Autumn 2022

Regional Water Resources Plan – Eastern and Midlands

Appendix 4 Study Area 4 Technical Report

Tionscadal Éireann
Project Ireland
2040

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

Baseline data included in the RWRP-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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Introduction and Background

1.0 Summary of Our Options Assessment Methodology

This is the Technical Report for Study Area 4 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 13 water resource zones located in Counties Westmeath, Meath, Offaly and Longford. 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.

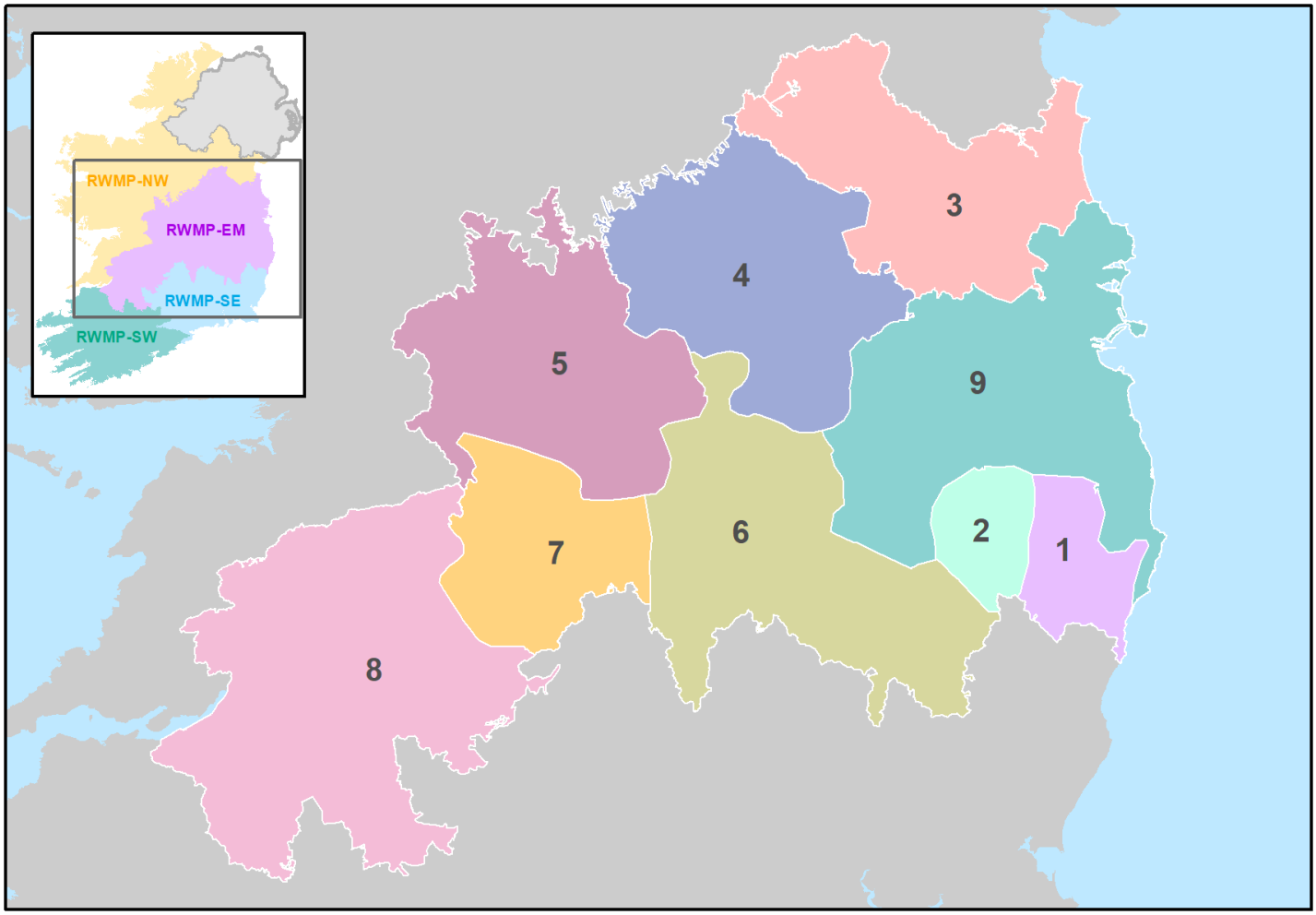


Figure 1.1 Overview of Study Areas within the Eastern and Midlands Region.

This Technical Report is for Study Area 4 (SA4), which consists of 13 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.

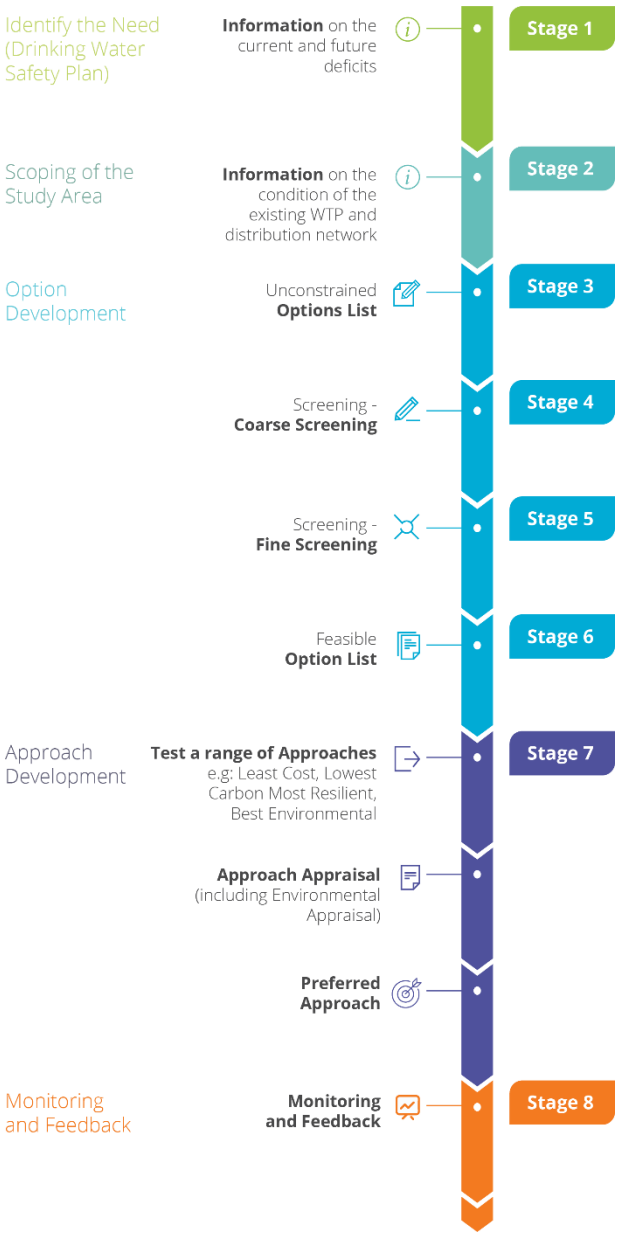


Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

There are approximately 88,000 people served by the public network in Study Area 4 via 13 water resource zones and 1,341 kilometres of distribution network. The Study Area is summarised in Figure 1.3 and Table 1.1. The largest town within this study area is Mullingar. Ballymahon, Enfield and Edenderry are other growth towns within the study area. The remaining WRZs consist of small settlements in the North East of Offaly, South West of Meath, and North West of Kildare. The sources of water consist of 3 surface water sources (2 lakes and 1 River) and 12 groundwater sources.

Mullingar and Ballany WRZs are supplied from Lough Owel and Lough Lene, respectively. Lough Owel is situated at the top of the River Brosna catchment which is part of the River Shannon basin while Lough Lene is located at the top River Deel catchment which is part of the River Boyne basin. The two sources are also designated as Special Areas of Conservation, meaning that consideration must be given to the conservation objectives which are under threat from abstraction. Both sources are complex

groundwater fed lakes where the hydrology is complex. Very low levels were experienced at these lakes during the 2018 drought, highlighting concerns about the long-term sustainability of these sources. Furthermore, as outlined in the abstraction licence for Lough Owel, the abstraction shall be such that the level of the lake does not fall below 98.90 m O.D.) and the operation of the controls at the southern end of the lake on the feeder canal to the Royal Canal must include the provision and operation of works to provide 3 million gallons compensation water per day to the feeder canal and wherever the level of the lake falls to 99.36 m O.D, to provide for the return to the lake of 1 million gallons per day. This highlights competing needs of the source, and the risk to water supply for Mullingar, now and in the future.

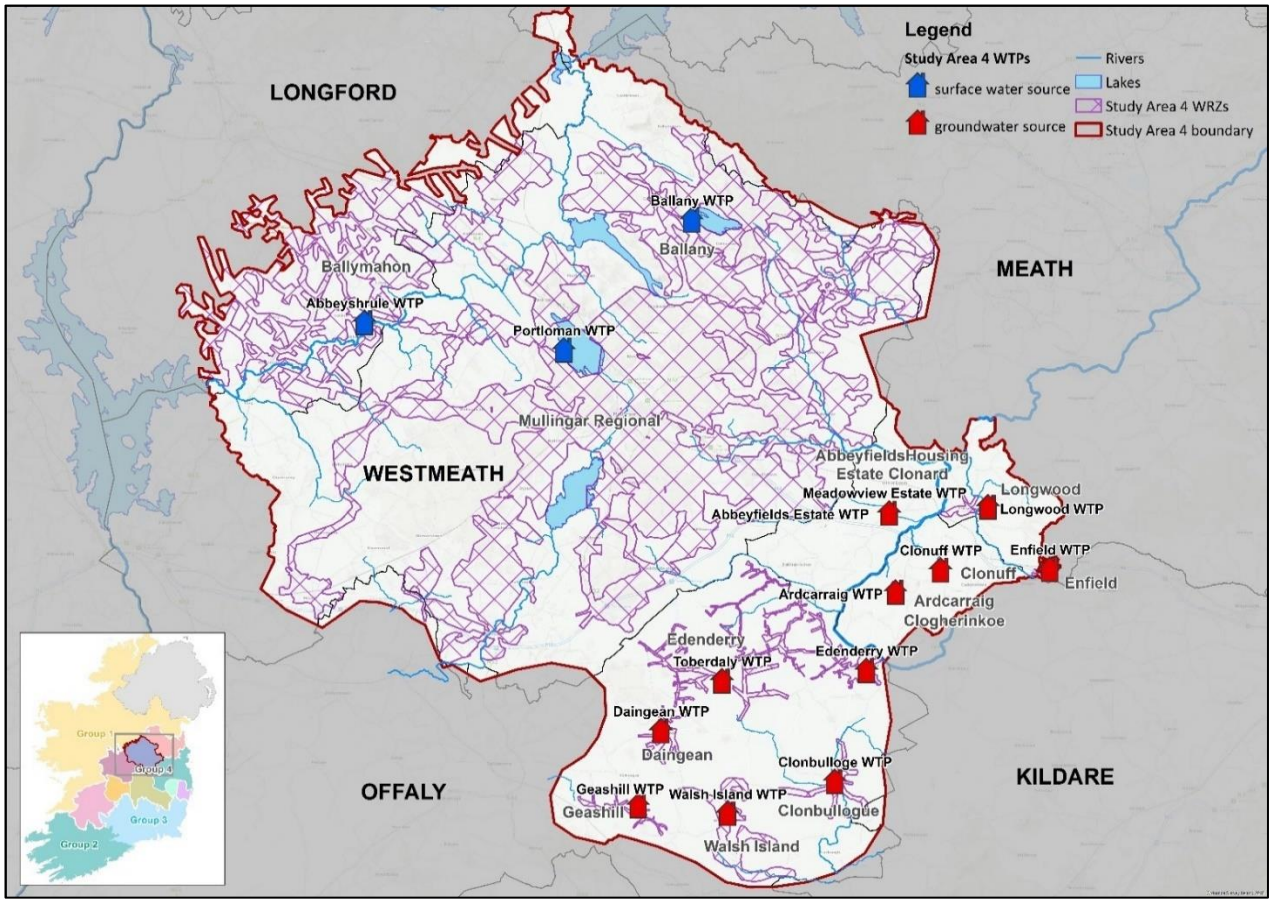


Figure 1.3 Study Area 4

The one existing river source serving the study area is an abstraction from the River Inny, a relatively large river that drains south westerly into Lough Ree where it joins the main River Shannon channel.

Two aquifer types form the basis for groundwater development in the study area, namely the Calp consisting of dark shaley limestone which is widespread in the region. Secondly, the regionally important karst aquifers around Kilbeggan, and immediately north of Mullingar and in the area surrounding Castlepollard supply groundwater to the urban hinterlands and also into the Lough Len and Lough Owel. The towns of Daingean, Longwood, Rhode, Cushina and Geashill are all supplied by groundwater sources sufficient to meet local needs. Overall, of the 12 groundwater supplies managed by Irish Water in the region, each abstracts relatively small volumes between 15m³/d to 4,000m³/d.

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 SA4 Overview

SA4	Total Population	87,870	Total Network Length (km)	1,341	Number of Water Resource Zones	13
Counties in Study Area	Longford, Meath, Offaly, Westmeath, Kildare					
Principal Settlements	Mullingar,Longford,Johnstownbridge,Edenderry,Drumlish,Meathas Truim (Edgeworthstown),Newtownforbes,Enfield,Kinnegad,Ballymahon,Castlepollard,Rhode,Tyrrellspass					
Number of Water Sources	15	Surface Water Sources	3	Groundwater Sources	12	

Water Treatment Plant	Source	Population	WTP Capacity (m^3/day)	Quality	Quantity	Reliability	Potential Sustainability
Ballany WTP	Lough Lene	8,366	7,200	●	○	○	●
Portloman WTP	Lough Owel	50,016	22,000	●	●	●	●
Daingean WTP	Groundwater	1,505	1,200	●	○	○	○
Clonbullogue WTP	Groundwater	858	420	●	○	○	○
Walsh Island WTP	Groundwater	978	1,000	●	○	○	○
Edenderry (Blundelwood) WTP	Groundwater	7,534	2,300	●	●	○	●
Toberdaly WTP	Groundwater	3,508	3,700	●	●	●	●

Geashill WTP	Groundwater	721	450	●	●	○	○
Enfield Borehole WTP	Groundwater	3,748	700	◉	●	○	●
Longwood WTP	Groundwater	1,757	600	●	○	○	○
Meadowview Estate WTP	Groundwater	70	20	●	●	○	○
Abbeyfields Estate WTP	Groundwater	264	75	●	●	○	●
Abbeyshrule WTP	River Inny	8,402	5,200	◉	●	○	○
Clonuff Borehole WTP	Groundwater	36	15	◉	○	○	○
Ardcarraig WTP	Groundwater	111	40	◉	●	○	○

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

2 Scoping the Study Area 4

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in Study Area 4, 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 SA4 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**
Ballany WTP	●	●	○	●
Portloman WTP	●	●	○	◐
Daingean WTP	●	○	●	○
Clonbullogue WTP	●	○	●	○
Walsh Island WTP	●	○	●	○
Edenderry (Blundelwood) WTP	●	◐	●	○
Toberdaly WTP	●	○	●	○

Quality: Barrier Scores				
Geashill WTP	●	●	●	●
Enfield Borehole WTP	●	●	●	●
Longwood WTP	●	●	●	●
Meadowview Estate WTP	●	●	●	●
Abbeyfields Estate WTP	●	●	●	●
Abbeyshrule WTP	●	●	●	●
Clonuff Borehole WTP	●	●	●	●
Ardcarraig 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, 13 of the 15 WTPs in the Study Area are considered to be at high risk of failing to achieve the required standards in relation to barrier and viruses (Barrier 1) chlorine residuals in our networks (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.

At present, Abbeyshrule WTP in SA4 is on the EPA RAL. Upgrades at Ballymahon 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 relation to a number of other supplies within SA4 in advance of the NWRP. Details of these are included in Table 2.2

Note the Abbeyfields WTP and Meadowview WTP provide supply to the Abbeyfields and Meadowview estates in Clonard. Due to water quality and source reliability issues at Meadowview WTP, the Meadowview WTP was rationalised to the Abbeyfields WTP. These were completed after the optioneering works for this Study Area commenced therefore they are reported on separately in this technical report.

Table 2.2 Critical Water Quality Requirements SA4

Critical Water Quality Requirements	Progress
1. **Ballymahon:** Abbeyshrule WTP Upgrade to provide new and upgrade existing processes to protect against the formation of Trihalomethanes (THMs).	Complete
2. **Mullingar:** The existing monitoring, control and inhibits at the Portloman Water Treatment Plant, were inadequate to mitigate against and prevent inadequately treated drinking water going into supply. The completed upgrades have modernised and improved the water treatment monitoring and control process at the plant and the water supply has been removed from the EPA’s Remedial Action List (RAL).	Complete
3. **Reservoir Cleaning Programme:** A major reservoir cleaning programme has been undertaken at 8 sites, which has reduced network water quality issues.	Complete
4. **Granard**: Lough Kinale WTP Upgrade to provide new and upgrade existing processes at the plant to protect against the formation of Trihalomethanes (THMs).	Complete
5. **Ardcarraig Clogherinkoe:** well head replacement	Assessment Complete
6. **Disinfection Programme:** In 2016, Irish Water completed a national review of all water treatment plants where disinfection upgrades were required. This review was followed by a programme of works to complete any required upgrades. In SA4, the following sites have been upgraded and commissioned: • Edenderry WTP • Toberdaly WTP • Clonbullogue WTP • Walsh Island WTP • Ardcarraig WTP Work will be completed in the following WTPs in 2021: • Longwood WTP • Enfield WTP	Ongoing

Critical Water Quality Requirements	Progress
Any requirements within the remaining supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP	

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.

Box 4.1 Abbeyshrule Water Treatment Plant Upgrade

Ballymahon WRZ is on the EPA Remedial Action List because the water treatment process at the plant was inadequate in protecting against the formation of Trihalomethanes (THMs). The upgrades have provided additional treatment and improved the existing water treatment processes, improving the drinking water quality, benefitting Ballymahon and the surrounding area.

Upgrades at Ballymahon are now complete, and we are currently in the process proving phase and working with the EPA to remove it from the RAL Project

Irish Water upgraded the water treatment plant to provide additional treatment and improved the existing water treatment processes. Control and monitoring systems were also installed to mitigate against THM formation.

Benefits

- Enable the removal of the Ballymahon Public Water Supply from the EPA's Remedial Action List (RAL)
- Ensure the delivery of safe, clean drinking water to residents and businesses in Ballymahon and the surrounding area
- Safeguard the water supply to this area
- Improve water quality and water treatment standards
- Improve the control and reliability of the Water Supply
- Ensure compliance with current drinking water quality regulations

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 .

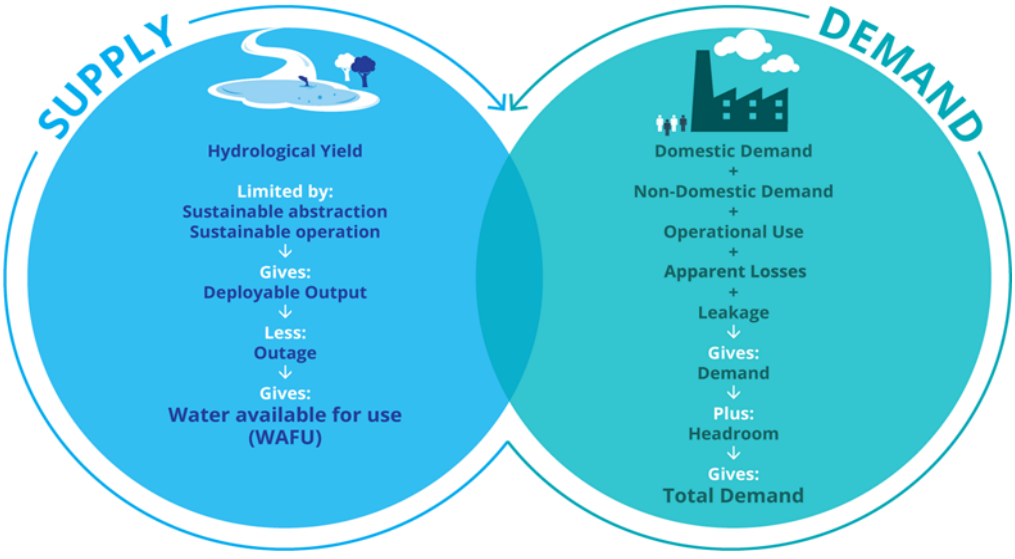


Figure 2.1 Supply Demand Balance

For each of the 13 WRZs in this Study Area, we assessed the baseline SDB 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 SA4 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:** 8 out of 13 water resource zones in the area suggest a supply demand balance deficit (based on a “do nothing” approach) under present & future scenarios. While sufficient on normal weather conditions, several would fail in drought. During the drought in summer 2018, all of our groundwater supplies were monitored due to falling levels in the groundwater bodies, and one of the supplies in SA4, Toberdaly which abstracts from the Daingean groundwater body, was noted as having a significant reduction in water available for abstraction. The levels in two of the surface water abstractions in SA4, namely Lough Owel and Lough Lene, were also severely affected during the drought.

A summary of the SDB deficit across all 13 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
Ballany	3200SC0003	8,366	-4,919	-5,034	-5,117	-5,185	-5,251	-5,304
Mullingar Regional	3200SC0001	50,016	-11,804	-11,985	-24,798	-25,171	-25,541	-25,837
Daingean PWS	2500SC0014	1,505	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Clonbullogue PWS	2500SC0007	858	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Walsh Island PWS	2500SC0006	978	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Edenderry / Rhode	2500SC0005	11,041	-4,204	-4,325	-4,420	-4,502	-4,582	-4,646
Geashill PWS	2500SC0004	721	-99	-106	-111	-116	-120	-124
Enfield	2300SC0018	3,748	-380	-534	-662	-791	-919	-1,022
Longwood	2300SC0016	1,757	No Deficit	No Deficit	-10	-21	-31	-39

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Clonard	2300SC0012	334	-37	-40	-41	-43	-45	-46
Ballymahon	2000SC0003	8,402	-914	-881	-942	-1,003	-1,062	-1,110
Clonuff	1400SC0005	36	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Ardcarraig Clogherinkoe	1400SC0004	111	-57	-58	-59	-60	-61	-62

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 22,414 m^3/day. 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 supply demand balance deficit will increase to approximately 38,190 m^3/day by 2044.

Our ongoing activities to improve the Supply Demand Balance in SA1 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.

2.3 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 network and appropriately manage our water production.

There are a number of problematic distribution and trunk mains throughout SA4. Irish Water & the Local Authority Water Services sections will continue to monitor the performance of all water mains in the network to ensure that the most problematic mains are replaced as required.

To date, a significant amount of watermain rehabilitation has been carried out across Study Area 4. 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 the drought in summer 2018 a number of water sources experienced issues including the source for Mullingar, Lough Owel. The low level in the lake, prompted a large-scale water conservation campaign and implementation of night time restrictions. This also prompted increased find and fix work in the region and take up on the first fix free scheme.

During our needs assessment Irish Water identified a number of these critical requirements and progress to date on these projects is summarised in Table 2.4.

Table 2.4 Critical water supply reliability requirements

Critical Water Supply Reliability Requirement	Progress
1. **Upgrade of Portloman WTP:** The quantity and quality of water available from this source have varied significantly in recent years, impacting on the operations of the WTP. Any interruption to deployable output from the WTP would result in immediate interruptions to water supply for a population of up to 50,000.	**Outline Design**
2. **Replacement of the Portloman WTP to Frewin Hill SR Complex Trunk Mains:** These pumped AC pipelines from Portloman WTP to Frewin Hill SR Complex supply the demand for the Mullingar WRZ. The mains were constructed in the late 1980's and are approaching the end of their design life. However, as they operate continuously, it is not possible to take the trunk mains out of service to carry out repairs. A significant burst on these truck mains, would impact up to 50,000 people.	**Assessment Complete**
3. **Replacement of the Ballany WTP to Castlepollard SR Complex Trunk Mains:** These pumped AC pipelines from Ballany WTP to Castlepollard SR Complex supply the demand for the Ballany WRZ. The mains were constructed in the late 1980's and are approaching the end of their design life. However, as they operate continuously, it is not possible to take the trunk mains out of service to carry out repairs. A significant burst on these truck mains, would impact a population of 8,300.	**Assessment Complete**
4. **Replacement of the Toberdaly WTP to Fahy SR Trunk Main:** The 200mm pumped AC pipeline from Toberdaly WTP to Fahy SR supplies the demand for the Edenderry/Rhode WRZ. It was constructed in the late 1970's and is approaching the end of their design life. However, as it operates continuously, it is not possible to take the trunk main out of service to carry out repairs. A significant burst on this truck main, would impact a population of 11,000.	**Assessment Complete**
5. **Replacement of the Richmond Hill to Ballymahon Water Tower Trunk Main:** The existing 200mm AC pipeline from Richmond Hill SR to Ballymahon Tower supplies circa 40% of the demand for Ballymahon. It was constructed in the early 1980's and is approaching the end of its design life. However, despite a significant burst history, as it is located on a national road and operates continuously, it presents major difficulties carrying out repairs. A significant burst on this truck main, would impact up to 8,300 people.	**Assessment Complete**
6. **Mullingar Watermains Rehabilitation Contract 4:** This project resulted in rehabilitate of 29 kilometres of aging and defective water mains in Mullingar	**Completed**
7. **Treated Water Storage:** Treated water storage is to be provided in Enfield, Longwood to provide security of supply under the treated water storage programme.	**In Design**
8. **Abbeyfields WTP and Meadowview WTP**: These WTPs provide supply to the Abbeyfields and Meadowview estates in Clonard. Due to water quality and source reliability issues at Meadowview WTP the Meadowview WTP was rationalised to the Abbeyfields WTP. These were completed after the optioneering works for this Study area commenced therefore they are reported on separately in this technical report.	**Completed**

Critical Water Supply Reliability Requirement	Progress
9. **Enfield:** Additional supply is required to facilitate new developments in the WRZ. A new containerised package WTP, supplied by a groundwater source, is proposed to the east of the town to provide additional supply required.	In Design
10. **Distribution Network Repairs and Upgrades:** Rolling programme of active leakage control, pressure management, find and fix and network upgrades.	In Progress

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.

2.4 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 legalisation on the SA4 supplies, we have assessed the potential impacts to our 3 no. surface water abstractions: Lough Owel (Portloman), Lough Lene (Ballany) and River Inny (Abbeyshrule).

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.

[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.

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

Description	Lough Owel (Portloman)	Lough Lene (Ballany)	River Inny (Abbeyshrule)
Current abstraction (m^3/d)	20,167	6,600	4,767
Hydrological yield (m^3/d)	14,400	1,961	90,425
Theoretical Future abstraction (m^3/day)	3,701	1,110	22,028

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	Lough Owel (Portloman)	Lough Lene (Ballany)	River Inny (Abbeyshrule)
Potential change in SDB[4](m^3/d)	-9,173	-791	none

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 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

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

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.

2.5 Water Resource Zone Needs Summary

Study Area 4 has 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 of 251 m^3/d in the region Additional Leakage Targets of 9,008 m^3/d to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d Interim additional supplies of 22.41 Ml/d within 10 years Total of 38.19 Ml/d additional supplies beyond the 10 year horizon
Reliability (In addition to progressing projects)	Continued network upgrades and improvements in the bulk and distribution networks and storage
Reliability (In addition to progressing projects)	Based on our initial desktop assessment, the volumes of water abstracted The volumes of water abstracted from Lough Owel (Portloman) and Lough Lene (Ballany) 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 4

3 Solution Types Considered in Study Area 4

In this chapter, we summarise the type of solutions we have considered to address identified need in Study Area 4.

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 SA4, the following unconstrained options have been reviewed.

3.1 Leakage Reduction

The Leakage reduction measures across the public water supply considered for SA4 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 SA4

WRZ	Net Leakage applied to SDB Reduction (m3)	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)
Ballymahon	79	257	336
Geashill PWS		62	62
Edenderry/Rhode		1,417	1,417
Walsh Island PWS		116	116
Daingean PWS		4	4
Mullingar Regional	172	4,813	4,985
Ballany		2,340	2,340

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 Framework Plan, we have not applied reductions to the SDB deficit for unquantifiable water conservation gains. 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 assessment are unconstrained by distance from the Study Area 4 and include:

- 37 stand-alone groundwater options across the Study Area
- 20 stand-alone surface water options across the Study Area
- Upgrades to our existing treatment plants
- Network connectivity and transfers from other Study Areas
- Rationalisation[5] and interconnection of WRZs within the Study Area

[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 SA4

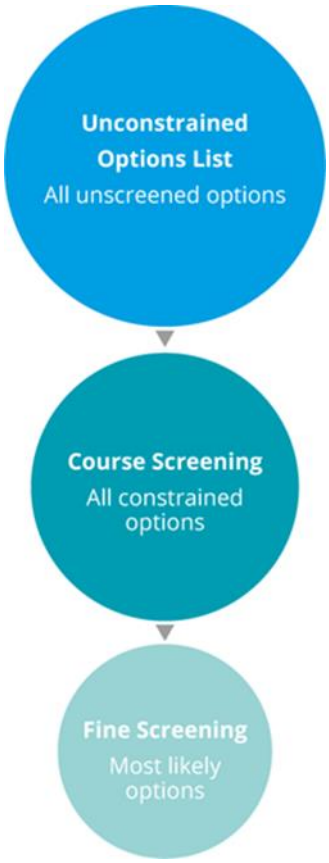
4 Option Development for Study Area 4

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 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 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 SA4, 113 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 SA4 Unconstrained Options

No. of Options	Option Type
37	Groundwater
20	Surface water
9	Transfer from Group Water Scheme
3	Interconnection GW
3	Interconnection SW
19	Cross Study Area Supply
17	Rationalise to another supply
1	Desalination
4	Upgrade Water Treatment Plant

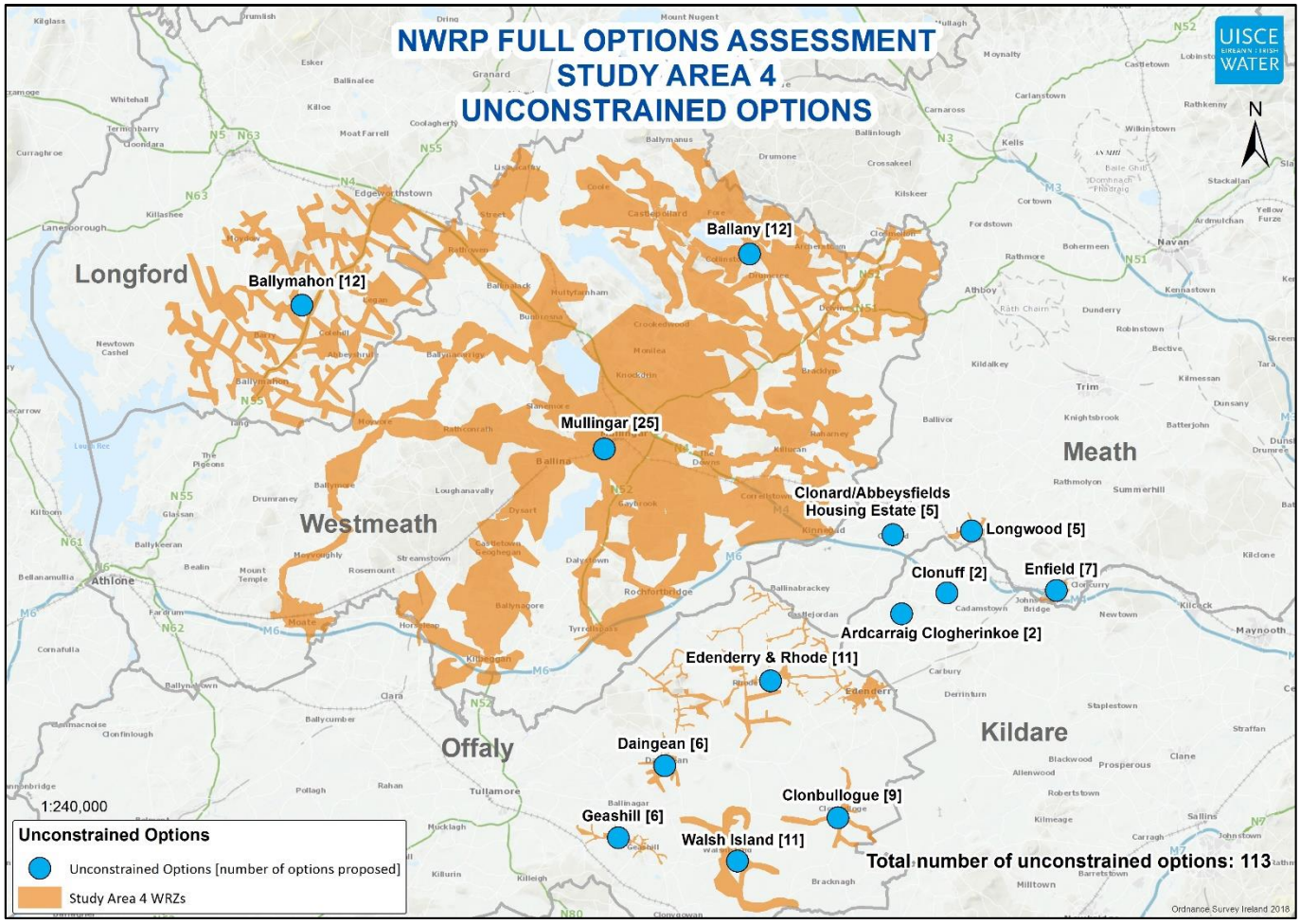


Figure 4.1 - SA4 Unconstrained Options

The 113 options were filtered through our screening process to eliminate those with potentially unviable environmental impacts or feasibility issues. This process is summarised below.

4.2 Coarse Screening

The 113 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, Hydrologist, Hydrogeologist, Ecologists and Environmental Scientists.

32 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 Edenderry and Rhode WRZ.

Example Rejected Option

Option SA4-86

New SW abstraction from River Boyne to supply deficit in Edenderry & Rhode WRZ.

Rejection Reason

It was determined that the sustainable allowable abstraction from the River Boyne at this location is 0.75 Ml/d, however additional supply of over 5 Ml/d 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.

The remaining 81 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 SA4 Remaining Options after Course Screening

No. of Options	Option Type
26	Groundwater
15	Surface water
2	Transfer from Group Water Scheme
3	Interconnection GW
3	Interconnection SW
17	Cross Study Area Supply
10	Rationalise to another supply
1	Desalination
4	Upgrade Water Treatment Plant

4.3 Fine Screening

The 81 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 Progressibility. 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, 7 further options were rejected, with the remaining 74 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 SA4 Remaining Options after Fine Screening (Feasible Options)

No. of Options	Option Type
24	Groundwater
12	Surface water
2	Transfer from Group Water Scheme
3	Interconnection GW
2	Interconnection SW
17	Cross Study Area Supply
10	Rationalise to another supply
0	Desalination
4	Upgrade Water Treatment Plant

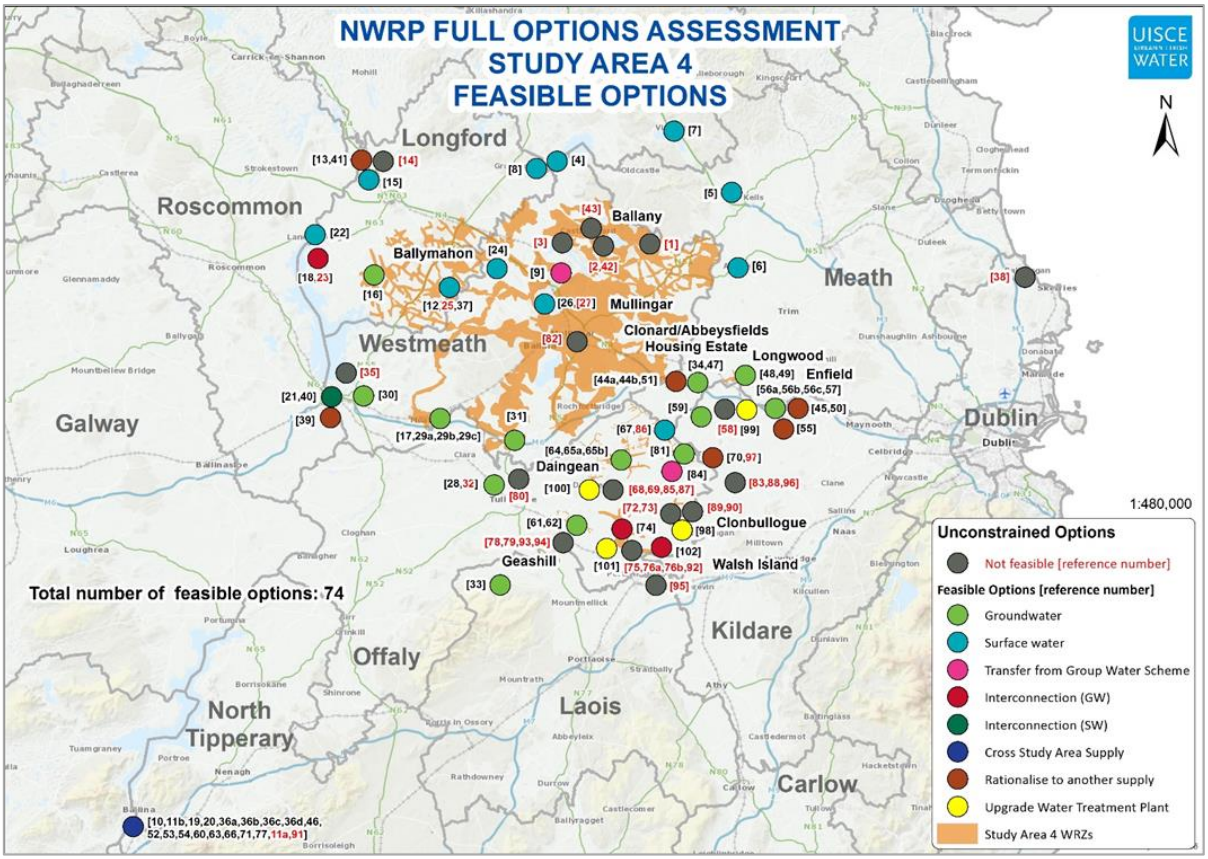


Figure 4.2 Fine Screening (Feasible Options)

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 supply demand balance deficit in the region ranges between approximately 22,415 m^3/d in 2019 during dry conditions, to a maximum of approximately 38,190 m^3/d in 2044 during dry conditions. During the options assessment stage, a total of 113 unconstrained options were assessed. Of these 39 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
12	Deliverability & Flexibility
3	Deliverability & Flexibility and Resilience
3	Deliverability & Flexibility and Sustainability
5	Deliverability & Flexibility, Resilience and Sustainability
16	Other reasons such as repeat options or Operational Options which did not provide additional supply.

The remaining 74 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 42 WRZ Options and 32 options which can be merged to form 11 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 SA4 Feasible Options Summary

Water Resource Zone	Option Type	
	WRZ Options	Study Area Options
Ardcarraig Clogherinkoe	1	1
Ballany	6	2
Ballymahon	6	4
Clonard/ Abbeysfields Housing Estate	2	3
Clonbullogue	1	1
Clonuff	1	0
Daingean	1	2
Edenderry & Rhode	5	2
Enfield WS	4	3
Geashill	2	1
Longwood WS	2	3
Mullingar Regional	10	8
Walsh Island	1	2

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 4.

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
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

Approaches Tested	Description	Policy Driver
		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.

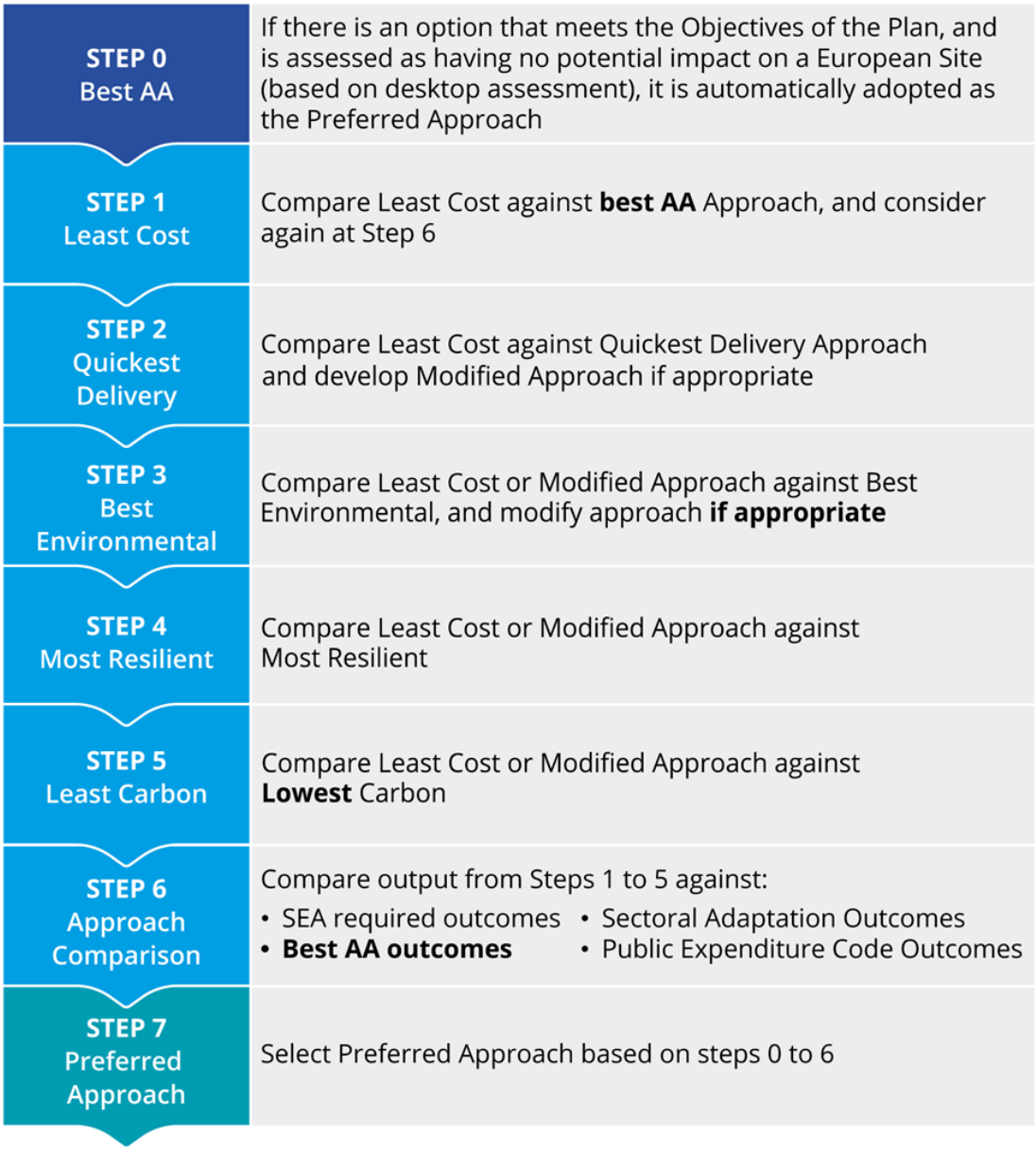


Figure 5.1 Figure of the 7 step assessment process

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 4

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this technical report there are 74 feasible options. 42 of these options are WRZ Options while 32 options are merged to form 11 Study Area Options. Table 5.2 outlines the 42 WRZ options for SA4, 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 SA4 Feasible Options

Water Resource Zone Name	Feasible Options SA4	
	Option Code	Option Description
Ballany	SA4-04	New SW abstraction from Lough Sheelin
Ballany	SA4-05	Supply part of Ballany from Kells/Oldcastle WTP (Co. Meath) - new source required (NSS)
Ballany	SA4-06	Supply part of Ballany from Athboy (Co. Meath) - new source required (NSS)
Ballany	SA4-07	Supply part of Ballany from Baileborough PWS (Co. Cavan) - new source required (Lough Ramor)
Ballany	SA4-08	Supply part of Ballany from Lough Kinale PWS (Co. Longford)
Ballany	SA4-09	Supply Ballany from neighbouring Group Water Scheme - (Multyfarnham GWS)
Ballymahon	SA4-12	Increase SW abstraction from River Inny
Ballymahon	SA4-13	Supply Ballymahon from Lough Forbes increase abstraction and upgrade WTP (Longford Central WRZ)
Ballymahon	SA4-15	Supply Edgeworthstown (partially fed from Abbeyshrule WTP) from Lough Forbes - Longford Central WRZ to reduce the demand on Ballymahon

Water Resource Zone Name	Feasible Options SA4	
	Option Code	Option Description
Ballymahon	SA4-16	New GW at Keenagh to supply deficit in Ballymahon (Funshinagh GWB - karstic)
Ballymahon	SA4-18	Interconnect Ballymahon and Lanesboro WRZs (new GW required at Lanesboro)
Ballymahon	SA4-22	River Shannon abstraction (Potential reuse of old ESB abstraction licence) - unlikely that this can be done and will have to reapply - Volume unknown
Mullingar Regional	SA4-24	New SW abstraction from River Inny located approximately 10km of the existing Portloman WTP to supplement supply to Mullingar WRZ. New WTP at abstraction.
Mullingar Regional	SA4-26	Maintain and reduce abstraction from Lough Owel - close connection to canal and continue pumping to canal to maintain satisfactory level
Mullingar Regional	SA4-29a	New GW abstraction at Moate to partly supply deficit in WRZ
Mullingar Regional	SA4-30	New GW abstraction at Annagh to partly supply deficit in WRZ
Mullingar Regional	SA4-33	Increase GW abstraction at Portlaoise to partly supply deficit in WRZ
Mullingar Regional	SA4-34	New GW abstraction at Clonard Co. Meath (Kilrathmurry Gravels GWB) to partly supply deficit in WRZ. Connection point north/ south of M4 - TBC
Mullingar Regional	SA4-36d	New Connection from NSS to Mullingar Regional
Mullingar Regional	SA4-37	Increase abstraction at Abbeyshrule WTP and upgrade WTP to supplement supply to Mullingar WRZ
Mullingar Regional	SA4-39	Increased abstraction at Lough Ree and upgrade existing Athlone WTP to supply full demand to Mullingar
Mullingar Regional	SA4-41	Rationalise Mullingar to Longford Central
Clonard/ Abbeysfields Housing Estate	SA4-44a	Rationalisation of Meadowview to Abbeyfields is complete - New G1 BH and upgrade Abbeyfields WTP to supply Clonard village
Clonard/ Abbeysfields Housing Estate	SA4-47	Increase GW abstraction to supply deficit
Longwood WS	SA4-48	Increase GW abstraction to supply deficit in Longwood WRZ
Longwood WS	SA4-49	New GW at Longwood - locally important gravel acquifer
Enfield WS	SA4-54	Rationalise Enfied WRZ to GDA (Kilcock connection) - NSS required
Enfield WS	SA4-55	Rationalise Enfied WRZ to Johnstown Bridge
Enfield WS	SA4-56c	New GW at Enfield WTP
Enfield WS	SA4-57	Increase GW abstraction to supply deficit in Enfield WRZ
Ardcarraig Clogherinkoe	SA4-59	Increase GW abstraction at Ardcarraig Clogherinkoe
Geashill	SA4-61	Increase GW abstraction at Geashill (poorly productive aquifer) and upgrade Geashill WTP

Water Resource Zone Name	Feasible Options SA4	
	Option Code	Option Description
Geashill	SA4-62	New GW abstraction at Geashill
Edenderry & Rhode	SA4-64	Increase GW abstraction at Edenderry and upgrade Edenderry WTP
Edenderry & Rhode	SA4-65b	New GW source to supply Edenderry & Rhode WRZ (Trim groundwater body; Kilrathmurry gravels groundwater body - approx. distance 3km; new watermains required)
Edenderry & Rhode	SA4-67	New SW source to supply deficit in Edenderry & Rhode WRZ. Nearby River Yellow 10% of Q95 = 2.8Ml/d
Edenderry & Rhode	SA4-81	Increase GW abstraction at Rhode and upgrade Toberdaly WTP
Edenderry & Rhode	SA4-84	Supply deficit from neighbouring Ballyfore/Ballykilleen GWS (network upgrades required, south of the WRZ)
Clonbullogue	SA4-98	No deficit - WQ upgrade required only
Clonuff	SA4-99	No deficit - WQ upgrade required only
Daingean	SA4-100	No deficit - WQ upgrade required only
Walsh Island	SA4-101	No deficit - WQ upgrade required only

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 SA4 Alignment of WRZ Option/s with Approach Categories

Water Resource Zone Name	Feasible Options SA4			Approach					
	No. of WRZ Options	Option Code	Option Description	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
Ballany	6	SA4-04	New SW abstraction from Lough Sheelin	-	-	-	-	-	-
		SA4-05	Supply part of Ballany from Kells/Oldcastle WTP (Co. Meath)	-	-	✓	✓	✓	-
		SA4-06	Supply part of Ballany from Athboy (Co. Meath)	-	-	-	-	-	-
		SA4-07	Supply part of Ballany from Baileborough PWS (Co. Cavan)	-	-	-	-	-	-
		SA4-08	Supply part of Ballany from Lough Kinale PWS (Co. Longford)	-	✓	-	-	-	-
		SA4-09	Supply Ballany from neighbouring Multyfarnham Group Water Scheme	✓	-	-	-	-	✓
Ballymahon	6	SA4-12	Increase SW abstraction from River Inny	-	-	✓	✓	✓	-
		SA4-13	Supply Ballymahon from Lough Forbes increase abstraction and upgrade WTP (Longford Central WRZ)	-	✓	-	-	-	-

Water Resource Zone Name	Feasible Options SA4			Approach					
	No. of WRZ Options	Option Code	Option Description	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
		SA4-15	Supply Edgeworthstown (partially fed from Abbeyshrule WTP) from Lough Forbes - Longford Central WRZ to reduce the demand on Ballymahon	-	✓	-	-	-	-
		SA4-16	New GW at Keenagh to supply deficit in Ballymahon (Funshinagh GWB - karstic)	✓	-	-	-	-	✓
		SA4-18	Interconnect Ballymahon and Lanesboro WRZs (new GW required at Lanesboro)	-	-	-	-	-	-
		SA4-22	River Shannon abstraction (Potential reuse of old ESB abstraction licence) - unlikely that this can be done and will have to reapply - Volume unknown	-	-	-	-	-	-
Mullingar	10	SA4-24	New SW abstraction from River Inny located approximately 10km of the existing Portloman WTP to supplement supply to Mullingar WRZ. New WTP at abstraction.	-	-	-	-	-	-
		SA4-26	Maintain and reduce abstraction from Lough Owel - close connection to canal and continue pumping to canal to maintain satisfactory level	-	-	-	-	-	-
		SA4-29a	New GW abstraction at Moate to partly supply deficit in WRZ	-	-	✓	-	-	-
		SA4-30	New GW abstraction at Annagh to partly supply deficit in WRZ	-	-	-	-	-	-
		SA4-33	Increase GW abstraction at Portlaoise to partly supply deficit in WRZ	-	-	-	-	-	-
		SA4-34	New GW abstraction at Clonard Co. Meath (Kilrathmurry Gravels GWB) to partly supply deficit in WRZ. Connection point north/ south of M4 - TBC	-	-	-	-	-	-
		SA4-36d	New Connection from NSS to Mullingar Regional	✓	✓	-	-	-	✓
		SA4-37	Increase abstraction at Abbeyshrule WTP and upgrade WTP to supplement supply to Mullingar WRZ	-	-	-	-	-	-
		SA4-39	Increased abstraction at Lough Ree and upgrade existing Athlone WTP to supply full demand to Mullingar	-	-	-	-	✓	-
		SA4-41	Rationalise Mullingar to Longford Central	-	-	-	✓	-	-
Clonard/ Abbeysfields Housing Estate	2	SA4-44a	Rationalisation of Meadowview to Abbeyfields is complete - New G1 BH and upgrade Abbeyfields WTP to supply Clonard village	-	-	-	-	-	-
		SA4-47	Increase GW abstraction to supply deficit	✓	✓	✓	✓	✓	✓
Longwood WS	2	SA4-48	Increase GW abstraction to supply deficit in Longwood WRZ	✓	✓	-	-	✓	✓
		SA4-49	New GW at Longwood - locally important gravel aquifer	-	-	✓	✓	✓	-

Water Resource Zone Name	Feasible Options SA4			Approach					
	No. of WRZ Options	Option Code	Option Description	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
Enfield	4	SA4-54	Rationalise Enfied WRZ to GDA (Kilcock connection) - NSS required	✓	✓	✓	-	✓	✓
		SA4-55	Rationalise Enfied WRZ to Johnstown Bridge	-	-	-	-	-	-
		SA4-56c	New GW at Enfield WTP	-	-	-	✓	-	-
		SA4-57	Increase GW abstraction to supply deficit in Enfield WRZ	-	-	-	-	-	-
Ardcarraig Clogherinkoe	1	SA4-59	Increase GW abstraction at Ardcarraig Clogherinkoe	✓	✓	✓	✓	✓	✓
Geashill	2	SA4-61	Increase GW abstraction at Geashill (poorly productive aquifer) and upgrade Geashill WTP	✓	✓	✓	-	✓	✓
		SA4-62	New GW abstraction at Geashill	-	-	-	✓	✓	-
Edenderry & Rhode	5	SA4-64	Increase GW abstraction at Edenderry and upgrade Edenderry WTP	-	✓	-	-	-	✓
		SA4-65b	New GW source to supply Edenderry & Rhode WRZ (Trim groundwater body; Kilrathmurry gravels groundwater body - approx. distance 3km; new watermains required)	-	✓	✓	✓	-	-
		SA4-67	New SW source to supply deficit in Edenderry & Rhode WRZ. Nearby River Yellow 10% of Q95 = 2.8Ml/d	✓	✓	-	-	✓	-
		SA4-81	Increase GW abstraction at Rhode and upgrade Toberdaly WTP	-	-	-	-	-	-
		SA4-84	Supply deficit from neighbouring Ballyfore/Ballykilleen GWS (network upgrades required, south of the WRZ)	-	-	-	-	-	-
Clonbullogue	1	SA4-98	No deficit - WQ upgrade required only	✓	✓	✓	✓	✓	✓
Clonuff	1	SA4-99	No deficit - WQ upgrade required only	✓	✓	✓	✓	✓	✓
Daingean	1	SA4-100	No deficit - WQ upgrade required only	✓	✓	✓	✓	✓	✓
Walsh Island	1	SA4-101	No deficit - WQ upgrade required only	✓	✓	✓	✓	✓	✓

The 7 Step Process outlined in Figure 5.1 was then applied to each WRZ in SA4, 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 SA4 at WRZ level, include the following:

- In 10 of the 13 Water Resource Zones, the Preferred Approach consists of the same Plan Level options as the Best AA and Best Environmental Approaches.
- No option has a -3 AA score against the European Site (Biodiversity) question. 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 SA4 WRZ Level Approach

Water Resource Zone Name	Feasible Options SA4 Tipperary North		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient	Preferred Approach
Ballany	SA4-05	Supply part of Ballany from Kells/Oldcastle WTP (Co. Meath)	-	-	-	✓	✓	✓	-	✓
Ballymahon	SA4-12	Increase SW abstraction from River Inny	-	-	-	✓	✓	✓	-	✓
Mullingar Regional	SA4-36d	New Connection from NSS to Mullingar Regional	-	✓	-	-	-	-	✓	✓
Clonard/ Abbeysfields Housing Estate	SA4-47	Increase GW abstraction to supply deficit	-	✓	✓	✓	✓	✓	✓	✓
Longwood WS	SA4-49	New GW at Longwood - locally important gravel aquifer	-	-	-	✓	✓	✓	-	✓
Enfield WS	SA4-54	Rationalise Enfied WRZ to GDA (Kilcock connection)	-	✓	✓	✓	-	✓	✓	✓
Ardcarraig Clogherinkoe	SA4-59	Increase GW abstraction at Ardcarraig Clogherinkoe	-	✓	✓	✓	✓	✓	✓	✓
Geashill	SA4-62	New GW abstraction at Geashill	-	-	-	-	✓	✓	-	✓
Edenderry & Rhode	SA4-65b	New GW source to supply Edenderry & Rhode WRZ (Trim groundwater body; Kilrathmurry gravels groundwater body - approx. distance 3km; new watermains required)	-	-	✓	✓	✓	-	-	✓
Clonbullogue	SA4-98	No deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓
Clonuff	SA4-99	No deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓
Daingean	SA4-100	No deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓
Walsh Island	SA4-101	No deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓

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 11 Study Area options.

Table 5.5 SA4 Study Area Options

Option Code	Feasible Options SA4		
	Water Resource Zone	Water Resource Zone Code	Option Description
Group 1	Ballany	3200SC0003	New connection to NSS for Ballany, Ballymahon, Mullingar, Clonard/ Abbeysfields Housing Estate, Longwood WS, Enfield WS, Ardcarraig Clogherinkoe, Geashill, Edenderry & Rhode, Daingean and Walsh Island WRZs
	Ballymahon	2000SC0003	
	Mullingar Regional	3200SC0001	
	Clonard/ Abbeysfields Housing Estate	2300SC0012	
	Longwood WS	2300SC0016	
	Enfield WS	2300SC0018	
	Ardcarraig Clogherinkoe	1400SC0004	
	Geashill	2500SC0004	
	Edenderry & Rhode	2500SC0005	
	Daingean	2500SC0014	
	Walsh Island	2500SC0006	
Group 2	Ballany	3200SC0003	Interconnect Ballany with Mullingar Regional and supply from NSS
	Mullingar Regional	3200SC0001	
Group 3	Ballymahon	2000SC0003	

Option Code	Feasible Options SA4		
	Water Resource Zone	Water Resource Zone Code	Option Description
	Mullingar Regional	3200SC0001	New GW abstraction at Moate for Mullingar Regional and interconnect with Ballymahon to supply deficit in Ballymahon WRZ
Group 4	Ballymahon	2000SC0003	New connection point from NSS connecting to Mullingar Regional and Ballymahon
	Mullingar Regional	3200SC0001	
Group 5	Edenderry & Rhode	2500SC0005	New GW source to supply Edenderry & Rhode WRZ. Rationalise Daingean to Edenderry & Rhode WRZ.
	Daingean	2500SC0014	
Group 6	Clonbullogue	2500SC0007	Interconnect Clonbullogue with Walsh Island for increased resilience
	Walsh Island	2500SC0006	
Group 7	Ballymahon	2000SC0003	Interconnect Ballymahon and Mullingar Regional with Athlone and upgrade Athlone WTP
	Mullingar Regional	3200SC0001	
Group 8	Clonard/ Abbeysfields Housing Estate	2300SC0012	New GW at Enfield WTP and rationalise Clonard WRZ
	Enfield WS	2300SC0018	
Group 9	Clonard/ Abbeysfields Housing Estate	2300SC0012	New G1 BH and upgrade Abbeyfields WTP to supply Clonard village. Rationalise Longwood to Clonard WRZ.
	Longwood WS	2300SC0016	
Group 10	Longwood WS	2300SC0016	New GW at Enfield WTP and rationalise Longwood to Enfield WRZ.
	Enfield WS	2300SC0018	
Group 11	Mullingar Regional	3200SC0001	New GW abstraction at Arden to partly supply deficit in WRZ.

The 11 Study Area options result in 9 SA Combinations including the WRZ level Approach. The 9 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SA4 Combinations Options Summary

Key	WRZ Approach Option	○	SA Grouped Option	□

WRZ	WRZ approach options	SA combination 1 (SA grouped option 1)	SA combination 2 (SA grouped option 2)	SA combination 3 (SA grouped option 4)	SA combination 4 (SA grouped option 5)	SA combination 5 (SA grouped option 7)	SA combination 6 (SA grouped option 8)	SA combination 7 (SA grouped option 9)	SA combination 8 (SA grouped option 10)
Ballany	○	□	□	○	○	○	○	○	○
Mullingar Regional	○	□	□	□	○	□	○	○	○
Clonard/ Abbeysfields Housing Estate	○	□	○	○	○	○	□	□	○
Longwood WS	○	□	○	○	○	○	○	□	□
Enfield WS	○	□	○	○	○	○	□	○	□
Clonuff	○	○	○	○	○	○	○	○	○
Ardcarraig Clogherinkoe	○	□	○	○	○	○	○	○	○
Edenderry & Rhode	○	□	○	○	□	○	○	○	○
Daingean	○	□	○	○	□	○	○	○	○
Clonbullogue	○	○	○	○	○	○	○	○	○
Walsh Island	○	□	○	○	○	○	○	○	○
Ballymahon	○	□	○	□	○	□	○	○	○
Geashill	○	□	○	○	○	○	○	○	○

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 Section 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 SA4, the WRZ Level Approach and Grouped Option 1 (Combination 1) had a very similar ranking under the Least Cost category. 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 two combinations against each other to identify which should go forward as the Least Cost approach, Grouped Option 1 (Combination 1) scored the same as the WRZ Level Approach for Best AA, but, as outlined in Table 5.7 below, it scored significantly better in every other category than the WRZ Level Approach. Overall, Combination 1 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 SA4 Summary of SA Combination of Performance against Approach Type

Ranked order (best to worst)	Best														Worst

WRZ	WRZ approach options	SA combination 1 (SA grouped option 1)	SA combination 2 (SA grouped option 2)	SA combination 3 (SA grouped option 4)	SA combination 4 (SA grouped option 5)	SA combination 5 (SA grouped option 7)	SA combination 6 (SA grouped option 8)	SA combination 7 (SA grouped option 9)	SA combination 8 (SA grouped option 10)
Least Cost		Best				Worst			
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	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores	0 No. -3 scores
Lowest Carbon		Worst				Best			
Most Resilient		Best				Worst			
Best Environmental	Worst	Best							

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 1
Best Environmental (BE)	Group 1
Quickest Delivery (QD)	Group 1
Most Resilient (MR)	Group 1
Lowest Carbon (LC)	Group 7
Best AA (BA)	Group 1

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. In terms of NPV Cost, the SA Group 1 has the lowest NPV Cost, as shown in Figure 5.2, with the lowest total costs (CAPEX and OPEX) over the solutions lifetime.

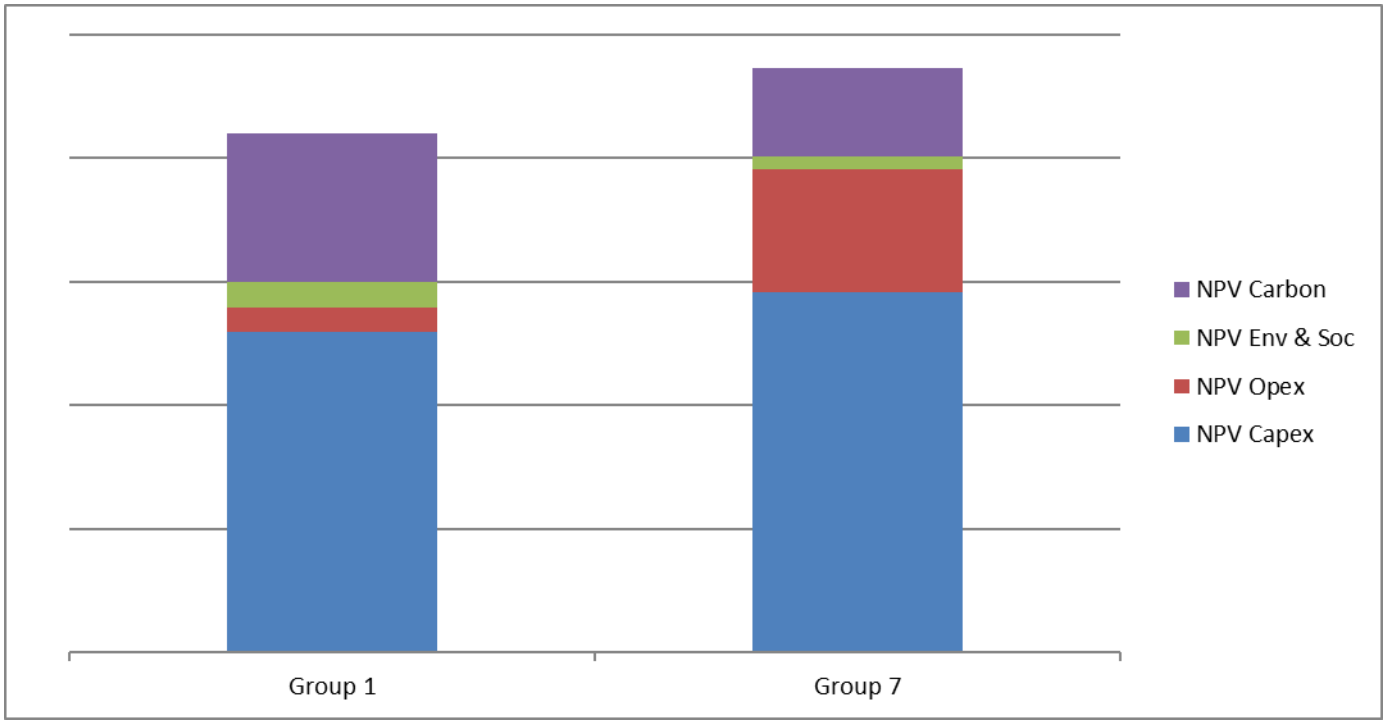


Figure 5.2 SA4 NPV Costs for WRZ and SA approaches

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 Methodology Least Cost is used in the beginning of the Approach Development process and is compared against the other best performing categories to decide on the best options. 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 and the Best AA Approach are the same Approach. The Least Cost approach was therefore retained at this stage.
- Step 2 – We compared the Quickest Delivery Approach against the Least Cost Approach. The Least Cost approach and the Quickest Delivery Approach are the same Approach. The Least Cost approach was therefore retained at this stage.
- Step 3 - We compared the Least Cost against the Best Environmental Approach. The Least Cost approach and the Best Environmental Approach are the same Approach. The Least Cost approach was therefore retained at this stage.
- Step 4 – We compared the Least Cost against the Most Resilient Approach. The Least Cost approach and the Most Resilient Approach are the same Approach. 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 Cost Approach performs better to the Least Carbon Approach for all other criteria, in fact it is the best performing combination under all the different approaches and the Least Carbont Approach performs poorly against NPV cost and Quickest Delivery criteria. The Least Cost approach was therefore retained at this stage.
- Step 6 – A final assessment of the Least Cost was completed against the Least Carbon, Best AA, Best Environmental and Most Resilient Approaches. The Least Cost Approach is the Best AA, Best Environmental and Most Resilient Approach. While the Least Cost

Approach has higher Carbon Cost associated with the provision of additional network, the interconnectivity of this supply provides resilience to our customers and provision of supply from a sustainable source reduces the environmental impact to our waterbodies. 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

On the basis of this initial assessment at Plan level, Combination represents the Preferred Approach for Study Area 4, which consists of the options listed in Table 5.9.

Table 5.9 Preferred Approach for SA4

WRZ_Name	Option Description
Ballany	Group 1 New connection to NSS for Ballany, Ballymahon, Mullingar, Clonard/ Abbeysfields Housing Estate, Longwood WS, Enfield WS, Ardcarraig Clogherinkoe, Geashill, Edenderry & Rhode, Daingean and Walsh Island WRZs
Mullingar Regional	
Clonard/ Abbeysfields Housing Estate	
Longwood WS	
Enfield WS	
Ardcarraig Clogherinkoe	
Edenderry & Rhode	
Daingean	
Walsh Island	
Ballymahon	
Geashill	
Clonbullogue	SA4-098 No deficit - Upgrade WTP
Clonuff	SA4-099

WRZ_Name	Option Description
	Upgrade WTP for Water Quality Purposes

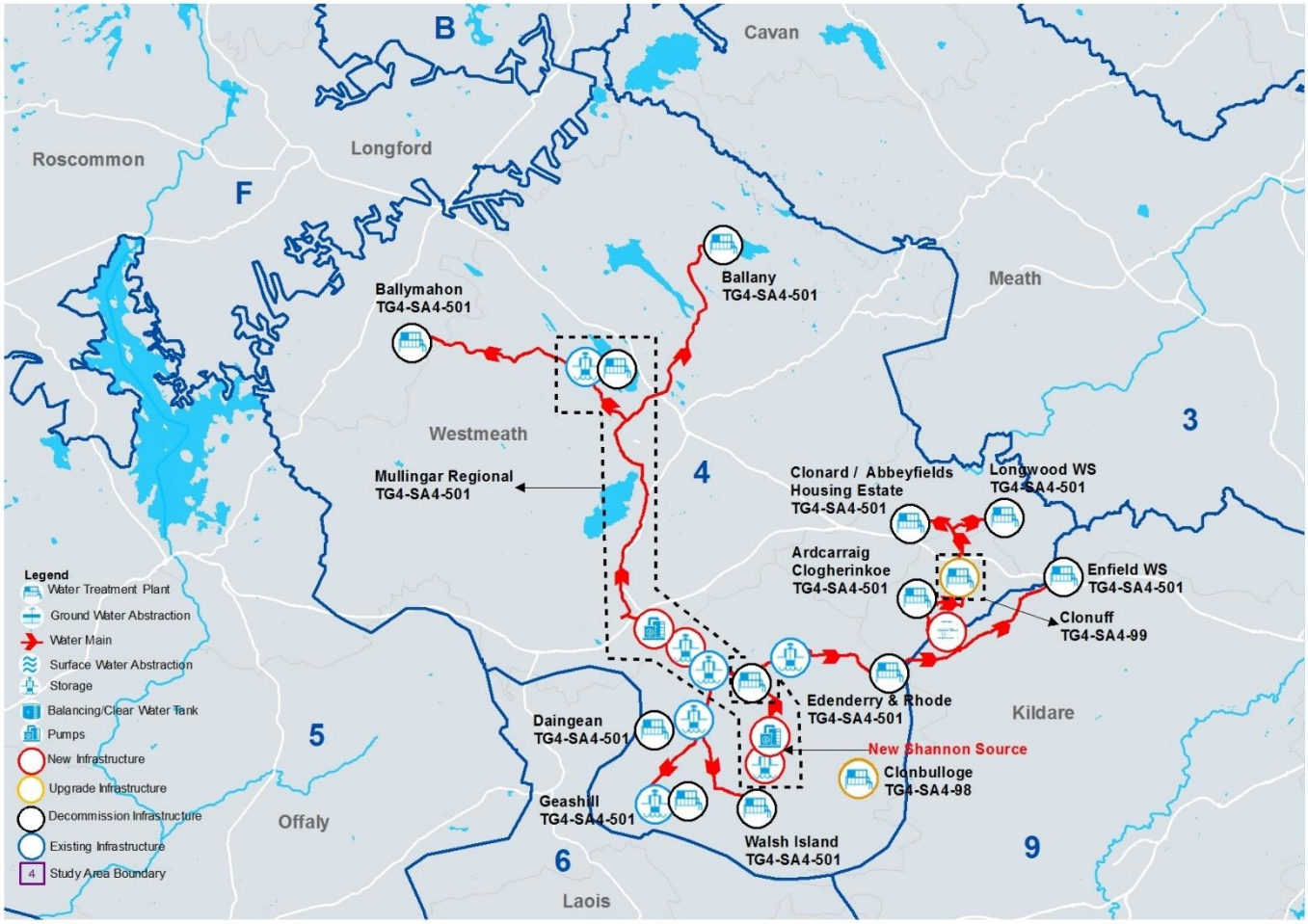


Figure 5.3 Preferred Approach SA4

The Preferred Approach (SA approach Group 4) is shown schematically in Figure 5.3

The Preferred Approach for SA4, 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 Natural Rate of Leakage Rise (NRR)
- Nett leakage reduction in Geashill PWS, Edenderry/Rhode, Walsh Island PWS, Mullingar Regional and Ballany Water Resource Zones, amounting to 251 m³ per 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
- 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 SA4, as summarised in Figure 5.3 and Table 5.8. The measures will only be progressed in the event of critical

need and/or public health impact and to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Before we adopt this approach at Plan level for SA4, 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); and
- **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 New Shannon Source enroute to the GDA WRZ, SA9. Therefore these options are dependent on the development of the Preferred Approach for the GDA WRZ SA9, and an alternative option is required for consideration as an alternative solution 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
Ballany	SA4-04 Maintain existing WTPs and abstraction from Lough Lene. New WTP and associated SW abstraction from Lough Sheelin (+5,304 m3/day)
Mullingar Regional	SA4-39 Decommission existing WTP and SW abstraction from Lough Owel Increased abstraction at Lough Ree and upgrade existing Athlone WTP to supply full demand to Mullingar (+25,837 m3/day)
Clonard/ Abbeysfields Housing Estate	SA4-47 Increase GW abstraction to supply deficit (+46 m3/day)
Longwood WS	SA4-49 Maintain existing WTP and abstraction and a new GW source (+39 m3/day)
Enfield WS	SA4-57 Maintain and increase existing WTP and provide new GW abstraction. (+1,022m3/day)
Ardcarraig Clogherinkoe	SA4-59 Maintain existing WTP and increase GW abstraction (+62 m3/day)
Edenderry & Rhode	SA4-65b Maintain existing WTPs and abstractions. New GW source to provide additional supply to Toberdaly WTP (+4,646m3/day)
Daingean	SA4-100 Upgrade to existing WTP no increase in output required.

WRZ Name	Alternate Option
Walsh Island	SA4-101 Upgrade to existing WTP no increase in output required.
Ballymahon	SA4-12 Maintain and increase existing WTP and SW abstraction from River Inny. (+1,110m3/day)
Geashill	SA4-62 Maintain and increase existing WTP and provide new GW abstraction. (+124m3/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 SA4 Interim Options

WTP Name	Interim Option
Ballany WTP	Upgrade WTP to IW Standards
Portloman WTP	Upgrade WTP to IW Standards Divert areas of Moate, Moyvore and Ballinacarrigy to be supplied from the Athlone WTP.
Daingean WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Clonbullogue WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards
Walsh Island WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Edenderry (Blundelwood) WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Toberdaly WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards
Geashill WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards
Enfield Borehole WTP	A new temporary package WTP, supplied by a groundwater source, to provide additional required supply prior to the development of the preferred approach.
Longwood WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards
Meadowview Estate WTP	As noted in Section 2.2 of this report this WTP has been decommissioned.
Abbeyfields Estate WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards
Abbeyshrule WTP	Upgrade WTP to IW Standards - Potential site for a containerised solution
Clonuff Borehole WTP	Develop new Borehole or Refurb existing Borehole, and upgrade WTP to IW Standards

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 included in the SDB?

A summary of the adaptability criteria and analysis we have undertaken for SA4 is shown in Table 7.1.

Table 7.1 Sensitivity Analysis for SA4

Uncertainty	Likelihood	Increase/ Decrease in Deficit (m^3/day)	Impact on Preferred Approach
Sustainability	Moderate/High (as our current abstractions are large compared to the water bodies from which they abstract)	+ 800 m^3/d	**The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the supply demand balance deficit**. Our outline sustainability assessments would mean a potential significant increase in deficit for SA4 based on the large reductions in the sustainable abstraction amounts from both Lough Owel and Lough Lene. However, the Preferred Approach involves the decommissioning of the Lough Owel source and augmenting SA4 with connections to an option that abstracts from a new Shannon source. Therefore, the Preferred Approach is a flexible outcome in terms of adaptive planning. Based on this scenario, the Preferred Approach would be the optimal solution.

Uncertainty	Likelihood	Increase/ Decrease in Deficit (m^3/day)	Impact on Preferred Approach
Demand Growth	Low/ Moderate (growth has been based on policy	-3.942 Ml/d	**The impact of lower than expected growth would reduce the supply demand balance deficit and the overall need requirement.** The supply demand balance deficit is spread across 8 individual water resource zones and is driven by quality as well as quantity issues. Therefore, the preferred approach is required, irrespective of whether there is any significant growth in the region. Based on this scenario, the Preferred Approach would be the optimal solution.
Leakage	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	9,008 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 need drivers in SA4 are across all 13 water resource zones and are driven by quality as well as availability issues and the requirement to move away from the Lough Owel source. Therefore, the Preferred Approach is required, even accounting for increased leakage savings. Based on this scenario, the Preferred Approach would be remains as the optimal solution.
	Low (Irish Water is focused on sustainability and aggressive leakage reduction)	251 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 Preferred Approach would be remains as the optimal solution.
Climate Change	High (international climate change	+ 1 Ml/d	**The impact of increased climate change scenarios would impact our existing**

Uncertainty	Likelihood	Increase/ Decrease in Deficit (m^3/day)	Impact on Preferred Approach
	targets have not been met)		**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 SA4, the existing lake abstraction from Lough Bane and Lough Lene would be vulnerable to increased climate change impact scenarios. However, these sources are decommissioned as part of the Preferred Approach. The existing river abstraction from River Inny is a large source resilient to any increased climate change impacts. Regarding the existing/new groundwater abstractions, there is more difficulty and uncertainty in assessing increased climate change impacts, however it is understood that generally groundwater will be more resilient than surface water sources. Based on this scenario, the decision to progress the Preferred Approach would remain sound.

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 adaptability 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

- Preferred Approach – The supplies in SA4 vary in size with a large number of small WRZs <1Ml/d as well as larger growth areas such as Mullingar. A regional Preferred Approach identifies a transfer from the lower Shannon at Parteen Basin as the preferred approach for the majority of the WRZs. This option will allow for and increase or reduction in demand and therefore, the Preferred Approach is adaptable to changing needs in the Study Area, over time.

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

8 Summary of Study Area 4

8 Summary of Study Area 4

The Preferred Approach for SA4 (summarised in Table 5.9 and Figure 5.5 in section 5.3.3) consists of Local WRZ supplies for 2 of the 13 Water Resource Zones. The Preferred Approach for the eleven remaining Water Resource Zones involve transfers from the New Shannon Source.

The preferred approach provides environmental benefits by;

- Decommissioning an existing abstraction from Lough Owel a SAC designated lake.
- Decommissioning an existing ground water abstraction in Enfield from a groundwater source that is adjacent to the River Blackwater.
- Meeting growth in Ballany by transferring water from another WRZ rather than increasing the existing abstraction from Lough Lene which will assist in Lough Lene meeting WFD objectives.

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 SA4 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 Natural Rate of Leakage Rise (NRR)
- Nett leakage reduction in Ballymahon and Mullingar Regional Water Resource Zones, amounting to 251 m^3 per 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
- 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 SA4, as summarised in Table 6.1 in Section 6. The measures will only be progressed in the event of critical need and/or public health impact and to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A Study Area 4 Water Treatment Plants

WTP Asset Name	Local Plant Names
Ardcarraig WTP	Ardcarraig Clogherinkoe WTP
Clonuff Borehole WTP	Clonuff Borehole WTP
Abbeyshrule WTP	Abbeyshrule WTP
Enfield Borehole WTP	Enfield WTP
Longwood WTP	Longwood WTP
Abbeyfields Estate WTP	Abbeyfields Estate WTP
Meadowview Estate WTP	Meadowview Estate WTP
Toberdaly WTP	Toberdaly WTP
Edenderry (Blundelwood) WTP	Edenderry WTP
Daingean WTP	Daingean WTP
Walsh Island WTP	Walsh Island WTP
Geashill WTP	Geashill WTP
Clonbullogue WTP	Clonbulloge WTP
Portloman WTP	Portloman WTP
Ballany WTP	Ballany WTP

Annex B Study Area 4 Rejection Register Summary

Study Area 4 – Coarse Screening Rejection

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA4-02	Increase abstraction from Lough Lene (groundwater fed lake) for Ballany	This option relates to a complex Ground water supplied lake. The assessments undertaken in the plan indicate that it is already under pressure and therefore was rejected on the grounds of Resilience, Deliverability & Flexibility and Sustainability.	•	•	•
TG4-SA4-11a	Interconnect Ballany with Mullingar Regional and supply deficit. Possible link to Roharney- already supplies Ballany - new source required (New Shannon Source)	The option is the same as option TG4-SA4-10 which connects Ballany to Mullingar WRZ therefore this option was not taken forward to fine screening stage. TG4-SA4-10 is advanced to fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		
TG4-SA4-23	GW abstraction at Lisreeva for Ballymahon WRZ	This option is the same as option TG4-SA4-18 which interconnects Ballymahon and Lanesboro WRZs therefore this option is not taken forward to fine screening stage. TG4-SA4-18 is advanced to the fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		
TG4-SA4-32	New GW abstraction at Tullamore to partly supply deficit in Mullingar WRZ	This option is the same as option TG4-SA4-28 which involves a new GW abstraction at Arden to partly supply deficit at WRZ therefore this option is not taken forward to fine screening stage. TG4-SA4-28 is advanced to the fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		
TG4-SA4-35	New abstraction from L. Killinure and upgrade WTP to supply Athlone and Mullingar WRZs	This option involves a new abstraction from Lough Killinure. A planning application for a new abstraction from this source was withdrawn in 2020 for environmental reasons therefore this option was not taken forward to fine screening stage.	•	•	•
TG4-SA4-42	Part supply with Lough Lene from Ballany WRZ to Mullingar	The desktop assessments undertaken indicate that the sustainable allowable abstraction from Lough Lene is less than the existing 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-SA4-58	Increase GW abstraction at Clonuff	This WRZ is no longer in deficit and therefore there is no need to progress this option at this time.	Clonuff WRZ is no longer in deficit.		
TG4-SA4-78	Supply deficit in Geashill WRZ from neighbouring Ballinagar GWS (network upgrades required)	There was significant uncertainty on the yield available from the Group Water Scheme source, as there is no data available. As there are other viable options for this WRZ this option was considered unviable at coarse screening stage.		•	
TG4-SA4-79	Supply deficit in Geashill WRZ from nearby Killeigh/Cloneygowen GWS (approx. distance 1km; new watermains and network upgrades required)	There was significant uncertainty on the yield available from the Group Water Scheme source, as there is no data available. As there are other viable options for this WRZ this option was considered unviable at coarse screening stage.		•	
TG4-SA4-80	Rationalise Geashill WRZ to Tullamore WRZ (approx. distance 5km via Meelaghans GWS; new watermains and network upgrades required, new source required)	This option requires transferring water via a significant length of pipeline over 5Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of the water. As there are other viable local alternative options for this water resource zone, this option was considered unviable at coarse screening stage and not taken forward to fine screening.		•	
TG4-SA4-82	Rationalise Edenderry/Rhode to Mullingar Regional WRZ - connection point TBC (approx. distance 7.5km, new watermains and network upgrades required)	This option is the same as option TG4-SA4-66 which connects Edenderry & Rhode to a WSP source therefore this option is not taken forward to fine screening. TG4-SA4-66 is advanced to the fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA4-83	Rationalise Edenderry/Rhode to GDA (Poulaphouca Regional WSZ) - connection point TBC (approx. distance 5km, new watermains and network upgrades required)	This option is the same as option TG4-SA4-66 which connects Edenderry & Rhode to a WSP source therefore this option is not taken forward to fine screening. TG4-SA4-66 is advanced to the fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		
TG4-SA4-85	Supply deficit in Rhode WRZ from neighbouring Mountlucas GWS (south of the WSZ, network upgrades required)	There was significant uncertainty on the yield available from the Group Water Scheme source, as there is no data available. As there are other viable options for this WRZ this option was considered unviable at coarse screening stage.		•	
TG4-SA4-86	New SW source to supply deficit in Edenderry & Rhode WRZ. Nearby River Boyne	The River Boyne at this location is a tributary of the main channel designated as the River Boyne and River Blackwater SAC. The River Boyne is a Moderate status waterbody under WFD. It was determined that the sustainable allowable abstraction from the River Boyne at this location is 0.75 MLD, however additional supply of over 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-SA4-68	Increase GW abstraction at Daingean and upgrade Daingean WTP (poorly productive aquifer)	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Daingean WRZ is no longer in deficit.		
TG4-SA4-69	New GW source to supply Daingean	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Daingean WRZ is no longer in deficit.		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
	(Rhode groundwater body - productive fissured bedrock)				
TG4-SA4-87	Supply deficit from in Daingean WRZ from neighbouring Mountlucas GWS (east of the WRZ; network upgrades required)	There was significant uncertainty on the yield available from the Group Water Scheme source, as there is no data available. As there are other viable options for this WRZ this option was considered unviable at coarse screening stage.		•	
TG4-SA4-72	Increase GW abstraction at Clonbullogue	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Clonbullogue WRZ is no longer in deficit.		
TG4-SA4-73	New GW abstraction at Clonbullogue (Rhode groundwater body)	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Clonbullogue WRZ is no longer in deficit.		
TG4-SA4-88	Rationalise Clonbullogue to GDA (Rathangan WSZ) for increased resilience (approx. distance is 2.5km, network upgrades required)	This option requires transferring water via a pipeline of 15Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of the water. There are other viable local alternative options at the water resource zone level, therefore it was considered not feasible at coarse screening stage and not taken forward to fine screening stage.		•	
TG4-SA4-97	Rationalise Clonbullogue to Edenderry/Rhode WRZ (approx. distance is 7km, new watermains and network upgrades required)	This option is the same as option TG4-SA4-91 which involves a new WSP source. As a result, this option would not be considered at coarse screening stage and not taken forward to the fine screening stage. TG4-SA4-91 is advanced to the fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA4-89	New SW abstraction at Clonbullogue WRZ - River Figile	This option required significant works for a relatively small supply. There were other viable alternative options for this WRZ. Therefore, it was not considered feasible at coarse screening stage, due to age of water and possible sedimentation issues. As a result, the option was not taken forward to fine screening.		•	
TG4-SA4-90	Supply deficit in Clonbullogue WRZ from nearby Bracknagh GWS (south of the WSZ; approx. distance 1.5km; new watermains and network upgrades required)	This option would require a transfer of water for a relatively small supply. Transferring small quantities of water over short distances can affect water quality. There were other local options at the water resource zone level, therefore it is considered not feasible at the coarse screening stage and not taken forward to the fine screening stage.		•	
TG4-SA4-91	New connection point from New Shannon Source connecting to Clonbullogue	This option would require a transfer of water for a relatively small supply. Transferring small quantities of water over short distances can affect water quality. There were other local options at the water resource zone level, therefore it is considered not feasible at the coarse screening stage and not taken forward to the fine screening stage.		•	
TG4-SA4-75	Increase GW abstraction at Walsh Island and upgrade Walsh Island WTP	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Walsh Island WRZ is no longer in deficit.		
TG4-SA4-76a	New GW abstraction to supply Walsh Island (Rhode groundwaterbody - productive fissured bedrock)	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Walsh Island WRZ is no longer in deficit.		
TG4-SA4-76b	New GW abstraction to supply Walsh Island (Rhode	This WRZ is no longer in deficit and therefore an option for supply does not need to be progressed at this time.	Walsh Island WRZ is no longer in deficit.		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
	groundwaterbody - productive fissured bedrock)				
TG4-SA4-92	New GW abstraction to supply Walsh Island (Bagenalstown Upper groundwaterbody - karstic bedrock)	This option is the same as option TG4-SA4-74, which interconnects Clonbullogue with Walsh Island WRZs. As a result, option would not be assessed at coarse screening stage and not taken forward to fine screening stage. TG4-SA4-74 is advanced to the fine screening stage.	This option is a repeat and is assessed as part of a different feasible option.		
TG4-SA4-93	Supply deficit in Walsh Island WRZ from nearby Ballinagar GWS (approx. distance 1km; new watermains and network upgrades required)	There is an uncertainty around the yield for this option and would require a transfer of water via a pipeline of c.5km, of new/upgraded network to connect Walsh Island to Ballinagar, for a relatively small supply. Transferring small quantities of water over short distances can affect the water quality. There were other local options at the water resource zone level, therefore it is not considered feasible at coarse screening stage and not taken forward to fine screening stage.	●	●	
TG4-SA4-94	Supply deficit in Walsh Island WRZ from nearby Killeigh/Cloneygowen GWS (approx. distance 2.5km; new watermains and network upgrades required)	There is an uncertainty around the yield for this option and would require a transfer of water via a pipeline of c.2.5km of new network additional network upgrades to supply deficit from Killeigh GWS for a relatively small supply. Transferring small quantities of water over short distances can affect the water quality. There were other local options at the water resource zone level, therefore it is not considered feasible at coarse screening stage and not taken forward to fine screening stage.	●	●	
TG4-SA4-95	Rationalise Walsh Island WRZ to Portarlington WRZ (approx. distance 6.5km; new watermains and network upgrades required, new source required)	There is an uncertainty around the yield for this option and would require a transfer of water via a pipeline of c.3km of new network and 9km of network upgrades to rationalise Walsh Island to Portarlington, for a relatively small supply. Transferring small quantities of water over short distances can affect the water quality. There were other local options at the water resource zone level, therefore it is not considered feasible at coarse screening stage and not taken forward to fine screening stage.	●	●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and Social Impacts)
TG4-SA4-96	Rationalise Walsh Island WRZ to GDA WRZ (approx. distance 14km; new watermains and network upgrades required, new source required)	This option would require a transfer of water via a pipeline of 14km for a relatively small supply. Transferring small quantities of water over short distances can affect the water quality. There were other local options at the water resource zone level, therefore it is not considered feasible at coarse screening stage and would not be taken forward to the fine screening stage.		•	

Study Area 4 - FS Rejection

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG4-SA4-01	New GW abstraction at Ballany	The desktop assessments undertaken indicate that an abstraction at Ballany would lead to a direct pathway to R. Blackwater SAC, Lough Bane & Lough Glass SAC and White lough & lough Doo SAC all of which include fen type habitat. Given the potential for impacts, this option was rejected and not taken through to fine screening stage.		•	•
TG4-SA4-03	New SW abstraction from Lough Derravaragh	The desktop assessments undertaken indicate that a surface water abstraction from Lough Derravaragh may impact Lough Derravaragh SPA. There is also the potential to have a direct impact on the qualifying interests through the lowering of lake level and impacting shallow areas of the lake used as breeding habitat of its QIs. In addition, this is a groundwater fed lake and, with the lack of data available, there is too much uncertainty in relation to the potential impact. As a result, this option was rejected on the basis of Deliverability & Flexibility and Sustainability.		•	•
TG4-SA4-14	Supply deficit from Lough Forbes to Ballymahon and interconnect WRZs for increased resilience	This option is too costly to progress for the purposes of resilience only. It was therefore rejected on this bases but was considered as part of a new new supply option (TG4-SA4-15).		•	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG4-SA4-25	New SW abstraction from River Inny located approximately 18km of the existing Portloman WTP to supplement supply to Mullingar WRZ. New WTP at abstraction.	This is a duplicate of TG4-SA4-37.	This option is a repeat and is assessed as part of a different feasible option.		
TG4-SA4-27	Maintain and reduce abstraction from Lough Owel - close connection to canal and pump treated effluent from WWTP to canal to maintain satisfactory levels in the canal	In accordance with IW current abstraction authorisation, IW must discontinue abstraction at Lough Owel before the end of the decade. Therefore, conintued abstraction from Lough Owel is considered unlikely. On that basis further investment is not preferable and suitable alternative options are considered	•	•	•
TG4-SA4-38	Proposed connection point from potential desalination plant at a site in North Dublin. Pipeline to supply full Mullingar WRZ demand	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 Mullingar and for this reason, it was screened out at coarse screening.		•	
TG4-SA4-43	Part supply from developed GW wellfield north of Ballany	The desktop assessments undertaken in this plan indicate that an abstraction at Ballany would lead to a direct pathway to R. Blackwater SAC, Lough Bane & Lough Glass SAC and White lough & lough Doo SAC all of which include fen type habitat. Given the potential for impacts, this option was rejected and not taken through to fine screening stage.		•	•