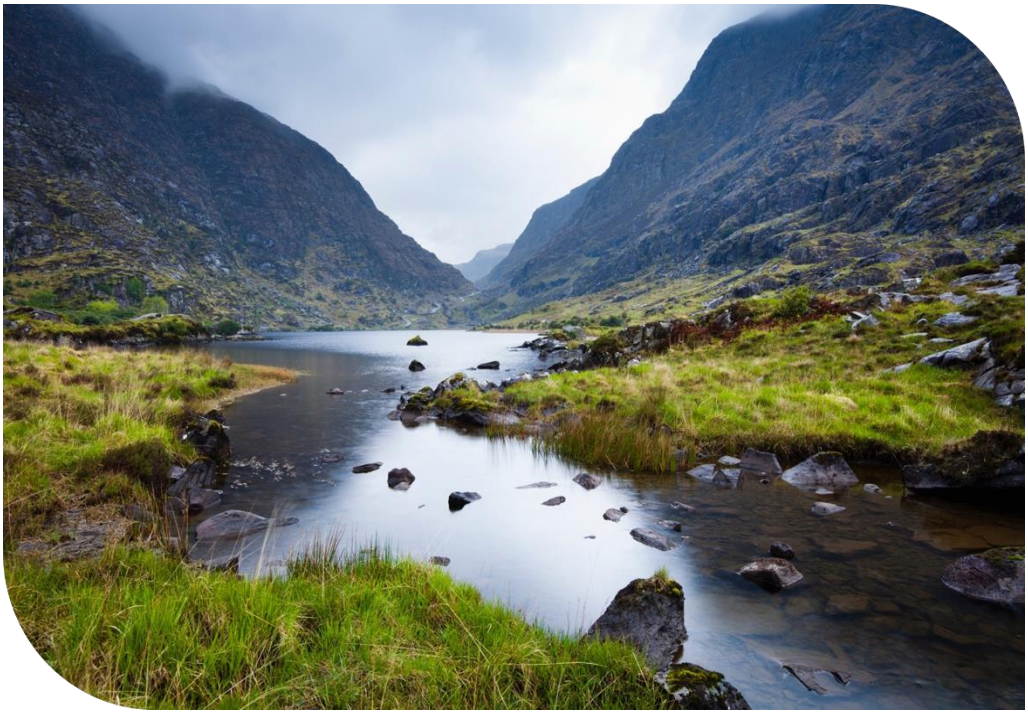
Autumn 2022

Regional Water Resources Plan – Eastern and Midlands

Appendix 1 Study Area 1 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.

Table of Contents

1 Introduction and Background

1 Introduction – Study Area 1

This is the Technical Report for Study Area 1 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 18 water resource zones located in County Wicklow and Wexford. 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 and 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.

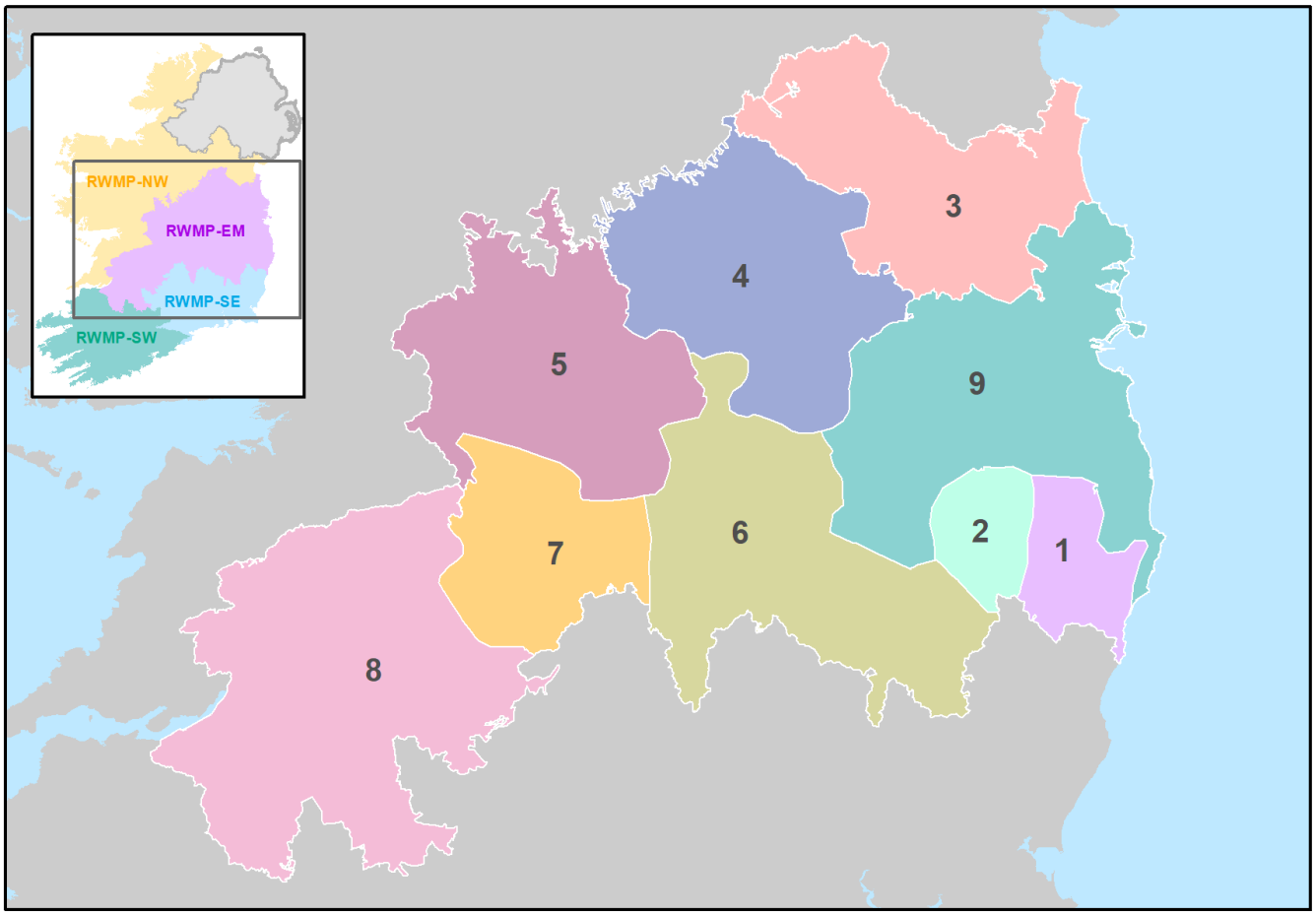


Figure 1.1 Overview of Study Areas within the Eastern and Midlands Region.

This Technical Report is for Study Area 1 (SA1), which consists of 18 individual water resource zones (WRZs). Within this Study Area, the Preferred Approach has been developed following the process shown in Figure 1.2 and as outlined in Section 8.3 of the Framework Plan.

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 national plan. 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.

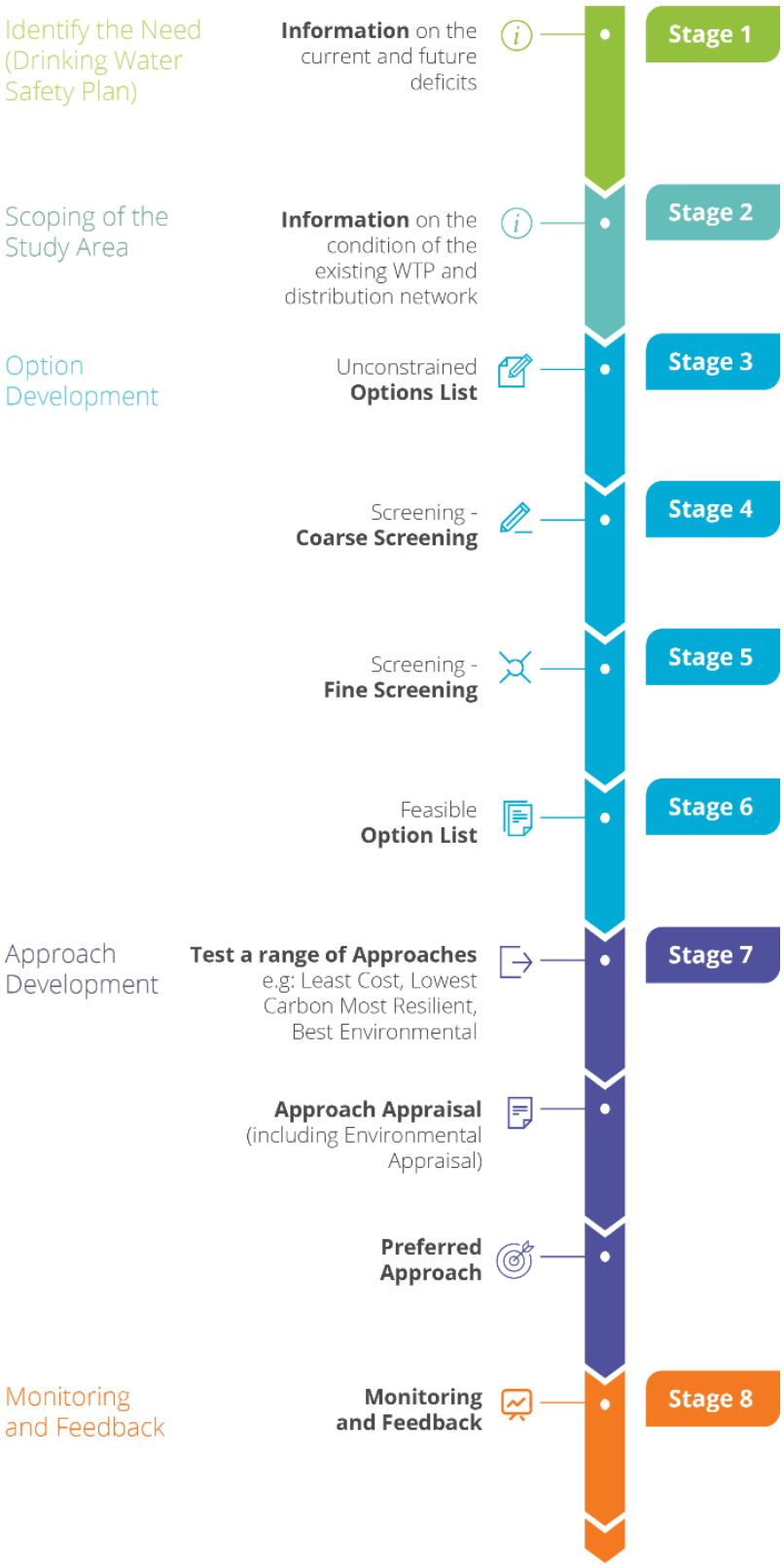


Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

Study Area 1 includes the area to the south of Wicklow Town and environs, and to the north of county Wexford. The Study Area is summarised in Figure 1.3 and Table 1.1.

The population within SA1 is approximately 24,000 people, served via 18 Water Resource Zones and 320 kilometres of distribution network. The study area is summarised in Figure 1.3. The area predominantly consists of small settlements. The sources of water include 15 groundwater sources and 5 surface water supplies.

SA1 is mainly located within the River Avoca catchment basin. The Avoca basin has three main rivers – the Avonmore, Avonbeg and Aughrim – which rise in the Wicklow Mountains and drain south easterly through the study area to the Irish Sea at Arklow. The majority of the existing SW sources supplying the area are small abstractions from minor tributaries within the Avoca basin. There is also a small abstraction from River Derry at Tinahely, which is part of the large River Slaney catchment basin in the south west of the study area.

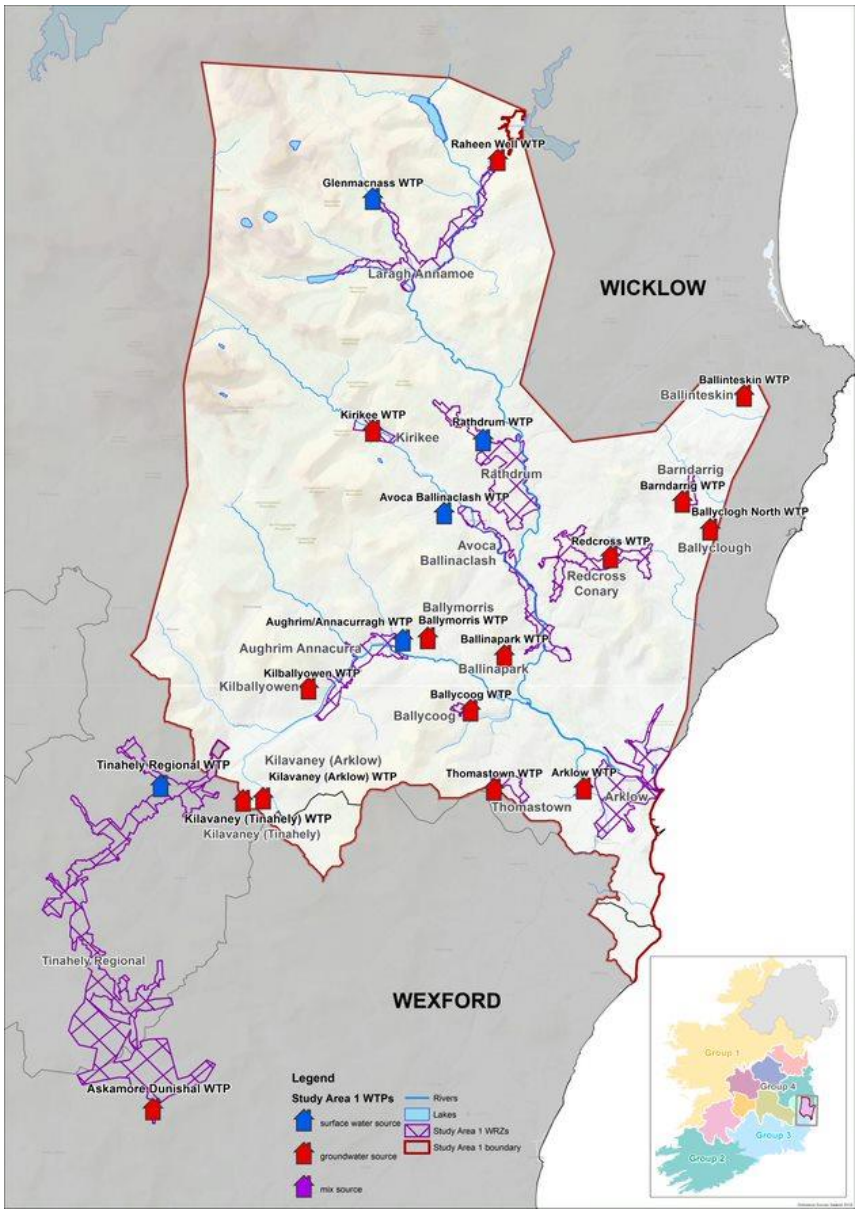


Figure 1.3 SA1 Mid Wicklow Water Supply Study Area

Note Tinahely Regional WTP and Askamore Dunishal WTP are in the Tinahely WRZ. While this WRZ is outside the Study Area it is reported in SA1 and SAM (South East Region) appendix as the WRZ is located directly on the boundary of SA1 and SAM.

The landscape of Co. Wicklow reflects the varied underlying geology. The mountains in the centre of the country are composed of Granite, with older Ordovician and Silurian metamorphic rocks to the east and west. The entire region is considered to be of poorly productive aquifer status, and much of the bedrock geology here is classed as Locally Important Aquifer/ or Poor Aquifer. Overall, of the 15 groundwater supplies managed by Irish Water in the region, they abstract relatively small volumes between 3m³/d to 350m³/d. Due to these relatively low volumetric requirements within the smaller water resource zones in SA1, groundwater sources are both sufficient yet sustainable to meet local needs. 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 SA1 Study Area Summary

Mid Wicklow	Total Population	24,050	Total Network Length (km)	320	Number of Water Resource Zones	18
Counties in Study Area	Wexford, Wicklow					
Principal Settlements	Arklow, Ashford,Rathdrum,Aughrim,Glenealy,Roundwood,Avoca,Laragh,Ballinaclash,Redcross,Barndarrig					
Number of Water Sources	20	Surface Water Sources	5	Groundwater Sources	15	

Water Treatment Plant	Source	Population	WTP Capacity (m^3/day)	Quality	Quantity	Reliability	Potential Sustainability
Raheen WTP	Groundwater	658	260	●	●	○	○
Glenmacnass WTP	Glenmacnass River		300	○	●	○	○
Rathdrum WTP	Tributary of Avonbeg Ballinder	1,889	537	○	●	●	●
Killballyowen Aughrim WTP	Groundwater	17	7	●	●	○	●
Ballymorris WTP	Groundwater		5	●	●	○	●
Kilavaney Tinahely WTP	Groundwater	6	9	●	○	○	○
Ballyclogh WTP	Groundwater	12	3	●	○	○	○
Kilavaney WTP	Groundwater	8	9	●	○	○	○
Ballinapark WTP	Groundwater	10	4	●	●	○	●
Ballinteskin WTP	Groundwater	51	12	●	●	○	●
Kirikee WTP	Groundwater	88	64	●	●	○	●

Thomastown WTP	Multiple Groundwater	179	100	●	●	●	●
Ballycoog WTP	Groundwater	52	56	●	●	●	●
Barndarrig WTP	Groundwater	217	187	●	●	●	●
Redcross WTP	Groundwater	577	350	●	●	●	●
Avoca Ballinaclash WTP	Tributary of Avonbeg River	1,345	380	●	●	●	●
Aughrim / Annacurragh WTP	Three Wells Stream	1,624	330	●	●	●	●
Tinahely Regional WTP	Derry River	3,282	2,400	●	●	●	●
Arklow (Ballyduff) WTP	Multiple Groundwater	13,688	6,764	●	●	●	●
Askamore Dunishal WTP	Multiple Groundwater	326	80	●	●	●	●

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

2 Scoping the Study Area 1

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in Study Area 1, 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 SA1 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**
Raheen WTP	●	●	●	●
Glenmacnass WTP	●	●	●	●
Rathdrum WTP	●	●	●	●
Killballyowen Aughrim WTP	●	TBC*	●	●
Ballymorris WTP	●	TBC*	●	●
Kilavaney Tinahely WTP	●	●	●	●
Ballyclogh WTP	●	●	●	●

Quality: Barrier Scores				
Water Treatment Plants	**Barrier 1: Bacteria & Virus**	**Barrier 2.1: Maintain chlorine Residual in the Network**	**Barrier 3 Protozoa (Crypto) Asset Potential**	**Barrier 6b THM's Leading Indicator**
Kilavaney WTP	●	●	○	○
Ballinapark WTP	●	●	○	○
Ballinteskin WTP	○	○	●	○
Kirikee WTP	○	●	●	○
Thomastown WTP	○	○	●	○
Ballycoog WTP	○	○	●	○
Barndarrig WTP	○	○	●	○
Redcross WTP	○	●	●	○
Avoca Ballinaclash WTP	○	●	○	○
Aughrim / Annacurragh WTP	○	●	○	●
Tinahely Regional WTP	○	●	○	○
Arklow (Ballyduff) WTP	○	○	○	○
Askamore Dunishal	○	○	●	○

*Water Treatment plant to be tested

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, 16 of the 20 WTPs in the Study Area are considered to be at high risk of failing to achieve the required standards in relation to primary disinfection (Barrier 2.1) and effectiveness of our Protozoa removal processes (Barrier 3). However, in some cases our desktop assessments can over-estimate risk, particularly when there is little available data on the catchment characteristics of our raw water sources. As our "Source to Tap" Drinking Water Safety Plan (DWSP) assessments, which are a requirement under the Recast Drinking Water Directive (2020), are developed for each water supply, the barrier scores for all of our supplies will be updated and become more reliable.

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

At present there are 2 WTPS within Study Area 1 on the Environmental Protection Agency (EPA) Remedial Action List (RAL), Aughrim / Annacurragh WTP and Ballymorris WTP.

Irish Water is currently progressing immediate corrective action in advance of the NWRP for a number of supplies within SA1. A national programme to improve disinfection standards (Barrier 1) at water treatment facilities across Ireland was initiated by Irish Water in 2016. Details of the 'in progress' projects to address critical water quality requirements are included in Table 2.2.

Table 2.2 Critical Water Quality Requirements SA1 – Mid Wicklow

Critical Water Quality Requirements	Progress
1.Avoca/Ballinaclash: Upgrade works at the water treatment plant, including installation of new Clarification, Filtration & Disinfection systems.	**Complete**
2.Aughrim/Annacurra: The water supply is on the EPA Remedial Action List due to Trihalomethane (THM) exceedance. The solution is to rationalise the supply to Arklow WRZ.	**In Design**
3. Ballymorris WTP: The water supply is on the EPA Remedial Action List due to Trihalomethane (THM) exceedance and there is currently in place. The Solution being progressed is to rationalise the supply to Arklow WRZ.	**In Design**
3.Kilavaney: Initial borehole assessments have been completed, and site is under review as part of NWRP	**Assessment Complete**
4.Reservoir Cleaning Programme: A major reservoir cleaning programme has been undertaken in reservoirs in Arklow & Redcross, which has reduced network water quality issues.	**Completed**
5.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. To date, the Disinfection Programme has completed upgrade works at 11 of the 18 water resource zones in SA1. • Avoca Ballinaclash • Ballinapark • Ballinteskin • Ballyclogh • Killballyowen (Annacurra) • Killballyowen (Aughrim) • Laragh Annamoe • Raheen • Rathdrum • Redcross Conary • Roundwood Any requirements within the remaining supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP	**Ongoing**
6.Arklow/Ballyduff: New water treatment plant, boreholes and pipework constructed to improve water quality and security of supply for the town.	**Complete**

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

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

2.2 Water Quantity – Supply Demand Balance

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

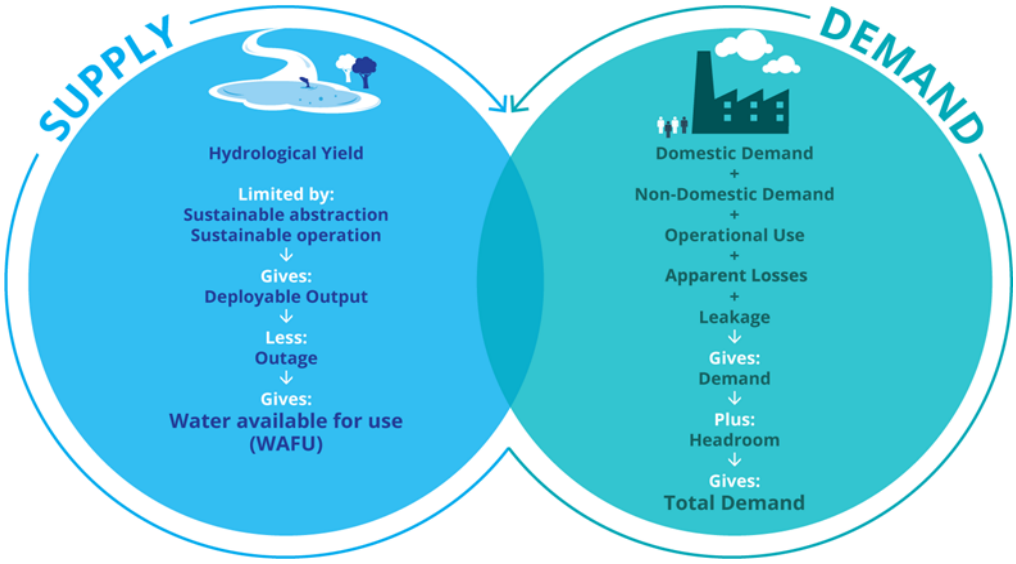


Figure 2.1 Supply Demand Balance

For each of the 18 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 SA1 manifest in the following ways:

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

historical monitoring, particularly in relation to groundwater supplies, some of the deficits may be data driven.

2. **Day to day operations:** 13 out of 18 water resource zones in the area suggest a supply demand balance deficit (based on a “do nothing” approach) under present & future scenarios. While sufficient during normal weather conditions, several would fail in drought. During the drought in summer 2018, all of our groundwater supplies were monitored due to falling levels in the groundwater bodies, and two of the supplies Barndarrig and Kirikee were severely impacted.

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

Table 2.3 WRZ SDB Dry Year Critical Period Deficits (DYCP)

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Laragh Annamoe Public Supply	3400SC0047	658	-62	-71	-76	-81	-86	-90
Rathdrum Public Supply	3400SC0046	1,889	-356	-381	-403	-417	-431	-442
Kilballyowen (Aughrim) Public Supply	3400SC0035	17	-4	-4	-4	-4	-4	-4
Ballymorris Public Supply	3400SC0033	17	-3	-3	-3	-3	-3	-3
Killavaney Public Supply (Tinahely)	3400SC0032	6	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Ballyclogh Public Supply	3400SC0031	12	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Killavaney Public Supply (Arklow)	3400SC0030	8	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Ballinapark Public Supply	3400SC0027	10	-19	-20	-20	-20	-20	-20
Ballinteskin Public Supply	3400SC0025	51	-19	-20	-20	-20	-20	-21
Kirikee Public Supply	3400SC0021	88	-16	-17	-18	-18	-19	-20
Thomastown Public Supply	3400SC0020	179	-6	-8	-9	-10	-11	-12
Ballycoog Public Supply	3400SC0018	52	-32	-34	-34	-35	-35	-36
Barndarrig Public Supply	3400SC0017	217	-55	-58	-60	-62	-65	-66

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Redcross Conary Public Supply	3400SC0012	577	-144	-151	-155	-158	-162	-165
Avoca Ballinaclash Public Supply	3400SC0007	1,345	-71	-80	-88	-96	-105	-111
Aughrim Annacurra Public Supply	3400SC0006	1,624	-252	-262	-271	-280	-289	-297
Tinahely Regional Supply	3400SC0002	3,608	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Arklow Public Supply	3400SC0001	13,688	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit

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 1,039 m^3/day for the Study Area. As a result, while we can continue to supply water, the water supplies in this area may come under pressure, particularly in drought conditions. In addition, there may be ongoing reliability issues.

This situation will further deteriorate over time due to climate change driven reductions in water resources, together with increased demand due to population growth. If we do nothing, the SDB deficit is estimated to increase to approximately 1,287 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 and distribution networks.

There are a number of problematic distribution and trunk mains throughout SA1. 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 1. This provides for a more reliable water supply, reducing instances of bursts and water outages. The works also improve water quality by replacing old cast iron and lead watermains, whilst reducing leakage and improving overall operation and maintenance of our supply system.

During our needs assessment for SA1 Irish Water has identified a number of critical requirements for upgrades to the existing asset base, including storage and trunk main requirements. Progress to date on these projects is summarised in Table 2.4.

Table 2.4 SA1 Critical Infrastructure Projects and Need Identification

Critical Requirement	Progress
1. **Lamberton Reservoir Refurbishment works:** A structural survey at Lamberton reservoir site found the existing water tower and large reservoir needed rehabilitation while the older small reservoir needed replacement. In 2018 these works were completed providing security of supply for the town of Arklow and a population of approx. 14,000	**Completed 2018**
2. **Arklow River crossing** 1No. 150mm uPVC and 1No. 100mm uPVC main cross the Arklow river via the road bridge and provide all the supply to those areas north of the river. Development potential is severely curtailed but failure of either of these mains would mean a difficult repair and loss of service to a population of approx. 3,200.	**Assessment Complete**
3. **Rathdrum Supply:** Insufficient yield from surface water source during DYCP demand. Poor-yielding borehole at reservoir site. Production struggled during 2018 drought period and tankering was required to maintain supply to a population of approx. 1,900. Development of new production well in progress.	**Under Construction**
4. **Ballycoog Storage:** Currently no treated water storage is available for Ballycoog WRZ. Demand is less than 50m^3/d below current Asset Planning storage threshold.	**Assessment Complete**
5. **Barndarrig Borehole** Poor yield during DYCP demands. Particular issues maintaining supply to a population of approx. 200 during the 2018 drought period.	**Assessment Complete**
6. **Boreholes at Roundwood WTP (Roundwood WRZ)** Intermittent production issues at boreholes (albeit performed satisfactorily during 2018 drought period) leading to low levels of supply to a population of approx. 900. Proposal to supply water via new pumps and rising main from Vartry WTP.	**Assessment Complete**
7. **Boreholes at Raheen WTP (Laragh Anamoe WRZ)** Intermittent production issues at boreholes (albeit performed satisfactorily during 2018 drought period) leading to low levels of supply to a population of approx. 700.	**Assessment Complete**
8. **New 300mm Glenealy supply main from Wicklow (Vartry) :** The Barnbawn source for the Glenealy scheme of approx. 300 population is unreliable and susceptible to THM formation. Current plan is to replace this source with the treated water supply from Vartry WTP via a new pipeline and connection to the trunkmain at Milltown near Rathnew.	**Assessment Complete**
9. **Borehole at Kirikee WTP:** Only one (low-production) borehole in service, no stand-by at this location to serve a population of approx. 90. Tankering required if/when demand exceeds 18m^3/day which has occurred during previous summers.	**Assessment Complete**
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 pending Abstraction Legislation on the SA1 Mid Wicklow Supplies, we have assessed the potential impacts on our 5 no. surface water abstractions: Mill Glen Stream (Rathdrum), River Avonbeg trib. (Avoca Ballinaclash), Glenmacnass River (Laragh), River Derry (Tinahely), and Three Wells Stream (Aughrim).

Table 2.5 presents the findings of this assessment in order to indicate the potential reductions to abstraction that may be required at our existing surface water supplies. The table presents our current abstraction levels[1], our source hydrological yield[2], and our estimated potential sustainable abstraction[3] amount which the source may be limited to in the future.

Based on this initial assessment, the volumes of water abstracted at Mill Glen Stream (Rathdrum), River Avonbeg tributary (Avoca Ballinaclash), River Derry (Tinahely), and Three Wells Stream (Aughrim) may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, sustainable abstraction quantities will be adjudicated by the EPA. We have assumed, given the need to maintain supplies, that a transition to new abstraction quantities would likely take place in the medium term.

[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	Mill Glen Stream (Rathdrum)	Avonbeg trib. (Ballinaclash)	Glenmacnass River (Laragh)	River Derry (Tinehely)	Three Wells Stream (Aughrim)
Current abstraction (m^3/day)	492	348	275	2,200	303
Hydrological yield (m^3/day)	370	600	2,228	4,164	356
Theoretical Future abstraction (m^3/day)	79	122	610	1,028	49

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	Mill Glen Stream (Rathdrum)	Avonbeg trib. (Ballinaclash)	Glenmacnass River (Laragh)	River Derry (Tinehely)	Three Wells Stream (Aughrim)
Potential change in SDB[4](m^3/d)	-237	-249	none	-1,361	-261

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

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

groundwater sources. We are not in a position to estimate changes to the groundwater availability until better data is available.

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

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

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

2.5 Water Resource Zone Needs Summary

Study Area 1 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
Quantity	Additional Leakage Targets of 625 m³/d to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500 m³/d Interim additional supplies of 1,085 m3/d within 10 years Total of 1,287m3/d additional supplies beyond the 10 year horizon
Reliability (In addition to projects in	Continued network upgrades and improvements in the bulk and distribution networks and storage
Sustainability	Based on our initial desktop assessment, the volumes of water abstracted The volumes of water abstracted at Mill Glen Stream (Rathdrum), River Avonbeg tributary (Avoca Ballinaclash), River Derry (Tinahely), and Three Wells Stream (Aughrim) 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 1

3 Solution Types Considered in Study Area 1

In this chapter, we summarise the type of solutions we have considered to address identified need for treated drinking water supply in Study Area 1.

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

3.1 Leakage Reduction

The Leakage reduction measures across the public water supply considered for SA1 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 **Error! Reference source not found.** have been a pplied 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 1,500m3/d, see Table 3.1.

Table 3.1 SELL Targets for WRZ in SA1

WRZ	Net Leakage Reduction applied to SDB(m^3)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d (m^3)	Leakage Targets to achieve SELL (m3)
Arklow Public Supply		490	490
Redcross Conary Public Supply		78	78
Ballycoog Public Supply		10	10
Ballinteskin Public Supply		14	14
Ballinapark Public Supply		12	12
Killavaney Public Supply (Arklow)		1	1

WRZ	Net Leakage Reduction applied to SDB(m^3)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d (m^3)	Leakage Targets to achieve SELL (m3)
Ballymorris Public Supply		2	2
Kilballyowen (Aughrim) Public Supply		2	2
Laragh Annamoe Public Supply		15	15

3.2 Water Conservation

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

3.3 Supply Smarter

The supply options considered as part of the options development are unconstrained by distance from SA1 and include:

- 27 stand-alone groundwater options, across the region
- 12 stand-alone surface water options, across the region
- 1 raw water connection
- 62 options to rationalise[5] to another WRZ
- 6 Water Treatment Plant Upgrades

[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 SA1

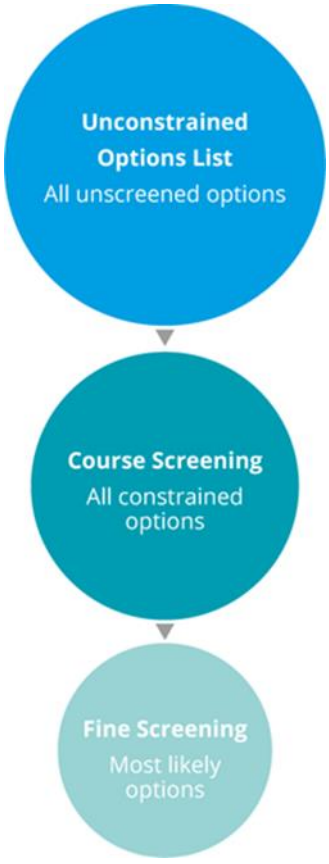
4 Option Development for Study Area 1

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

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

The options assessment screening process involves the following:

- Developing a long list of unconstrained options – Unconstrained Options constitute all of the possible solutions, which either fully or partly resolve a water supply deficit, regardless of any cost, environmental or social constraints. In developing the Unconstrained List, we identify options that are applicable to meet the needs of the study area;
- Coarse Screening – We filter the unconstrained options using a coarse screening assessment where we remove any options that fail to meet desktop assessment criteria under: Resilience, Deliverability and Flexibility or Sustainability (Environmental and Social Impacts); and
- Fine Screening – We filter the remaining options from the coarse screening exercise through a fine screening assessment, which includes 33 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 and Appendix A 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 SA1, 109 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 SA1 Unconstrained Options

No. of Options	Option Type
27	Groundwater
12	Surface water
1	Raw water connection
63	Rationalise to another supply
6	Upgrade Water Treatment Plant

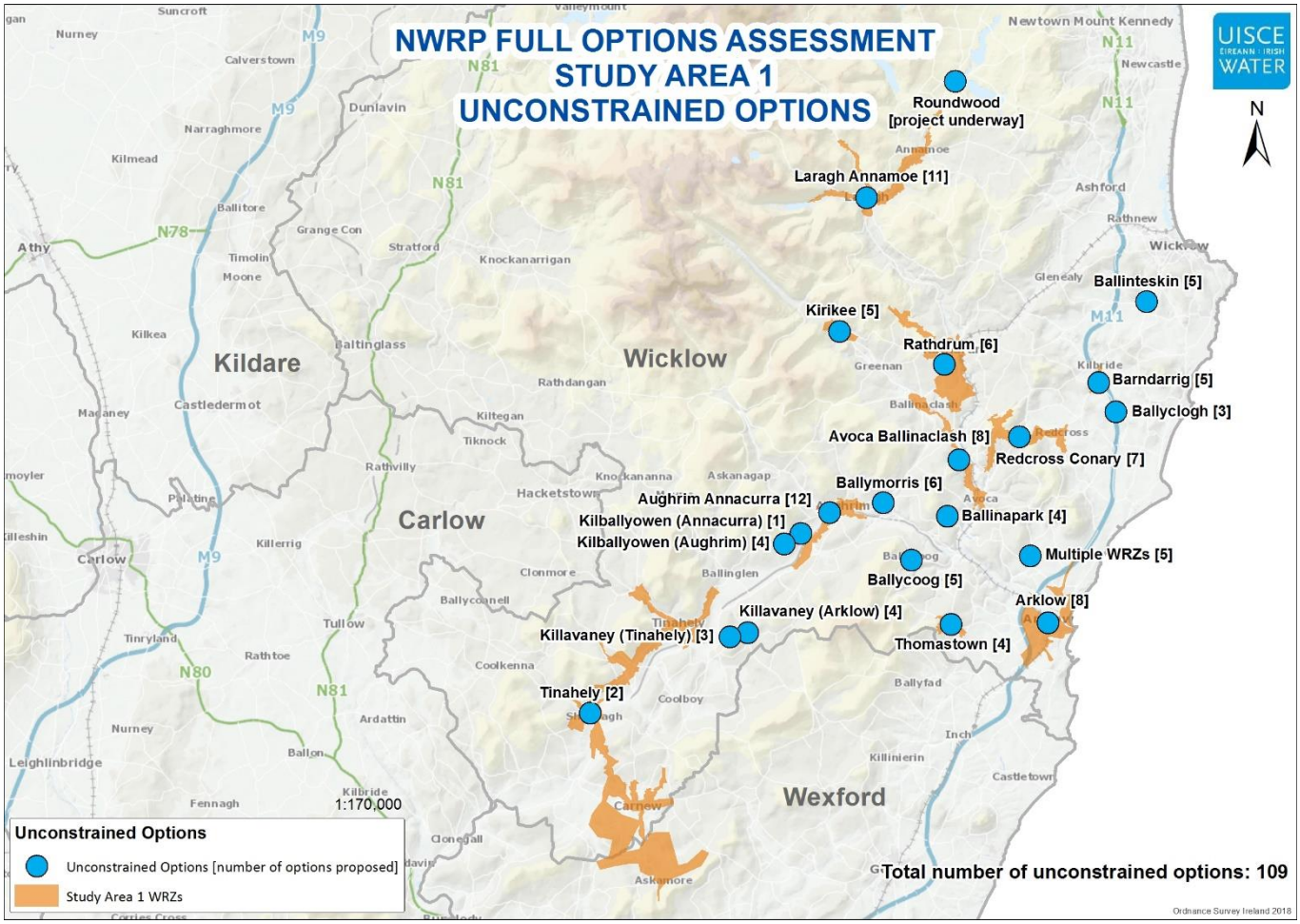


Figure 4.1 SA1 Unconstrained Options

The 109 options were filtered through our screening process to eliminate those with potentially unviable environmental impacts or feasibility issues.

4.2 Coarse Screening

The 109 Unconstrained Options were assessed through Coarse Screening against the criteria of:

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

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

55 Unconstrained Options were rejected at this stage as they were found to be unviable in relation to one or more assessment criteria. Details of these options and the justification for their rejection are outlined in the rejection summary, Annex B of this report.

The rejection summary records the criteria against which the rejected options were assessed as having a ‘red’ score for the purposes of the coarse screening exercise (as explained in more detail in Chapter 8 of the framework plan), and accordingly were not brought forward at the coarse screening phase. The box below provides an example of a rejection justification for an option considered for the WRZs.

Example Rejected Option

Option SA1-501

Rationalise Arklow Public Supply, Aughrim Annacurra Public Supply, Avoca Ballinaclash Public Supply, Ballinapark Public Supply, Ballinteskin Public Supply, Ballyclogh Public Supply, Ballycoog Public Supply, Ballymorris Public Supply, Barndarrig Public Supply, Kilballyowen (Aughrim) Public Supply, Killavaney Public Supply (Arklow), Killavaney Public Supply (Tinahely), Kirikee Public Supply, Laragh Annamoe Public Supply, Rathdrum Public Supply, Redcross Conary Public Supply, Thomastown Public Supply and Tinahely to Vartry WTP.

Rejection Reason

This was considered part of a grouped option to rationalise 19 WTPs to Vartry WTP. The option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, it was considered not feasible at coarse screening stage due to age of water and sedimentation and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.

The option requires a significant length of new pipeline of over 6km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water and sedimentation of mains. Therefore as there were other viable options for these WRZs this option was not considered feasible at coarse screening stage.

The remaining 54 options were progressed to further assessment through the Fine Screening process. The rejected options are summarised in Annex B of this technical report. Annex B 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 options remaining after Coarse Screening are summarised by type in Table 4.3.

Table 4.3 SA1 Remaining Options after Coarse Screening

No. of Options	Option Type
19	Groundwater
8	Surface water
1	Raw water connection
23	Rationalise to another supply
3	Upgrade Water Treatment Plant

4.3 Fine Screening

The 54 remaining options were subject to a more detailed multi-criteria assessment (MCA) at the Fine Screening Stage using desktop assessments of performance against 33 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, no further options were rejected, with the remaining 54 options are considered to be feasible and brought forward to desktop outline design and costing. These are summarised in Table 4.4 and shown spatially Figure 4.2.

Table 4.4 SA1 Remaining Options after Fine Screening (Feasible Options)

No. of Options	Option Type
19	Groundwater
8	Surface water
1	Raw water connection
23	Rationalise to another supply
3	Upgrade Water Treatment Plant

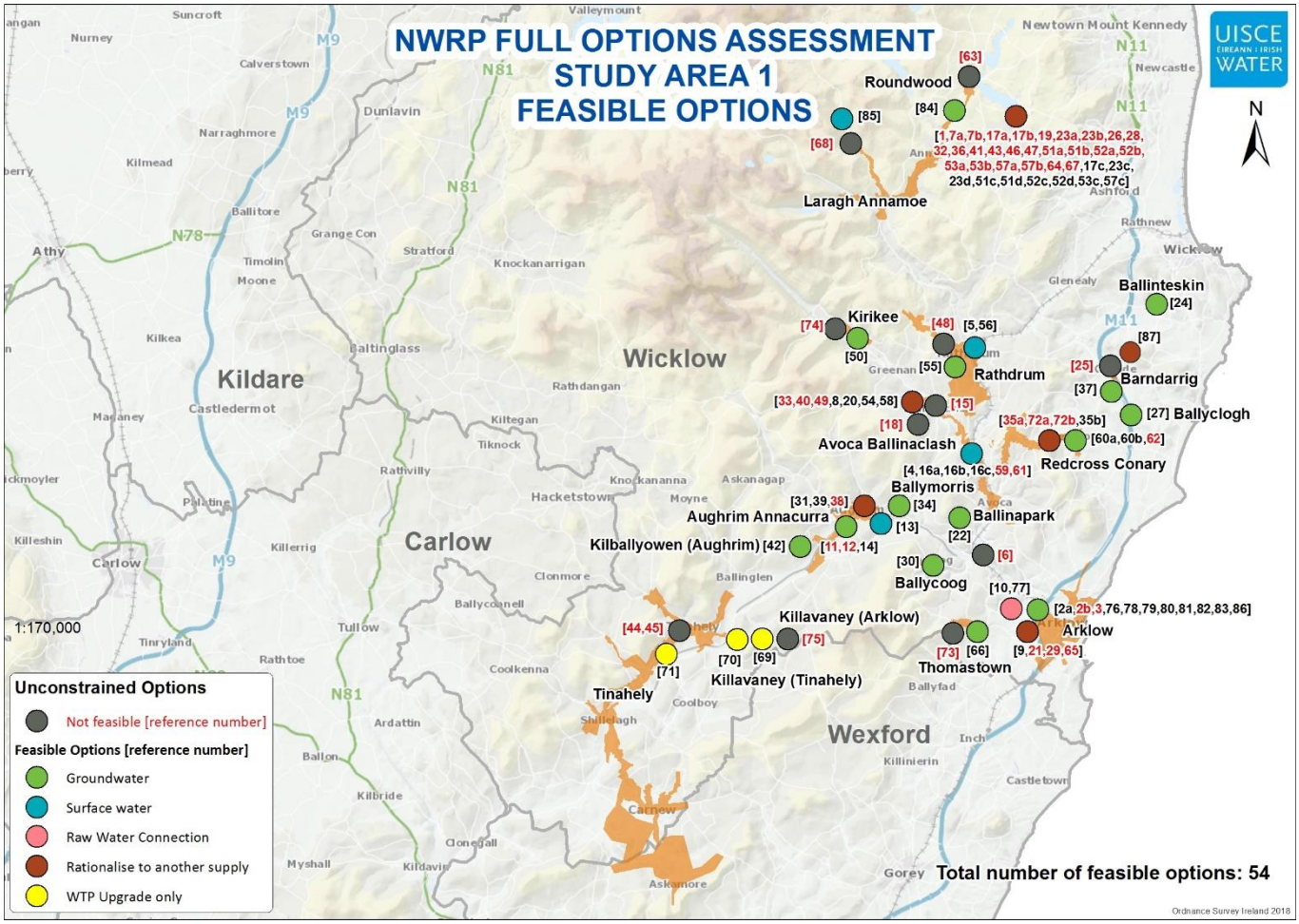


Figure 4.2 Fine Screening (Feasible Options)

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 estimated SDB deficit in the region ranges between 977m^3/d in 2019 during dry conditions, to a maximum of 1,287 m^3/d in 2044 during dry conditions. During the options assessment stage, a total of 109 unconstrained options were assessed. Of these, 55 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
3	Resilience
46	Deliverability & Flexibility
4	Resilience, Sustainability & Deliverability & Flexibility
2	Other reasons such as repeat options or Operational Options which did not provide additional supply

The remaining 54 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 1. From this table it can be noted that there are 26 WRZ Options and 28 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 SA1 Feasible Options Summary

Water Resource Zone Name	Option Type	
	WRZ Option	Study Area Option
Arklow Public Supply	1	4
Aughrim Annacurra Public Supply	3	7
Avoca Ballinaclash Public Supply	1	5
Ballinapark Public Supply	2	0
Ballinteskin Public Supply	1	1
Ballyclogh Public Supply	1	0
Ballycoog Public Supply	1	0
Ballymorris Public Supply	2	2
Barndarrig Public Supply	1	2
Kilballyowen (Aughrim) Public Supply	2	0
Killavaney Public Supply (Arklow)	1	0
Killavaney Public Supply (Tinahely)	1	0
Kirikee Public Supply	1	0
Laragh Annamoe Public Supply	2	2
Rathdrum Public Supply	3	2
Redcross Conary Public Supply	1	3
Thomastown Public Supply	1	0
Tinahely	1	0

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 1.

5.1 Approach Development

5.1.1 Introduction to Approach Development

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

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

Table 5.1 The Six Approaches

Approaches Tested	Description	Policy Driver
Least Cost	Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social and Carbon Costs.	Public Spending Code
Best Appropriate Assessment (AA)	Lowest score against the European Sites (Biodiversity) sub-criteria question: Score = 0 equates to no likely significant effects (LSEs). If, in our opinion, these 0 scoring options meet the deficit/ plan objectives, they are automatically picked as the Preferred Approach. Score = -1 or -2 equates to LSEs that can be addressed with general/standard mitigation measures. Score = -3 equates to LSEs that may be harder to mitigate or require significant project level assessment.	Habitats Directive
Quickest Delivery	Based on an estimate of the time taken to bring an option into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening This is particularly relevant where an option might be required to address an urgent Public Health issue.	Statutory Obligations under the Water Supply Act and Drinking Water Regulations

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

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

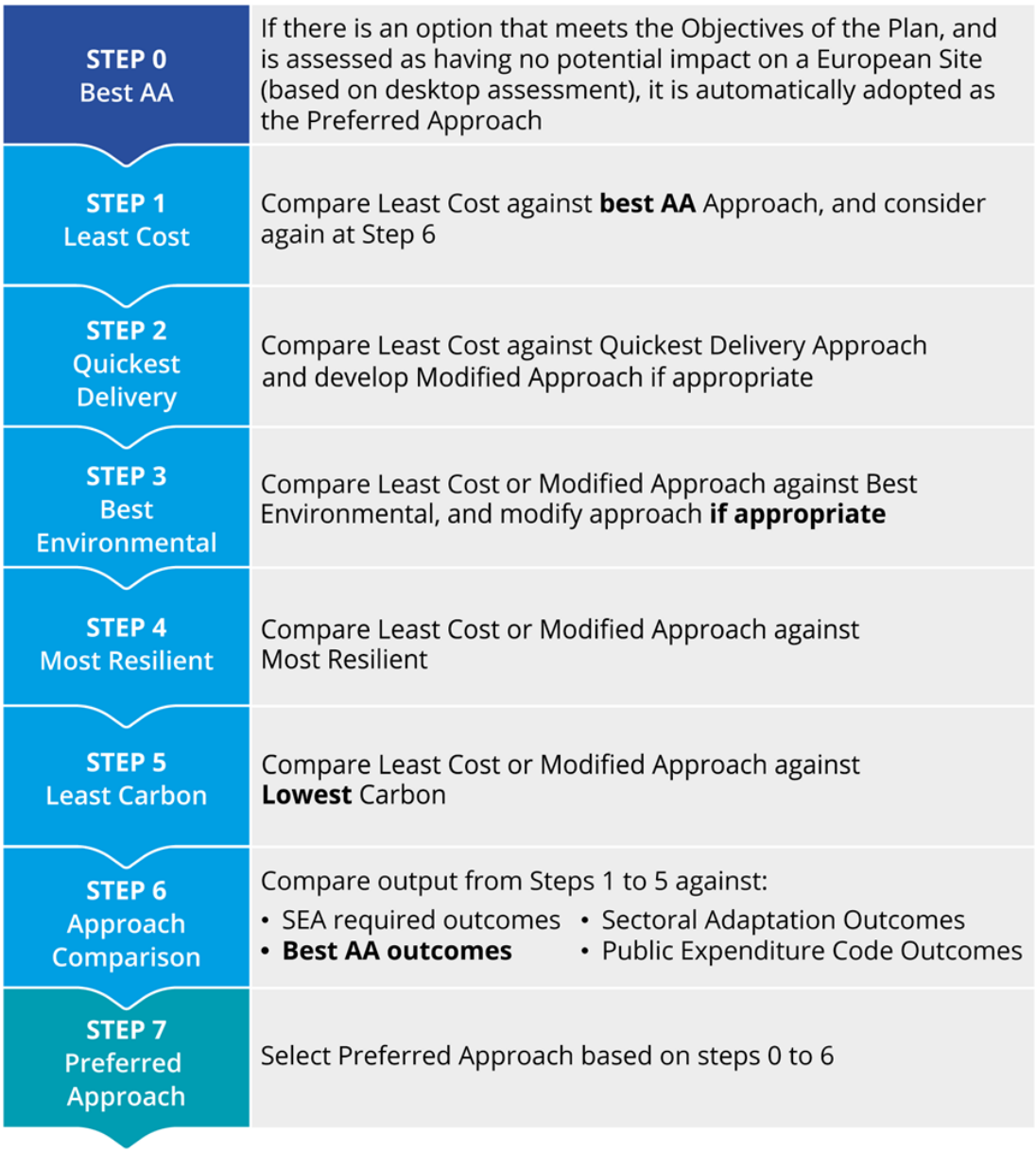


Figure 5.1 Figure of the 7 step assessment process

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

- **Stage 1** – We assess the water resource zones individually to develop an initial Preferred Approach, the **WRZ Preferred Approach** for all of the supplies in the Study Area
- **Stage 2** – We assess whether there are any larger options that might resolve deficits across multiple WRZs within a Study Area. We then develop combinations of these options (SA Combinations).
- **Stage 3** – We assess the SA Combinations and the WRZ Level approach in order to determine the best performing combination. This is known as the Preferred Approach at SA Level.

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

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

Further details on these three stages is provided in Chapter 7 of the RWRP -EM. Section 5.2 provides an overview of the application of this process to SA 1.

5.2 Preferred Approach Development Process for Study Area 1

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this technical report there are 54 feasible options. 26 of these options are WRZ Options while 28 options are merged to form 11 Study Area Options. Table 5.2 outlines the 26 WRZ options for SA1, 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 SA1 Feasible Options

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow	
	Option Code	Option Description
Aughrim Annacurra Public Supply	SA1-010	Raw water connection from Woodenbridge wellfied to new WTP at Aughrim
Aughrim Annacurra Public Supply	SA1-013	new abstraction from Aughrim River near WTP
Aughrim Annacurra Public Supply	SA1-014	new GW source
Avoca Ballinaclash Public Supply	SA1-016a	new SW source from River Avoca (10% of Q95 is 15MLD)
Ballinapark Public Supply	SA1-020	rationalisation of Ballinapark Pump Station to Avoca Ballinaclash WTP
Ballinapark Public Supply	SA1-022	Ballinapark Public Supply - Increase GW abstraction
Ballinteskin Public Supply	SA1-024	Increase GW abstraction
Ballyclogh Public Supply	SA1-027	WTP Upgrade/ Increase GW abstraction
Ballycoog Public Supply	SA1-030	Increase GW abstraction
Ballymorris Public Supply	SA1-031	rationalisation of Ballymorris WTP to Aughrim WTP (requiring new source)
Ballymorris Public Supply	SA1-034	Increase GW abstraction
Barndarrig Public Supply	SA1-037	Increase GW abstraction

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow	
	Option Code	Option Description
Kilballyowen (Aughrim) Public Supply	SA1-039	rationalisation of Killballyowen Aughrim Pump Station to Aughrim WTP. Need to upgrade the main if rationalising to Aughrim WTP.
Kilballyowen (Aughrim) Public Supply	SA1-042	Increase GW abstraction
Kirikee Public Supply	SA1-050	New GW on site and near existing BH
Rathdrum Public Supply	SA1-054	rationalisation of Rathdrum WTP to Avoca Ballinaclash WTP
Rathdrum Public Supply	SA1-055	new GW source
Rathdrum Public Supply	SA1-056	New SW abstraction from River Avonmore (10% of Q95 is 13.4 MLD)
Redcross Conary Public Supply	SA1-060a	Increase GW abstraction
Thomastown Public Supply	SA1-066	Increase GW abstraction
Killavaney Public Supply (Arklow)	SA1-069	No Deficit - Do nothing but upgrade WTP for Quality need
Killavaney Public Supply (Tinahely)	SA1-070	No Deficit - Do nothing but upgrade WTP for Quality need
Tinahely	SA1-071	No Deficit - Do nothing but upgrade WTP for Quality need
Laragh Annamoe Public Supply	SA1-084	Increase GW at Raheen Borehole
Laragh Annamoe Public Supply	SA1-085	Increase SW abstraction at Glenmacnass
Arklow Public Supply	SA1-086	Increase GW and upgrade WTP for water quality deficits

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 SA1 Alignment of WRZ Options with Approach Categories

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
Aughrim Annacurra Public Supply	3	Raw water connection from Woodenbridge wellfield to new WTP at Aughrim	-	-	-	-	-	-
		New abstraction from Aughrim River near WTP	-	✓	✓	✓	✓	✓
		New GW source	✓	-	-	-	-	-
Avoca Ballinaclash Public Supply	1	New SW source from River Avoca	✓	✓	✓	✓	✓	✓
Ballinapark Public Supply	2	Rationalisation of Ballinapark Pump Station to Avoca Ballinaclash WTP	✓	✓	✓	-	✓	✓
		Ballinapark Public Supply - Increase GW abstraction	-	-	-	✓	-	-
Ballinteskin Public Supply	1	Increase GW abstraction	✓	✓	✓	✓	✓	✓
Ballyclogh Public Supply	1	WTP Upgrade/ Increase GW abstraction	✓	✓	✓	✓	✓	✓
Ballycoog Public Supply	1	Increase GW abstraction	✓	✓	✓	✓	✓	✓
Ballymorris Public Supply	2	Rationalisation of Ballymorris WTP to Aughrim WTP	✓	✓	✓	-	✓	✓
		Increase GW abstraction	-	-	-	✓	-	-
Barndarrig Public Supply	1	Increase GW abstraction	✓	✓	✓	✓	✓	✓
Kilballyowen (Aughrim) Public Supply	2	Rationalisation of Killballyowen Aughrim Pump Station to Aughrim WTP.	-	✓	-	-	-	✓
		Increase GW abstraction	✓	-	✓	✓	✓	-
Kirikee Public Supply	1	New GW on site and near existing BH	✓	✓	✓	✓	✓	✓
Rathdrum Public Supply	3	Rationalisation of Rathdrum WTP to Avoca Ballinaclash WTP	-	-	-	-	-	-
		New GW source	-	-	-	✓	✓	-
		New SW abstraction from River Avonmore	✓	✓	✓	-	-	✓
Redcross Conary Public Supply	1	Increase GW abstraction	✓	✓	✓	✓	✓	✓
Thomastown Public Supply	1	Increase GW abstraction	✓	✓	✓	✓	✓	✓
Killavaney Public Supply (Arklow)	1	No Deficit - Do nothing but upgrade WTP for Quality need	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient
Killavaney Public Supply (Tinahely)	1	No Deficit - Do nothing but upgrade WTP for Quality need	✓	✓	✓	✓	✓	✓
Tinahely	1	No Deficit - Do nothing but upgrade WTP for Quality need	✓	✓	✓	✓	✓	✓
Laragh Annamoe Public Supply	2	Increase GW at Raheen Borehole	✓	-	-	-	✓	-
		Increase SW abstraction at Glenmacnass	-	✓	✓	✓	-	✓
Arklow Public Supply	1	Increase GW and upgrade WTP for water quality deficits	✓	✓	✓	✓	✓	✓

The 7 Step Process outlined in Figure 5.1 was then applied to each WRZ in SA1, 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 WRZ level Approach development for SA at WRZ level include the following:

- In terms of Best AA, 16 WRZs options score a 0 in relation to potential impact on a designated European Site;
- The Best AA and the Best Environmental (overall SEA score) approach is identified for 13 of the 18 WRZs;
- Of the 18 WRZ level preferred approaches, none have a -3 score against biodiversity. A -3 Score against biodiversity indicates a potential high risk (without mitigation measures) under the biodiversity criterion for a European Site.

The WRZ level approaches for each WRZ in SA1 are outlined in Table 5.4.

Table 5.4 SA1 WRZ Level Approach

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient	Preferred Approach
Arklow Public Supply	SA1-086	Increase GW and upgrade WTP for water quality deficits	✓	✓	✓	✓	✓	✓	✓	✓
Tinahely	SA1-071	No Deficit. Upgrade WTP for Quality need	✓	✓	✓	✓	✓	✓	✓	✓
Aughrim Annacurra Public Supply	SA1-014	New abstraction from Aughrim River near WTP	✓	✓	-	-	-	-	-	-
Avoca Ballinaclash Public Supply	SA1-016a	new SW source from River Avoca (10% of Q95 is 15Ml/d)	✓	✓	✓	✓	✓	✓	✓	✓
Redcross Conary Public Supply	SA1-060a	Increase GW abstraction	✓	✓	✓	✓	✓	✓	✓	✓
Barndarrig Public Supply	SA1-037	Increase GW abstraction	✓	✓	✓	✓	✓	✓	✓	✓
Ballycoog Public Supply	SA1-030	Increase GW abstraction	✓	✓	✓	✓	✓	✓	✓	✓
Thomastown Public Supply	SA1-066	Increase GW abstraction	✓	✓	✓	✓	✓	✓	✓	✓
Kirikee Public Supply	SA1-050	New GW on site and near existing B	✓	✓	✓	✓	✓	✓	✓	✓
Ballinteskin Public Supply	SA1-024	Increase GW abstraction		✓	✓	✓	✓	✓	✓	✓
Ballinapark Public Supply	SA1-020	Rationalisation of Ballinapark Pump Station to Avoca Ballinaclash WTP	✓	✓	✓	✓		✓	✓	✓
Killavaney Public Supply (Arklow)	SA1-069	No Deficit. Upgrade WTP for Quality need	✓	✓	✓	✓	✓	✓	✓	✓
Ballyclogh Public Supply	SA1-027	WTP Upgrade/ Increase GW abstraction	✓	✓	✓	✓	✓	✓	✓	✓
Killavaney Public Supply (Tinahely)	SA1-070	No Deficit. Upgrade WTP for Quality need	✓	✓	✓	✓	✓	✓	✓	✓
Ballymorris Public Supply	SA1-031	Rationalisation of Ballymorris WTP to Aughrim WTP (requiring new source)	✓	✓	✓	✓	-	✓	✓	✓
Kilballyowen (Aughrim) Public Supply	SA1-042	Increase GW abstraction	✓	✓	-	✓	✓	✓	-	✓
Rathdrum Public Supply	SA1-056	New SW abstraction from River Avonmore	✓	✓	✓	✓	-	-	✓	✓

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient	Preferred Approach
Laragh Annamoe Public Supply	SA1-085	SA1-085: Increase SW abstraction at Glenmacnass	-	-	✓	✓	✓	-	✓	✓

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, nore 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 SA1 Grouped options

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow		
	Option Code	Option Description	SA Grouped Option
Avoca Ballinaclash Ballinteskin Barndarrig Laragh Annamoe Rathdrum Redcross Conary	SA1-503	Rationalise Avoca Ballinaclash, Ballinteskin, Barndarrig, Laragh Annamoe, Rathdrum, Redcross Conary WRZs to Vartry WTP	Group 3
Ballinteskin Laragh Annamoe	SA1-504	Rationalise Ballinteskin, Laragh Annamoe, supplies and Raheen Well WTP to Vartry WTP	Group 4
Avoca Ballinaclash Redcross Conary	SA1-505	Rationalise Redcross Conary Supplies to Avoca Ballinaclash new SW abstraction.	Group 5
Arklow Aughrim Annacurra	SA1-506	Rationalise Aughrim Annacurra WTP to Arklow WTP. New well at Woodenbridge wellfield and upgrade Arklow WTP	Group 6

Water Resource Zone Name	Feasible Options SA1 Mid Wicklow		
	Option Code	Option Description	SA Grouped Option
Aughrim Annacurra Avoca Ballinaclash	SA1-508	New SW abstraction from Avoca River for Avoca WRZ. Rationalise Aughrim Annacurra to Avoca WRZ.	Group 8
Redcross Conary Barndarrig	SA1-511	Increase GW abstraction at Redcross and rationalise Barndarrig	Group 11
Arklow Aughrim Annacurra	SA1-512	Increase GW abstraction at Woodenbridge for Arklow WRZ. Transfer raw water from Woodenbridge to Aughrim WTP and replace Aughrim WTP	Group 12
Arklow Aughrim Annacurra Ballymorris	SA1-513	Increase GW abstraction at Woodenbridge for Arklow WRZ. Treat water at Woodenbridge and pump to Aughrim PS and Ballymorris	Group 13
Arklow Aughrim Annacurra Ballymorris	SA1-514	Rationalise Ballymorris and Aughrim Annacurra WTPs to Arklow WTP. New well at Woodenbridge wellfield and upgrade Arklow WTP	Group 14
Aughrim Annacurra Avoca Ballinaclash Rathdrum	SA1-50A	Interconnect Aughrim Annacurra, Avoca Ballinaclash and Rathdrum. New SW abstraction from the River Avoca (10% of Q95 = 15Ml/d)	Group A
Aughrim Annacurra Avoca Ballinaclash Rathdrum	SA1-50B	Interconnect Aughrim Annacurra, Avoca Ballinaclash and Rathdrum. New SW abstraction from the River Avonmore (10% of Q95 = 13.4 Ml/d)	Group B

The 11 Study Area options result in 20 SA Combinations including the WRZ level Approach. The 20 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SA1 Combinations

Key	WRZ Approach Option	○	SA Grouped Option	□

WRZ	WRZ approach options	SA combination 1 (SA grouped option 3)	SA combination 2 (SA grouped option 4)	SA combination 3 (SA grouped option 5)	SA combination 4 (SA grouped option 6)	SA combination 5 (SA grouped option 8)	SA combination 6 (SA grouped option 11)	SA combination 7 (SA grouped option 12)	SA combination 8 (SA grouped option 13)	SA combination 9 (SA grouped option 14)	SA combination 10 (SA grouped option 3 & 6)	SA combination 11 (SA grouped option 3 & 12)	SA combination 12 (SA grouped option 3 & 13)	SA combination 13 (SA grouped option 3 & 14)	SA combination 14 (SA grouped option 5 & 6)	SA combination 15 (SA grouped option 8 & 11)	SA combination 16 (SA grouped option 4, 5 & 6)	SA combination 17 (SA grouped option 4, 6 & 11)	SA combination 18 (SA grouped option A)	SA combination 19 (SA grouped option B)
Arklow	○	○	○	○	□	○	○	□	□	□	□	□	□	□	□	○	□	□	○	○
Tinahely	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Aughrim Annacurra	○	○	○	○	□	□	○	□	□	□	□	□	□	□	□	□	□	□	□	□
Avoca Ballinaclash	○	□	○	□	○	□	○	○	○	○	□	□	□	□	□	□	□	○	□	□
Redcross Conary	○	□	○	□	○	○	□	○	○	○	□	□	□	□	□	□	□	□	○	○
Barndarrig	○	□	○	○	○	○	□	○	○	○	□	□	□	□	○	□	○	□	○	○
Ballycoog	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Thomastown	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Kirikee	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Ballinteskin	○	□	□	○	○	○	○	○	○	○	□	□	□	□	○	○	□	□	○	○
Ballinapark	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Killavaney	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Ballyclogh	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

WRZ	WRZ approach options	SA combination 1 (SA grouped option 3)	SA combination 2 (SA grouped option 4)	SA combination 3 (SA grouped option 5)	SA combination 4 (SA grouped option 6)	SA combination 5 (SA grouped option 8)	SA combination 6 (SA grouped option 11)	SA combination 7 (SA grouped option 12)	SA combination 8 (SA grouped option 13)	SA combination 9 (SA grouped option 14)	SA combination 10 (SA grouped option 3 & 6)	SA combination 11 (SA grouped option 3 & 12)	SA combination 12 (SA grouped option 3 & 13)	SA combination 13 (SA grouped option 3 & 14)	SA combination 14 (SA grouped option 5 & 6)	SA combination 15 (SA grouped option 8 & 11)	SA combination 16 (SA grouped option 4, 5 & 6)	SA combination 17 (SA grouped option 4, 6 & 11)	SA combination 18 (SA grouped option A)	SA combination 19 (SA grouped option B)
Killavaney	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Ballymorris	○	○	○	○	○	○	○	○	□	□	○	○	□	□	○	○	○	○	○	○
Kilballyowen	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Rathdrum	○	□	○	○	○	○	○	○	○	○	□	□	□	□	○	○	○	○	○	□
Laragh Annamoe	○	□	□	○	○	○	○	○	○	○	□	□	□	□	○	○	□	□	○	○

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 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 SA1, Grouped Option 3 & 13 (Combination 12) and Grouped Option 3 & 14 (Combination 13) had a very similar ranking under the Least Cost category. The Least Cost Approach is determined using an Irish Water Net Present Value (NPV) 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 option, in terms of Best AA both combinations had zero -3 scores, both had the same scores for resilience and they had very similar MCA score for Quickest Delivery. Combination 13 scored better for the Lowest Carbon. Of the 2 combinations, Grouped Option 3 & 14 (Combination 13) performed slightly better against the SEA objectives and accordingly has been identified as the Least Cost option and brought forward to the Approach Development Stage.

Table 5.7 SA1 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 3)	SA combination 2 (SA grouped option 4)	SA combination 3 (SA grouped option 5)	SA combination 4 (SA grouped option 6)	SA combination 5 (SA grouped option 8)	SA combination 6 (SA grouped option 11)	SA combination 7 (SA grouped option 12)	SA combination 8 (SA grouped option 13)	SA combination 9 (SA grouped option 14)	SA combination 10 (SA grouped option 3 & 6)	SA combination 11 (SA grouped option 3 & 12)	SA combination 12 (SA grouped option 3 & 13)	SA combination 13 (SA grouped option 3 & 14) - Preferred Approach	SA combination 14 (SA grouped option 5 & 6)	SA combination 15 (SA grouped option 8 & 11)	SA combination 16 (SA grouped option 4, 5 & 6)	SA combination 17 (SA grouped option 4, 6 & 11)	SA combination 18 (SA grouped option A)	SA combination 19 (SA grouped option B)
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	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	0 No. -3 scores	0 No. - 3 scores
Lowest Carbon	Best																Worst			
Most Resilient	Best												Worst*	Worst*						
Best Environmental	Worst													Best						

* SA Combination 12 and 13 have the same score against the Most Resilient Criteria

The SA Combinations 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 3&14
Best Environmental (BE)	Group 3&14
Quickest Delivery (QD)	Group 4, 6 & 11
Most Resilient (MR)	WRZ Approach
Lowest Carbon (LC)	WRZ Approach
Best AA (BA)	Group 3&14

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, Group 3 & 14 has the lowest NPV Cost, as shown in Figure 5.2 with the lowest total costs (CAPEX and OPEX) over the solutions lifetime.

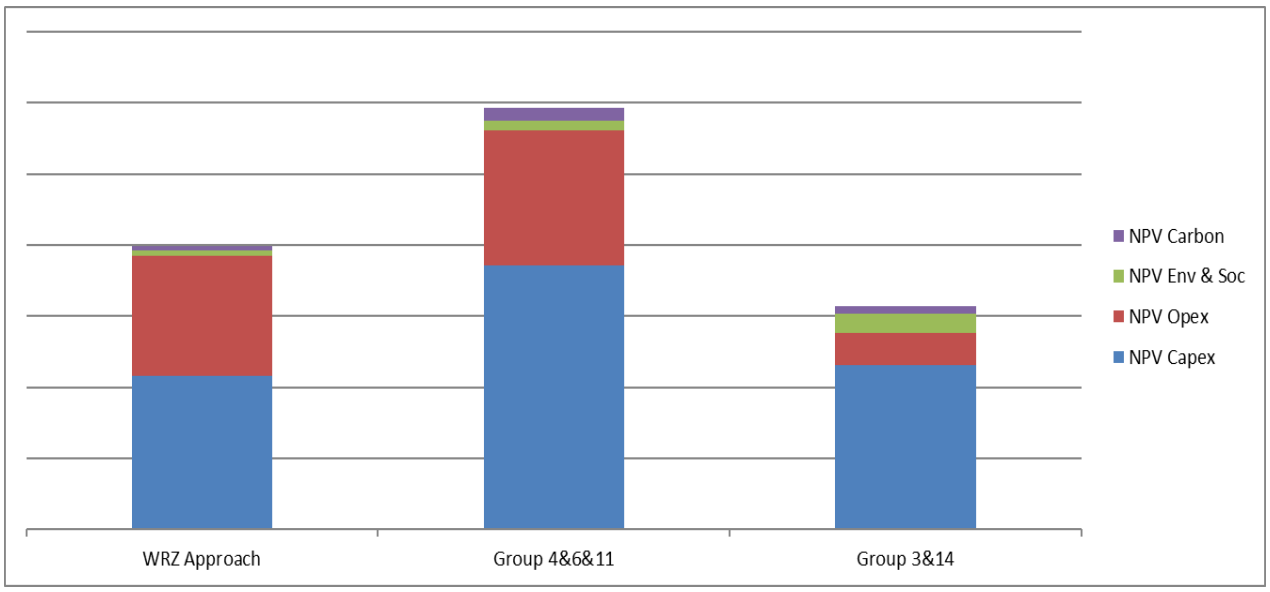


Figure 5.2 SA1 NPV Costs for WRZ and SA approaches

In accordance with the Options Methodology, these approaches are then compared against each other using the 7-Step process in Figure 5.1 to generate the best value combination of options at the Study Area level. The best value combination of options at the Study Area level results in the SA Preferred Approach. 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 Quickest Delivery approach does not deliver significantly better scores against the quickest delivery criteria compared to the Least Cost and the Least Costs Approach is the Best AA and Best Environmental. 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 Most Resilient Approach preforms poorly again the environmental criteria and, while the Least Cost approach performs worst in the Most Resilient category, there is not a significant difference between the resilience scores and the Least Costs Approach is the Best AA and Best Environmental. The Least Cost approach was therefore retained at this stage.
- Step 5 - We compared the Least Cost Approach against the Least Carbon Approach. The Least Carbon Approach has lower carbon costs compared to the Least Cost Approach, however, carbon costs for both approaches are low when compared the total NPV costs. The Least Costs Approach is the Best AA and Best Environmental Approach. 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, Quickest Delivery and Most Resilient Approaches. The Least Costs Approach is the Best AA and Best Environmental Approach. While the Least Cost

Approach has higher carbon costs compared to the Least Carbon Approach carbon costs are low when compared the total NPV costs. While the Least Cost approach did not perform well against the resilience criteria there is not a significant difference in the resilience score between the Least Cost and the Most Resilience Approach. 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, Group 3 & 14 represents the Preferred Approach for Study Area 1 Mid Wicklow, which consists of the options listed in Table 5.9. The preferred approach enables the proposed decommissioning of the Avoca Ballinaclash and Rathdrum abstractions which may not meet sustainability guidelines as outlined in Section 2.4.

Table 5.9 Preferred Approach for SA1

WRZ Name	Preferred Approach Option Description SA Combination – Group 3&14
Arklow Public Supply	Group 14 Rationalise Ballymorris and Aughrim Annacurra WTPs to Arklow WTP. New well at Woodenbridge wellfield and upgrade Arklow WTP
Aughrim Annacurra Public Supply	
Ballymorris Public Supply	
Tinehely	SA1-071: No Deficit - Do nothing but upgrade WTP for Quality need
Avoca Ballinaclash Public Supply	Group 3 Rationalise Avoca Ballinaclash, Ballinteskin, Barndarrig, Laragh Annamoe, Rathdrum, Redcross Conary WRZs to Vartry WTP
Redcross Conary Public Supply	
Ballinteskin Public Supply	
Rathdrum Public Supply	
Laragh Annamoe Public Supply	
Barndarrig Public Supply	
Ballycoog Public Supply	SA1-030: Increase GW abstraction
Thomastown Public Supply	SA1-066: Increase GW abstraction
Kirikee Public Supply	SA1-050: New GW on site and near existing BH

WRZ Name	Preferred Approach Option Description SA Combination – Group 3&14
Ballinapark Public Supply	SA1-020: Rationalisation of Ballinapark Pump Station to Avoca Ballinaclash WTP
Killavaney Public Supply (Arklow)	SA1-069: No Deficit - Do nothing but upgrade WTP for Quality need
Ballyclogh Public Supply	SA1-027: WTP Upgrade/ Increase GW abstraction
Killavaney Public Supply (Tinahely)	SA1-070: No Deficit - Do nothing but upgrade WTP for Quality need
Kilballyowen (Aughrim) Public Supply	SA1-042: Increase GW abstraction

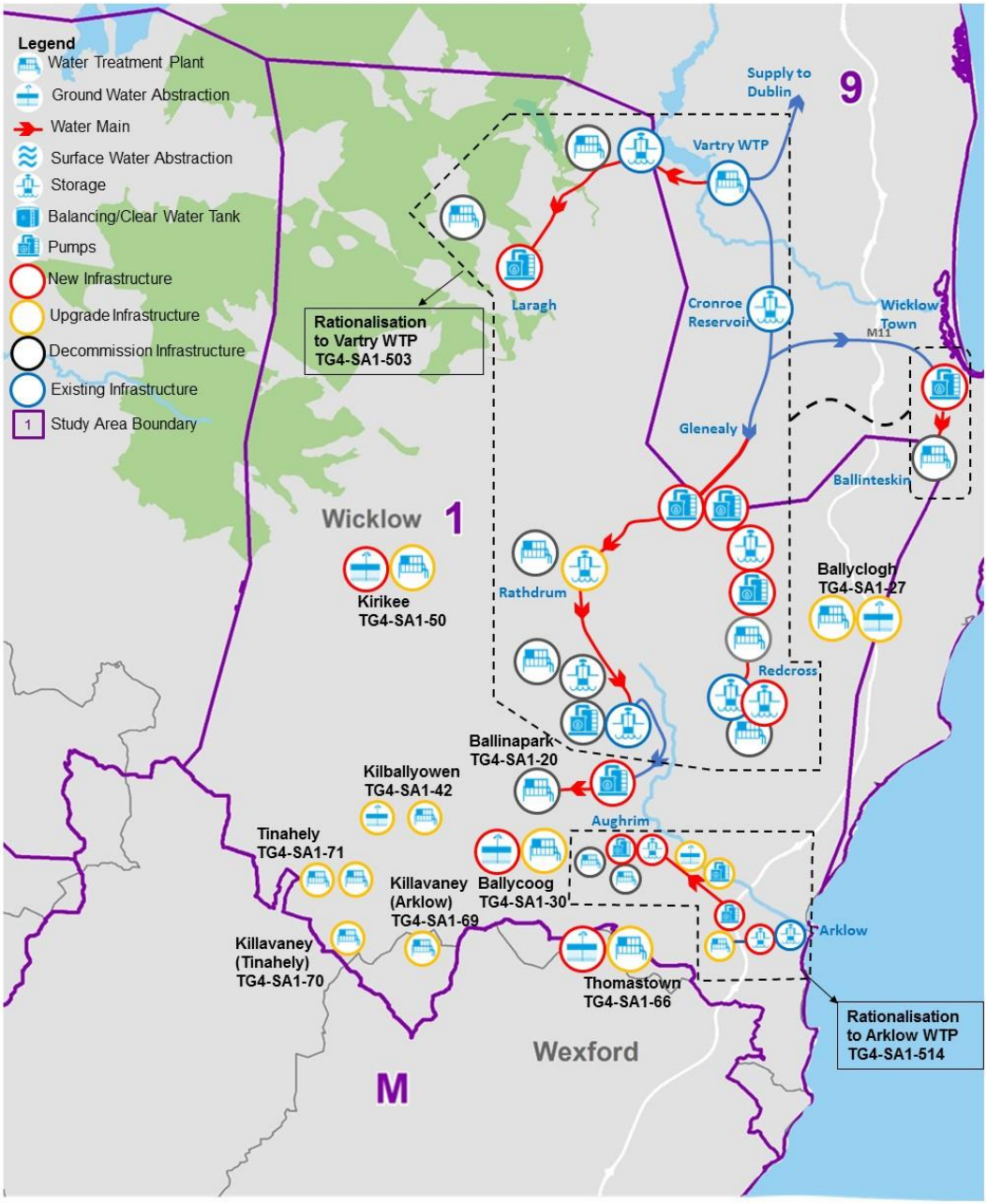


Figure 5.3 SA1 Preferred Approach

As noted in Section 7 of the RWRP the PA for the Barndarrig WRZ was modified further to information obtained during the consultation period.

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

The Preferred Approach for SA1 Mid Wicklow 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).
- 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.

Before we adopt this approach at Plan level for SA1, 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 the Redcross Conary Public Supply, Ballinteskin Public Supply, Barndarrig Public Supply, Rathdrum Public Supply, Laragh Annamoe Public Supply, Ballinapark Public Supply and Avoca Ballinaclash Public Supply is to obtain supply from the GDA WRZ via the Vartry WTP. These options are dependent on the development of the Preferred Approach for the GDA WRZ SA9, therefore an alternative option is required for consideration as an alternative at Regional level and in the event the Preferred Approach for SA9 cannot advance. The alternative options considered are outlined in Table 5.10 below.

Table 5.10 Alternative Options for WRZs dependent on another SA option

WRZ Name	Alternate Option
Avoca Ballinaclash Public Supply	SA1-016a Maintain and upgrade existing WTP and abstraction and provide additional supply from new SW abstraction from the River Avoca (+111m3/day)
Redcross Conary Public Supply	SA1-060a Maintain and upgrade existing WTP and Increase existing GW abstraction (+165m3/day)
Ballinteskin Public Supply	SA1-024 Maintain and upgrade existing WTP and Increase GW abstraction (+21m3/day)
Barndarrig Public Supply	SA1-037 Maintain and upgrade existing WTP and Increase GW abstraction (+66m3/day)
Rathdrum Public Supply	SA1-056 Maintain and upgrade existing WTP and New SW abstraction and New WTP from the River Avonmore (+744m3/day)

WRZ Name	Alternate Option
Laragh Annamoe Public Supply	SA1-085 Maintain and upgrade existing WTPs and increase SW abstraction from the River Glenmacnass (+90m3/day)
Ballinapark Public Supply	SA1-022 Maintain and upgrade existing WTP and Increase GW abstraction (+20m3/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 urgent or 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 SA1 Interim Options

WTP Name	Interim Option
Arklow (Ballyduff) WTP	Upgrade WTP to IW Standards – Potential site for a containerised solution
Askamore Dunishal WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Tinahely Regional WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Aughrim / Annacurragh WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Avoca Ballinaclash WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Redcross WTP	Upgrade WTP to IW Standards
Barndarrig WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Ballycoog WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Thomastown WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Kirikee WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Ballinteskin WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Ballinapark WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Kilavaney WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Ballyclogh WTP	Upgrade WTP to IW Standards – Potential site for a containerised solution
Kilavaney Tinahely WTP	Upgrade WTP to IW Standards – Potential site for a containerised solution
Ballymorris WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Killballyowen Aughrim WTP	Upgrade WTP to IW Standards – Potential site for a containerised solution
Rathdrum WTP	Refurb existing Borehole, and upgrade WTP to IW Standards – Potential site for a containerised solution
Glenmacnass WTP	Refurb existing Borehole, and upgrade WTP to IW Standards
Raheen WTP	Refurb existing Borehole, and upgrade WTP to IW Standards

Small Towns and Villages Growth Programme Irish Water's Investment Plan 2020-2024 includes a number of programmes and projects targeted at providing for growth. One such programme is the Small Towns and Villages Growth Programme (STVGP) which will provide funding for Water and Waste Water Treatment Plant growth capacity in smaller settlements which are not otherwise provided for in the Capital Investment Plan 2020 to 2024. The STVGP is focused on supporting growth in areas already served by IW infrastructure but where current or future capacity deficits have been identified.

Irish Water have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant county development plan. Under this programme interim options works will be considered in the Rathdrum and Laragh Water Resource Zones.

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 reduce leakage below SELL within the timeframe of the plan resulting in lower Needs?

A summary of the adaptability criteria and analysis we have undertaken for SA1 is shown in Table 7.1.

Table 7.1 Sensitivity Analysis for SA1

Uncertainty	Likelihood	Increase/Decrease in Deficit	Impact on Preferred Approach
Sustainability	Moderate/High (as our current abstractions are large compared to the water bodies from which they abstract)	+2,108 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 assessment found that the Derry River (Tinahely), River Avonbeg trib. (Avoca Ballinaclash), Three Wells Stream (Aughrim), and Mill Glen Stream (Rathdrum) sources may be at risk. However, the Avoca Ballinaclash and Rathdrum abstractions are to be decommissioned as part of the Preferred Approach. The preferred approach for Tinahely WRZ is a WTP upgrade as there is currently no deficit. If there is a requirement to reduce the Derry River Abstraction, further to site based assessments, we will review feasible options for Tinahely.
			Based on this scenario, the Preferred Approach remains the optimal solution.

Uncertainty	Likelihood	Increase/Decrease in Deficit	Impact on Preferred Approach
Climate Change	High (international climate change targets have not been met)	+100 m^3/d	**Higher climate change scenarios would impact our existing supplies and result in decreased water availability at certain times of year.** Although the likelihood of this scenario is high based on climate change adaptation to date, potential impacts may be mitigated against by optimizing our operations on a more environmentally sustainable basis across the range of supplies. Within SA1, several existing small river abstractions would be vulnerable to increased climate change impacts scenarios. However, these sources are decommissioned as part of the Preferred Approach except for Three Wells Stream (Aughrim) which would have a minor increase to the deficit. Regarding the existing groundwater abstractions to be maintained, 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 Preferred Approach remains the optimal solution.
Demand Growth	Low/Moderate (growth has been based on policy)	-200 m^3/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 18 individual water resource zones and is driven by quality as well as quantity issues. In this rural area, growth is relatively low.
			Based on this scenario, the Preferred Approach remains the optimal solution.
Leakage Targets	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	625 m^3/d	**The impact of achieving SELL would reduce the supply demand balance deficit and the overall need requirement.** The need drivers in SA1 are across all 13 water resource zones and are driven by quality as well as availability issues. Therefore, the Preferred Approach is required, even accounting for increased leakage savings. Based on this scenario, the Preferred Approach remains the optimal solution

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

Based on the 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 – As the Supplies in SA1 Mid Wicklow are relatively small, and as conservative limits have been applied to the supply availability assessments, the Preferred Approach is adaptable to a range of future outlooks in relation to sustainability and climate change. The demand growth in the area is small, and the Supply Demand Deficits are primarily driven by reliability. As Water Treatment Plants are modular, capacity will be delivered on a phased basis, allowing for adaptation across a range of futures. Our Preferred Approach is therefore Adaptable.

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

8 Summary of Study Area 1

Summary of Study Area 1

The Preferred Approach for SA1 Mid Wicklow (summarised in Table 5.8 and Figure 5.3) consists of WRZ options for 9 of the 18 Water Resource Zones in the Study Area, primarily driven by the small scale of the supplies and difficulties in transporting small volumes of water over long distances. The Preferred Approach for the 9 remaining Water Resource Zones are Study Area Options to connect rationalise the Aughrim Annacurra WRZ and Ballymorris WRZ to the Arklow WRZ , and Avoca Ballinaclash Public Supply, Ballinapark, Ballinteskin, Barndarrig, Rathdrum and Laragh Annamoe WRZs to the Vartry Water Treatment Plant in SA9 Greater Dublin Area. 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 provides environmental benefits by;

- Decommissioning existing abstractions from the Mill Glen Stream and the Avonbeg tributary, abstractions which may not meet sustainability guidelines as outlined in Section 2.4.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.The Preferred Approach for SA1 Mid Wicklow 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)
- 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 SA1, as summarised in Table 6.1. The measures will only be progressed in the event of critical need to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A Study Area 1 Water Treatment Plants

WTP Asset Name	Local WTP Name
Arklow (Ballyduff) WTP	Arklow WTP
Tinahely Regional WTP	Tinahely Regional WTP
Rathdrum WTP	Rathdrum WTP
Avoca Ballinaclash WTP	Avoca Ballinaclash WTP
Redcross WTP	Redcross WTP
Aughrim / Annacurragh WTP	Aughrim / Annacurragh WTP
Glenmacnass WTP	Laragh WTP
Raheen WTP	Raheen Well WTP
Barndarrig WTP	Barndarrig WTP
Thomastown WTP	Thomastown WTP
Kirikee WTP	Kirikee WTP
Ballycoog WTP	Ballycoog WTP
Ballinteskin WTP	Ballinteskan WTP
Kilavaney WTP	Kilavaney (Arklow) WTP
Kilavaney Tinahely WTP	Askamore Dunishal WTP
Killballyowen Aughrim WTP	Kilballyowen (Aughrim) WTP
Ballymorris WTP	Ballymorris WTP
Ballinapark WTP	Ballinapark WTP
Ballyclogh WTP	Ballyclogh North WTP
Askamore Dunishal WTP	Askamore Dunishal WTP

Annex B Study Area 1 Rejection Register Summary

Study Area 1 – Coarse Screening Rejection SA1

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-01	Rationalisation of Arklow WTP to Vartry WTP	This option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-07a	Rationalisation of Aughrim Annacurra WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option it was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-17a	rationalisation of Avoca Ballinaclash WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option it was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-19	Rationalisation of Ballinapark Pump Station to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-23a	rationalisation of Ballinteskin Pump Station to Vartry WTP, via existing watermain to Cronroe WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-26	rationalisation of Ballyclogh North Pump Station to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-28	rationalisation of Ballycoog WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-32	rationalisation of Ballymorris WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-36	rationalisation of Barndarrig WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-41	rationalisation of Killballyowen Aughrim Pump Station to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-43	rationalisation of Kilavaney Arklow Pump Station to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-46	rationalisation of Kilavaney Tinahely Pump Station to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-47	rationalisation of Kirikee WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-51a	rationalisation of Raheen Well WTP to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-52a	rationalisation of Laragh WTP to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-53a	rationalisation of Rathdrum WTP to Vartry WTP, assesed previously as part of Mid Wicklow Scheme	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-57a	rationalisation of Redcross Intermediate Reservoir to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-64	rationalisation of Thomastown WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-67	rationalisation of Tinahely Regional WTP to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 19 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 100Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-02b	Increase GW abstraction at Aughrim Annacurra and interconnect with Aughrim Annacurra Public Supply	This option included increasing the abstraction at Aughrim Annacurra to supply deficit for Aughrim Annacurra and transfer additional supply to Arklow WRZ. As there is a great uncertainty around available yield at this source , this option is not considered feasible and was not taken forward to the fine screening stage.	•	•	•
TG4-SA1-03	Bankside filtration from Avoca River	There is a deficit of 18m3/day for Arklow WRZ. This is a costly option to meet such a small demand. There are better viable options available and therefore this option was screened out on deliverability and not taken through to the fine screening stage.		•	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-06	Interconnect Aughrim Annacurra, Avoca Ballinaclash and Rathdrum, maintain existing GW sites and expand Arklow GW	This was considered part of a grouped option to rationalise 5 WRZs to the Arklow WRZ. The option requires a significant length of pipeline for relatively small supplies. Transferring small quantities of water over long distances can affect the quality of water. Therefore, it was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-07b	rationalisation of Aughrim Annacurra WTP to Vartry WTP	This option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-17b	Rationalisation of Avoca Ballinaclash WTP to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	
TG4-SA1-23b	rationalisation of Ballinteskin Pump Station to Vartry WTP, via existing watermain to Cronroe WTP	As per above, this option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-51b	rationalisation of Raheen Well WTP to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-52b	rationalisation of Laragh WTP to Vartry WTP for long term OPEX savings (not in deficit)	As per above, this option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-53b	rationalisation of Rathdrum WTP to Vartry WTP, assesed previously as part of Mid Wicklow Scheme	As per above, this option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	
TG4-SA1-57b	rationalisation of Redcross Intermediate Reservoir to Vartry WTP	As per above, this option was considered as part of a grouped option to rationalise 7 WTPs to Vartry WTP. This grouped option requires a significant length of pipeline over 38Km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, the grouped option was considered not feasible due to age of water and possible sedimentation issues and would not be taken forward to fine screening stage. Rationalisation of the WRZs individually or in smaller groups were considered in other options.		•	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-11	New GW source - Aughrim Private Well (Trout Farm)	This option was previously considered by IW, however, there were Land Ownership and 3rd party access issues. This would not necessarily be a bar to progressing an option in all circumstances; however, as there are other viable alternative options for this WRZ this option was not taken forward to fine screening stage.		●	
TG4-SA1-12	Increase GW abstraction at Aughrim Annacurra Public Supply and interconnect with Arklow Public Supply	This option included increasing the abstraction at Aughrim Annacurra to supply deficit for Aughrim Annacurra and transfer additional supply to Arklow WRZ. As there is a great uncertainty around available yield at this source, this option is not considered feasible and was not taken forward to the fine screening stage.	●	●	●
TG4-SA1-15	increase abstraction from the existing Avonbeg River tributary abstraction	Based on IW desktop assessment the current abstraction from this source already appears to be over sustainable abstraction limit and therefore, it was rejected at coarse screening stage	●	●	●
TG4-SA1-18	New GW source at Avoca Ballinaclash Public Supply	The proposed abstraction is located in a Locally Important Aquifer. A desktop assessment shows the required abstraction is unlikely to be sustainable at this location. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria of the RWRP EM and was not taken forward to fine screening stage.	●	●	●
TG4-SA1-21	rationalisation of Ballinapark Pump Station to Arklow WTP or Aughrim WTP	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not brought forward to fine screening stage for this Study Area..		●	
TG4-SA1-25	rationalisation of Ballyclogh North Pump Station to Barndarrig (requiring new source at Barndarrig)	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not brought forward to fine screening stage		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-29	rationalisation of Ballycoog WTP to Arklow WTP or Aughrim WTP	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not brought forward to fine screening stage		●	
TG4-SA1-33	rationalisation of Ballymorris WTP to Avoca Ballinaclash WTP (requiring new source)	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not brought forward to fine screening stage.		●	
TG4-SA1-35a	rationalisation of Barndarrig WTP to Red Cross	This option is considered as part of a group option to supply water to increase supply to Redcross and transfer additional supply to Barndarrig. Transferring small quantities of water over long distances can affect the quality of water. As there are other alternative options for these WRZs this option was not brought forward to fine screening stage.		●	
TG4-SA1-38	rationalisation of Killballyowen Annacurragh Pump Station to Aughrim WTP (This is complete - assess as part of Aughrim Optioneering and update WRZ)	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to fine screening stage.		●	
TG4-SA1-40	rationalisation of Killballyowen Aughrim Pump Station to Avoca Ballinaclash WTP	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to fine screening stage.		●	
TG4-SA1-44	rationalisation of Kilavaney Arklow Pump Station to Tinahely for long term OPEX savings (not in deficit)	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to fine screening stage.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
TG4-SA1-45	rationalisation of Kilavaney Tinahely Pump Station to Tinahely WTP for long term OPEX savings (not in deficit)	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to fine screening stage.		•	
TG4-SA1-48	rationalisation of Kirikee WTP to Rathdrum WTP	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward at fine screening stage.		•	
TG4-SA1-49	rationalisation of Kirikee WTP to Avoca Ballinaclash WTP	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to fine screening stage.		•	
TG4-SA1-59	New SW from River Avoca (10% of Q95 is 15MLD)	This option is considered as part of a group option to supply water to increase supply to Redcross and transfer additional supply to Barndarrig. Transferring small quantities of water over long distances can affect the quality of water. As there are other alternative options for these WRZs this option was not taken forward to fine screening stage.		•	
TG4-SA1-61	New abstraction on the River Avoca at Redcross and connect to Barndarrig and Ballyclogh	This option is a repeat of group option 10 and as a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	This option is a repeat and is assessed as part of a different feasible option		
TG4-SA1-62	New GW abstraction at Redcross and connect to Barndarrig and Ballyclogh	This option is a repeat of group option 11 and as a result, it is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	This option is a repeat and is assessed as part of a different feasible option		
TG4-SA1-63	new abstraction from Vartry Reservoir - this will be connected next	This project was progressing at the time this screening review was undertaken and is due to be commissioned in the coming months but is not yet complete.	N/A		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability (Environmental and social impacts)
	year and assess as part of GDA				
TG4-SA1-65	rationalisation of Thomastown WTP to Arklow WTP	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to fine screening stage.		●	
TG4-SA1-68	No Deficit - Do nothing but upgrade WTP for Quality need	Due to an SDB update this WRZ is now projected to be in deficit in 2044 and, as such a new supply option is required to address this need. Therefore, this option which solely relates to upgrade of the WTP for Quality Need is no longer suitable and was rejected at coarse screening stage.	●		
TG4-SA1-72a	rationalise Ballycoog Public Supply to Redcross	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to the fine screening stage.		●	
TG4-SA1-72b	rationalise Ballycoog Public Supply to Redcross	The option requires a significant length of pipeline for a relatively very small supply. Transferring small quantities of water over long distances can affect the quality of water. As there are other viable alternative option for this WRZ this option was not taken forward to the fine screening stage.		●	
TG4-SA1-73	WTP Upgrade for Thomastown Public Supply	Due to an SDB update this WRZ is now projected to be in deficit in 2044 and, as such a new supply option is required to address this need. Therefore, this option which solely relates to upgrade of the WTP for Quality Need is no longer suitable and was rejected at coarse screening stage.	●		
TG4-SA1-74	WTP Upgrade for Kirikee Public Supply	Due to an SDB update this WRZ is now projected to be in deficit in 2044 and, as such a new supply option is required to address this need. Therefore, this option which solely relates to upgrade of the WTP for Quality Need is no longer suitable and was rejected at coarse screening stage.	●		
TG4-SA1-75	Increase GW abstraction at Killavaney Public Supply (Arklow)	No longer in deficit and therefore, this new source option is no longer required.		●	