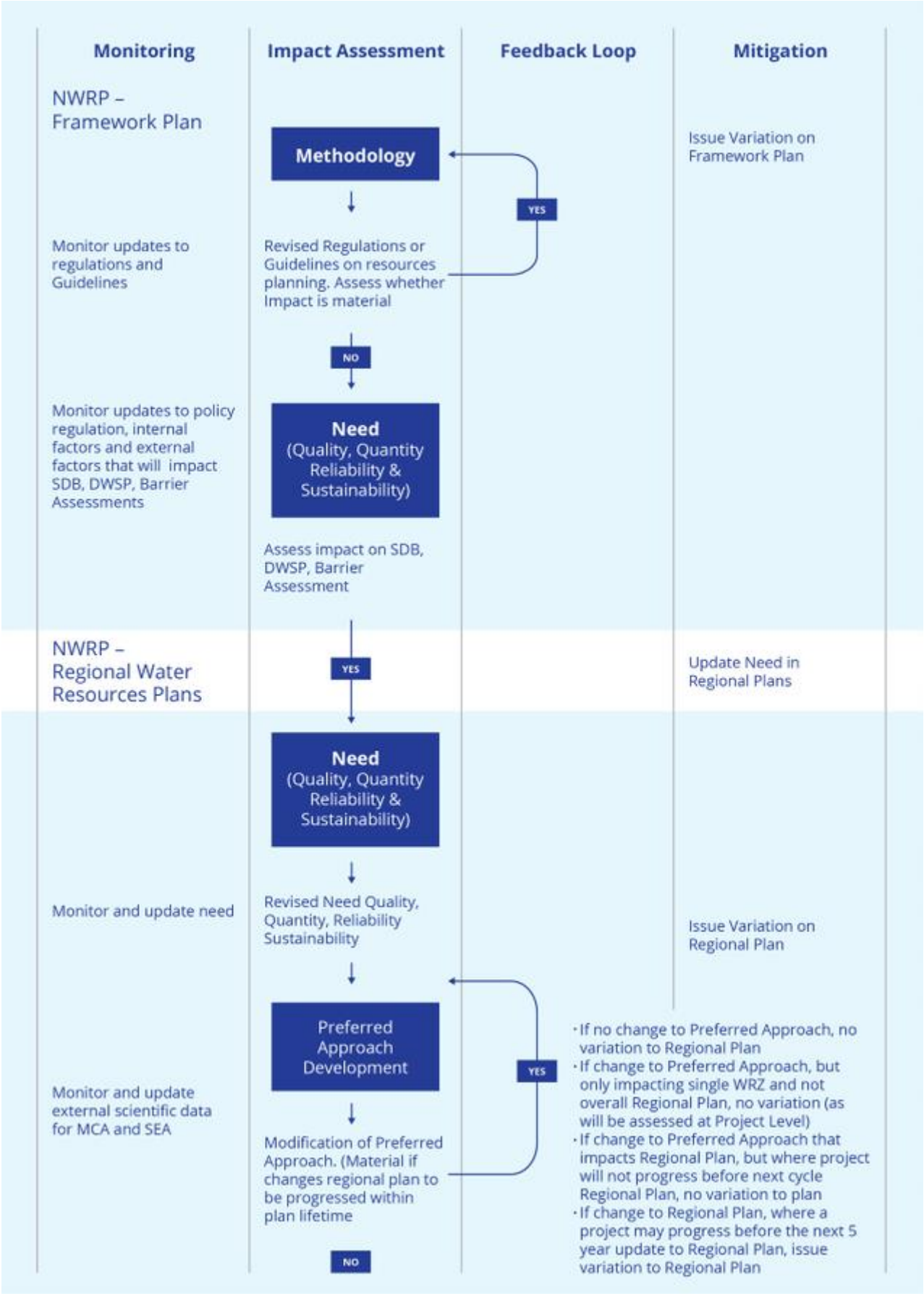


Figure 9.1 Continuous Monitoring and Mitigation Feedback Loop

9.2.1 Identifying Internal and External Factors that may Impact the NWRP

The NWRP may be influenced by a number of internal and external factors. Uisce Éireann is committed to a programme of continuous monitoring to ensure both internal and external factors that may influence the NWRP are identified.

External Factors

External factors which can influence the performance of our water supplies include:

- 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; and
- Funding availability and requirements to improve Levels of Service (LoS) to water users.

Uisce Éireann is committed to reviewing the RWRP-SE following the publication of any relevant new legislation, regulations and policies. Key policy instruments and publications that will be monitored, include:

- The Drinking Water Directive which concerns the quality of water intended for human consumption, which may impact our treatment requirements. Preferred Approaches will be reviewed in the event of any changes to the Irish Drinking Water Regulations to ensure that any additional or revised obligations such as further treatment requirements are accounted for.
- Uisce Éireann's Water Services Strategic Plan (WSSP) which sets out our 25-year objectives under the Water Services (No. 2) Act 2013.
- The pending abstraction legislation reform, which has the potential to increase the Deficits by reducing the amount of water which we can abstract from our sources (both existing and future identified sources).
- The 3rd Cycle of the River Basin Management Plan (2018-2021) which has identified significant pressures in water bodies in relation to hydromorphology, land use planning, agriculture, siltation and hazardous chemicals. All of these pressures have the potential to reduce the amount of water we can abstract, reduce water quality and or change suitable abstraction point infrastructure or locations. Any data that becomes available from the upcoming River Basin Management Plan which will cover 2022-2025 will be incorporated into the RWRP-SE as appropriate. This will enable the early incorporation of changes to the SDB and the revision, if necessary, of Preferred Approaches;
- Policies such as Enterprise 2025, Manufacturing 4.0, and sector specific publications such as BioPharma and Distilling.
- The Status of Ireland's Climate Report for Ireland which provides datasets and analyses of climate observations from which climate scenarios can be built into the SDB.

The above is a non-exhaustive list. Uisce Éireann will review policies routinely and update the Framework Plan as necessary.

In order to address reductions in water supply availability due to climate disruption and environmental impacts, Uisce Éireann has ensured that conservative estimates have been used within our SDB but will continue to assess supply availability and modify the SDB appropriately.

In order to address domestic demand growth the Uisce Éireann Spatial Planning team continues to interface directly with the Regional Assemblies and the Local Authority Planning departments, through a ten-year capacity register as well as during the preparation of the Regional Growth Strategies and the

County Development Plans. This approach allows Uisce Éireann to understand domestic growth trends and allow for such growth in the SDB.

To gain insight into growth in non-domestic demand, Uisce Éireann also engages with key stakeholders including the Department of Enterprise, Trade and Employment, Enterprise Ireland, Industrial Development Agency (IDA), Údarás na Gaeltachta and Local Authority Planners. It is recognised however, that it can be difficult to predict growth in high water use sectors.

Uisce Éireann will also utilise the knowledge that we gain regarding demand through our Connection Developer Services function which is a Pre-connection Enquiry process allowing forward planning for new connections. All Uisce Éireann developments will be subject to budgetary and regulatory constraints, including oversight by the Commission for Regulation of Utilities.

Internal Factors

Internal factors which can influence the performance of our water supplies include:

- Leakage and Network Performance
- Data Quality, Quantity and Availability

The public water supply in Ireland is a live asset base and is subject to continuous change. New assets such as WTPs, storage reservoirs, and trunk and distribution mains are continuously developed and upgraded. Knowledge and data relating to our assets is improving and will be fed into the SDB.

Leakage reduction and network improvements are core to the NWRP. Whilst certain leakage commitments have been built into the SDB, leakage is dynamic and naturally increases over time as assets deteriorate. For this reason, leakage is a function of continuous leakage reduction and maintaining established leakage savings across aging assets. Therefore, across a large distribution network there will always be uncertainty in leakage values.

It is now Government policy, under the Water Services Act 2017, to charge for excess usage of domestic water, recognising that water is a precious natural resource and that we all need to conserve water to enable a sustainable future. Uisce Éireann is currently at the early stages of implementing the excess usage charge. Once the excessive usage 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.

Uisce Éireann recognises that currently there are gaps within our data sets. While Uisce Éireann is confident that uncertainties associated with assumptions/limited data sets have been addressed appropriately, we recognise that further improvements can be gained by improving the data that is available to us for our baseline supply assessments and forecasts. Uisce Éireann is committed to the development and delivery of a 5 to 10-year data and intelligence improvement programme on data related to the SDB, water quality, asset registers, outage allowances, headroom and performance of asset base (including network models). As actual data becomes available, this data will be updated in accordance with the feedback and monitoring process. As part of the roll out of the DWSP, we will also progress site specific Source Risk Assessments and incorporate knowledge gained from this into our Preferred Approaches. Similarly, through catchment initiatives, the completion of Source Risk Assessments and increased monitoring of our WTPs and distribution networks (as part of the roll out of the DWSPs), our data quality, quantity and availability continue to increase. These improvements will be used to modify our SDB as appropriate and feed into Preferred Approaches.

9.2.2 Needs Identification

In relation to Needs identification, the feedback and monitoring process involves:

- Updating Needs identification by updating the SDB, DWSPs and Barrier Scores to reflect these changes; and
- Incorporating feedback from SEA mitigation actions and the Monitoring Plan set out in the SEA Statement that is prepared for the NWRP Framework Plan.

Uisce Éireann is committed to continuously updating changes to the Need in order to update the SDB. The SDB is therefore continuously evolving as more data becomes available to us. DWSPs can both inform and be informed by the SDB. Similarly, Barrier Scores both inform and are informed by the SDB.

Growth and economic development are key parameters influencing the identified Need. Growth and economic development will be used to prioritise the roll out of the Preferred Approaches identified for the RWRP-SE. The implementation of Preferred Approaches will be prioritised to ensure that there is no further deterioration in the Level of Service (LoS) to our customers, recognising that current LoS are in most cases already below the target LoS.

Figure 9.1 above summarises the monitoring and feedback loop that will be implemented in relation to the NWRP.

9.2.3 Feedback

Upon identification of a change through the monitoring process, Uisce Éireann will assess the impact of these changes on the Framework Plan and the Regional Water Resources Plans:

- When changes are deemed to be material and a variation to the NWRP Framework Plan and/or RWRP(s) is required, Uisce Éireann will screen the change for SEA and Appropriate Assessment (AA) in accordance with its legal obligations, and where required it will carry out an SEA and/or AA before adopting the variation (including public and/or statutory consultation, as appropriate).
- Non-material changes will be fed into the next cycle of the NWRP.
- If an update or change in circumstances is not considered to result in a material change to the position as set out in either the Framework Plan or relevant RWRP, then an assessment will be completed to determine the impact on the Need i.e., impact on the SDB, DWSP or Barrier Assessment. An assessment will then be completed to determine whether the change to the Need affects the relevant Preferred Approach.
- If there is no change to the Preferred Approach, then there is no variation to the Regional Plan;
- If there is a change to the Preferred Approach, but this impacts a single WRZ, then there is no variation to the RWRP-SE; however, the change will be assessed at project level. This envisages a situation where refinements to a single project or closely related project within a WRZ will be considered within their own environmental assessments. The change would not have any systemic impacts on the wider RWRP.
- If there is a change to the Preferred Approach that impacts the Regional Option, but the project will not progress before the next 5-year review cycle, then no variation is made to the Regional Plan. Instead, the relevant change is incorporated and assessed through the next review cycle.
- If the project may progress before the next 5-year review cycle then a variation to the Regional Plan is issued, with associated Screening for SEA and AA as required.

9.3 Future Actions

Additional opportunities were identified following consideration of stakeholder feedback from the Framework Plan consultations and a list of commitments (subject to funding) were identified by Uisce Éireann to support the implementation of the NWRP:

- Development of a representative raw water sampling strategy within five years.
- Development of a live water quality reporting mechanism within an appropriate timeframe.
- Development of a strategy to improve understanding of supply risk including Source Risk Assessment studies, supply assessments, source surveys, source monitoring, and source models to facilitate greater understanding of supplies and roll-out of appropriate studies.
- Integration of Geological Survey of Ireland, Regional Groundwater Availability Assessments into the NWRP desktop studies as the information becomes available (currently under development).
- Development of a 5 to 10-year data and intelligence improvement programme, on data related to the SDB, water quality, asset register and performance of asset base (including network models).
- Commitment to recalculate sustainable economic level of leakage (SELL) within the timeframe of the NWRP, and to commit to further review of WRZ specific appropriate levels of leakage.
- Commitment to review the programme and funding for network renewal and high burst frequency mains.
- Commitment to undertake a pilot study on rainwater harvesting through the innovation fund. (Uisce Éireann is a stakeholder in wider water conservation measures).
- Commitment to promote, develop and expand on research and innovation within the organisation.
- Commitment to continually review the NWRP based on emerging policy data.
- Development of a household water conservation application to encourage water conservation in the home under the “Use Less” pillar.
- Publication of a report on per capita consumption (PCC) on www.water.ie.

9.4 References

1. Environmental Protection Agency. 2021. *The Tiering of Environmental Assessment – The influence of Strategic Environmental Assessment on Project-level Environmental Impact Assessment.*

10 Conclusions

10.1 Introduction

This document, the Regional Water Resources Plan South East (RWRP-SE), is the fourth and final of four (4) Regional Plans. Together, the four Regional Plans and our Framework Plan form Ireland's first National Water Resources Plan (NWRP). The NWRP allows us to review all our water supplies in a consistent way and to develop a clear approach to move towards safe, secure, reliable, and sustainable public water supplies through prioritised investment in water services over the short, medium and long-term.

Three regional plans, the RWRP for the Eastern and Midlands region, the RWRP for the South West region and the RWRP for the North West region have been finalised and adopted. The RWRP for the South East region is the final region. The Framework Plan, Regional Plans and supporting documentation are available at https://www.water.ie/projects/strategic-plans/national-water-resources/.

In developing the RWRP-SE, Uisce Éireann considered relevant government policy and legislation, and a range of external factors which have the potential to impact our water supplies. These include the effects of climate change, increased population growth, economic development and tighter drinking water and environmental standards. The water resources planning process will enable Uisce Éireann to support the sustainable development of our water resources at a regional and national scale.

This RWRP-SE has developed plan level solutions, known as Preferred Approaches, to address the Needs of the 111 Water Resource Zones (WRZs) within the South East Region. The purpose of the Plan is to allow us to understand the scale and type of transformation required across the entire public water supply in terms of achieving our Quality, Quantity, Reliability and Sustainability objectives for existing and future water users.

To understand the current state of our assets and its surrounding environment, the RWRP-SE reviewed the:

- External baseline across the South East Region in terms of natural resources, population growth and economic development, and impacts of climate change; and
- Internal baseline of our existing water supply asset base in terms of capacity and performance of supplies (abstractions and treatment plants) and efficiency of our distribution networks.

10.2 Baseline of the Public Water Supplies in the South East Region

The existing water supply asset base within the South East Region consists of 120 groundwater sources and 43 surface water sources that feed 143 Water Treatment Plants (WTPs). On average 161 million litres per day (Ml/d) of water is produced by these WTPs and fed into WRZs within the South East Region. The South East Region has 111 WRZs. The distribution network consists of approximately 6,321 kilometres of water mains. The existing WTPs and major interconnecting water pipelines (Trunk Mains) are shown in Figure 10.1.

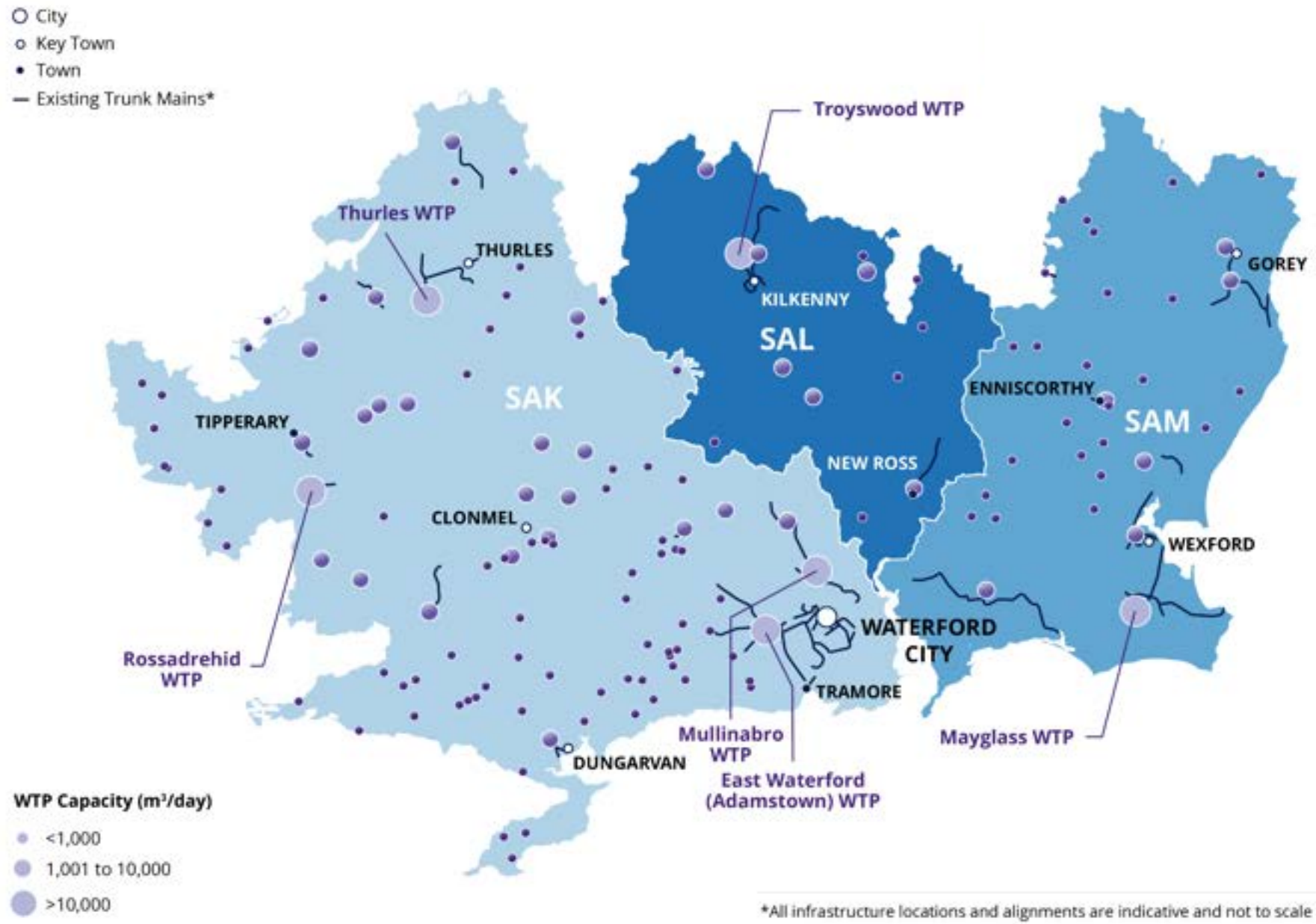


Figure 10.1 Existing Water Treatment Plants (WTPs) and Major Interconnecting Pipelines (Trunk Mains)

The current Needs across the water supplies in the South East Region can be summarised as follows:

- 28% of the supplies do not meet a 1 in 50-year Level of Service (LoS) in normal weather conditions.
- 41% of the supplies do not meet the 1 in 50 LoS in drought conditions.
- 80% of supplies are associated with a 'high-risk' for one of our Water Quality Barriers and therefore do not conform to the conservative Quality risk reduction standards we have set for ourselves as a water utility.
- Based on desktop assessments, 28 of our supplies may not meet sustainable abstraction levels in the short to medium term.
- Efficiency of our current distribution networks is poor, and it is estimated that approximately 47% of the water that is passed through our watermains in this region is lost through leakage.

We also face the challenges of:

- Facilitating government policy on growth and economic development; and
- Transforming our supplies to ensure that the entire public water supply is environmentally sustainable and adaptable to climate change.

10.3 Plan Development

The purpose of the RWRP-SE is to determine the Preferred Approach and interim solutions we need to transform our water supplies in the South East Region over the short, medium and long-term. The RWMP-SE, as proposed, will achieve the standards we set for ourselves in the Framework Plan, including:

- At least a 1 in 50 LoS across all water supplies in all-weather scenarios including normal, dry, drought and winter conditions. This means that the probability of our customers experiencing a water shortage or severe limitations to supply is 2% in any given year.
- Ensuring that the correct barriers are in place at all our sources, WTPs and within our distribution networks, to reduce risks to water quality to an acceptable level.
- Ensuring that all our supplies are environmentally sustainable and resilient to climate change.

To achieve this, as part of the RWRP-SE we reviewed 1,054 Unconstrained Options to address the identified Needs and took them through the option screening process. This produced a feasible list of 778 Options. We have developed plan level outline designs and costings for all 778 Feasible Options.

The basis of the Feasible Options considered within the RWRP-SE is that they must be environmentally sustainable, technically feasible, promotable and deliverable. The Feasible Options are summarised in Figure 10.2. They cover a broad range of supply types including; supply rationalisation (where smaller water supply systems are decommissioned and connected to larger supply systems), new and increased groundwater and surface water sources, water transfers and desalination.

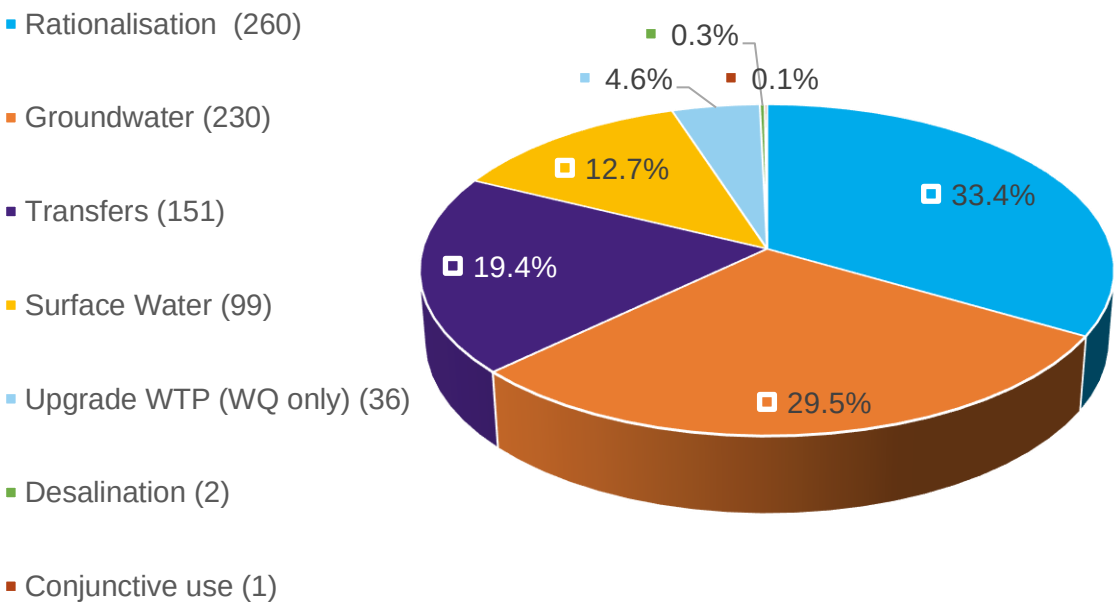


Figure 10.2 Feasible Option Types

The Feasible Options consist of both small local options that are only suitable to address the Need in the immediate vicinity of a supply, and larger Study Area and Cross Study Area Options that can address Need across multiple supplies. We assessed all the Feasible Options to develop the Preferred Approach for each WRZ. The Preferred Approach is the Feasible Option, or combination of Feasible Options, that provide the best overall outcome for the supply in terms of the assessment criteria we set within the Framework Plan. As outlined in Section 7.2, the criteria align with relevant government policy.

Within the Approach Development Process, we applied the resources planning methodology (EBSD – Economics of Balancing Supply and Demand) uniformly to rank and appraise the Options. This provided a robust and transparent process to support the selection of a Preferred Approach that represents the best overall outcome against our assessment criteria. In other words, the Plan does not promote particular types of Options. If a small local solution scores best against the Plan and policy objectives (encapsulated by the assessment criteria) our Approach Development Process would present this as the Preferred Approach. Similarly, if a larger Study Area or Regional Option provides a better outcome across a number of supplies, this would be selected as the Preferred Approach.

10.4 Plan Outcome

As set out in Section 8, our Option Development Process for the South East Region did not identify any feasible options with the potential, in terms of quantity and distribution of supply, for a large-scale interconnection of multiple WRZs across the Study Area boundaries. For this reason, the Study Area (SA) Preferred Approach that is presented in Section 7 is identified as the 'Best Value' solution to address the regional water supply Need. The Regional Preferred Approach is therefore defined as the combination of the three (3) SA Preferred Approaches for the South East Region.

The Regional Preferred Approach consists of a combination of local water supply sources and Study Area solutions. These involve:

- Reducing the number of WRZs in the South East Region from 111 to 58;
- Constructing 455 kilometres of trunk mains (diameter > 300mm) to develop larger interconnected WRZs for the urban areas in the region;
- 13 new water treatment plants (WTPs);
- Decommissioning 63 WTPs and 66 existing sources;
- Increasing the barrier performance of the 56 remaining WTPs and upgrading the capacity of 24 of these to address the current supply Deficit and to meet forecast growth; and
- Reducing leakage from the 2019 baseline, which represents 47% of regional demand, to 24% of regional demand. (For WRZs with a demand greater than 1,500 cubic meters per day (m^3/day), leakage will be reduced to 21% of the average WRZ demand). Leakage reduction will be achieved through pressure management, active leakage control, find and fix and asset replacement.

The outcome of delivering the Regional Preferred Approach as proposed, is that:

- All WRZs in the South East Region will have an improved minimum LoS of 1 in 50 in drought and winter conditions, as well as increased resilience during normal and dry;
- All WRZs will include appropriate barriers to mitigate against water quality risk; and
- All WRZs will be resilient with improved environmental sustainability.

These outcomes are described further in Section 10.5.

10.5 Benefits of the Preferred Approach for the South East Region

10.5.1 Reducing Quantity Risk

If all the Options identified in the Regional Preferred Approach are delivered there will be no supply deficit for any of the WRZs in the South East Region. This means that following implementation of the RWRP-SE, each WRZ will have enough water in supply (Water Available for Use) to meet peak water demand during all-weather planning scenarios (Normal Year Annual Average (NYAA), Dry Year Annual Average (DYAA), Dry Year Critical Period (DYCP) and Winter Critical Period (WCP)) at a 1 in 50 LoS. This achieves the objectives identified under the Lose Less and Supply Smarter pillars set out in our Framework Plan.

In the South East Region, the supply deficit and forecast growth will be met by 46 local independent supply systems (Figure 7.11). Twelve (12) new interconnected systems (Figure 7.12) will be created that will incorporate 57 pre-existing WRZs within the region. A further eight (8) WRZs will be connected to supply systems in the Eastern and Midlands Region. The interconnected supplies will benefit an estimated 60% of the 2044 population.

The largest interconnected systems across the study areas supply about 48% of the regional population. These are shown in Figure 10.3 and include:

- Expansion of the existing East Waterford Supply System that will develop a new surface water abstraction from the River Suir, upstream of Carrick-on-Suir. The system will supply Waterford and surrounds and an additional nine (9) WRZs that will be connected to the scheme;
- Interconnection of ten (10) WRZs near Clonmel that benefit from a new surface water abstraction from the River Suir and new WTP near at Barnes;
- Interconnection to Thurles WRZ to supply the forecast deficit across five (5) WRZs;
- Connection of the Ballyragget Public Water Supply to the existing Kilkenny supply system in Study Area L for increased resilience; and

- Increased abstraction from the existing River Slaney source to supply the Enniscorthy Town deficit and additional demand of four connecting WRZs.

As well as the proposed upgraded and new supply sources, the regional Deficit will be addressed by leakage reduction measures. Uisce Éireann has committed to leakage targets beyond the Sustainable Economic Levels of Leakage (SELL) (as outlined in Section 5). The additional targets will reduce leakage levels to 21% of demand in WRZs where demand exceeds 1,500 m^3/day. When smaller WRZs with higher leakage targets are considered, this averages to 24% of demand across the region.

Figure 10.4 shows the cities, Key Towns and other settlements that will benefit from the Lose Less Pillar (leakage reduction) of the Framework Plan.

Additional benefits of the Preferred Approach for the South East Region include:

- Each supply will have the appropriate headroom and outage standards to ensure that we can provide a minimum 1 in 50-year LoS to water users. Provision of the 1 in 50 LoS to our customers will reduce the number of outages our customers would typically expect to experience and reduce the frequency of water conservation orders and hose pipe bans required.
- The 12 new interconnected systems will allow us to balance peaking and variability in demand across a larger baseline thus reducing our vulnerability to events such as droughts.
- Overall Quantity risk will also be reduced based on utilising sustainable sources for supplies. This will support population growth and economic development within the South East Region and ensure that the growth targets set by the Regional Assemblies and Local Authorities can be achieved.
- Increased efficiency and economies of scale in delivering leakage reduction measures to large interconnected systems (compared with fragmented systems). This will also result in environmental benefits from energy and carbon savings and reduce pressure on abstractions.

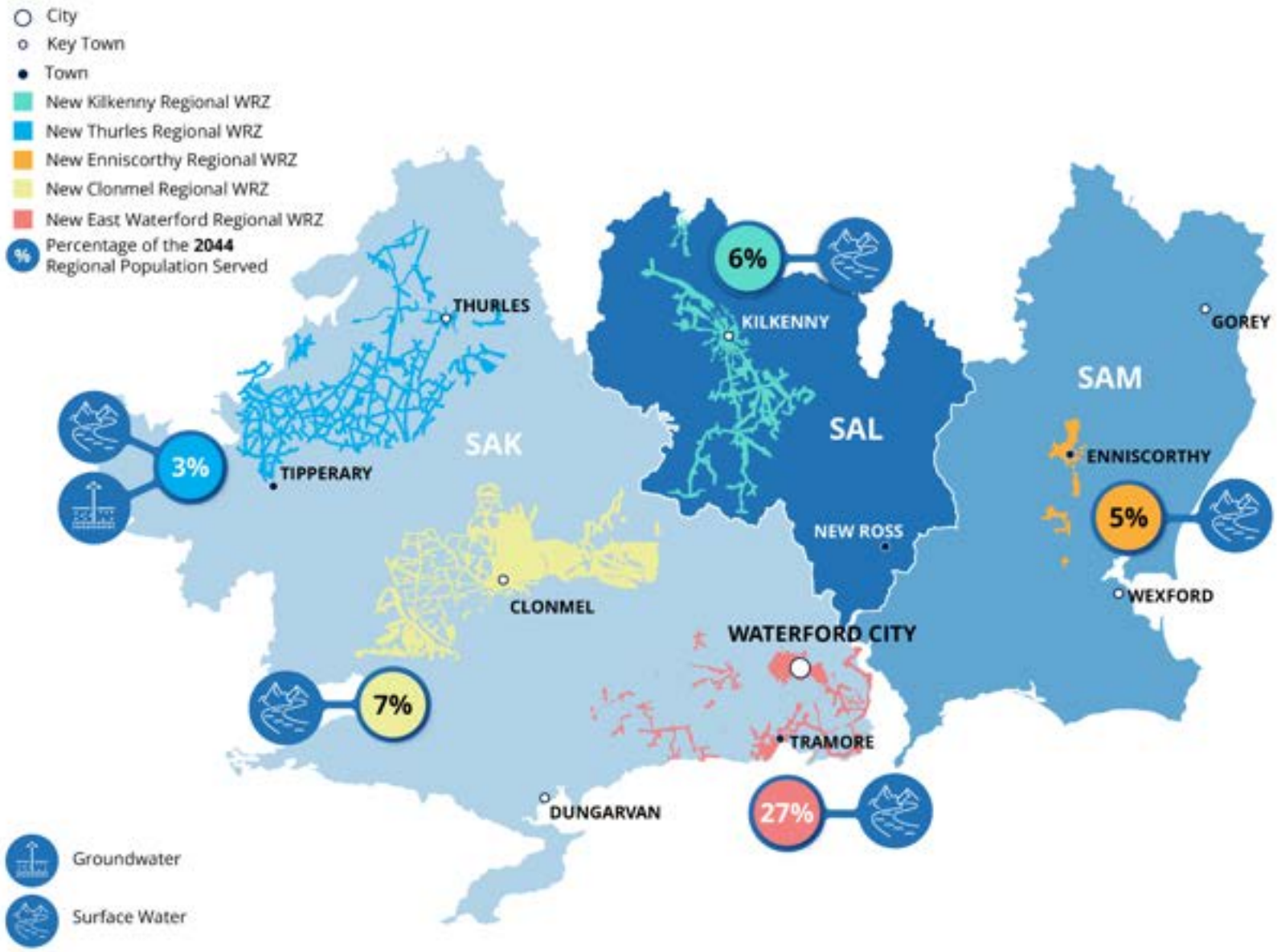


Figure 10.3 Large Interconnected Supplies in the South East Region

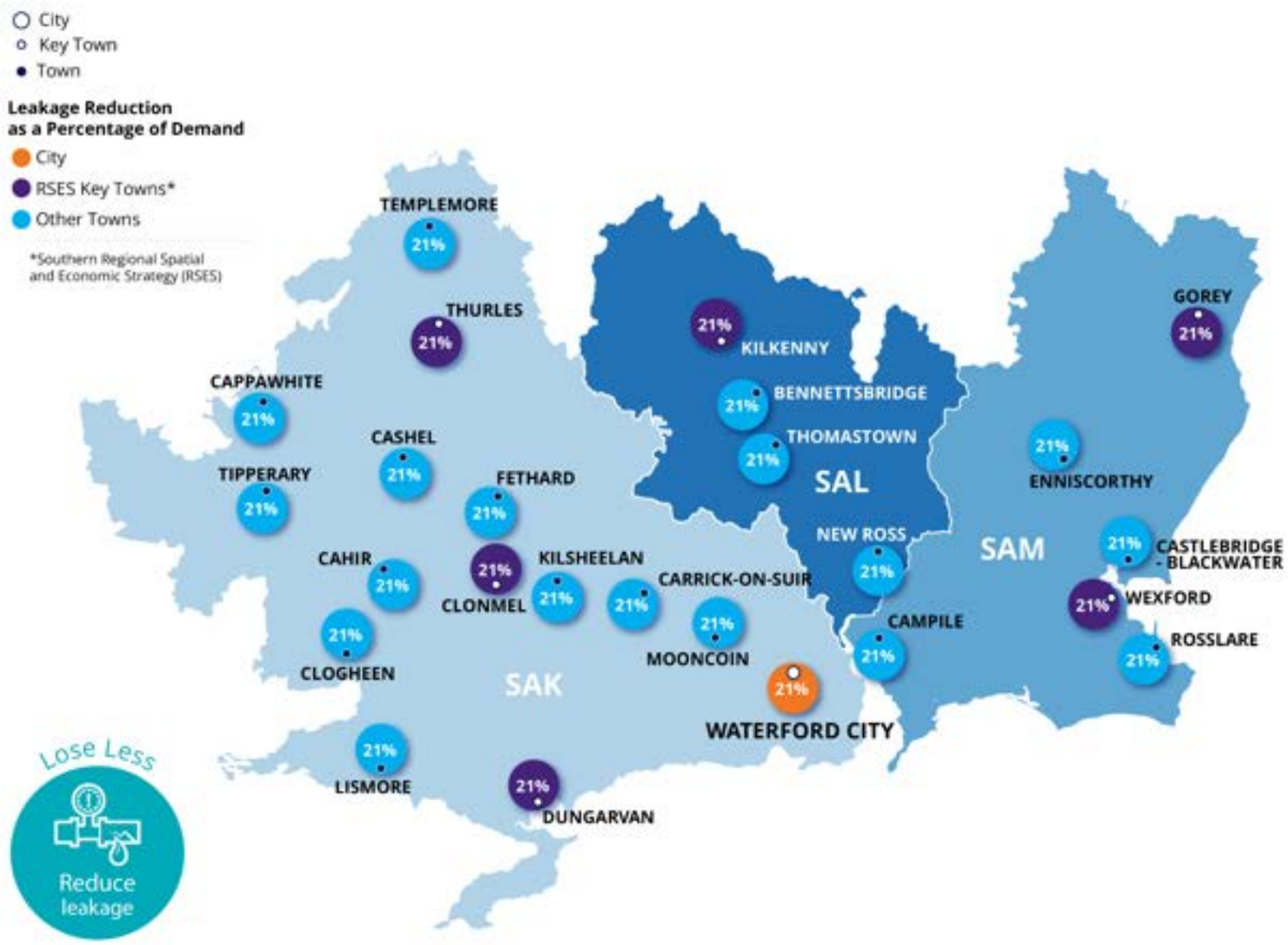


Figure 10.4 Leakage Reduction Targets for the South West Region

10.5.2 Reducing Risk to Water Quality

Although our compliance with the Drinking Water Regulations is over 99%, at present 80% of the 143 WTPs in the South East Region have barrier or alarm deficits when assessed against the risk reduction standards we have set for ourselves as a utility. This means that, in some cases, the treatment assets do not have the capability to fully address quality risks at all times; particularly after very heavy rainfall, where the raw water quality in our sources may deteriorate significantly for short periods of time.

Quantity and Quality risks are interrelated, as often Water Quality risks are caused or exacerbated by insufficient capacity in our WTPs. For example, having sufficient treatment capacity to allow us to take filters offline for essential repairs results in lower potential risks to Water Quality. For this reason, peaking and outage allowances are included within the Supply Demand Balance and the design standards for future projects within the capital investment plans.

In addition to this, raw water quality can fluctuate significantly based on weather conditions in the natural environment. Controlling Water Quality risk across a very large number of isolated supplies 24 hours per day, 365 days per year can be challenging. Therefore, larger water supplies, which allow for more focussed operational controls and monitoring, can help address this risk. The effectiveness and efficiency of larger supplies with improved interconnectivity is evidenced in the majority of other EU jurisdictions, many of which have far fewer WRZs despite having larger populations.

Where it is not possible to interconnect systems due to the isolated location of the WRZ or the potential environmental impact of associated construction work or operations, we have developed smaller local supplies. For these smaller systems, we manage operational risk by selecting sources that are less susceptible to large variations in water quality with good source protection.

When the Options identified in the Regional Preferred Approach are delivered there should be no barrier deficit at any of the WTPs in the South East Region. Therefore, the risk of drinking water non-compliance or boil water notices will be significantly reduced.

In the South East Region this will be achieved via delivery of 14 new WTPs, capacity and barrier performance upgrades to 24 existing WTPs and barrier performance upgrades to a further 56 existing WTPs. In addition to the capital works, source protection measures and development of full Drinking Water Safety Plans for each supply will allow for appropriate and continuous risk management in accordance with the requirements of the recast Drinking Water Directive.

Additional Water Quality benefits of the Preferred Approach include:

- The creation of 12 new interconnected systems. This will decommission 63 existing WTPs. The reduced number of WTPs will allow tighter management and operational controls over water quality. This will in turn enable targeted investment in the maintenance of a smaller amount of infrastructure. As an example, the expansion of the Clonmel water supply system will decommission 10 WTPs and create a network of 3 remaining WTPs and 1 new WTP serving approximately 23,000 customers in the South East Region by 2044. The interconnected network will also include five (5) new treated water storages that will enable plant shutdowns and trunk main repairs, while maintaining supplies to customers.
- Small new or upgraded local groundwater sources will supply 27 WRZs that meet approximately 30% of the estimated 2044 regional demand. These sources have been selected based on water availability, sustainability, natural storage and stable raw water quality. The Preferred Approach for these WRZs will also involve appropriate source protection, treatment barriers and treated water storage specific to each WRZ. Therefore, the operational vulnerability of having a larger number of small supplies will be offset by utilising secure and stable sources.

- One (1) WRZ, Galtee Regional, will be supplied by new local surface water sources that will serve 5% of the estimated 2044 regional demand. The Water Quality risk to these systems will be managed using correct treatment barriers within the new and upgraded WTPs, including appropriate plant shut down and strategic storage. The water supply system includes four existing WTPs and two treated water storages that provide flexibility to manage plant shut down for maintenance.

10.5.3 Reliability and Sustainability

In the South East Region, Uisce Éireann currently abstracts from 163 different water sources and has 143 WTPs which collectively serve 369,240 people or 9% of the national population; all of which need to be maintained and operated in a sustainable manner. Surface water abstractions make up 66% of the water delivered to customers, either from rivers or lakes, with the remaining 34% from groundwater sources. These surface water and groundwater interactions are an important consideration when identifying options to support increased water demands and in managing the water quality we supply.

Some of the lowest areas of rainfall across Ireland occur in the South East Region. The South East Region is typically characterised by rainfall levels of less than 1,200 mm. The far east of the region including the Wexford coast, and Waterford City experience the driest conditions across both the region and Ireland with an average annual rainfall of less than 1000 mm. The west of the region around the Knockmealdown mountain range experiences rainfall levels of 1,200 mm to 2,000 mm. Waterford City, Tramore and Kilkenny are the areas which have the greatest population density, are situated in areas of lower rainfall meaning that the most populated areas are at risk of becoming water stressed. Water supply reliability is further impacted by adverse weather conditions including storms, cold weather conditions and dry periods. Due to climate change it is likely that over time in Ireland we will encounter wetter and stormier conditions at certain times of the year, and prolonged dry periods at other times of the year. Therefore, the reliability and sustainability of our sources will become more reliant on appropriate storage in the natural environment over time.

Sustainability issues are also not just a result of climatic conditions. In Ireland, many of our water supplies were developed in a piecemeal manner over time, with water sources based on proximity to the populations they served. As towns and villages have grown in size over time, it has meant that some of these supply sources now have sustainability issues, particularly in dry weather.

Under the Water Framework Directive (WFD), Ireland must ensure that all waterbodies achieve ‘Good’ status by 2027. As outlined in Section 2.3.7, the Government is currently developing new legislation that will introduce abstraction licensing to align with the WFD. This legislation will set the amount Uisce Éireann can take from the water supplies that it abstracts water from. Uisce Éireann lacks comprehensive data to fully understand the impact of the pending legislation on many of its abstractions. Uisce Éireann is building a telemetry system that will aid bringing all this data together (as it was historically collected by individual local authorities), but this will take time. Therefore, improved monitoring and gathering better data is a priority. On an interim basis, Uisce Éireann has developed an initial desktop assessment based on available information. This conservative assessment is used to identify existing surface water sites where abstractions may exceed sustainable abstraction thresholds and to identify sustainable future sources. This assessment was used in developing our Preferred Approach for the South East Region.

In addition to this, the assessment criteria used in our approach appraisal process has been developed using the objectives of the Strategic Environmental Assessment. This means environmental sustainability is built into the core of our plans and that all Feasible Options and Preferred Approaches have been assessed as being sustainable at plan level. This will be further assessed at project level, as the projects identified within the Preferred Approach progress.

The Preferred Approach for the South East Region is reliable, sustainable and resilient to climate change, based on the following:

- The process of assessing performance of existing and future abstractions is based on conservative standards on water availability.
- The Feasible Options must be assessed to be sustainable at a plan level.
- The approach appraisal process utilises a multi criteria assessment where the assessment criteria are based on the objectives of the Strategic Environmental Assessment.
- With the Preferred Approach in place, approximately 60% of the 2044 demand will be supplied by interconnected systems (including existing schemes). This will provide operational flexibility and increased resilience. Most of the remaining 2044 demand will be supplied from local groundwater systems.
- Sixty-six sources will be decommissioned through supply rationalisation. This provides the benefit of abandoning seven potentially unsustainable surface water abstractions.

The reliability of our water supplies is also dependent on the standard of our network infrastructure. The Study Area Technical Reports (Appendices 1-3) outline a number of vulnerable critical assets within each Study Area. These critical assets will be replaced or rehabilitated as part of the development of the Preferred Approach, reducing the risk of outage across our supplies.

10.5.4 Transformation

The development of the RWRP-SE allows Uisce Éireann for the first time to review water supply needs collectively across the South East Region and across the entire spectrum of risk including Quality, Quantity, Reliability and Sustainability. It allows us to consider local options to resolve these Needs and larger Study Area and Regional options that can address multiple supplies.

The Plan allows us to move away from reactive management of risk at a single source or for a single Need (e.g., Quality risk alone), to a more holistic view of the transformation required across all of our supplies to meet the objectives set out in the Water Services Strategic Plan (WSSP) and the Water Services Policy Statement (WSPS). The WSSP is Uisce Éireann ’s Strategic Plan which is a plan required under statute and sets out Uisce Éireann ’s business objectives in terms of water and wastewater services. The WSPS 2018-2025, is the Governments policy document on water services.

The Regional Preferred Approach for the South East Region will result in almost 60% of the population being served by interconnected WRZs. The six largest expanded networks will serve almost half of the regional population and meet approximately 44% of the forecast Demand by 2044.

The RWRP-SE provides:

- An understanding of, *inter alia,* the current state of our infrastructure, the potential Sustainability of our supplies, potential Water Quality issues, the location and Quantity of potential new sources and the settlements they can supply, the additional settlements that existing abstractions can supply and where investment is needed and its priority.
- A high degree of flexibility in our plans, particularly in terms of domestic and non-domestic growth. Having an interconnected network allows us to facilitate and support higher growth in connected settlements within the South East Region, including small settlements if Need manifests itself in that way over time.
- More balance across the South East Region, with the abstractions for regional supplies balanced across the major catchments of the region. Water abstraction to support public water supply will become more sustainable and resilient to future shocks such as drought and climate change.
- Improved risk management achieved by interconnecting supplies and reducing the number of water supply systems to operate and maintain. Where it is not possible to merge WRZs through

interconnected supplies, we will manage risk by selecting secure protected water sources and appropriate treatment barriers.

- An understanding of the transformation required across our water supplies, to ensure that we can have reliable and sustainable supplies into the future.
- An understanding of the scale and asset type we require to ensure quality and that our customers receive the required Quality and Quantity.
- A combination of solutions - Use Less, Use Less and Supply Smarter.
- The investment required over the short, medium and long term to transform our supplies.
- A sensitivity assessment that allows us to test the Preferred Approach against a range of future scenarios.

10.5.5 Alignment with Policy

The Framework Plan was designed to align with all relevant government policy, including policy on water services, growth and economic development, the environment, climate change adaptation and public spending. The Preferred Approach identified within the RWRP-SE therefore aligns with the government policy framework and Uisce Éireann ’s own internal policies and standards for our water supplies.

10.5.6 Alignment with Investment Planning

The adoption of the RWRP-SE, along with the RWRP-EM, RWRP-SW and RWRP-NW, will identify the Preferred Approach to address Quality, Quantity, Reliability and Sustainability issues for every WRZ in Ireland. Therefore, the NWRP will provide the foundation for understanding the strategic investment requirement to transform our water supplies and will drive our future investment plans for water services. Uisce Éireann will prioritise this capital need utilising a Value Framework to ensure the projects that offer the most value to our customers is progressed first. The future forecast for capital investment will be built on that basis. This will result in a 40-year Investment Plan that includes accurately scoped and appropriately prioritised capital projects.

10.6 Alternatives to the Plan

During the Study Area Level assessment process outlined in Section 7, the Feasible Options were compared to see whether any Study Area or Regional Options were available to meet the Need across multiple WRZs. For some Study Areas this led to the identification of Preferred Approaches which involve a cross study area transfer.

For the Regional Level assessment, the potential Preferred Approach has been reviewed further to consider potential for any additional alternative combinations at this level. The potential for large feasible options with the capability to provide regional interconnectivity is limited by the volume of water we can sustainably abstract from water sources; and the cost and challenge of transporting small volumes of water across long distances.The Preferred Approach for each Study Area does however comprise some large, interconnected supplies and in this way provides the benefit of resilience and improved environmental outcomes, through the decommissioning of unsustainable sources.

Across the Wexford and Wicklow study area (SAM), many solutions rely on increased or new groundwater abstractions where the aquifer yield is calculated using plan level assessments. If project level investigations determine the yield is not sufficient to meet the full extent of forecast growth over the planning period, the groundwater supplies may need to be supplemented by interconnecting to the

Greater Dublin Area supply system via the Rathvilly WTP. This supply option was identified as the next best feasible solution.

10.7 Interim Options

Given the significant issues with the baseline supplies in terms of Quality, Quantity, Reliability and Sustainability, the “do nothing” approach is not feasible. Need will also get worse over time due to growth in demand and reduction in supply availability and resilience due to climate change.

It may take a considerable period of time to deliver the Preferred Approach across all supplies within the South East Region due factors such as:

- Scale of Need across all WRZs;
- Likely minimum project lead-in times; and
- Uisce Éireann ’s current capital funding arrangements.

Therefore, Uisce Éireann also recognises the need for localised, shorter-term interventions within existing supplies to address critical water Quality risk and supply Reliability issues before the Preferred Approach can be implemented in full. Accordingly, within the RWRP-SE we have also developed an “interim solution” approach, which allows such interventions to be identified and prioritised. As a general principle, this interim approach envisages shorter term improvements to existing infrastructure and equipment. These interventions are not intended to deliver a long-term solution to supply and water quality issues. They are generally smaller in scale and rely on making best use of existing infrastructure to meet urgent or priority need to address water Quality risk or supply Reliability. The interim solutions are determined in line with the Preferred Approach and as such, they are considered “no regrets” infrastructure investment. The Interim Options are outlined in Technical Appendices 1 to 7 and summarised in Section 7.6.

10.8 Conclusions

The existing public water supply in the South East Region serves a population of 369,240 people, and 29,700 businesses. The Region is split into 111 WRZs. The water supplies in the South East Region require significant transformation and investment to meet the requirements of safe, secure, reliable and sustainable water supply.

The Framework Plan set the standards we must achieve to meet Uisce Éireann ’s objectives as set out in the WSSP. It also developed the methodology we would use to identify the Preferred Approach to resolve Needs across our water supplies.

Within the RWRP-SE we summarised the Need across the 111 supplies and identified the Preferred Approach at Regional Level to address these Needs. Delivery of the Preferred Approach will provide the best overall outcome for the region in relation to environmental, ecological and resilience outcomes and will result in:

- Transformation of water services in the region from a fragmented supply system with large variation in levels of service, to an interconnected supply with uniform and improved level of service.
- Customer benefits in terms of increased Reliability and reduced occurrence of outages across our supplies.
- Customer benefits in terms reduced water Quality risk and instances of boil water notices.
- Improved resilience, through interconnected sources that will provide operational flexibility, allowing us to manage seasonal variation in water availability and drought events.

- Sources that are more environmentally sustainable and allow us to adapt to climate change and align with the requirements of the Water Framework Directive and Habitats Directive.
- Improved operational control across our water supplies, and ability to react to adverse events.
- Improved efficiency of our distribution networks in terms of leakage, pressure and strategic storage.
- Ability to facilitate growth and economic development.
- Alignment of our services with Ireland's key policy documents.

10.9 Next steps

The Regional Water Resources Plan – South East (RWRP-SE) adoption marks the completion of the second and final development phase of the National Water Resources Plan development. The RWRP-SE has been finalised after considering SEA requirements, NIS recommendations and consultation comments. The RWRP-SE Public Consultation Report presents a summary of the 30 consultation responses received and reviewed.

The outputs of the RWRP-SE and the three previously adopted regional plans (the RWRP for the Eastern and Midlands region, the RWRP for the South West region and the RWRP for the North West) will be combined for prioritisation and progression through the future cycles of capital investment planning. Together, the four RWRPs and the Phase one NWRP-Framework Plan, which outlines the methodologies applied to develop Preferred Approaches (solutions to the identified need), constitute Uisce Éireann's first national water resources plan for the public water supply in the Republic of Ireland. The implementation of the plan will ensure secure, safe, reliable and sustainable drinking water supplies across Ireland for the next 25 years.

Uisce Éireann will continue to review and update the NWRP. As emerging data and information becomes available, they will be incorporated into the NWRP through the feedback and monitoring process set out in section 8.3.8 of the Framework Plan.

Glossary of Acronyms and Terms

Term	Description
AA	Appropriate Assessment- an assessment of the potential adverse effects of a plan or project (in combination with other plans or projects) on Special Areas of Conservation (SAC) and Special Protection Areas (SPAs). These sites are protected by National and European Law
AEP	Annual Exceedance Probability
ALC	Active Leakage Control
ALL	Appropriate Leakage Level
Apparent Losses	Water that is used in properties (both domestic and non-domestic) through permanent and temporary connections that are currently unknown to Irish
ASSAP	Agricultural Sustainability and Advisory Programme
AWS	Alliance for Water Stewardship
BAP	Biodiversity Action Plan
Barrier	A 'Barrier' consists 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.
BIM	Bord Iascaigh Mhara
BWN	Boil Water Notice
CAP	Climate Action Plan
CDP	County/City Development Plan
CFRAM	Catchment Flood Risk Assessment and Management
CRU	Commission for Regulation of Utilities
CSL	Customer Side Leakage
CSO	Central Statistics Office
CWS	Certified Water Steward
DAERA	Department of Agriculture, Environment and Rural Affairs
DAFM	Department of Agriculture, Food and the Marine
Decommission	When we withdraw a water treatment and associated abstractions from service and provide supply to customers from a new source or by increasing abstraction from an existing alternative source. Decommissioning works will

Term	Description
	not be carried out until the new required infrastructure is commissioned and abstraction licenses have been obtained for either the new source, or to increase the abstraction from the existing alternative source.
Deficit	When the Water Available for Use is lower than the volume which is required (the demand).
Demand	The volume of treated water required covering the volume required by customers (both domestic and non-domestic demand), operational usage, apparent losses and loses through leakage.
Distribution Network Leakage	Water losses across the public distribution network (excluding Customer Side Leakage).
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
DWSP	Drinking Water Safety Plan
DYAA	Dry Year Annual Average
DYCP	Dry Year Critical Period
EBSD	Economics of Balancing Supply and Demand
Ecological Status	Classification of surface water bodies which is assessed by the abundance of aquatic flora and fauna.
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
EWS	European Water Stewardship
FDC	Flow Duration Curve
GDA	Greater Dublin Area
GHG	Greenhouse Gas Emissions
GSI	Geological Survey Ireland
GWB	Groundwater Bodies
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.

Term	Description
Hydrological Yield	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 or groundwater body.
IBEC	Irish Business and Employers Confederation
ICARUS	Irish Climate Analysis and Research Unit
IDA	Industrial Development Authority Ireland
IFI	Inland Fisheries Ireland
INAB	Irish National Accreditation Board
INNS	Invasive Non-Native Species
INTERREG	Series of European Regional Co-Operation Programmes
LAP	Local Area Plan
LAWPRO	Local Authority Waters Programme
LMS	Leakage Management System
LoS	Level of Service- the frequency or return period of supply failure. For example, if the LoS is stated as 1 in 50, as a consumer, you would only ever expect to experience a supply failure due to water availability, on average, once every 50 years. That is, there would be a 2% chance of experiencing a supply failure in any given year.
Lose Less	Reducing water lost through leakage and improving the efficiency of our distribution networks.
LSE	Likely Significant Effect
LWB	Lake Water Bodies
MASP	Metropolitan Area Strategic Plan
MCA	Multi-Criteria Assessment
Ml/d	Mega litres per day
NAP	National Adaptation Plan
NBS	Nature Based Solutions
NDP	National Development Plan
NIS	Natura Impact Statement
NFGWS	National Federation of Group Water Schemes

Term	Description
NHA	National Heritage Area
NOM	Natural Organic Matter
NPDWAG	National Pesticides and Drinking Water Action Group
NPF	National Planning Framework
NPO	National Policy Objective
NPV	Net Present Value
NPWS	National Parks and Wildlife Service
NRR	Natural Rate of Rise of Leakage
NSAI	National Standards Authority of Ireland
NWRP	National Water Resources Plan
NYAA	Normal Year Annual Average
Oocyst	A thick-walled structure containing a zygote that serves to transfer parasites to a new host.
OPR	Office of the Planning Regulator
PA	Preferred Approach
PCC	Per Capita Consumption
Preferred Approach	The solution or combination of solutions that are assessed as the most effective in meeting the objectives of the National Water Resources Plan.
Progressibility	Criterion to assess relative difference between options, and how progressible different options may be.
RAL	Remedial Action List – a register of public water supplies that are in need of corrective action, usually at a water treatment plant. The EPA requires Irish Water to complete an action programme for each supply on the list.
Q95	The flow in a river equaled or exceeded 95% of the time.
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
RPO	Regional Policy Objective
RSES	Regional Spatial and Economic Strategy
RWB	River Water Bodies
RWRP	Regional Water Resources Plan

Term	Description
SA	Study Area
SAC	Special Area of Conservation
SDB	Supply Demand Balance
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority of Ireland
SELL	Sustainable Economic Level of Leakage
SME	Small and Medium Sized Enterprise
SPA	Special Protection Area
SPI	Standardised Precipitation Index
STVGP	Small Towns and Villages Growth Programme
Supply Smarter	Improving the quality, resilience and security of our supply through infrastructure improvements, operational improvements and development of new sustainable sources of water.
Surplus	When the Water Available for Use is greater than the volume which is required (the demand).
SWB	Surface Water Bodies
Tankering	Delivery of water supplies by water tanker
THM	Trihalomethane- a by-product which can be formed when water supplies which contain Natural Organic Matter are disinfected.
Total Leakage	The combined water losses across the public distribution network in addition to leaking in private customer supply pipes and private plumbing systems (based on estimated values for customer side leakage).
Typology	The method by which waters of a similar ecological sensitivity are grouped into types for the Water Framework Directive, is referred to as a typology. For example, a river may be assigned to types based on altitude and alkalinity.
UKTAG	United Kingdom Technical Advisory Group
Unconstrained Option	An option for water supply not limited by cost or feasibility.
Use Less	Reducing water use through efficiency measures
WAFU	Water Available For Use- the amount of water that can be supplied from a supply system taking into account infrastructure capacity constraints, treatment losses and planned and unplanned events which can reduce supplies.
WCP	Winter Critical Period

Term	Description
WFD	Water Framework Directive
WHO	World Health Organisation
WRZ	Water Resources Zone
WSPS	Water Services Policy Statement
WSSP	Water Services Strategic Plan
WSZ	Water Supply Zone
WTP	Water Treatment Plant