

7

**PREFERRED
APPROACH –
STUDY AREA**

7.1 Introduction

The purpose of this section of the draft RWRP-EM is to examine all potential Feasible Option that could be used to address the identified Need across the 134 Water Resource Zones (WRZs) in the 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 spatial Levels: individual WRZs, Study Area Level, and Regional Level (Figure 7.1). This process involves comparison of the Feasible Option 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 7 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.

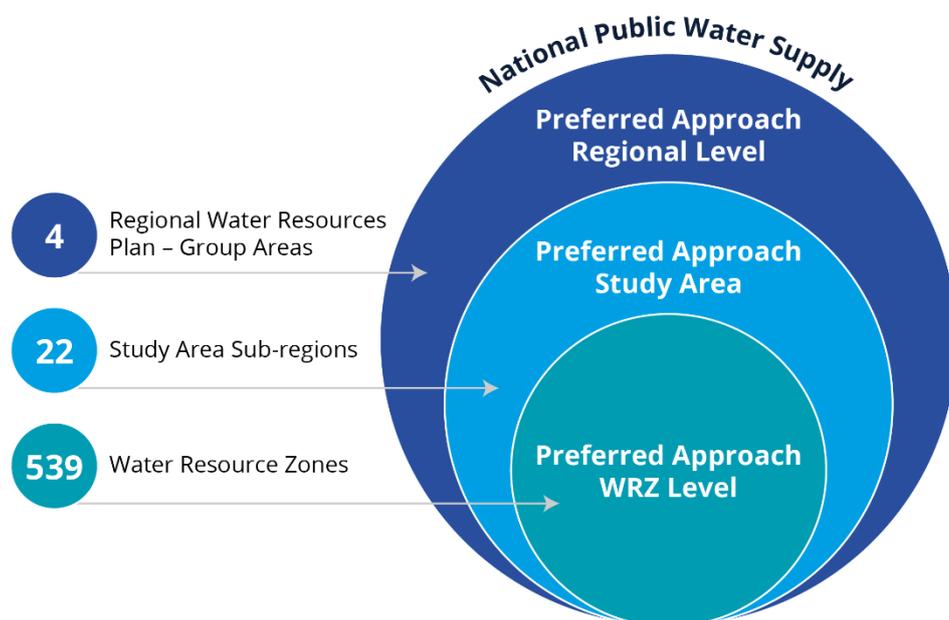


Figure 7.1 Spatial Level Assessment

The process we follow, which is based on a hierarchical view of the 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 Eastern and Midlands 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 Eastern and Midlands 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 Eastern and Midlands 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 Option to address Need within each WRZ and Study Area, and across the Eastern and Midlands Region as a whole. This process is designed to identify the option that meets identified Deficits while providing the best overall outcomes when considered against a range of criteria.

Specifically, this Approach Development Process assesses the Feasible Option under six 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 NWRP with all relevant Government Policy. The six 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 a particular outcome. 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 Option

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 Option 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

Approaches Tested	Description	Policy Driver
Quickest Delivery	Based on an estimate of the time taken to bring an option into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening This is particularly relevant where an option might be required to address an urgent Public Health issue.	Statutory Obligations under the Water Supply Act 2007 and Drinking Water Regulations
Best SEA Environmental	This is the option or combination of Option with the highest total score across the 19 No. SEA MCA sub-criteria questions	SEA Directive and Water Framework Directive
Most Resilient	This is the option or combination of Option with the highest total score against the resilience criteria.	National Adaptation Plan and Climate Action Plan
Lowest Carbon	This is the option or combination of Option with the lowest embodied and operational carbon cost	Climate Action Plan

Least Cost Approach

The Least Cost Approach is determined using an Irish Water 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 Option provide similar NPV costs, and in some circumstances, so as to ensure that no such Option are excluded at this early stage by reference only to "least cost", Irish Water has considered that all Option 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, Irish Water has applied wider factors, including SEA and Habitats objectives, as part of its exercise of professional judgement as provided for 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.

Best Appropriate Assessment (Best AA) Approach

The Best AA approach gives maximum consideration to the Option with no potential for impacts on European Designated sites (no Likely Significant Effects or LSEs) or Option 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. It puts avoidance of impacts on European sites at the forefront taking account of the fact that Option with a high likelihood of significant effects which could lead to adverse effects on a European Site have already been removed at Coarse Screening stage.

Quickest Delivery Approach

The quickest delivery 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 Eastern and Midlands 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 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 impact 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. We also review the scoring against individual criteria to identify where assessment reflects important differences between Option 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 a no -3 biodiversity score. The Best Environmental is the Combination with the best performing environmental score with the least no 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 from the four MCA screening questions (refer to Table 8.6 of the Framework Plan) relating to resilience criteria. 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 Irish Water's carbon reduction policies and the National Adaptation Framework (NAF)¹ in relation to climate change.

7.2.2 Approach Ranking and Appraisal

The EBSD (Economics of Balancing Supply and Demand) method is applied to rank the Option in order of lowest to highest NPV cost and with regard to their applicable MCA scores for the six Approach Categories. The EBSD method determines an optimum combination of Option 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, Option may achieve similar, although not exactly identical, scores within an Approach Category. In these circumstances, to ensure that Option which perform better overall are not excluded from the approach development process, Irish Water takes a wider look at the combination to consider which of these comparable Option to categorise as the “Best” approach within each category. In particular, Irish Water takes into account whether the option or combination of Option 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 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.

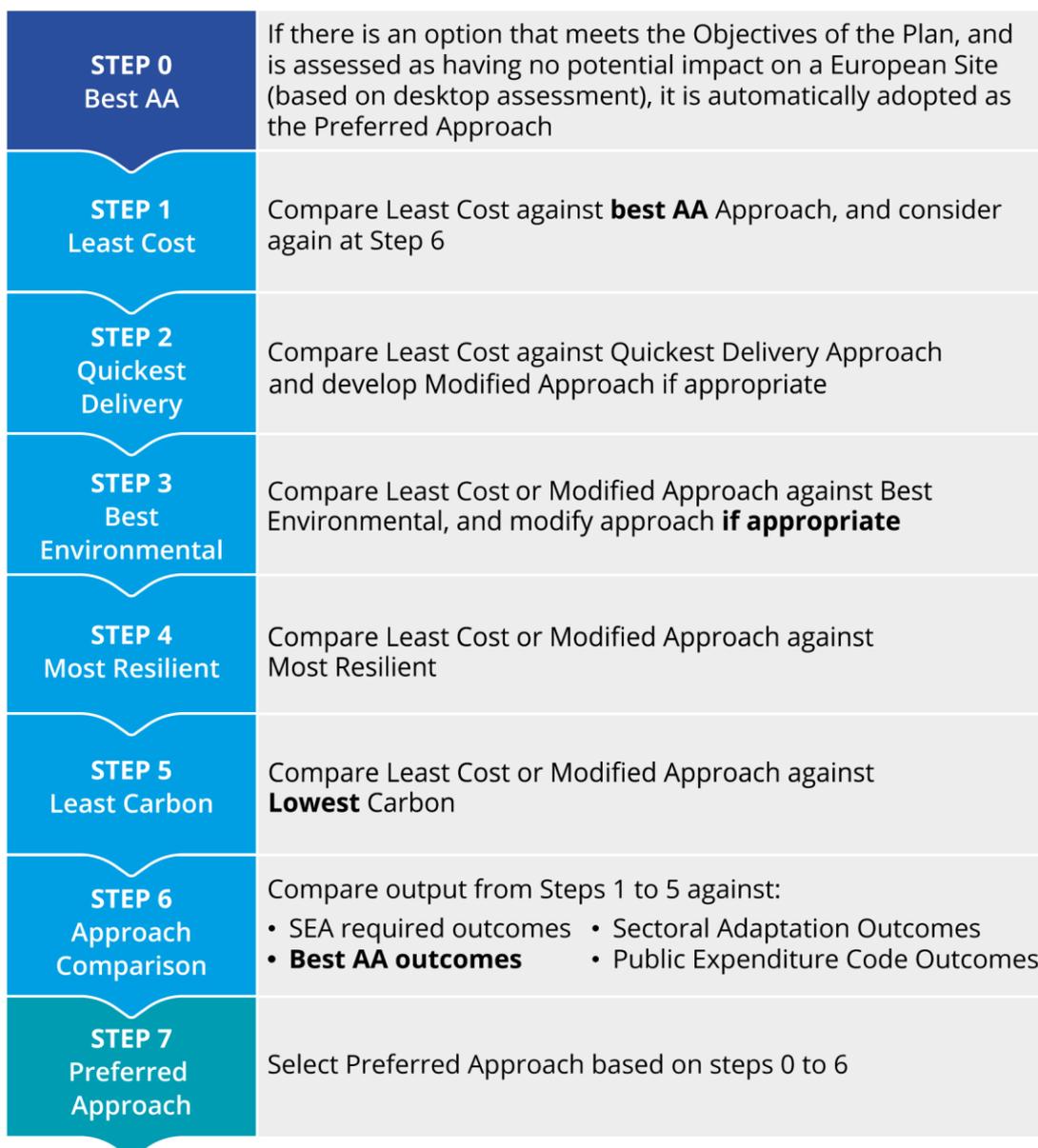


Figure 7.2 Seven (7)-Step Approach Development Process

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 Option being considered subsequently at the Project Level. Assessments at this stage are desk based and Plan Level assessments. Environmental impacts and costing of projects are further reviewed at Project Level where alternatives will need to be considered as part of the Environmental Impact Assessment process in the usual way. No statutory consent or funding consent is conferred by inclusion of any option in the NWRP. Any projects that are progressed following this plan 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).

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 Option 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 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, the - WRZ Preferred Level approach - for all of the supplies in the Study Area

Stage 2 – We assess whether there are any larger Option that might resolve Deficits across multiple WRZs that are located within the same Study Area. We then develop combinations of these Option (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 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 Option that could be used to resolve the Need within the WRZ (Unconstrained Option) and then to eliminate those that are not feasible or that have identifiable environmental issues at a desktop level (Option assessment screening). This is set out in Section 6.

The remaining Feasible Option are categorised as Option that resolve the Need for one WRZ only (“WRZ Option”), and Option that resolved the Need for more than one WRZ (“Study Area Option”). To illustrate, Table 7.2 below provides an overview of the number of feasible WRZ Option and Study Area Option for the 13 WRZs in Study Area 4.

Table 7.2 SA4 – Option Types

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

As set out further in the Study Area Technical Appendices 1-9, Feasible Option to resolve the Need at WRZ Level and Study Area Level may consist of individual or multiple projects, the progression of which will be subject to budgetary and regulatory constraints.

Irish Water's next step is to assess the Feasible Option for each WRZ and identify the best performing option within each of the six Approach Categories for the relevant WRZ.

To illustrate using the Ballany WRZ, as can be seen from Table 7.2 there are six (6) feasible WRZ Option for that WRZ. Further details of these WRZ Option are provided in Table 7.3. We use the EBSD tool to rank the WRZ Option against the six Approach Categories as outlined in Table 7.3, and Irish Water then determines which option provides the best outcome in each category (e.g. Least Cost, Best AA etc). As set out in the example below, Option SA4-05, provides the best outcome under three Approach Categories, being Best AA (biodiversity), Best SEA (overall environmental), and Lowest Carbon. In relation to the other Approach Categories, SA4-08 ranks the best for Quickest Delivery and SA4-09 ranks the best for Least Cost and Most Resilient.

Table 7.3 SA4, Ballany WRZ Option

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

The above process is completed in respect of each of the 134 WRZs across the nine (9) Study Areas within the Eastern and Midlands Region. A record of this analysis is set out in the Technical Report for each of the Study Areas (Appendices 1-9).

7.2.3.2 Approach Appraisal - WRZ Level

Once Irish Water has identified the Option with the best outcomes within each of the Approach Categories, these Option are then brought through to the Approach Development Process, as set out in Figure 7.2 above. 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.

For Example, for Ballany WRZ the 7-step process presented in Figure 7.3 was worked through.

STEP 0 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.
STEP 1 Least Cost	We compared the Least Cost Approach against the Best AA Approach. While the Least Cost Approach has a -3 biodiversity score, there are no other Approaches assessed as having no potential impact on the European Site. The Least Cost Approach was therefore retained at this stage.
STEP 2 Quickest Delivery	We compared the Quickest Delivery Approach against the Least Cost Approach. The Quickest Delivery Approach does not deliver significantly better scores against the Quickest Delivery criteria and while it performs better against the Environmental Criteria, it has higher carbon costs. The Least Cost Approach was therefore retained at this stage.
STEP 3 Best Environmental	We compared the Least Cost Approach against the Best Environmental Approach. While the Best Environmental Approach didn't perform significantly better against the environmental criteria it doesn't have a -3 biodiversity score and it isn't significantly more expensive, therefore the Best Environmental Approach was taken forward at this stage.
STEP 4 Most Resilient	We compared the Best Environmental Approach against the Most Resilient Approach. The Most Resilient approach is the Least Cost Approach. It does not deliver significantly better scores against the resilience criteria and has a -3 biodiversity score. The Best Environmental Approach was therefore retained at this stage.
STEP 5 Least Carbon	We compared the Best Environmental Approach against the Lowest Carbon Approach. The Best Environmental Approach is the Lowest Carbon Approach. The Best Environmental Approach was therefore retained at this stage.
STEP 6 Approach Comparison	A final assessment of the Best Environmental Approach was completed against the Least Carbon, Best AA, Best Environmental and Most Resilient Approaches. The Best Environmental Approach is the Best AA and Lowest Carbon Approach and does not have significantly lower scores across any of the other criteria. The Best Environmental Approach was therefore retained at this stage.
STEP 7 Preferred Approach	The Best Environmental Approach was selected as the Preferred Approach for the Water Resource Zone.

Figure 7.3 WRZ Level Preferred Approach Development – SA4, Ballany WRZ

As mentioned above this process was 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.

7.2.3.3 Selection of Preferred Approach – WRZ Level Approach

We follow this same process for the WRZs within each Study Area, until we have the initial Preferred Approach for each WRZ within each of the nine (9) Study Areas in the Eastern and Midlands Region.

When it comes to assessment at Study Area Level, the individual WRZ Preferred Approach will be combined for assessment purposes and referred to as the **WRZ Level Approach**. The WRZ Level Approach is the combination of all individual WRZ Preferred Approaches that together will meet the Need for the entire Study Area (although it will do so on a WRZ-by-WRZ basis).

The WRZ Level approach for SA4 is summarised in Table 7.4. This shows the combination of the WRZ Preferred Approach in the Study Area and their alignment with the six Approach Categories as determined by the application of the 7-step process to each WRZ.

As can be seen from the table, the Preferred Approach for only two (2) of the thirteen (13) WRZs is a source from another Study Area – Mullingar Regional involves a connection from the New Shannon Source (NSS) (transfer from the Parteen Basin to the GDA) and Enfield is rationalised to the Greater Dublin Area (GDA). The Preferred Approach for the remaining WRZs are local Option, i.e. supplies from within the same Study Area. Local supplies from the same study area account for approximately 90% of the Preferred Approach at WRZ Level across the Eastern and Midlands Region.

Historically, this is the way water supplies have been operating in Ireland. Geographical constraints on supplies have led to a system that contains a significant number of isolated supplies, which is less resilient than larger centralised supplies.

For this reason, Irish Water then looks at solutions for WRZ at a broader Study Area Level to see if there are circumstances, whereby a larger more resilient supply might be available to meet the local need.

The Stage 1 process is summarised in Figure 7.4.

Table 7.4 SA4 WRZ Level Approach – Assessment Outcome

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

Water Resource Zone Name	Feasible Option SA4 Tipperary North		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best Environmental	Lowest Carbon	Most Resilient	Preferred Approach
Clonuff	SA4-99	No Deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓
Daingean	SA4-100	No Deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓
Walsh Island	SA4-101	No Deficit - WQ upgrade required only	-	✓	✓	✓	✓	✓	✓	✓



Figure 7.4 Preferred Approach Development – Stage 1

7.2.4 Stage 2 – Study Area Combinations

As outlined in Section 6, there are three types of Option considered within the NWRP:

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

Accordingly, once the Preferred Approach for each of the individual WRZs has been identified, the next step is to determine the overall Preferred Approach for each of the nine (9) Study Areas in the Eastern and Midlands Region. To achieve this outcome, we identify the "Study Area Option", which as noted above are Option that can address Need in more than one WRZ. Irish Water then develops various combinations which contain Study Area Option and WRZ Option to provide supply for the entire Study Area. These are called "SA Combinations". The Stage 2 process is summarised in Figure 7.5.

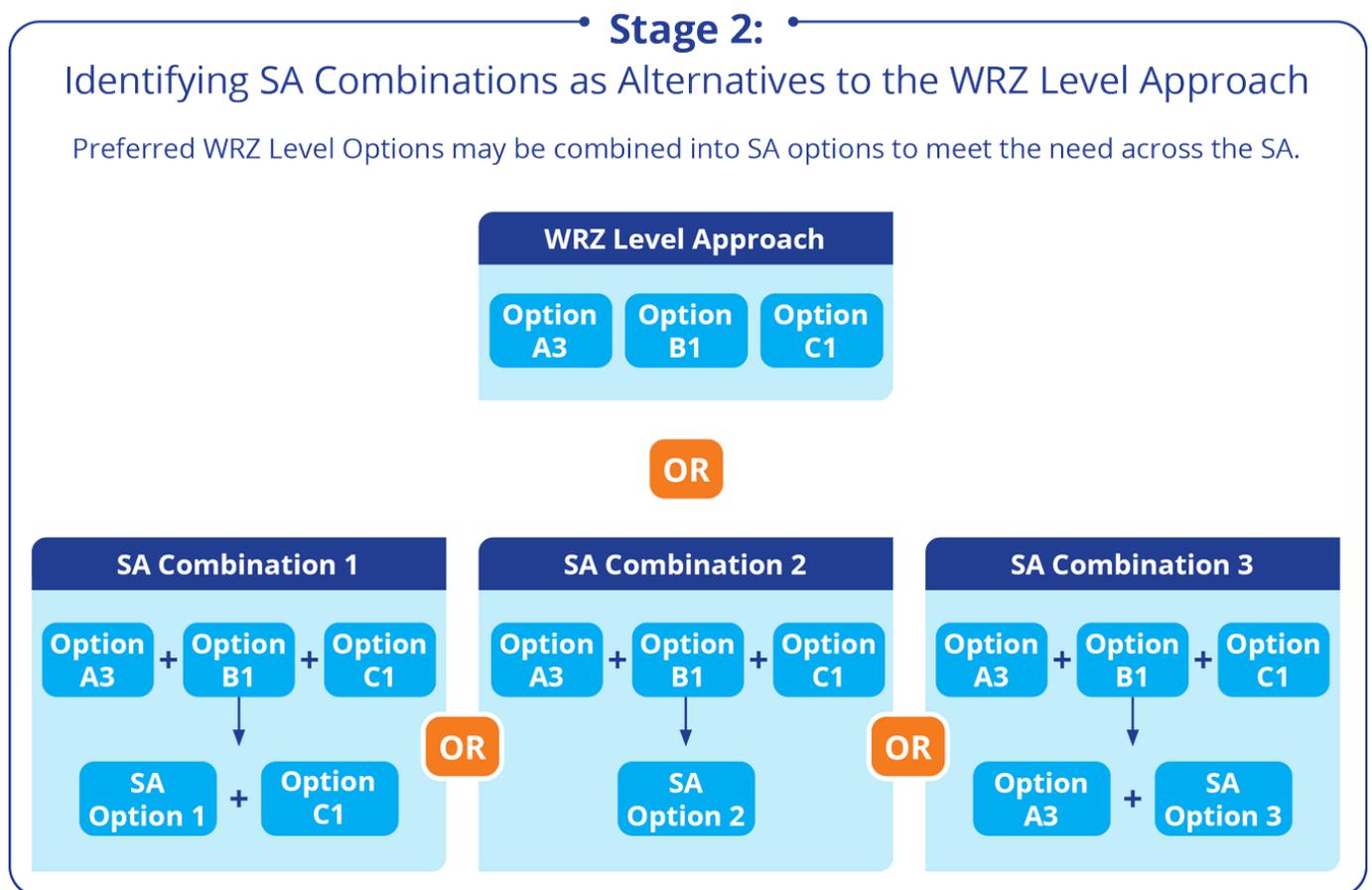


Figure 7.5 Preferred Approach Development – Stage 2

As mentioned above, for each Study Area, one of the SA Combinations will always be the WRZ Level Approach, which as explained above is the overall combination of each individual WRZ Preferred Approach within the relevant Study Area. In Table 7.5 we show an example of this for Study Area 3.

Again, while these are presented as a combination of Option to meet a particular need, each project will be subject to its own budgetary and regulatory constraints.

Table 7.5 SA3 WRZ Level Approach - Assessment Outcome

Key	WRZ Level Approach Option	<input type="checkbox"/>	SA Grouped Option	<input type="checkbox"/>
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WRZ	WRZ Level approach	SA combination 1 (SA grouped option 3)	SA combination 2 (SA grouped option 4)	SA combination 3 (SA grouped option 7)	SA combination 4 (SA grouped option 8)	SA combination 5 (SA grouped option 9)	SA combination 6 (SA grouped option 10)	SA combination 7 (SA grouped option 16)	SA combination 8 (SA grouped option 17)	SA combination 9 (SA grouped option 20)	SA combination 10 (SA grouped option 22)	SA combination 11 (SA grouped option 22b)	SA combination 12 (SA grouped option 23)	SA combination 13 (SA grouped option 8 and 16)
Athboy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bailieboro RWSS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ballivor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kells-Oldcastle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kilmessan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moynalty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Navan-Midmeath	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
South Louth and East Meath	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
St Louis, National School, Rathkenny	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trim	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The table above demonstrates the variety of SA combinations for SA3. For example, SA combination 1 contains Group Option 3, which resolves the Need for two (2) WRZs, Navan Mid Meath and South Louth East Meath. Therefore, a SA combination for this Group includes the Group Option for Navan Mid Meath and South Louth East Meath while the Need for the remaining WRZ is resolved by the Preferred Approach at WRZ Level.

As can be seen, even when we consider all permutations of Study Area Option to create the SA combinations, there are some water supplies that will always require 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 such 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 (including the WRZ Level Approach) identified for each Study Area.

Table 7.6 Number of SA Combinations for each Study Area

Number of SA Combinations								
SA1	SA2	SA3	SA4	SA5	SA6	SA7	SA8	SA9
20	2	14	9	14	17	5	20	12

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 and the SA Combinations, developed in Stage 2.

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 Option that provide the best overall outcome, when considered against the six Approach Categories.

To assist us in this exercise, again we use the EBSD tool to rank the Study Area Combinations against the six Approach Categories and identify the Option that deliver the best outcomes relative to each of these categories.

Table 7.7 shows an example of the output from the EBSD process for SA3.

Table 7.7 Stage 3 – EBSD Output for SA3 (SA Combinations Assessment)

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

Ranked order (best to worst)	Best													Worst
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As can be seen in Table 7.8, when we present the data in this way it allows us to understand the relative benefits of each group of Option.

The SA combinations including the WRZ Level Approach outlined in Table 7.5 are assessed to determine the approach categories as summarised in Table 7.8.

Table 7.8 Best Combinations for SA3

Approach Categories	Best Performing Combination
Least Cost (LCo)	Group 23 (SA Combination 12)
Best Environmental (BE)	Group 4 (SA Combination 2)
Quickest Delivery (QD)	Group 10 (SA Combination 6)
Most Resilient (MR)	Group 16 (SA Combination 7)
Lowest Carbon (LC)	Group 16 (SA Combination 7)
Best AA (BA)	Group 4 (SA Combination 2)

7.2.5.2 Approach Appraisal – Study Area Level

We then compare the best performing Option or combinations of Option (listed in Table 7.8) within each of the six Approach Categories using the 7-step process set out in Figure 7.2 above, 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 option or combination of Option that provides the best overall solution for that Study Area. Again, 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 3.

STEP 0 Best AA	<p>There is no SA combination in SA3 assessed as having no potential impact on a European Site (based on a desktop assessment). Proceed with the 7-step process.</p>
STEP 1 Least Cost	<p>We compared the Least Cost Approach against the Best AA Approach. There is no SA combination in SA3 assessed as having no potential impact on a European Site. The Least Cost Approach does not contain any options with a -3 biodiversity score and is comparable to the Best AA Approach, therefore the Least Cost Approach was retained at this stage.</p>
STEP 2 Quickest Delivery	<p>We compared the Quickest Delivery Approach against the Least Cost Approach. The Quickest Delivery Approach has higher carbon costs than the Least Cost Approach, performs poorly against the environmental criteria and has an option with a -3 biodiversity score. The Least Cost Approach was therefore retained at this stage.</p>
STEP 3 Best Environmental	<p>We compared the Least Cost Approach. There was not a significant difference between the environmental score for the Best Environmental Approach. The Least Cost Approach and the Least Carbon Approach performed better against the quickest delivery and carbon criteria, while the resilience scores were comparable. The Least Cost Approach was therefore retained at this stage.</p>
STEP 4 Most Resilient	<p>We compared the Least Cost against the Most Resilient Approach. The Most Resilient Approach performs poorly against the environmental criteria, and considering the carbon costs for the Least Cost Approach are 5% of the carbon costs for the Least Carbon Approach, the Least Cost Approach was retained at this stage.</p>
STEP 5 Least Carbon	<p>We compared the Least Cost Approach against the Least Carbon Approach. The Least Carbon Approach is the same as the Most Resilient Approach and as noted above this combination performs poorly against the environmental criteria, and considering the carbon costs for the Least Cost Approach are 5% of the carbon costs for the Least Carbon Approach, the Least Cost Approach was retained at this stage.</p>
STEP 6 Approach Comparison	<p>A final assessment of the Least Cost Approach. The Least Cost Approach is comparable to the Best AA, Best Environmental, Quickest Delivery and Least Carbon Approach. The Most Resilient Approach performs poorly against the environmental criteria. The Least Cost Approach overall is a well performing option against the SEA and Habitats Objectives of the Plan and was therefore retained at this stage.</p>
STEP 7 Preferred Approach	<p>The Least Cost Approach was therefore selected as the Preferred Approach for the Water Resource and Study Area Levels.</p>

Figure 7.6 SA Level Preferred Approach Development – SA3

7.2.5.3 Selection of Preferred Approach – SA Level Approach

Table 7.9 summarises the comparison of the best performing SA combinations for SA 3.

When we compare the four 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 four different combinations and therefore the colours denoting relative performance between the ‘Best Performing SA Combinations’ for a particular Approach Type are different to the colour representing relative performance within the wider ranking. For example, for Combination 12, the Quickest Delivery Score is ranked third against the three (3) other Best Performing SA Combination (represented by a yellow colour in Table 7.9); whereas it is ranked amongst the best five (5) of all fourteen (14) combinations (represented by a lighter green colour code in Table 7.7).

Table 7.9 suggests that Group 23, Group 4 and Group 16 are the Best AA because they have the same number of -3 biodiversity scores (i.e., none of these Option had -3 scores). However, Group 4 was selected as the Best AA approach after comparing the number of -2 and -1 biodiversity scores.

Table 7.9 Summary of the MCA Scoring for the Best Performing SA Combinations – SA3

Category Criteria	Preferred Approach Combination 12 (Group 23) (LCo)	Combination 2 (Group 4) (BE, BA)	Combination 6 (Group 10) (QD)	Combination 7 (Group 16) (LC, MR)
Least Cost Score	Best		Worst	
Quickest Delivery Score		Worst	Best	
Best AA Score	No -3 Biodiversity Scores	No -3 Biodiversity Scores	One -3 Biodiversity Score	No -3 Biodiversity Scores
Lowest Carbon Score			Worst	Best
Most Resilient Score		Worst		Best
Best Environmental Score		Best	Worst	

Key			
Ranked order (best to worst)			
Worst			Best

The outcome when we follow the 7-step process is that SA combination 12 (Group 23) is the Preferred Approach for Study Area 3. As can be seen with reference to Table 7.7, this combination of Feasible Option is well balanced in terms of performance against all criteria and performs significantly better overall than any other combination (including the WRZ Level Approach). In particular, the combination of Option performs well against the environmental criteria and contains no option with a -3-biodiversity score.

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

7.3.1 Approach Description

The application of the three stage Approach Development Process resulted in the Preferred Approach at Study Area Level comprising grouped Option (supplying multiple WRZs within a Study Area) for eight (8) of the nine (9) Study Areas in the Eastern and Midlands Region. The exception is SA9 where there is only one WRZ. All Option (or combination of Option) that address the Need for SA9 are defined as WRZ Option, as they will provide a supply to only a single WRZ. Therefore, the WRZ Level Approach and the SA Preferred Approach for SA9 are the same.

Table 7.10 illustrates the benefits of developing the Preferred Approach at Study Area Level. The 134 WRZs across the Eastern and Midlands Region will be supplied by 92 WRZ Option and 10 grouped supply systems. 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 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	
SA1	18	10	2	8
SA2	12	10	1	2
SA3	11	4	1	7
SA4	13	2	1	11
SA5	10	10	-	-
SA6	28	26	1	2
SA7	10	7	1	3
SA8	31	22	3	9
SA9	1	1*	n/a	n/a
Region Total	134	92	10	42

* SA9 consists of a single WRZ. Therefore, all Option (or combination of Option) that address the Need for SA9 are defined as WRZ Option, as they will provide a supply to only one WRZ.

Table 7.11 summarises the WRZ Level Approach and the SA Preferred Approach for the nine (9) Study Areas of the Eastern and Midlands Region. Option types include new and increased groundwater (GW) and surface water (SW) abstractions, new and upgraded water treatment plants (WTPs), rationalisations

(connection of WTPs and/or WRZs, usually accompanied by decommissioned abstractions and WTPs) and transfers from sources within or outside of the Study Area.

The Technical Report for SA9, the Greater Dublin Area (GDA), was prepared first due to the fact that this is the Study Area with the highest population and greatest Supply Demand Balance Deficit. The Preferred Approach for SA9, as set out in Table 7.11, comprises the development of the New Shannon Source (NSS) and a pipeline transfer to provide supply to the GDA. The sustainable yield available from the NSS has the potential to supply a demand that is greater than the demand required in the GDA. Therefore, the SA9 Preferred Approach provides the opportunity to supply WRZs in other Study Areas. Subsequently, when developing the Preferred Approach for other WRZs and Study Areas for the Eastern and Midlands Region, Cross Study Area Interconnection Options were considered such as transfers from the GDA directly, and transfers from the NSS via a direct interconnection with the proposed pipeline transferring treated water from the NSS to the GDA WRZ.

These Cross Study Area interconnections were identified as part of the Preferred Approach for eight (8) of the nine (9) Study Areas. The PA identified for four (4) of these Study Areas (SA4, SA6, SA7, SA8) will obtain supply from the NSS via a connection to the pipeline transferring treated water from the NSS to the GDA. The PA identified for three (3) Study Areas (SA1, SA2 and SA3) will connect via the GDA supply network. In total the Cross SA interconnection involves ten (10) Options that will benefit thirty-four (34) WRZs, including the GDA. These Options are assessed again at a Regional Level as set out in Section 8.

Where WRZs depend on the development of the Preferred Approach for the GDA, alternative Options have been identified in the event that the Preferred Approach for the GDA cannot advance. The alternative Option for the relevant Study Areas is described in the SA Technical Reports (Appendices 1-9) and summarised in Table 8.4 in Section 8, which explains the development of the Regional Preferred Approach.

It should be noted that assessments, Preferred Approaches and the Option identified within them at this stage are at Plan Level. Environmental impacts and costing of Options are further reviewed at Project Level. No statutory consent or funding consent is conferred by inclusion in the NWRP (National Water Resource Planning) Framework. Any Option that are progressed following this Plan will require individual environmental assessments, including Environmental Impact Assessment and Appropriate Assessment (as required), in support of planning applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

Full details of the SA Preferred Approach development are included in Technical Appendices 1-9.

Table 7.11 WRZ Level Approach and SA Preferred Approach

Study Area	WRZ Level Approach	SA Preferred Approach
<p>SA1 Mid Wicklow</p>	<p>18 WRZ Option:</p> <ul style="list-style-type: none"> - 10 Option with increased GW/SW abstractions. - 1 increased GW abstraction. Decommission 1 WTP. - 2 new SW abstractions and WTPs. - 2 rationalisations (Ballinpark to Avoca Ballinclash WTP and Ballymorris to Aughrim). Decommission 2 WTPs. - 3 Option with WTP upgrades (WQ only). 	<p>10 WRZ Option:</p> <ul style="list-style-type: none"> - 6 Option with increased GW/SW abstractions. - 1 GW rationalisation (Ballinpark to Avoca Ballinclash WTP). Additional supply from NSS*. Decommission 1 WTP. - 3 Option with WTP upgrades (WQ only). <p>2 SA Grouped Option:</p> <ul style="list-style-type: none"> - Rationalise 6 WRZs to Vartry WTP in SA9, improving resilience through interconnections. Transfer from NSS* to supply Deficit. <ul style="list-style-type: none"> - Decommission 7 WTP. - Increase groundwater abstraction at an existing wellfield at Woodenbridge. <ul style="list-style-type: none"> - Decommission 2 WTPs
<p>SA2 West Wicklow</p>	<p>12 WRZ Option:</p> <ul style="list-style-type: none"> - 9 Option with increased GW abstractions and 2 new WTPs. - 1 new GW abstraction. - 1 rationalisation and transfer from the NSS* (Hacketstown to Rathvilly SA6). - 1 option with WTP upgrade/s (WQ only). 	<p>10 WRZ Option:</p> <ul style="list-style-type: none"> - 7 Option with increased GW abstractions. - 1 new GW abstraction. - 1 rationalisation and transfer from the NSS* (Hacketstown to Rathvilly SA6). - 1 option with WTP upgrade/s (WQ only). <p>1 SA Grouped Option:</p> <ul style="list-style-type: none"> - Rationalise 2 WRZs (Hollywood - Donard and Dunlavin) to Ballymore Eustace WTP (SA9) via a new connection to the Ballymore Eustace - Old Kilcullen trunk main. Additional supply from the NSS*. Decommission 3 WTPs.
<p>SA3 Meath</p>	<p>11 WRZ Option:</p> <ul style="list-style-type: none"> - 8 Option with new/increased GW/SW abstractions. 3 New WTPs. Decommission 2 WTP. - 2 rationalisation and transfer from the NSS*(GDA To South Louth and East Meath; Mullingar to Ballivor). Decommission 2 WTPs. - 1 option with WTP upgrade/s (WQ only). 	<p>4 WRZ Option:</p> <ul style="list-style-type: none"> - 2 Option with increased GW abstractions. - 1 Option with WTP upgrade/s (WQ only). - 1 new GW abstraction and 1 new WTP. <p>1 SA Grouped Option:</p> <ul style="list-style-type: none"> - A single rationalisation and transfer from the NSS* resolve the Deficit for seven (7) of the WRZs, namely Athboy, Ballivor, Kells-Oldcastle, Kilmessan, Navan-Mid Meath, South Louth and East Meath, and Trim. This involves improved interconnection

Study Area	WRZ Level Approach	SA Preferred Approach
		<p>between WRZs, and connection to the GDA.</p> <ul style="list-style-type: none"> - 4 Option with WTPs upgrades (WQ only). - Decommission 11 WTPs.
<p>SA4 West Meath</p>	<p>13 WRZ Option:</p> <ul style="list-style-type: none"> - 6 Option with new/increased GW/SW abstractions. Decommission 1 WTP. - 2 cross SA transfers (Kells-Oldcastle (SA3) to Ballany; NSS* to Mullingar). Decommission 1 WTP. - 1 rationalisation and transfer (GDA to Enfield). Decommission 1 WTP. - 4 Option with WTP upgrades (WQ only). 	<p>2 WRZ Option:</p> <ul style="list-style-type: none"> - 2 Option with WTP upgrades (WQ only). <p>1 SA Grouped Option:</p> <ul style="list-style-type: none"> - A single rationalisation and transfer resolve the Deficit for eleven (11) of the WRZs, namely Ballany, Ballymahon, Mullingar, Clonard/ Abbeysfields Housing Estate, Longwood WS, Enfield WS, Ardcarraig Clogherinkoe, Geashill, Edenderry and Rhode, Daingean and Walsh Island. This includes improved interconnection between WRZs, and connection to the NSS*. - Decommission 13 WTPs.
<p>SA5 Offaly/Roscommon</p>	<p>10 WRZ Option:</p> <ul style="list-style-type: none"> - 4 Option with increased GW/SW abstractions. - 2 Option with new GW abstractions. 1 new WTP - 4 Option with WTP upgrades (WQ only). 	<p>10 WRZ Option:</p> <p>The SA Preferred Approach improves the WRZ Level Approach by increasing the existing GW abstraction at 2 locations, Lisbrock and Killeglan, to supply Roscommon, instead of constructing a new abstraction. This reduces the overall cost. All other WRZ Option remain the same as the WRZ Level Approach.</p>
<p>SA6 Laois</p>	<p>28 WRZ Option:</p> <ul style="list-style-type: none"> - 6 new GW abstractions and 1 new WTP. - 16 Option with increased GW abstractions. - 1 rationalisation (Coonin Hill, Drim and Knocks WTPs) – GW source. Decommission 2 WTPs. - 2 cross SA transfer (NSS* to Tullamore; GDA via Srowland to Carlow Town). Decommission 2 WTPs. - 3 Option with WTP upgrades (WQ only). 	<p>26 WRZ Option:</p> <ul style="list-style-type: none"> - 5 new GW abstractions. 1 new WTP - 15 Option with increased GW abstractions. - 1 rationalisation (Coonin Hill, Drim and Knocks WTPs) –GW source. Decommission 2 WTPs. - 2 cross SA transfer (NSS* to Tullamore; GDA via Srowland to Carlow Town). Decommission 2 WTPs. - 3 Option with WTP upgrades (WQ only). <p>1 SA grouped option:</p> <ul style="list-style-type: none"> - Interconnecting Ballinakill and Durrow and includes increased GW abstraction.

Study Area	WRZ Level Approach	SA Preferred Approach
<p style="text-align: center;">SA7 North Tipperary</p>	<p>10 WRZ Option:</p> <ul style="list-style-type: none"> - 2 new GW abstractions. Decommission 1 WTP (Terryglass). - 3 Option with increased GW/SW abstractions. - 1 cross study transfer (new connection point from the NSS* to Cloughjordan). Decommission 1 WTP. - 1 rationalisation and increased abstraction (Dunkerrin, Lisduff and Moneygall WTPs). Decommission 3 WTPs. - 3 Option with WTP upgrades (WQ only). 	<p>7 WRZ Option:</p> <ul style="list-style-type: none"> - 2 new GW abstractions. Decommission 1 WTP (Terryglass). - 2 Option with increased GW/SW abstractions. - 3 Option with WTP upgrades (WQ only). <p>1 SA Grouped Option:</p> <ul style="list-style-type: none"> - Interconnection between three (3) WRZs, namely Dunkerrin/Moneygall, Greyford Source to Crotta and Cloughjordan. - Transfer from the NSS*. - 6 decommissioned WTPs.
<p style="text-align: center;">SA8 Limerick Clare</p>	<p>31 WRZ Option:</p> <ul style="list-style-type: none"> - 3 new GW abstractions and 1 new WTP. - 17 Option with increased GW/SW. abstractions. - 1 new connection point from the NSS* to Newport. Decommission 2 WTPs. - 3 rationalisation and transfer (Limerick to Croom PWS; O'Briensbridge PWS; and Murroe/Foileen/Cappamore). Decommission 6 WTPs. - 6 Option with WTP upgrades (WQ only) - 1 Advanced Leakage Reduction (Ennis) + 1 local increase in GW abstraction. 	<p>22 WRZ Option:</p> <ul style="list-style-type: none"> - 2 new GW abstractions. - 12 Option with increased GW/SW abstractions. - 1 new connection point from the NSS* to Newport. Decommission 2 WTPs. - 2 rationalisation and transfer (Limerick to Croom PWS; Limerick to O'Briensbridge PWS). Decommission 3 WTPs. - 4 Option with WTP upgrades (WQ only). - 1 Advanced Leakage Reduction (Ennis) + 1 local increase in GW abstraction. <p>3 SA Grouped Option:</p> <ul style="list-style-type: none"> - Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore/Murroe/Foileen, Pallasgreen and Doon. Decommission 8 WTPs. - Increase SW abstraction and supply spare capacity from Limerick City to neighbouring WRZs, South West Regional, Foynes Shannon Estuary and Adare. Decommission 1 WTP. - Supply spare capacity from Glenosheen/Jamestown/Kilmallock to KilfinaneArdpatrick. Rationalise Kilfinane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP). Decommission 2 WTPs.

Study Area	WRZ Level Approach	SA Preferred Approach
<p>SA9** Greater Dublin Area</p>	<p>The SA Preferred Approach comprises one (1) option, and if progressed, will involve the development of a single project that includes a new surface water abstraction from the Parteen Basin, referred to as the New Shannon Source (NSS) of 210 Ml/day to meet the Deficit for the GDA. This volume does not include additional supply that may be required to meet the Need in other Study Areas where the Preferred Approach requires a supply from the GDA or the NSS. The additional abstraction volume required to address the collective Need of these Study Areas and the GDA, is assessed as part of the development of the Regional Preferred Approach (see Section 8).</p> <p>The option also includes:</p> <ul style="list-style-type: none"> - A new 200 Ml/day WTP at Birdhill. - Twin rising mains from abstraction to new WTP (2 km). - New break pressure tank, 2 clear water tanks, new pumping station (ps) and booster ps, new termination point reservoir in Peamont. - 1600 mm diameter pipeline from WTP to break pressure tank (~41 km). - 1600 mm diameter pipeline from the break pressure tank to the termination point reservoir (~130 km). <p><u>Common to All Requirements</u></p> <p>In addition to the above combination of Option, interventions for improved resilience and quality have been identified. These interventions include upgrades to all WTPs, new storages, new and upgraded trunk mains, pump upgrades and rationalisation of 2 (two) WTPS – Roundwood Well WTP and Glenealy WTP. They do not provide additional supply to the GDA and are common to all Option Combinations that are assessed for SA9.</p> <p>The SA9 Preferred Approach Summary Table in Section 7.5.9 lists the components of the Common to All Requirements.</p>	<p>The SA Preferred Approach comprises one (1) option, and if progressed, will involve the development of a single project that includes a new surface water abstraction from the Parteen Basin, referred to as the New Shannon Source (NSS) of 210 Ml/day to meet the Deficit for the GDA. This volume does not include additional supply that may be required to meet the Need in other Study Areas where the Preferred Approach requires a supply from the GDA or the NSS. The additional abstraction volume required to address the collective Need of these Study Areas and the GDA, is assessed as part of the development of the Regional Preferred Approach (see Section 8).</p> <p>The option also includes:</p> <ul style="list-style-type: none"> - A new 200 Ml/day WTP at Birdhill. - Twin rising mains from abstraction to new WTP (2 km). - New break pressure tank, 2 clear water tanks, new pumping station (ps) and booster ps, new termination point reservoir in Peamont. - 1600 mm diameter pipeline from WTP to break pressure tank (~41 km). - 1600 mm diameter pipeline from the break pressure tank to the termination point reservoir (~130 km). <p><u>Common to All Requirements</u></p> <p>In addition to the above combination of Option, interventions for improved resilience and quality have been identified. These interventions include upgrades to all WTPs, new storages, new and upgraded trunk mains, pump upgrades and rationalisation of 2 (two) WTPS – Roundwood Well WTP and Glenealy WTP. They do not provide additional supply to the GDA and are common to all Option Combinations that are assessed for SA9.</p> <p>The SA9 Preferred Approach Summary Table in Section 7.5.9 lists the components of the Common to All Requirements.</p>

* New Shannon Source (NSS) - transfer from the Parteen Basin to the Greater Dublin Area (GDA).

** SA9 consists of a single WRZ. For this reason, all Option (or combinations of Option) that address the Need for SA9 are defined as WRZ Option. The WRZ Level Approach and SA Preferred Approach are therefore the same.

A summary of the infrastructure components for the WRZ Level Approach and SA Approach Type is provided in Table 7.12.

Table 7.12 SA Preferred Approach (PA) and WRZ Level Approach Assessment – Infrastructure Components

SA	Approach Type	Infrastructure Component						
		New Pipeline (km)	New WTPs	Upgrade WTPs *	New/Upgraded Abstracts.	Decomm. WTPs	Decomm. Abstracts.	Water Storage
SA1	SA Preferred Approach	62	0	10	7	10	9	5
	WRZ Level Approach	14	2	19	15	2	1	3
SA2	SA Preferred Approach	27	0	9	7	3	3	3
	WRZ Level Approach	12	2	11	6	1	1	2
SA3	SA Preferred Approach	160	1	8	3	11	11	7
	WRZ Level Approach	111	3	12	8	4	4	7
SA4	SA Preferred Approach	174	0	2	0	13	13	2
	WRZ Level Approach	109	0	12	6	3	3	8
SA5	SA Preferred Approach	16	1	16	8	0	0	5
	WRZ Level Approach	18	1	14	7	0	0	5
SA6	SA Preferred Approach	77	1	38	23	4	5	10
	WRZ Level Approach	62	0	35	20	4	5	8
SA7	SA Preferred Approach	36	0	11	4	7	7	4
	WRZ Level Approach	16	0	13	6	5	5	4
SA8	SA Preferred Approach	138	0	31	18	16	17	13
	WRZ Level Approach	56	1	33	15	4	4	9
SA9* *	SA Preferred Approach***	173	1	0	1	0	0	3

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

** SA9 consists of a single WRZ. For this reason, all Option (or combinations of Option) that address the Need for SA9 are defined as WRZ Option. The WRZ Level Approach and SA Preferred Approach are therefore the same.

***Infrastructure components associated with the 'Common to All Requirements' (see Table 7.11 SA9 Preferred Approach description) are not included.

7.3.2 Assessment against the Six Approach Categories

Table 7.13 compares the relative Multi Criteria Assessment (MCA) scores of the Preferred Approach at Study Area Level against the WRZ Level Approach for each of the six Approach Categories. 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 - 9). The SEA Eastern and Midlands Regional Report contains more information related to the environmental assessment outcomes.

Table 7.13 SA Preferred Approach (PA) and WRZ Level Approach Assessment – MCA Scores

Study Area	Approach Type	Approach Category					
		Least Cost	Quickest Delivery	Best AA	Lowest Carbon	Most Resilient	Best Env.
SA1	SA Preferred Approach	Best		0 No. -3 scores		Worst	Best
	WRZ			0 No. -3 scores	Best	Best	Worst
SA2	SA Preferred Approach	Best	Worst	0 No. -3 scores	Worst	Best	Best
	WRZ	Worst	Best	0 No. -3 scores	Best	Worst	Worst
SA3	SA Preferred Approach	Best		0 No. -3 scores			
	WRZ			0 No. -3 scores			
SA4	SA Preferred Approach	Best	Best	0 No. -3 scores	Worst	Best	Best
	WRZ			0 No. -3 scores			Worst
SA5	SA Preferred Approach	Best		0 No. -3 scores			Worst
	WRZ			0 No. -3 scores			
SA6	SA Preferred Approach	Best		0 No. -3 scores			
	WRZ		Best	1 No. -3 scores			Worst
SA7	SA Preferred Approach		Worst	0 No. -3 scores		Best	Best
	WRZ			0 No. -3 scores			Worst
SA8	SA Preferred Approach	Best		1 No. -3 scores			Best
	WRZ			1 No. -3 scores			
SA9 ²	SA Preferred Approach	Best		1 No. -3 scores	Best	Best	Best

¹ A Best AA score of -3 equates to Likely Significant Effects (LSEs) that may be harder to mitigate or require significant Project Level assessment

² SA9 consists of a single WRZ. For this reason, all Option (or combinations of Option) that address the Need for SA9 are defined as WRZ Option. The WRZ Level Approach and SA Preferred Approach are therefore the same.

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

Study Area	SA Preferred Approach (PA) comparison with WRZ Level Approach
SA1	<p>The PA is the Least Cost, Best AA and Best Environmental approach.</p> <p>The WRZ Level Approach has the lowest pipeline length and the lowest number of decommissioned sites. However, it has the highest number of WTP upgrades and new/upgrade abstractions.</p> <p>The PA has an estimated NPV that is 23% lower than the WRZ Level Approach.</p> <p>Neither approach consists of high-risk Option that could impact on European sites.</p> <p>Whilst the PA will have a slightly longer delivery timescale, the Quickest Delivery Approach scores considerably lower against environmental objectives and has a higher carbon score.</p> <p>The PA scores best against the SEA objectives for public wellbeing and landscape due to the decommissioning and rationalisation of existing infrastructure. The PA also has the lowest number of increased groundwater abstractions and related to this has the lowest impacts to biodiversity.</p> <p>The reduction in resilience is not significant between the PA and WRZ Level Approach and therefore the PA is the most appropriate choice when considering scores across all of the Approach Categories.</p> <p>The PA has a slight increase in carbon compared to the WRZ Level Approach (which is the Best Carbon approach). This is associated with the energy required to treat, store and pump the water through the proposed 48 km network. However, this is not considered to be significant when compared against the other benefits of the PA.</p>
SA2	<p>The PA is the Least Cost, Best AA, Most Resilient and Best Environmental approach.</p> <p>Compared with the WRZ Level Approach, the SA Preferred Approach has twice the length of pipeline, no new WTPs and more decommissioned WTPs and abandoned abstractions.</p> <p>The PA has an estimated NPV that is 9% lower than the WRZ Level Approach.</p> <p>Neither approach consists of high-risk Option that could impact on European sites.</p> <p>The delivery of the PA will take more time than the WRZ Level Approach but the environmental, cost and resilience benefits of the PA outweighed the additional delivery time requirements.</p> <p>The PA scores better against the SEA objectives as it is likely to have lower materials and waste impacts due to the rationalisation of assets. It is also likely to have a lower landscape impact as it requires less above ground infrastructure.</p> <p>The PA has a higher carbon impact due to the increased energy requirements through the abstraction, pumping and treatment requirements associated with this option, however, lower performance in this category is outweighed by the significant gains in resilience, overall environmental improvement and costs savings associated with the PA.</p>

Study Area	SA Preferred Approach (PA) comparison with WRZ Level Approach
SA3	<p>The PA is the Least Cost Approach.</p> <p>The PA includes a SA Grouped Option that intends to rationalise seven (7) of the WRZs. It has a longer length of pipeline requirement to the WRZ Level Approach; however, when all projects are delivered will reduce the number of upgraded WTPs, new WTPs and upgraded abstractions as well as decommissioning more WTPs.</p> <p>The NPV for the PA and the WRZ Level Approach are similar and estimated to be within 3% of each other; however, the PA has improved scorings on most of the other Approach Categories.</p> <p>Neither approach consists of high-risk Option that could impact on European sites.</p> <p>The PA scores better against the SEA objectives as it is likely to have a lower impact on public health and well-being and improve the landscape due to the higher number of WTPs being decommissioned and less construction.</p> <p>The lower resilience score for the PA is not considered to be significant. No other approach enables similar resilience to the WRZ Level Approach whilst maintaining the environmental credentials offered by the PA.</p>
SA4	<p>The PA is the Least Cost, Quickest Delivery, Best AA, Most Resilient and Best Environmental approach.</p> <p>The PA includes a SA Grouped Option that intends to rationalise 11 of the 13 WRZs. It involves the decommissioning of 10 more WTPs compared with WRZ Level Approach, and correspondingly 10 less WTP upgrades.</p> <p>The PA scores best for five of the Approach Categories.</p> <p>The NPV for the PA is comparable to the WRZ Level Approach, which is estimated to be 3% higher.</p> <p>Neither approach consists of high-risk Option that could impact on European sites.</p> <p>As the PA only involves three (3) separate Option, it is the Quickest Delivery approach. It also connected to a more resilient source, with increasing resilience over the long-term.</p> <p>The PA whole life carbon estimate (including construction and operation) indicates increased contribution to carbon emissions mostly through operational energy use. Mitigation for carbon emissions would be considered and could include increased sourcing of energy from renewable sources and improving energy efficiency.</p>
SA5	<p>The PA is the Least Cost Approach.</p> <p>The PA is similar in terms of infrastructure development as the WRZ Level Approach; however, the PA does have a shorter length of pipeline and is therefore the lower cost option.</p> <p>The PA has an estimated NPV that is significantly lower (9%) than the WRZ Level Approach.</p> <p>For the remaining five categories, the two approaches achieve a similar ranking. Whilst the PA leads to a small decrease in environmental resilience compared with the WRZ Level Approach, this is not considered significant because there are no alternative approaches which would enable better environmental resilience whilst improving the AA score.</p>

Study Area	SA Preferred Approach (PA) comparison with WRZ Level Approach
SA6	<p>The PA is the Least Cost Approach.</p> <p>The PA is similar in terms of infrastructure development as the WRZ Level Approach, although it does have a longer length of pipeline (~15 km).</p> <p>The NPV for the PA and the WRZ Level Approach are similar and is estimated to be within 2% of each other.</p> <p>The PA has been selected as it has no high-risk Option that could impact on European sites, while the WRZ Level Approach has one high-risk option. The PA also avoids potential impacts on the Owenbeg River section of the River Barrow and Nore SAC.</p> <p>Whilst the delivery time of the PA will be longer than the WRZ Level Approach the difference is not considered to be significant when taking into account that a quicker delivery is anticipated to lead to a decline in environmental credentials and some impacts on European Sites.</p>
SA7	<p>The PA is the Best AA, Most Resilient and Best Environmental approach.</p> <p>The PA results involves more than double the pipeline length than the WRZ, however has two (2) fewer upgraded WTPs and increased abstractions and decommissions three (3) more WTPs.</p> <p>The NPV for the PA and the WRZ Level Approach are similar and is estimated to be within 1% of each other.</p> <p>Neither approach consists of high-risk Option that could impact on European sites.</p> <p>The PA has been selected as it has a higher environmental score and is more resilient than the WRZ Level Approach. It also performs slightly better than the WRZ Level approach for carbon. The slightly higher cost of the SA Preferred Approach (approximately 1% higher) is not considered significant when compared against the environmental gains offered by the PA. The increase in delivery time between the WRZ Level Approach and the PA is also not considered to be significant.</p>
SA8	<p>The PA is the Lowest Cost and Best Environmental approach.</p> <p>The WRZ Level Approach has the lower pipeline length and less decommissioned sites. However, it has the highest number of WTP upgrades and new/upgrade abstractions.</p> <p>The PA has an estimated NPV that is 19% lower than the WRZ Level Approach. The lower cost is associated with the reduced number of WTP and abstraction upgrades as a consequence of the rationalised supplies.</p> <p>Both the WRZ Level Approach and PA consist of one (1) high-risk option that could impact on European sites. Mitigation measures to address the risk are set out in the Natura Impact Statement (NIS) to the draft RWRP-EM.</p> <p>The PA scores better against the SEA objectives as it is likely to have improve the landscape due to the higher number of WTPs being decommissioned and less construction. The PA is also likely to have less adverse impact on the water environment due to the reduced number of increased abstractions.</p> <p>The higher carbon and resilience score is not considered significant when compared against the environmental gains through the selection of the PA.</p>

Study Area	SA Preferred Approach (PA) comparison with WRZ Level Approach
SA9	<p>The PA is the Lowest Cost, Best AA, Lowest Carbon, Most Resilient and Best Environmental approach.</p> <p>As a single WRZ, the Preferred Approach for SA9 is both the WRZ Level Approach and the SA Preferred Approach. A comparative assessment between the two approaches is therefore not applicable.</p> <p>The SA9 Technical Report (Appendix 9) includes a comparative assessment between other combinations of Option that were assessed to determine the Preferred Approach for SA9.</p>

Appropriate Assessment (AA)

There were no -3 scores for Preferred Approach (PA) Option for SA1-SA7; however, there are Option with -2 and -1 scores and as such there is potential for Likely Significant Effects (LSEs) on European Sites. The Preferred Approach (PA) for SA8 and SA9 have one (1) option with a -3 score. Whilst the Preferred Approach for SA8 and SA9 are assessed to have potential LSE (-3 score), other approaches were assessed as less favourable overall as they have higher environmental impacts and are less resilient.

Our assessment shows that all potential LSEs on European Sites across all Study Areas can be addressed by mitigation measures as set out in the NIS to the draft RWRP-EM. No Adverse Effect on Site Integrity (AESI) are identified at Plan Level.

SEA Objectives

Six (6) of the nine (9) Study Areas have a SA Preferred Approach that is the Best Environmental Approach. This includes SA1, SA2, SA4, SA7, SA8 and SA9. The Preferred Approach for all these Study Areas include a transfer from the Parteen Basin (the New Shannon Source) and corresponding supply rationalisations that include the decommissioning of WTPs and their associated abstractions. The decommissioned WTPs will likely improve the landscape and the rationalisation is likely to have less adverse impact on the water environment due to the reduced number of increased abstractions.

Although the Preferred Approach for SA5 scores worst against the Best Environmental criteria compared with other option combinations, there is not a significant difference between the best environmental scores. There are also no alternative option combinations that would enable better environmental resilience whilst improving the AA score. It also scores relatively well for carbon.

SA3 and SA6 score better than the WRZ Level Approach against the Best Environmental criteria, however, are not ranked as the Best Environmental against all other option combinations. The scores, however, were not significantly lower than the scores for the Best Environmental Approach. For SA3, the main difference between the Best Environmental Approach and the Preferred Approach is that the Preferred Approach includes an additional groundwater abstraction and WTP upgrade, decommissions more WTPs and has half the pipeline length. It therefore has an associated lower cost. The difference in the environmental scores is not considered significant compared with the cost benefit outcome. For SA6, the Best Environmental Approach has over double the length of pipeline and a higher number of treated water storages. For this reason, it scores 'Best' in the Least Cost category.

Least Carbon

Many of the SA Preferred Approaches do not rank high relative to other option combinations against the Least Carbon criteria. It should be noted that at detailed Project Level, the carbon performance can be improved significantly through energy efficient design and investigation of low carbon initiatives². It should be noted that at detailed Project Level, the carbon performance can be improved significantly through energy efficient design and investigation of low carbon initiatives³. Also, further work on future operational modes will allow us to optimise the interconnected supplies, in order to provide resilience and environmental benefit whilst balancing energy and carbon impacts.

7.3.3 Cost Comparison

The cost efficiency derived through the rationalisation of supplies and network connections can be seen by comparing the Net Present Value (NPV) for the WRZ Level Approach with the SA Preferred Approach. The percentage difference between the two (2) approaches is presented in Table 7.15.

SA1 and SA8 notably achieve the largest reductions of 23% and 19% respectively. The reduction can be associated with the rationalisation of six (6) WRZs to Vartry WTP by one SA Grouped Option for SA1; and three (3) SA Grouped Option rationalising eight (8) WRZS for SA8. Further detail of these Option is provided in Section 7.5.8 and the corresponding Technical Appendices.

Table 7.15 Cost Comparison

Cost Difference (%) SA Preferred Approach cf. WRZ Level Approach								
SA1	SA2	SA3	SA4	SA5	SA6	SA7	SA8	SA9
-23% ↓	-9% ↓	3% ↑	-3% ↓	-9% ↓	2% ↑	1% ↑	-19% ↓	N/A

↓ = Reduced cost

↑ = Increased cost

Figure 7.8 compares the total cost of the WRZ Level Approaches and the SA Preferred Approaches for SA1 to SA8. SA9 is not included in this comparison as the WRZ Level Approach is the SA Preferred Approach, hence the cost if presented in the two charts would be the same.

There is an overall 7% reduction in the total Plan Level cost across SA1 to SA8, which is achieved by interconnecting and rationalising supplies at the Study Area Level. The environmental and social costs and carbon costs are slightly higher for the SA Preferred Approach overall. This is mostly associated with the additional construction of the pipeline infrastructure to interconnect WRZs and sources. However, the operational cost is considerably reduced, due to the rationalisation of multiple supplies and associated decommissioned WTPs.

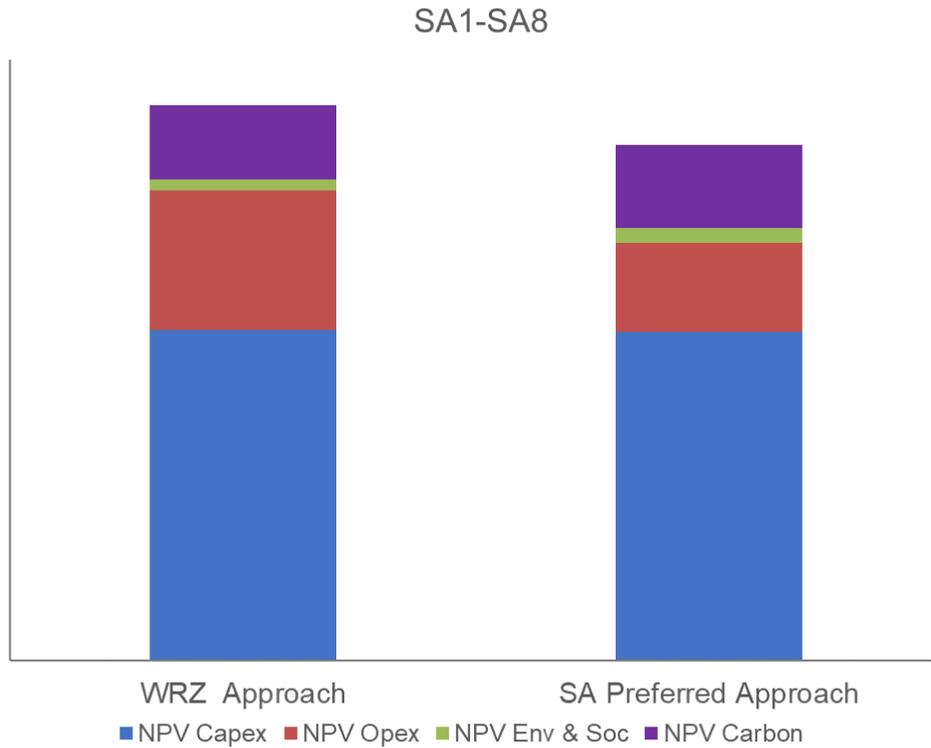


Figure 7.8 NPV Costs for WRZ Level Approach and Study Area Preferred Approach (SA1-SA8)

7.4 SA Preferred Approach

7.4.1 Water Supply Sources

The SA Preferred Approach for the nine (9) Study Areas address the supply Deficit through:

- Independent local WRZ supplies - small local surface water and groundwater sources;
- Within SA interconnected supplies - interconnected WRZs supplied from a source within the SA; and/or
- Cross SA interconnected supplies – interconnected WRZs supplied from a source outside the SA.

For WRZs that are not in Deficit, the Preferred Approach includes only 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.

Table 7.16 Preferred Approach Source Types

WRZ Source Type	Number of WRZs								
	SA1	SA2	SA3	SA4	SA5	SA6	SA7	SA8	SA9
Local source (GW)	6	8	3	-	4	21	3	16	-
Local source (SW)	-	-	-	-	3	-	1	1	-
Within SA interconnection	3	-	-	-	-	2	-	11	-
Cross SA interconnection	6	3	7	11	-	2	3	1	1
WTP upgrade (WQ only)	3	1	1	2	3	3	3	2	-

Under the Preferred Approach sixty-one (61) local groundwater supplies (increased or new) and five (5) local surface water supplies (increased or new) contribute to meeting an estimated 8% and 6% of the Deficit across the Eastern and Midlands Region, respectively. The supplies are mostly expansions of existing sources with some new abstractions.

As noted in Section 7.3.1, eight (8) of the nine (9) Study Areas benefit from Cross SA interconnections supplied from the New Shannon Source (NSS), which is the Preferred Approach for SA9, Greater Dublin Area (GDA). Four (4) of these Study Areas (SA4, SA6, SA7, SA8) will obtain supply from the NSS via a connection to the pipeline transferring treated water from the NSS to the GDA. Three (3) Study Areas (SA1, SA2 and SA3) will connect via the GDA supply network. The Cross SA interconnection involves ten (10) Option that benefit thirty-four (34) WRZs, including the GDA, and contributes to resolving 80% of the Deficit across all Study Areas.

The remaining 6% of the Deficit across the nine (9) Study Areas is met by Within SA Interconnections. These include: four (4) interconnections to the Limerick City supply system, utilising the spare capacity at Clareville WTP; and three (3) rationalisations to groundwater sources with associated upgraded existing supplies.

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

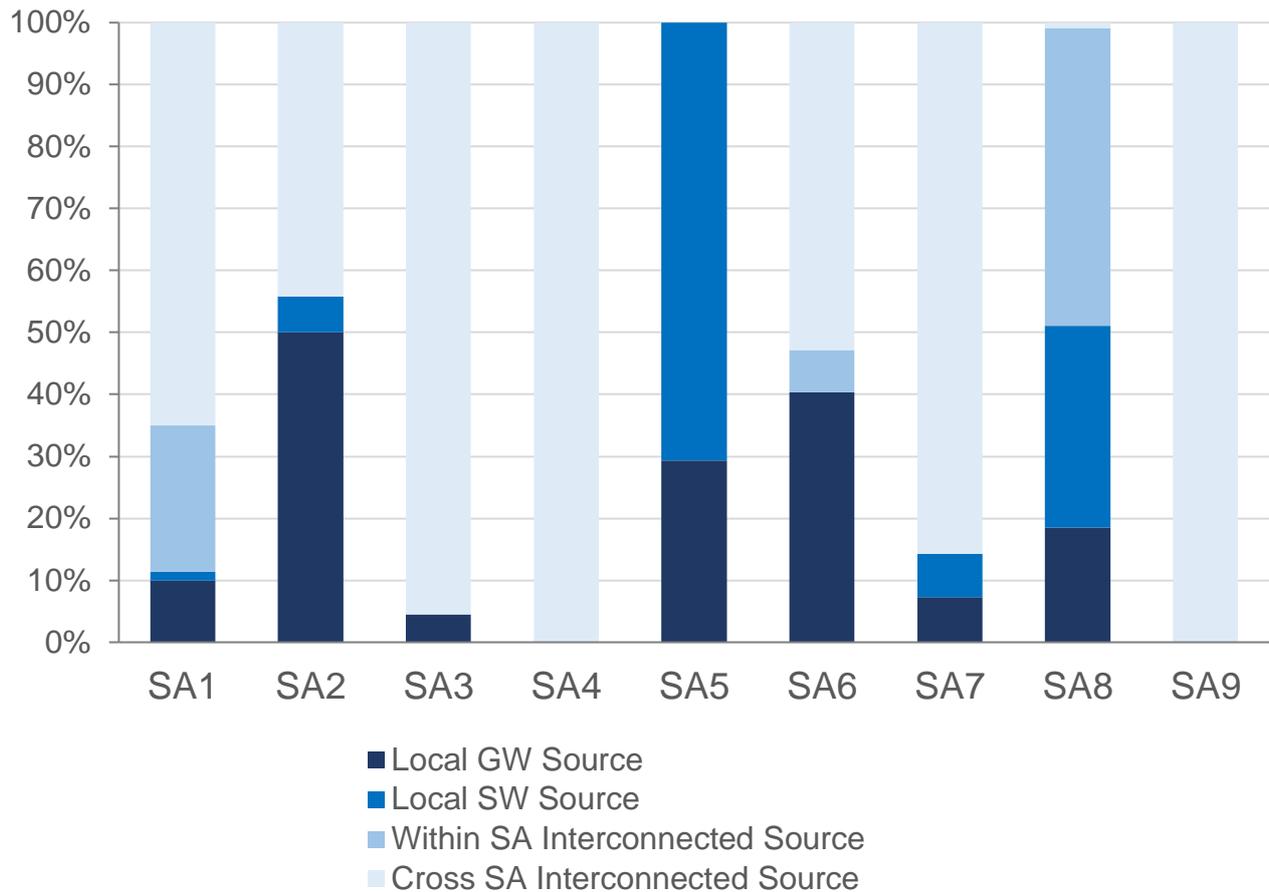


Figure 7.9 Preferred Approach Source Type – Percentage (%) of Deficit Supplied

Rationalised Supplies

Seven (7) Study Areas include Option that rationalise water supply systems. This involves the connection of a WRZ to another water supply system, accompanied by the decommissioning of Water Treatment Plants (WTPs) and their abstractions. Across the Eastern and Midlands Region the SA Preferred Approach will decommission 66 WTPs and abandon 67 abstractions.

Rationalised systems provide the benefit of a reduced number of WTPs, which is likely to have SEA benefits of reduced landscape impact, and over the longer term will reduce operational costs. Resilience and Flexibility are also improved through larger, interconnected supplies.

7.4.2 Changes to Existing Infrastructure

Figure 7.10 shows the existing WTPs and key interconnecting pipelines across the region. Currently, the two largest WTPs are Ballymore Eustace WTP and Leixlip WTP, which supply the Greater Dublin Area (GDA) and have capacities exceeding 200,000 m³/day. Table 7.17 lists the WTPs with capacities exceeding 10,000 m³/day and the WRZs they supply.

Table 7.17 Water Treatment Plant Capacities >10,000 m³/day

Water Treatment Plant	WRZ Name	Capacity ¹ (m ³ /day)
TABAthlone WTP	Athlone	12,400
Ballyboden WTP	Greater Dublin Area	12,800
Ballymore Eustace WTP	Greater Dublin Area	286,000
Castle Lake WTP	Shannon/Sixmilebridge	13,800
Clareville WTP	Limerick	79,800
Coolbawn WTP	Nenagh	12,800
Drumcliffe WTP	Ennis	14,700
Foynes WTP	Shannon Estuary	20,500
Leixlip WTP	Greater Dublin Area	215,400
Liscartan WTP	Navan and Midmeath	13,200
Portloman WTP	Mullingar Regional	20,100
Rathvilly WTP	Carlow North	10,500
Srowland WTP	Greater Dublin Area	34,800
Staleen WTP	South Louth and East Meath	28,900
Vartry WTP	Greater Dublin Area	68,800

¹22 hr WTP Design Capacity

The changes to existing infrastructure associated with the SA Preferred Approaches are shown in Figure 7.11 to Figure 7.13 for Options benefitting from 'Local WRZ sources', 'Within Study Area Interconnections' and Cross Study Area Interconnections', respectively. They display new, upgraded and decommissioned WTPs and new interconnecting mains.

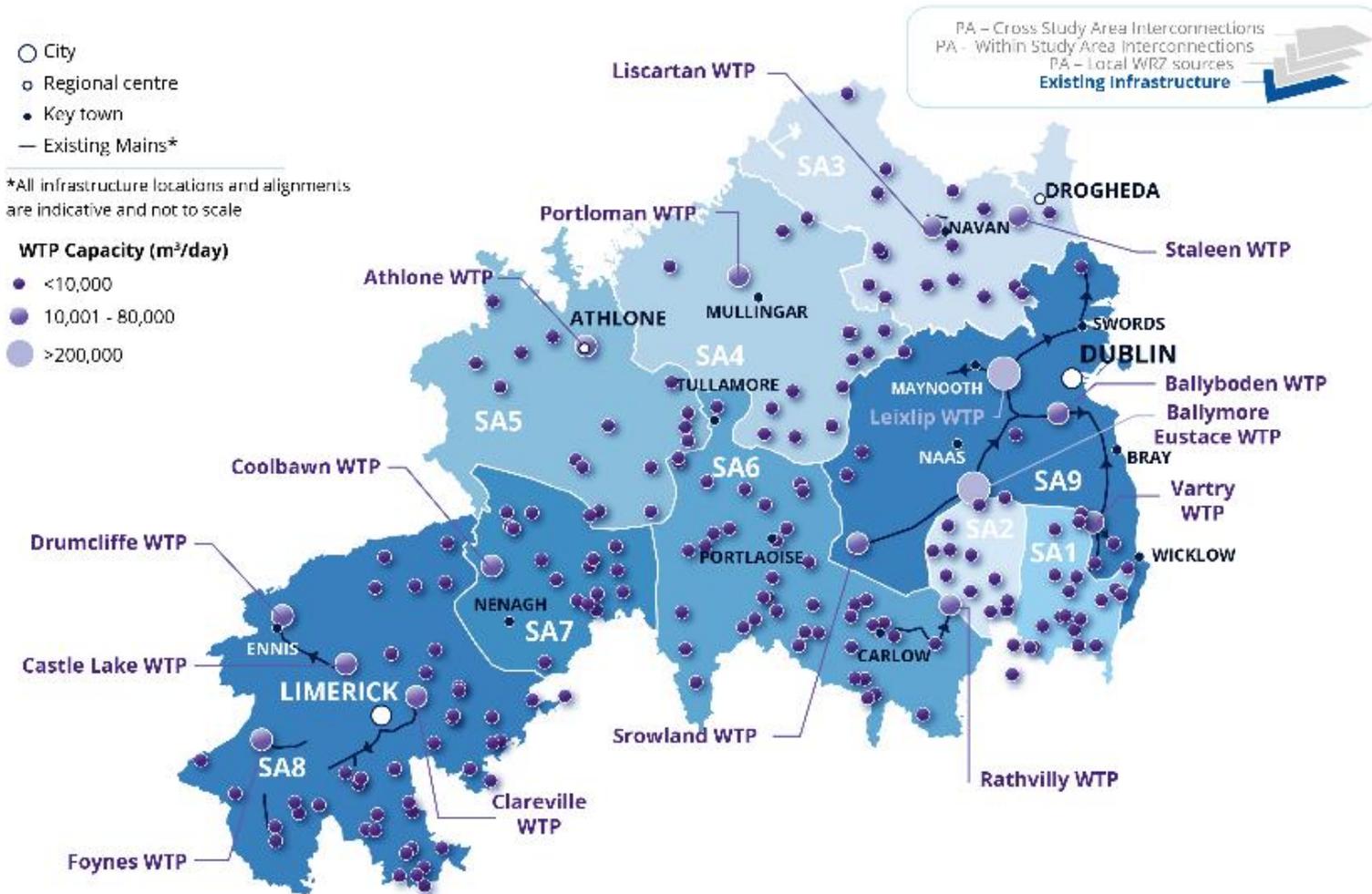


Figure 7.10 Existing Infrastructure

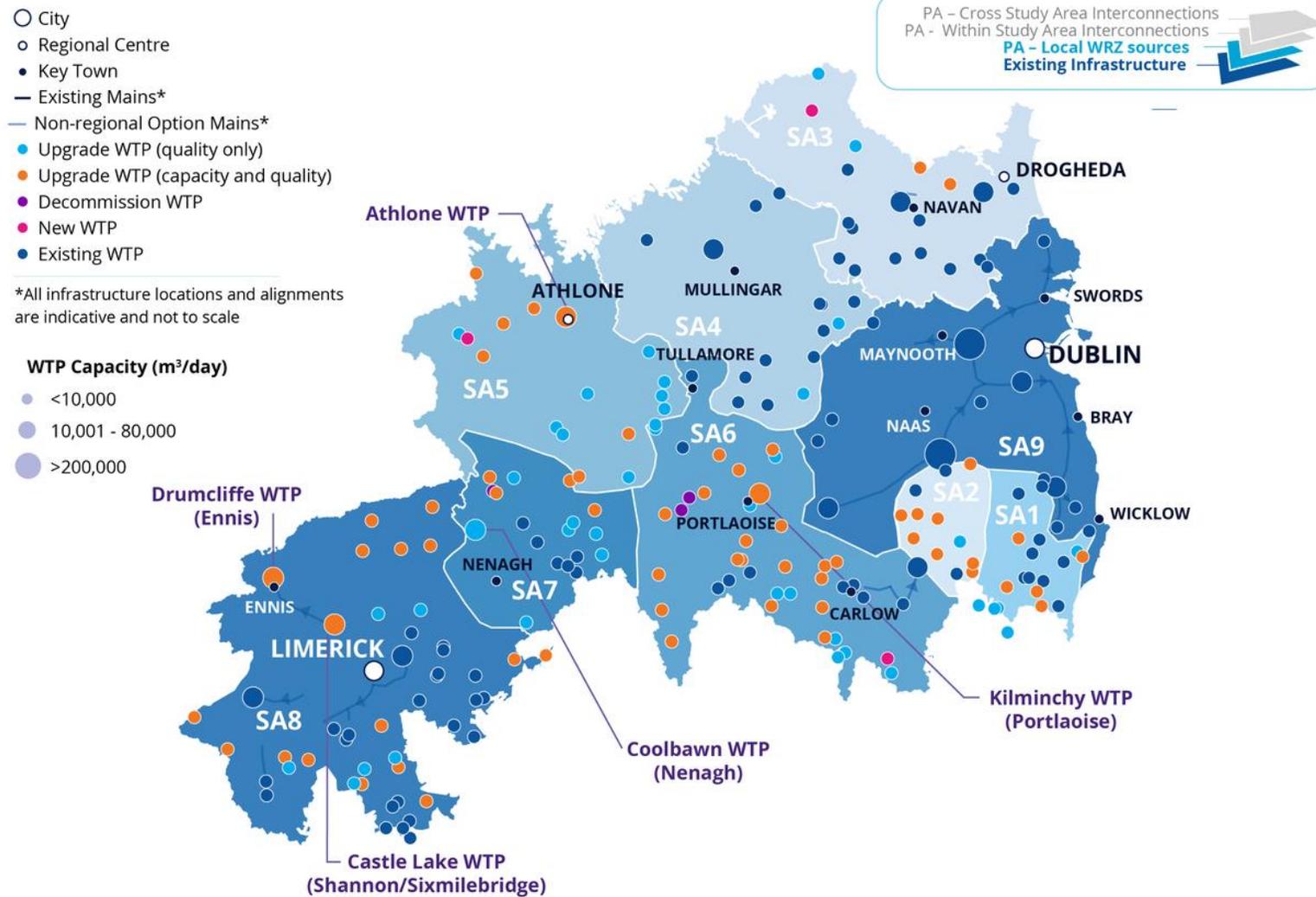


Figure 7.11 Preferred Approach – Local WRZ Sources

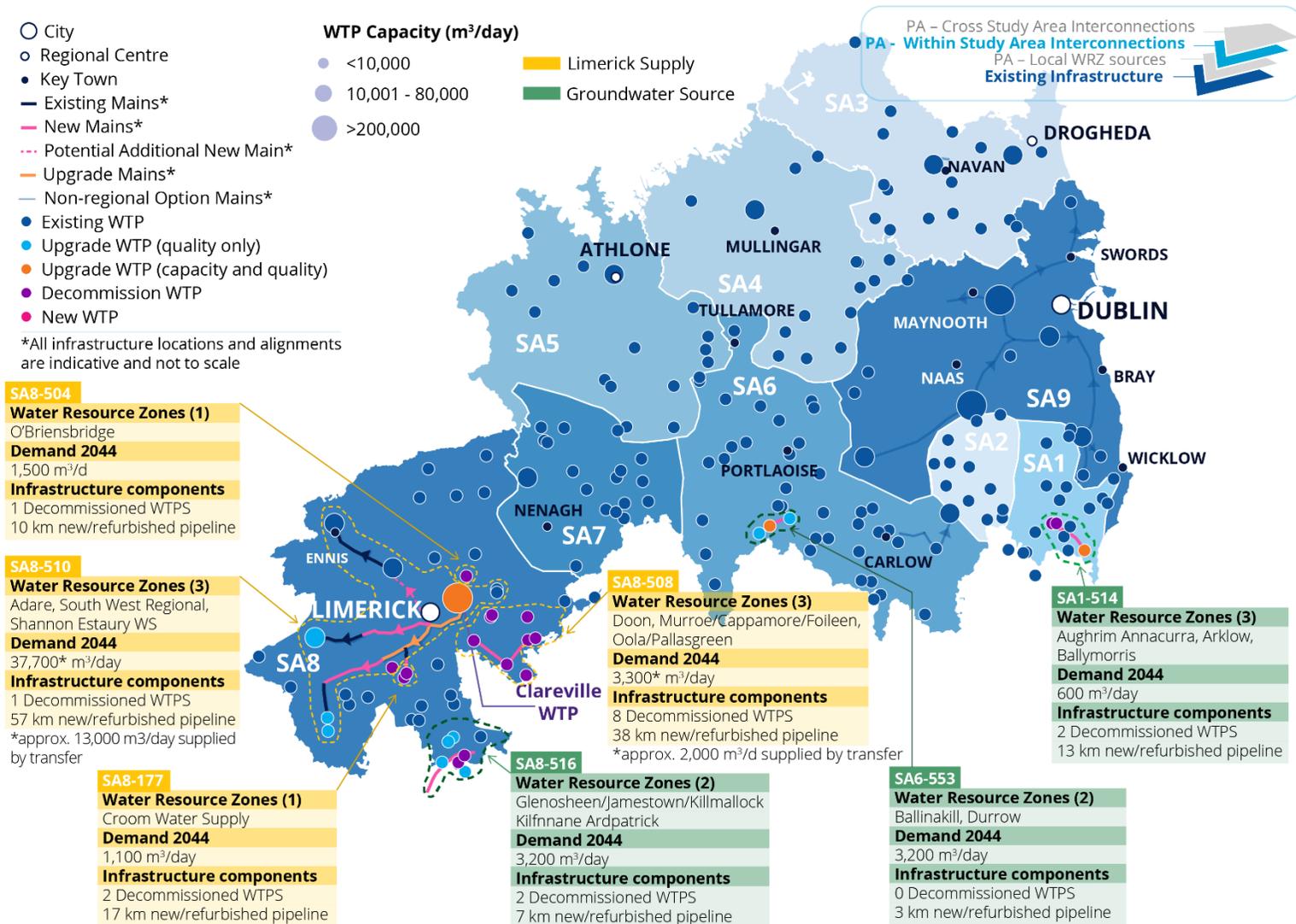


Figure 7.12 Preferred Approach – Within SA Interconnections

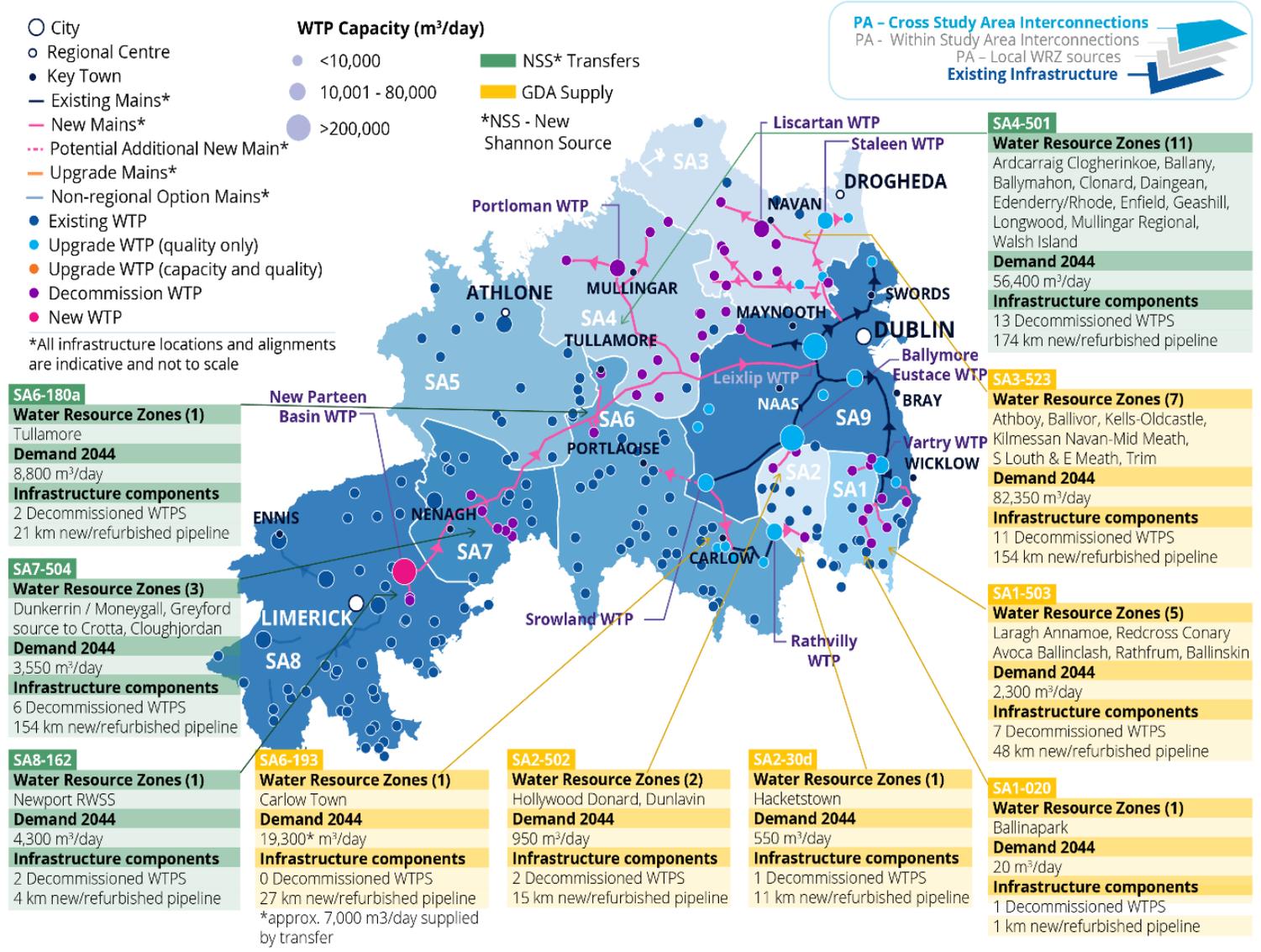


Figure 7.13 Preferred Approach – Cross SA Interconnections

7.4.3 Addressing Leakage

Leakage reduction measures are a key component of the Preferred Approach to addressing Need across the Eastern and Midlands Region. As outlined in Section 5.2, the measures aim to achieve the National Sustainable Economic Level of Leakage (SELL) targets by 2034.

The total volume reduction required to meet the National SELL target is 213 MI/day. This will be achieved through the following contributions:

- 39% within the GDA (representing 84 MI/day).
- 11% for other WRZs across the Eastern and Midlands Region (representing 22.5 ML/day).
- 50% through measures implemented in WRZs across the South West, North West and South East Regions (representing 106.5 MI/day).

The Preferred Approach for the GDA includes leakage reduction that will fully achieve the 84 MI/day SELL target for the GDA by 2034.

For WRZs outside of the GDA that are located within the Eastern and Midlands Region, the Preferred Approach incorporates 3 MI/day of the 22.5 ML/day SELL target. This has been prioritised across the Study Areas based on:

- Size of supply demand Deficits;
- Existing abstractions with sustainability issues; and
- Observed impacts during the 2018 drought.

Therefore, across the Eastern and Midlands Region, the Preferred Approach includes the following leakage reductions which contribute to achieving the SELL target:

- SA3 - 356 m³ per day through net leakage reduction in Athboy, Bailieboro, Navan Mid Meath and Trim.
- SA4 - 251 m³ per day through net leakage reduction in Ballymahon and Mullingar Regional.
- SA5 – 570 m³ per day through net leakage reduction in Birr, South Roscommon and Athlone.
- SA6 - 823 m³ per day through net leakage reduction in Carlow North, Clogh- Castlecomer, Portlaoise, Portarlington and Tullamore.
- SA8 - 978 m³ per day through net leakage reduction in Ennis, Shannon/ Sixmilebridge, and Limerick City.
- SA9 – 84,000 m³ per day through net leakage reduction.

(Note: 1,000 m³ per day is equivalent to 1 MI/day).

Further to the volume reductions incorporated as part of the Preferred Approach, Irish Water has committed to achieve the remaining 19.5 MI/day of the SELL target for the Eastern and Midlands Region by 2034; and has set an additional leakage target for the Region of 35.5 ML/day that exceeds the SELL target, also to be met by 2034. This will be achieved by reducing leakage levels to 21% of Total Demand for larger WRZs where the demand is greater than 1,500 m³ per day.

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.

In order to ensure that the solutions (Preferred Approach) which we develop (Section 6-8) remain appropriate in the scenario of reduced leakage and static demand we have carried out a sensitivity analysis of our solutions (Preferred Approach). This has allowed us to understand the impact of leakage reductions on the proposed solution (Preferred Approach) and whether it would still be valid under a

reduced leakage scenario. This process allows us to balance the delivery of the solution (Preferred Approach) between the Lose Less pillar (Section 5.2) and Supply Smarter pillar (Section 5.4).

7.4.4 Addressing Water Quality

Our Interim Barrier Assessment (described in our Framework Plan and summarised in Section 3.3.2 of this draft RWRP-EM) identified Water Quality driven Need to inform the Preferred Approach development. The assessment determined that 181 of the 201 water treatment plants in the Region have a high risk of not meeting one or more of four Water Quality Barriers. However, in some cases our desktop assessments can over-estimate risk, particularly when there is little available data on the catchment characteristics of our raw water sources. As our “Source to Tap” Drinking Water Safety Plan (DWSP) assessments (which are a requirement under the Recast Drinking Water Directive (2020)) are developed for each water supply, the barrier scores for all our supplies will be updated and become more reliable.

A **‘Barrier’** consists of any actions, processes, procedures, standards or assets (treatment plants, water mains, pumping stations etc) put in place across the entire system from catchment to tap to achieve water of sufficient quality and quantity. The four Barriers include: 1) Protection against bacteria and virus; 2) Maintain chlorine residuals in the network; 3) Protozoa removal processes; 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 2014, as amended (Drinking Water Regulations), but an assessment of the asset capability standard compared with the asset standard as set out in Section 5.7 of the Framework Plan. 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 treatment plants that are not associated with an in-flight project (a project that is in progress- these are described in section 4 of the draft RWRP). The Water Treatment Plant (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 EPA direction or are listed on the EPA Remedial Action List (as outlined in Table 3.15 of this draft RWRP-EM).

7.4.5 Environmental Sustainability

As outlined at Section 3.7.2 of the Framework Plan, the Government is currently developing new legislation that will introduce abstraction licensing. Licence applications will be assessed against environmental criteria to ensure compliance with 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.

The RBMP⁴ suggests that abstractions greater than 25 m³/day may be reviewed to examine any potential risk to WFD objectives; and all abstractions greater than 2,000 m³/day will require a licence. The new regulatory regime will inevitably result in modifications to the way that Irish Water currently abstract from its individual water sources. However, as this legislation is still being developed, Irish Water do not have full visibility of the future regulatory regime and therefore cannot reliably include an estimation of sustainable abstraction within the Supply Demand Balance (SDB) calculations. A more detailed site by site assessment will be required when the legislation is published in its final form.

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

A sensitivity analysis (presented in Section 7.6) is conducted for each WRZ, to allow us to stress test the sensitivity of the Preferred Approach against potential sustainability driven reductions to existing abstractions (again, taking a conservative and precautionary approach as to the level of reductions that may be required). This will ensure that our decision making is robust, and the Preferred Approaches are adaptable and compatible with future potential regulatory regimes, in so far as this can be anticipated at this stage. The sensitivity analysis is presented in Section 7.6.

Our assessment has identified twenty (20) surface water sites where potential abstraction reductions may be required in the future, based on conservative estimates of what a future regime may require. These are listed in the Table 2.4 of this Plan.

Figure 7.14 and Figure 7.15 show our existing surface water and ground water abstraction sites. For surface water, the sites where potential abstraction reductions may be required in the future, as a result of the new licencing regime, are highlighted in red.

Legend

- ◆ Surface water abstraction
- ◆ Abstractions potentially at risk of exceeding sustainable thresholds
- River
- Lake
- Study area boundary
- WFD Ecological Status or Potential
- High
- Good
- Moderate
- Poor
- Unassigned

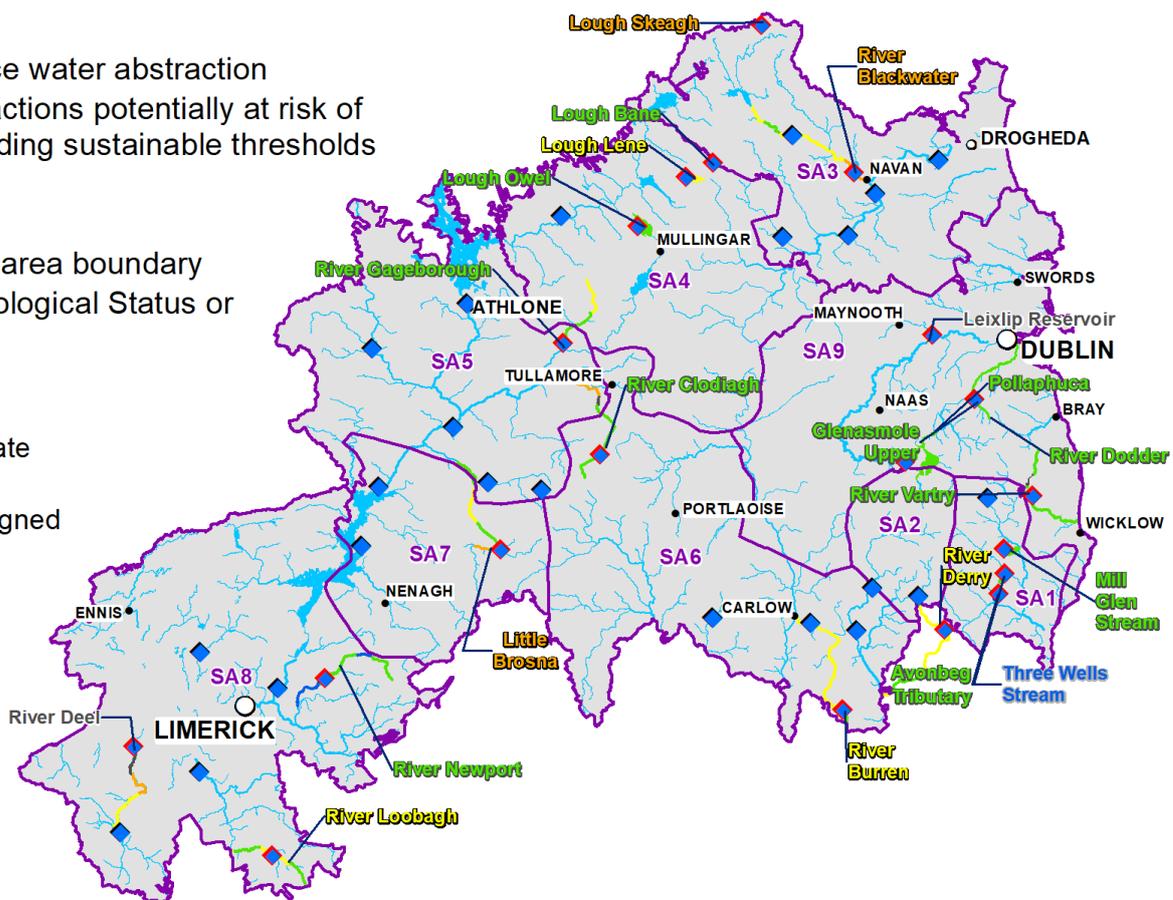


Figure 7.14 Existing Surface Water Abstractions

Legend

- ◆ Groundwater abstraction
- River
- Lake
- Study area boundary

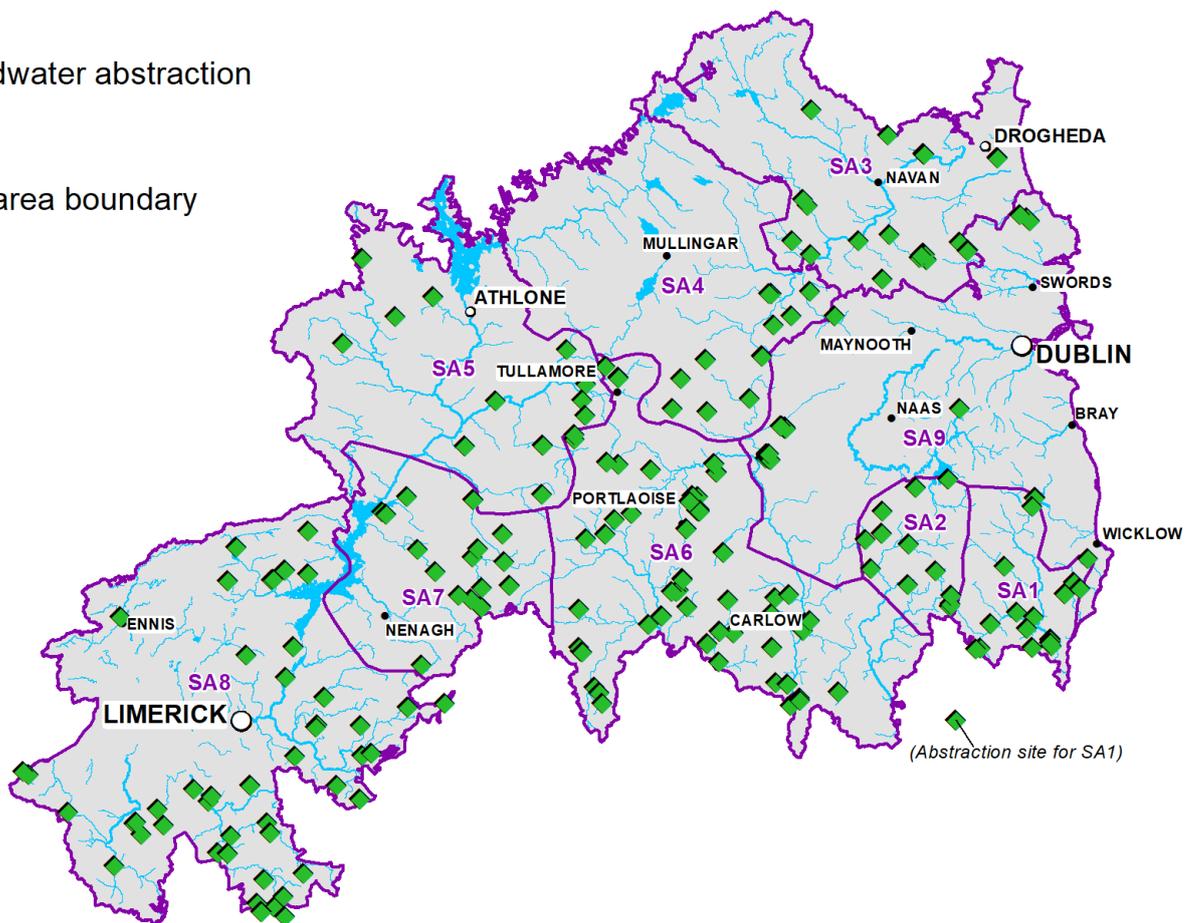


Figure 7.15 Existing Groundwater Abstractions

When developing our Preferred Approach, we considered solutions to improve the sustainability at the sites that were assessed to be potentially impacted by new legislation. Through the rationalisation of supplies, it is anticipated that nine (9) of the 20 surface water abstraction sites will be abandoned. This has the potential to improve the environmental outcomes at these sites and reduce the uncertainty posed by the future legislation.

Table 7.18 lists the abstractions that will be abandoned as part of the SA Preferred Approach. Figure 7.16 displays their location in the context of the waterbody WFD Ecological Status or Potential.

Table 7.18 Preferred Approach – Abstractions Potentially Exceeding Sustainable Abstraction Thresholds

Study Areas	Number of Abstraction Sites	Site Name (WRZ)
SA1	3	Tributary of Avonberg Ballinder (Rathdrum Public Supply) Three Wells Stream (Aughrim Annacurra Public Supply) Tributary of Avonberg River (Avoca Ballinclash Public Supply)
SA2	-	n/a
SA3	2	River Blackwater – Liscarton (Navan-Mid Meath) Lough Bane (Kells-Oldcastle)
SA4	2	Lough Lene (Ballany) Lough Owel (Mullingar Regional)
SA5	-	n/a
SA6	1	Clodiagh River (Tullamore)
SA7	-	n/a
SA8	1	Mulkear River (Newport RWSS)
SA9	-	n/a

For the remaining eleven (11) abstractions, the Preferred Approach will facilitate the reduction of supplies from three (3) of these abstractions and reduce pressure on a further two (2) by supplying projected increases in demand with alternative sources. Six (6) abstractions may require alternative supply solutions. This is outlined in Table 7.16, which summarises the outcomes of the sensitivity analysis that is undertaken to ensure the Preferred Approaches are adaptable and compatible with future potential regulatory regimes.

The actual reductions that may be needed in future will depend on the specific requirements of the future legislation. Irish Water 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. Figure 7.17 and Figure 7.17 show the changes to abstractions under the Preferred Approach development, including abstractions that will be increased, upgraded and abandoned.

Legend

- Surface Water Abstractions
 - ◆ New abstraction
 - ◆ Maintain abstraction
 - ◆ Upgrade abstraction
 - ◆ Decommission abstraction
- Surface water abstractions potentially exceeding sustainable abstraction thresholds
- River
- Lake
- Study area boundary
- WFD Ecological Status or Potential
 - High
 - Good
 - Moderate
 - Poor
 - Unassigned

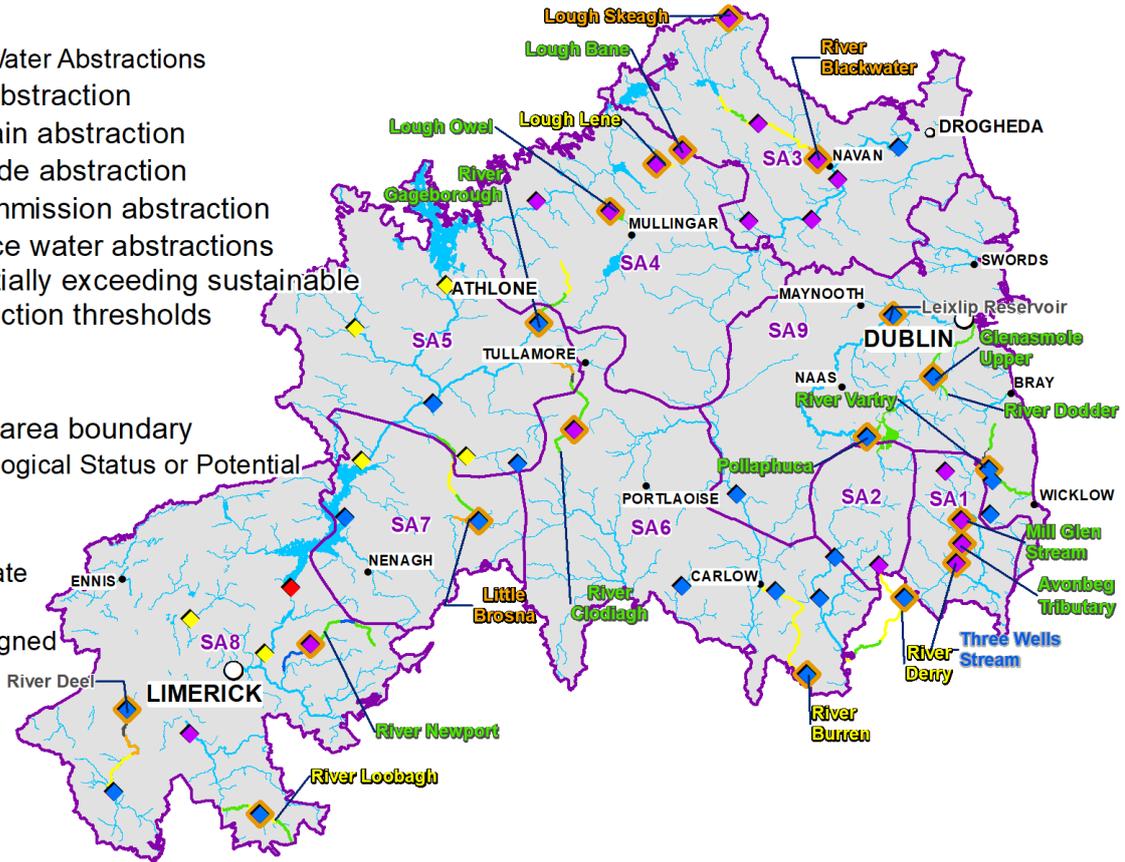


Figure 7.16 Preferred Approach – Surface Water Abstractions

Legend

- Preferred
 - ◆ New abstraction
 - ◆ Maintain abstraction
 - ◆ Upgrade abstraction
 - ◆ Abandon abstraction
- River
- Lake
- Study area boundary

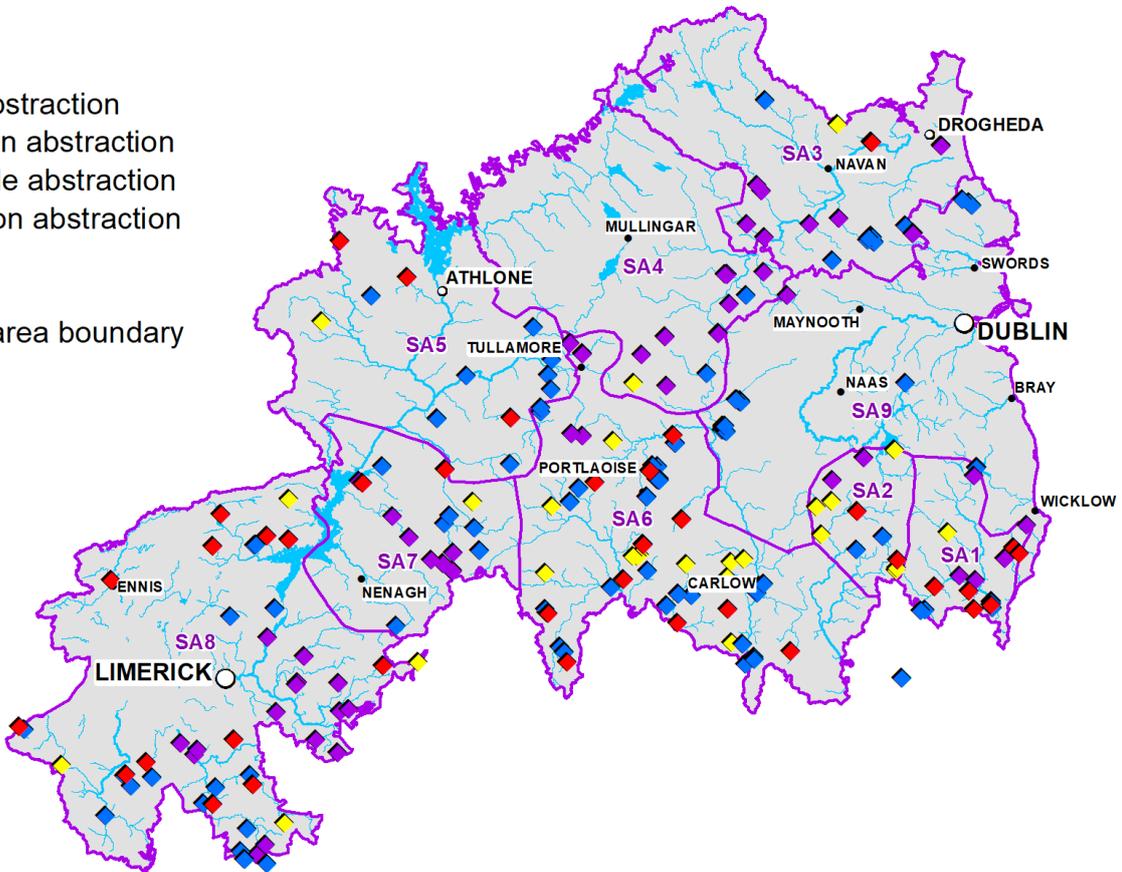


Figure 7.17 Preferred Approach – Groundwater Abstractions

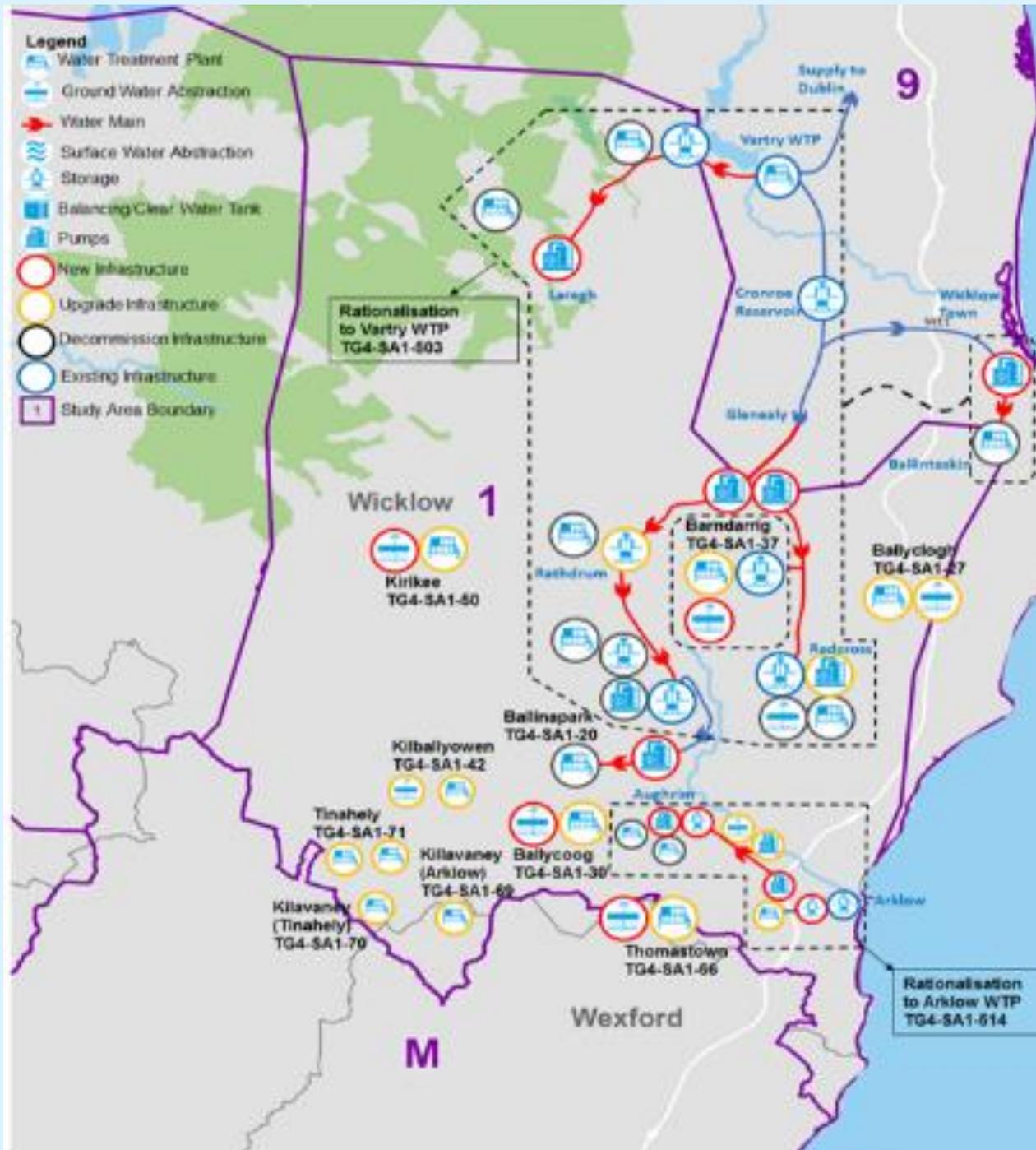
7.5 SA Preferred Approach Summaries

The following sections provide a summary of the Preferred Approaches for each Study Area. Further details are contained in the Study Area Technical Reports in Appendices 1-9.

7.5.1 Study Area 1 – Wicklow

Study Area 1					
No. of WRZs	SA1 lies within the counties of Wicklow and Wexford, covering an area of approximately 680 km ² . The population of the Study Area is 24,000.				
18	The Principal Settlements are Arklow, Ashford, Rathdrum, Aughrim, Glenealy, Roundwood, Avoca, Laragh, Ballinaclash, Redcross, and Barndarrig.				
	Arklow is the only Principal Settlement with a population greater than 10,000.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	20	Groundwater	15	DYCP 2019	1,039
High Risk WTP	18	Surface Water	5	DYCP 2044	1,287
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	3	Increase	5	Increase	0
Upgrade (Capacity & WQ)	7	Maintain	5	Maintain	1
Decommission	10	Decommission	5	Decommission	4
New	0	New	2	New	0
<p>The Preferred Approach (PA) for SA1 consists of ten (10) WRZ options and two (2) SA Grouped Options.</p> <p>The SA Grouped Options involve:</p> <ul style="list-style-type: none"> rationalisation of Aughrim Annacurra WRZ and Ballymorris WRZ to the Arklow WRZ. This option requires an increased GW abstraction at an existing wellfield at Woodenbridge, Arklow Ballyduff WTP upgrade, new storage and approximately 13km of new/upgraded network. rationalisation of six (6) WRZs to Vartry WTP in SA9, improving resilience through interconnections: Avoca Ballinaclash, Redcross Conary, Ballintekin, Rathdrum. Laragh Annamoe, Barndarrig. The option will require new pumps and approximately 48km of new/upgraded network to connect the WRZ's and allow for the additional supply. <p>The Preferred Approach provides environmental benefits by decommissioning existing abstractions from the Mill Glen Stream and the Avonbeg tributary. These abstractions may not meet sustainability guidelines.</p> <p>The Preferred Approach includes ongoing leakage management through our National Leakage Reduction Programme.</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 1

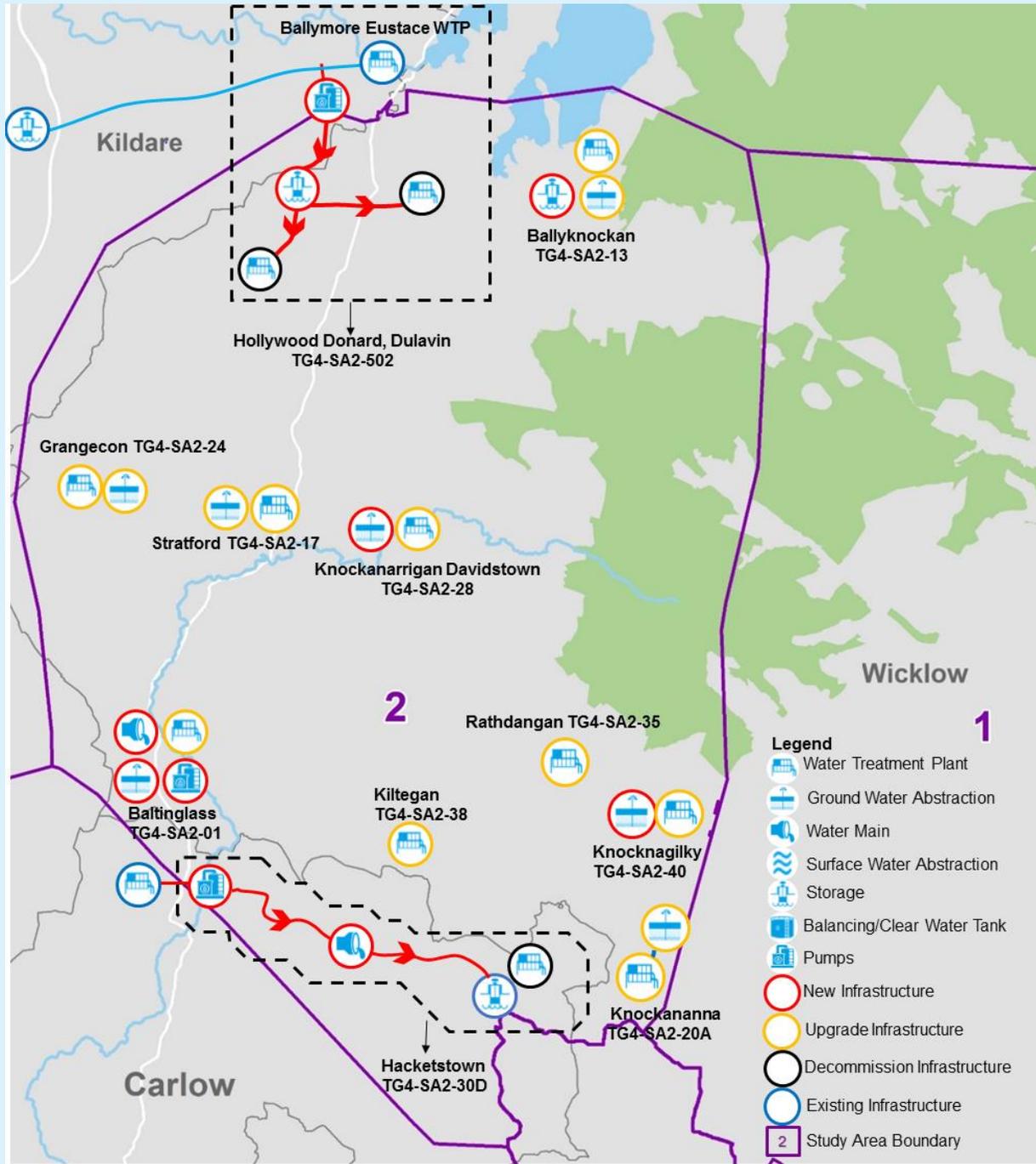


*TG4-SAX-00X are the Option Codes assigned to each option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-9.

7.5.2 Study Area 2 – West Wicklow

Study Area 2					
No. of WRZs	SA2 lies within the counties of Carlow, Kildare and Wicklow, covering an area of approximately 545 km ² . The population of the Study Area is about 6,800.				
	The Principal Settlements are Baltinglass, Dunlavin, Donard, Hacketstown, Stratford, Ballyknockan and Knockananna.				
12	The largest settlement is Baltinglass, with a population of approximately 2,200.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	12	Groundwater	11	DYCP 2019	1,278
High Risk WTP	11	Surface Water	1	DYCP 2044	1,510
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	2	Increase	5	Increase	0
Upgrade (Capacity & WQ)	7	Maintain	4	Maintain	0
Decommission	3	Decommission	2	Decommission	1
New	0	New	2	New	0
<p>The Preferred Approach for SA2 consists of local WRZ supplies for ten (10) of the twelve (12) WRZs in the Study Area. This includes a new connection at Rathvilly WTP (in SA6) and the decommissioning of the Hacketstown WTP.</p> <p>There is one (1) SA Grouped Option proposed for two (2) WRZs, Dunlavin and Holywood. This involves rationalising these two WRZs to Ballymore Eustace WTP (SA9) via a new connection to the Ballymore Eustace – Old Kilcullen trunk main. The option includes a new pumping station, a new service reservoir and approximately 15 km of new/upgraded network.</p> <p>The Preferred Approach includes ongoing leakage management through our National Leakage Reduction Programme.</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 2

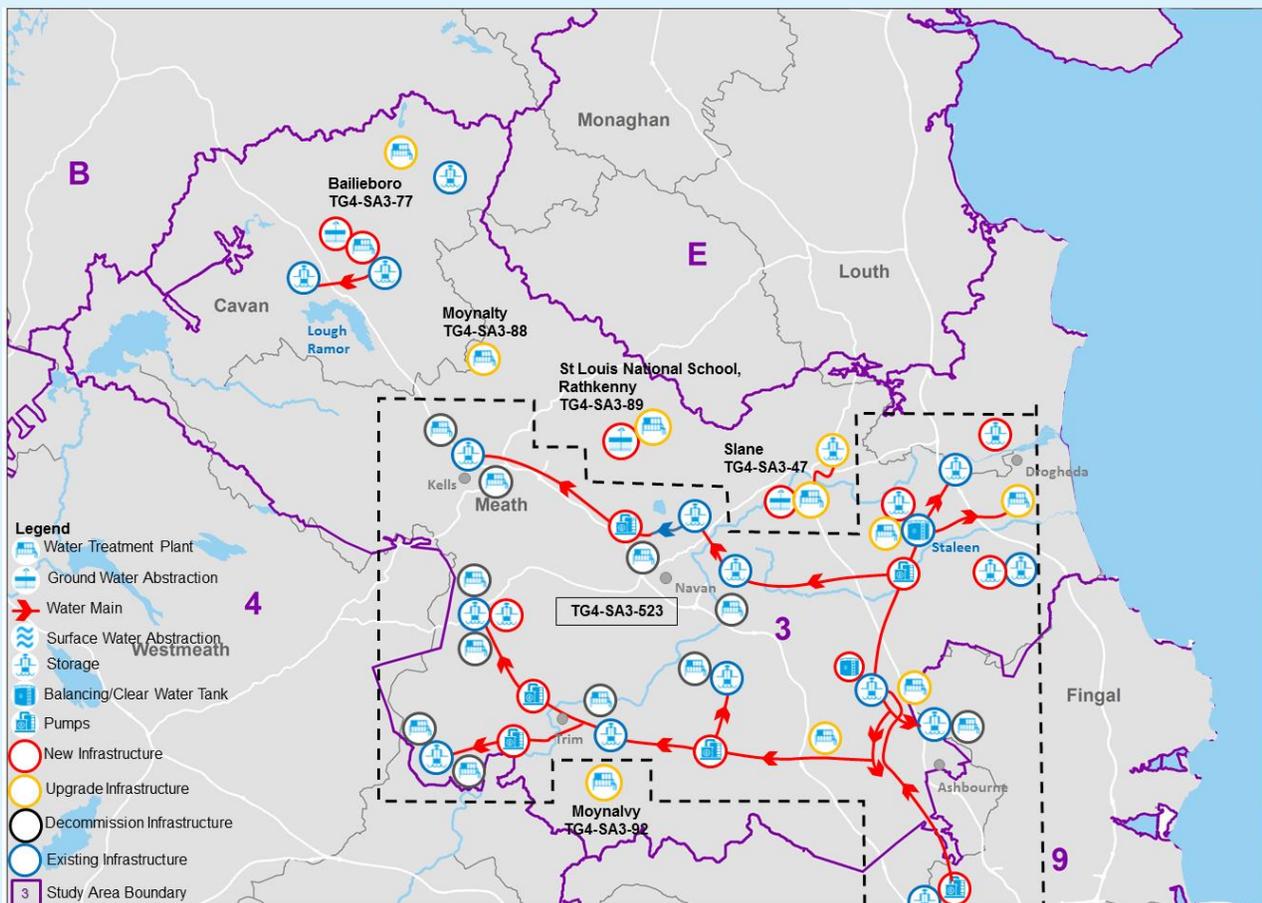


*TG4-SAX-00X are the Option Codes assigned to each option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-9.

7.5.3 Study Area 3 - Meath

Study Area 3					
No. of WRZs	SA3 lies within the counties of Cavan, Louth, Fingal, Westmeath and Meath, covering an area of approximately 2,400 km ² . The population of the Study Area is about 190,000.				
11	The Principal Settlements are Drogheda, Ashbourne, Laytown-Bettystown-Mornington-Donacarne, Ratoath, Trim, Ceanannas Mór (Kells), Duleek, Gormanston, Dunshaughlin, Stamullen, Bailieborough, Virginia, Clogherhead, Carlanstown and Slane. Settlements with a population over 10,000 include Navan, Drogheda, Laytown-Bettystown-Mornington and Ashbourne.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	19	Groundwater	13	DYCP 2019	18,155
High Risk WTP	18	Surface Water	7	DYCP 2044	26,013
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	6	Increase	1	Increase	0
Upgrade (Capacity & WQ)	2	Maintain	6	Maintain	2
Decommission	11	Decommission	6	Decommission	5
New	1	New	2	New	0
<p>The Preferred Approach for SA3 consists of local WRZ supplies four (4) of the WRZs in the Study Area.</p> <p>A single SA Grouped Option resolves the deficit for seven (7) of the WRZs, namely Athboy, Ballivor, Kells-Oldcastle, Kilmessan, Navan-Mid Meath, South Louth & East Meath, and Trim. This involves improved interconnection between WRZs, and supply from a New Shannon Source. New storages, new pumps and watermain network of approximately 154km will be required as part of this option.</p> <p>The Preferred Approach provides environmental benefits by decommissioning existing abstractions from the River Boyne at Liscarton WTP and Lough Bane. These abstractions may not meet sustainability guidelines.</p> <p>Net leakage reduction of 356 m³/day is included to move towards achieving the National SELL Target by 2034.</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 3

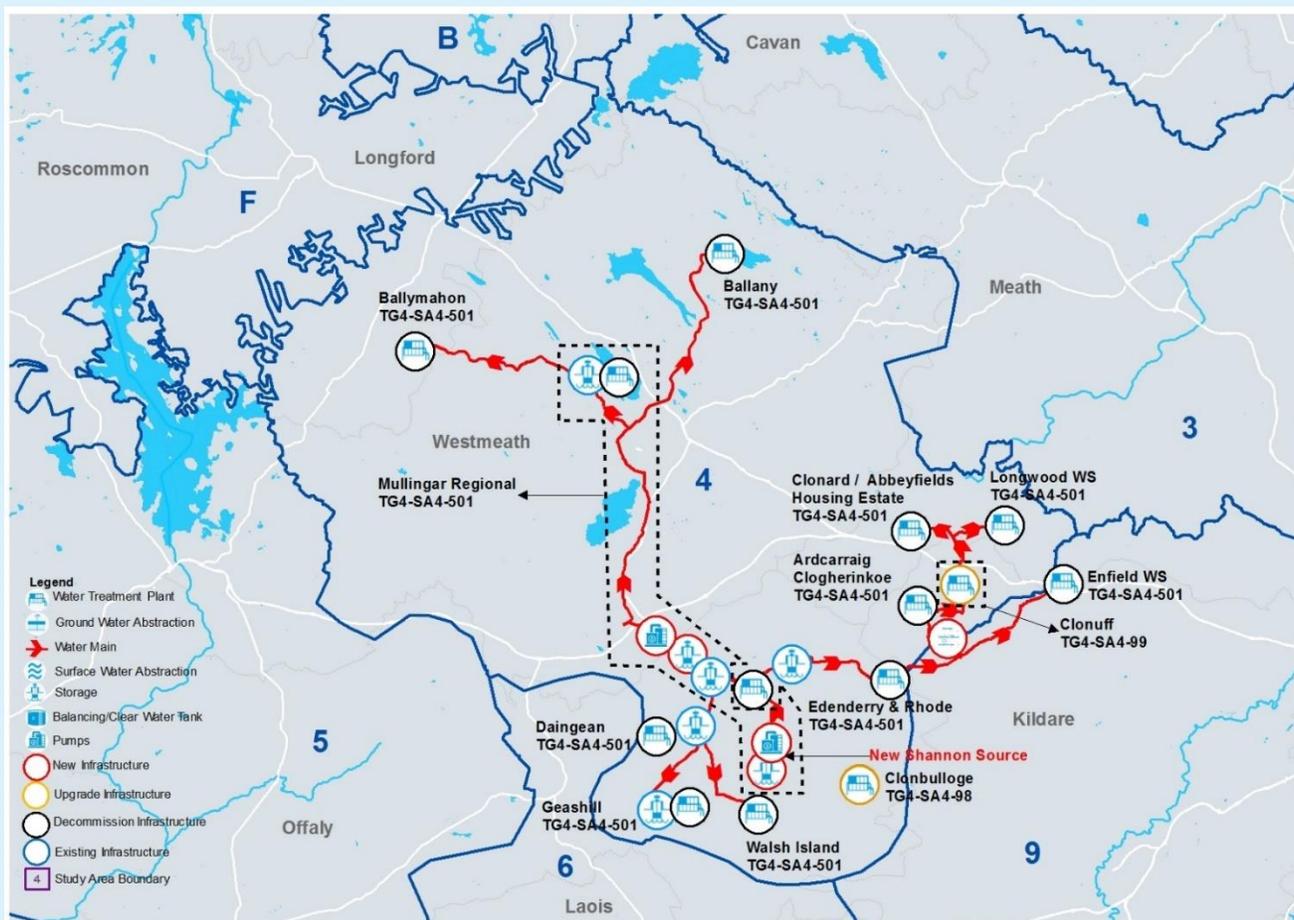


*TG4-SAX-00X are the Option Codes assigned to each option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-9.

7.5.4 Study Area 4 – West Meath

Study Area 4					
No. of WRZs	SA4 lies within the counties of Cavan, Longford, Westmeath, Meath, Offaly and Kildare covering an area of approximately 2,640 km ² . The population of the Study Area is about 87,900.				
13	The Principal Settlements are Mullingar, Longford, Johnstownbridge, Edenderry, Drumlish, Meathas Truim (Edgeworthstown), Newtownforbes, Enfield, Kinnegad, Ballymahon, Castlepollard, Rhode and Tyrrellspass. Mullinger is the only settlement with a population over 10,000.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	15	Groundwater	12	DYCP 2019	22,414
High Risk WTP	13	Surface Water	3	DYCP 2044	38,190
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	2	Increase	0	Increase	0
Upgrade (Capacity & WQ)	0	Maintain	2	Maintain	0
Decommission	13	Decommission	10	Decommission	3
New	0	New	0	New	0
<p>The Preferred Approach for SA4 consists of Local WRZ supplies for two (2) of the thirteen (13) WRZs. These supplies are not in deficit; however, WTPs will be upgraded to improve water quality. The remaining eleven (11) WRZs involve transfers from the New Shannon Source (NSS).</p> <p>The Preferred Approach provides environmental benefits by decommissioning Lough Owel (a SAC designated lake), Enfield GW source adjacent to the River Blackwater, and by meeting growth in Ballany by the NSS transfer rather than increasing existing abstraction at Lough Lane. The decommissioning of these abstractions will assist in meeting WFD objectives.</p> <p>Net leakage reduction of 254 m³/day is included to move towards achieving the National SELL Target by 2034.</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 4

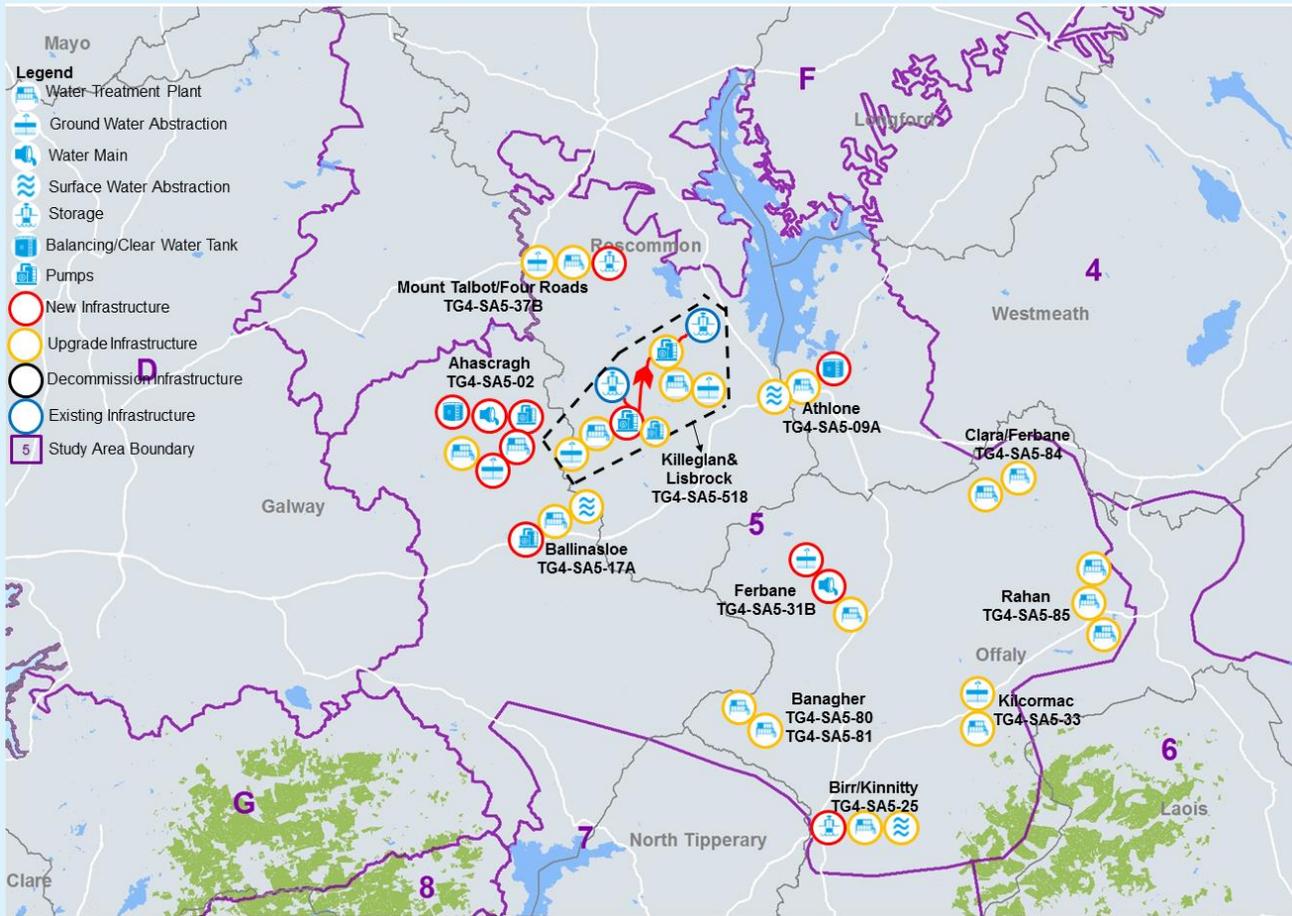


*TG4-SAX-00X are the Option Codes assigned to each option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-9.

7.5.5 Study Area 5 – Offaly/Roscommon

Study Area 5					
No. of WRZs	SA5 lies within the counties of Galway, Roscommon, Longford, Westmeath, Tipperary, Offaly and Laois, covering an area of approximately 2,590 km ² . The population of the Study Area is about 72,000.				
10	The Principal Settlements are Athlone, Tullamore, Ballinasloe, Roscommon, Birr, Clara, Ferbane, Mucklagh, Banagher, Cloghan, Athleague, Ahascragh and Kinnitty. Athlone is the only settlement with a population over 10,000.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	16	Groundwater	12	DYCP 2019	6,155
High Risk WTP	14	Surface Water	7	DYCP 2044	9,041
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	9	Increase	5	Increase	3
Upgrade (Capacity & WQ)	7	Maintain	7	Maintain	4
Decommission	0	Decommission	0	Decommission	0
New	1	New	1	New	0
<p>The Preferred Approach for SA5 consists of local WRZ options for all of the WRZs in the Study Area, primarily driven by the small scale of the supplies and difficulties in transporting small volumes of water over long distances.</p> <p>For one of the larger demand areas, South Roscommon (Lisbrock & Killeglan), the Preferred Approach involves increasing the existing groundwater abstraction at Killeglan and Lisbrock, upgrading the associated WTPs and providing new/upgraded network to allow for the additional supply.</p> <p>The Preferred Approach includes net leakage reduction of 570 m³/day to move towards achieving the National SELL Target by 2034.</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 5

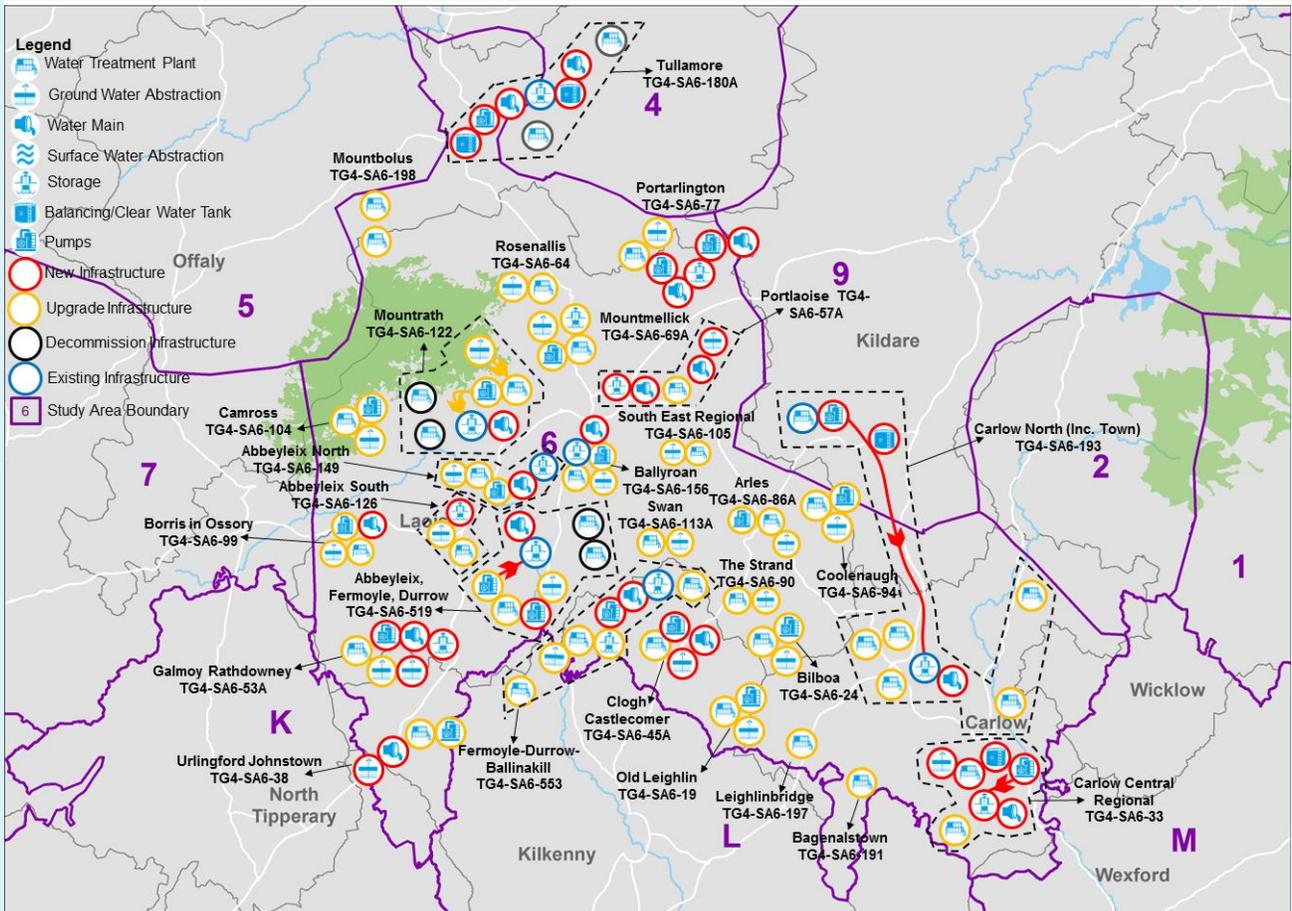


*TG4-SAX-00X are the Option Codes assigned to each option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-9.

7.5.6 Study Area 6 – Laois

Study Area 6					
No. of WRZs	SA6 lies within the counties of Carlow, Kildare, Kilkenny, Laois, Tipperary, Offaly, Westmeath, Wexford and Wicklow covering an area of approximately 3,030 km ² . The population of the Study Area is about 126,700.				
	The Principal Settlements are Carlow, Portlaoise, Portarlinton, Tullow, Mountmellick, Castledermot, Abbeyleix, Mountrath, Ballon, Muinebeag (Bagenalstown), Ballyroan and Durrow.				
28	The principal settlements with a population of over 10,000 include Carlow, Portlaoise and Tullamore.				
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	42	Groundwater	38	DYCP 2019	30,525
High Risk WTP	40	Surface Water	6	DYCP 2044	35,679
Preferred Approach Summary					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	17	Increase	11	Increase	0
Upgrade (Capacity & WQ)	21	Maintain	23	Maintain	5
Decommission	4	Decommission	4	Decommission	1
New	1	New	12	New	0
<p>The Preferred Approach for SA6 consists of WRZ options for 26 of the 28 WRZs. One of the WRZ Options includes rationalisation of Cloonin Hill and Drim WTPs to Knocks WTP. For two of the larger demand areas, namely Carlow Town and Tullamore, the SA Preferred Approach involves connecting to the New Shannon Source:</p> <ul style="list-style-type: none"> • Carlow will be supplied by a transfer from Srowland WTP (SA9) to Browneshill Reservoir. This option will require the provision of new storage, new pumps and lay approximately 28.6 km of new network. • Tullamore will be supplied via a connection to the proposed NSS. This includes a balancing storage at NSS connection, new reservoir, new/upgraded pumps and approximately 21.5km of new/upgraded network. <p>The single SA Grouped Option involves interconnecting the remaining two WRZs, Ballinakill and Durrow, and includes increase GW abstraction and WTP upgrades.</p> <p>The Preferred Approach includes net leakage reduction of 823 m³/day to move towards achieving the National SELL Target by 2034. 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 6



*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 1-9.

7.5.7 Study Area 7 – North Tipperary

Study Area 7	
No. of WRZs	SA7 lies within the counties of Clare, Galway, Laois, Tipperary, and Offaly and covers an area of approximately 1,460 km ² . The population of the Study Area is about 31,300. The Principal Settlements are Nenagh, Roscrea, Portumna, Newtown, Borrisokane, Cloughjordan, Shinrone, Portroe, Moneygall and Silvermines.
10	There are no principal settlements (settlements with a population of over 10,000) within SA7. The two settlements with the highest populations (exceeding 5,000) include Nenagh and Roscrea.

Current Supply System

WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	18	Groundwater	16	DYCP 2019	773
High Risk WTP	17	Surface Water	3	DYCP 2044	984

Preferred Approach Snapshot

Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	7	Increase	1	Increase	1
Upgrade (Capacity & WQ)	4	Maintain	8	Maintain	2
Decommission	7	Decommission	7	Decommission	0
New	0	New	2	New	0

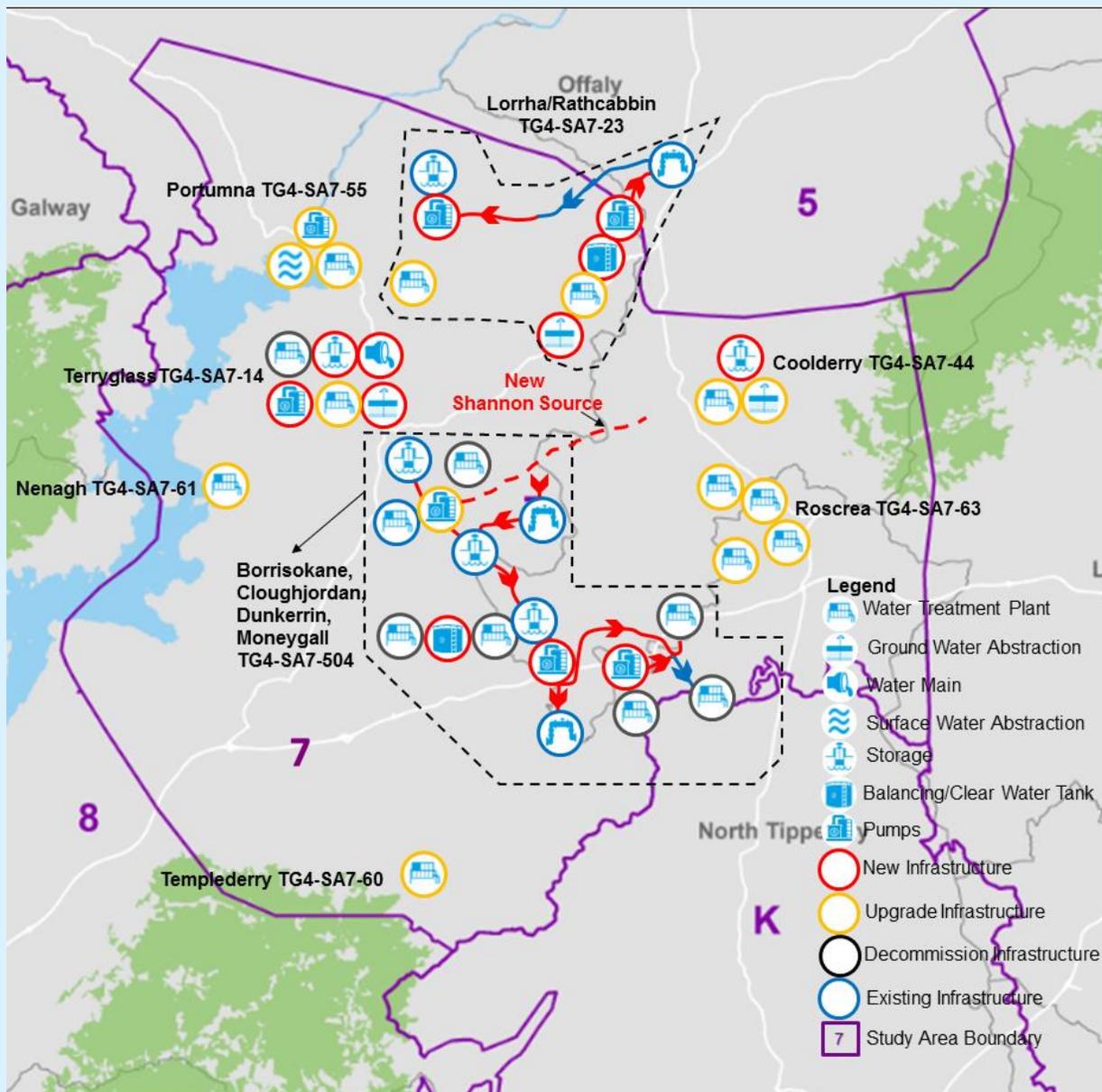
The Preferred Approach for SA7 consists of WRZ options for seven (7) of the ten (10) WRZs in the Study Area. One of the options is a new GW abstraction at Crossanagh, including an upgrade to Crossanagh WTP, new/upgraded pumps and approximately 500m of new/upgraded network. A new service reservoir or upgrades to existing reservoir will be required in Terryglass.

The remaining WRZ options involve increased groundwater or surface water abstractions and WTP upgrades.

The single SA Grouped Option improves the interconnection between three (3) WRZ, namely Dunkerrin/Moneygall, Greyford Source to Crotta and Cloughjorda. A new supply will be provided from the proposed New Shannon Source. This option includes new/upgraded pumps, new storage at Jones Well WTP and approximately 29km of new/upgraded network to allow for the transfer of additional supply between WRZs.

The Preferred Approach includes ongoing leakage management through our National Leakage Reduction Programme. Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.

Study Area 7



*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 1-9.

7.5.8 Study Area 8 – Limerick Clare

Study Area 8	
No. of WRZs	SA8 lies within the counties of Galway, Clare, Tipperary, Limerick City and County, and Cork covering an area of approximately 4,180 km ² . The population of the Study Area is about 233,600. The Principal Settlements are Limerick city and suburbs, Ennis, Shannon. South West Regional, Annacotty, Sixmilebridge, Ardnacrusa or Castlebank, Mungret, Newport, Ballina, Caherconlish, Adare, Clonlara and Foynes
31	Other than Limerick City and Suburbs which has a population exceeding 100,000, Ennis is the only settlement with a population over 10,000.

Current Supply System

WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	47	Groundwater	41	DYCP 2019	22,007
High Risk WTP	39	Surface Water	7	DYCP 2044	28,084

Preferred Approach Snapshot

Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	14	Increase	4	Increase	2
Upgrade (Capacity & WQ)	17	Maintain	22	Maintain	3
Decommission	16	Decommission	15	Decommission	2
New	0	New	12	New	1

The Preferred Approach for SA8 consists of WRZ options for 22 of the 32 WRZs in the Study Area. One WRZ (Newport) is dependent on the New Shannon Source to GDA. The option includes a sump at the offtake, new/upgraded pumps and approximately 4.5km of new/upgraded network. There are also two (2) rationalisations that involve connection to the Limerick WRZ for Croom and O'Briensbridge WRZs.

There are three (3) SA Grouped Options. Two of these also include connection to the Limerick WRZ:

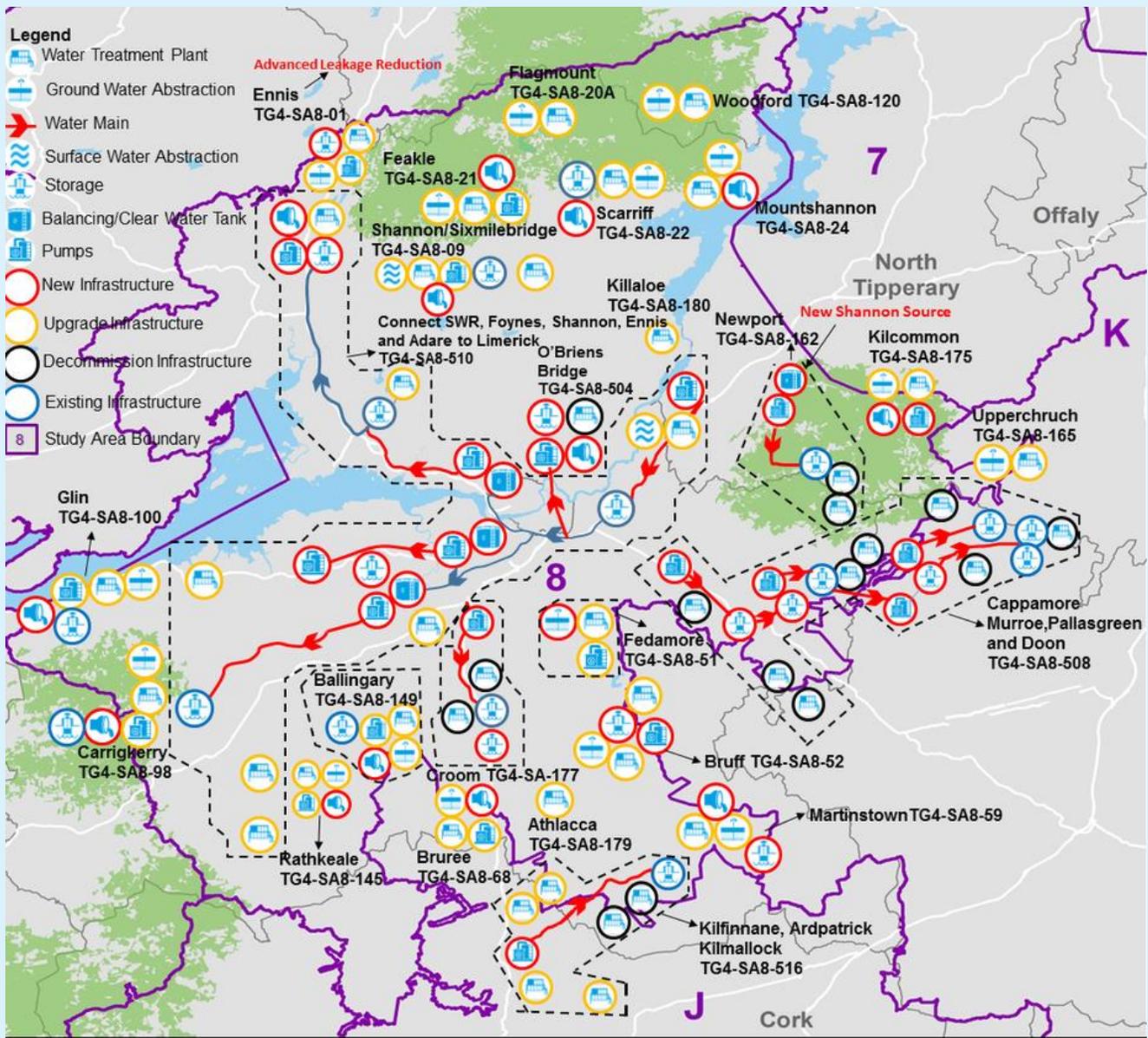
Interconnection of Cappamore/Murroe/Foileen, Pallasgreen and Doon.

Interconnection of South West Regional, Foynes Shannon Estuary and Adare.

The other involves the supply of spare capacity from Glenosheen/Jamestown/Kilmallock to KilfinaneArdpatrick. Rationalise Kilfinane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP).

The Preferred Approach includes net leakage reduction of 978 m³/day to move towards achieving the National SELL Target by 2034. Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.

Study Area 8

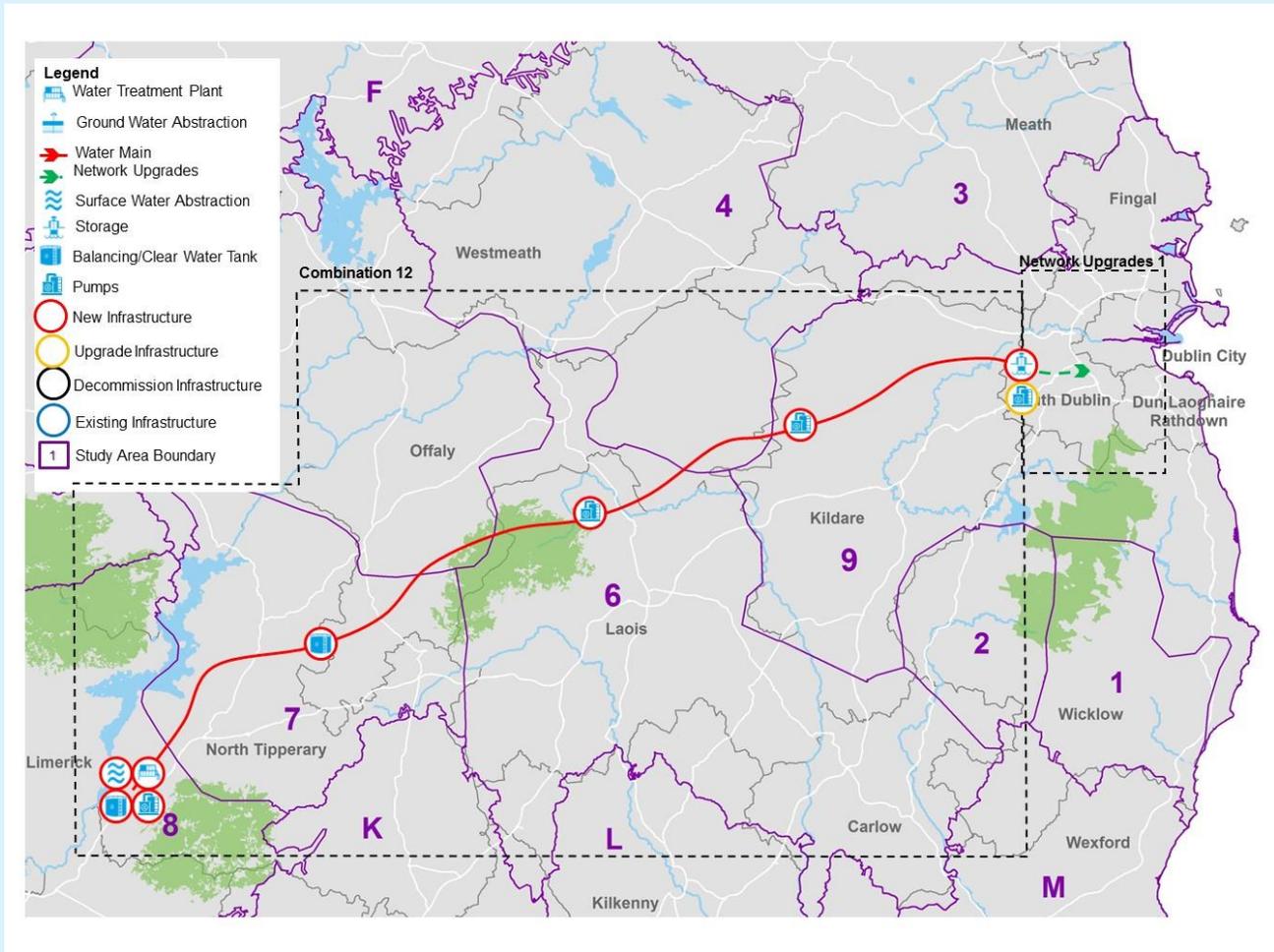


*TG4-SAX-00X are the Option Codes assigned to each option. A description of each option can be found in Table 5.9 of the Technical Appendices 1-9.

7.5.9 Study Area 9 – Greater Dublin Area

Study Area 9					
No. of WRZs	Study Area 9 consists of a single Water Resource Zone covering County Dublin and parts of Counties Meath, Wicklow and Kildare, supplying a population of approximately 1.7 million. The area consists of Dublin City and the principal settlements of: Bray, Wicklow, Blessington, Leixlip, Newbridge, Naas, Clonee and parts of Ashbourne.				
1					
Current Supply System					
WTPs	No.	Water Source Type	No.	Supply Deficit	m ³ .day
Existing WTP	12	Groundwater	5	DYCP 2019	132,190
High Risk WTP	11	Surface Water	7	DYCP 2044	194,373
Preferred Approach Snapshot					
Number of WTPs	No.	GW Abstractions	No.	SW Abstractions	No.
Upgrade (WQ only)	10	Increase/New	0	Increase/New	0
Upgrade (Capacity & WQ)	0	Maintain	4	Maintain	6
Decommission	2	Decommission	1	Decommission	1
New	1	New	0	New	1
<p>The Preferred Approach for SA9 comprises a new surface water abstraction of 210MLD from The Parteen Basin. The option also includes a new WTP at Birdhill with an output capacity of 200MLD, twin rising mains from the abstraction to WTP (2km), a new break pressure tank, 2 clear water tanks, new pumping station & booster pumping station, new termination point reservoir in Peamount. The supply will be transferred approximately 41km from the WTP to the break pressure tank via a new 1600mm pumped pipeline. From the break pressure tank the supply will flow by gravity for the first 170MI/d and pumped when demand goes above 170MI/d. The pipeline from the Break pressure tank to the termination point reservoir will be 1600mm diameter with an approximate length of 130km.</p> <p>The Preferred Approach also includes interventions for improved resilience and quality have been identified. These include upgrades to all WTPs, new storages, new and upgraded trunk mains, pump upgrades and rationalisation of 2 (two) WTPS – Roundwood Well WTP and Glenealy WTP.</p> <p>The Preferred Approach includes net leakage reduction of 84,000 m³/day to move towards achieving the National SELL Target by 2034.</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 9



*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 1-9.

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, Irish Water must have a means to continue delivering safe, secure and reliable water supplies (on a short to medium term basis) while we deliver our Preferred Approach.

On this basis, interim, short term capital maintenance solutions have been identified for all WTPs and will be utilised when needed. These solutions will allow Irish Water 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 option 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 therefore are considered “no regrets” infrastructure investment.

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

These solutions, in most cases, will only be used to allow time to deliver the longer-term solution. The interim solutions are determined in line with the Preferred Approach and as such, they are considered “no regrets” infrastructure investment.

7.6.1 Study Area 1 to Study Area 8

The potential interim solutions for Study Areas 1 to 8 are summarised in Table 7.19 and described in the Technical Appendices 1 -8.

Table 7.19 SA1 to SA8 Interim Solutions

Interim Solutions	Number of Option by Type							
	SA1	SA2	SA3	SA4	SA5	SA6	SA7	SA8
Upgrade WTP to IW standards	2	-	5	2	5	8	3	5
Upgrade WTP to IW standards- Potential site for containerised solution	4	-	2	1	-	1	1	11
Refurb existing borehole and upgrade WTP to IW standards	9	8	9	-	9	35	7	23
Refurb existing borehole and upgrade WTP to IW standards- potential for a containerised solution	5	2	1	-	-	4	7	6
Upgrade the WTP to maximise output	-	-	1	-	-	-	-	-
Progress the PA	-	1	-	-	-	-	-	1
Progress the PA: Part-rationalise the supply	-	-	2	-	-	-	-	1
Develop new borehole and upgrade WTP to IW standards	-	-	-	-	-	-	-	1
Develop new borehole or refurb existing borehole and upgrade WTP to IW standards	-	-	-	6	2	-	-	-
Develop new borehole or refurb existing borehole and upgrade WTP to IW standards - potential site for containerised solution	-	-	-	3	-	-	-	-
A new temporary package WTP supplied by GW to provide additional supply required before implementation of the PA	-	-	-	1	-	-	-	-
Total no. of Options	20	11	20	13	16	48	18	48

Irish Water's Investment Plan 2020-2024 includes a number of programmes and projects targeted at providing for growth. One such programme is the Small Towns and Villages Growth Programme (STVGP) which will provide funding for Water and Wastewater Treatment Plant growth capacity in

smaller settlements which are not otherwise provided for in the Capital Investment Plan 2020 to 2024. The STVGP is focused on supporting growth in areas already served by Irish Water infrastructure but where current or future capacity deficits have been identified. Irish Water have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant County Development Plan. The interim Option that will be considered under this programme include those for the following WRZs: Rathdrum and Laragh (SA1); Ballivor (SA3); and Adare, Rathkeale, Kilfinane and Murrow WTP (SA8).

7.6.2 Study Area 9 (Greater Dublin Area)

The Preferred Approach for SA9, which includes a transfer of drinking water from the River Shannon, is a significant project. Irish Water recognises it will take time to progress a project of this scale and complexity through the necessary consent, procurement and construction phases to make it fully operational.

At present the GDA has a critical supply demand balance issue, with planning deficits in normal conditions in the order of 48 Ml/d in 2019. Even when accounting for heavy investment in leakage reduction, this Deficit will increase further based on expected growth and economic development (aligned with the National Planning Framework).

As outlined in Section 4 we have a number of ongoing supply intervention projects including the new WTP at Vartry and the Srowland network extension project which alongside leakage and water conservation measures will allow us to maintain the existing Level of Service (LoS) to our customers while facilitating growth to 2025. Therefore, we will need further supply interventions, beyond the ongoing supply interventions, prior to the delivery of the Preferred Approach.

Without such interventions Irish Water will potentially need to implement measures to protect the LoS provided to existing water users, which may include potential restrictions on new connections to the network. Such measures, if required to be implemented, would severely impact growth and economic development in the region.

The recommended interim option for the GDA involves a temporary increase in abstraction from the River Liffey and increase in production at Leixlip and Ballymore Eustace WTPs, subject to the appropriate statutory consents. The proposed interim solution aligns with recommendations in the Department of Housing Planning and Local Governments Water and Wastewater Quality Sectoral Adaptation Plan⁵. Further information regarding the selection of the Interim Option for the GDA is given in the SA9 Technical Report (Appendices 1 - 9).

The NWRP does not confer funding availability and any interim measures will be subject to budget availability, AA screening and other relevant consents in the normal way. Irish Water will work with the EPA, ESB and OPW to further investigate this interim option. We acknowledge that this proposal is not sustainable in the long term. However, with optimisation of the existing inlet and storage in the system, any potential impacts could be mitigated, and the proposal would be temporary in nature until the Preferred Approach is delivered.

The potential interim solutions for the SA9 supplies are summarised in Table 7.20. These solutions alongside leakage and water conservation measures will allow us to maintain the existing Level of Service (LoS) to our customers while facilitating growth prior to the delivery of the Preferred Approach. In long term these solutions will improve resilience in the network and improve the security and reliability of the supply to the GDA.

Table 7.20 Interim Option

Interim Option Description	Implementation Year	Option Capacity (MI/d)
Leixlip WTP Upgrade - +50MI/d – Winter Critical Period and Normal Year Annual Average only	2028 earliest	50
Increase abstraction at Ballymore Eustace (BME) by optimising storage at Poulaphouca Reservoir and provision of 24km main from BME to the Saggart Area	2025 earliest	62

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 our consumption forecasts to calculate our Total Demand. We have identified areas where we will focus improvements in data to reduce the certainty of our forecasts. These are outlined in Section 9 of this Plan.

Future events that could alter the Supply Demand Balance 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 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 Supply Demand Balance 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.

We describe the scenarios we have assessed 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 SA technical reports (Appendices 1-9).

Table 7.21 Sensitivity Analysis of the Preferred Approach

Sensitivity Criteria	Impact on the SA Preferred Approach								
	SA1	SA2	SA3	SA4	SA5	SA6	SA7	SA8	SA9
Sustainability Impact*									
Status of abstraction potentially impacted by new legislations with PA in place	Decommission 3 Maintain 1	None in SA2	Decommission 2 Maintain 1	Decommission 2	Maintain 1	Decommission 1 Reduce 1	Maintain 1	Decommission 1 Reduce 2	Maintain 2 (PA will reduce pressure on sources)
Likelihood	Moderate/ High	Moderate/ High	Moderate/ High	Moderate/ High	Moderate/ High	Moderate/ High	Moderate/ High	Moderate/ High	Moderate/ High
Change in Deficit (m ³ /day) 	+2,108	+0	+5,800	+800	+700	+1056	+1035	+13,700	+90,000
Climate Change Impact									
Likelihood	High	High	High	High	High	High	High	High	High
Change in Deficit (m ³ /day) 	+100	+100	+400	+1000	+200	+1800	+100	+4000	+10,000
Demand Growth Impact									
Likelihood	Low/ Moderate	Low/ Moderate	Low/ Moderate	Low/ Moderate	Low/ Moderate	Low/ Moderate	Low/ Moderate	Low/ Moderate	Low/ Moderate
Change in Deficit (m ³ /day) 	-200	-283	-7700	-3942	-200	-200	-200	-200	-40,000

Sensitivity Criteria	Impact on the SA Preferred Approach								
	SA1	SA2	SA3	SA4	SA5	SA6	SA7	SA8	SA9
Leakage Targets not met									
Likelihood	Low	Low	Low	Low	Low	Low	Low	Low	Low
Change in Deficit (m ³ /day) 	-	-	+356	+251	+571	+823	-	+978	+84,000
Leakage Targets exceeded									
Likelihood	Moderate/High	Moderate/High	Moderate	Moderate/High	Moderate/High	Moderate	Moderate / High	Moderate/High	Low
Change in Deficit (m ³ /day) 	-135	-32	-12,669	-8,785	-5,293	-7,180	-1,305	-18,742	-83,000

 = 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 3.19 in Section 3 of this Plan. 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.

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

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

The outcomes of the sensitivity analysis are discussed in more detail in the SA Technical Reports (Appendix 1 - 9).

7.8 Summary

Our SA Preferred Approaches consist of a combination WRZ Option and SA Option 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 591 Feasible Option.

Our SA Preferred Approaches:

- Consist of 102 Option comprising 92 WRZ Option and 10 Study Area (SA) Grouped Option. SA Option supply more than one WRZ and generally rationalise supplies, with associated environmental benefits.
- Comprise 61 increased or new local groundwater supplies, and five (5) increased or new local surface water supplies that contribute to meeting an estimated 8% and 6% of the Deficit across the Eastern and Midlands Region.
- Supply 80% of the Deficit through Cross Study Area Interconnections. This involves ten (10) Option benefitting 34 WRZs.
- Supply 6% of the regional Deficit through Within SA Interconnections. These include: four (4) interconnections to the Limerick City supply system, utilising the spare capacity at Clareville WTP; and three (3) rationalisations to groundwater sources with associated upgraded existing supplies.
- Upgrade WTPs to reduce Water Quality risks identified through our Barrier Assessments (including 18 WRZs that are not in Deficit).
- Reduce investment costs by approximately 7% across the Region when compared with alternative independent and smaller scale WRZ Option.
- Increase resilience by delivering solutions through interconnections and rationalisation.
- Improve sustainability outcomes by decommissioning 66 WTPs and abandoning 67 associated abstractions. This includes nine (9) 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 196 Interim Option to ensure shorter term Deficits are addressed to account for lead times in delivery of Option 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.

The development of our SA Preferred Approaches at the Regional Level is presented in Section 8.

7.9 References

1. Department of Communications, Climate Action and Environment, 2018. *National Adaptation Framework. Planning for a Climate Resilient Ireland*. [online] Available at [National Adaptation Framework](#). [Accessed 24 October 2021].
2. European Commission website. https://ec.europa.eu/environment/nature/biodiversity/nnl/index_en.htm [Accessed 12 November 2021]
3. European Commission website. https://ec.europa.eu/environment/nature/biodiversity/nnl/index_en.htm [Accessed 12 November 2021]
4. River Basin Management Plan for Ireland 2018 – 2021, Department of Housing, Planning and Local Government.
5. Department of Environment Climate and Communications, 2020. *Water Quality and Water Services Infrastructure, Climate Change Sectoral Adaptation Plan*. [online] Available at: [gov.ie](#) [Accessed 03 Nov 2021].