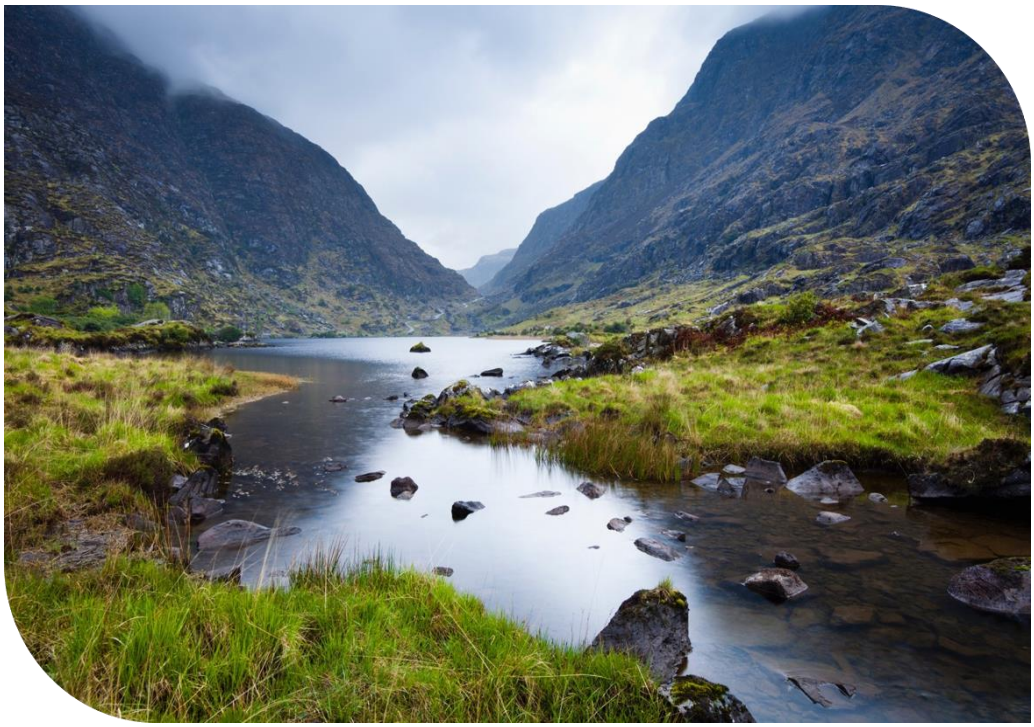
Autumn 2022

Regional Water Resources Plan – Eastern and Midlands

Appendix 3 Study Area 3 Technical Report



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-EM 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-EM. 2019 was selected as the base year to align with the planning period (2019-2025) of the NWRP.

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1 Introduction and Background

1 Introduction – Study Area 3

This is the Technical Report for Study Area 3 which applies the Options Assessment Methodology, as set out in the National Water Resources Plan Framework Plan (NWRP-FP), the final version of which was reviewed by the authors of this Technical Report Prior to finalisation of this Technical Report. This document should be reviewed in conjunction with the Framework Plan and the Regional Water Resources Plan – Eastern and Midlands (RWRP-EM), which explain key concepts and terminology used throughout the report.

This Study Area includes 11 water resource zones located in Counties Meath, Louth and Cavan. This Technical Report includes:

- The summary of Identified Need in this Study Area including Quality, Quantity, Reliability and Sustainability
- Options considered within the Study Area
- The range of approaches to resolve Identified Need
- Development of an Outline Preferred Approach for the Study Area; and
- The adaptability of our Preferred Approach.

The Preferred Approach for this Study Area feeds into the regional Preferred Approach detailed in the RWRP-EM.

1.1 Summary of Our Options Assessment Methodology

In Chapter 8 of the Framework Plan, we described the Option Assessment Methodology that will be used to develop a national programme of proposed solutions for all of our water supplies. The objective of these solutions is to resolve the needs identified through the Supply Demand Balance (SDB), Water Quality, Reliability and Sustainability assessments. These needs will be discussed in further detail in this report. In the RWRP-EM, we apply this methodology to the Eastern Midlands Region shown in Figure 1.1.

As outlined in Section 1.9.4 of the Framework Plan, the regional boundaries have been delineated for the purpose of delivering the National Water Resources Plan. As a national plan sources outside the delivery region may be considered to meet need within a particular region.

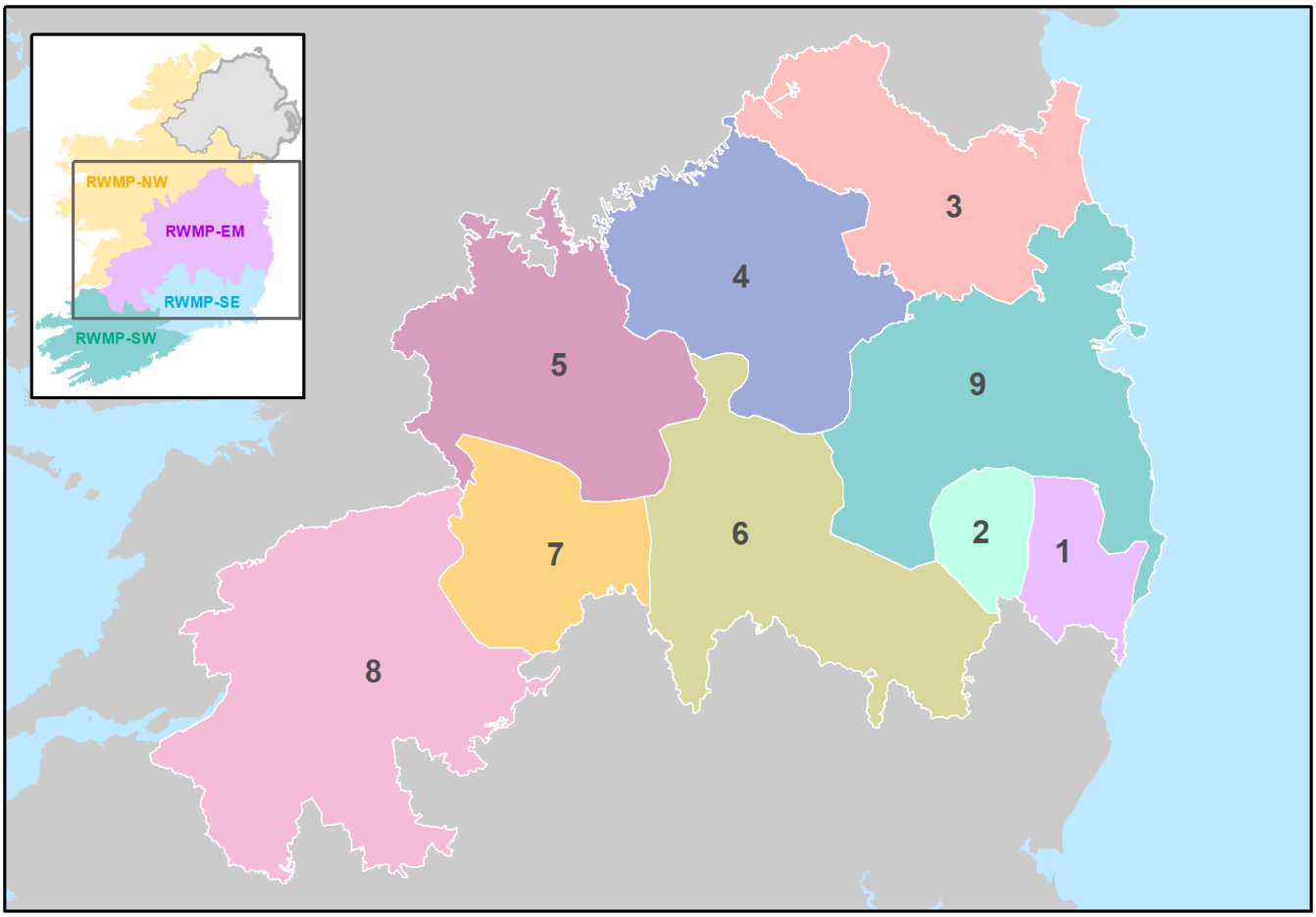


Figure 1.1 Overview of Study Areas within the Eastern and Midlands Region

This Technical Report is for Study Area 3 (SA3), which consists of 11 individual water resource zones (WRZs). Within this Study Area, the Preferred Approach has been developed following the process shown in Figure 1.2.

In this document, Option codes are labelled using the following naming convention: SAX-00X

- SAX refers to the Study Area within which the option is located.
- 00X refers to the individual option number.
- Any references to TG4 refers the Eastern and Midlands Region (Regional Group 4).

It should be noted that assessments and preferred approaches and solutions 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 NWRP (National Water Resource Planning) Framework. Any projects that are progressed following this plan 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.

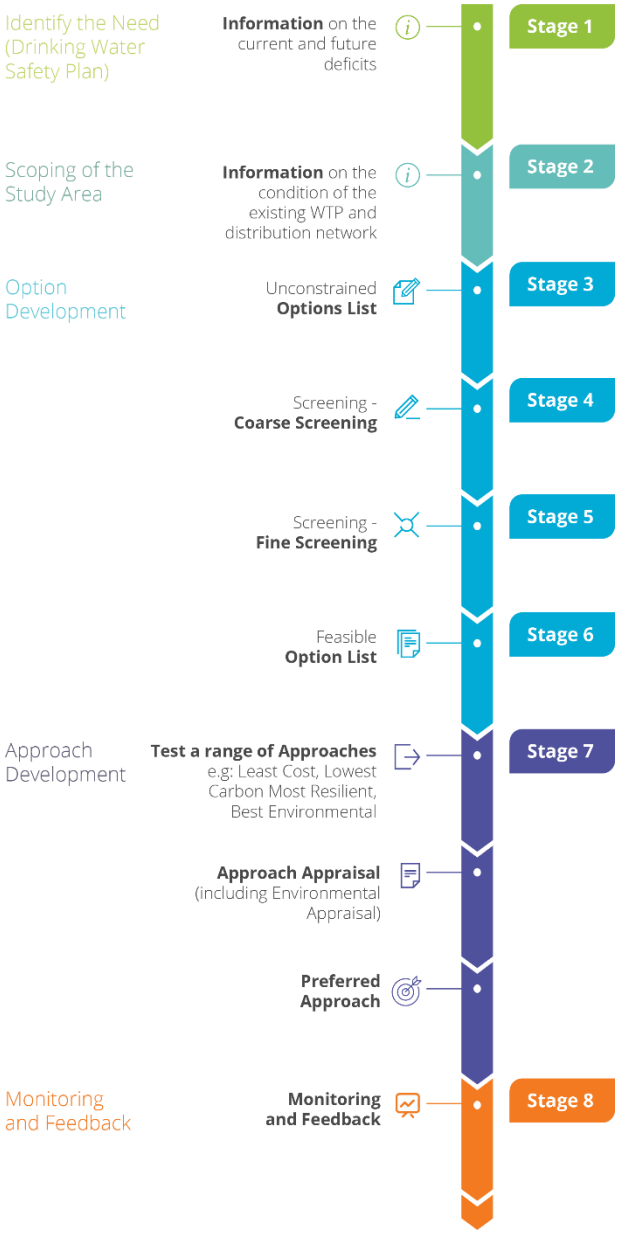


Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

SA3 consists of 11 WRZs supplying a population of approximately 190,000 via approximately 1,900 kilometres of distribution network. The principal settlements are Navan, Drogheda, Laytown-Bettystown-Mornington-Donacarney and Ashbourne. The Study Area is summarised in Figure 1.3 and Table 1.1.

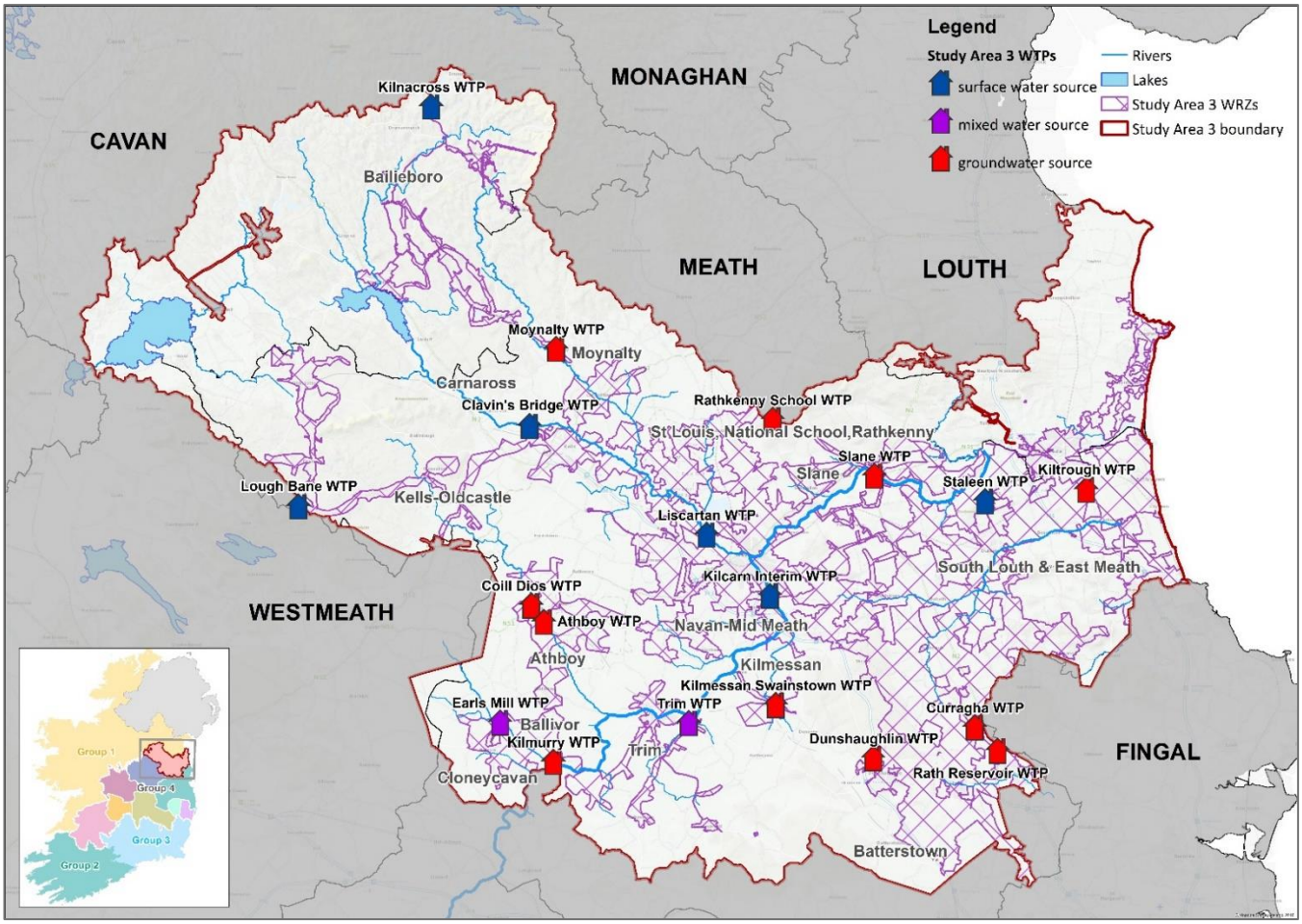


Figure 1.3 Study Area 3

The sources of water consist of 7 surface water sources and 13 groundwater abstractions in SA3.

The majority of the study area is located within the large River Boyne catchment basin. The Boyne catchment drains a total area of 2,694 km^2, as it comprises of 20 sub-catchments, 114 river water bodies and 11 lakes. The catchment has two main rivers, the main channel of the River Boyne which rises in the south west, and the River Blackwater which rises in the north west and joins the Boyne at Navan. After the Navan confluence, the Boyne turns to flow easterly out to the Irish Sea as it enters the tidal waters the between the Haven and Mornington Point, Co. Meath.

The study area has 7 surface water abstractions from the Boyne catchment - 5 river and 2 lake abstractions. The most significant of these are the river abstractions from at Liscarton WTP (Blackwater) and Staleen WTP (Boyne). The two existing lake sources, Lough Bane and Skeagh Lough, are located in different areas of the upper Boyne catchment. Lough Bane is a complex groundwater fed lake located across in the west of the study area on the border of Co. Meath and Co. Westmeath, and flows out to the River Deel (Boyne). Skeagh Lough is located in Co. Cavan in the north west of the study area, and flows out to the River Blackwater.

The geology of the study area can be divided into four main groups: Ordovician and Silurian shales, greywackes and volcanics; Lower Carboniferous limestones and shales; Upper Carboniferous (Calp) sandstones and shales; and Permian/ Triassic sandstones. Two aquifer types form the basis for groundwater development in Meath, namely the Calp consisting of dark limestone and shale which is widespread in the region. Secondly, karstified diffuse limestone (Rkd) in north-east Meath has substantial groundwater volumes along the Trim, Slane and Drogheda axis.

Table 1.1 also provides an overview of the risk of failure against the Quality, Quantity, Reliability, Potential Sustainability criteria. A further breakdown of these scores is provided in Section 2.

Table 1.1 SA3 Overview

	Total Population	189,980	**Total Network Length (km)**	1,927	**Number of Water Resource Zones**		11
Counties in Study Area	Cavan, Louth, Meath						
Principal Settlements	Drogheda,Ashbourne,Laytown-Bettystown-Mornington-Donacarney,Ratoath,Trim,Ceanannas Mór (Kells),Duleek,Gormanston,Dunshaughlin,Stamullen,Bailieborough,Virginia,Clogherhead,Carlanstown,Slane						
Number of Water Sources	20	**Surface Water Sources**	7		**Groundwater Sources**	13	
Water Treatment Plant	**Source**	**Population**	**WTP Capacity (m^3/day)**	**Quality**	**Quantity**	**Reliability**	**Potential Sustainability**
Kilcarn WTP	River Boyne (Kilcarn)	40,101	1,620	●	●	●	●
Liscartan WTP	River Blackwater (Liscarton)		14,400	●	●	●	●
Rathkenny School WTP	Groundwater	5	8	●	●	●	●
Moynalty WTP	Groundwater	188	250	●	●	●	●
Trim WTP	River Boyne & BH	11,399	5,500	●	●	●	●
Kilmessan Swainstown WTP	Groundwater	1,138	500	●	●	●	●
Slane WTP	Groundwater	3,066	2,000	●	●	●	●
Earlsmill WTP	Groundwater	2,540	300	●	●	●	●

	Total Population	189,980	Total Network Length (km)	1,927	Number of Water Resource Zones		11
Kilmurry WTP	Groundwater		700	●	●	●	●
Coill Dios WTP	Groundwater	4,669	500	●	●	●	●
Athboy WTP	Groundwater		1,300	●	●	●	●
Clavin's Bridge WTP	River Blackwater	11,117	1,500	●	●	●	●
Lough Bane WTP	Lough Bane		3,500	●	●	●	●
Rath WTP	Groundwater	12,845	500	●	●	●	●
Staleen WTP	River Boyne	73,436	34,415	●	●	●	●
Curragha WTP	Groundwater		1,200	●	●	●	●
Kiltrough WTP	Groundwater	13,830	3,000	●	●	●	●
Dunshaughlin WTP	Groundwater	7,716	3,600	●	●	●	●
Bailieborough WTP	Skeagh Lough	7,931	3,500	●	●	●	●

Score	Irish Water Asset Standard Assessment
	Low Risk
	Medium Risk
	High Risk

2

Scoping the Study Area

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in Study Area 3, in terms of water quality, quantity, reliability and sustainability.

To identify the issues and corresponding need with the water supplies in this Study Area, and to inform the nature, scale and scope of the solutions that we need to consider to meet them, we have assessed:

- The **water quality** that we can supply;
- The **water quantity** that we can supply;
- The **reliability** of our existing supplies; and
- Additional information that impacts the long-term **sustainability** of our sources or infrastructure.

2.1 Water Quality

We assess the water quality investment needs of our water supplies by assessing the performance of our assets against the barriers set out in Chapter 5 of the Framework Plan. As set out in Chapter 5 of the Framework Plan, Irish Water is developing scientifically robust datasets to assign risk. Irish Water are utilising the well-established 'Failure Mode Effect Analysis' which provides a step-by-step approach for identifying all possible failure modes that can result in a hazardous event. Once identified, we assess risk against the existing controls (Barriers), which we have in place for source protection within our water treatment plants and networks. This Barrier Assessment process highlights where there is a deficit or potential for future deficit in these controls or treatment process elements.

The barriers are an internal gauge and the initial desktop assessments of barrier performance for SA3 are summarised in Table 2.1

Table 2.1 Quality: Barrier Scores

Quality: Barrier Scores				
Water Treatment Plants	**Barrier 1: Bacteria & Virus**	**Barrier 2.1: Maintain chlorine Residual in the Network**	**Barrier 3 Protozoa (Crypto) Asset Potential**	**Barrier 6b THM's Leading Indicator**
Kilcarn WTP	●	●	●	●
Liscartan WTP	●	●	●	●
Rathkenny School WTP	●	●	●	●
Moynalty WTP	●	●	●	●
Trim WTP	●	●	●	●
Kilmessan Swainstown WTP	●	●	●	●

Quality: Barrier Scores				
Water Treatment Plants	**Barrier 1: Bacteria & Virus**	**Barrier 2.1: Maintain chlorine Residual in the Network**	**Barrier 3 Protozoa (Crypto) Asset Potential**	**Barrier 6b THM's Leading Indicator**
Slane WTP	●	●	●	●
Earlsmill WTP	●	●	●	●
Kilmurry WTP	●	●	●	●
Coill Dios WTP	●	●	●	●
Athboy WTP	●	●	●	●
Clavin's Bridge WTP	●	●	●	●
Lough Bane WTP	●	●	●	●
Rath WTP	●	●	●	●
Curragha WTP	●	●	●	●
Kiltrough WTP	●	●	●	●
Dunshaughlin WTP	●	●	●	●
Staleen WTP	●	●	●	●
Bailieborough WTP	●	●	●	●

Score	Irish Water Asset Standard Assessment
●	Low Risk
●	Medium Risk
●	
●	High Risk

The colour coding within the outline assessment indicates the severity of the potential risk of barrier failure. It should be noted that the table is not an indicator of non-compliance with the European Union (Drinking Water) Regulations 2014 as amended (Drinking Water Regulations), but an internal Irish Water assessment of the asset capability standard compared with the asset standard 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.

Based on the barrier assessment, 17 of the 19 WTPs in the Study Area are considered to be at high risk of failing to achieve the required standards in relation to in relation to primary disinfection (Barrier 2.1) and effectiveness of our Protozoa removal processes (Barrier 3). However, 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 (2020), are developed for each water supply, the barrier scores for all of our supplies will be updated and become more reliable.

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

Currently, there are 3 WTPs within SA3 on the Environmental Protection Agency (EPA) Remedial Action List. Trim WTP within the Trim WRZ, Kilcarn WTP within the Navan Mid Meath WRZ and Bailieborough WTP within the Bailieborough WRZ. Upgrades at Baileborough are now complete, and we are currently in the process proving phase and working with the EPA to remove it from the RAL.

Irish Water is currently progressing immediate corrective action in advance of the NWRP for a number of supplies within SA3. A national programme to improve disinfection standards (Barrier 1) at water treatment facilities across Ireland was initiated by Irish Water in 2016. Details of the 'in progress' projects to address critical water quality requirements are included in Table 2.2.

Table 2.2 Critical Water Quality Requirements SA3

Critical Requirement	Progress
1.Staleen WTP The Staleen WTP was on the EPA's remedial action list (RAL) due to elevated levels of trihalomethanes above the standard in the Drinking Water Regulations. The WTP required upgrade of Coagulation, Flocculation and Clarification Process, filtration process and additional filtration tanks and installation of UV disinfection and chemical disinfection process and other works to achieve drinking water regulations compliance. Works at the plant are complete and the supply was removed from the RAL list Q1 2021.	**Works Complete**
2.Bailieborough WTP During Q4 of 2019, high levels of manganese in the raw and treated water were detected at the plant. The plant was placed on the RAL pending the upgrade of the manganese treatment system at the plant. Works are nowcomplete.	**Works Complete**
3.Liscarton WTP Individual process improvements are ongoing with filters upgraded and in operation. Works at the plant are complete and Liscarton WTP was removed from the EPA RAL in July 2021.	**Works Complete**

Critical Requirement	Progress
3.Kilcarn WTP There are issues at the WTP as the DAFF unit is coming to the end of its design life. Proposal to replace the WTP with a package plant solution in the interim prior to the delivery of the long term preferred approach for the area.	**In Design**
4.Trim WTP upgrade There are issues at the WTP as the DAFF unit is coming to the end of its design life. Required upgrades to the WTP are currently at outline design phase.	**Outline Design**
5.Reservoir Cleaning Programme A major reservoir cleaning programme has been completed at 38 sites, which has reduced network water quality issues.	**Ongoing**
6.Disinfection Programme In 2016, Irish Water completed nationwide review of all water treatment plants where disinfection upgrades were required, followed by a programme of works to complete the required upgrades. To date, the disinfection programme has completed upgrade works at 1 WTP in SA3 and works are progressing at 6 WTPs including Slane WTP and Killmurray WTP. Any requirements within the remaining supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP	**Ongoing**

In summary, in relation to water quality, Irish Water will:

- Continually update Barrier Performance issues in the WRZ which have the potential to impact on drinking water quality in the region;
- Improve these assessments through the development of DWSPs for all of our supplies;
- Address the priority risks identified on the EPA Remedial Action List (noting that steps have already been taken, and are ongoing, to address these risks); and
- All residual need (grey dots) in relation to water quality, see Table 2.1, will be brought through our options assessment process.

2.2 Water Quantity – Supply Demand Balance

Irish Water assesses the water quantity investment needs of our supplies by developing SDB calculations for each of our water supplies as outlined in Chapter 3, 4 and 6 of the Framework Plan. The calculations are used to assess the amount of water available in our supplies and compare that to the current and forecast demand for water in accordance with Figure 2.1.

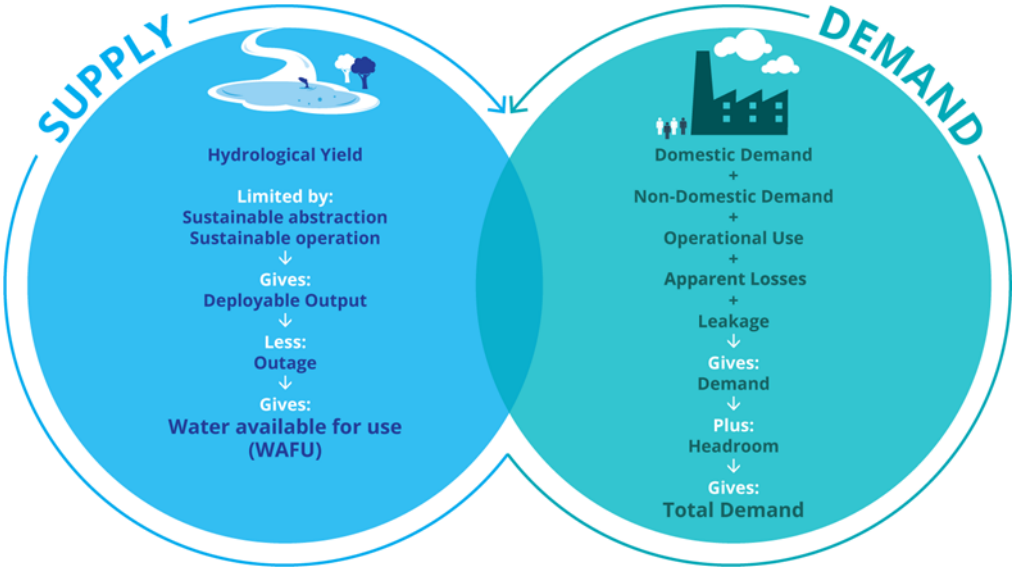


Figure 2.1 Supply Demand Balance

For each of the 11 WRZs in this Study Area, We assessed the baseline SDB for this WRZ and developed 25-year forecasts of supply and demand, in accordance with Figure 2.1.

The SDB assessments were carried out for each of the weather event planning scenarios (Normal Year Annual Average, Dry Year Annual Average, Dry Year Critical Period, Winter Critical Period) which described in Chapter 2 of the Framework Plan. The SDB deficits in SA1 manifest in the following ways:

1. **Inappropriate standards and levels of risk for a strategic water supply:** As water supply is essential for public health, Irish Water must ensure appropriate standards of supply and be able to cope with drought conditions, peak events, and maintenance of assets. This requires adequate reserve capacity in our supplies to provide a 1 in 50 Level of service. At present, not all supplies within this Study Area meet the required levels of reserve capacity. However, due to the lack of historical monitoring, particularly in relation to groundwater supplies, some of the deficits may be data driven.

2. **Day to day operations:** At present, 10 out of 11 of the WRZs in SA3 the area suggest a supply demand balance deficit (based on a “do nothing” approach) under present & future scenarios. While sufficient during normal weather conditions, several would fail in drought. During the drought in summer 2018 demand in the South Louth East Meath WRZ increased to levels greater than the safe production capacity.

A summary of the SDB deficit across all 18 Water Resource Zones is summarised in Table 2.3. The water resources zones are detailed in Appendix L of the Framework Plan - Supply Demand Balance Summaries.

Table 2.3 WRZ SDB Dry Year Critical Period Deficits

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Navan-Mid Meath	2300SC0055	40,101	-1,581	-1,745	-2,054	-2,364	-2,672	-2,918
St Louis, National School, Rathkenny	2300SC0045	5	-4	-4	-4	-4	-4	-4
Moynalty	2300SC0027	188	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Trim	2300SC0014	11,399	-442	-450	-514	-578	-641	-692
Kilmessan	2300SC0011	1,138	-98	-110	-118	-126	-135	-141
Slane	2300SC0009	3,066	-430	-469	-490	-512	-534	-551
Ballivor	2300SC0007	2,540	-53	-73	-89	-104	-119	-131
Athboy	2300SC0006	4,669	-387	-355	-398	-434	-469	-497
Kells-Oldcastle	2300SC0005	11,117	-3,396	-3,500	-3,575	-3,647	-3,718	-3,776
South Louth & East Meath	2100SC0001	107,827	-10,318	-11,794	-12,896	-13,864	-14,826	-15,596
Bailieboro RWSS	0200SC0015	7,931	-1,446	-1,480	-1,554	-1,609	-1,664	-1,707

As outlined in Chapter 4 of the Framework Plan, the estimated population currently living in each WRZ has been based on the 2016 Census data. Forecasts for future populations have been based on draft growth projections from the National Planning Framework (NPF), and updated information from the Regional Spatial and Economic Strategies (RSES) and Local Authority Planning sections (where available).

The target 1 in 50 level of service in the region were applied in each case, along with the corresponding requirements for reserves, indicating that our supplies are operating with a cumulative SDB deficit of approximately 18,155 m^3/day for the Region. As a result, while we can continue to supply water, the water supplies in this area may come under pressure, particularly in drought conditions. In addition, there may be ongoing reliability issues.

This situation will further deteriorate over time due to climate change driven reductions in water resources, together with increased demand due to population growth. If we do nothing, the SDB deficit is projected to increase to approximately 26,013 m^3/day by 2044.

Our ongoing activities to improve the Supply Demand Balance in SA3 are prioritised as:

- Ongoing leakage management including active leakage control, pressure management and find and fix activities to meet target levels of Leakage.
- Water Conservation measures, including information campaigns and initiatives, and Water Conservation Orders during drought periods.Water Supply Reliability

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.

There are a number of problematic distribution and trunk mains across this Study Area. Irish Water, in partnership with each County Council, will continue to monitor the performance of all water mains in the network to ensure the most problematic mains are replaced as required.

To date, a significant amount of watermain rehabilitation has been carried out across Study Area 3. This provides for a more reliable water supply, reducing instances of bursts and water outages. The works also improve water quality by replacing old cast iron and lead watermains, whilst reducing leakage and improving overall operation and maintenance of our supply system.

During our needs assessment, Irish Water has identified a number of critical requirements for upgrades to the existing asset base, including storage and trunk main requirements. Progress to date on these projects is summarised in Table 2.4.

Table 2.4 SA3 Critical Infrastructure Projects and Need Identification

Critical Requirement	Progress
1. **Replacement of Proudstown Reservoir to Navan Town Water Main:** The 525mm AC main between Proudstown Reservoir and Navan town main delivers a supply up to a population of approximately 30,000 and is the primary supply main to Navan. This main has experienced a high burst history with a number of recent high profile bursts and is in need of replacement. Failure of this main would result in water and flood damage to properties in close proximity to the main and outages to a population of approximately 30,000.	**Complete**
2. **Replacement of the Staleen to Windmill Hill Main:** The Staleen to Windmill Hill 400mm AC main is the primary trunkmain to the villages of Ratoath and Ashbourne. This main has a high burst failure rate and has been identified for replacement. A significant burst on this trunkmain, would potentially impact a population up to 26,000.	**Assessment Complete**
3. **Replacement of the Windmill Hill to Ratoath Water Main:** The 12" main between Curragha and Ratoath village delivers a supply to Ratoath, Fairyhouse, Kilbride and their environs. This section of the 12" main has experienced a high burst history and requires replacement. Failure of this main would result in outages to approximately 11,000 customers.	**Detailed Design**
4. **New Pipeline from Duleek to Navan:** The Navan Mid Meath WRZ is 90% reliant on water supply from the Listcarton WTP. Given this arrangement it is difficult to carry out routine maintenance and repairs at the plant and the Navan - Mid Meath WRZ is vulnerable to an unplanned outage at the Liscarton WTP, which could result in an water supply outage for 40,000. A main connecting Navan Mid Meath to the South Louth East Meath WRZ which will be used to supplement supply and refill storage in the Navan Mid Meath WRZ in the event of a planned or unplanned outage at the Liscarton WTP. The main will also be used to reduce pressure on the Liscarton WTP if there is a planned or unplanned outage at the Kilcarn WTP.	**Detailed Design**
5. **Staleen to Drogheda Main:** The gravity 400mm AC main between Staleen and Drogheda is the primary supply to Drogheda. This main is currently delivering above its design capacity. The main and has been identified for upgrade. Failure of this primary main downstream of Donore reservoir would result in outages to a population of approximately 50,000.	**Outline Design**
6. **Raw water rising main from Roughgrange to Staleen WTP:** The supply to the Staleen plant water is abstracted from the River Boyne and delivered from the pumping station at Roughgrange through two rising mains, a 600mm diameter AC pipe and a smaller, 450mm diameter pipe, also AC. In May 2018 the 600mm rising main, burst which resulted a period of reduced supply to significant areas of East Meath and South Louth. A significant burst on this rising main, would potentially impact up to 90,000	**Completed 2018**

Critical Requirement	Progress
population in the South Louth, East Meath area, including the town of Drogheda. This main had been the subject of a number of previous bursts and following a detailed condition assessment a programme to replace the 600mm main AC was implemented.	
7. **Treated Water Storage:** Treated water storage is to be provided in Ballivor to provide security of supply under the treated water storage programme.	**In Design**

In summary, there are some asset reliability issues across the distribution network within the WRZ. Some critical infrastructural projects, outlined in Table 2.4, to address these issues have been identified and are in progress. In addition to this, a continuous programme of repairs, upgrades and leakage reduction is being progressed as part of Irish Waters National Leakage Reduction Programme across all Study Areas.

2.3 Water Supply Sustainability

The water supplies within the region were developed over time to address the needs of the local populations and to support growth and development. Most of these supplies predate most modern environmental legislation and none of our current abstractions in this area were developed through any formalised abstraction process.

As outlined at Section 3.7.2 of the Framework Plan, the Government is currently developing new legislation dealing with water abstractions. As this legislation is still being developed, we do not have full visibility of the future regulatory regime. We have therefore not progressed through a theoretical licencing process on a site by site basis and cannot reliably include an estimation of sustainable abstraction within the SDB calculations. Instead, we use the hydrological yield, water treatment capacity and bulk transfer limitations in our calculation of DO. This assessment procedure is set out at Appendix C of the Framework Plan, and in line with a precautionary approach.

To understand the potential impact of the abstraction legislation on the SA3 South Louth East Meath Supplies, we have assessed the potential impacts to all of oursurface water abstractions – 5 river abstractions from the River Boyne / Blackwater, and 2 lake abstractions from Lough Bane and Skeagh Lough.

Table 2.5 presents these findings to show the potential reductions to our available supplies. The table presents our current abstraction levels[1], our source hydrological yield[2], and our estimated sustainable abstraction[3] amount which the source may be limited to in the future.

Based on this initial assessment, the volumes of water abstracted from the River Blackwater at Liscarton and Lough Bane and Skeagh Lough may not meet sustainability guidelines. However, under the

[1] Based on WTP 22hr (DYCP) capacity
[2] Our hydrological yield estimate is the 'safe' yield calculated to be available during a 1 in 50 year drought event. We use this figure in the SDB calculations to determine whether a WRZ is projected to be in deficit or surplus
[3] 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 our best understanding of how the EPA may enforce future abstraction licencing applying UKTAG guidance.

proposed regulatory regime, sustainable abstraction quantities will be adjudicated by the EPA. We have assumed, given the need to maintain supplies, that a transition to new abstraction quantities would likely take place in the medium term.

Table 2.5 Comparison of Current Abstraction, Hydrological Yield and Theoretical Future Abstraction

Description	River Blackwater (Liscarton)	River Boyne (Kilcarn)	River Boyne (Staleen)	River Blackwater (Clavin's Bridge)	River Boyne (Trim)	Lough Bane	Skeagh Lough
Current abstraction (m^3/d)	13,200	1,485	31,547	1,375	5,042	3,208	3,208
Hydrological yield (m^3/d)	41,239	126,956	170,719	7.895	117,409	384	2,579
Theoretical Future abstraction (m^3/day)	11,095	30,114	43,197	3,325	28,502	213	527

The potential change to the SDB for each WRZ, as a result of these potential reductions in abstraction during Dry Weather Flow are summarised in Table 2.6.

Table 2.6 Potential Change to the SDB Based on Potential Abstraction Reductions

Description	River Blackwater (Liscarton)	River Boyne (Kilcarn)	River Boyne (Staleen)	River Blackwater (Clavin's Bridge)	River Boyne (Trim)	Lough Bane	Skeagh Lough
Potential change in SDB[4](m^3/d)	-3,939	none	none	none	none	-151	-1,818

The net impact of these potential minimum environmental flow requirements has been assessed using the outline assessment methodology described in Appendix C of the Framework Plan.

Groundwater abstractions will 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.

As noted in Section 3.2.2 of the Framework Plan producing robust desktop assessments of water availability from our existing groundwater abstractions is very difficult. Ideally, yield estimates would be based on a three-dimensional assessment of the geology within the vicinity of the supply, supplemented with long term records on pumping and drawdown of water levels over many years. Irish Water does not have this type of information available for most of our groundwater supplies and while we will aim to complete site-specific studies of groundwater availability, this may take many years.

On an interim basis Irish Water has developed an initial assessment for existing abstractions based on best available information. For more information, please see Appendix C Supply Assessment and

[4] Based on potential changes to the projected 2044 Dry Year Critical Period (DYCP) scenario

Appendix G Regulatory and Licensing Constraints of the NWRP - Framework Plan. Over the coming years, Irish Water will work with the environmental regulator EPA and the Geological Survey of Ireland, 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.

In summary, when considering the requirements of the Water Framework Directive (WFD), some of our schemes may be subject to reductions in abstraction, especially during drought periods. While we have developed a potential understanding of the impact of the legislation we cannot reliably include an estimation of sustainable abstraction within the SDB calculations.

However, we do use our sustainable abstraction estimations to assess the sensitivity of the Preferred Approach as set out in Chapter 7 of this Technical Report. This assessment determines whether the Preferred Approach is adaptable to change across a range of potential future scenarios and verifies our ability to adapt and increases our resilience to future changes.

When the new Legislation on abstraction of water has been enacted and regulatory assessments completed if an abstraction is confirmed to be affecting a waterbody status the Supply Demand Balance will be updated as outlined in the monitoring and feedback section of the RWRP, Section 9.2.2. All future abstractions considered through the Framework Plan options assessment are validated for sustainability, including options to increase abstraction at existing sites.

2.4 Water Resource Zone Needs Summary

Study Area 3 has significant issues in relation to quality, quantity, reliability and sustainability which must be addressed as part of the Preferred Approach to future water resources planning, summarised in Table 2.7.

Table 2.7 Summary of Need Quality, Quantity, Reliability, Sustainability

Quality	Upgrades required at all WTPs, aligned with the barrier approach
Quantity	Net leakage reduction 356 m^3/d in the region Additional Leakage Targets of 13,147 m^3/d to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d The SDB deficit in the region ranges between 18,155 m^3/d in 2019 during dry conditions, to a maximum of 26,013 m^3/d in 2044 during dry conditions.
Reliability (In addition to progressing projects)	Continued network upgrades and improvements in the bulk and distribution networks
Sustainability	Based on our initial desktop assessment, the volumes of water abstracted The volumes of water abstracted from the River Blackwater at Liscarton and Lough Bane and Skeagh Lough may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, this will be adjudicated by the EPA. Over the coming years, Irish Water will work with the environmental regulator EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources.

All of these needs will be considered within our options assessment process and in the development of the Preferred Approach.

Further details of planned, live and recently completed projects are available on our website see: https://www.water.ie/projects-plans/our-projects/

3

Solution Types Considered in Study Area 3

3 Solution Types Considered in Study Area 3

In this chapter, we summarise the type of solutions we have considered to address identified need for treated drinking water supply in Study Area 3.

As outlined in Chapter 7 of the Framework Plan, we consider measures across the following three pillars: **Lose Less**, **Use Less** and **Supply Smarter** in forming our list of unconstrained options, which are assessed for short, medium and long-term solutions. For the SA1 as part of our unconstrained options, the following options have been reviewed.

3.1 Leakage Reduction

The Leakage reduction measures across the public water supply considered for SA3 are based on what we assess to be both achievable and sustainable and include:

- Ongoing leakage management, including active leakage control, pressure management and Find and Fix activities, to offset Natural Rate of Leakage Rise (NRR); and
- Net leakage reductions targets listed in Table 3.1 have been applied to SDB deficit to move towards achieving the national Sustainable Economic Level of Leakage (SELL) target prioritised based on
    - Supply demand deficit;
    - Existing abstractions with sustainability issues; and
    - Drought impacts.
- Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m^3/d, see Table 3.1.

Table 3.1 SELL Targets for WRZ in SA3

WRZ	Net Leakage Reduction applied to SDB(m^3)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d (m3)	Total Leakage Targets (m3)
South Louth & East Meath		8,792	8,792
Athboy	63		63
Bailieboro	40		40
Navan Mid Meath	190	2,268	2,458
Slane		286	286
Trim	63	1,327	1,390
Moynalty		12	12
St Louis, National School, Rathkenny		5	5

WRZ	Net Leakage Reduction applied to SDB(m^3)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d (m3)	Total Leakage Targets (m3)
Kells-Oldcastle		456	456

3.2 Water Conservation

At present, Irish Water is conducting pilot studies in relation to water conservation stewardship in businesses and is actively pursuing Conservation Education Awareness Campaigns and partnerships. During drought conditions in 2018 and 2020, a Water Conservation Order was implemented in order to protect our water supplies and reduce pressure on the natural environment during this period. We will continue to promote 'Water Conservation Activities', collecting and monitoring data over a number of years to assess the benefits. As part of the NWRP – Framework Plan, we have not applied reductions to the SDB deficit for unquantifiable water conservation gains, however as stipulated within the Consultation Report prepared in relation to the NWRP- Framework Plan, IW will progress pilot studies on water conservation measures. Based on the outcomes of these studies, we may include such factors in future iterations of our NWRP. However, we do assume that any gain will offset consumer usage growth factors.

3.3 Supply Smarter

The supply options considered as part of the options development are unconstrained by distance from SA3 and include:

- 15 standalone groundwater options across the Study Area;
- 9 standalone surface water options across the Study Area;
- WTP Upgrades;
- Interconnection and Rationalisation[5] of WRZs within the Study Area; and
- Network connectivity and transfers from other Study Areas.

[5] Rationalisation of a WRZ includes providing part or full supply to the WRZ from another WRZ. Often some or all of the WTPs in the WRZ obtaining supply are decommissioned as part of this process.

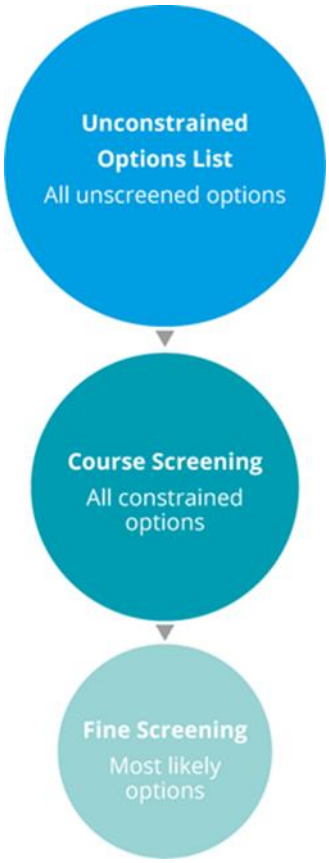
4 Option Development SA3

4 Option Development for Study Area 3

This chapter describes how our options assessment methodology was applied to produce a Feasible Options list to meet the identified needs.

The purpose of our options assessment process, as outlined in Chapter 8 of the Framework Plan, is to consider the widest practicable range of solutions to resolve identified need within a given area. A suitable screening criterion is then applied to filter out any options that are not feasible, based on sustainability (environmental and social impacts), resilience or deliverability. As sustainability is at the heart of our plan, environmental and social assessment criteria are included at the earliest stages of the screening process. At the outset of the process, some fundamental rules are applied even before screening begins to ensure the protection of the environment. For example, having regard to WFD objectives, Irish Water does not allow for any inter-catchment raw water transfers due to the high risk of transferring invasive non-native species (INNS) between catchments and non-compliance with WFD objectives.

The options assessment screening process involves the following:



- Developing a long list of unconstrained options – Unconstrained Options constitute all of the possible solutions, which either fully or partly resolve a water supply deficit, regardless of any cost, environmental or social constraints. In developing the Unconstrained List, we identify options that are applicable to meet the needs of the study area;
- 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 detailed questions, related to environmental objectives identified for the SEA (including biodiversity, the water environment and requirements under climate change adaptation) as well as Resilience, Deliverability and Progressibility.

The coarse screening and fine screening questions, and the associated scoring criteria, are included in Chapter 3 of the Study Area Environmental Report.

4.1 Developing a List of 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 abstractions or to identify any potential new water sources within the Study Area; as summarised in Table 4.1.

Table 4.1 Desktop Assessments for Unconstrained Options

Existing and New Ground Water sources	A Hydrogeologist conducts a desktop groundwater availability assessment of all potential aquifers and aquitards within, and within a reasonable distance of, the study area.
Existing and New Surface Water sources and Conjunctive Use Options	A Hydrologist carries out a desktop surface water availability assessment of all potential catchments and waterbodies within, and within a reasonable distance of, the study area.
Water Treatment upgrades, Desalination, Rationalisation and Effluent Reuse Options	An Engineer reviews any potential increases in capacity at existing water treatment sites and any potential conjunctive use or effluent reuse options.

Based on these desktop assessments, Irish Water developed an initial list of unconstrained options for new supplies and increases and upgrades to existing supplies and assets. An unconstrained options review workshop was then held with our Local Authority Partners to identify any additional unconstrained options that may be available based on local knowledge. A total list of unconstrained options was then compiled.

For SA3, 101 Unconstrained Options were identified to address need. These unconstrained options were not limited by cost, distance from the area or feasibility. These options are summarised in Table 4.2 and shown spatially in Figure 4.1

Table 4.2 SA3 Unconstrained Options

No. of Options	Option Type
15	Groundwater
1	Rationalisation (GW)
9	Surface Water
16	Rationalisation (SW)
3	Effluent Discharge (SW)
3	Rationalisation – Effluent Discharge
3	Quarry Discharge (SW)
1	Rationalisation - Quarry Discharge
1	Rationalisation
40	Rationalisation - Transfer
3	Conjunctive Use
2	Rationalisation – Conjunctive Use
1	Desalination

No. of Options	Option Type
1	Raw water Storage
1	WTP Upgrade
1	Critical Infrastructure

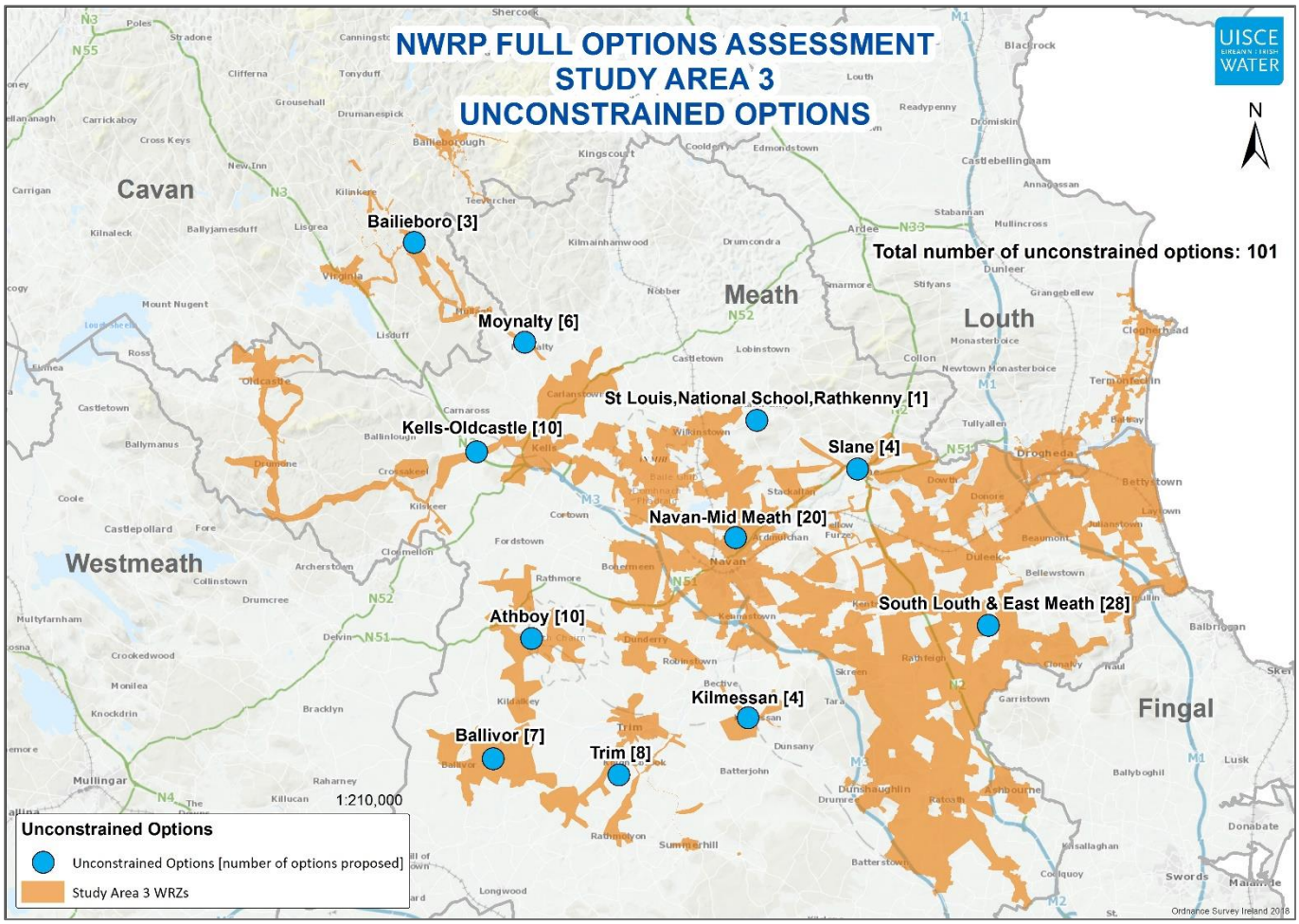


Figure 4.1 SA3 Unconstrained Options

The 101 options were filtered through our screening process to eliminate those with potentially unviable environmental impacts or feasibility issues.

4.2 Coarse Screening

The 101 identified Unconstrained Options were assessed through Coarse Screening against the criteria of:

- Resilience;
- Deliverability and Flexibility; and
- Sustainability (Environmental and Social Impacts).

The Coarse Screening process is summarised in Chapter 8 of the Framework Plan. The coarse screening assessments were conducted by a specialist team, including Engineers, Hydrologists and, Hydrogeologists, Ecologists, and Environmental Scientists.

24 Unconstrained Options were rejected at this stage as they were found to be unviable in relation to one or more assessment criteria. Details of these options and the justification for their rejection are outlined in the rejection summary, Annex B of this report. The rejection summary records the criteria against which the rejected options were assessed as having a 'red' score for the purposes of the coarse screening exercise (as explained in more detail in Chapter 8 of the framework plan), and accordingly were not brought forward at the coarse screening phase. The box below provides an example of a rejection justification for an option considered for the South Louth East Meath WRZ.

Example Rejected Option

Option SA3-06a

Merge South Louth East Meath and Navan Midmeath WRZs. Staleen Expansion. The increased abstraction will be offset by discharge of water from dewatering at Platin downstream of the abstraction. Rath Reservoir WTP, Kilcarn WTP and their abstractions will be decommissioned as part of this option.

Rejection Reason

The Platin Quarry abstracts sufficient groundwater to maintain the water table below the working quarry flow. This options proposes to divert this abstracted water to the River Boyne downstream of the Staleen abstraction The overall WFD status of the ground waterbody in this location is classified as poor status. Currently the water abstracted is returned to the local environment via the River Nanny which is also classified as poor WFD status. Using discharge from the quarry as a source of supply will result in WTP operations been completely dependent on the quarry operations and would impact the ground waterbody and surface waterbody meeting WFD objectives. Therefore this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

The remaining 77 options were progressed to further assessment through the Fine Screening process. The rejected options are summarised in Annex A of this technical report. Annex A records the criteria against which the rejected options were assessed as having a "red" score for the purposes of the coarse

screening exercise (as explained in more detail in Chapter 8 of the Framework Plan), and accordingly were not brought forward at the coarse screening stage. The remaining options are summarised in Table 4.3.

Table 4.3 SA3 Remaining Options after Course Screening

No. of Options	Option Type
11	Groundwater
1	Rationalisation (GW)
7	Surface Water
9	Rationalisation (SW)
2	Effluent Discharge (SW)
2	Rationalisation – Effluent Discharge
1	Quarry Discharge (SW)
1	Rationalisation - Quarry Discharge
38	Rationalisation - Transfer
2	Conjunctive Use
2	Rationalisation – Conjunctive Use
1	WTP Upgrade

4.3 Fine Screening

The 77 remaining options were subject to a more detailed multi-criteria assessment (MCA) at the Fine Screening Stage using desktop assessments of performance against specified questions relating to Sustainability (Environmental and Social Impacts), Resilience, Deliverability and Progressivity. These questions are set out in Appendix N of the Framework Plan. The assessment for each option was based on an objective assessment with uniform scoring criteria, based on best publicly available datasets.

At Fine Screening stage, no further options were rejected, with all 77 options considered to be feasible and brought forward to desktop outline design and costing. These are summarised in Table 4.4 and shown spatially in Figure 4.2.

Table 4.4 SA3 Remaining Options after Fine Screening (Feasible Options)

No. of Options	Option Type
11	Groundwater
1	Rationalisation (GW)
7	Surface Water
9	Rationalisation (SW)

No. of Options	Option Type
2	Effluent Discharge (SW)
2	Rationalisation – Effluent Discharge
1	Quarry Discharge (SW)
1	Rationalisation - Quarry Discharge
38	Rationalisation - Transfer
2	Conjunctive Use
2	Rationalisation – Conjunctive Use
1	WTP Upgrade

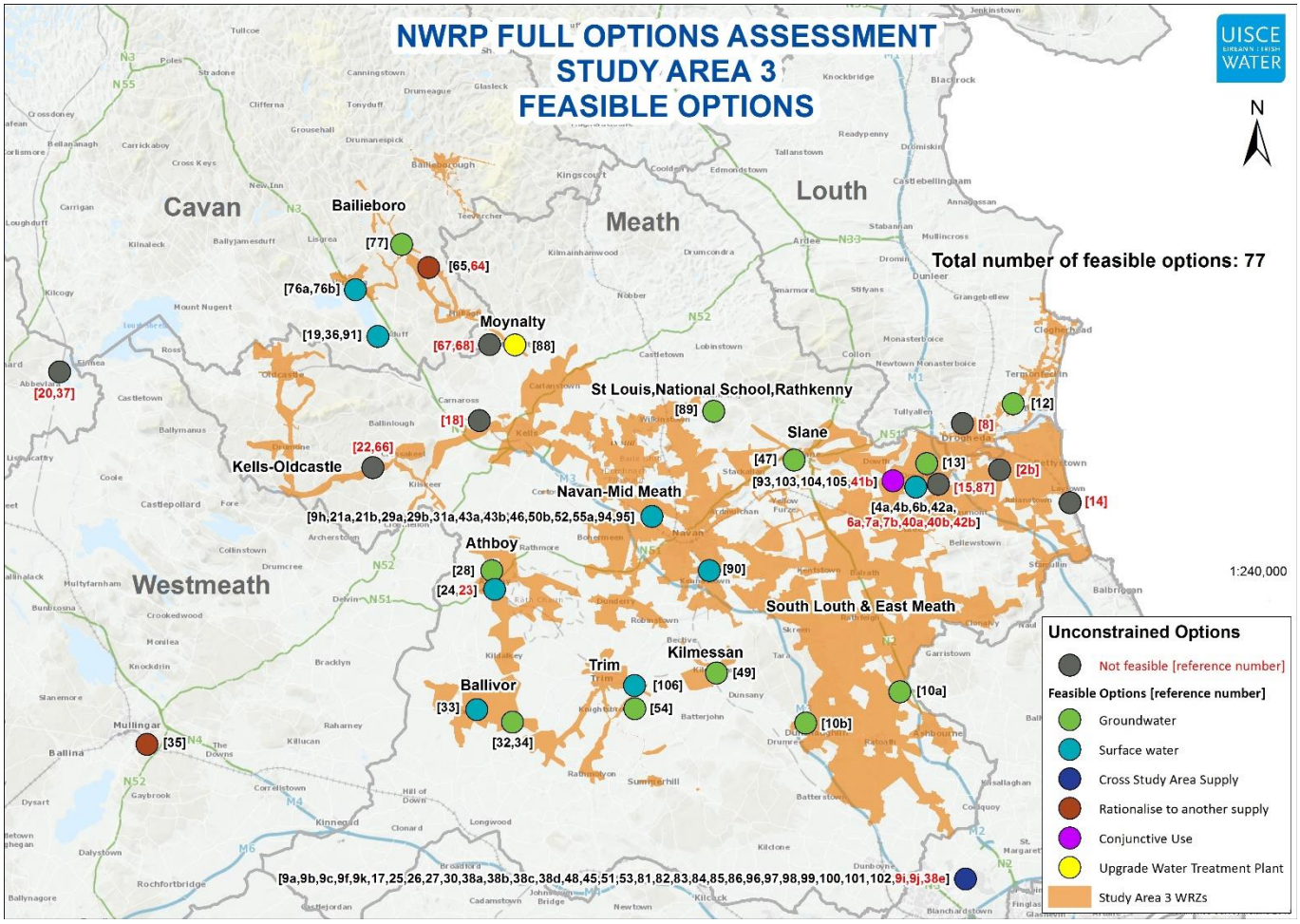


Figure 4.2 SA3 Spatial Overview of the Feasible Options

For the purposes of the NWRP, outline designs have been prepared at a desktop level for each feasible option (for use as part of comparative assessments between options). The outline designs include a high level inventory of option requirements, including capacities of plants, pipelines, pumps and treatment requirements. They include comparative budget costs estimates for required site level studies (including site level environmental assessments), Capital (CAPEX), Operational (OPEX), Environmental and Social (E&S) costs and Carbon Costs for use in the next stage of the assessment process.

4.4 Options Assessment Summary

The SDB deficit in the region ranges between approximately 18,155 m3/d in 2019 during dry conditions, to a maximum of approximately 26,013 m3/d in 2044 during dry conditions. During the options assessment stage, a total of 101 unconstrained options were assessed. Of these, 24 options were screened out for the reasons summarised in Table 4.5 and recorded in Annex B.

Table 4.5 Rejected Options Summary

No. of Options	Reason for Rejection
2	Resilience
7	Deliverability & Flexibility
2	Resilience & Deliverability & Flexibility
13	Deliverability & Flexibility, Resilience & Sustainability

The remaining 77 feasible options are categorised into options that resolve the need for one WRZ only “WRZ options” and options that resolved the need for more than one WRZ “ Study Area options”. Table 4.6 provides an overview of the number of WRZ options and Study Area options for the WRZs in Study Area 3. From this table it can be noted that there are 27 WRZ Options and 55 options which can be merged to form 12 Study Area Options.

A summary of the number of options and whether they are WRZ or SA options is contained in Table 4.6

Table 4.6 SA3 Feasible Options Summary

WRZ Name	Option Type	
	WRZ Option	Study Area Option
Athboy	2	7
Bailieboro RWSS	2	1
Ballivor	4	3
Kells-Oldcastle	1	6
Kilmessan	1	3

WRZ Name	Option Type	
	WRZ Option	Study Area Option
Moynalty	1	1
Navan-Midmeath	3	11
South Louth & East Meath	9	9
Slane	1	3
St Louis, National School, Rathkenny	1	0
Trim	2	6

5 Approach Development

5 Approach Development

This chapter describes how we tested different combinations of the Feasible Options to develop a Preferred Approach to meet the needs we identified for the WRZ in Study Area 3.

5.1 Approach Development

5.1.1 Introduction to Approach Development

The purpose of the NWRP is to examine all potential options that could be used to resolve issues within the water resource zone (unconstrained options) and then to eliminate those that are not feasible or that have identifiable environmental issues at a desktop level (options assessment screening). Of the remaining feasible options Irish Water's next step is to assess a number of approaches to resolve need across the Study Area. An approach is a way of configuring an option or options to meet the deficit focused on a particular outcome. For example, a "Least Carbon" approach would be the option or combination of options that would involve the least embodied and operational carbon load over the lifetime of the option. As part of the NWRP, Irish Water considers six approaches, as summarised in Table 5.1.

These six approaches have been outlined at Section 8.3.7 of the Framework Plan and were consulted on as part of the SEA Scoping consultation conducted between 9th November 2017 and 22nd December 2017. These approaches have been specifically chosen to ensure that the NWRP aligns with all the relevant Government Policies outlined in Table 5.1.

Table 5.1 The Six Approaches

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 (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

Approaches Tested	Description	Policy Driver
Best Environmental	This is the option or combination of options with the highest total score across the 19 No. SEA MCA sub-criteria questions	SEA Directive and Water Framework Directive
Most Resilient	This is the option or combination of options with the highest total score against the resilience criteria.	National Adaptation Framework and Climate Action Plan
Lowest Carbon	This is the option or combination of options with the lowest embodied and operational carbon cost.	Climate Action Plan

We then compare the options identified as the best performing within each of the six approach criteria (Least Cost, Best AA, Lowest Carbon etc.) against each other as outlined in Figure 5.1 to come up with a Preferred Approach that meets the objectives of the Framework Plan and aligns with all relevant Government Policy.

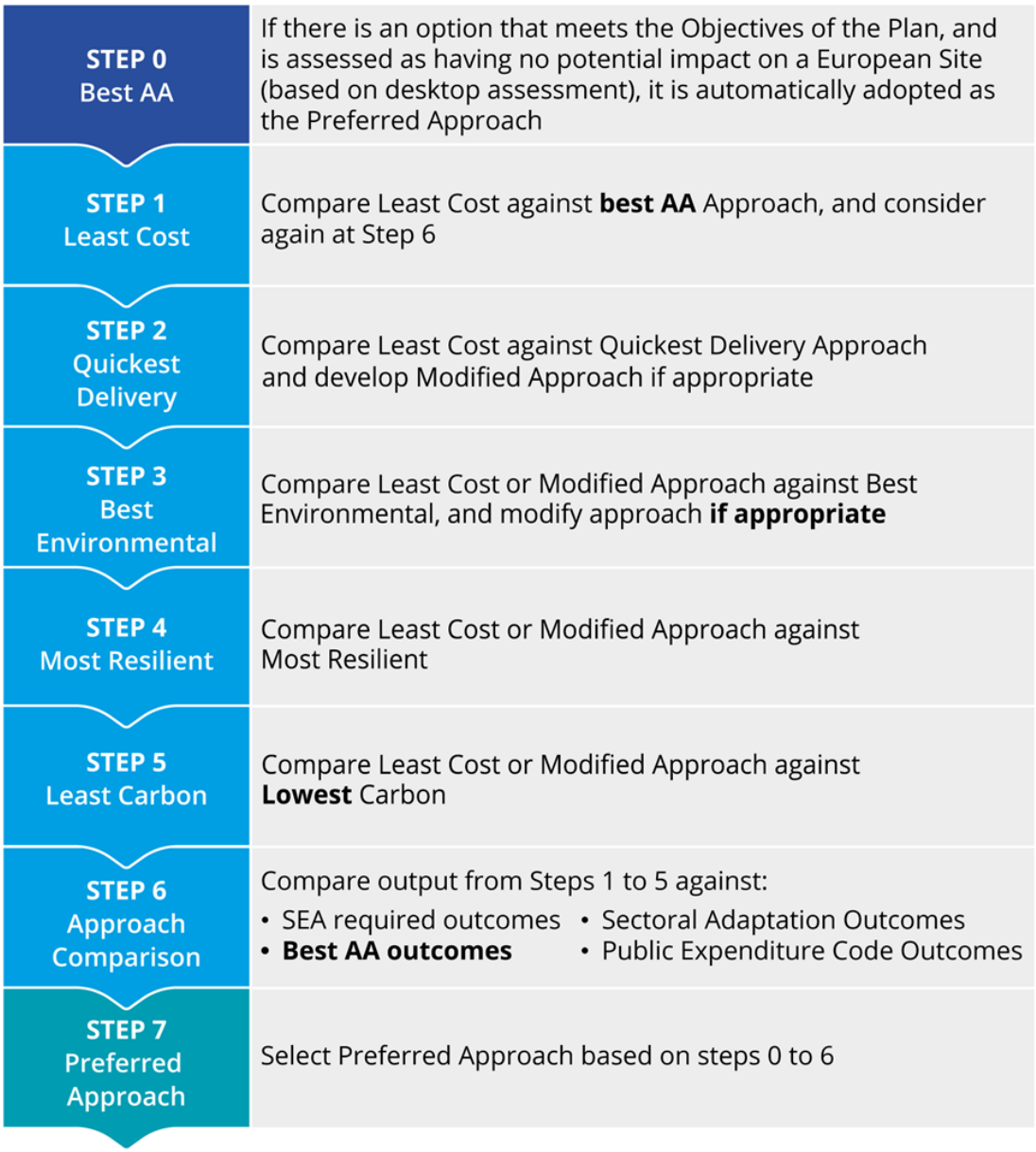


Figure 5.1 Figure of the 7 step assessment process

This methodology which is futured detailed in Chapter 7 of the RWRP -EM follows a process to develop the Preferred Approach for a Study Area across three stages;

- **Stage 1** – We assess the water resource zones individually to develop an initial Preferred Approach, the **WRZ Preferred 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 within a Study Area. 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. This is known as the Preferred Approach at SA Level.

At each stage of assessment as detailed above, we carry out an assessment of the cumulative and in-combination effects of the Preferred Approach as detailed in the SEA Environmental Report for the RWRP-EM and the Environmental Review for this Study Area.

Within the Regional Plan, we will examine the Preferred Approach at a third spatial level for the entire Eastern Midlands Strategic Study Areas and will make any required changes in order to develop a Preferred Approach across the entire Region.

Further details on these three stages is provided in Chapter 7 of the RWRP -EM. Section 5.2 provides an overview of the application of this process to SA 3.

5.2 Preferred Approach Development Process for Study Area 3

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this technical report there are 77 feasible options. 27 of these options are WRZ Options while 50 options are merged to form 12 Study Area Options. Table 5.2 outlines the 27 WRZ options for SA3, providing option reference numbers and detailing the WRZs they provide a solution to. These solutions are presented as "Options" for the purposes of this plan; however, will be subject to their own regulatory, timing and budgetary constraints.

Table 5.2 SA3 Feasible Options

Water Resource Zone Name	Feasible Options SA3 Meath	
	Option Code	Option Description
South Louth & East Meath	SA3-004b	Increase abstraction and WTP capacity at Staleen WTP. Pump Treated Effluent from Drogheda WwTW downstream of Staleen abstraction as compensate flow).
South Louth & East Meath	SA3-006b	Increase abstraction and treatment capacity at Staleen WTP. Use discharge from Platin Quarry as compensation flow downstream of abstraction. (Currently discharged to Nanny River but WQ from Platin needs to be tested)
South Louth & East Meath	SA3-009a	Transfer from GDA (new source required)
South Louth & East Meath	SA3-012	Developed wellfield in Ballinreask north of Drogheda and increase WTP capacity at Kiltrough WTP
South Louth & East Meath	SA3-013	Develop wellfield in GW Donore/ Old Bridge wellfield development west of Drogheda (potential of 5 Ml/d)
Athboy	SA3-024	New SW abstraction at River Athboy with increase treatment capacity at Hill of Ward WTP
Athboy	SA3-028	Increase GW abstraction and treatment capacity at Hill of Ward WTP
Ballivor	SA3-032	GW enhancement at Kilmurry WTP. Rationalise Earlesmill WTP to Kilmurry WTP - new rising main (6-7km) and decommission existing WTP
Ballivor	SA3-033	Increase SW abstraction from Stoneyford River and treatment capacity at Earlsmill WTP.
Ballivor	SA3-034	Increase GW abstraction and increase treatment capacity at Kilmurry WTP

Water Resource Zone Name	Feasible Options SA3 Meath	
	Option Code	Option Description
Ballivor	SA3-035	Rationalise Ballivor to Mullingar - Westmeath (new source required at Mullingar)
Slane	SA3-047	Increase existing GW abstraction and increase capacity at WTP.
Kilmessan	SA3-049	Increase existing abstraction and treatment plant capacity at Kilmessan WTP
Trim	SA3-054	New local GW option
Bailieboro RWSS	SA3-076a	New SW abstraction at Lough Ramor (SAE) (10% of Q50 = 21 Ml/d). Involves relocating Virginia WWTP outfall from lake to d/s of lake so requiring new pipeline and pump to transfer treated effluent to new outfall location.
Bailieboro RWSS	SA3-077	New local GW option
Moynalty	SA3-088	Not in deficit - Upgrade WTP
St Louis, National School, Rathkenny	SA3-089	Increase GW abstraction and increase treatment capacity.
Navan-Midmeath	SA3-090	Increase SW abstraction from the River Boyne and upgrade Kilcarn WTP
Kells-Oldcastle	SA3-091	New SW abstraction at Lough Ramor and provide WTP at abstraction and decommission Clavin's Bridge WTP, or transfer to Clavin's Bridge for treatment. Also includes decommissioning of Lough Bane source/WTP. Involves relocating Virginia WWTP outfall from lake to d/s of lake so requiring new pipeline and pump to transfer treated effluent to new outfall location.
South Louth & East Meath	SA3-093	Develop wellfield in GW Donore/ Old Bridge wellfield development west of Drogheda (potential of 5 Ml/d). Conjunctive Use Staleen-Donore: Groundwater source to be used during low flows in the Boyne and as the Boyne will be used during winter months groundwater source will be allowed to recharge.
Navan-Midmeath	SA3-094	Develop new WTP at Dowdstown and decommission Kilcarn WTP. New abstraction intake from Boyne.
Navan-Midmeath	SA3-095	Develop new WTP at Dowdstown and decommission Liscarton and Kilcarn WTP. New abstraction intake from Boyne.
South Louth & East Meath	SA3-105	Bring Rosehall WTP back into operation and upgrade WTP. Use conjunctively with GWS source in Ballymenhery. Use SW 50% of the time, using GW source during critical periods.
Trim	SA3-106	Increase SW abstraction from River Boyne and upgrade Trim WTP
South Louth & East Meath	SA3-010a	Increase abstraction and treatment capacity at Curragha WTP

Water Resource Zone Name	Feasible Options SA3 Meath	
	Option Code	Option Description
South Louth & East Meath	SA3-010b	Increase abstraction and treatment capacity at Dunshaughlin WTP

The WRZ options are then assessed against the six approach types, outlined in Table 5.1 and the result of this process is provided in Table 5.3.

Table 5.3 SA3 Alignment of WRZ Option/s with Approach Categories

WRZ Name	No. Of WRZs Options	Option Code	Option Description	Approach Categories					
				Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
Athboy	2	SA3-024	New SW abstraction at River Athboy with increase treatment capacity at WTP	-	-	-	-	-	✓
		SA3-028	Increase GW abstraction and treatment capacity at WTP	✓	✓	✓	✓	✓	-
Bailieboro RWSS	2	SA3-076a	New SW abstraction at Lough Ramor (SAE). Option involves relocating Virginia WWTP outfall from lake to downstream of lake therefore new pipeline and pump are required to transfer treated effluent to new outfall location.	-	-	-	-	-	✓
		SA3-077	New local GW option	✓	✓	✓	✓	✓	-
Ballivor	4	SA3-032	GW enhancement at Kilmurry WTP. Rationalise Earlesmill WTP to Kilmurry WTP - new rising main (6-7km) and decommission existing WTP	-	-	-	-	-	-
		SA3-033	Increase SW abstraction from Stoneyford River and treatment capacity at Earlsmill WTP.	-	-	-	-	-	✓
		SA3-034	Increase GW abstraction and increase treatment capacity at Kilmurry WTP	✓	✓				-
		SA3-035	Rationalise Ballivor to Mullingar - Westmeath	-	-	✓	✓	✓	-
Kells-Oldcastle	1	SA3-091	New SW abstraction and WTP at Lough Ramor. Decommission Clavin's Bridge WTP and transfer	✓	✓	✓	✓	✓	✓

WRZ Name	No. Of WRZs Options	Option Code	Option Description	Approach Categories					
				Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
			to Clavin's Bridge for treatment. Also includes decommissioning of Lough Bane source/WTP. Involves relocating Virginia WWTP outfall from lake to d/s of lake so requiring new pipeline and pump to transfer treated effluent to new outfall location.						
Kilmessan	1	SA3-049	Increase existing abstraction and treatment plant capacity at Kilmessan WTP	✓	✓	✓	✓	✓	✓
Moynalty	1	SA3-088	No deficit. Upgrade WTP to address WQ issues.	✓	✓	✓	✓	✓	✓
Navan-Midmeath	3	SA3-090	Increase SW abstraction from the River Boyne and upgrade Kilcarn WTP	✓	✓	✓	✓	✓	✓
		SA3-094	Develop new WTP at Dowdstown and decommission Kilcarn WTP. New abstraction intake from Boyne.	-	-	-	-	-	-
		SA3-095	Develop new WTP at Dowdstown and decommission Liscarton and Kilcarn WTP. New abstraction intake from Boyne.	-	-	-	-	-	-
South Louth & East Meath	9	SA3-004b	Increase abstraction and WTP capacity at Staleen WTP. Pump Treated Effluent from Drogheda WwTW downstream of Staleen abstraction as compensate flow).	-	-	-	-	-	-
		SA3-006b	Increase abstraction and treatment capacity at Staleen WTP. Use discharge from Platin	-	-	-	-	-	-

WRZ Name	No. Of WRZs Options	Option Code	Option Description	Approach Categories					
				Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
			Quarry as compensation flow downstream of abstraction. (Currently discharged to Nanny River but WQ from Platin needs to be tested)						
		SA3-009a	Transfer from GDA (new source required)	✓	✓	✓	✓	✓	✓
		SA3-012	Develop wellfield in Ballinreask north of Drogheda and increase WTP capacity at Kiltrough WTP	-	-	-	-	-	-
		SA3-013	Develop wellfield in GW Donore/ Old Bridge west of Drogheda (potential yield of 5 Ml/d)	-	-	-	-	-	-
		SA3-093	Develop wellfield in GW Donore/ Old Bridge west of Drogheda (potential yield of 5 Ml/d). Conjunctive Use Staleen-Donore: Groundwater source to be used during low flows in the Boyne and as the Boyne will be used during winter months groundwater source will be allowed to recharge.	-	-	-	-	-	-
		SA3-105	Bring Rosehall WTP back into operation and upgrade WTP. Use conjunctively with GWS source in Ballymenhery. Use SW 50% of the time, using GW source during critical periods.	-	-	-	-	-	-
		SA3-010a	Increase abstraction and treatment capacity at Curragha WTP	-	-	-	-	-	-

WRZ Name	No. Of WRZs Options	Option Code	Option Description	Approach Categories					
				Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
		SA3-010b	Increase abstraction and treatment capacity at Dunshaughlin WTP	-	-	-	-	-	-
Slane	1	SA3-047	Increase existing GW abstraction and increase capacity at WTP.	✓	✓	✓	✓	✓	✓
St Louis, National School, Rathkenny	1	SA3-089	Increase GW abstraction and increase treatment capacity.	✓	✓	✓	✓	✓	✓
Trim	2	SA3-054	New local GW option	-	-	-	-	-	-
		SA3-106	Increase SW abstraction from River Boyne and upgrade Trim WTP	✓	✓	✓	✓	✓	✓

The 7 Step Process outlined in Figure 5.1 was applied to each WRZ in SA3, in order to develop a WRZ level approach. A summary of the outcome of this assessment at WRZ level (i.e. WRZ options only) is shown in Table 5.4.

The findings of the Preferred Approach development for SA3 at WRZ level include the following:

- In terms of Best AA, one WRZ options score a 0 in relation to potential impact on a designated European Site and this option was selected as the preferred approach;
- The Best AA approach and Best Environmental is identified in all of 11 WRZs;
- Of the 11 WRZ approach options, none have a -3 score against biodiversity. A -3 Score against biodiversity indicates a potential high risk (without mitigation measures) under the biodiversity criterion for a European Site.

Preferred Approaches at WRZ level are outlined in Table 5.4.

Table 5.4 SA3 WRZ Level Approach

Water Resource Zone Name	Feasible Options SA3 Meath		Zero AA	Approach						
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best Enviromental	Lowest Carbon	Most Resilient	Preferred Approach
South Louth & East Meath	SA3-009a	Transfer from GDA (new source required)	-	✓	✓	✓	✓	✓	✓	✓
Athboy	SA3-028	Increase GW abstraction and treatment capacity at Hill of Ward WTP	-	✓	✓	✓	✓	✓	-	✓
Ballivor	SA3-035	Rationalise Ballivor to Mullingar - Westmeath (new source required at Mullingar)	-	-	-	✓	✓	✓	-	✓
Slane	SA3-047	Increase existing GW abstraction and increase capacity at WTP.	-	✓	✓	✓	✓	✓	✓	✓
Kilmessan	SA3-049	Increase existing abstraction and treatment plant capacity at Kilmessan WTP	-	✓	✓	✓	✓	✓	✓	✓
Bailieboro RWSS	SA3-077	New local GW option	-	✓	✓	✓	✓	✓		✓
Moynalty	SA3-088	Not in deficit - Upgrade WTP	-	✓	✓	✓	✓	✓	✓	✓
St Louis, National School, Rathkenny	SA3-089	Increase GW abstraction and increase treatment capacity.	✓	✓	✓	✓	✓	✓	✓	✓
Navan-Midmeath	SA3-090	Increase SW abstraction from the River Boyne and upgrade Kilcarn WTP	-	✓	✓	✓	✓	✓	✓	✓
Kells-Oldcastle	SA3-091	New SW abstraction at Lough Ramor and provide WTP at abstraction and decommission Clavin's Bridge WTP, or transfer to Clavin's Bridge for treatment. Also includes decommissioning of Lough Bane source/WTP. Involves relocating Virginia WWTP outfall from lake to d/s of lake so requiring new pipeline and pump to transfer treated effluent to new outfall location.	-	✓	✓	✓	✓	✓	✓	✓
Trim	SA3-106	Increase SW abstraction from River Boyne and upgrade Trim WTP	-	✓	✓	✓	✓	✓	✓	✓

5.2.2 Stage 2 - Creation of the Study Area Combinations

The Second Stage of our Approach Development Process involves identifying the Study Area options that can address Need in more than one WRZ within the Study Area, and then develop various combinations which contain elements of the different options. These are called SA Combinations. SA Combinations will consist of a number of different projects or options; however, looking at a wider, more holistic, spatial scale benefits the plan level assessment in considering what options might work across multiple WRZ's.

For each Study Area, one of the SA Combinations will always be the WRZ Level Approach. The WRZ Level Approach is the combination of all of the individual the Preferred Approach at WRZ level for the entire Study Area. Table 5.5 below provides a summary of the 12 Study Area options.

Table 5.5 SA3 Study Area Options

Option Code	Feasible Options SA3		
	Water Resource Zone	Water Resource Zone Code	Option Description
Group 3	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath and the GDA WRZs. Additional supply will come for new source for the GDA. Rath Reservoir WTP, Kilcarn WTP and their abstractions will be decommission as part of this option.
	Navan-Midmeath	2300SC0055	
Group 4	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath, Kells Oldcastle, Athboy, Ballivor, Slane Kilmessan, Trim and the GDA WRZs. Additional supply will come for new source for the GDA. Rath Reservoir WTP, Lough Bane WTP, Clavin's Bridge WTP, Earlsmill WTP, Kilcarn Interim WTP and Kilmessan Swainstown WTP and their abstractions will be decommissioned as part of this option.
	Kells-Oldcastle	2300SC0005	
	Athboy	2300SC0006	
	Ballivor	2300SC0007	
	Navan-Midmeath	2300SC0055	
	Slane	2300SC0009	
	Kilmessan	2300SC0011	
	Trim	2300SC0014	
Group 7	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath, Athboy, Trim and the GDA WRZs. Additional supply will come for new source for the GDA. Rath Reservoir WTP, Kilcarn WTP and their abstractions will be decommission as part of this option.
	Athboy	2300SC0006	
	Navan-Midmeath	2300SC0055	
	Trim	2300SC0014	
Group 8	Kells-Oldcastle	2300SC0005	Merge Navan Midmeath, Kells Oldcastle, Athboy, Slane, Trim WRZs. A new WTP will be constructed at Dowdstown with an output capacity of 11.8Ml/d with the upgrading of Slane WTP and Trim WTP to produce additional 0.55Ml/d and 0.7Ml/D respectively. Clavin's Bridge WTP, Lough Bane WTP, Kilcarn Interim WTP and their abstractions will be decommissioned as part of this option.
	Athboy	2300SC0006	
	Navan-Midmeath	2300SC0055	
	Slane	2300SC0009	
	Trim	2300SC0014	
Group 9	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath, Kells Oldcastle, Athboy, Ballivor, Kilmessan, Trim and the GDA WRZs. Additional supply will come for new source for the GDA and a new WTP at Dowdstown (31.8Ml/d). Rath Reservoir WTP, Clavin's Bridge WTP, Lough Bane WTP, Coill Dios WTP, Athboy WTP, Earlsmill WTP, Kilmurray WTP, Liscarton WTP, Kilcarn Interim WTP, Kilmessan Swainstown WTP, Trim WTP and their abstractions will be decommissioned as part of this option
	Kells-Oldcastle	2300SC0005	
	Athboy	2300SC0006	
	Ballivor	2300SC0007	
	Navan-Midmeath	2300SC0055	
	Kilmessan	2300SC0011	
	Trim	2300SC0014	
Group 10	South Louth & East Meath	2100SC0001	Merge South Louth East Meath and Navan Midmeath WRZs. Staleen Expansion. The increased abstraction will be offset by
	Navan-Midmeath	2300SC0055	

Option Code	Feasible Options SA3		
	Water Resource Zone	Water Resource Zone Code	Option Description
			discharge of treated effluent from Drogheda Wastewater Treatment Plant downstream of the new abstraction. Rath Reservoir WTP, Kilcarn WTP and their abstractions will be decommission as part of this option.
Group 16	Moynalty	2300SC0027	Merge Moynalty & Bailieboro WRZs. New abstraction from Lough Ramor and new WTP near source. Bailieboro and Moynalty WTPs and their associated abstraction will be decommissioned as part of this option. Involves relocating Virginia WWTP outfall from lake to d/s of lake so requiring new pipeline and pump to transfer treated effluent to new outfall location.
	Bailieboro RWSS	0200SC0015	
Group 17	Kells-Oldcastle	2300SC0005	Merge Kells Oldcastle & Navan Mid Meath WRZs. New abstraction from Lough Ramor and new WTP near source to supply deficit. Kilcarn WTP and its associated abstraction will be decommissioned as part of this option. Involves relocating Virginia WWTP outfall from lake to d/s of lake so requiring new pipeline and pump to transfer treated effluent to new outfall location.
	Navan-Midmeath	2300SC0055	
Group 20	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath, Athboy and the GDA WRZs. Additional supply will come for new source from the GDA. Rath Reservoir WTP, Coill Dios WTP, Kilcarn Interim WTP and their abstractions will be decommissioned as part of this option
	Athboy	2300SC0006	
	Navan-Midmeath	2300SC0055	
Group 22	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath, Kells Oldcastle, Athboy, Slane and Trim and the GDA WRZs. Additional supply will come for new source for the GDA. Rath Reservoir WTP, Clavin's Bridge WTP, Lough Bane WTP, Kilcarn Interim WTP, Trim WTP and their abstractions will be decommission as part of this option.
	Navan-Midmeath	2300SC0055	
	Kells-Oldcastle	2300SC0005	
	Athboy	2300SC0006	
	Slane	2300SC0009	
	Trim	2300SC0014	
Group 23	South Louth & East Meath	2100SC0001	Merge South Louth East Meath, Navan Midmeath, Kells Oldcastle, Athboy, Ballivor, Kilmessan, Trim and the GDA WRZs. Additional supply will come for new source for the GDA. Rath Reservoir WTP, Clavin's Bridge WTP, Lough Bane WTP, Coill Dios WTP, Athboy WTP, Earlsmill WTP, Kilmurray WTP, Liscarton WTP, Kilcarn Interim WTP, Kilmessan Swainstown WTP, Trim WTP and their abstractions will be decommissioned as part of this option
	Kells-Oldcastle	2300SC0005	
	Athboy	2300SC0006	
	Ballivor	2300SC0007	
	Navan-Midmeath	2300SC0055	
	Kilmessan	2300SC0011	
	Trim	2300SC0014	
Group 24	South Louth & East Meath	2100SC0001	Develop wellfield in GW Donore/ Old Bridge wellfield development west of Drogheda (potential of 5 Ml/d) for resilience in Drogheda and Navan Mid Meath. Conjunctive Use Staleen-Donore: Groundwater source to be used during low flows in the Boyne and as the Boyne will be used during winter months groundwater source will be allowed to recharge.
	Navan-Midmeath	2300SC0055	

The 18 Study Area options result in 14 SA Combinations including the WRZ level Approach. The 14 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SA3 Combinations Options Summary

Key	WRZ Approach Option	○	SA Grouped Option	□

WRZ	WRZ level approach	SA combination 1 (SA grouped option 3)	SA combination 2 (SA grouped option 4)	SA combination 3 (SA grouped option 7)	SA combination 4 (SA grouped option 8)	SA combination 5 (SA grouped option 9)	SA combination 6 (SA grouped option 10)	SA combination 7 (SA grouped option 16)	SA combination 8 (SA grouped option 17)	SA combination 9 (SA grouped option 20)	SA combination 10 (SA grouped option 22)	SA combination 11 (SA grouped option 22b)	SA combination 12 (SA grouped option 23)	SA combination 13 (SA grouped option 8 & 16)
Athboy	○	○	□	□	□	□	○	○	○	□	□	□	□	□
Bailieboro RWSS	○	○	○	○	○	○	○	□	○	○	○	○	○	□
Ballivor	○	○	□	○	○	□	○	○	○	○	○	○	□	□
Kells-Oldcastle	○	○	□	○	□	□	○	○	□	○	□	□	□	□
Kilmessan	○	○	□	○	○	□	○	○	○	○	○	○	□	□
Moynalty	○	○	○	○	○	○	○	□	○	○	○	○	○	□
Navan-Midmeath	○	□	□	□	□	□	□	○	□	□	□	□	□	□
Slane	○	○	□	○	□	○	○	○	○	○	□	□	○	□
South Louth & East Meath	○	□	□	□	○	□	□	○	○	□	□	□	□	□
St Louis, National School, Rathkenny	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Trim	○	○	□	□	□	□	○	○	○	○	□	□	□	□

5.2.3 Stage 3 – Preferred Approach at Study Area Level

As part of stage three, we compare the WRZ Level Approach and the SA Combinations to determine the Preferred Approach that provides the best outcome for the Study Area.

We use the EBSD tool to rank the combinations against the assessment criteria and we then compare the best performing SA Combinations under each of the six approach types, using the 7 step process set out in Fig 5.1, to establish the Preferred Approach at Study Area level. The results of this process are provided in Table 5.7.

In accordance with Sections 7.2.2 of the RWRP EM, where options or combinations of options achieve similar, although not exactly identical scores under the six approach types, IW takes a wider look at the comparable combinations /options to consider which to categorise as the "Best" approach within each category. In particular, IW 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 professional judgement from the multi-disciplinary teams, identified in section 8.3.7.4 of the Framework Plan.

For SA3, five SA combinations had a very similar ranking under the Least Cost category.

- WRZ Level Approach
- Grouped Option 3 (Combination 1)
- Grouped Option 16 (Combination 7)
- Grouped Option 23 (Combination 9)
- Grouped Option 8 & 16 (Combination 12)

The Least Cost Approach is determined using an Irish Water Net Present Value assessment tool. The NPV tool uses a strict set of requirements and is limited in what flexibility it offers. Therefore, as set out in further detail in Section 7.2.1 of the RWRP EM, where an Option or Combination of Options provide similar NPV costs, and in some circumstances so as to ensure that no option is discounted at this early stage by reference only to "Least Cost" only, Irish Water 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 recognises the desktop nature of the NPV assessment and the fact that the figures will almost certainly change at project stage.

When we compare these five combinations against each other to identify which should go forward as the Least Cost approach, all 5 combinations scored similarly, if not the same, under Quickest Delivery and Best AA apart from Grouped Option 8 & 16 (Combination 12) which performs worst against the Quickest Delivery Criteria and has one -3 biodiversity score. Grouped Option 16 (Combination 7) scored the highest under the Lowest Carbon and Most Resilient Category. However, Grouped Option 23 (Combination 12) scored significantly better against the environmental criteria than the other Combinations and was also very close to Grouped Option 16 (Combination 7) in terms of Lowest Carbon. Overall Combination 12 performs well against the SEA and Habitats Objectives of the plan and accordingly has been identified as the Least Cost option and brought forward to the Approach Development Stage.

Table 5.7 SA3 Summary of SA Combination of Performance against Approach Type

Ranked order (best to worst)	Best													Worst

WRZ	WRZ level approach	SA combination 1 (SA grouped option 3)	SA combination 2 (SA grouped option 4)	SA combination 3 (SA grouped option 7)	SA combination 4 (SA grouped option 8)	SA combination 5 (SA grouped option 9)	SA combination 6 (SA grouped option 10)	SA combination 7 (SA grouped option 16)	SA combination 8 (SA grouped option 17)	SA combination 9 (SA grouped option 20)	SA combination 10 (SA grouped option 22)	SA combination 11 (SA grouped option 22b)	SA combination 12 (SA grouped option 23)	SA combination 13 (SA grouped option 8 & 16)
Least Cost							Worst						Best	
Quickest Delivery							Best							Worst
Best AA *no. of -3 scores against biodiversity	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	1 No. -3 scores	0 No. -3 scores	1 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	1 No. -3 scores
Lowest Carbon								Best				Worst		
Most Resilient						Worst		Best						
Best Environmental			Best				Worst							

The SA combinations including the WRZ approach outlined in Table 5.6 are assessed to determine the approach categories as summarised in Table 5.8

Table 5.8 Best Combinations

Approach Categories	Best Performing Combination
Least Cost (LCo)	Group 23
Best Environmental (BE)	Group 4
Quickest Delivery (QD)	Group 10
Most Resilient (MR)	Group 16
Lowest Carbon (LC)	Group 16
Best AA (BA)	Group 4

The MCA assessment included the following assessment criteria:

- Resilience;
- Deliverability and Flexibility;
- Progressibility; and
- Sustainability (Environmental and Social Impacts).

The NPV Costs are based on four criteria:

- Capital Costs – the cost to construct the option, including all overheads, consent and land acquisition costs;
- Operational Costs – the whole life cost to operate the option, including operators, chemical requirements and energy requirements including pumping;
- Carbon Costs – the whole life embodied and operational Carbon costs of the option; and
- Environmental and Social – the whole life Environmental and Social cost of the option covering climate regulation, traffic disruption and food production (carbon emissions are covered separately in the bullet point above).

The wider range of costs used in the estimation of the NPV aligns our Plan with any future Project Level Cost Benefit Analysis, in accordance with the Public Spending Code.

Figure 5.2 compares the NPV costs for the best combinations and shows WRZ level Approach, Group 16 and Group 23 have the lowest overall NPV cost with Group 23 providing the lowest OPEX cost of the solutions lifetime. All combinations have comparable carbon cost.

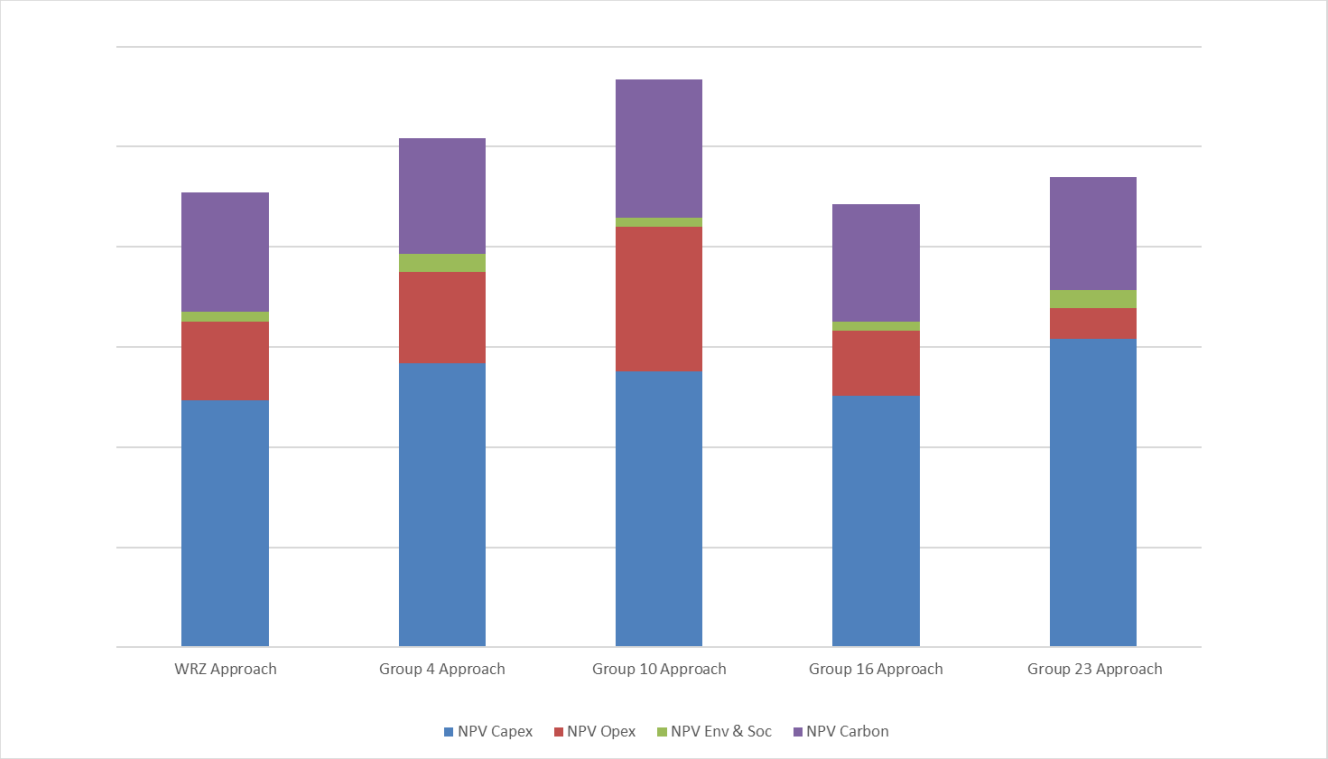


Figure 5.2 SA3 NPV Costs for WRZ and SA approaches

These approaches are then compared against each other using the 7-Step process in Figure 5.2 to generate the best value combination of options at the Study Area level. The best value combination of options at the Study Area level is the SA Preferred Approach. In accordance with the Options Assessment Methodology the Approach Development process begins with the Least Cost option and then compares against other best performing options to ensure the most robust combination is chosen.

The outputs from the assessment were as follows:

- Step 1 – We compared the Least Cost Approach against the Best AA approach. The least cost approach contained no options with a -3 biodiversity score and is comparable to the Best AA approach therefore the least Cost Approach was retained at this stage.
- Step 2 – We compared the Quickest Delivery Approach against the Least Cost Approach. The Quickest Delivery approach has higher Carbon Costs than the Least Cost Approach, performs poorly against the environmental criteria and has an option with a -3 biodiversity score. The Least Cost approach was therefore retained at this stage.
- Step 3 - We compared the Least Cost against the Best Environmental Approach. There was not a significant difference between the environmental score for the Best Environmental Approach and the Least Cost Approach and the Least Cost Approach performed better against the quickest delivery and carbon criteria while the resilience scores were comparable. The Least Cost Approach was therefore retained at this stage.
- Step 4 – We compared the Least Cost against the Most Resilient Approach. The Most Resilient Approach preforms poorly against the environmental criteria. The Least Cost approach was therefore retained at this stage.
- Step 5 - We compared the Least Cost Approach against the Least Carbon Approach. The Least Carbon Approach is the same as the Most Resilient Approach and as noted above this combination preforms poorly against the environmental criteria and considering the carbon

costs for the Least Cost Approach are within 5% of the Carbon Costs for the Least Carbon Approach the Least Cost approach was retained at this stage.

- Step 6 – A final assessment of the Least Cost was completed against the Least Carbon, Best AA, Best Environmental, Quickest Delivery and Most Resilient Approaches. The Least Cost Approach is comparable to the Best AA, Best Environmental, Quickest Delivery and Least Carbon Approach. The Most Resilient Approach preforms poorly against the environmental criteria. The Least Cost approach was therefore retained at this stage.
- Step 7 – The Least Cost Approach was therefore selected as the Preferred Approach for the Water Resource and Study Area Levels.

5.3 Study Area Preferred Approach Summary

The Preferred Approach (Group 23) comprised the options listed in listed in Table 5.9.

Table 5.9 Preferred Approach for SA3

WRZ ID	WRZ Name	Option Description
2300SC0006	Athboy	Grouped Option 23 Merge South Louth East Meath, Navan Midmeath, Kells Oldcastle, Athboy, Ballivor, Kilmessan, Trim and the GDA WRZs. Additional supply will come for new source for the GDA. Rath Reservoir WTP, Clavin's Bridge WTP, Lough Bane WTP, Coill Dios WTP, Athboy WTP, Earlsmill WTP, Kilmurray WTP, Liscarton WTP, Kilcarn Interim WTP, Kilmessan Swainestown WTP, Trim WTP and their abstractions will be decommissioned as part of this option
2300SC0007	Ballivor	
2300SC0005	Kells-Oldcastle	
2300SC0011	Kilmessan	
2300SC0055	Navan- Midmeath	
2100SC0001	South Louth & East Meath	
2300SC0014	Trim	
0200SC0015	Bailieboro RWSS	SA3-077 New local GW option
2300SC0027	Moynalty	SA3-088 Not in deficit - Upgrade WTP
2300SC0009	Slane	SA3-47 Increase existing GW abstraction and increase capacity at WTP.
2300SC0045	St Louis, National School, Rathkenny	SA3-089 Increase GW abstraction and increase treatment capacity.

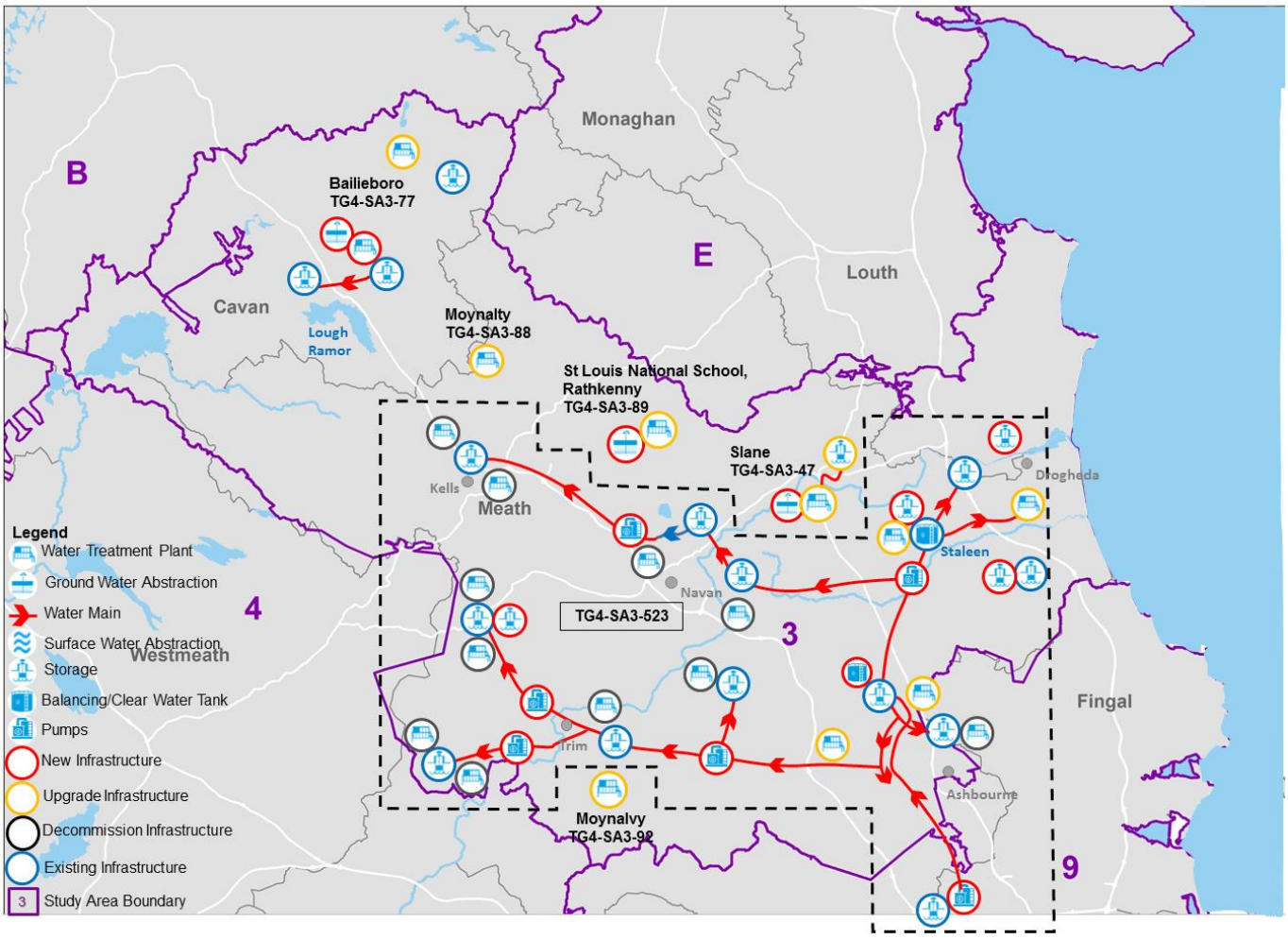


Figure 5.3 SA3 Preferred Approach

The Preferred SA 3 Approach is shown schematically in Figure 5.3.

The Preferred Approach for SA3 also includes for demand side (**Lose Less** and **Use Less**) measures, including:

- Ongoing leakage management including active leakage control, pressure management and find and fix activities to offset NRR;
- Net leakage reductions, amounting to 356 m³/day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034;
- Continuation of IW household and business water conservation campaigns, initiatives and education programmes; and
- The option to implement legally enforceable Water Conservation Orders in drought periods in order to protect the environment and our public water supplies.

Before we adopt this approach at Plan level for SA3, we must give consideration to the following:

- **Interim Solutions**: Based on scale of investment required across the entire country it is likely that it may take 5-10 investment cycles before we address all issues with the existing water supplies. Therefore, small localised options may be required on an interim basis to secure priority need in existing supplies until the SA Preferred Approach can be delivered;
- **Sensitivity Analysis**: When planning for water supplies over a medium to long term horizon, we must give consideration to adaptability of our plan to change across a range of future scenarios (for example, what if population growth rates are lower than expected or what if we are unable to secure a licence in the medium term to abstract the quantity water currently allowed for at a given location).
- **Alternative options for WRZs dependent on another SA option:** The Preferred Approach for Navan Mid Meath, South Louth East Meath, Kells Oldcastle, Trim, Athboy, Ballivor and Kilmessan is to obtain supply from the GDA WRZ. These options are dependent on the development of the Preferred Approach for the GDA WRZ SA9, therefore an alternative option is required for consideration as an alternative at Regional level and in the event the Preferred Approach for SA9 cannot advance. The alternative options considered are outlined in Table 5.10 below.

Table 5.10 Alternative Options for WRZs dependent on another SA option

WRZ Name	Alternate Option
Navan Mid Meath	SA3-090 Maintain and upgrade existing WTP and increase existing SW abstraction from the River Boyne for the Kilcarn WTP (+2918m3/day)
South Louth & East Meath	SA3-004b Maintain existing WTPs and abstractions. Increase existing abstraction from the River Boyne and WTP capacity at Staleen WTP. Pump Treated Effluent from Drogheda WwTW downstream of Staleen abstraction as compensate flow to mitigate impact of increasing abstraction. (+13,057m3/day)
Kells-Oldcastle	SA3-091 Decommission existing WTPs and SW abstractions from the Lough Bane* and the River Blackwater. New SW abstraction and WTP at Lough Ramor and provision of network to provide supply to the WRZ. (+5,491m3/day)
Trim	SA3-106 Increase SW abstraction from River Boyne and upgrade Trim WTP (692 m3/day)
Athboy	SA3-028 Maintain existing WTPs and abstractions. New GW abstraction and associated WTP (497 m3/day)
Ballivor	SA3-033 Maintain existing WTPs and abstraction at Kilmurray WTP. Increase SW abstraction from Stoneyford River and treatment capacity at Earlsmill WTP. (+131 m3/day)
Kilmessan	SA3-049 Increase existing abstraction and treatment plant capacity at Kilmessan WTP (+141 m3/day)

6 Preferred Plan Constraints – Interim Solutions

6 Interim Solutions

As outlined in more detail 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, Irish Water 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 IW 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 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 option would typically involve the upgrade of the existing WTP in line with proposed growth predictions. As for 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 options, 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 therefore are considered “no regrets” infrastructure investment

A decision to progress any interim solution will be based on priority need to address water quality risk or supply reliability e.g. RAL, drought issues or critical need for example. The Regional Plan 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.

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.

Table 6.1 SA3 Interim Options

WTP Name	Interim Option
Bailieborough WTP	Upgrade WTP to IW Standards
Dunshaughlin WTP	Upgrade WTP to IW Standards
Kiltrough WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Rath WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Lough Bane WTP	Upgrade WTP to IW Standards
Slane WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Trim WTP	Upgrade WTP to IW Standards
Moynalty WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Rathkenny School WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Liscartan WTP	Upgrade WTP to IW Standards –
Athboy WTP	
Coill Dios WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Earlsmill WTP	Decommission WTP and provide supply from Kilmurry WTP
Kilmurry WTP	Rationalise Ballivor WRZ to Trim WRZ. Decommision Kilmurry and Earls Mill WTPs when the upgrades to the Trim WTP are complete.
Clavin's Bridge WTP	Upgrade WTP to IW Standards – Potential site for a containerised solution
Kilmessan WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Moynalty WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Kilcarn WTP	Upgrade WTP to IW Standards – Potential site for a containerised solution
Curragha WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Stalleen WTP	Upgrade of WTP to maximise output capacity to allow for growth prior to the delivery preferred approach

Small Towns and Villages Growth Programme Irish Water'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 Waste Water Treatment Plant growth capacity in smaller settlements which are not otherwise provided for in the

Capital Investment Plan 2020 to 2024. The STVGP is focused on supporting growth in areas already served by IW infrastructure but where current or future capacity deficits have been identified. Irish Water have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant county development plan. Under this programme mains rehab works will be considered in the Ballivor WRZ. These works will remove a constraint in the network and allow more supply to the system from the Kilmurry WTP.

7

Preferred Approach – Sensitivity Analysis

7 Preferred Approach – Sensitivity Analysis

Our supply demand forecast and water quality barrier deficit assessments have been developed using the application of best practice methods within the data available. We have identified areas where we will focus improvements in data to improve the certainty of our forecasts. However, all long term forecasts are subject to uncertainty. We have explored the sensitivity of our supply and demand forecasts to some of the key factors which influence them through a range of scenarios. This enables us to test the sensitivity of the Preferred Approach to changes in need, in order to ensure that our decision making is robust and that the approach is adaptable. We describe the factors which have been considered in Chapter 8 of the Framework Plan. In summary we test our Preferred Approach against the following questions:

1) What if the deployable output across our supplies is reduced based on sustainability limits within the new legislation on abstraction resulting in a larger supply demand balance deficit?
2) What if climate change impacts on our existing supplies are greater than anticipated?
3) What if our forecasts are too great and expected demand growth does not materialise resulting in a smaller supply demand balance deficit?
4) What if we are able to achieve SELL and 21% leakage targets in our larger WRZs within the timeframe of the plan resulting in lower Needs?
5) What if we fail to achieve our leakage targets?

A summary of the adaptability criteria and analysis we have undertaken for SA3 is shown in Table 7.1.

Table 7.1 Sensitivity Analysis for SA3

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
Sustainability	Moderate	+ 5.8 Ml/d	**The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the SDB deficit.** Our outline sustainability assessments would mean a potential increase in deficit for SA3 based on reductions in the sustainable abstraction amounts from the River Boyne (Liscarton WTP), Lough Bane and Lough Skeagh, affecting the Navan Midmeath, Kells-Oldcastle and Bailieboro WRZs.
			The preferred approach decommissions abstraction from the River Boyne (Liscarton WTP) and Lough Bane therefore restrictions in abstractions will not impact the preferred approach. The current abstraction at Lough Skeagh is included in the preferred approach therefore alterative options

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
			would need to be considered to reduce abstraction from this source if required.
Climate Change	High (international climate change targets have not been met)	+ 400 m^3/d	**Higher climate change scenarios would impact our existing supplies and result in decreased water availability at certain times of year.** Although the likelihood of this scenario is high based on climate change adaptation to date, potential impacts may be mitigated against by optimizing our operations on a more environmentally sustainable basis across the range of supplies.
			Within SA, several existing river abstractions would be vulnerable to increased climate change impacts scenarios. However, the preferred approach aims to decommission several of these abstractions therefore, the SA Preferred Approach remains the optimal solution.
Demand Growth	Moderate (growth has been based on policy)	-7.7 Ml/d	**The impact of lower than expected growth would reduce the SDB deficit and the overall need requirement.** The SDB deficit is spread across 11 individual water resource zones and is driven by quality as well as quantity issues. SA3 includes several regional towns where steady growth is predicted.
			The scale of preferred approach can be reduced if growth is not realised therefore, the SA Preferred Approach remains the optimal solution.
Leakage Targets	Low (Irish Water is focused on sustainability and aggressive leakage reduction)	356 m^3/d	**The impact of lower than expected leakage savings would increase the SDB deficit and the overall need requirement.** As Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets as opposed to accepting lower targets.
			Based on this scenario, the SA Preferred Approach remains the optimal solution.

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	-13,147 m^3/d	**The impact of achieving SELL and 21% leakage targets in our larger WRZs would reduce the supply demand balance deficit and the overall need requirement.** The scale of preferred approach can be reduced if additional leakage target are met therefore, the SA Preferred Approach remains as the optimal solution.
			Based on this scenario, the SA Preferred Approach remains as the optimal solution.

In reality, a combination of these scenarios may occur together. For example, growth in demand might be lower if we achieve greater leakage reductions. However, if this coincided with a reduction in permitted abstraction volume under the abstraction licensing regime, the reduction in demand may offset some or all of the loss in supply availability due to abstraction sustainability reductions.

Based on the sensitivity assessment, the Interim and Preferred Approaches perform as follows:

- Interim Approach – As the purpose of the Interim Approach is to allow for priority Quality and Quantity issues, the solutions will have a limited design life (usually less than 10 years). They allow time to assess the Preferred Approach and improve adaptability within our Plan; and
- Preferred Approach – The supplies in SA3 vary in size with 6 small WRZs <1.5 Ml/d as well as large growth areas such as Navan and Drogheda. The majority of preferred options look to merge WRZs and decommission existing surface water and groundwater supplies which will require further investigation at project level. However, the Preferred Approach grouped option will improved interconnection between WRZs and could provide scope for future connections to other WRZs. Our Preferred Approach is therefore adaptable.

In summary, our sensitivity assessment of the Interim and Preferred Approaches demonstrates that they are both highly adaptable to a range of futures, and therefore represent ‘no regrets’ infrastructure.

8

Summary of Study Area 3

8 Summary of Study Area 3

The Preferred Approach for SA3 (summarised in Table 5.8 and Figure 5.3 of Section 5) consists of local WRZ supplies for 4 of the WRZs in the Study Area and a grouped option to merge the remaining WRZs to SA9 the GDA.

The preferred approach provides environmental benefits by decommissioning existing abstractions from the River Boyne at Liscarton WTP and Lough Bane, abstractions which may not meet sustainability guidelines as outlined in Section 2.4.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience. The Preferred Approach for SA3 also includes for demand side (**Lose Less** and **Use Less**) measures, including:

- Ongoing leakage management including active leakage control, pressure management and find and fix activities to offset NRR;
- Net leakage reduction amounting to 356 m³/day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034;
- Continuation of IW household and business water conservation campaigns, initiatives and education programmes; and
- The option to implement legally enforceable Water Conservation Orders in drought periods in order to protect the environment and our public water supplies.

As part of our Preferred Approach we have also identified a range of interim solutions for SA3, as summarised in Table 6.1 in Section 6. The measures will only be progressed in the event of critical need to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A Study Area 3 Water Treatment Plants

WTP Asset Name	Local Plant Names
Bailieborough WTP	Kilnacross WTP
Staleen WTP	Staleen WTP
Liscartan WTP	Liscartan WTP
Dunshaughlin WTP	Dunshaughlin WTP
Trim WTP	Trim WTP
Kilcarn WTP	Kilcarn Interim WTP
Lough Bane WTP	Lough Bane WTP
Kiltrough WTP	Kiltrough WTP
Curragha WTP	Curragha WTP
Slane WTP	Slane WTP
Athboy WTP	Athboy WTP
Clavin's Bridge WTP	Clavin's Bridge WTP
Kilmurry WTP	Kilmurry WTP
Coill Dios WTP	Coill Dios WTP
Kilmessan Swainstown WTP	Kilmessan Swainstown WTP
Rath WTP	Rath Reservoir WTP
Earlsmill WTP	Earls Mill WTP
Moynalty WTP	Moynalty WTP
Rathkenny School WTP	Rathkenny School WTP

Annex B Study Area 3 Rejection Register Summary

Study Area 3 – Coarse Screening Rejection Register

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA3-02b	Increase abstraction and WTP capacity at Kiltrough for South Louth East Meath	Based on plan level assessment the overall WFD status of the groundwater body at Kiltrough is considered poor therefore it was not considered viable to increase an abstraction from this source and not taken forward to the fine screening stage.	●	●	●
TG4-SA3-06a	Merge South Louth East Meath and Navan Midmeath WRZs. Staleen Expansion. The increased abstraction will be offset by discharge of water from dewatering at Platin downstream of the abstraction. Rath Reservoir WTP, Kilcarn WTP and their abstractions will be decommissioned as part of this option.	The Platin Quarry abstracts sufficient groundwater to maintain the water table below the working quarry flow. This option proposes to divert this abstracted water to the River Boyne downstream of the Staleen abstraction. The overall WFD status of the ground waterbody in this location is classified as poor . Currently the water abstracted is returned to the local environment via the River Nanny, which is also classified as poor WFD status. Using discharge from the quarry as a source of supply will result in WTP operations being completely dependent on the quarry operations and would likely impact the ground waterbody and surface waterbody meeting WFD objectives. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG4-SA3-07a	Increase abstraction by 5MLD for Staleen WTP (include plant upgrade) and transfer water from dewatering at Platin just downstream from Staleen abstraction on River Boyne.	The Platin Quarry abstracts sufficient groundwater to maintain the water table below the working quarry flow. This option proposes to divert this abstracted water to the River Boyne downstream of the Staleen abstraction. The overall WFD status of the ground waterbody in this location is classified as poor . Currently the water abstracted is returned to the local environment via the River Nanny, which is also classified as poor WFD status. Using discharge from the quarry as a source of supply will result in WTP operations being completely dependent on the quarry operations and would likely impact the ground waterbody and surface waterbody meeting WFD objectives. Therefore, this	●	●	●

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
		option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.			
TG4-SA3-07b	Increase abstraction by 5MLD for Staleen WTP (include plant upgrade) and transfer water from dewatering at Platin just downstream from Staleen abstraction on River Boyne.	The Platin Quarry abstracts sufficient groundwater to maintain the water table below the working quarry flow. This option proposes to divert this abstracted water to the River Boyne downstream of the Staleen abstraction. The overall WFD status of the ground waterbody in this location is classified as poor . Currently the water abstracted is returned to the local environment via the River Nanny, which is also classified as poor WFD status. Using discharge from the quarry as a source of supply will result in WTP operations being completely dependent on the quarry operations and would likely impact the ground waterbody and surface waterbody meeting WFD objectives. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG4-SA3-40a	Merge South Louth East Meath and Navan Midmeath WRZs. Staleen Expansion. The increased abstraction will be offset by discharge of water from dewatering at Platin downstream of the abstraction. Rath Reservoir WTP, Kilcarn WTP and their abstractions will be	The Platin Quarry abstracts sufficient groundwater to maintain the water table below the working quarry flow. This option proposes to divert this abstracted water to the River Boyne downstream of the Staleen abstraction. The overall WFD status of the ground waterbody in this location is classified as poor . Currently the water abstracted is returned to the local environment via the River Nanny, which is also classified as poor WFD status. Using discharge from the quarry as a source of supply will result in WTP operations being completely dependent on the quarry operations and would likely impact the ground waterbody and surface waterbody meeting WFD objectives. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
	decommissioned as part of this option.				
TG4-SA3-40b	Supply deficit at Navan-Midmeath from South Louth and East Meath via Staleen WTP (dewatering at Platin to provide increased yield of 5 MLD)	The Platin Quarry abstracts sufficient groundwater to maintain the water table below the working quarry flow. This option proposes to divert this abstracted water to the River Boyne downstream of the Staleen abstraction. The overall WFD status of the ground waterbody in this location is classified as poor . Currently the water abstracted is returned to the local environment via the River Nanny, which is also classified as poor WFD status. Using discharge from the quarry as a source of supply will result in WTP operations being completely dependent on the quarry operations and would likely impact the ground waterbody and surface waterbody meeting WFD objectives. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	•	•	•
TG4-SA3-08	Bring Rosehall WTP back into operation and upgrade WTP for partial supply to South Louth East Meath	Based on plan level assessments, it was determined that the combined sustainable allowable abstraction from Bernatin and Killinear Reservoir is 1MLD, however 4.5 MLD is required. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	•	•	•
TG4-SA3-09i	Increase surface water abstraction and treatment capacity at Clavin's Bridge to supply Kells - Oldcastle WRZ. Lough Bane WTP and it's	The River Blackwater is designated as the River Boyne and River Blackwater SAC. The River Blackwater is a “moderate status” waterbody under the WFD. Based on plan level assessments, it was determined that the sustainable allowable abstraction from the River Blackwater at this location is 3.3 MLD. Therefore, allowing for an additional 16MLD,over and above the current abstraction, to meet the full demand for this WRZ does not make this feasible.. Abstracting the volume of water required to make this a feasible option is considered likely to	•	•	•

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
	abstraction will be decommissioned as part of this option. This option will limit the abstraction downstream and at Staleen WTP therefore a new source will need to be obtained from the GDA for South Louth East Meath.	result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.			
TG4-SA3-18	Increase surface water abstraction and treatment capacity at Clavin's Bridge to supply Kells - Oldcastle WRZ. Lough Bane WTP and it's abstraction will be decommissioned as part of this option. This option will limit the abstraction downstream and at Staleen WTP therefore a new source will need to be oobtained from the GDA for South Louth East Meath.	The River Blackwater is designated as the River Boyne and River Blackwater SAC. The River Blackwater is a “moderate status” waterbody under the WFD. Based on plan level assessments, it was determined that the sustainable allowable abstraction from the River Blackwater at this location is 3.3 MLD. Therefore, allowing for an additional 2.3MLD, over and above the current abstraction, to meet the full demand for this WRZ does not make this feasible. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.			

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA3-09j	Transfer from GDA (new source required) to South Louth & East Meath, allow increased abstraction from the River Boyne at Athboy	This grouped option considered a new abstraction at Athboy to meet the required deficit in this WRZ. This option was considered as a grouped option with South Louth East Meath with the intention that the the abstraction at Athboy would reduce the existing abstraction at Staleen. However, based on plan level assessment it was determined that increasing abstraction at Athboy would not influence [or benefit] Staleen, therefore, this grouped option is not required. This option is considered separately at Athboy WRZ option TG4-SA3-24.		●	
TG4-SA3-23	New SW abstraction at River Boyne at Athboy WTP	This grouped option considered a new abstraction at Athboy to meet the required deficit in this WRZ. This option was considered as a grouped option with South Louth East Meath with the intention that the the abstraction at Athboy would reduce the existing abstraction at Staleen. However, based on plan level assessment it was determined that increasing abstraction at Athboy would not influence [or benefit] Staleen, therefore, this grouped option is not required. This option is considered separately at Athboy WRZ option TG4-SA3-24.			
TG4-SA3-14	Desalination - New RO plant to supply the area of Meath and Louth	Due to high energy costs, it was determined that a single desalination plant should be considered with the Greater Dublin Area. The proposed desalination plant in North Dublin will require a 2:1 blending ratio with freshwater to ensure delivery of potable water to our customers and also to ensure that all infrastructure is protected. This optimum level of blending cannot be provided when considering the full demand for the Greater Dublin Area, along with demand for South Louth East Meath and for this reason it was screened out at coarse screening.		●	
TG4-SA3-15	Provision of new raw water storage/bank-side storage at Staleen. This will allow storage of water for use during low flow periods.	This option requires a significant level of storage and it would also require significant amount of land. The plan level assessments identified a potential significant negative impact on the land in the area and as such it was discounted on the grounds of Deliverability and Flexibility. In addition, there are other viable options for this WRZ		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA3-20	Merge Kells Oldcasle & Navan Mid Meath WRZs. New abstraction from Lough Kinale and new WTP near source to supply deficit. Kilcarn WTP and its associated abstraction will be decommissioned as part of this option.	This option was considere6d as part of a grouped option to provide supply to Kells Oldcastle and Navan Mid Meath from the Lough Kinale. The option requires a significant length of pipeline of over 35km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, as there were other viable options for these WRZs this option was not considered feasible at coarse screening stage.	•	•	
TG4-SA3-37	Merge Kells Oldcasle & Navan Mid Meath WRZs. New abstraction from Lough Kinale and new WTP near source to supply deifict. Kilcarn WTP and its associated abstraction will be decommissioned as part of this option.	This option was considered as part of a grouped option to provide supply to Kells Oldcastle and Navan Mid Meath from the Lough Kinale. The option requires a significant length of pipeline of over 35km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, as there were other viable options for these WRZs this option was not considered feasible at coarse screening stage.	•	•	
TG4-SA3-22	Split Kells-Oldcastle WRZs - Kells to be supplied from Liscartan WTP (Navan-Mid Meath WRZ) and Oldcastle to be supplied from Lough Bane	This option was considered as part of a grouped option to provide supply to the entire Kells Oldcastle WRZ from Lough Bane. On desktop assessment of the yield available at Lough Bane it was determined that the existing abstraction was already greater than the sustainable allowable abstraction. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	•	•	•

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA3-38e	Supply Navan-Midmeath from GDA (requires new source). New main required across to Navan.	This option was considered as part of a grouped option to provide supply to the entire Kells Oldcastle WRZ from Lough Bane. On desktop assessment of the yield available at Lough Bane it was determined that the existing abstraction was already greater than the sustainable allowable abstraction. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG4-SA3-41b	Supply deficit at Navan-Midmeath from South Louth and East Meath via new GW at Kiltough during the summer, and increase abstraction from the Boyne (treated at Staleen) during the winter - interim	The overall WFD status of the groundwaterbody at Kiltrough is considered poor therefore it was not considered viable to increase an abstraction from this source.	●	●	●
TG4-SA3-42b	Supply deficit at Navan-Midmeath from South Louth and East Meath via increased SW abstraction at Staleen, requiring pumping of Treated Effluent from Drogheda to just downstream of Staleen abstraction	This was unviable as a single option and considered as part of a grouped option.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA3-64	Rationalise Moynalty WRZ to Bailieboro RWSS - Lough Skeagh will be the source	On plan level assessment of the yield available at Lough Skeagh it was determined that the existing abstraction was already greater than the sustainable allowable abstraction. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	•	•	•
TG4-SA3-66	Rationalise Moynalty WRZ to Kells-Oldcaslte WRZ	This option requires a significant length of pipeline for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, as there were other viable options for this WRZ, including options to transfer water over a shorter distance this option was not considered feasible at coarse screening stage.		•	
TG4-SA3-67	GW enhancement at Moynalty and treatment for nitrate issue	WRZ is not in deficit therefore this proposed option not required at this time.	•		
TG4-SA3-68	New SW abstraction at Moynalty River (10% Q95 = 800m3/day) and treatment for nitrate issue	WRZ is not in deficit therefore this proposed option not required at this time.	•		
TG4-SA3-87	Resilience infrastructure to facilitate development. Option involves the installation of a new pumping station at Carnes (location tbc) to deliver Bellewstown demand	This option was put forward during the options review meeting. However, this option is not a supply option. Instead, the option will be considered by IW as a critical infrastructure option.		•	