



**7**



**Preferred  
Approach –  
Study Area**



## 7.1 Introduction

The purpose of this section of the RWRP-NW is to examine all potential Feasible Options that could be used to address the identified Need (both in terms of Quantity and Quality) across the 119 Water Resource Zones (WRZs) in the North West Region. The Approach Development Process, which is set out in Section 8.3.7 of the Framework Plan, seeks to identify the Preferred Approach for addressing Need at three (3) spatial Levels: individual WRZs, Study Area (SA) Level, and Regional Level (Figure 7.1). This process involves comparison of the Feasible Options at each level using defined criteria.

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

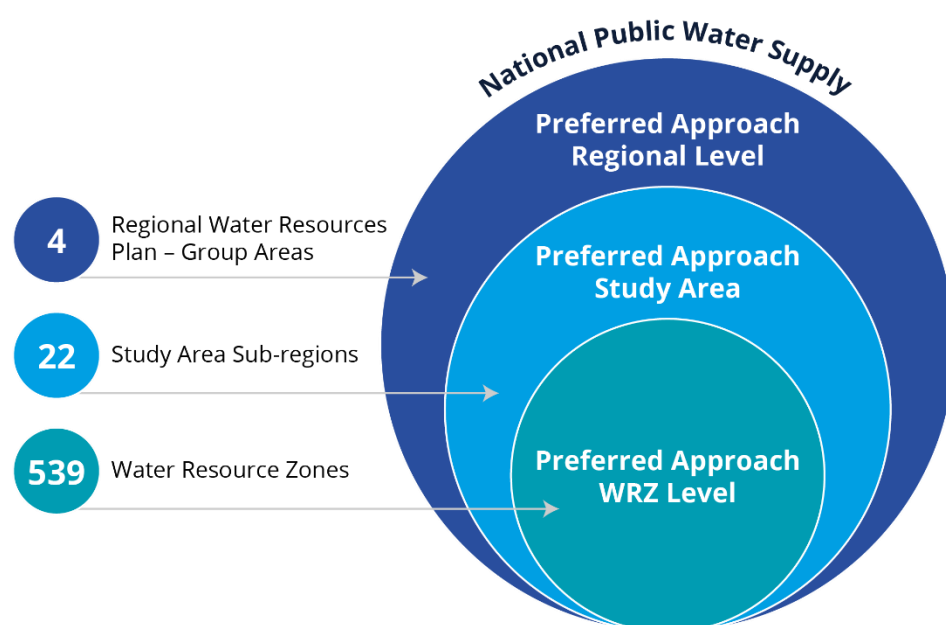


Figure 7.1 Spatial Level Assessment

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

This section,

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

## 7.2 Approach Development Process

### 7.2.1 Approach Categories

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

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

Table 7.1 Range of Approaches to Test Feasible Options

Approaches Tested	Description	Policy Driver
Least Cost	Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social and Carbon Costs	Public Spending Code
Best Appropriate Assessment (Best AA)	<p>Lowest score against the European Sites (Biodiversity) sub-criteria question:</p> <p>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.</p> <p>Score = -1 or -2 equates to LSEs that can be addressed with general/standard mitigation measures.</p> <p>Score = -3 equates to LSEs that may be harder to mitigate or require significant Project Level assessment.</p>	Habitats Directive
Quickest Delivery	<p>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</p> <p>This is particularly relevant where an Option might be required to address an urgent Public Health issue.</p>	Statutory Obligations under the Water Supply Act and Drinking Water Regulations
Best SEA Environmental	This is the Option or combination of Options with the highest total score across the 19 No. Strategic Environmental Assessment (SEA) Multi-Criteria Assessment (MCA) sub-criteria questions.	SEA Directive and Water Framework Directive
Most Resilient	This is the Option or combination of Options with the highest total score against the four (4) resilience criteria. These include outages, financial uncertainty, regulatory changes, and climate change.	National Adaptation Plan and Climate Action Plan

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

### Least Cost Approach

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

### Best Appropriate Assessment (Best AA) Approach

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

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

### Quickest Delivery Approach

The Quickest Delivery Approach is based on the estimated time for an Option to be brought into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening. This approach allows us to potentially optimise the Preferred Approach by minimising the time taken for an Option to become operational. This could be appropriate in a WRZ with a critical water quality issue that might impact on public health as this approach would identify the Option that could potentially be delivered in the shortest possible timeframe. As the NWRP does not confer funding or statutory consent for any project, and the identified Needs across the North West Region must be considered, we would be unlikely to modify an approach based on Quickest Delivery, unless there is a critical driver.

### Best Environmental Approach

The Best SEA Environmental Approach is the Option performing best overall across the 19 SEA objective-based Multi Criteria Assessment (MCA) environmental criteria, assessed as part of the Fine Screening assessment (described in Section 8.3.5 of the Framework Plan). Positive and negative scores

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

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

### Most Resilient Approach

The Most Resilient Approach is the Option with the highest scores against four (4) resilience MCA screening criteria. These include outages, financial uncertainty, regulatory changes, and climate change. This approach is aligned to the NWRP objective to ensure a safe and secure water supply in the short, medium and long term.

### Lowest Carbon Approach

The Lowest Carbon Approach is the Option with the lowest embodied and operational carbon costs. This approach is aligned with Uisce Éireann's carbon reduction policies and the National Adaptation Framework (NAF)<sup>1</sup> in relation to climate change.

## 7.2.2 Approach Ranking and Appraisal

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

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

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

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

<b>STEP 0</b> Best AA	If there is an option that meets the Objectives of the Plan, and is assessed as having no potential impact on a European Site (based on desktop assessment), it is automatically adopted as the Preferred Approach
<b>STEP 1</b> Least Cost	Compare Least Cost against <b>best AA</b> Approach, and consider again at Step 6
<b>STEP 2</b> Quickest Delivery	Compare Least Cost against Quickest Delivery Approach and develop Modified Approach if appropriate
<b>STEP 3</b> Best Environmental	Compare Least Cost or Modified Approach against Best Environmental, and modify approach <b>if appropriate</b>
<b>STEP 4</b> Most Resilient	Compare Least Cost or Modified Approach against Most Resilient
<b>STEP 5</b> Least Carbon	Compare Least Cost or Modified Approach against <b>Lowest</b> Carbon
<b>STEP 6</b> Approach Comparison	Compare output from Steps 1 to 5 against: <ul style="list-style-type: none"> <li>• SEA required outcomes</li> <li>• Sectoral Adaptation Outcomes</li> <li>• <b>Best AA outcomes</b></li> <li>• Public Expenditure Code Outcomes</li> </ul>
<b>STEP 7</b> Preferred Approach	Select Preferred Approach based on steps 0 to 6

Figure 7.2 Seven (7)-Step Approach Development Process

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

It should be noted that the identification of a Preferred Approach at a plan level does not confer any consent to develop a project, nor does it preclude other Options being considered subsequently at the project level. Assessments at this stage are desk-based and plan level assessments. No statutory consent or funding consent is conferred by inclusion of any Option in the NWRP. Any projects that are progressed following identification as a Preferred Approach in the Regional Plans, will require individual environmental assessments, including Environmental Impact Assessment and Appropriate Assessment (as required) in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

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

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

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

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

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

### 7.2.3 Stage 1 – WRZ Level Approach

#### 7.2.3.1 Test a Range of Approach Types - WRZ Level

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

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

To illustrate, Table 7.2 provides an overview of the number of feasible WRZ Options and Study Area Options for the 23 WRZs in Study Area B (SAB) in County Cavan and Monaghan.

Table 7.2 Study Area B – Option Types

Water Resource Zone	Option Type	
	WRZ Option	Study Area Option
Ballyconnell PWS	2	4
Ballyhaise PWS (GWS Import)	2	3
Ballyjamesduff RWSS	1	5
Bawnboy PWS	1	5
Belturbet PWS	1	4
Blacklion PWS (GWS Import)	4	0
Cashilard	1	1
Cavan RWSS	2	9
Clones	2	3
Coothill PWS	3	2
Derrykillew	1	1
Emyvale (GWS Import)	3	2
Glaslough (GWS Import)	3	2
Gowna	2	5
Gowna (GWS Import)	1	1
Kinlough Tullaghan	2	1
Lough Egish	1	2
Monaghan	2	5
Newbliss	1	3
Pettigo Pub	4	1
Shercock PWS (GWS Import)	2	3
Smithboro	2	4
Swanlinbar PWS	2	4

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

There may be WRZs where there are no feasible WRZ Options available to address the Need. In these circumstances the WRZ Level Approach is excluded from the Approach Development Process as it does



not meet the Deficit for the region. This is discussed further in Section 7.2.4 and Section 7.2.5. For SAB, one or more feasible WRZ Options were identified for all WRZs.

The Approach Development Process at WRZ Level is illustrated using the Cootehill PWS WRZ in SAB, County Cavan and Monaghan. As can be seen from Table 7.2 above, there are three (3) feasible WRZ Options for Cootehill PWS WRZ. We rank the three (3) WRZ Options against the six (6) Approach Categories using the EBSD tool. As set out in Table 7.3, all three Options (SAB-059, SAB-060 and SAB-063) were considered to be similar in relation to Best AA criteria and were therefore all ranked as the Best AA. Two (2) Options (SAB-059 and SAB-060) were considered to be similar in terms of delivery timescales and were therefore both ranked the Quickest Delivery. Two (2) Options (SAB-059 and SAB-063) were considered to be similar in terms of resilience and were therefore both ranked the Most Resilient. Option SAB-060 provides the best outcome under four (4) Approach Categories, being the Least Cost, Quickest Delivery, Best AA and Lowest Carbon. Option SAB-059 ranked the highest for the Quickest Delivery, Best AA and Most Resilient. Option SAB-063 ranked the highest for the Best AA, Best Environmental and Most Resilient.

As previously mentioned, in some instances, Options may achieve similar, although not identical, scores within an Approach Category. As described in Section 7.2.2, where Options or combinations of Options achieve similar, although not exactly identical scores under the six (6) approach types, Uisce Éireann takes a wider look at the comparable combinations/Options to consider which to categorise as the “Best” approach within each category. Therefore, prior to the Seven (7)-Step process, the two Options that achieve similar scores for an approach category are compared to determine which approach should go forward as the ‘Best’ in that approach category.

Table 7.3 SAB, Cootehill WRZ - WRZ Options

WRZ Name	Feasible Options – Cootehill WRZ			Approach					
	No. of WRZ Options	Option Code	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA (Environmental)	Lowest Carbon	Most Resilient
Cootehill PWS	3	SAB-059	New SW abstraction from Lough Drumore to supply deficit. Treat at the existing Kilawaun WTP.	-	✓	✓	-	-	✓
		SAB-060	New SW abstraction from River Drumore to supply deficit. Treat at the existing Kilawaun WTP.	✓	✓	✓	-	✓	-
		SAB-063	New SW abstraction from Annalee River	-	-	✓	✓	-	✓

### 7.2.3.2 Approach Appraisal - WRZ Level Approach

Once Uisce Éireann has identified the Option with the best outcomes within each of the Approach Categories, these Options are then brought through to the Approach Development Process. As noted previously, this process allows us to compare the best ranked approaches within each category at WRZ

Level relative to each other, to select the Option that provides the best overall solution for that WRZ. This process is demonstrated in Figure 7.3 for the Cootehill PWS WRZ in SAB.

<b>STEP 0</b> Best AA	There are no options assessed as having no potential impact on a European Site (based on a desktop assessment). Proceed to the 7-step process.
<b>STEP 1</b> Least Cost	We compared the Least Cost Approach against the Best AA Approach. The Least Cost Approach is also the Best AA Approach with all feasible options having a - 1 biodiversity score. The Least Cost Approach was therefore retained at this stage.
<b>STEP 2</b> Quickest Delivery	We compared the Quickest Delivery Approach against the Least Cost Approach. Two options are comparable in terms of delivery time (Quickest Delivery). The Least Cost Approach is also the Quickest Delivery Approach and therefore the Least Cost Approach was retained at this stage.
<b>STEP 3</b> Best Environmental	We compared the Least Cost against the Best Environmental Approach. The Best Environmental Approach was not significantly better than the Least Cost Approach and was also associated with significantly higher (13 x) carbon as well as increasing overall costs. Therefore the Least Cost Approach was retained at this stage because it offered no significant environmental benefit.
<b>STEP 4</b> Most Resilient	We compared the Least Cost Approach against the Most Resilient Approach. The Most Resilient Approach was flagged during workshops as being associated with some potential ownership issues whilst offering no other significant benefits. Therefore the Least Cost Approach was retained at this stage.
<b>STEP 5</b> Least Carbon	We compared the Least Cost Approach against the Lowest Carbon Approach. The Least Cost Approach is the Lowest Carbon Approach. The Least Cost Approach was therefore retained at this stage.
<b>STEP 6</b> Approach Comparison	A final assessment of the Least Cost Approach was completed against the Least Carbon, Best AA, Best Environmental and Most Resilient Approaches. The Least Cost Approach is also the Quickest Delivery, Best AA and Lowest Carbon. The Best Environmental is associated with higher carbon costs whilst the Most Resilient Option was linked to potential ownership issues. The Least Cost Approach was therefore retained at this stage.
<b>STEP 7</b> Preferred Approach	The Least Cost Approach was selected as the Preferred Approach for the Water Resource Zone.

Figure 7.3 WRZ Level Preferred Approach Development - SAB, Cootehill PWS WRZ

We follow this same process for the WRZs within each Study Area to establish the Preferred Approach for each WRZ across the seven (7) Study Areas of the North West Region. The individual WRZ Preferred Approaches are combined and referred to as the **WRZ Level Approach**. This Stage 1 process is outlined in Figure 7.4.

• **Stage 1:** •

WRZ Level Preferred Approach Development



Figure 7.4 Preferred Approach Development – Stage 1

The outcome of the Stage 1 process for SAB is summarised in Table 7.4. This shows the combination of the WRZ Preferred Approaches in the Study Area and their alignment with the six (6) Approach Categories, as determined by the application of the Seven (7)-Step process. Each of the 23 WRZs has a local Option available.

In some study areas there may be no local WRZ Option available for some WRZs. For example, there are four (4) WRZs in SAA that do not have a feasible local Option. The Technical Report for Study Area A (Appendix 1) provides further details. Such a scenario highlights the benefit of identifying Options at a broader Study Area Level (Section 7.2.4).

Even where a local Option is available for each WRZ, some of these Options may have the potential to meet the Deficit of more than one WRZ. Combining WRZs into SA Option can be a good alternative to the local WRZ Option, as SA Options are likely to deliver cost efficiencies by supplying multiple WRZs. They also may provide wider environmental and social benefits through the rationalisation of infrastructure and abstraction points.

Table 7.4 SAB (County Cavan and Monaghan) WRZ Level Approach –Assessment Outcome

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Ballyconnell PWS	TG1-SAB-027	Increase GW abstraction from existing boreholes to supply deficit.	-	✓	-	✓	✓	✓	-	✓
Ballyhaise PWS (GWS Import)	TG1-SAB-067	Keep supplying Ballyhaise WRZ from Annagh GWS	✓	✓	✓	✓	✓	✓	✓	✓
Ballyjamesduff RWSS	TG1-SAB-051	Upgrade WTP for water quality improvements. Ballyjamesduff WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Bawnboy PWS	TG1-SAB-036	Upgrade WTP for water quality improvements. Bawnboy WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Belturbet PWS	TG1-SAB-187	Upgrade Belturbet WTP for water quality improvements. Belturbet PWS WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Blacklion PWS (GWS Import)	TG1-SAB-077 & TG1-SAB-078	Keep supplying Blacklion WRZ from Gowan GWs (Cuilcagh Mountain Spring and Garvagh Lough)	✓	✓	✓	✓	✓	✓	✓	✓
Cashilard	TG1-SAB-192	Upgrade Cashilard WTP for water quality improvements. Cashilard WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Cavan RWSS	TG1-SAB-001	Increase existing SW abstraction from Lough Acanon Dam and supply deficit.	✓	✓	-	✓	✓	✓	-	✓
Clones	TG1-SAB-086	Increase GW abstraction from existing boreholes to supply deficit.	-	✓	-	✓	✓	✓	-	✓
Cootehill PWS	TG1-SAB-060	New SW abstraction from River Drumore to supply deficit. Treat at the existing Kilawaun WTP.	-	✓	✓	✓	-	✓	-	✓
Derrykillev	TG1-SAB-186	New GW abstraction to supply Derrykillev WRZ.	-	✓	✓	✓	✓	✓	✓	✓
Emyvale (GWS Import)	TG1-SAB-115	Keep supplying Emyvale WRZ from Glaslough and Tyholland GWS.	✓	✓	✓	✓	✓	✓	-	✓
Glaslough (GWS Import)	TG1-SAB-123	Keep supplying Glaslough WRZ from Glaslough and Tyholland GWS.	✓	-	✓	✓	✓	✓	-	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Gowna	TG1-SAB-133	Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Gowna (GWS Import)	TG1-SAB-084	Keep supplying Gowna WRZ from Erne Valley GWS.	-	✓	✓	✓	✓	✓	✓	✓
Kinlough Tullaghan	TG1-SAB-202	New SW abstraction from Glenade Lough and upgrade of existing Glenade WTP	-	-	✓	✓	✓	-	✓	✓
Lough Egish	TG1-SAB-127	Upgrade WTP for water quality improvements. Lough Egish WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Monaghan	TG1-SAB-190 & TG1-SAB-191	Upgrade Togan (Lake) WTP for water quality improvements. Monaghan WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Newbliss	TG1-SAB-189	Upgrade Newbliss WTP for water quality improvements. Newbliss WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Pettigo Pub	TG1-SAB-173	Increase GW abstraction from existing BHs.	✓	✓	-	✓	✓	✓	-	✓
Shercock PWS (GWS Import)	TG1-SAB-072	Keep supplying Shercock WRZ from Dhuish GWS.	✓	✓	-	✓	✓	✓	-	✓
Smithboro	TG1-SAB-104	Increase GW abstraction from existing boreholes to supply deficit.	✓	✓	✓	✓	-	✓	-	✓
Swanlinbar PWS	TG1-SAB-188	Upgrade Swanlinbar WTP for water quality improvements. Swanlinbar PWS WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	-	✓

### 7.2.4 Stage 2 – Study Area Combinations

As outlined in Section 6, there are three (3) types of Options considered within the NWRP:

- WRZ Option – Options that address Need in one WRZ only
- SA Option – Options that can address needs across multiple WRZs, generally within a Study Area
- Regional Option – Options that can address the needs in multiple WRZs across multiple Study Areas.

Accordingly, once the WRZ Level Preferred Approach for each of the individual WRZs has been identified, we determine whether there are alternative SA Options that can address need in more than one WRZ and replace the WRZ Options. Uisce Éireann then develops various combinations of Study Area Options and WRZ Options that can address the Deficit for the entire Study Area. These are called "SA Combinations". This Stage 2 process is summarised in Figure 7.5.

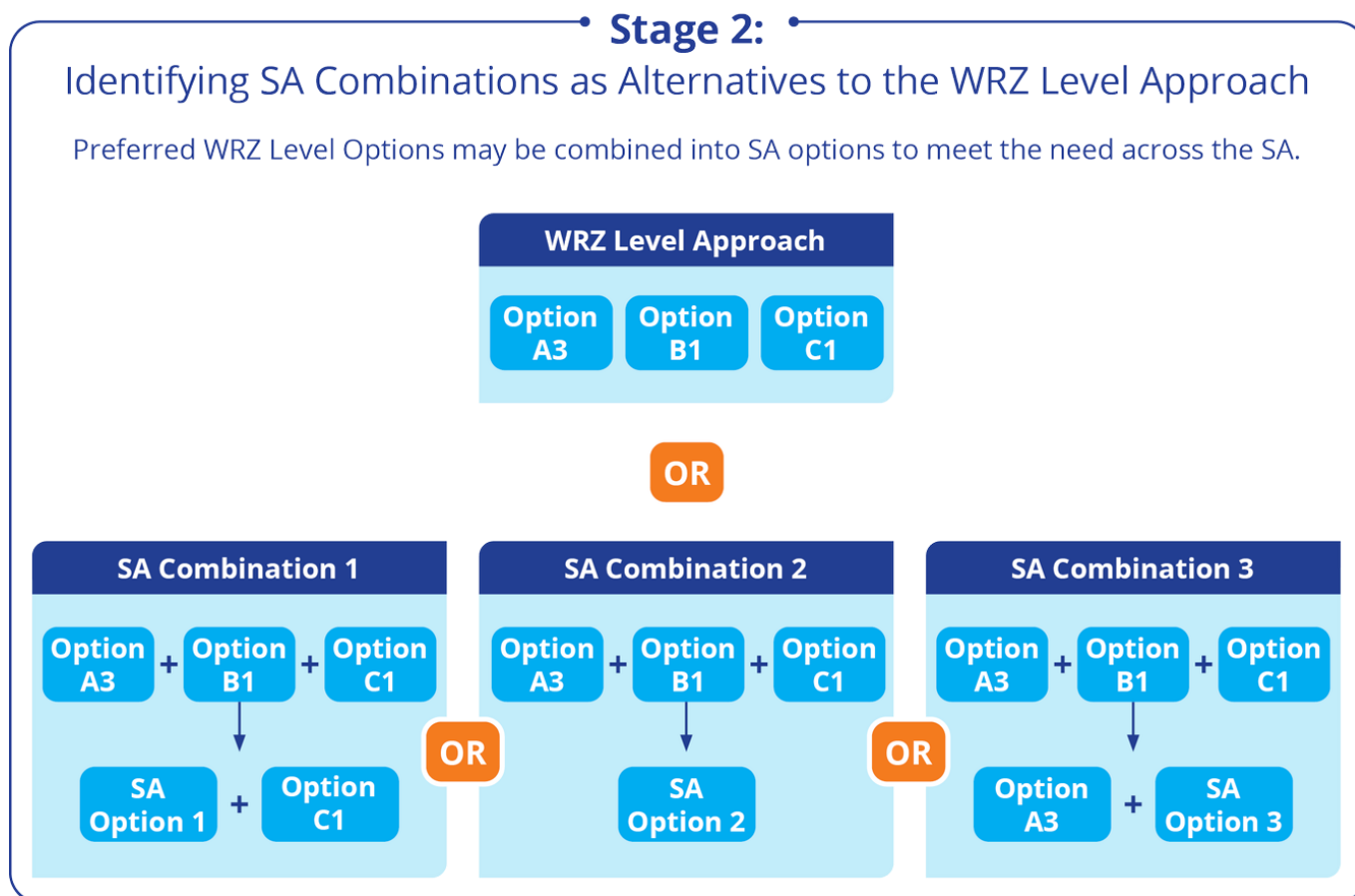


Figure 7.5 Preferred Approach Development – Stage 2

The WRZ Level Approach will form one of these combinations for assessment at the Study Area Level, if it can meet the full Deficit of the Study Area. Where this is not the case (that is, where feasible WRZ Options are not identified for all WRZs in the Study Area) the WRZ Level Approach is not included in the Seven (7) - Step Option Development Process.

In our example of SAB, six (6) SA Combinations were developed and taken through the Seven (7)-Step process to identify the 'Best' performing combination of Options across the six (6) Approach Categories. The combinations for SAB are summarised in Table 7.5.

Table 7.5 SAB (County Cavan and Monaghan) SA Level Approach - Assessment Outcome

<b>Key</b>	WRZ Level Approach Option	<input type="radio"/>	SA Grouped Option	<input type="checkbox"/>
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WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 1, 22, 24, 35,38 and 49)	SA Combination 2 (SA Grouped Option 1, 24, 35,38 and 49)	SA Combination 3 (SA Grouped Option 24, 35, 38 and 49)	SA Combination 4 (SA Grouped Option 24, 35, 38, 49, 53 and 55)	SA Combination 5 (SA Grouped Option 1, 35,38 and 49)
Ballyconnell PWS	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ballyhaise PWS (GWS Import)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>
Ballyjamesduff RWSS	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bawnboy PWS	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Belturbet PWS	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blacklion PWS (GWS Import)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cashilard	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cavan RWSS	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Clones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cootehill PWS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Derrykillew	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emyvale (GWS Import)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>
Glaslough (GWS Import)	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>
Gowna	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
Gowna (GWS Import)	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
Kinlough Tullaghan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lough Egish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Monaghan	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="checkbox"/>	<input type="radio"/>
Newbliss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 1, 22, 24, 35,38 and 49)	SA Combination 2 (SA Grouped Option 1, 24, 35, 38 and 49)	SA Combination 3 (SA Grouped Option 24, 35, 38 and 49)	SA Combination 4 (SA Grouped Option 24, 35, 38, 49, 53 and 55)	SA Combination 5 (SA Grouped Option 1, 35,38 and 49)
Pettigo Pub	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shercock PWS (GWS Import)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Smithboro	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Swanlinbar PWS	<input type="radio"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 7.5 demonstrates the variety of SA Combinations for SAB. For example, SA Combination 5 contains five (5) Group Options - 1, 35,38 and 49. Group 1, Group 35 and Group 49 each resolve the need in two (2) WRZs. Group 1 meets the need in Cavan RWSS and Ballyjamesduff RWSS, Group 35 meets the need in Derrykillew and Ballyshannon & Bundoran whilst Group 4 meets the need in Cashilard and Ballyshannon & Bundoran. Group Option 38 resolves the need in four (4) WRZs (Belturbet PWS, Swanlinbar PWS, Bawnboy PWS and Ballyconnell PWS). The Need for the remaining WRZs in SA Combination 5 is resolved by the Preferred Approach at WRZ Level.

Even when we consider all permutations of Study Area Options to create the SA Combinations, there are some water supplies that will always require a WRZ Level Option. For example, in SAB Blacklion PWS (GWS Import), Clones, Cootehill PWS, Kinlough Tullaghan, Lough Egish, Newbliss, Pettigo Pub, Shercock PWS (GWS Import) and Smithboro are always supplied by a WRZ Level Option. These WRZs are typically very small, isolated supplies serving a limited number of people. Due to the age of our water network and water quality issues associated with transferring small volumes of water over long distances, a local supply is a more suitable solution for t WRZs. In these cases, the emphasis of the NWRP is to ensure that the best possible resilient local sources are identified.

In Table 7.6 we show the number of SA Combinations identified for each Study Area in the North West Region.

Table 7.6 Number of SA Combinations for each Study Area

Number of SA Combinations						
SAA	SAB	SAC	SAD	SAE	SAF	SAG
13	5	13	22	12	13	8

## 7.2.5 Stage 3 – Study Area Level Preferred Approach

### 7.2.5.1 Test a Range of Approach Types – Study Area Level

As part of Stage 3, we compare the WRZ Level Approach (which is a combination of all the WRZ Level Options identified at WRZ level) and the SA Combinations developed in Stage 2. Where the WRZ Level Approach cannot meet the full supply deficit of the Study Area, it is excluded at this stage of comparison.

The purpose of this exercise is to ensure that the Preferred Approach selected at Study Area Level for each Study Area is the combination of Options that provide the best overall outcome when considered against the six (6) Approach Categories. To assist us in this exercise, we use the EBSD tool to rank the Study Area Combinations against the six (6) Approach Categories.

Table 7.7 shows an example of the output from the EBSD process for SAB. The presentation of the data in this way allows us to understand the relative benefits of each combination of Options.

Table 7.7 Stage 3 – EBSD Output for SAB (SA Combinations Assessment)

Ranked order (best to worst)	Best					
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WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 1, 22, 24, 35,38 and 49)	SA Combination 2 (SA Grouped Option 1, 24, 35,38 and 49)	SA Combination 3 (SA Grouped Option 24, 35, 38 and 49)	SA Combination 4 (SA Grouped Option 24, 35,38, 49, 53 and 55)	SA Combination 5 (SA Grouped Option 1,35, 38 and 49)
Least Cost				Worst		Best
Quickest Delivery	Best				Worst	
Best AA biodiversity	No -3 impact	No -3 impact	No -3 impact	No -3 impact	No -3 impact	No -3 impact
Lowest Carbon	Worst					Best
Most Resilient	Worst					Best
Best Environmental	Worst					Best

The SA combinations outlined in Table 7.7 are assessed to determine the 'Best' performing combination in each Approach Category. These are summarised in Table 7.8.

**Table 7.8 Best SA Combinations for SAB**

<b>Approach Categories</b>	<b>Best Performing Combination</b>
Least Cost (LCo)	SA Combination 5 (Group 1, 35, 38 & 49)
Best Environmental (BE)	SA Combination 5 (Group 1, 35, 38, & 49)
Quickest Delivery (QD)	WRZ Approach
Most Resilient (MR)	SA Combination 5 (Group 1, 35, 38, & 49)
Lowest Carbon (LC)	SA Combination 5 (Group 1, 35, 38, & 49)
Best AA (BA)	SA Combination 5 (Group 1, 35, 38, & 49)*

\* Least number of -1 AA impacts

### **7.2.5.2 Approach Appraisal – Study Area Level**

We then compare the best performing Option or combinations of Options (listed in Table 7.8) within each of the six (6) Approach Categories using the Seven (7)-Step Process to establish the Preferred Approach at Study Area Level. As at WRZ Level, this process allows us to compare the best ranked approaches within each Approach Category at Study Area Level relative to each other, to select the combination of Options that provides the best overall solution for that Study Area. This process is conducted via a workshop, and the decision-making and outcomes are recorded for each supply.

As an illustration, we set out in Figure 7.6 how we applied this process to Study Area B.

<b>STEP 0</b> Best AA	There is no SA combination in SAB assessed as having no potential impact on a European Site (based on a desktop assessment). Proceed with the 7-step process.
<b>STEP 1</b> Least Cost	We compared the Least Cost Approach (Combination 5) against the Best AA Approach (Combination 5). The Least Cost Approach is the Best AA and was therefore retained at this stage.
<b>STEP 2</b> Quickest Delivery	We compared the Least Cost Approach (Combination 5) against the Quickest Delivery Approach (WRZ Approach). Whilst the Quickest Delivery Approach scored the same in terms of the no. of AA -3 scores it was associated with a higher no. of -1 AA scores compared to the Least Cost Approach. The Quickest Delivery Approach also performed poorly against the environmental, resilience and lowest carbon criteria when compared to the Least Cost Approach. The Quickest Delivery Approach cost is also significantly higher than Least Cost. The Least Cost Approach was therefore retained at this stage.
<b>STEP 3</b> Best Environmental	We compared the Least Cost Approach (Combination 5) against the Best Environmental Approach (Combination 5). The Best Environmental Approach is also the Least Cost Approach. Therefore the Least Cost Approach is retained at this stage.
<b>STEP 4</b> Most Resilient	We compared the Least Cost Approach (Combination 5) against the Most Resilient Approach (Combination 5). The Most Resilient Approach is also the Least Cost Approach. Therefore the Least Cost Approach is retained at this stage.
<b>STEP 5</b> Least Carbon	We compared the Lowest Carbon Approach (Combination 5) against the Least Cost Approach (Combination 5). The Lowest Carbon Approach is also the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.
<b>STEP 6</b> Approach Comparison	A final assessment of the Least Cost Approach was completed against the Best AA, Quickest Delivery, Best Environmental, Most Resilient and Least Carbon Approaches. Whilst the Least Cost Approach does not have the lowest score for the Quickest Delivery it has the highest score for all other criteria and therefore the Least Cost Approach was retained at this stage.
<b>STEP 7</b> Preferred Approach	The Least Cost Approach (which was also the Best AA, Best Environmental, Most Resilient and Lowest Carbon Approach) was therefore selected as the Preferred Approach for the Water Resource and Study Area Levels.

Figure 7.6 SA Level Preferred Approach Development – SAB

### 7.2.5.3 Selection of Preferred Approach – SA Level Approach

Table 7.9 summarises the comparison of the best performing SA combinations for SAB.

When we compare the three (3) best performing approaches against each other (representing the Stage 3 analysis for the selection of the Preferred Approach), their relative performance against categories they were not identified as 'best' in, may be different compared to their relative performance within the wider ranking against all the combinations, as presented in Table 7.7. Furthermore, in Table 7.7 the colour scale used to indicate the relative ranking of all combinations requires more gradations of colour to account for the large number of option combinations that can be assessed. Table 7.9 only contains two (2) different combinations and therefore the colours denoting relative performance between the 'Best Performing SA Combinations' for a particular Approach Type are different to the colour representing relative performance within the wider ranking. For example, for the WRZ Approach, the Least Score is ranked last against the two (2) Best Performing SA Combinations (represented by an orange colour in Table 7.9); whereas it is ranked 4th amongst the six (6) combinations in Table 7.7.

Table 7.9 suggests that SA Approach 1 and 2 are the Best AA because they have the same number of -3 biodiversity scores (i.e., they each have no (0) -3 biodiversity scores). However, SA Approach 5 was selected as the Best AA approach overall, after comparing the number of -2 and -1 biodiversity scores.

Table 7.9 Summary of the MCA Scoring for the Best Performing SA Combinations – SAB

Category Criteria	SA Approach 1 (WRZ Approach) (QD)	SA Approach 2 (SA Combination 5) (LCo, BA, LC, MR, BE)
Least Cost Score	Worst	Best
Quickest Delivery Score	Best	Worst
Best AA Score	No -3 Scores	No -3 Scores
Lowest Carbon Score	Worst	Best
Most Resilient Score	Worst	Best
Best Environmental Score	Worst	Best

Key	
Ranked order (best to worst) within the two selected approaches	
Worst	Best

The outcome when we follow the Seven (7)-Step Process is that SA Approach 3 (SA combination 5) is the Preferred Approach for SAB. As can be seen with reference to Table 7.7, this combination of Feasible Options is the most balanced in terms of performance against all criteria. In particular, the combination of Options performs well against the environmental criteria.

The general Preferred Approach development process at Study Area Level (Stage 3) is summarised in Figure 7.7.

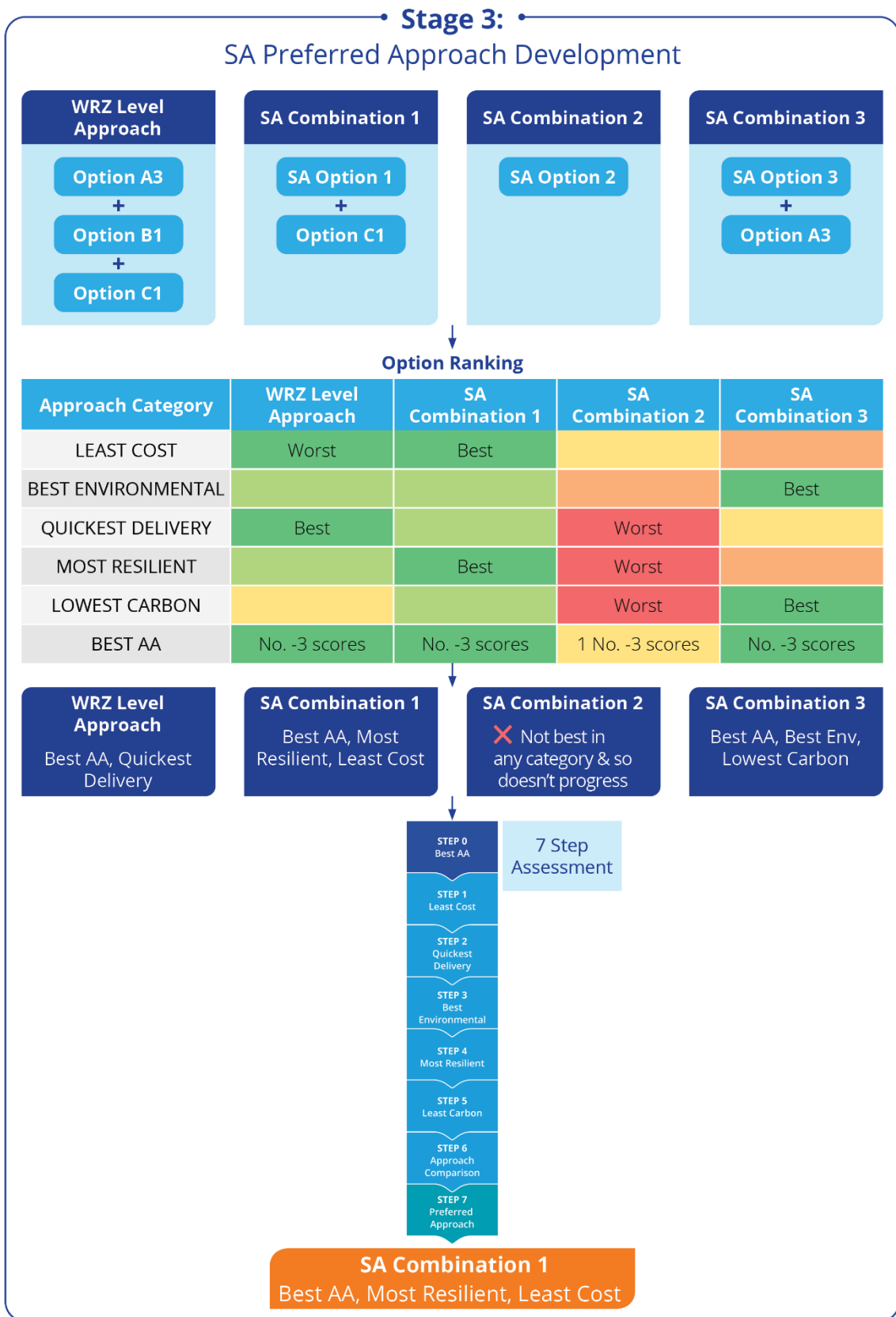


Figure 7.7 SA Preferred Approach Development – Stage 3

## 7.3 WRZ Level Approach and SA Preferred Approach

In this section, we compare the benefits of developing interconnected systems (under the SA Preferred Approach), with the option of continuing to supply existing WRZs independently (under the WRZ Level Approach).

One of the benefits of developing the Preferred Approach at Study Area Level is the ability to create an interconnected network and rationalise our infrastructure to provide a more resilient supply to our customers. In the following sections, we compare the combination of Options that make up the SA Preferred Approach with the WRZ Options that combine to form the WRZ Level Approach. The comparison considers the difference in the infrastructure components and total estimated cost of the Option. Additionally, the overall benefit of the SA Preferred Approach is described with reference to the NWRP objectives represented by the six (6) Approach Categories.

### 7.3.1 SA Preferred Approach Description

The Preferred Approach at Study Area Level comprises 21 SA Grouped Options that collectively supply 119 WRZs across the North West Region (Table 7.10). This creates an interconnected network and allows us to rationalise our infrastructure providing a more resilient supply to our customers. There is also the benefit of eventually moving away from some of our potentially unsustainable abstractions by reducing our abstraction points. Reviewing our supplies at a Study Area Level allows us to understand the regional sustainability of our abstractions.

Table 7.10 SA Preferred Approach

Study Area	Number of WRZs	SA Preferred Approach		Number of WRZs benefitting from a SA Grouped Option
		WRZ Option	SA Grouped Option	
SAA	21	5	3	16
SAB	23	17	4	8
SAC	17	11	3	6
SAD	25	14	4	11
SAE	9	7	2	2
SAF	15	12	2	3
SAG	9	4	3	5
<b>Region Total</b>	<b>119*</b>	<b>70</b>	<b>21</b>	<b>51</b>

\* Includes 10 Group Water Schemes and four (4) small imports from Northern Ireland.

Table 7.11 and Table 7.12 compare the SA Preferred Approach with the WRZ Level Approach. The Option summary in Table 7.11 describes whether the supply Deficit will be met through new and/or increased groundwater (GW) and surface water (SW) abstractions, rationalisations (connection of water treatment plants (WTPs) and/or WRZs, which are usually accompanied by decommissioned abstractions and WTPs), transfers from sources within or outside of the Study Area, Group Water Schemes (GWSs) or water imports from Northern Ireland. The number of Options that only comprise a water quality upgrade to an existing WTP is also presented for those WRZs that are not in Deficit and therefore do not require a new or upgraded supply or transfer from another supply system.

Table 7.12 details the infrastructure components associated with the Options identified for each Study Area. Overall, the SA Preferred Approach across the seven (7) Study Areas of the North West Region requires 13 fewer new WTPs, 18 fewer WTP upgrades, and 29 fewer new or increased abstraction sources, than the WRZ Level Preferred Approach. The SA Grouped Options making up the SA Preferred Approach will also eventually result in the decommissioning of 25 more WTPs and the abandonment of 23 more abstractions, presenting the potential to deliver improved environmental outcomes. The higher interconnectivity created by the SA Preferred Approach requires approximately 310 kilometres of more pipeline compared with the WRZ Level Approach and 9 more water storages.

Full details of the SA Preferred Approach development are included in Technical Appendices 1-7.

Table 7.11 Comparison of Option Types

Study Area	WRZ Level Approach	SA Preferred Approach
SAA Donegal	<p><b>18 WRZ Options*</b></p> <ul style="list-style-type: none"> <li>- 14 Options with increased/new GW/SW abstractions.</li> <li>- 1 Option with a WTP upgrade (WQ only).</li> <li>- 2 Options involving 'within' WRZ supply rationalisations.</li> </ul> <p><b>4 WRZ with no feasible WRZ Option:</b></p> <ul style="list-style-type: none"> <li>- Bunrana</li> <li>- Fanad West</li> <li>- Inishowen West/Carndonagh/Culdaff</li> <li>- Owenteskiny</li> </ul> <p>* Letterkenny &amp; Inishowen East &amp; Eddie Fullerton Pollan Dam WRZ have 2 WRZ level Options abstracting from 2 sources.</p>	<p><b>5 WRZ Options:</b></p> <ul style="list-style-type: none"> <li>- 3 Options with increased/new GW/SW abstractions.</li> <li>- 2 Options involving 'within WRZ supply rationalisations.</li> </ul> <p><b>3 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 1 Option interconnecting 4 WRZs.</li> <li>- 1 Option rationalising and interconnecting 8 WRZs. Two (2) of the 8 WRZs are in SAB.</li> <li>- 1 Option rationalising 1 WRZ (Glenties Adara) to Lettermacaward and interconnecting Owenteskiny and Killybegs.</li> </ul>
SAB Cavan and Monaghan	<p><b>25 WRZ Options*</b></p> <ul style="list-style-type: none"> <li>- 9 Options with increased/new GW/SW abstractions.</li> <li>- 0 Options involving 'within' WRZ supply rationalisations.</li> <li>- 9 Options with WTP upgrades (WQ only).</li> </ul>	<p><b>17 WRZ Options*:</b></p> <ul style="list-style-type: none"> <li>- 5 Options with increased/new GW/SW abstractions.</li> <li>- 4 Options with WTP upgrades (WQ only).</li> <li>- 7 Options that keep supplying from Group Water Schemes (GWSs).</li> <li>- 1 Option involving a new GW import.</li> </ul>



Study Area	WRZ Level Approach	SA Preferred Approach
	<ul style="list-style-type: none"> <li>- 7 Options involving GWS imports.</li> </ul> <p>* Blacklion PWS (GWS Import) and Monaghan WRZs have 2 WRZ level Options each.</p>	<p><b>4 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 1 Option interconnecting 2 WRZs.</li> <li>- 1 Option rationalising 3 WRZs to 1 WRZ with an increased GW abstraction.</li> <li>- 2 Options rationalising 2 WRZs to a Grouped Option in SAA.</li> </ul>
<p>SAC Mayo and Sligo</p>	<p><b>16 WRZ Options</b></p> <ul style="list-style-type: none"> <li>- 14 Options with increased/new GW/SW abstractions.</li> <li>- 1 Option involving GWS imports.</li> <li>- 1 Option rationalising Swinford to Kilaturley GWS.</li> </ul> <p><b>1 WRZ with no feasible WRZ Option:</b></p> <ul style="list-style-type: none"> <li>- Lough Easkey Regional Water Supply.</li> </ul>	<p><b>11 WRZ Options:</b></p> <ul style="list-style-type: none"> <li>- 6 Options with increased/new GW/SW abstractions.</li> <li>- 2 Options with a WTP upgrade (WQ only).</li> <li>- 1 Option involving a GWS import.</li> <li>- 2 Options rationalising to a GWS.</li> </ul> <p><b>3 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 2 Options collectively rationalising 3 WRZs to 2 WRZs.</li> <li>- 1 Option rationalising 1 WRZ to SAD and increasing the SW abstraction.</li> </ul>
<p>SAD Galway and Mayo</p>	<p><b>24 WRZ Options</b></p> <ul style="list-style-type: none"> <li>- 22 Options with increased/new GW/SW abstractions.</li> <li>- 1 Option involving a GWS import.</li> <li>- 1 desalination Option.</li> </ul> <p><b>1 WRZ with no feasible WRZ Option</b></p> <ul style="list-style-type: none"> <li>- Carraroe</li> </ul>	<p><b>14 WRZ Options:</b></p> <ul style="list-style-type: none"> <li>- 13 Options with increased/new GW/SW abstraction.</li> <li>- 1 desalination Option.</li> </ul> <p><b>4 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 2 Options including rationalisation with increased SW/GW abstractions collectively rationalising 3 WRZs to 2 WRZs.</li> <li>- 1 Option with a rationalisation to a new community scheme/GWS</li> <li>- 1 Option with a new abstraction creating a new RWSS.</li> </ul>
<p>SAE Louth</p>	<p><b>8 WRZ Options</b></p> <ul style="list-style-type: none"> <li>- 3 Options with increased/new GW/SW abstractions.</li> <li>- 3 Options with WTP upgrades (WQ only).</li> <li>- 1 Option involving a GWS import.</li> <li>- 1 Option involving a Northern Ireland import.</li> </ul> <p><b>1 WRZ with no feasible WRZ Option</b></p>	<p><b>7 WRZ Options:</b></p> <ul style="list-style-type: none"> <li>- 3 Options involving a WTP upgrade for WQ.</li> <li>- 1 Option involving a Northern Ireland import.</li> <li>- 3 Options involving new/increased SW/GW abstractions.</li> </ul> <p><b>2 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 1 Option involving rationalisation of Collon Drybridge to South Louth East Meath (in the Eastern and Midlands</li> </ul>

Study Area	WRZ Level Approach	SA Preferred Approach
	<ul style="list-style-type: none"> <li>- Drumcondrath</li> </ul>	<p>region) and associated new GW abstraction.</p> <ul style="list-style-type: none"> <li>- 1 Option involving a new groundwater abstraction.</li> </ul>
<p>SAF Roscommon and Leitrim</p>	<p><b>15 WRZ Options</b></p> <ul style="list-style-type: none"> <li>- 9 Options with increased/new GW/SW abstractions.</li> <li>- 0 Options involving ‘within’ WRZ supply rationalisations. Decommission 0 WTPs.</li> <li>- 4 Options with WTP upgrades (WQ only).</li> <li>- 2 Option maintaining supply from a GWS.</li> </ul>	<p><b>12 WRZ Options:</b></p> <ul style="list-style-type: none"> <li>- 6 Options involving new/increased abstractions.</li> <li>- 4 Options involving WTP upgrades for WQ.</li> <li>- 2 Options that keep supplying from Group Water Schemes (GWSs).</li> </ul> <p><b>2 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 1 Option interconnecting 2 WRZs and increasing a SW abstraction.</li> <li>- 1 Option rationalising to SAD and increasing GW abstraction.</li> </ul>
<p>SAG Clare</p>	<p><b>9 WRZ Options</b></p> <ul style="list-style-type: none"> <li>- 8 options with increased/new GW/SW abstractions.</li> <li>- 1 Option with WTP upgrades (WQ only).</li> </ul>	<p><b>4 WRZ Options:</b></p> <ul style="list-style-type: none"> <li>- 2 Options involving WTP upgrades (for WQ).</li> <li>- 2 Options involving new/increased SW/GW abstractions.</li> </ul> <p><b>3 SA Grouped Options:</b></p> <ul style="list-style-type: none"> <li>- 2 Rationalisation Options with increased GW abstraction, collectively rationalising 2 WRZs to 2 WRZs.</li> <li>- 1 interconnection Option with an increased SW abstraction.</li> </ul>

Table 7.12 Infrastructure Component Summary

SA	Approach Type	Infrastructure Component						
		New Pipeline (km)	New WTPs	Upgrade WTPs *	New/Upgraded Abstracts	Decomm. WTPs	Decomm. Abstracts	No. of Water Storage
SAA	SA Preferred Approach	278	3	21	9	8	10	25
	WRZ Level Approach	146	7	23	15	0	3	13
SAB	SA Preferred Approach	47	0	13	6	4	4	1
	WRZ Level Approach	25	3	16	10	1	1	3
SAC	SA Preferred Approach	90	1	13	8	6	6	6
	WRZ Level Approach	83	3	14	18	5	4	6
SAD	SA Preferred Approach	149	6	21	20	12	12	17
	WRZ Level Approach	43	8	28	25	4	8	17
SAE	SA Preferred Approach	30	0	13	6	3	5	7
	WRZ Level Approach	34	0	15	5	1	2	6
SAF	SA Preferred Approach	39	0	16	7	2	2	5
	WRZ Level Approach	32	0	17	9	1	0	6
SAG	SA Preferred Approach	59	0	7	4	3	3	3
	WRZ Level Approach	20	2	9	7	1	1	4
Total	SA Preferred Approach	692	10	104	60	38	42	64
	WRZ Level Approach	383	23	122	89	13	19	55

SA	Approach Type	Infrastructure Component						
		New Pipeline (km)	New WTPs	Upgrade WTPs *	New/Upgraded Abstracts	Decomm. WTPs	Decomm. Abstracts	No. of Water Storage
<b>Difference</b>		<b>+310</b>	<b>-13</b>	<b>-18</b>	<b>-29</b>	<b>+25</b>	<b>+23</b>	<b>+9</b>

\* Includes WTP upgrades for both Water Quality only (for those WRZs that are not in Deficit) and WTPs with capacity upgrades.

### 7.3.2 Assessment against the Six Approach Categories

Table 7.13 shows the Multi Criteria Assessment (MCA) ranking of the Preferred Approach at Study Area Level and the WRZ Level Approach for SAA to SAG. The ranking (colour coding) presented in Table 7.13 is relative to all SA Combinations identified for the Study Area.

As the WRZ Level Approach did not meet the Deficit for SAA, SAC, SAD, and SAE, it has not been assessed and assigned a score within each Approach Category.

A comparative description for each Study Area is presented in Table 7.14. Further justification for the selection of the SA Preferred Approach is set out in detail in the supporting Study Area Technical Reports (Appendix 1 - 7). The SEA North West Regional Environmental Report details the environmental assessment outcomes.

Table 7.13 Multi Criteria Assessment (MCA) Scores



Study Area	Approach Type	Approach Category					
		Least Cost	Quickest Delivery	Best AA*	Lowest Carbon	Most Resilient	Best Env.
SAA	SA Preferred Approach		Worst	1 No -3 scores			Best
	WRZ Level Approach**			1 No -3 Scores			
SAB	SA Preferred Approach	Best		0 No. -3 Scores	Best	Best	Best
	WRZ Level Approach		Best	0 No. -3 Scores	Worst	Worst	Worst
SAC	SA Preferred Approach	Best		2 No. -3 Scores	Best		
	WRZ Level Approach**			2 No -3 Scores			
SAD	SA Preferred Approach	Best		5 No. -3 Scores	Best		
	WRZ Level Approach**			3 No. -3 Scores			
SAE	SA Preferred Approach	Best	Best	0 No. -3 Scores		Worst	
	WRZ Level Approach**			0 No. -3 Scores			
SAF	SA Preferred Approach		Best	2 no. -3 Scores			
	WRZ Level Approach	Best		1 No. -3 Scores	Best		
SAG	SA Preferred Approach	Best	Best	0 No.-3 Scores			
	WRZ Level Approach			0 No.-3 Scores			

\* A Best AA score of -3 equates to Likely Significant Effects (LSEs) that may be harder to mitigate or require significant project level assessment.

\*\* The WRZ Level Approach did not meet the Deficit for SAA, SAC, SAD, and SAE. For this reason, the WRZ Level Approach has not been assessed and assigned a score for the purpose of determining the best performing alternative within each Approach Category.

Table 7.14 SA Level Preferred Approach (PA) comparison with the WRZ Level Approach

Study Area	Comparative Assessment
SAA	<p><b>The PA is the Best Environmental Approach.</b></p> <p>The PA for SAA includes 3 SA Options and 5 WRZ Options that supply the deficit across all WRZs. There are no feasible WRZ Options for four (4) WRZs in the Study Area. For this reason, the WRZ Level Approach can meet the deficit for only 17 of the 21 WRZs.</p> <p>The PA decommissions 10 abstraction sources compared with three (3) decommissioned abstractions under the WRZ Level Approach. The PA has the advantage of requiring 6 fewer new or increased abstractions and therefore has a lower impact on biodiversity and the water environment.</p> <p>The interconnected Options of the PA will require an estimated 132 km more pipeline than the WRZ Options and will reduce the number of WRZs from 21 to 6.</p> <p>The PA has an estimated NPV cost that is 11% higher than WRZ Level Approach. The increased costs are associated with the additional pipeline length and water storage infrastructure and the additional works required to secure supply to four (4) more WRZs.</p> <p>The PA has one (1) high-risk Option under the Appropriate Assessment that will require further assessment at project level to confirm mitigation opportunities. This includes the rationalisation and interconnection of seven (7) WRZs to Letterkenny, which involves an increased abstraction from the River Crana and new abstractions from Gartan Lough and Glen Lough.</p> <p>The high environmental score for the PA is associated with the lower materials and waste impacts due to the rationalisation of assets. The PA is also likely to have a lower landscape impact as it requires less abstractions and WTPs. Benefits to the water environment are also achieved through the abandonment of 10 abstractions (nine (9) of which may not meet sustainability guidelines during dry weather flows). Cessation of abstractions from these surface water sources has potential to improve water quality and benefit water dependent biodiversity including aquatic ecology.</p>
SAB	<p><b>The PA is the Least Cost, Best AA, Lowest Carbon, Most Resilient and Best Environmental Approach.</b></p> <p>The PA for SAB comprises 4 SA Options and 17 WRZ Options compared with 25 WRZ Options for the WRZ Level Approach. Both approaches can meet the deficit across all WRZs in the study area.</p> <p>The PA provides the following advantages compared to the WRZ Level Approach: four (4) fewer new or upgraded abstractions, three (3) more decommissioned WTPs and three (3) more decommissioned abstractions. Additionally, the PA Approach requires three (3) fewer upgraded WTPs and there are no new WTPs.</p> <p>The interconnected Options of the PA will require an estimated 22 km more pipeline than the WRZ Options and will reduce the number of WRZs from 23 to 18. The PA will require two (2) fewer water storages.</p> <p>The NPV cost is estimated to be 10% less than the WRZ Level Approach. This cost benefit is the result of lower capital expenditure due to fewer new and increased WTPs; as well as lower operational costs associated with the reduced number of WTPs.</p> <p>The PA has been selected as the Lowest Carbon, Best Environmental and Best AA Approach due to the reduced infrastructure requirements. The Best AA score is based on the PA having the least number of negative AA impacts. The PA has no high-risk Option that could impact on European sites that will require further assessment at project level.</p> <p>The high environmental score for the PA is associated with the lower materials and waste impacts due to the rationalisation of assets. The PA is also likely to have a lower landscape</p>

Study Area	Comparative Assessment
	<p>impact as it requires less water storages and abstractions. Benefits to the water environment are also achieved through the abandonment of four (4) abstractions (one of which may not meet sustainability guidelines during dry weather flows). Cessation of abstractions from this surface water sources has potential to improve water quality and benefit water dependent biodiversity including aquatic ecology.</p> <p>The PA has a relatively long delivery timescale when compared across all SA combinations that were assessed for the study area. However, the low score in this category is outweighed by the significant gains in overall environmental improvement.</p> <p>The SA Grouped Options of the PA merge WRZs through interconnections and rationalisation. This improves the resilience score of the PA compared with the independent local solutions that make up the WRZ Level Approach.</p>
SAC	<p><b>The PA is the Least Cost and Lowest Carbon Approach.</b></p> <p>The PA for SAC includes 3 SA Options and 11 WRZ Options that supply the deficit across all WRZs. There are no feasible WRZ Options for one of the WRZs in the Study Area. For this reason, the WRZ Level Approach can meet the deficit for only 16 of the 17 WRZs.</p> <p>The PA decommissions two (2) additional abstraction sources and one (1) additional WTP. It also has the advantage of requiring 10 fewer new or increased abstractions and two (2) fewer new WTPs. The PA Approach therefore has a lower impact on biodiversity and the water environment. The PA requires only 7 km additional pipeline compared to the WRZ Level Approach.</p> <p>The PA has been selected as the Least Cost Approach. The NPV cost is estimated to be 6% lower than the WRZ Level Approach. This is mostly attributed to the lower capital expenditure, due to the PA requiring fewer new and upgraded WTPs and abstractions.</p> <p>The PA has only two (2) high-risk Options that could impact on European sites, which will require further assessment at project level to confirm mitigation opportunities. The first Option involves an increased groundwater abstraction from Belmullet groundwater body to supply the deficit in Ceide Fields WRZ. The second Option involves a new surface water abstraction from Keel Lough to supplement Accorymore Lake during dry periods.</p> <p>The high environmental score for the PA is associated with the lower materials and waste impacts due to the reduction in water storage requirement and reduced requirement for new abstractions. Benefits to the water environment are also achieved through the abandonment of six (6) abstractions, particularly as four (4) of these abstractions may not meet sustainability guidelines during dry weather flows. Cessation of abstractions from these surface water sources has potential to improve water quality and benefit water dependent biodiversity, including aquatic ecology.</p>
SAD	<p><b>The PA is the Least Cost and Lowest Carbon Approach.</b></p> <p>The PA for SAD includes 4 SA Options and 14 WRZ Options that supply the deficit across all WRZs. There are no feasible WRZ Options for one WRZ in the Study Area. For this reason, the WRZ Level Approach can meet the deficit for only 24 of the 25 WRZs.</p> <p>The PA requires seven (7) fewer WTP upgrades and two (2) fewer new WTPs and decommissions an extra eight (8) WTPs and four (4) additional abstraction sources. It also has the advantage of requiring five (5) fewer new or increased abstractions and therefore has a lower impact on biodiversity and the water environment.</p> <p>The PA has been selected as the Least Cost Approach compared with other Study Area Option combinations. Compared with the WRZ Level Approach, the estimated NPV cost is 6% higher.</p>

Study Area	Comparative Assessment
	<p>The increased costs are associated with the 106 km additional pipeline length and water infrastructure required to secure supply for one (1) more WRZ.</p> <p>The PA has five (5) high-risk Options that could impact on European sites, which will require further assessment at project level to confirm mitigation opportunities. This is associated with four (4) new/increased abstractions which could impact SAC's/SPA's and the construction of a desalination plant which could have impacts on mobile marine mammals.</p> <p>The high environmental score for the PA is associated with the lower materials and waste impacts due to the rationalisation of assets. Substantial benefits to the water environment are also achieved through the abandonment of 12 abstractions, particularly as 11 of these abstractions may not meet sustainability guidelines during dry weather flows. Cessation of abstractions from these surface water sources has potential to improve water quality and benefit water dependent biodiversity including aquatic ecology.</p> <p>The PA has increased risks due to the number of high-risk Options when compared across all SA Combinations; however, all combinations were associated with at least two (2) -3 Scores and the risk of the PA SA Combination is outweighed by the significant benefits relating to reduced carbon, cost and delivery time.</p>
SAE	<p><b>The PA is the Least Cost, Quickest Delivery and Best AA Approach.</b></p> <p>The PA for SAE, includes 2 SA Options and 7 WRZ Options, that supply the deficit across all WRZs. There are no feasible WRZ Options for one WRZ in the Study Area. For this reason, the WRZ Level Approach can meet the deficit for only 8 of the 9 WRZs.</p> <p>The PA provides the following advantages compared to the WRZ Level Approach: it requires approximately 4 km less of pipeline, decommissions two (2) additional WTPs and three (3) abstraction sources and requires two (2) less WTP upgrades.</p> <p>The PA has been selected as the Least Cost Approach overall when performance against other Approach Categories is also considered. Although the NPV is higher than WRZ Level Approach, it is within 5% and the PA secure the supply to one additional WRZ.</p> <p>There are no high-risk Options that could impact on European sites associated with the PA. Four of the Options have a -1 AA score while the remaining five (5) Options have been assessed to have no AA impacts. For this reason, when compared with the other Option combinations, the PA was selected as the Best AA Approach.</p> <p>The approach is comparable to the WRZ Level Approach in terms of numbers of new and decommissioned abstractions/WTPs, but the Approach can be delivered on a shorter timescale at less cost. Substantial benefits to the water environment are also achieved through the abandonment of five (5) abstractions. One (1) of these abstractions may not meet sustainability guidelines during dry weather flows. Cessation of abstractions from these surface water sources has potential to improve water quality and benefit water dependent biodiversity including aquatic ecology.</p> <p>The PA is less resilient when compared across all SA Combinations; however, the low score in this category is outweighed by the significant gains in terms of environmental benefits, delivery and cost.</p>



Study Area	Comparative Assessment
SAF	<p><b>The PA is the Quickest Delivery Approach.</b></p> <p>The PA for SAF includes 2 SA Options and 12 WRZ Options that supply the deficit across all WRZs.</p> <p>The PA decommissions one (1) more WTP and two (2) more abstraction than the WRZ Level Approach. It requires one (1) less WTP upgrade and two (2) fewer new/upgraded abstractions and therefore has a lower impact on biodiversity and the water environment. It also requires one (1) less water storage. The PA requires a similar length of pipeline as the WRZ Level Approach.</p> <p>Compared with the WRZ Level Approach, the estimated NPV cost is 7% higher. The increased costs are associated with the additional pipeline length required to interconnect supply systems.</p> <p>The PA has two (2) high-risk Options that could impact on European sites, which will require further assessment at project level to confirm mitigation opportunities. This is associated with the increased groundwater abstraction at Gortgarrow Spring and the rationalisation of Kilkerrin/Moylough and Dunmore/Glenmaddy P.S, as well as the construction of a new intake from the middle Lake to meet the demand in North Roscommon RWSS.</p> <p>The PA has two (2) more Options with -3 AA scores than the combination of options selected as the Best AA Approach; however, this is outweighed by the significant gains in cost and delivery. Although the Best AA Approach had no -3 AA impacts, it was associated with the development of a more vulnerable local groundwater source for Kilkerrin. The PA allows the development of a more secure source for Kilkerrin, which is also proposed as a solution for Glenamaddy in Study Area D and hence the risk is only counted once across the region. The other -3 AA impact is related to an abstraction at Lough Gara which is linked to an existing abstraction and so mitigations can be developed at short, medium and long timescales.</p>
SAG	<p><b>The PA is the Least Cost and Quickest Delivery Approach.</b></p> <p>The PA for SAG, includes 3 SA Options and 4 WRZ Options, compared with 9 WRZ Options for the WRZ Level Approach. Both approaches can meet the deficit across all WRZs in the study area.</p> <p>The PA decommissions two (2) additional WTPs and two (2) additional abstraction points. It requires two (2) fewer new WTPs, two (2) fewer WTP upgrades, three (3) fewer new/upgraded abstractions and one (1) less water storage. The PA therefore has a lower impact on biodiversity and the water environment. The PA requires approximately 39 km more of pipeline compared to the WRZ Level Approach.</p> <p>The PA has been selected as the Least Cost Approach overall. The total NPV cost is estimated to be 16% less than WRZ Level Approach due to the smaller infrastructure requirements.</p> <p>The PA has no high-risk Options that could impact on European sites.</p> <p>The PA has a slightly lower environmental score than the Best AA Approach, however, the Best AA Approach would require boring through rock over a long distance and so the PA was maintained as this was considered more problematic than the increased cost and carbon. The PA is also likely to have a lower landscape impact as it requires less abstractions and decommissions more existing abstractions. Benefits to the water environment are achieved through the abandonment of three (3) abstractions, particularly as two (2) of these abstractions may not meet sustainability guidelines during dry weather flows. Cessation of abstractions from these surface water sources has potential to improve water quality and benefit water dependent biodiversity including aquatic ecology.</p>

## Appropriate Assessment (AA)

Study Area Combinations for four (4) of the seven (7) Study Areas have -3 scores, indicating there are Options with the potential for Likely Significant Effects (LSEs) on European Sites that cannot be ruled out without further detailed site level assessments. These Options have been assessed as -3 either because the mitigation may be complex or there is uncertainty around potential impacts.

The Preferred Approach for SAA has one (1) -3 scores associated with the following SA combination:

- The rationalisation and interconnection of seven (7) WRZs to Letterkenny (Option SAA-566). The Option requires the completion of works within or crossing a number of SACs which could lead to construction impacts. In addition, abstractions have the potential to impact a number of SPAs and SACs.

The Preferred Approach for SAC has two (2) -3 scores associated with the following SA combinations:

- The increased groundwater abstraction from the Belmullet groundwater body to supply the deficit to Ceide Fields WRZ with an associated upgrade to the WTP (Option SAC-039). The works within the Glenamoy Bog complex SAC may lead to construction impacts whilst the abstraction may impact Groundwater Dependent Terrestrial Ecosystems (GWDTE).
- The new surface water abstraction from Keel Lough and raw water transfer to the existing WTP requiring upgrades (Option SAC-142). Whilst the new source will only be used to supplement Accormore Lake during dry periods the required construction works and subsequent abstraction may impact Keel Machair/Menaun Cliffs and Croaghaun/Slievemore SAC.

The Preferred Approach for SAD has five (5) -3 scores associated with the following SA combinations:

- The formation of the New Connemara Regional Water Supply System which requires a new SW abstraction from Kylemore Lough and a new WTP. Construction impacts may be realised through works within and/or crossing The Twelve Bens/Garraun Complex SAC, Maumturk Mountains SAC and West Connacht Coast SAC. Abstraction impacts may also be seen in Twelve Bens/Garraun Complex. Potential impacts could be seen in the Illaunnaon SPA.
- The new surface water abstraction from Lough Corrib (Option SAD-033). Works within the Lough Corrib SAC and near Lesser Horseshoe Bat foraging ranges designated within Lough Carra/Mask Complex SAC and Ballymaglancy Cave, Cong SAC could sever commuting routes and foraging habitats. Abstraction has the potential to impact the Lough Corrib SAC. Potential impacts are also possible to Lough Corrib SPA and Lough Mask SPA.
- The new groundwater abstraction from Gortgarogh groundwater body spring (Option SAD-040). Construction impacts may arise due to works near Lough Corrib SAC and Lough Lurgeen Bog/Glenamaddy Turlough SAC. Abstraction may impact GWDTE in the SACs and there are potential impacts to Lough Corrib SPA and Lough Mask SPA.
- The rationalisation of Carraroe, Rosmuc and Teeranea Lettermote to Spiddal (Lough Bouliska) involving an increased abstraction from Lough Bouliska (Option SAD-543). Works within and or crossing Connemara Bog SAC and Kilkeiran Bay and Islands SAC may lead to construction impacts. The abstraction may also impact the Connemara Bog Complex SAC whilst there are also potential impacts to the Connemara Bog Complex SPA.
- The construction of a desalination plant to supply the deficit to Inishboffin (Option SAD-055). Construction works may lead to impacts within Inishboffin and Inishshark SAC. Effects of desalination due to brine discharge and chemical use may affect mobile marine mammals in SACs up to 100 km away, notably Inishboffin and Inishshark SAC and West Connacht Coast SAC. Potential impacts could also impact Inishboffin, Omev Island and Turbot Island SPA and High Island, Inishshark and Davillaun SPA.

The Preferred Approach for SAF has two (2) -3 score associated with the following SA combinations:

- Increased groundwater abstraction at Gortgarrow Spring WTP and rationalisation of Kilkerrin/Moylough and Dunmore/Glenamaddy P.S (Option SAF-534). Works near the Lough Corrib SAC and Shankill West Boy SAC may result in construction impacts. The abstraction may impact GWTDE in the Lough Corrib SAC. Potential impacts may occur to the River Suck Callows SPA.
- The construction of a new intake from the middle lake to meet the demand in the North Roscommon RWSS (Option SAF-052). The work required in and near Callow Bog SAC could lead to construction impacts. Additionally, the works and abstraction may have impacts within the Lough Gara SPA.

There are Options with -1 and -2 scores across all seven (7) Study Areas and as such there is the potential for Likely Significant Effects (LSEs). The potential for LSEs however is generally construction related impacts and it is considered that these LSEs will not result in Adverse Effect on Site Integrity (AESI) if mitigation is in place.

## SEA Objectives

The Preferred Approach for SAA and SAB are both assessed as the Best Environmental approach when compared with alternative option combinations. The environmental benefits include improvement to the reliability of supply and reduced long term impact that is achieved through the rationalisation of assets. Benefits to the environment are also achieved through the abandonment of abstractions, which have the potential to improve water quality and benefit water dependent biodiversity.

The Preferred Approach for SAC and SAE are both assessed as the Least Cost Approach and their environmental scores were similar to Option combination selected as the Best Environmental Approach. For SAE, the Preferred Approach is also the Best AA Approach, with no high-risk Options that could impact on European sites.

The Preferred Approach for SAD, SAF and SAG are considered to be the Least Cost and Quickest Delivery. As with SAC and SAE, the Preferred Approach was assigned a similar environmental score to the Best Environmental Approach. When the environmental scores are similar then it may be more appropriate to take through the Least Cost or Quickest Delivery Approach. For example, for SAG the Best Environmental Approach included the provision of a pipeline over a long distance, which was associated with a high degree of uncertainty with respect to timelines and costs. Therefore, taking the Least Cost and Quickest Delivery Approach was considered to be the most appropriate approach. Further detail of these comparisons is presented in the SEA Environmental Reviews.

The Preferred Approach for all seven Study Areas includes the eventual decommissioning of 38 WTPs and 42 abandoned abstractions, of which 32 are surface water sources. Twenty-eight (28) of the abandoned surface water sources are abstractions that may not meet sustainability guidelines under dry weather flows (as assessed by Uisce Éireann using the UKTAG guidelines)<sup>2</sup>. Cessation of abstractions from these surface water sources has potential to benefit ecology and support Water Framework Directive (WFD) objectives.

We have also determined that 44 of the surface water abstractions that will be maintained under the Preferred Approach may not meet sustainability guidelines during dry weather flows. While the plan level assessment has identified that these abstractions may not meet sustainability guidelines, further project level assessments will need to be carried out in the context of applications for planning permission and/or abstraction licences under the new legislative regime. The Preferred Approach, however, does improve or avoid further deterioration at these sources by reducing existing abstractions or developing additional sources to support growth. Reduced abstractions have the potential to benefit aquatic ecology and contribute to the meeting of WFD objectives for these sources. Many of our existing abstractions will require a licence under the new abstraction legislation. Detailed environmental assessments will be submitted with these licence applications which will be assessed and adjudicated by the EPA. The SEA

and AA set a framework for identifying mitigation and monitoring so that these can be part of the decision-making and inform Option design and development. This is further discussed in Section 9.

### Least Carbon

The Preferred Approaches for SAB, SAC and SAD are the Lowest Carbon Approach. For the remaining study areas, the carbon score was similar to the combination of Options selected as the Lowest Carbon Approach. For these study areas, the Preferred Approach was selected in preference to the Lowest Carbon Approach as it had a lower NPV cost, and for SAF offered greater resilience.

### 7.3.3 Cost Comparison

Table 7.15 compares the cost difference for the SA Preferred Approach and the WRZ Level Approach for each Study Area. The higher cost of the Preferred Approach for SAA, SAD and SAE is due in the most part to the additional infrastructure that will be developed to ensure the needs of all WRZs in the Study Area are met. Under the WRZ Level Approach, there were no feasible options for some WRZs in these study areas. For this reason, the cost associated with meeting the needs of these WRZs could not be assessed. If feasible WRZs were available and included in the assessment, the Study Area Preferred Approach would reduce relative to the cost of the WRZ Level Approach. The costs for SAF are similar, with the slightly higher cost attributed to the additional pipeline construction required to interconnect WRZs.

The cost of the Preferred Approach for SAB, SAC and SAG are all considerably less than the WRZ Level Approach. This can be explained by the combination of lower capital costs, due to there being fewer new and upgraded WTPs and abstractions; and lower operational costs, given the smaller number of WTPs serving the same demand. Embedded and operational carbon costs are also subsequently lower.

Table 7.15 Cost Comparison

Cost Difference (%)						
SA Preferred Approach cf. WRZ Level Approach						
SAA	SAB	SAC	SAD	SAE	SAF	SAG
11% ↑	-10% ↓	-6% ↓	6% ↑	3% ↑	7% ↑	-16% ↓

↓ = Reduced cost

↑ = Increased cost

Figure 7.8 compares the total cost of the WRZ Level Approach and the SA Preferred Approach across the region. Overall, the total cost of the SA Preferred Approach is estimated to be only 2% higher, despite meeting the needs of a larger number of WRZs. The greater length of trunk mains proposed under the Preferred Approach results in a capital cost that is 15% greater than the cost of local options under the WRZ Level Approach; however, the operational costs are 24% lower due the smaller number of WTPs.

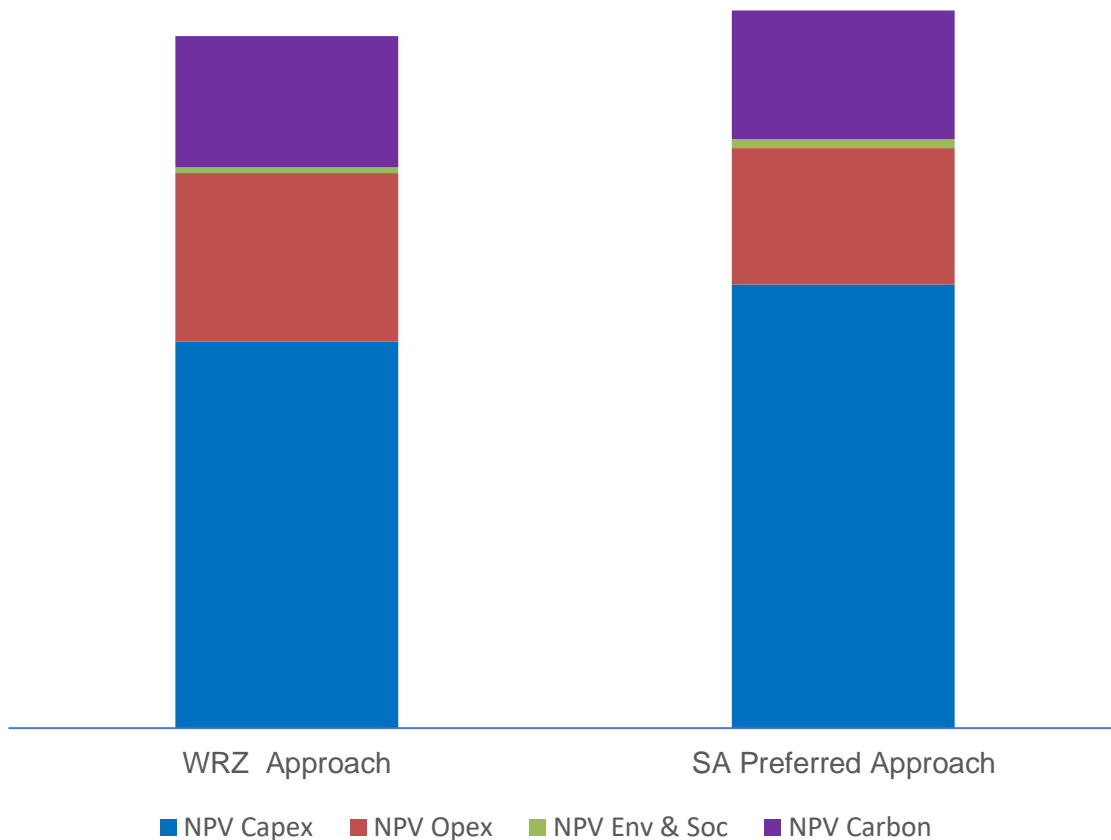


Figure 7.8 Regional NPV Costs for WRZ Level Approach and Study Area Preferred Approach

## 7.4 SA Preferred Approach

### 7.4.1 Water Supply Sources

The SA Preferred Approach for the 7 Study Areas address the supply Deficit across all WRZs in the North West Region through:

- 39 Independent local WRZ sources - local surface water and groundwater sources;
- 15 Within Study Area (SA) interconnected supplies – benefitting 51 WRZs supplied from a new or upgraded source within the Study Area;
- 4 Cross Study Area (SA) interconnected supplies – benefitting 5 WRZs supplied from a new or upgraded source outside the Study Area;
- 12 interconnections to Group Water Schemes; and
- 1 small, existing import from a Northern Ireland source.

For 14 WRZs that are not in deficit and therefore do not require a new or upgraded resource supply, the Preferred Approach includes a WTP water quality processing upgrade (WQ upgrade only). Table 7.16 lists the number of WRZs supplied by each source type, and the WRZs where a WTP upgrade (WQ only) is required.

Under the Preferred Approach 19 local groundwater supplies and 20 local surface water supplies contribute to meeting an estimated 7% and 30%, respectively, of the 2044 Deficit across the North West Region in a dry year. The supplies are mostly expansions of existing sources with some new abstractions.

The interconnection of supply systems reduces the number of WRZs in the region from 119 to 81. Sixty-three (63%) of the Deficit across the seven (7) Study Areas is met by interconnecting and rationalising supplies, which will benefit 54 WRZs. Across the North West Region, the SA Preferred Approach, once delivered, will eventually decommission 38 WTPs and abandon 42 abstractions. As mentioned previously, the reduction in the number of WTPs achieved through supply rationalisation is likely to have benefits of reduced landscape impact, and over the longer term will reduce operational costs. Furthermore, the abandonment of abstractions will deliver environmental benefits to the surface water and groundwater bodies. Resilience and Flexibility are also improved through larger, interconnected supplies.

Table 7.16 Preferred Approach Source Types

	Number of WRZs							
	SAA	SAB	SAC	SAD	SAE	SAF	SAG	Total
Local source (GW)	-	2	3	6	3	3	2	19
Local source (SW)	3	3	3	7	1	3	-	20
Within SA interconnection	18	6	5	12	1	2	5	49
Cross SA interconnection	-	2	1	-	1*	1	-	5
GWS Import	-	7	3	-	-	2	-	12
Northern Ireland Import	-	-	-	-	1	-	-	1
WTP upgrade (WQ only)	-	3	2	-	3	4	2	14

\*Rationalisation of the Drybridge Collon supply to South Louth East Meath WRZ in the Eastern and Midlands Region.

The four (4) cross SA interconnections supply less than 1% of the regional Deficit and benefit five (5) WRZs. These include:

- Rationalising Derrykillew WRZ and Cashilard WRZ in SAB to Ballyshannon/Bundoran) WRZ in SAA and supplying the demand from the proposed new WTP at Knader and new abstraction on the River Erne.
- Rationalising Kiltimagh in SAC to the Lough Mask WRZ supply in SAD, interconnecting Kiltimagh to the expanded Lough Mask and Westport water supply scheme.
- Rationalising Kilkerrin/Moylough WRZ in SAF to Dunmore Glenamaddy in SAD, which will include a new groundwater abstraction to supply the new demand and meet the forecast Deficit for both WRZs.
- Rationalising Drybridge Collon supply in SAE to South Louth East Meath WRZ in the Eastern and Midlands Region.

The remaining Deficit will be created through interconnections to existing Group Water Schemes (GWS): Stranooden GWS in SAB, Kilaturley GWS in SAC.

The relative contribution of the types of sources that will address the 2044 supply Deficit is represented in Figure 7.9.

The Option Development Process at the Study Area Level has not identified any large Regional Options that can connect and supply multiple WRZs across the 7 Study Areas of the North West Region. This is further discussed in Section 8, where we consider the Regional Preferred Approach.

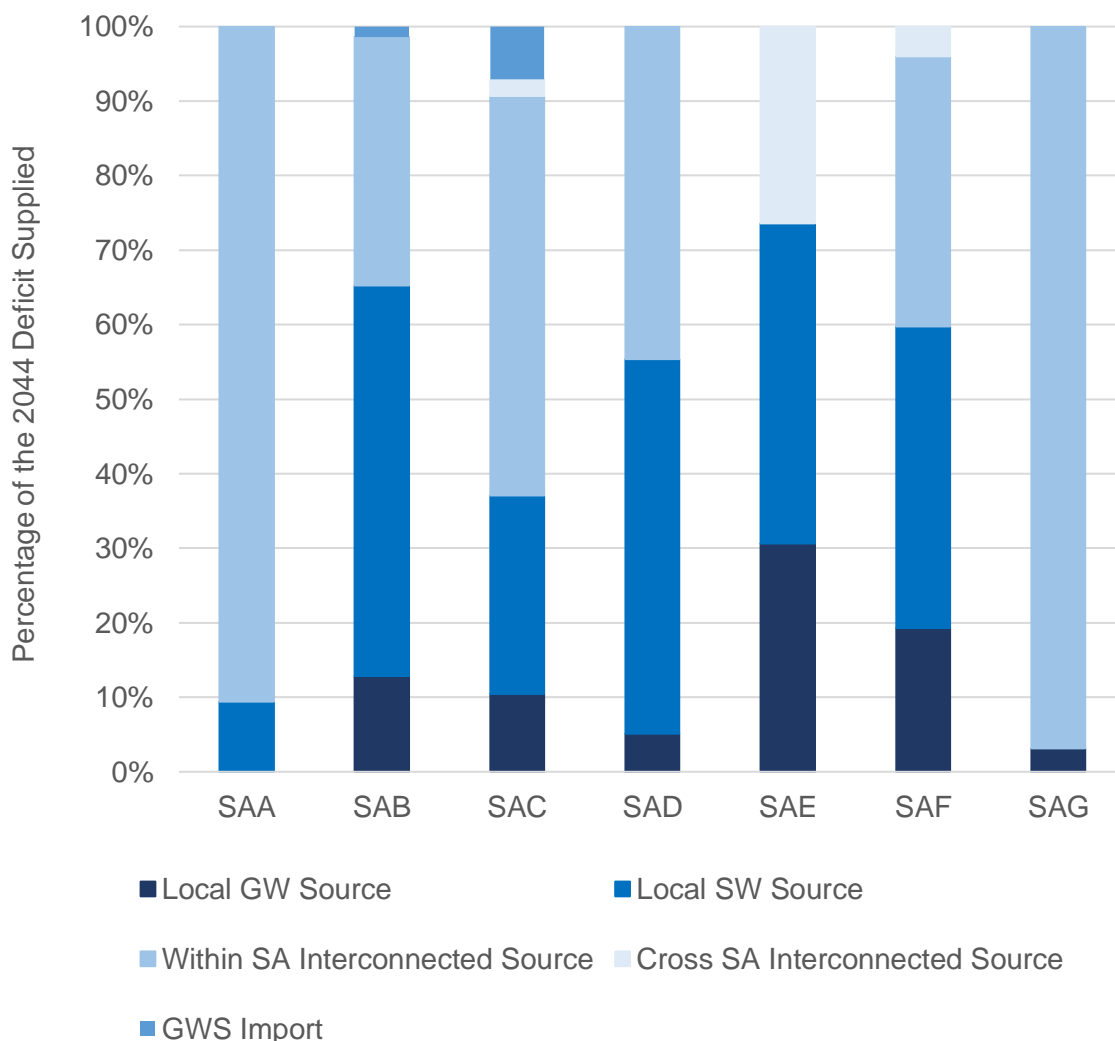


Figure 7.9 Preferred Approach Source Type - Percentage (%) of 2044 Deficit Supplied in a Dry Year

### 7.4.2 Changes to Existing Infrastructure

The existing WTPs and major interconnecting pipelines across the region are displayed in Figure 7.10. There are eight (8) WTPs (out of 142 WTPs in the region) with a 22-hour design capacity of greater than 10,000 m<sup>3</sup>/day (Table 7.17). The three largest WTPs are located in Study Area D. Terryland WTP (the largest) and Tuam (Luimnagh) WTP (the third largest) serve Galway City and surrounds, which has an average demand of 70,000 m<sup>3</sup>/day. The second largest WTP in the region, Tourmakeady, is part of the Lough Mask Water Supply Scheme. Uisce Éireann is progressing plans to upgrade the plant and extend supply to North West Roscommon and North Galway. These works follow on from works completed in 2018 which extended supply to Ballinlough/Loughlyn and Williamstown.

The Galway City and Lough Mask Water Supply Schemes are the largest interconnected systems in the region. Most other WRZs are currently supplied from local independent sources serviced by small-scale WTPs.

Table 7.17 Water Treatment Plant Capacities greater than 10,000 m<sup>3</sup>/day

Water Treatment Plant	WRZ Name	Capacity* (m <sup>3</sup> /day)
Terryland WTP	Lough Corrib (Galway City, Tuam, Loughrea)	50,420
Tourmakeady WTP	Lough Mask & Westport	34,830
Tuam (Luimnagh) WTP	Lough Corrib (Galway City, Tuam, Loughrea)	33,000
Cavanhill WTP	Cavanhill & North Louth	25,030
Foxes Den WTP	Sligo Town & Environs	18,150
New Doolough WTP	West Clare	15,110
Illies WTP	Letterkenny & Inishowen & Eddie Fullerton Pollan Dam	12,830
Letterkenny (Goldrum) WTP	Letterkenny & Inishowen & Eddie Fullerton Pollan Dam	11,000

\* 22 hr WTP Design Capacity

The SA Preferred Approach increases the security of supply through upgraded abstractions and treatment capacity. Safe supplies are achieved through improved treatment processing, and resilience is increased by interconnecting systems where this is feasible. These improvements are displayed through the infrastructure changes presented in Figure 7.11 and Figure 7.12.

Options that involve upgraded or new local WRZ sources are presented in Figure 7.11. The Grouped SA Options that will interconnect two or more WRZs, are displayed in Figure 7.12.

Within Study Area A, there are two Grouped Options that will each merge eight (8) WRZs into two interconnected systems:

- Option SAA-566, which involves developing Eddie Fullerton Pollan Dam, Glen Lough and Gartan Lough, rationalising four (4) WRZs to the new sources and interconnecting four (4) others.
- Option SAA-542/SAB-549, which proposes a new WTP at Knader, and abstraction at Ballyshannon on River Erne/ESB Dam-Kathleen Falls. In addition to three (3) WRZs in SAA, there will be two (2) Group Water Schemes and two (2) WRZs in SAB that will be connected to the new source.

These Options combined will meet an estimated 2044 DYCP deficit of 37,800 m<sup>3</sup>/day and serve a population of almost 150,000, representing about 16% of the 2044 regional population.

In SAD, the rationalisation of two WRZs to the Lough Mask and Westport system will serve 7% of the 2044 population. An estimated deficit of 18,000 m<sup>3</sup>/day will be met by an increased abstraction at Lough Mask and upgrade of Tourmakeady WTP.

The proposed interconnection of Ennistymon and West Clare WRZs improves supply resilience and an increased abstraction from Doo Lough addresses the Deficit and supports the rationalisation of Killadysert to the West Clare system. The increased supply will meet an estimated deficit of 5,600m<sup>3</sup>/day. The expanded supply system will serve a 2044 population of approximately 27,800.



Table 7.18 lists the large interconnected systems, including a list of the benefitting WRZs. Details of the smaller interconnected systems are provided in the Technical Appendices 1-7.

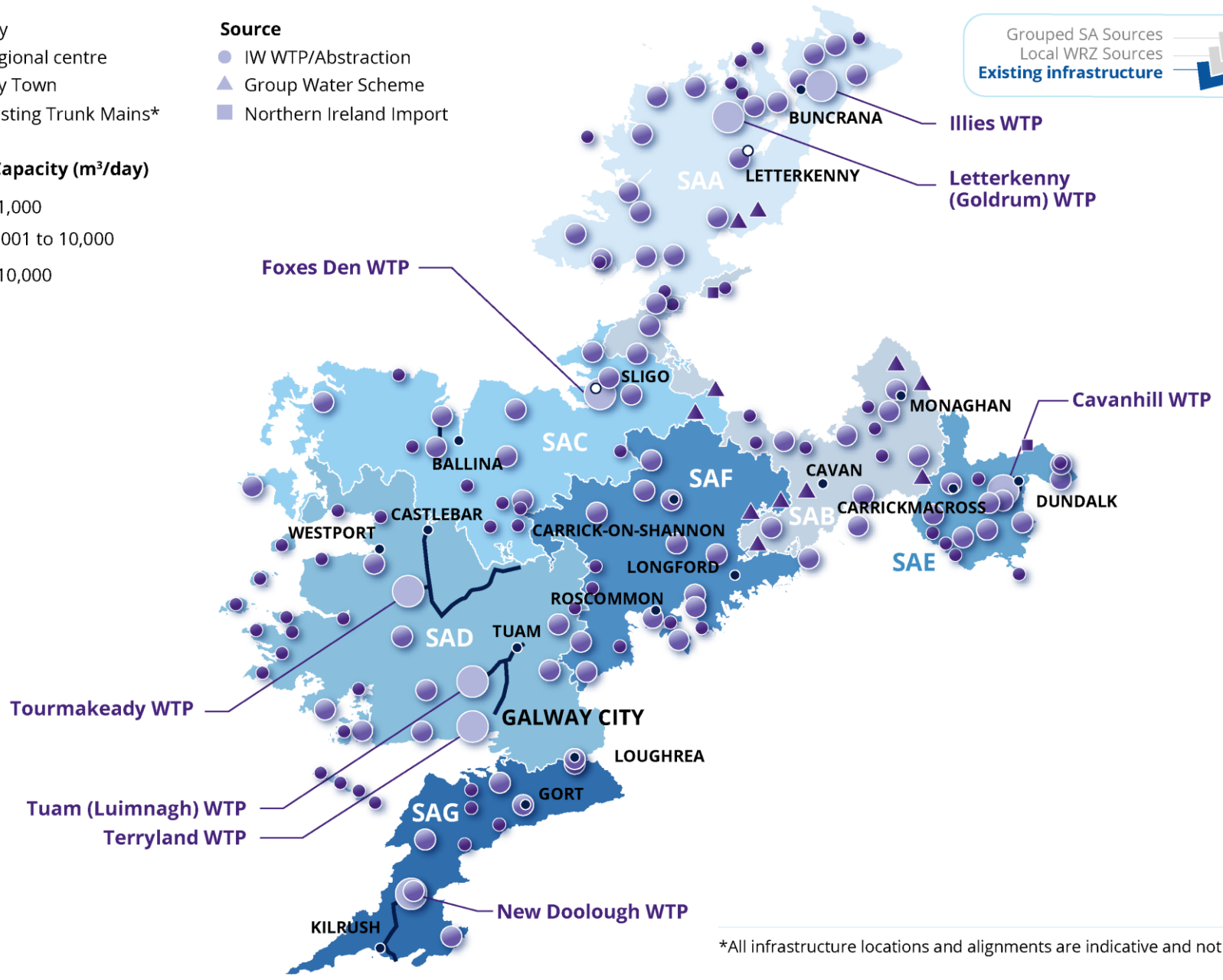
- City
- Regional centre
- Key Town
- Existing Trunk Mains\*

**WTP Capacity (m<sup>3</sup>/day)**

- <1,000
- 1,001 to 10,000
- >10,000

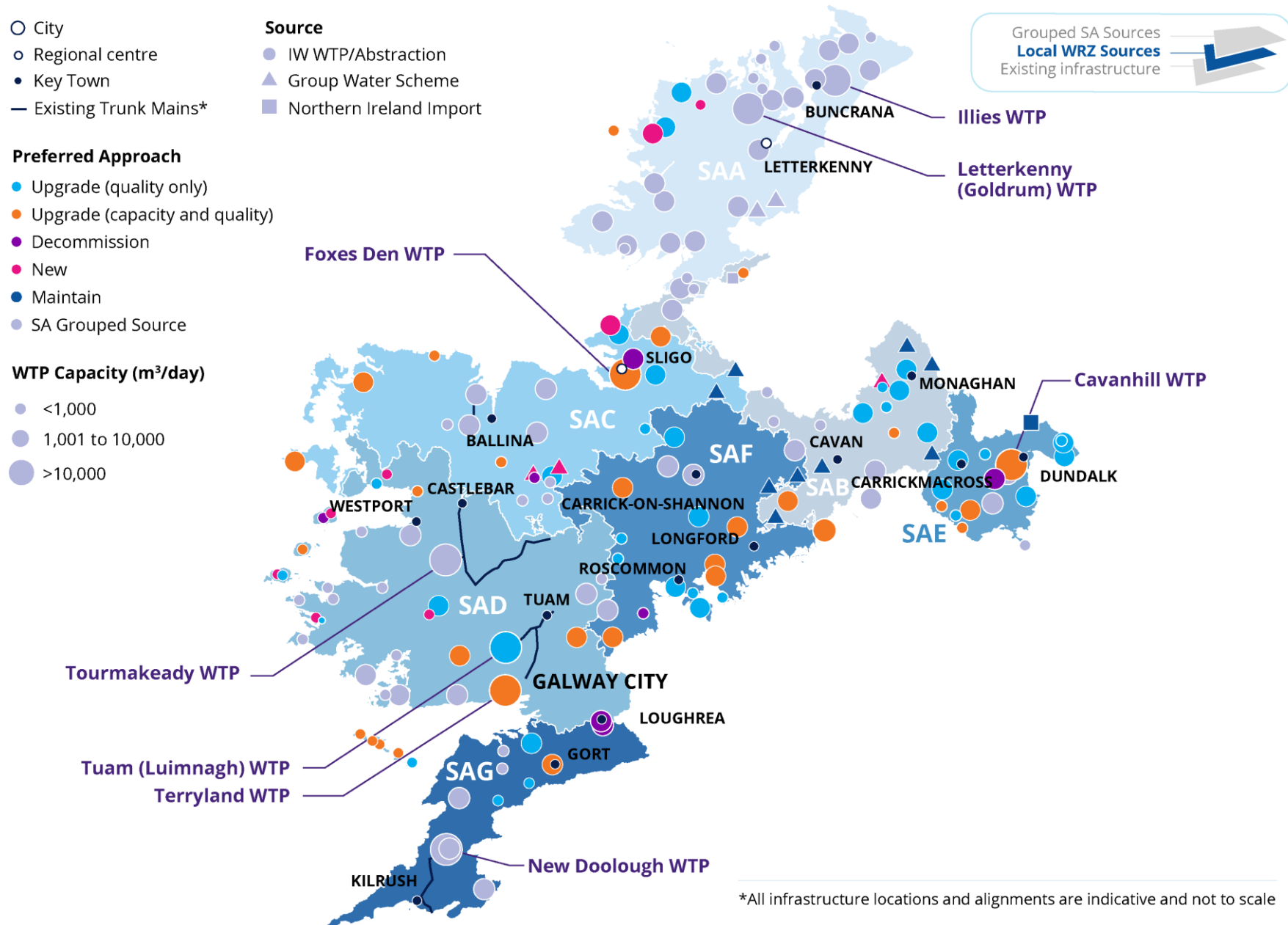
- Source**
- IW WTP/Abstraction
  - ▲ Group Water Scheme
  - Northern Ireland Import

Grouped SA Sources  
Local WRZ Sources  
**Existing infrastructure**



\*All infrastructure locations and alignments are indicative and not to scale

**Figure 7.10 Existing Infrastructure**



\*All infrastructure locations and alignments are indicative and not to scale

Figure 7.11 Preferred Approach – Local WRZ Sources

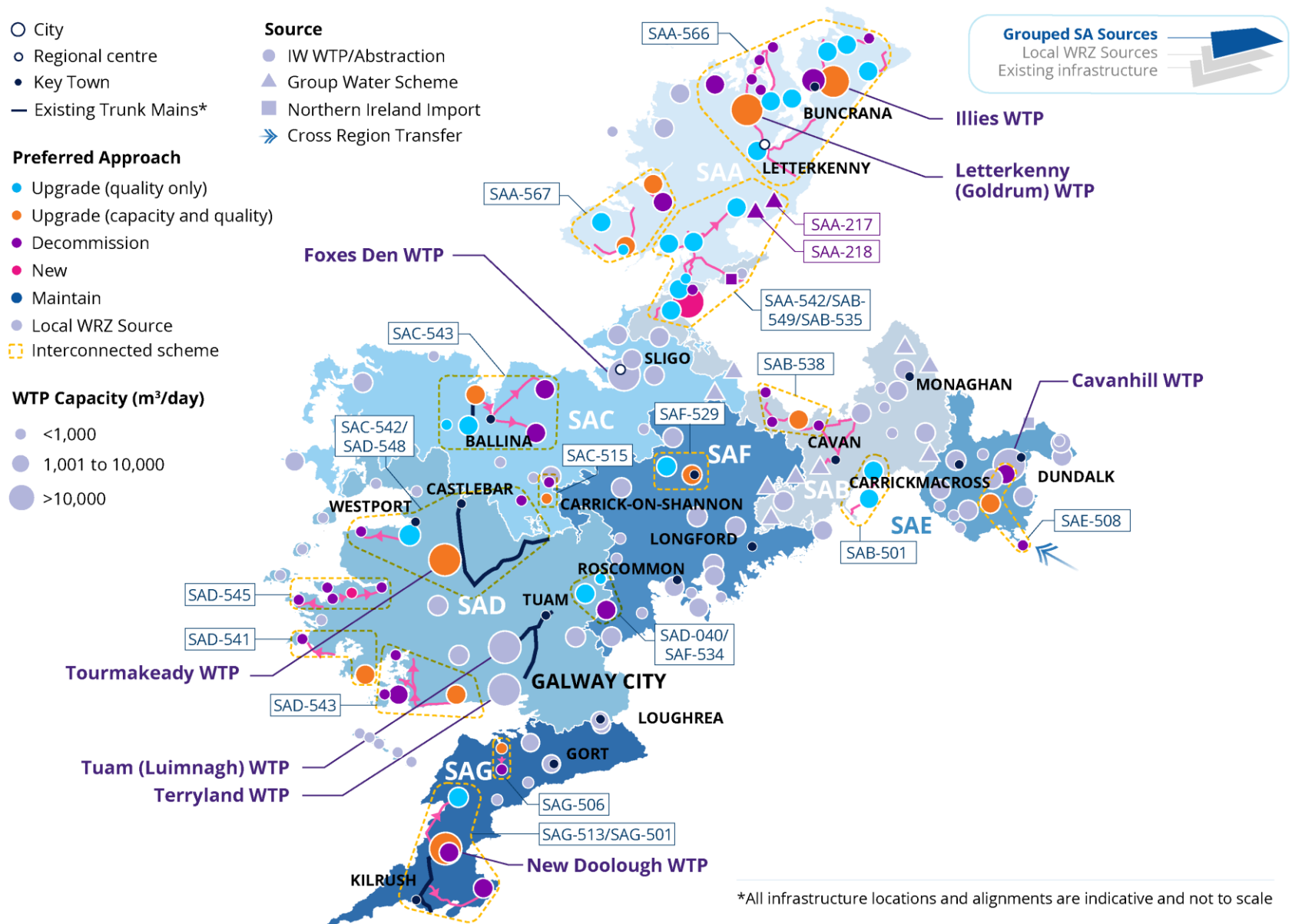


Figure 7.12 Preferred Approach – SA Grouped Sources

Table 7.18 Study Area Preferred Approach – SA Grouped Sources

Option number	Source WRZ	Benefitting WRZs	No. of WRZs	Trunk Main (km)	No. of Decomm. WTPs	DYCP		Population (2044)
						Demand 2044 (m3/d)	Deficit 2044 (m3/d)	
SAA-542/ SAB-549/SAB-535/SAA-217/SAA-218	Ballyshannon & Bundoran	Alt Raws Ballyshannon & Bundoran Cashilard Derrikillew Donegal (River Eske) Frosses-Inver Lough Mourne Meeneragh/Cronalaghey	8	90	1	27,850	11,100	47,030
SAA-566	Letterkenny & Inishowen & Eddie Fullerton Pollan Dam	Buncrana Carrigart-Downings & Cranford Creeslough Dunfanaghy Culdaff Inishowen West/Carndonagh/ Culdaff Fanad East Fanad West Letterkenny & Inishowen East & Eddie Fullerton Pollan Dam	8	127	7	52,240	26,710	101,950
SAA-567	Killybegs and Lettermacaward	Glenties-Ardara Killybegs Lettermacaward Owenteskiny	4	48	1	13,730	5,230	15,610
SAB-538	Ballyconnell PWS	Ballyconnell PWS Bawnboy PWS Belturbet PWS Swanlinbar PWS	4	27	3	2,050	350	4,520
SAB-501	Ballyjamesduff RWSS	Ballyjamesduff RWSS Cavan RWSS	2	3	0	9,300	930	22,650

Option number	Source WRZ	Benefitting WRZs	No. of WRZs	Trunk Main (km)	No. of Decomm. WTPs	DYCP		Population (2044)
						Demand 2044 (m3/d)	Deficit 2044 (m3/d)	
SAC-515	Kilkelly	Kilkelly Knock Airport	2	4	1	1,970	1,400	1,190
SAC-543	Ballina	Ballina Lough Easkey Regional Water Supply Lough Talt Regional Water Supply	3	55	2	31,400	9,910	49,140
SAD-541	Carna Kilkieran RWSS	Ballyconneely Carna Kilkieran RWSS	2	19	1	3,300	80	2,890
SAD-543	Spiddal	Carraroe Rosmuc Spiddal Teeranea Lettermore	4	55	3	8,360	1,870	15,740
SAD-545	New Connemara RWSS (Kylemore Lough)	Cleggan Claddaghduff Leenane Tully-Tullycross	3	44	4	880	190	1,270
SAD-548/ SAC-542	Lough Mask & Westport	Lough Mask & Westport Louisburgh Kiltimagh PWS	3	16	2	54,080	17,620	62,790
SAE-508	South Louth East Meath (Eastern and Midlands Region)	Ardee / Collon / Drybridge (Interconnection to supply Collon and Drybridge only)	1	11	2	6,350	1,700	15,740
SAF-529	Carrick-on-Shannon	Boyle Regional Carrick-on-Shannon	2	17	0	19,020	5,730	27,540
SAF-534/ SAD-040	Dunmore / Glenamaddy	Dunmore / Glenamaddy Kilkerrin / Moylough	2	6	1	4,140	1,010	4,780

Option number	Source WRZ	Benefitting WRZs	No. of WRZs	Trunk Main (km)	No. of Decomm. WTPs	DYCP		Population (2044)
						Demand 2044 (m3/d)	Deficit 2044 (m3/d)	
SAG-501/513	West Clare	Ennistymon Killadysart PWS West Clare	3	52	2	28,770	5,610	27,750
SAG-506	Turlough	Carran PWS Turlough	2	6	1	650	150	540

### 7.4.3 Addressing Leakage

Leakage reduction measures are a key component of the Preferred Approach to addressing Need across the North West Region. As outlined in Section 5.2, the measures aim to nationally reduce leakage by 400 million litres per day (MI/d) by 2034. This will be achieved through the following contributions:

- 39.5 % within the Eastern and Midlands Region (representing 158 MI/d)
- 23.5% within the South West Region (representing 94 MI/day)
- 25.5% within the North West Region (representing 102 MI/day)
- 11.5% within the South East Region (representing 46 MI/day)

Leakage outside of the Greater Dublin Area WRZ (which is in the Eastern and Midlands Region) across all four regions of the NWRP, is prioritised on an annual basis as part of the National Leakage Reduction programme. This allows Uisce Éireann's leakage reduction programmes to be flexible and targeted, to meet specific emerging needs. For this reason, leakage targets are not automatically applied to the Supply Demand Balance (SDB) calculations.

As set out in Section 4.3.3 of the Framework Plan and Section 5.2.2 of this RWRP-NW, leakage targets for 2019 were applied to the SDB for priority supplies based on:

- supply demand deficit,
- existing abstractions with sustainability issues,
- and drought impacts.

For supplies within the North West region, leakage targets of 3.54 MI/d were included in the SDB for 2019. Leakage targets for future years will be allocated to supplies to meet specific emerging needs.

Planned leakage targets (built into the SDB) across WRZs in the North West Region include the following reductions:

- SAA - 0.63 MI/d through net leakage reduction in Rosses, Donegal (River Eske), Lough Mourne, Letterkenny & Inishowen East & Eddie Fullerton Pollan Dam and Ballyshannon & Bundoran.
- SAB - 0.10 MI/d through net leakage reduction in Cavan RWSS, Kinlough Tullaghan and Monaghan.
- SAC - 0.58 MI/d through net leakage reduction in North Leitrim Regional Water Supply, Ballina and Sligo Town & Environs.
- SAD - 1.45 MI/d through net leakage reduction in Lough Corrib (Galway City, Tuam, Loughrea) and Lough Mask & Westport.
- SAE - 0.04 MI/d through net leakage reduction in Carrickmacross.
- SAF - 0.51 MI/d through net leakage reduction in Carrick-on-Shannon, Lanesboro & Newtowncashel and North Roscommon Regional Water Supply Scheme.
- SAG - 0.23 MI/d through net leakage reduction in Ennistymon

(Note: 1,000 m<sup>3</sup> per day is equivalent to 1 MI/day).

This does not mean that only 3.54 MI/d will be applied for the region between 2019 and 2034 but rather, we have committed to a target for 2019 in the SDB and we have provided flexibility to prioritise supplies for future leakage reduction.

Our current leakage targets are to reduce leakage in supply systems with demand greater than 1,500 m<sup>3</sup>/day (1.5 MI/d), to 21% of total demand by 2034. For the North West Region, this equates to a total leakage reduction of 98 MI/d, which will reduce leakage to 23% of demand on average across the region.

Our leakage targets will be reviewed annually and will be subject to further modification. At project level, when we proceed to develop the Preferred Approach, we will review the SDB and subtract the target leakage reductions from the Deficit at this stage. This ensures that the Preferred Approaches are not oversized, or that the needs are not over emphasized.



The achievement of these additional leakage targets may mean that the supply volume delivered by the Preferred Approach would not be required in full. This will provide the opportunity to adapt the Preferred Approach, for example through changes in the delivery timeframe or modular designs. In the circumstance that higher than projected growth occurs, the additional leakage reductions would go towards balancing the additional demand generated through higher growth.

To ensure the Preferred Approach that we develop remains appropriate in the scenario of reduced leakage and static demand, we have carried out a sensitivity analysis of our Preferred Approach (Section 7.7). This has allowed us to understand the impact of leakage reductions on the proposed Preferred Approach and whether the Preferred Approach would still be valid under a reduced leakage scenario. This process allows us to balance the delivery of the Preferred Approach between the Lose Less pillar (Section 5.2) and Supply Smarter pillar (Section 5.4).

#### 7.4.4 Addressing Water Quality

Uisce Éireann's Interim Barrier Assessment (described in our Framework Plan and summarised in Section 3.3.2 of this RWRP-NW) identifies Water Quality driven Need to inform the Preferred Approach development. The assessment determined that 97 of the 142 WTPs in the Region have a high risk of not meeting one (1) or more of four (4) Water Quality Barriers. However, these are internal Uisce Éireann assessments and in some cases our desktop assessments can over-estimate risk, particularly when there is little available data on the catchment characteristics of our raw water sources. As our "Source to Tap" Drinking Water Safety Plan (DWSP) assessments (which are a requirement under the Recast Drinking Water Directive (DWD)<sup>4</sup>) are developed for each water supply, the barrier scores for all our supplies will be updated and become more reliable.

A '**Barrier**' consists of any actions, processes, procedures, standards or assets (WTPs, water mains, pumping stations etc) put in place across the entire system, from catchment to tap, to achieve water of sufficient quality and quantity. The four Barriers include: 1) Protection against bacteria and virus; 2) Maintain chlorine residuals in the network; 3) Protozoa removal processes; and 4) Prevention of the formation of trihalomethanes (THMS).

It should be noted that the assessment is not an indicator of non-compliance with the European Union (Drinking Water) Regulations 2023<sup>5</sup>, but an assessment of the asset capability standard compared with the asset standard as set out in Section 5.7 of the Framework Plan. The assessment provides an indication of the need to invest in areas of our asset base (human and structural) through resource planning, to ensure that we can address potential risks or emerging risks to our supplies.

The Preferred Approach for all study areas includes upgrades to water quality treatment efficiency for all WTPs that are not associated with an in-flight project (a project that is in progress). In-flight projects for the North West Region are described in Section 4. The WTP upgrades are designed to address the risks identified in Section 3.3.2 through improvements in filtration, coagulation and ultraviolet (UV) treatment. They do not include improvement measures that are related to actions required on WTPs that are subject to an Environmental Protection Agency (EPA) direction or are listed on the EPA Remedial Action List (as outlined in Table 3.15 of this RWRP-NW).

#### 7.4.5 Environmental Sustainability

In December 2022, the Water Environment (Abstractions and Associated Impoundments) Act (the "Abstractions Act") was published; however, it has not yet commenced. The Abstractions Act will align abstraction licensing with the requirements of the Water Framework Directive (WFD) (2000/60/EC), both

for the specific abstraction and in combination with other activities. The Environmental Protection Agency (EPA) will determine the licences.

Whilst the regulations and guidelines for the new abstraction regime are being developed, we are assessing existing abstractions to identify surface water sites that may exceed future abstraction thresholds. We have taken a precautionary approach based on our current understanding of how proposed abstraction legislation might be applied. This assessment suggests that certain schemes may be subject to reductions in abstraction under the new legislation; however, this will ultimately be determined by the EPA based on the project level information before them. This independent assessment of surface water abstractions is based on UKTAG standards to determine (i) the potential impact on our SDB and (ii) to identify possible alternative solutions to improve the sustainability of our abstractions. This assessment procedure is set out in Appendix C of the Framework Plan and is in line with a precautionary approach.

A sensitivity analysis (presented in Section 7.7) is conducted for each WRZ, to allow us to stress test the sensitivity of the Preferred Approach against potential sustainability driven reductions to existing abstractions (again, taking a conservative and precautionary approach as to the level of reductions that may be required). This will ensure that our decision making is robust, and the Preferred Approaches are adaptable and compatible with the future legislative framework for abstractions, in so far as this can be anticipated at this stage.

#### **7.4.5.1 Surface Water Abstractions**

Our assessment has identified 72 existing surface water sites where potential abstraction reductions may be required in the future under the future legislative framework for abstractions (which will ensure Ireland can meet its obligations under the WFD). Our assessment is based on conservative estimates of what a future regime may require). The 72 sites are shown in Figure 7.13 by symbols outlined in red. The WFD ecological status of the surface water waterbody is represented by the colour coded site identifier. The site names are listed in Table 7.19 against the corresponding site number that is displayed in Figure 7.13.

**Legend**

- City
- Regional Centre
- Town
- ◆ Surface water abstraction
- ◆ Surface water abstractions that may not meet sustainability guidelines during dry weather flows
- ◆ meet sustainability guidelines during dry weather flows
- ▭ Study area boundary
- ▭ Local authority boundary
- River
- ▭ Lake

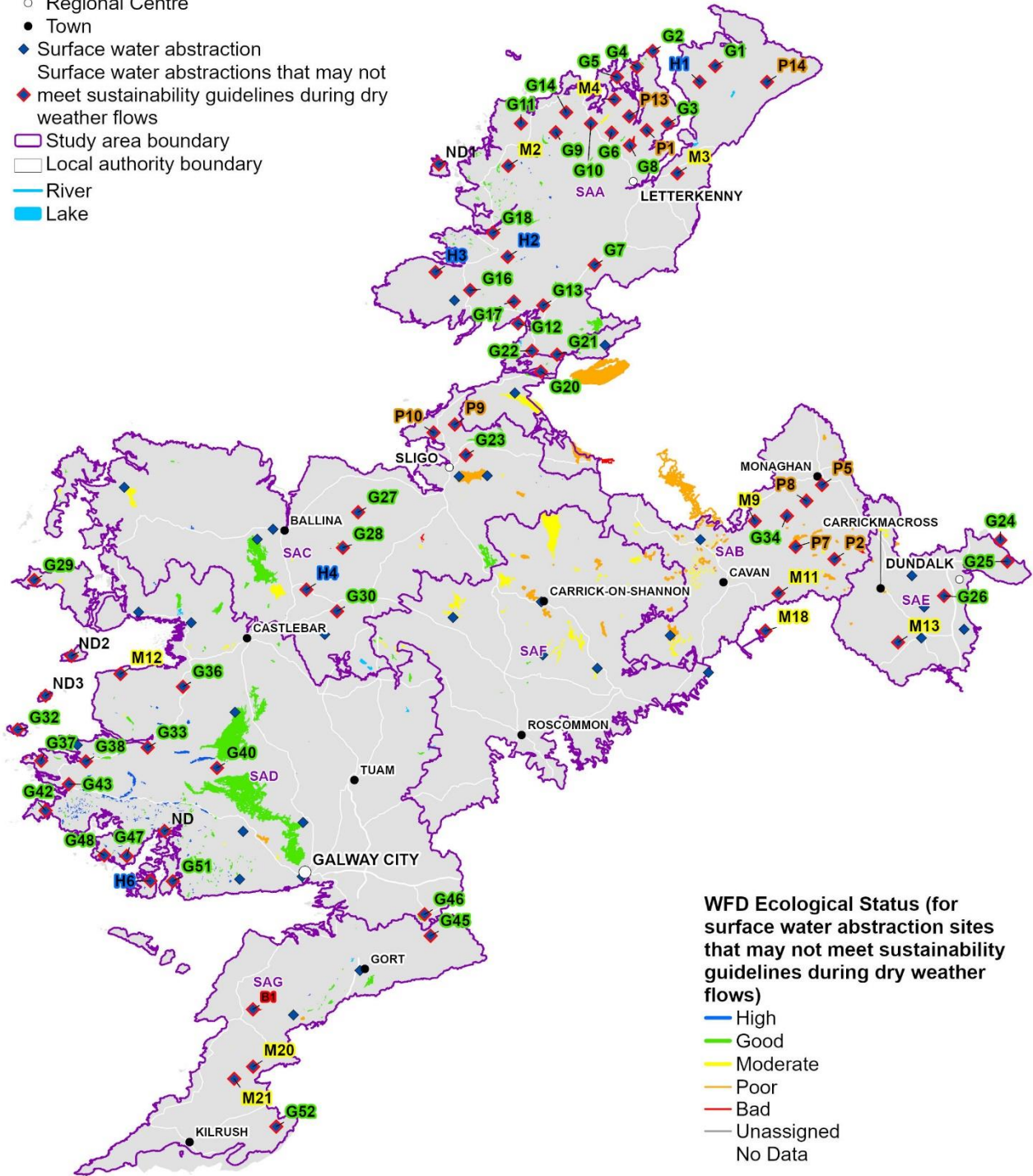


Figure 7.13 Existing Surface Water Abstractions

When developing our Preferred Approach, we considered solutions to improve the sustainability at the sites that were assessed to be potentially impacted by the new legislation.

Twenty-eight (28) of the 72 surface water abstractions that have been identified as potentially exceeding sustainable abstraction thresholds are intended to be decommissioned as part of the Preferred Approach. These sites are shown in Figure 7.14, which presents the changes to surface water abstractions under the Preferred Approach development, including new abstractions and existing abstractions which will be maintained, upgraded or abandoned. The decommissioning of potentially unsustainable abstractions has the potential to improve the environmental outcomes at these sites and reduce the uncertainty posed by the future legislation.

The remaining 44 surface water abstractions that may not meet sustainability guidelines during dry weather flows, will be maintained under the Preferred Approach due to a lack of viable alternatives. The Preferred Approach, however, does improve or avoid further deterioration at these sources by reducing existing abstractions or developing additional sources to support growth. Where abstractions are to be upgraded these will be supported by compensation flow releases.

The actual reductions that may be needed in future will depend on the specific requirements of the future legislation. Uisce Éireann will update the NWRP as appropriate to account for these requirements, once known, using the monitoring and feedback process set out in Section 9 of this Plan.

Table 7.19 Preferred Approach – Abstractions Potentially Exceeding Sustainable Abstraction Thresholds

Preferred Approach Outcome	Abstraction Sites	
	Decommission	Maintain
SAA	<b>H1</b> - Lough Doo (Buncrana)	<b>H3</b> - Lough Nalughraman (Owenteskiny)
	<b>H2</b> - Lough Anna (Glenties-Ardara)	<b>G1</b> - Lough Fad (Inishowen West & Carndonagh & Culdaff)
	<b>G2</b> - Shannagh Lake (Fanad East)	<b>G3</b> - Gort Lough (Letterkenny & Inishowen East & Pollan Dam)
	<b>G4</b> - Lough Naglea (Fanad West)	<b>G6</b> - Lough Salt (Letterkenny & Inishowen East & Pollan Dam)
	<b>G5</b> - Lough Nameeltoge (Carrigart-Downings & Cranford)	<b>G7</b> - Lough Mourne (Lough Mourne)
	<b>G9</b> - Muckish (Creel Slough Dunfanaghy)	<b>G8</b> - Lough Keel (Letterkenny & Inishowen East & Pollan Dam)
	<b>G14</b> - Lough Agher (Creel Slough Dunfanaghy)	<b>G10</b> - Lough Greenan (Letterkenny & Inishowen East & Pollan Dam)
	<b>M4</b> - Lough Nambraddan (Carrigart-Downings & Cranford)	<b>G11</b> - Lough Lagha (Gortahork-Falcarragh)
	<b>P13</b> - Lough Nacreaght (Carrigart-Downings & Cranford)	<b>G12</b> - St. Peters Lough 2 (Frosses-Inver)
		<b>G13</b> - River Eske (Donegal)
		<b>G16</b> - Lough Aderry Intake (Killybegs)
		<b>G17</b> - Glencoagh Lough (Frosses-Inver)
		<b>G18</b> - Lough Derkmore-Impoundment (Letternacaward)

Preferred Approach Outcome	Abstraction Sites	
	Decommission	Maintain
		<p><b>G21</b> - Lough Unshin (Ballyshannon &amp; Bundoran)</p> <p><b>G22</b> - Lough Gorman (Ballyshannon &amp; Bundoran)</p> <p><b>M2</b> - Lough Keel Intake (Rosses)</p> <p><b>M3</b> - Crana River / Pollan Dam (Letterkenny &amp; Inishowen East &amp; Pollan Dam)</p> <p><b>P1</b> - Lough Columbkille (Letterkenny &amp; Inishowen East &amp; Pollan Dam)</p> <p><b>P14</b> - Lough Fad (Letterkenny &amp; Inishowen East &amp; Pollan Dam)</p> <p>ND1 - Lough Shore (Arranmore Island)</p>
SAB	<p><b>G20</b> - St. Columbkille Lake (Cashilard)</p>	<p><b>G34</b> - Feagh Lough (Newbliss)</p> <p><b>M9</b> - Corconnolly Lake (Clones)</p> <p><b>M11</b> - Lough Acanon Dam (Cavan RWSS)</p> <p><b>M18</b> - Nadrageel Lough (Ballyjamesduff RWSS)</p> <p><b>P2</b> - Lough Bawn (Ballybay (Lough Egish))</p> <p><b>P5</b> - Corcaghan Lough (Monaghan)</p> <p><b>P7</b> - Coragh Lough (Cootehill PWS)</p> <p><b>P8</b> - Greagh Lough (Monaghan)</p>
SAC	<p><b>G23</b> - Kilsellagh Impounding Reservoir (Sligo Town &amp; Environs)</p> <p><b>G27</b> - Lough Talt (Lough Talt Regional Water Supply)</p> <p><b>G28</b> - Lough Easkey (Lough Easky Regional Water Supply)</p> <p><b>G30</b> - Carrowcanada Spring (Stream) (Swinford)</p>	<p><b>H4</b> - Lough Muck Intake (Foxford)</p> <p><b>G29</b> - Accorymore Lake Intake (Achill)</p> <p><b>P9</b> - Lyle (North Sligo Regional Water Supply)</p> <p><b>P10</b> - Gortnaleck (North Sligo Regional Water Supply)</p>
SAD	<p><b>H6</b> - Lough Illauntrasna (Teeranea_Lettermore P.S.)</p> <p><b>G33</b> - Mountain Stream (unnamed) (Leenane P.S.)</p> <p><b>G37</b> - Lough Courhoor (Cleggan_Claddaghduff)</p> <p><b>G38</b> - Diamond Hill Stream (Tully-Tullycross)</p>	<p><b>G32</b> - Lough Fawna (Inisboffin P.S.)</p> <p><b>G36</b> - Moher Lake (Lough Mask &amp; Westport)</p> <p><b>G40</b> - Coolin Lough (Clonbur P.S.)</p> <p><b>G43</b> - Lough Nambrackeagh (Clifden)</p> <p><b>G47</b> - Loughaunore Intake (Carna_Kilkieran RWSS)</p>

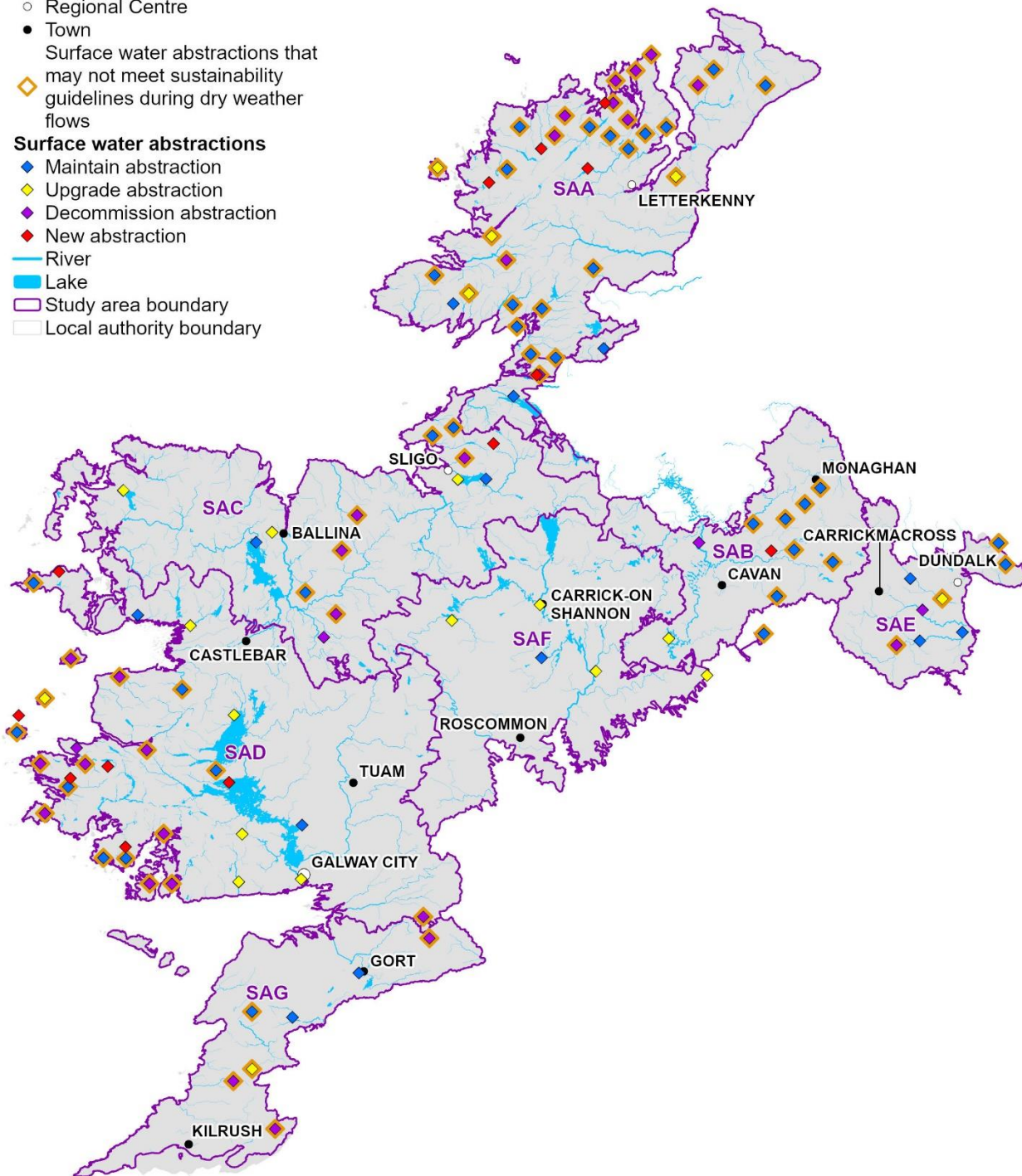
Preferred Approach Outcome	Abstraction Sites	
	Decommission	Maintain
	<p><b>G42</b> – Lake Anaserd (Ballyconnely P.S)</p> <p><b>G45</b> - Lough Rea – Lake Road PWS (Lough Corrib (Galway City, Tuam, Lough Rea))</p> <p><b>G46</b> - Lough Rea – Knockanaima PWS (Lough Corrib (Galway City, Tuam, Lough Rea))</p> <p><b>G51</b> - Loughuanwillan (Carraroe)</p> <p><b>M12</b> - Bunnahowen River (Louisburgh)</p> <p>ND - Lough Aroolagh (Rosmuc P.S)</p> <p>ND2 - Knockmore (Clare Island)</p>	<p><b>G48</b> - Lough Lerin (Carna_Kilkieran RWSS)</p> <p>ND3 - Coolacknick Lake Intake (Inishturk)</p>
SAE	<p><b>M13</b> - Lough Brackan (Drumcondrath)</p>	<p><b>G24</b> - Carlingford Mountain (unnamed stream)</p> <p><b>G25</b> - Barnavave (Cavanhill &amp; North Louth)</p> <p><b>G26</b> - River Fane (Stephenstown) (Cavanhill &amp; North Louth)</p>
SAF	No abstractions identified	No abstractions identified
SAG	<p><b>G52</b> - Gortglass Lough (Killadysert PWS)</p> <p><b>M20</b> - Doo Lough – Old WTP (West Clare)</p>	<p><b>M21</b> - Doo Lough – New WTP (West Clare)</p> <p><b>B1</b> - Licken Lake (Ennistymon)</p>

**Legend**

- City
- Regional Centre
- Town
- ◇ Surface water abstractions that may not meet sustainability guidelines during dry weather flows

**Surface water abstractions**

- ◆ Maintain abstraction
- ◇ Upgrade abstraction
- ◇ Decommission abstraction
- ◆ New abstraction
- River
- Lake
- Study area boundary
- Local authority boundary



**Figure 7.14 Preferred Approach – Surface Water Abstractions**

### 7.4.5.2 Groundwater Abstractions

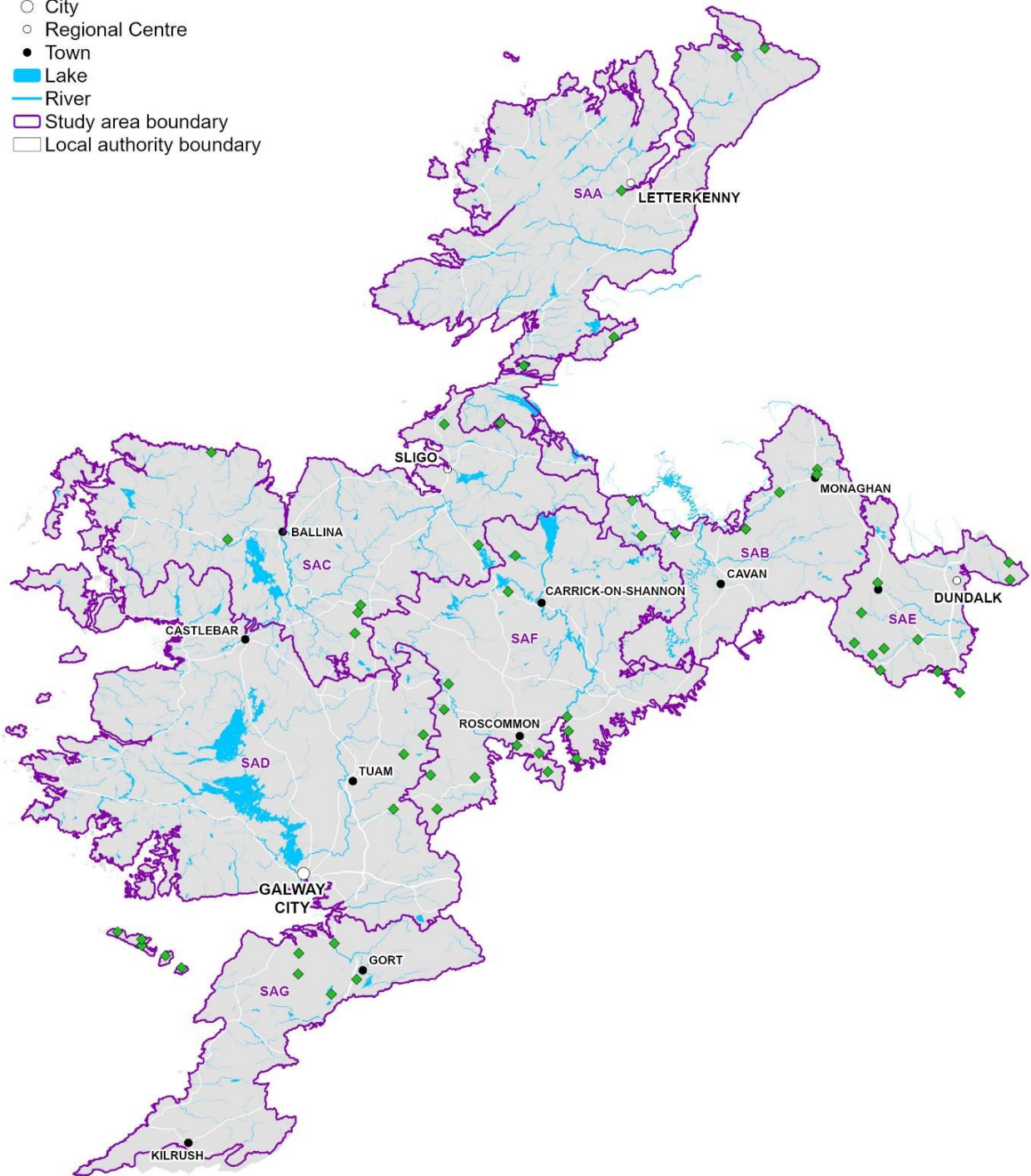
As explained in Section 3.2.2 of the Framework Plan, groundwater abstractions will need to conform to the proposed new abstraction licencing regime as well. Due to the limited long-term records on pumping and drawdown of water levels for many of our groundwater supplies, it is difficult to present robust desktop assessments of water availability for our existing groundwater abstractions. Until site-specific studies of groundwater availability are completed, Uisce Éireann have developed an initial assessment for existing abstractions based on best available information. Appendix C and Appendix G of the Framework Plan describes our approach to groundwater supply assessments and the regulatory and licencing constraints, respectively. Over the coming years, Uisce Éireann will work with the environmental regulator (the EPA) and the Geological Survey of Ireland (GSI), to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources. We are not in a position to estimate changes to the groundwater availability until better data is available.

The 57 existing groundwater sources are shown in Figure 7.15, while Figure 7.16 presents our groundwater sources with the SA Preferred Approach in place. If the SA Preferred Approach is delivered as proposed, abstractions from 10 groundwater sources will be decommissioned, there will be increased abstractions from 18 sources and 9 new groundwater sources will be developed.



**Legend**

- ◆ Groundwater abstraction
- City
- Regional Centre
- Town
- Lake
- River
- ▭ Study area boundary
- ▭ Local authority boundary



**Figure 7.15 Existing Groundwater Abstractions**

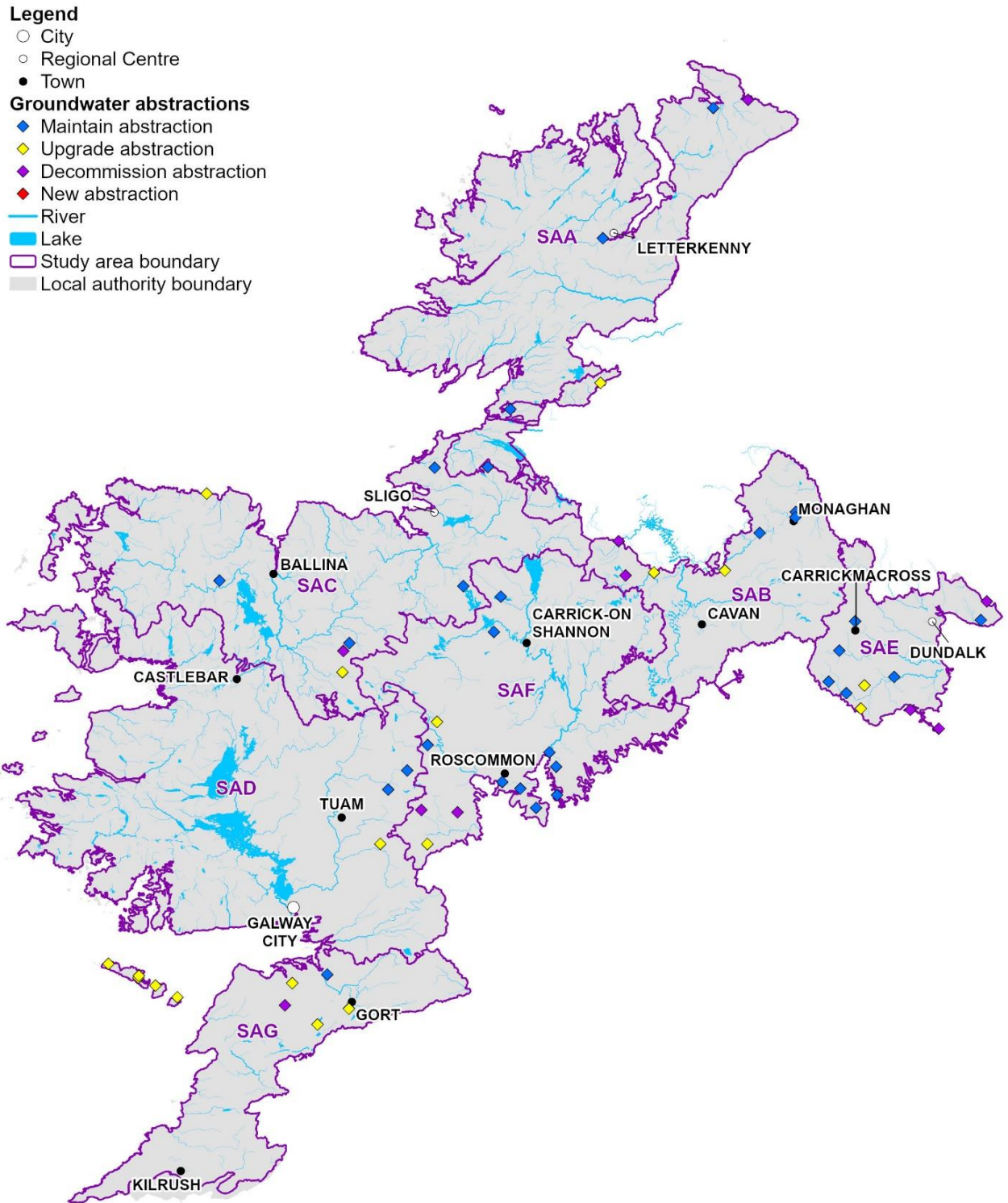


Figure 7.16 Preferred Approach - Groundwater Abstractions

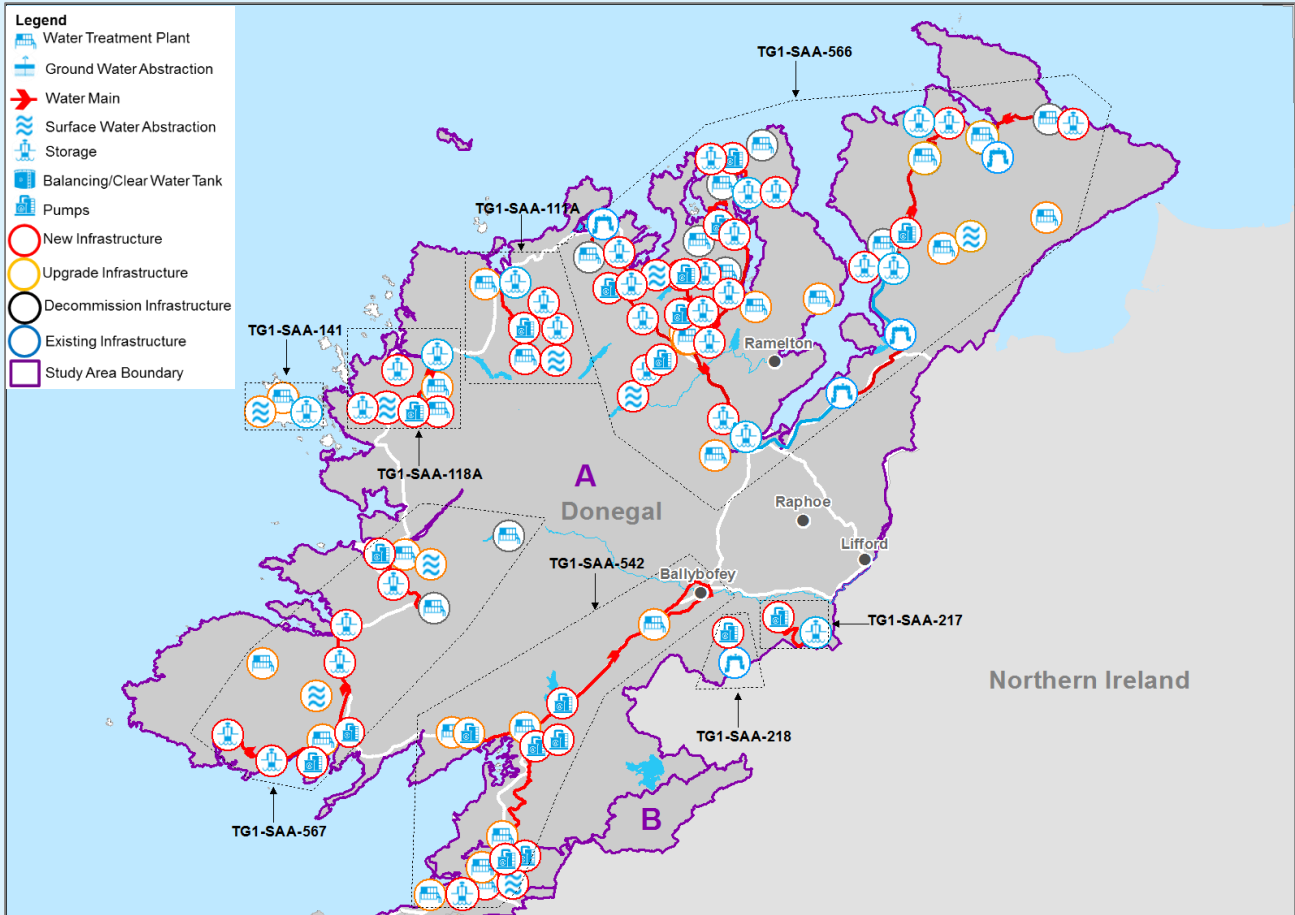
## **7.5 SA Preferred Approach Summaries**

The following sections provide a summary of the Preferred Approaches for each Study Area. Further details are contained in the Study Area Technical Reports in Appendices 1-7.

## 7.5.1 Study Area A – Donegal

Study Area A					
<b>No. of WRZs</b>	SAA lies within the county of Donegal, covering an area of approximately 4,630 km <sup>2</sup> . The population of the Study Area is approximately 149,600.				
<b>21</b>	The Principal Settlement (with a population of over 10,000) is Letterkenny.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	29	Groundwater	4	DYCP 2019	40,460
High Risk WTP	22	Surface Water	31	DYCP 2044	47,520
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	16	Increase	0	Increase	4
Upgrade (Capacity & WQ)	5	Maintain	3	Maintain	18
Decommission	8	Decommission	1	Decommission	9
New	3	New	0	New	5
<p>The Preferred Approach (PA) for SAA consists of local WRZ Options for 5 of the 21 WRZs in the Study Area. The 16 other WRZs are supplied by 3 SA Grouped Options that involve interconnections between one or more supplies, reducing the total number of WRZs from 21 to 6. The SA Grouped Options include:</p> <ul style="list-style-type: none"> <li>• One Option (SA-542) which interconnects 4 WRZs (Donegal (River Eske), Lough Mourne, Ballyshannon &amp; Bundoran and Frosses-Inver) with an associated new abstraction from the River Knaddar.</li> <li>• One Option (SA-566) which rationalises and interconnects 8 WRZs increasing the existing surface water abstraction from the River Crana and providing new abstractions from Gartan Lough and Glen Lough. Two (2) of the 8 WRZs are in SAB.</li> <li>• One Option (SA-567) which rationalises Glenties Adara to Lettermacaward and interconnects Owenteskiny and Killybegs with an associated increase to the existing surface water abstraction from Lough Derkmore.</li> </ul> <p>The Preferred Approach provides environmental benefits by decommissioning 9 existing abstractions that may not meet sustainability guidelines- Lough Doo (Bunrana), Lough Naglea (Fanad West), Lough Nambraddan (Carrigart-Downings &amp; Cranford), Lough Nameeltoge (Carrigart-Downings &amp; Cranford), Lough Nacreaght (Carrigart-Downings &amp; Cranford), Lough Anna (Glenties-Ardara), Lough Agher Creeslough Dunfanaghy), Muckish,(Creeslough Dunfanaghy) and Shannagh Lake (Fanad East).</p> <p>Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAA, planned leakage reduction programmes will reduce leakage by 634 m<sup>3</sup>/day in Rosses, Donegal (River Eske), Lough Mourne, Letterkenny &amp; Inishowen East &amp; Eddie Fullerton Pollan Dam and Ballyshannon &amp; Bundoran WRZs. We have also committed to additional Leakage Targets of 20,605 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.</p> <p>Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.</p>					

## Study Area A

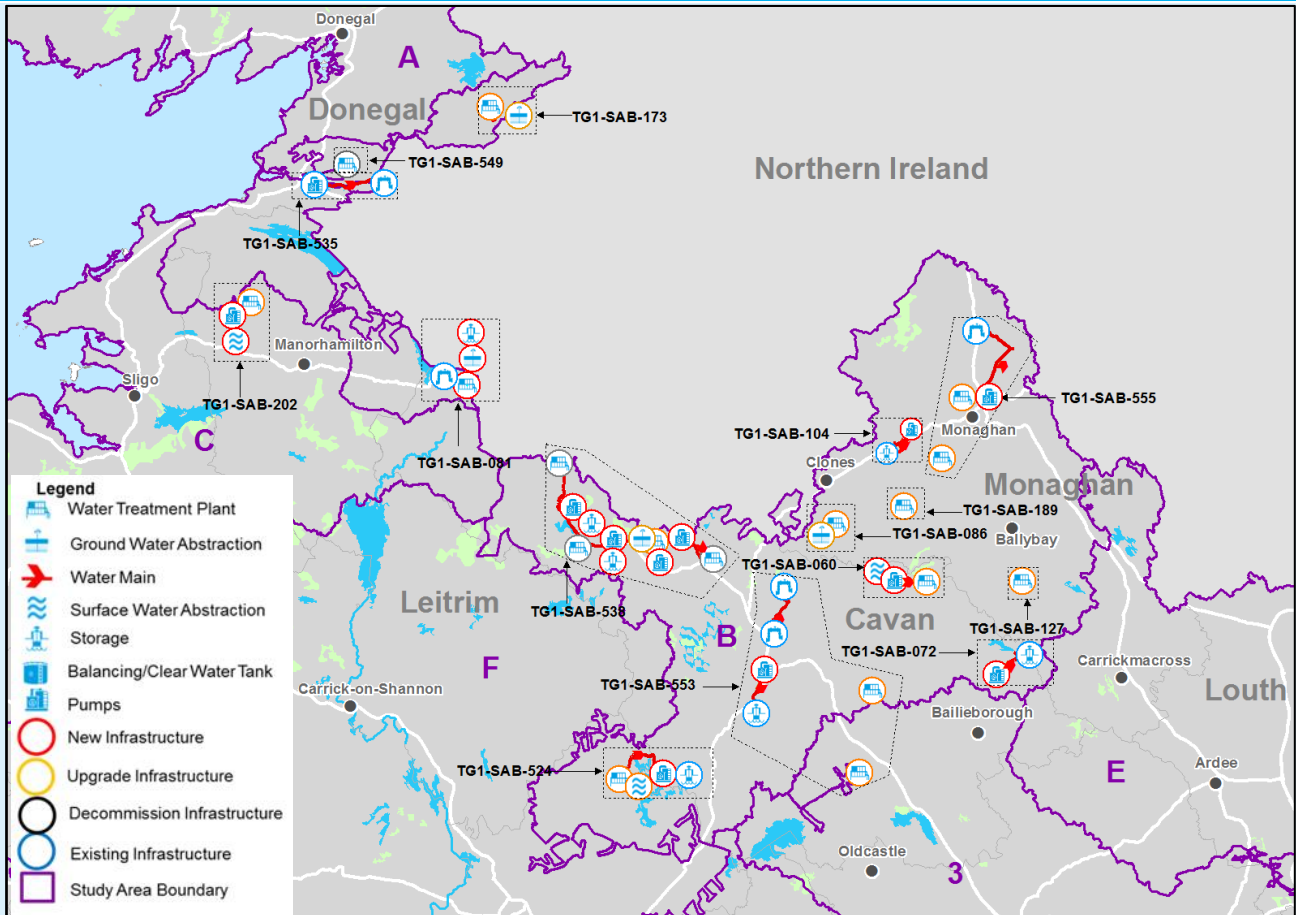


TG1-SAX-00X are the Option Codes assigned to each Option. A description of each Option can be found in Table 5.9 of the Technical Appendices 1-7.

## 7.5.2 Study Area B – Cavan and Monaghan

Study Area B					
<b>No. of WRZs</b>	SAB lies within the counties of Cavan, Monaghan, Leitrim, Longford, Donegal and Sligo covering an area of approximately 2,790 km <sup>2</sup> . The population of the Study Area is approximately 58,270.				
23	The Principal Settlement (with a population of over 10,000) is Cavan.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	17	Groundwater	9	DYCP 2019	2,720
High Risk WTP	14	Surface Water	12	DYCP 2044	3,840
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	8	Increase	3	Increase	1
Upgrade (Capacity & WQ)	5	Maintain	4	Maintain	9
Decommission	4	Decommission	2	Decommission	2
New	0	New	0	New	2
<p>The Preferred Approach (PA) for SAB consists of local WRZ Options for 17 of the 23 WRZs in the Study Area. Eight (8) WRZs are supplied by 4 SA Grouped Options reducing the total number of WRZs from 23 to 18. The SA Grouped Options include:</p> <ul style="list-style-type: none"> <li>• Three (3) rationalisations: <ul style="list-style-type: none"> <li>○ Derrykillew (NI import) rationalised to Ballyshannon in SAA (SAB-535).</li> <li>○ Belturbet, Swanlinbar and Bawnboy rationalised to Ballyconnell (SAB-538) upgrading the existing groundwater abstraction.</li> <li>○ Cashilard rationalised to Ballymagoarty (part of Ballyshannon/Bundoran in SAA) (SAB-549).</li> </ul> </li> <li>• One (1) Option interconnecting Cavan to Ballyjamesduff (SAB-501)</li> </ul> <p>The Preferred Approach provides environmental benefits by decommissioning 1 existing abstraction that may not meet sustainability guidelines — St Columbkil Lake (Cashilard).</p> <p>Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAB, planned leakage reduction programmes will reduce leakage by 96 m<sup>3</sup>/day in Cavan RWSS, Kinlough Tullaghan and Monaghan WRZs. We have also committed to additional Leakage Targets of 1,142 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.</p> <p>Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.</p>					

## Study Area B



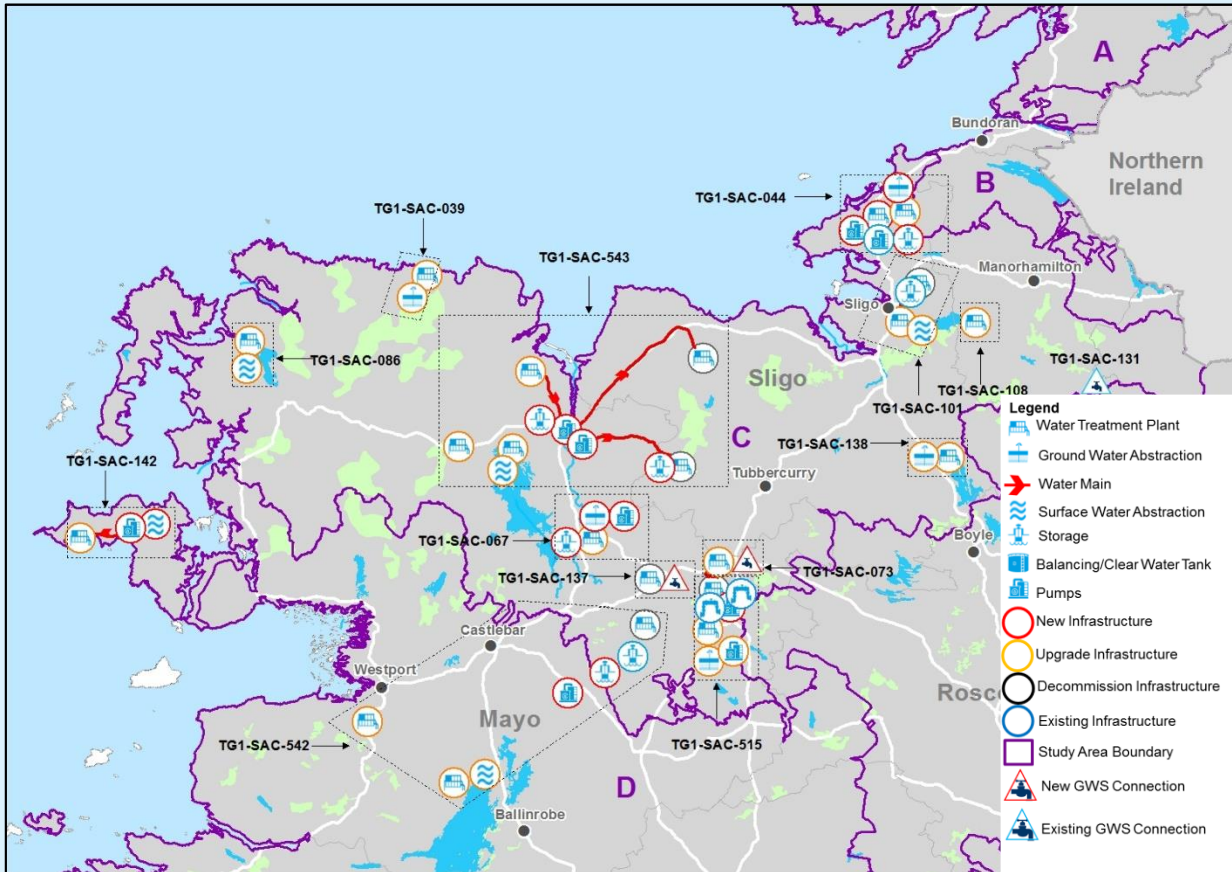
TG1-SAX-00X are the Option Codes assigned to each Option. A description of each Option can be found in Table 5.9 of the Technical Appendices 1-7.

### 7.5.3 Study Area C – Mayo and Sligo

Study Area C					
<b>No. of WRZs</b>	SAC lies within the counties of Mayo, Sligo, Leitrim, Cavan and Roscommon covering an area of approximately 5,150 km <sup>2</sup> . The population of the Study Area is approximately 96,790.				
<b>17</b>	The Principal Settlements (with a population of over 10,000) are Sligo, Castlebar and Ballina.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	19	Groundwater	7	DYCP 2019	15,590
High Risk WTP	17	Surface Water	14	DYCP 2044	21,070
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	6	Increase	2	Increase	3
Upgrade (Capacity & WQ)	7	Maintain	4	Maintain	6
Decommission	6	Decommission	1	Decommission	5
New	1	New	2	New	1
<p>The Preferred Approach (PA) for SAC consists of local WRZ Options for 11 of the 17 WRZs in the Study Area. The other 6 WRZs are supplied by 3 SA Grouped Options reducing the total number of WRZs from 17 to 13. The SA Grouped Options include:</p> <p>Three (3) rationalisations with associated increased abstractions and WTP upgrades:</p> <ul style="list-style-type: none"> <li>• Kiltimagh rationalised to Lough Mask (in SAD), increasing the SW abstraction at Lough Mask and upgrading Tourmakeady WTP (SAC-542).</li> <li>• Knock Airport rationalised to Kilkelly WRZ, increasing the GW abstraction at Kilkelly WRZ and upgrading Kilkelly WTP for capacity (SAC-515).</li> <li>• Lough Easky and Lough Talt rationalised to Lisglennon WTP, increasing SW abstraction at Lough Conn and upgrading Lisglennon WTP for capacity (SAC-543).</li> </ul> <p>The Preferred Approach provides environmental benefits by decommissioning 4 existing abstractions that may not meet sustainability guidelines -Lough Talt (Lough Talt Regional Water Supply), Lough Easkey (Lough Easky Regional Water Supply), Kilsellagh Impounding Reservoir and Carrowcanada Spring (Swinford WRZ).</p> <p>Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAC, planned leakage reduction programmes will reduce leakage by 578 m<sup>3</sup>/day in North Leitrim Regional Water Supply, Ballina and Sligo Town &amp; Environs WRZs. We have also committed to additional Leakage Targets of 11,961 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.</p> <p>Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.</p>					



## Study Area C



\*TG1-SAX-00X are the Option Codes assigned to each Option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-7.

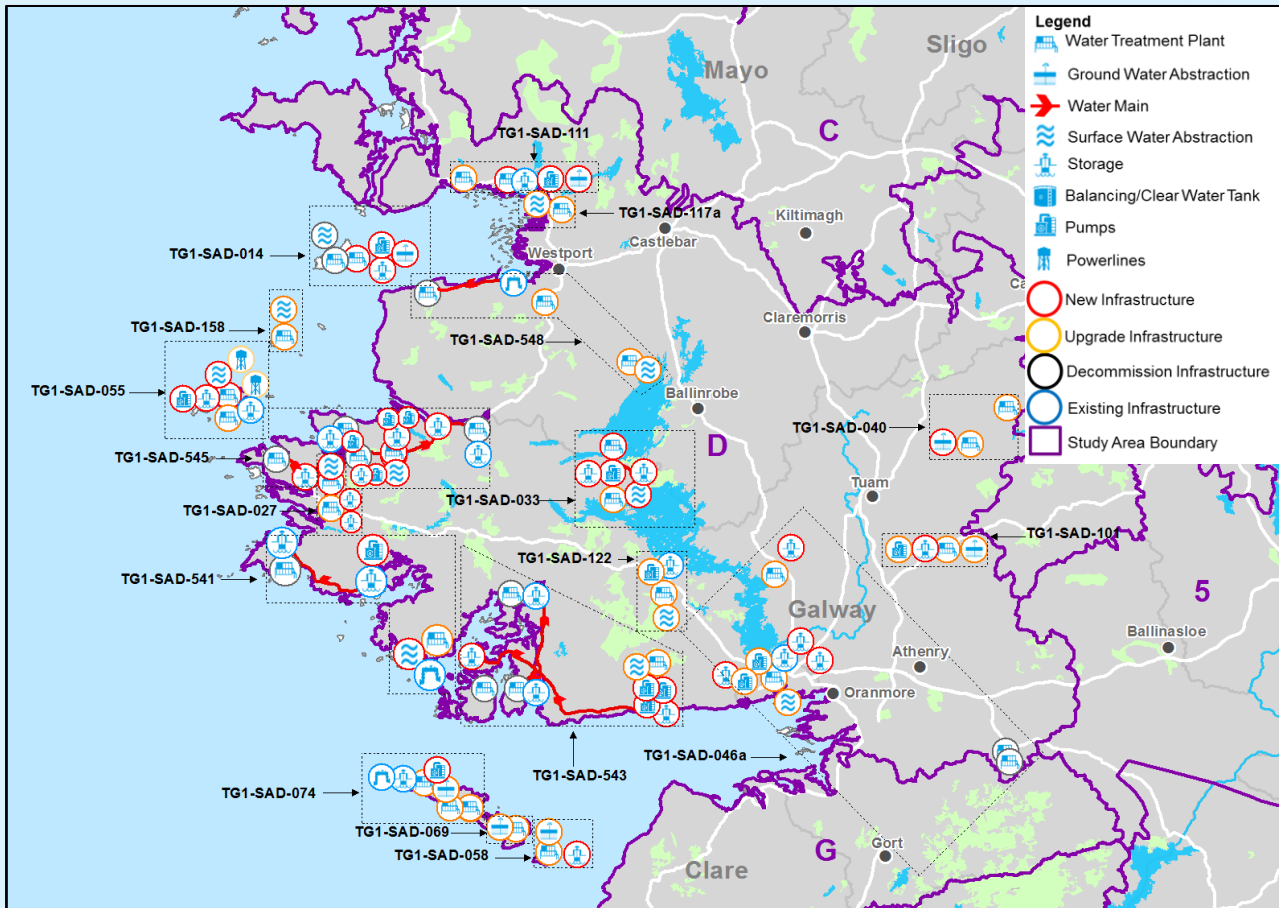
## 7.5.4 Study Area D – Galway and Mayo

Study Area D					
<b>No. of WRZs</b>	SAD lies within the counties of Galway, Mayo, Roscommon, and Galway City covering an area of approximately 6,700 km <sup>2</sup> . The population of the Study Area is approximately 228,610.				
<b>25</b>	The Principal Settlements (with a population of over 10,000) are Galway City and Suburbs and Castlebar.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	33	Groundwater	8	DYCP 2019	29,500
High Risk WTP	17	Surface Water	26	DYCP 2044	44,120
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	9	Increase	6	Increase	6
Upgrade (Capacity & WQ)	12	Maintain	2	Maintain	8
Decommission	12	Decommission	0	Decommission	12
New	6	New	3	New	5
<p>The Preferred Approach (PA) for SAD consists of local WRZ Options for 14 of the 25 WRZs in the Study Area. The other 11 WRZs are supplied by 4 SA Grouped, reducing the total number of WRZs from 25 to 18. The SA Grouped Options include:</p> <ul style="list-style-type: none"> <li>• Two (2) rationalisations with associated increased abstractions and WTP upgrades: <ul style="list-style-type: none"> <li>○ Ballyconneely rationalised to Carna Kilkieran with water supplied from a new SW abstraction and upgrades to existing WTPs (SAD-541).</li> <li>○ Carraroe, Rosmuc and Teeranea Lettermore rationalised to Spiddal (Lough Bouliska) with an increase to the existing surface water abstraction (SAD-543)</li> </ul> </li> <li>• One (1) Option with a rationalisation to a new community/GWS: <ul style="list-style-type: none"> <li>○ Louisburgh is rationalised to Murrisk via a new community/GWS developed to take water from Westport to Murrisk involving an increased SW abstraction from Lough Mask and upgrade to Tourmakeady WTP (SAD-548).</li> </ul> </li> <li>• One (1) RWSS: <ul style="list-style-type: none"> <li>○ A new abstraction and WTP allows the formation of the New Connemara RWSS (SAD-545). Cleggan, Leenane, Letterfrack and Tullycross WTPs and their abstractions will be decommissioned as part of this Option.</li> </ul> </li> </ul> <p>The Preferred Approach provides environmental benefits by decommissioning 11 existing abstractions that may not meet sustainability guidelines -Lake Anaserd (Ballyconneely), Loughaunwillan (Carraroe), Lough Courhoor (Cleggan_Claddaghduff), Mountain Stream (unnamed) (Leenane P.S), Diamond Hill Stream (Tully-Tullycorss), Lough Aroolagh (Rosmuc P.S), Lough Illauntrasna (Teeranea_lettermore P.S), Lough Rea (Galway City, Tuam and Lough Rea) x 2, Knockmore (Clare Island), and Bunnahowen River (Louisburgh).</p>					

## Study Area D

Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAD, planned leakage reduction programmes will reduce leakage by 1,448 m<sup>3</sup>/day in Lough Corrib (Galway City, Tuam, Loughrea) and Lough Mask & Westport WRZs. We have also committed to additional Leakage Targets of 40,107 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.

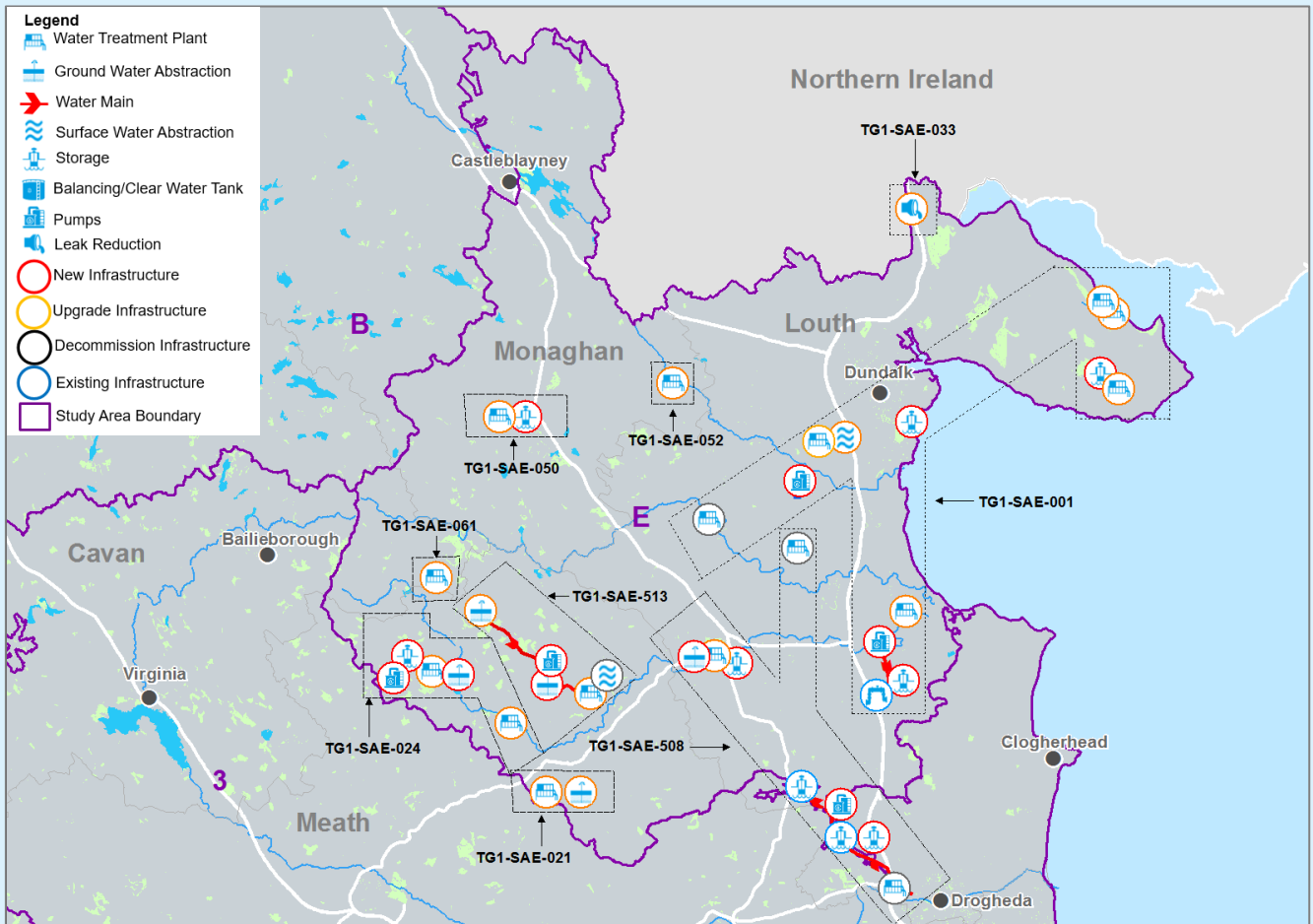


\*TG1-SAX-00X are the Option Codes assigned to each Option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-7.

## 7.5.5 Study Area E – Louth

Study Area E					
<b>No. of WRZs</b>	SAE lies within the counties of Louth, Monaghan, Meath and Cavan covering an area of approximately 1,260 km <sup>2</sup> . The population of the Study Area is approximately 84,050.				
<b>9</b>	The Principal Settlements (with a population of over 10,000) are Drogheda and Dundalk.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	16	Groundwater	11	DYCP 2019	1,230
High Risk WTP	14	Surface Water	8	DYCP 2044	3,230
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	8	Increase	2	Increase	1
Upgrade (Capacity & WQ)	5	Maintain	6	Maintain	5
Decommission	3	Decommission	3	Decommission	2
New	0	New	3	New	0
<p>The Preferred Approach (PA) for SAE consists of local WRZ Options for 7 of the 9 WRZs in the Study Area. The other 2 WRZs are supplied by 2 SA Grouped Options. The SA Grouped Options include:</p> <ul style="list-style-type: none"> <li>• One (1) rationalisation with a new groundwater abstraction and WTP upgrade: <ul style="list-style-type: none"> <li>○ Collon Drybridge rationalised to South Louth East Meath including a new GW abstraction (SAE-508).</li> </ul> </li> <li>• One (1) new groundwater abstraction: <ul style="list-style-type: none"> <li>○ A new groundwater abstraction at Rowlagh and an upgrade to Drumcondrath WTP (SAE-513).</li> </ul> </li> </ul> <p>The Preferred Approach provides environmental benefits by decommissioning 1 existing abstraction that may not meet sustainability guidelines –Lough Brackan (Drumcondrath).</p> <p>Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAE, planned leakage reduction programmes will reduce leakage by 40 m<sup>3</sup>/day in the Carrickmacross WRZ. We have also committed to additional Leakage Targets of 4,945 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.</p> <p>Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.</p>					

## Study Area E

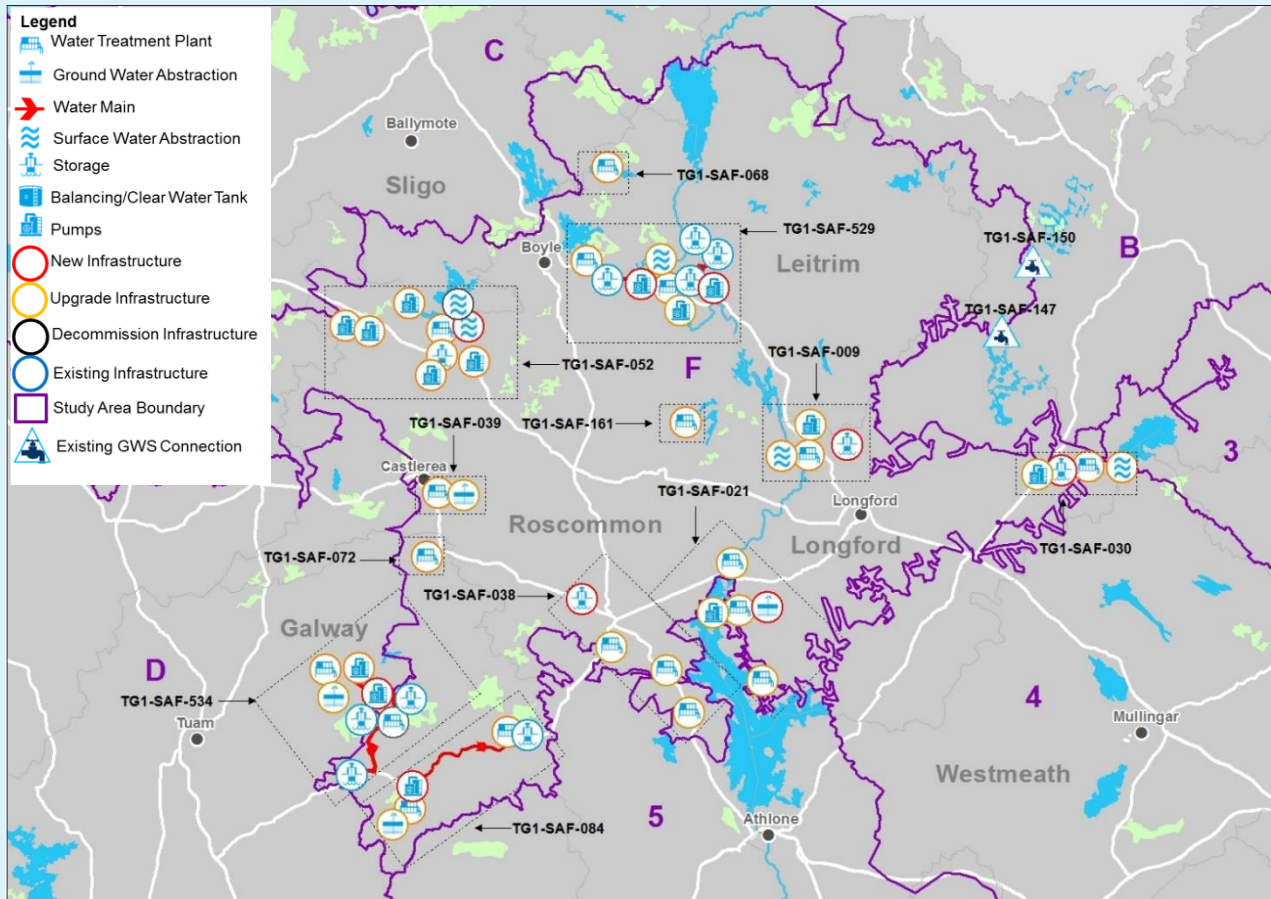


\*TG1-SAX-00X are the Option Codes assigned to each Option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-7.

## 7.5.6 Study Area F – Roscommon and Leitrim

Study Area F					
<b>No. of WRZs</b>	SAF lies within the counties of Roscommon, Leitrim, Longford, Galway, Sligo, Cavan, Mayo and Westmeath covering an area of approximately 3,990 km <sup>2</sup> . The population of the Study Area is approximately 85,570.				
<b>15</b>	The Principal Settlement is (with a population of over 10,000) is Longford.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	18	Groundwater	13	DYCP 2019	12,990
High Risk WTP	6	Surface Water	5	DYCP 2044	15,820
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	9	Increase	2	Increase	4
Upgrade (Capacity & WQ)	7	Maintain	9	Maintain	1
Decommission	2	Decommission	2	Decommission	0
New	0	New	1	New	0
<p>The Preferred Approach (PA) for SAF consists of local WRZ Options for 12 of the 15 WRZs in the Study Area, which include connections to 2 adjacent study areas. Three (3) WRZs are supplied by 2 SA Grouped Options. The number of WRZs in the Study Area reduces from 15 to 12 as a result of interconnecting supply systems. The SA Grouped Options include:</p> <ul style="list-style-type: none"> <li>• One (1) interconnection: <ul style="list-style-type: none"> <li>○ Interconnect Boyle Ardcarne with South Leitrim involving an increased surface water abstraction and upgrade to Carrick-on-Shannon WTP (SAF-529).</li> </ul> </li> <li>• One (1) rationalisation with associated increased abstractions and WTP upgrades: <ul style="list-style-type: none"> <li>○ Rationalise Kilkerrin/Moylough to Dunmore/Glenmaddy, increasing the existing surface water abstraction at Gortgarrow Springs and upgrade Gortgarrow Springs WTP (SAF-534).</li> </ul> </li> </ul> <p>Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAF, planned leakage reduction programmes will reduce leakage by 513 m<sup>3</sup>/day in the Carrick-on-Shannon, Lanesboro &amp; Newtowncashel and North Roscommon Regional Water Supply Scheme. We have also committed to additional Leakage Targets of 10,431 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.</p> <p>Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.</p>					

## Study Area F



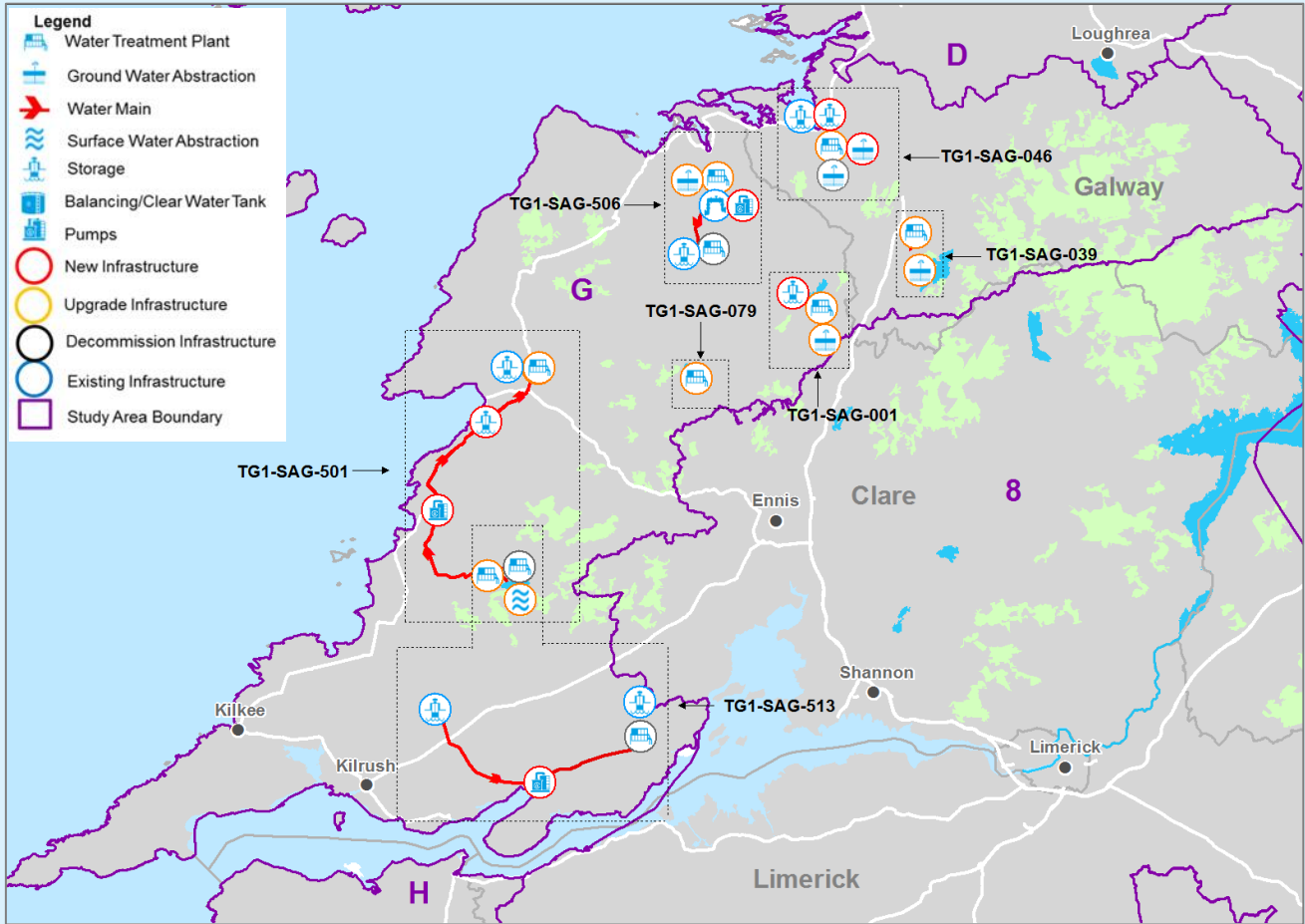
\*TG4-SAX-00X are the Option Codes assigned to each Option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-7.

## 7.5.7 Study Area G – Clare

Study Area G					
<b>No. of WRZs</b>	SAG lies within the counties of Clare and Galway covering an area of approximately 2,390 km <sup>2</sup> . The population of the Study Area is approximately 29,800.				
<b>9</b>	The Principal Settlements (with a population of over 10,000) are Drogheda and Dundalk.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m <sup>3</sup> /day
Existing WTP	10	Groundwater	5	DYCP 2019	5,640
High Risk WTP	7	Surface Water	6	DYCP 2044	5,950
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	3	Increase	3	Increase	1
Upgrade (Capacity & WQ)	4	Maintain	1	Maintain	3
Decommission	3	Decommission	1	Decommission	2
New	0	New	0	New	0
<p>The Preferred Approach (PA) for SAG consists of local WRZ Options for 4 of the 9 WRZs in the Study Area. The other 5 WRZs are supplied by 3 SA Grouped reducing the total number of WRZs from 9 to 6 The SA Grouped Options include:</p> <ul style="list-style-type: none"> <li>Two (2) rationalisations with associated increased abstractions and WTP upgrades: <ul style="list-style-type: none"> <li>Carran WRZ rationalised to Turlough increasing the abstraction from Turlough borehole and upgrading Turlough WTP (SAG-506).</li> <li>Killadysart PWS rationalised to West Clare Old Doolough WTP increasing the abstraction from Doo Lough and upgrading the existing WTP (SAG-513).</li> </ul> </li> <li>One Interconnection: <ul style="list-style-type: none"> <li>Ennistymon interconnected to West Clare increasing the abstraction from Doo Lough (SAG-501).</li> </ul> </li> </ul> <p>The Preferred Approach provides environmental benefits by decommissioning 2 existing abstractions that may not meet sustainability guidelines – Gortglass Lough (Killadysert PWS) and Doo Lough (West Clare).</p> <p>Ongoing leakage management through our National Leakage Reduction Programme, also contributes by reducing the volume of water lost in distributing water to demand centres. In SAG, planned leakage reduction programmes will reduce leakage by 231 m<sup>3</sup>/day in the Ennistymon WRZ. We have also committed to additional Leakage Targets of 9,156 m<sup>3</sup>/day that will reduce leakage to 21% of demand in WRZs where the demand exceeds 1,500 m<sup>3</sup>/day.</p> <p>Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.</p>					



## Study Area G



\*TG4-SAX-00X are the Option Codes assigned to each Option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-7.

## 7.6 Interim Solutions

As outlined in Section 8.3.7.6 of the Framework Plan, the NWRP provides for an “interim solution” approach, which allows shorter term interventions to be identified and prioritised, when needed. The Preferred Approach for each WRZ, Study Area and Region will be delivered on a phased basis subject to budget and regulatory constraints. It will take many investment cycles to deliver the Preferred Approach across all WRZs, therefore, Uisce Éireann must have a means to continue delivering safe, secure, and reliable water supplies (on a short to medium term basis) while we deliver our Preferred Approach.

On this basis, interim, short-term capital maintenance solutions have been identified for all WTPs and will be utilised when needed. These solutions will allow Uisce Éireann time to deliver the Preferred Approach, while at the same time, maintaining a sustainable water supply. These interim solutions are generally smaller in scale and rely on making best use of already existing infrastructure.

Examples of general interim measures for different water sources include the following:

- For groundwater sites, where the Preferred Approach requires that the existing WTP is to be maintained, the interim solution would typically provide for refurbishment of the existing boreholes or development of new boreholes and borehole pumps, and an upgrade of the treatment process in line with proposed growth predictions. This may require a staged upgrade of the WTP. For example, the interim solution would typically include an upgrade of the WTP to provide supply to existing customers with consideration given to a further required expansion of the WTP at a later date.
- For surface water sites, where the Preferred Approach requires that the existing WTP is to be maintained, the interim solution would typically involve the upgrade of the existing WTP in line with proposed growth predictions. Similar to groundwater sites this may require a staged upgrade of the WTP where the interim solution would typically include an upgrade of the WTP to provide supply to existing customers with consideration given to a further required expansion of the WTP at a later date.
- For groundwater and surface water sites where the Preferred Approach involves the decommissioning of the WTP by providing supply to the customers from another WTP within the WRZ or from another WRZ/Study Area/Region, the interim solution would involve the advancement of the rationalisation of the WTP, by provision of part supply or full supply if possible. If rationalisation is not feasible at that point in time due to dependencies on Study Area or Regional Option, containerised WTP upgrade solutions would be considered for the WTP. This involves the provision of a package WTP within a containerised unit. These package plants can be modified for use on other sites in the future and therefore are considered “no regrets” infrastructure investment.

A decision to progress any interim solution will be based on urgent or priority need to address water quality risk or supply reliability e.g., WTPs on the EPA Remedial Action List (RAL), drought issues or critical need. The RWRP-NW does not confer funding availability for any project and any interim measures will be subject to budget availability, relevant environmental assessment and other required consents in the normal way.

The interim solutions are for the purpose of maintaining continuity of supply and facilitating growth while we deliver the objective of the NWRP. However, it should be noted that the interim solutions will not improve the Level of Service. These solutions, in most cases, will only be used to allow time to deliver the longer-term solution. The interim solutions are determined in line with the Preferred Approach and as such, they are considered “no regrets” infrastructure investment.

The potential interim solutions for Study Areas A to G are summarised in Table 7.20 and described in the Technical Appendices 1 -7.

Table 7.20 Interim Solutions - Study Area A to Study Area G

Interim Solutions	Number of Interim Solutions by Type						
	SAA	SAB	SAC	SAD	SAE	SAF	SAG
Upgrade WTP to Uisce Éireann standards	18	6	7	13	4	5	3
Upgrade WTP to Uisce Éireann standards - potential site for containerised solution	7	2	5	12	1	0	2
Refurbish existing borehole(s) and upgrade WTP to Uisce Éireann standards - potential for a containerised solution	1	1	0	0	2	1	0
Refurbish existing borehole and upgrade WTP to Uisce Éireann standards	2	6	2	4	9	4	4
Refurbish existing spring abstractions and upgrade the WTP to Uisce Éireann standards	0	0	4	4	0	6	0
Refurbish existing spring abstraction & borehole, and upgrade WTP to Uisce Éireann standards	1	0	0	0	0	1	0
Refurbish existing spring and upgrade WTP to Uisce Éireann standards - potential site for a containerised solution	0	1	1	0	0	1	1
Refurb existing spring and upgrade WTP to Uisce Éireann standards	0	1	0	0	0	0	0
<b>Total no. of solutions</b>	<b>29</b>	<b>17</b>	<b>19</b>	<b>33</b>	<b>16</b>	<b>18</b>	<b>10</b>

Uisce Éireann's Investment Plan 2020-2024 includes a number of programmes and projects targeted at providing for growth. One such programme is the Small Towns and Villages Growth Programme (STVGP) which will provide funding for Water and Wastewater Treatment Plant growth capacity in smaller settlements which are not otherwise provided for in the Capital Investment Plan 2020-2024. The STVGP is focused on supporting growth in areas already served by Uisce Éireann infrastructure where current or future capacity deficits have been identified. Uisce Éireann have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant County Development Plan. The interim solution for the North Sligo WRZ (SAC) will be considered under this programme.

## 7.7 Sensitivity Analysis

Our supply demand forecast has been developed using the best available information and application of best practice methods where we have data to do so. The uncertainty associated with our data is captured within our estimate of Headroom. The Headroom component is added to the Demand component of the SDB. We have identified areas where we will focus improvements in data to improve the certainty of our forecasts. These are outlined in Section 9 of this RWRP-NW.

Future events that could alter the SDB and impact on Need, such as climate change and new abstraction legislation, introduce uncertainty to our long-term forecasts. For this reason, we undertake a Sensitivity Analysis that allows us to stress test our Preferred Approaches against a range of possible futures. This ensures that our decision making is robust and that the Preferred Approaches are adaptable.

We test our Preferred Approaches against future scenarios defined by five (5) uncertainty factors:

- **Sustainability:** New abstraction legislation introducing sustainability limits on quantities to be abstracted, increasing the SDB Deficit.
- **Climate change:** Climate change reduction in water availability at certain times of the year is greater than anticipated, increasing the SDB Deficit.
- **Growth forecast:** Growth in demand is lower than forecast, reducing the SDB Deficit.
- **Leakage targets exceeded:** We achieve better than expected levels of effectiveness and efficiency in reducing leakage, reducing the SDB Deficit.
- **Leakage targets not met:** Leakage does not reduce to target levels within the planning period, increasing the SDB Deficit.

We have not assessed against a scenario where growth is higher than forecast, as we consider the projections that we have used in our SDB calculation reflect an optimistic growth forecast. Furthermore, the scenario of higher than forecast growth would have the same impact as a scenario where Leakage targets are not met.

The uncertainty factors are tested independently. A combination of these scenarios may occur together. For example, we may find growth in demand is lower than forecast, and/or we achieve greater leakage reduction at the same time as the abstraction licensing regime limits our water availability. In this case, reductions in demand would offset some of the increasing deficit arising due to abstraction sustainability reductions.

As data and models improve over time Uisce Éireann will incorporate a more extensive approach to sensitivity analysis in the form of Adaptive Planning. This will provide the flexibility to respond to uncertainty when it occurs.


Overall, our sensitivity assessment of the Interim Solutions and Preferred Approach indicates they are highly adaptable to a broad range of futures, and therefore represent 'no regrets' infrastructure

We describe the scenarios we have assessed in further detail in Chapter 8 of the Framework Plan. A summary of the outcomes of the analysis we have undertaken is given in Table 7.21. Further details can be found in the Study Area Technical Reports (Appendices 1-7).

Table 7.21 Sensitivity Analysis of the Study Area Preferred Approach

Sensitivity Criteria	Impact on the SA Preferred Approach						
	SAA	SAB	SAC	SAD	SAE	SAF	SAG
<b>Sustainability Impact*</b>							
Status of abstraction potentially impacted by new legislations with PA in place	Decommission 9 Maintain 20	Decommission 1 Maintain 8	Decommission 4 Maintain 4	Decommission 11 Maintain 7	Decommission 1 Maintain 3	Decommission 0 Maintain 0	Decommission 2 Maintain 2
Likelihood	Moderate/High	Moderate/High	Moderate/High	Moderate/High	Moderate/High	Moderate/High	Moderate/High
Change in Deficit (m <sup>3</sup> /day) 🚫	+38,000	+8,000	+10,000	+10,000	+20,000	+0	+21,000
<b>Climate Change Impact</b>							
Likelihood	High	High	High	High	High	High	High
Change in Deficit (m <sup>3</sup> /day) 🚫	+2,000	+200	+600	+400	+300	+0	+600
<b>Demand Growth Impact</b>							
Likelihood	Low/Moderate	Low/Moderate	Low/Moderate	Low/Moderate	Low/Moderate	Low/Moderate	Low/Moderate
Change in Deficit (m <sup>3</sup> /day) 🟢	-40,455	-2,274	-26,817	-29,504	-1,233	-15,823	-5,946
<b>Leakage Targets not met</b>							
Likelihood	Low	Low	Low	Low	Low	Low	Low
Change in Deficit (m <sup>3</sup> /day) 🚫	+634	+96	+578	+1,448	+40	+513	+231

### Leakage Targets Exceeded

Likelihood	Moderate/High	Moderate/High	Moderate/High	Moderate/High	Moderate/High	Moderate/High	Moderate/High
Change in Deficit (m <sup>3</sup> /day) 	-20,605	-1,142	-11,961	-40,107	-4,945	-10,431	-9,156

 = Reduced SDB Deficit

 = Increased SDB Deficit

\* Number of abstractions potentially impacted by new legislation that are proposed to be decommissioned in the Preferred Approach. Abstractions which will be potentially impacted by the new legislation are set out in Table 7.19. These impacts are based on conservative estimates of what a future regulatory regime may require. The actual reductions that may be needed in future will depend on the specific requirements of that legislation.

## 7.8 Review of Preferred Approach arising from Consultation

As set out in Section 9 of the RWRP-NW, the NWRP will be formally updated every five years at which point there will be further opportunities for public participation. Baseline forecasts and data feeding into the NWRP will be reviewed annually. Our data is continuously improving, and it is important that we review our Preferred Approach further to the receipt of updated data.

During the consultation period for the RWRP-NW we received submissions from the National Federation of Group Water Schemes (NFGWS) and several individual GWSs that supported the continuation of supplies to seven (7) WRZs. For these WRZs, the Preferred Approach we proposed in the draft RWRP-NW was to discontinue supplies from GWSs and consider alternative feasible options where available. This approach was taken due to the uncertainty regarding regulatory decisions on the sustainability of abstractions under the new abstraction legislation<sup>6</sup>. However, the consultation submissions outlined the current and future improvement plans proposed by the GWSs which aim to achieve Water Framework Directive objectives in relation to abstractions. These include source protection works, water conservation measures, and water treatment plant upgrades. Furthermore, we acknowledge that there will be greater clarity on sustainable abstraction limits once the new abstraction legislation and associated regulations are confirmed. Therefore, at this stage, if existing abstractions are deemed to be unsustainable by the EPA, GWSs could consider alternative sources to ensure sustainability or Uisce Éireann can reassess the alternative feasible options that we have identified through the NWRP option development process. For this reason, we have updated the Preferred Approach in the final RWRP-NW to continue supplying the following WRZs from GWSs - Arvagh, Gowna, Killeshandra, Blacklion, Ballyhaise, Glaslough, and Emyvale. As the abstraction legislation is implemented, Uisce Éireann will continue to work with GWSs to secure sustainable supplies for our customers into the future.

The updated Preferred Approach for Glaslough and Emyvale WRZs results in a change to the Preferred Approach for Monaghan WRZ. Given the Monaghan WRZ will now be in surplus for the planning period, a new or increased supply is not required. We have therefore revised the Monaghan WRZ Preferred Approach to upgrade the existing WTPs for water quality improvements.

Similarly, the update to the Preferred Approach for Ballyhaise PWS WRZ results in a change to the Preferred Approach for Cavan and Ballyjamesduff WRZs. We have updated the Preferred Approach to interconnect the two WRZs and supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS only. Ballyhaise PWS will not connect to Ballyjamesduff but will continue to be supplied from Annagh GWS.

Table 7.21 compares the Preferred Approach presented in the draft RWRP-NW with the updated Preferred Approach following the public consultation process. These updates are reflected throughout Section 7, Section 8 and Section 10 of this final Plan. Further details are also provided in the respective Study Area Technical Reports.

Table 7.21 Comparison of the Preferred Approach for the Draft RWRP-NW and the Final RWRP-NW

Study Area	WRZ Code and Name	Draft RWRP-NW Preferred Approach Option	Post Consultation RWRP-NW Preferred Approach Option
B	Blacklion PWS (GWS Import)	New GW abstraction (karstic) to supply Blacklion WRZ and new water treatment plant.	Keep supplying Blacklion WRZ from Gowlan GWS (Cuilcagh Mountain Spring and Garvagh Lough).
B	Gowna (GWS Import)	Rationalise Gowna (GWS Import) to Gowna WRZ.	Keep supplying Gowna WRZ from Erne Valley GWS.
B	Ballyhaise PWS (GWS Import)	Interconnect Cavan and Ballyjamesduff WRZs. Supply spare	Keep supplying Ballyhaise WRZ from Annagh GWS.

Study Area	WRZ Code and Name	Draft RWRP-NW Preferred Approach Option	Post Consultation RWRP-NW Preferred Approach Option
		<p>capacity from Ballyjamesduff RWSS to Cavan RWSS.</p> <p>Upgrade Lismean WTP for water quality improvements. Ballyjamesduff RWSS is not in deficit - supply spare capacity to Cavan RWSS.</p> <p>Interconnect Ballyhaise and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS.</p>	
B	Ballyjamesduff RWSS	<p>Interconnect Cavan and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS.</p> <p>Upgrade Lismean WTP for water quality improvements. Ballyjamesduff RWSS is not in deficit - supply spare capacity to Cavan RWSS.</p> <p>Interconnect Ballyhaise and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS.</p>	<p>Interconnect Cavan and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS. Upgrade Lismean WTP (Ballyjamesduff WRZ) for water quality improvements. Ballyjamesduff RWSS is not in deficit - supply spare capacity to Cavan RWSS.</p>
B	Cavan RWSS	<p>Interconnect Cavan and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS.</p> <p>Upgrade Lismean WTP for water quality improvements. Ballyjamesduff RWSS is not in deficit and supply spare capacity to Cavan RWSS.</p> <p>Interconnect Ballyhaise and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS.</p>	<p>Interconnect Cavan and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS. Upgrade Lismean WTP (Ballyjamesduff WRZ) for water quality improvements. Ballyjamesduff RWSS is not in deficit - supply spare capacity to Cavan RWSS.</p>
B	Gowna	Rationalise Gowna (GWS Import) to Gowna WRZ.	Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit.
B	Glaslough (GWS Import)	Upgrade existing WTPs for water quality improvements. Monaghan WRZ is not in deficit. Rationalise	Keep supplying Glaslough WRZ from Glaslough and Tyholland GWS.



Study Area	WRZ Code and Name	Draft RWRP-NW Preferred Approach Option	Post Consultation RWRP-NW Preferred Approach Option
		Emyvale and Glaslough to Monaghan WRZ.	
B	Emyvale (GWS Import)	Upgrade existing WTPs for water quality improvements. Monaghan WRZ is not in deficit. Rationalise Emyvale and Glaslough to Monaghan WRZ.	Keep supplying Emyvale WRZ from Glaslough and Tyholland GWS.
B	Monaghan	Upgrade existing WTPs for water quality improvements. Monaghan WRZ is not in deficit. Rationalise Emyvale and Glaslough to Monaghan WRZ.	Upgrade Togan (Lake) WTP and Crosses WTP for water quality improvements. Monaghan WRZ is not in deficit.
F	Killeshandra PWS (GWS Import)	New SW abstraction from Lake Town and new WTP.	Keep supplying Killeshandra WRZ from Erne Valley GWS.
F	Arvagh PWS (GWS Import)	Rationalise Arvagh to Gowna WRZ Increase SW abstraction and WTP capacity and supply Arvagh.	Maintain supply to Arvagh WRZ from Erne Valley GWS.

## 7.9 Summary

Our SA Preferred Approaches consist of a combination WRZ Options and SA Options that perform best against our criteria of Resilience, Deliverability and Flexibility and Sustainability. These solutions have been developed with input from technical and local experts through workshops involving the assessment of 811 Feasible Options.

Our SA Preferred Approaches:

- Consist of 91 Options comprising 70 WRZ Options and 21 Study Area (SA) Grouped Options. The SA Grouped Options supply more than one WRZ and generally rationalise supplies, with associated environmental benefits.
- Comprise 19 increased or new local groundwater supplies, and 20 increased or new local surface water supplies that contribute to meeting an estimated 7% and 30% of the Deficit across the North West Region.
- Supply 63% of the regional Deficit by interconnecting and rationalising supplies. This is combined with upgraded or new groundwater or surface water sources). The interconnected systems benefit 54 WRZs.
- Supply approximately 1% of the regional Deficit through four (4) Cross Study Area Interconnections benefitting five (5) WRZs. One (1) of the interconnections is supplied from a WRZ located outside of the North West Region (South Louth West Meath WRZ in the Eastern and Midlands Region).
- Upgrade all WTPs to be maintained under the Preferred Approach, to reduce water quality risks identified through our Barrier Assessments.
- Increase resilience by delivering solutions through interconnections and rationalisation and providing 64 more water storages.

- Improve sustainability outcomes by decommissioning 38 WTPs and abandoning 42 associated abstractions. This includes twenty-eight (28) surface water abstraction sites that have been assessed to be potentially impacted by future abstraction legislation. The assessment was based on a conservative estimate of what a future regulatory regime may require.
- Include 142 Interim Solutions to ensure shorter term Deficits are addressed to account for lead times in delivery of Options that will ultimately meet the Deficit across the 25-year planning period.
- Are adaptable to change across a range of future scenarios including climate change, growth projections, sustainability outcomes and changes in leakage targets.

## 7.10 References

1. Department of Communications, Climate Action and Environment. 2018. *National Adaptation Framework. Planning for a Climate Resilient Ireland*. [Online]. Available from: <https://www.gov.ie/en/publication/fbe331-national-adaptation-framework/>.
2. UK Technical Advisory Group (UKTAG). 2008. UK Environmental Standards and Condition (PHASE 1). Water Framework Directive.
3. Southern Regional Assembly, 2021. Southern Region Spatial and Economic Strategy. [Online]. Available from <https://www.southernassembly.ie/regional-planning/regional-spatial-and-economic-strategy>.
4. Directive (EU) 2020/2184 of the European Parliament and of the council of 16 December 2020.
5. European Union (Drinking Water) Regulations 2023. (S.I. No. 99/2023).
6. Water Environment (Abstractions and Associated Impoundments) Act 2022 [Online]. Available from: <https://www.irishstatutebook.ie/eli/2022/act/48/enacted/en>