8

PREFERRED APPROACH - REGIONAL

8.1 Introduction

As outlined in Section 1.9.4 of the Framework Plan and Section 1.6 of this document, given the large number of WRZs per capita of population, the NWRP has been subdivided into 22 Study Areas (SAs) across four (4) Regions.

These subdivisions are necessary and appropriate to make the option development and assessment tasks manageable for both Irish Water and the public/stakeholders during the consultation phase. Notwithstanding the sub-division, solutions are not constrained by distance i.e. WRZ, Study Area or Regional boundaries, but instead by the criteria of Resilience, Sustainability, Flexibility and Deliverability.

One of the key benefits of having a Regional Plan is that it allows us to consider options to address Need for each individual supply, and then to further assess whether the outcomes of the Plan can be improved by reviewing larger Study Area (SA) Options which serve multiple WRZs at Study Area Level; or even larger Regional Options that can resolve Need in multiple WRZs across more than one Study Area.

Regional Options in some cases perform better than local solutions, as they:

- Allow us to look at the resilient supplies across a wider area.
- Provide opportunities to decommission problematic unsustainable local sources.
- Allow us to balance our overall regional abstraction in an improved way across multiple catchments, with improvements in sustainability.
- Improve operational control by having fewer Water Treatment Plants (WTPs) to manage.
- Provides more resilient WRZs that are less sensitive to peaks in demand during critical events.

Note: Peaking factors and headroom allowances are smaller for larger WRZs, as shown in Table 4.13 and Table 4.14 in the National Water Resources Framework Plan www.water.ie/nwrp.

As outlined in Section 7.3.1 of this Plan, during the Coarse and Fine Screening process only one Regional Option has been identified for the Eastern and Midland Region. This consists of a transfer from the Shannon River, referred to as the New Shannon Source (NSS), which has the potential to supply multiple Study Areas. No other source with as large a potential, both in terms of quantity and distribution of supply, was identified.

As part of Section 7, we reviewed the Preferred Approach at WRZ and Study Area Level. During that process we assessed the Feasible Options to see whether any SA or Regional Options were available to meet the Need across multiple WRZs. For some Study Areas this led to the identification of a Preferred Approach at Study Area Level which involves an external transfer i.e., from a supply in another Study Area.

Therefore, in this section, Section 8 we must review the Preferred Approach in combination as there is potential for an impact on the ‘parent’ or existing supply, which needs to be assessed. We look at the Regional Option in the round to see how it performs when it is applied to multiple Study Areas. In the case of the Eastern and Midlands Region, Study Area 9 (the Greater Dublin Area (GDA)) is the ‘parent’ supply for most Study Area transfers. The Preferred Approach for SA9, which includes the development of the NSS, will need to be modified to allow for this additional required demand.

For the purposes of the RWRP-EM, we have also looked at two (2) alternative regional approaches that do not involve cross Study Area transfers. The Combinations considered are detailed in Table 8.1 below.

Table 8.1 Regional Approaches Considered

Approach	Description
Combination 1: Regional Approach with Transfers	This is essentially a combination of the Preferred Approach for all Study Areas taking into account the additional capacity NSS option to support the transfers to Study Areas outside SA9. This Approach is detailed further in Section 8.2.
Combination 2: Regional Approach One without Transfers	This approach retains the NSS as the Preferred Approach for SA9; however, it utilises Local Options instead of Study Area transfers. These Local Options are identified in each of the Technical Appendices for Study Area 1-8. This Approach is detailed further in Section 8.3.
Combination 3: Regional Approach Two without Transfers	This approach considers a scenario where the Preferred Approach for SA9 does not progress and an alternative option, which comprises a Desalination option, is considered for SA9. This approach does not support regional transfers. Study Areas 1-8 are supplied by Local Options. This Approach is detailed further in Section 8.3.

These Combinations are then assessed through the Approach Development Process, as set out in Section 7.

8.2 Combination 1 - Regional Approach with Transfers

As previously noted, this is a combination of the Preferred Approach for all Study Areas taking into account the additional capacity NSS option to support the transfers to Study Areas outside SA9.

The Option Assessment process in the Study Area assessments, as outlined in Technical Reports for SA1 to SA9 has identified 36 WRZs where the Preferred Approach at Study Area Level is to obtain supply either directly from the GDA or from the NSS on route to the GDA.

8.2.1 WRZs where the Preferred Approach is to Obtain Supply Directly from the GDA

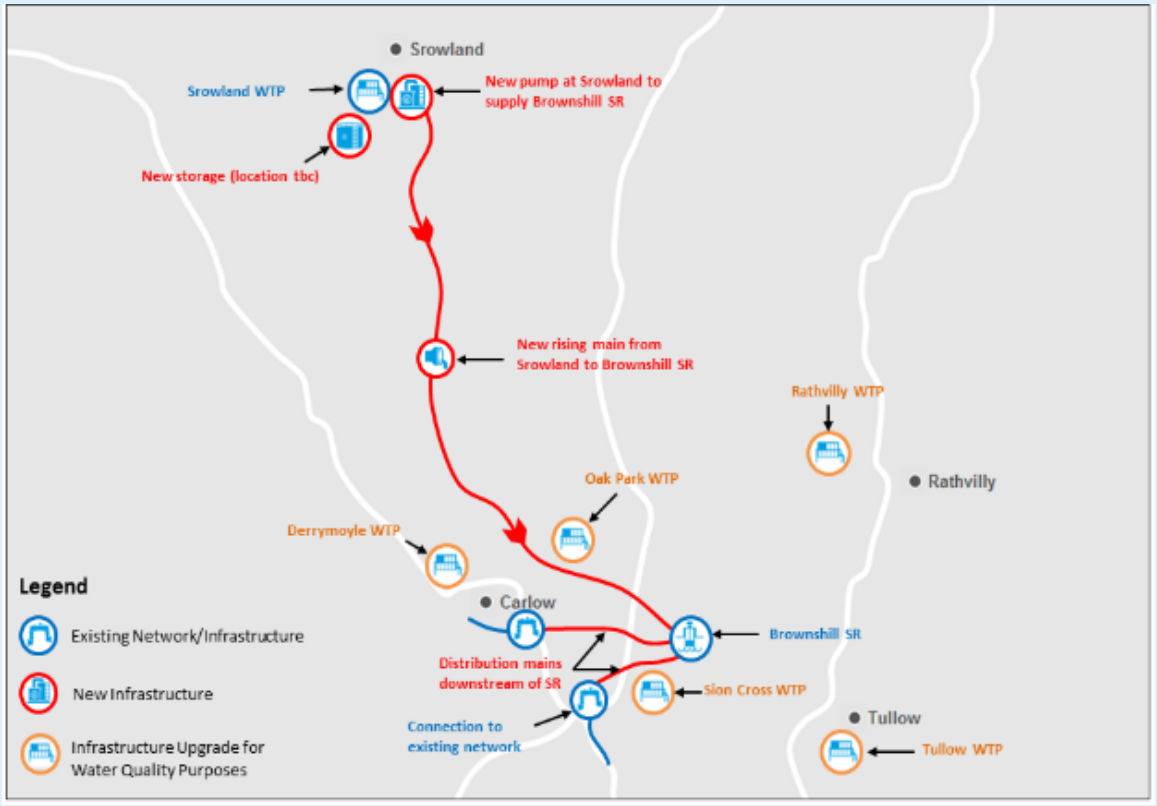
There are 18 WRZs where the Preferred Approach at Study Area Level is to obtain supply directly from the GDA. Box 8.1 and Box 8.2 provide an example of the Preferred Approach for two (2) of these WRZs. The Preferred Approach can provide part or the full supply to the WRZ from the GDA. For example, Box 8.1 provides an example for the Carlow North WRZ where part supply is provided from the GDA, while Box 8.2 provides an example of SA Grouped Options for six (6) WRZs in Study Area 1 where all supply for the WRZs is to be provided from the GDA. Table 8.2 lists all 18 WRZs where the Preferred Approach is to obtain additional supply or part supply from the GDA. The examples refer to the Water Available For Use (WAFU) with an Option in place. WAFU is the amount of water that can be supplied from a supply system, taking into account infrastructure capacity constraints, treatment losses and planned and unplanned events that can reduce supply.

Box 8.1 – Preferred Approach Carlow North WRZ

The SA Preferred Approach for SA6, includes a WRZ Option for the Carlow North WRZ (Option SA6 -193) which comprises a connection from the Carlow North WRZ to the GDA WRZ, as shown in the figure below. The existing WTPs Derrymoyle, Rathvilly, Tullow, Oak Park and Sion Cross WTPs are to be maintained and upgraded for water quality purposes. As the water available for use from the existing WTPs is 8.7 Ml/d (based on available yield in a Dry Year Critical Period (DYCP)) and the estimated DYCP demand is 19.3 Ml/d, there is a Deficit of approximately 10.6 Ml/d. The Preferred Approach to meet this Deficit is to supply from the GDA. Therefore, it is proposed that this WRZ will obtain part supply from the GDA.

Note: The Dry Year Critical Period (DYCP) is the weather planning scenario that is used in the NWRP to estimate our supply Deficit that the Plan must address. It represents the period within a dry year where demands can be significantly above average.

SA	WRZ Code	Current WRZ	DYCP Demand (m^3/day)	DYCP WAFU with the Option in Place (m^3/day)	Supply Required from GDA (m^3/day)
SA6	0100SC0001	Carlow North	19,260	8,670	10,590



Box 8.2 – Preferred Approach for SA1

The SA Preferred Approach for SA1, includes a SA Grouped Option for six (6) WRZs - Avoca Ballinaclash Public Supply, Ballinteskin Public Supply, Laragh Annamoe Public Supply, Rathdrum Public Supply, Barndarrig Public Supply and the Redcross Conary Public Supply (Option SA6 -503) - which connects the WRZ to the GDA WRZ, as shown in the figure below. Due to the age, condition and limited volume of supply provided by the existing WTPs they are all proposed to be decommissioned as part of the Option. Therefore, water available for use from the existing WTPs will reduce to zero when the Preferred Approach is in place. As the total Demand required for the six (6) WRZs is 2.4 Ml/d (see the table below) the Preferred Approach is to provide this supply from the GDA. Therefore, it is proposed that these WRZs will obtain all supply from the GDA.

SA	WRZ Code	Current WRZ	2044 DYCP Demand (m^3/day)	DYCP WAFU with the Option[1] in Place (m^3/day)	Supply Required from GDA (m^3/day)
SA1	3400SC0007	Avoca Ballinaclash Public Supply	460	0	460
SA1	3400SC0012	Redcross Conary Public Supply	490	0	490
SA1	3400SC0025	Ballinteskin Public Supply	30	0	30
SA1	3400SC0046	Rathdrum Public Supply	740	0	740
SA1	3400SC0017	Barndarrig Public Supply	110	0	110
SA1	3400SC0047	Laragh Annamoe Public Supply	600	0	600
Total			2,430	0	2,430

[1] The WAFU reduces to zero because the Preferred Approach for these WRZs is to decommission the existing WTPs once the connection to the GDA has been provided.

Box 8.2 – Preferred Approach for SA1 continued

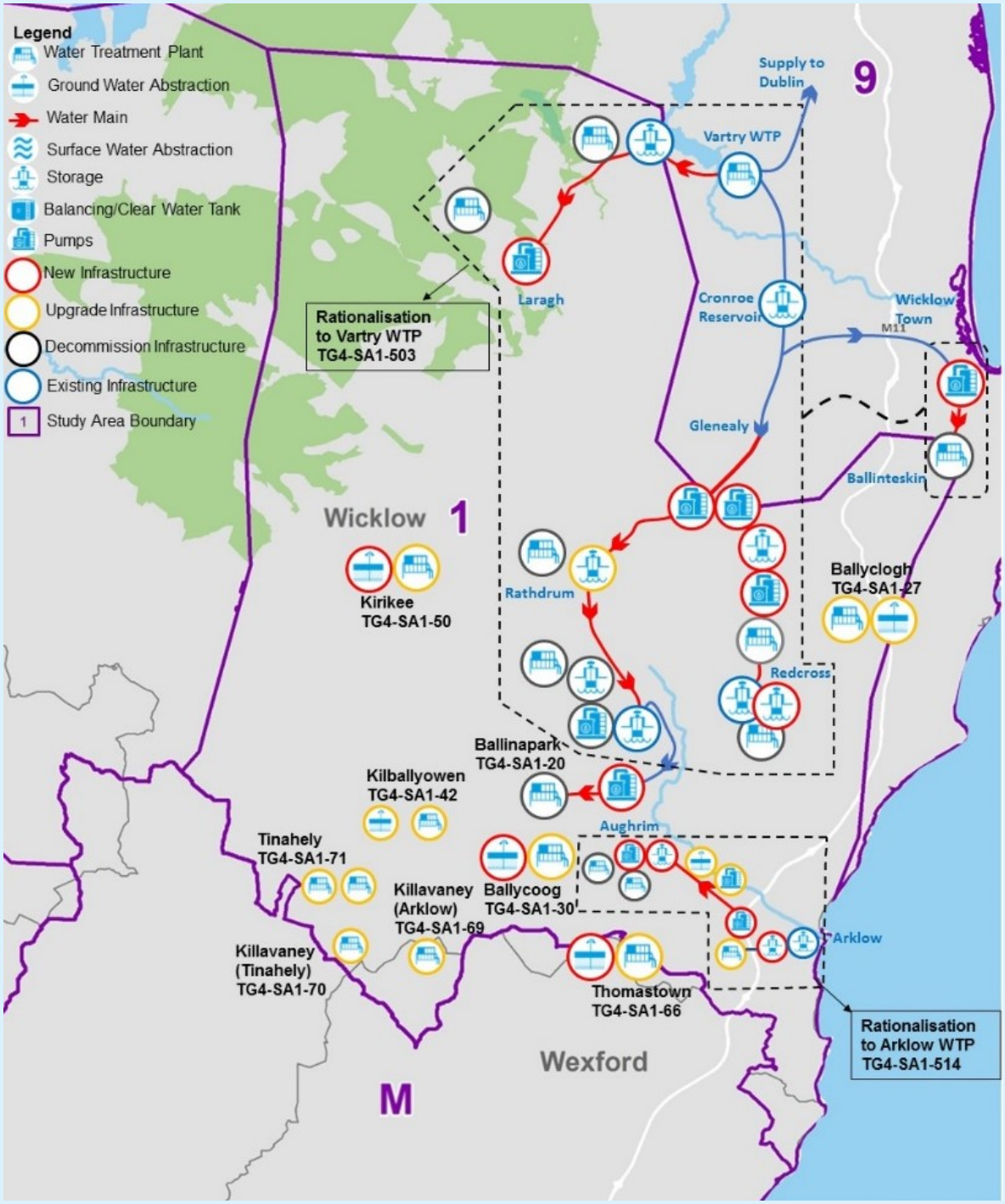


Table 8.2 provides details of the DYCP Demand and WAFU once the connections to the GDA are complete across all 18 benefitting WRZs. As can be seen from Table 8.2 the WAFU reduces to zero for all except two (2) WRZs. This is a result of the fact that the Preferred Approach for these WRZs is to decommission the existing WTPs once the connection to the GDA has been provided.

The Preferred Approach for the GDA (SA9), the NSS, would need to be adapted to accommodate this required supply from the GDA. Once the Preferred Approach for all WRZs is in place, these WRZs will combine to form one larger WRZ - the GDA Regional WRZ.

If the WRZ's remain isolated, the required additional demand from the NSS would be 62 Ml/d as outlined in Table 8.2. However, as outlined in Section 4.4 and Section 4.6 of the Framework Plan, larger WRZs are more resilient and less sensitive to peaks in demand during critical events. Therefore, peaking factors (used to estimate our design capacity) are lower for larger WRZs. Similarly, for larger WRZs, the uncertainty in the supply demand calculation reduces, as any potential changes in demand estimates will have a relatively lower impact than for smaller WRZs. As a result, the headroom allowance that we need to plan for is lower. The combination of reduced peaking effects and reduced headroom allowance means that the estimated supply volume that we need to design for to provide a 1 in 50 Level of Service (LoS) to customers is less. One of the key benefits for merging WRZs is this reduction in the design capacity required to provide the 1 in 50 LoS due to the increased resilience of larger water supply systems.

Headroom is the term given to a buffer in the Supply Demand Balance (SDB). It accounts for the uncertainty with both the data and the assumptions used in the supply and demand estimates and forecasts.

The **LoS** refers to the Reliability of the supply that our customers can expect to receive and is expressed as a frequency or return period of supply failure. A 1 in 50 LoS means that customers would only expect to experience a supply failure, on average, once every 50 years, or there would be a 2% chance of experiencing a supply failure in any given year.

Therefore, rather than sum the required demand from the individual WRZs listed in Table 8.2 to obtain a total required demand of 62 Ml/d, the Supply Demand Balance (SDB) is recalculated to understand the overall required demand when the WRZs are combined to form the GDA Regional WRZ.

The Sustainable Economic Level of Leakage (SELL) targets for the GDA and the SELL targets for WRZs listed in Table 8.2 are also incorporated into the updated SDB calculation. SELL targets for WRZs listed in Table 8.2 include our initial SELL targets and the additional leakage targets that aim to reduce leakage levels to 21% of Total Demand for larger WRZs (WRZs where demand is greater than 1,500 m^3/d). This is further explained in Section 5.2.1.

The recalculated DYCP Deficit in 2044 for the GDA Regional WRZ is 214 Ml/d. As outlined in Section 2.2 of the Study Area report for SA9 (Appendix 9), the DYCP Deficit for the existing GDA is 183 Ml/d. Merging the WRZs listed in Table 8.2 with the GDA results in a 31 Ml/d increased demand that would need to be supplied via the GDA.

Merging the WRZs and applying leakage targets reduces the additional supply volume that we need to design for to meet the estimated Deficit from 62 Ml/d to 31Ml/d.

Table 8.2 Water Resource Zones to be Connected to the GDA

SA	WRZ Code	Current WRZ	2044 DYCP Demand (m^3/day)	DYCP WAFU[1] with Option in Place (m^3/day)	Deficit Required from GDA (m^3/day)
SA1	3400SC0007	Avoca Ballinaclash Public Supply	460	0	460
SA1	3400SC0012	Redcross Conary Public Supply	490	0	490
SA1	3400SC0025	Ballinteskin Public Supply	30	0	30
SA1	3400SC0046	Rathdrum Public Supply	740	0	740
SA1	3400SC0047	Laragh Annamoe Public Supply	600	0	600
SA1	3400SC0017	Barndarrig Public Supply	110	0	110
SA1	3400SC0027	Ballinapark Public Supply	20	0	20
SA2	3400SC0004	Dunlavin Public Supply	420	0	420
SA2	3400SC0005	Hollywood Donard Public Supply	530	0	530
SA2	0100SC0005	Hacketstown	570	0	570
SA3	2100SC0001	South Louth & East Meath	50,640	34,580[2]	16,060
SA3	2300SC0005	Kells-Oldcastle	5,490	0	5,490
SA3	2300SC0006	Athboy	1,900	0	1,900
SA3	2300SC0007	Ballivor	1,050	0	1,050
SA3	2300SC0011	Kilmessan	600	0	600
SA3	2300SC0014	Trim	5,730	0	5,730
SA3	2300SC0055	Navan-Mid Meath	16,940	0	16,940
SA6	0100SC0001	Carlow North	19,260	8,670[3]	10,590
Total			105,580	43,250	62,330

[1] The WAFU reduces to zero because the Preferred Approach for the corresponding WRZs is to decommission the existing WTPs once the connection to the GDA has been provided.

[2] Supply is provided by the existing Staleen, Kiltrough, Curragha and Dunshaughlin WTPs, which are proposed to be maintained as part of the Preferred Approach.

[3] Supply is provided by the existing; Derrymoyle, Rathvilly, Tullow, Oak Park and Sion Cross WTPs, which are proposed to be maintained as part of the Preferred Approach, see Box 8.1.

8.2.2 WRZs where the Preferred Approach is to Obtain Supply from the NSS

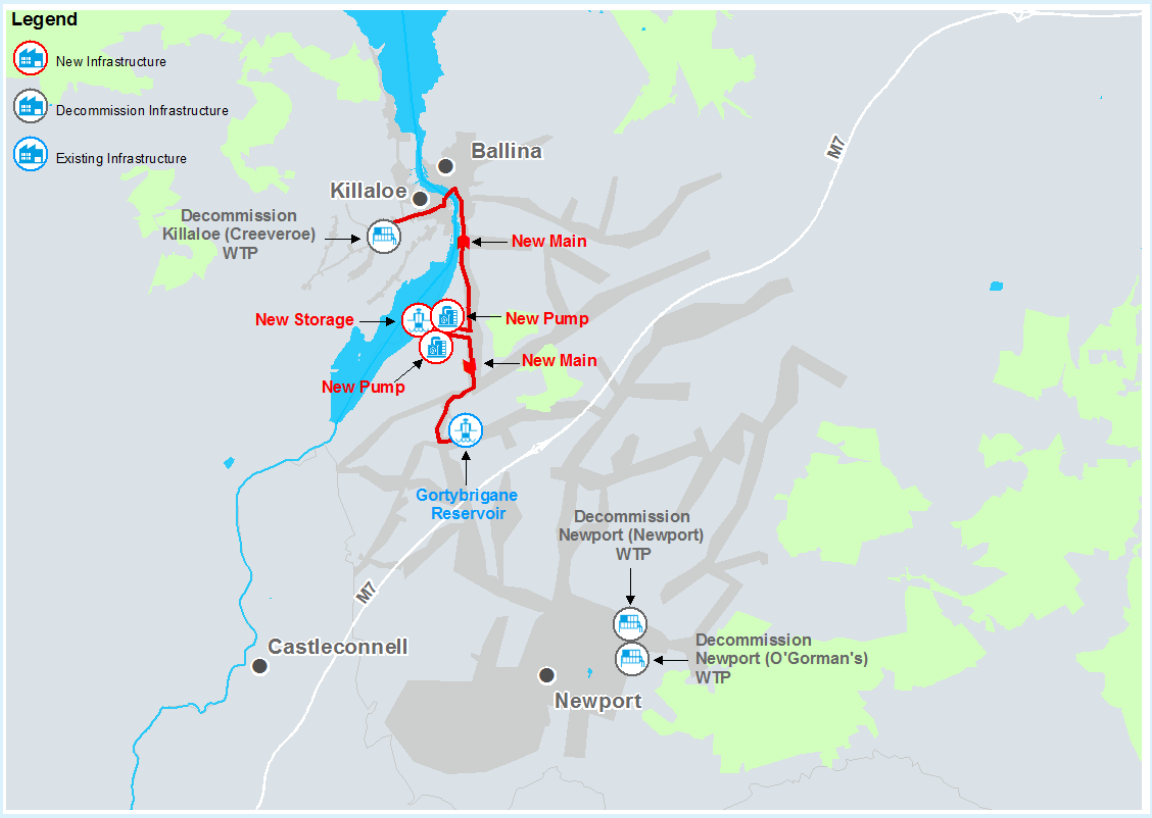
Further to these 18 WRZs, there are 18 WRZs which lie close to the route of the proposed pipeline transferring treated water from the NSS to the GDA, the Preferred Approach for SA9. The Preferred Approach for these WRZs is to obtain supply from the NSS via four (4) transfers from the pipeline connecting the NSS to the GDA. The details of these transfers and the WRZ are provided in Box 8.3 to 8.6.

Box 8.3 – Transfer 1

The SA Preferred Approach for SA8, includes a SA Grouped Option for two (2) WRZs - Newport and Killaloe (Option SA8 -512) - which comprises a connection from the proposed Preferred Approach for SA9. The proposed new source of supply for the Newport WRZ and Killaloe WRZ is the proposed WTP at Birdhill where the raw water from the NSS will be treated prior to transfer to the GDA WRZ.

The Preferred Approach for SA8 includes the proposed decommissioning of the existing treatment plants serving the Killaloe and Newport WRZs, due to the age and condition of the existing WTPs therefore the entire demand is required to be provided from the proposed WTP at Birdhill (see figure below). The 2044 DYCP Demand for the Killaloe and Newport WRZs is approximately 5.5 Ml/d. This reduces to 3.9 Ml/d when are merged and leakage targets are considered.

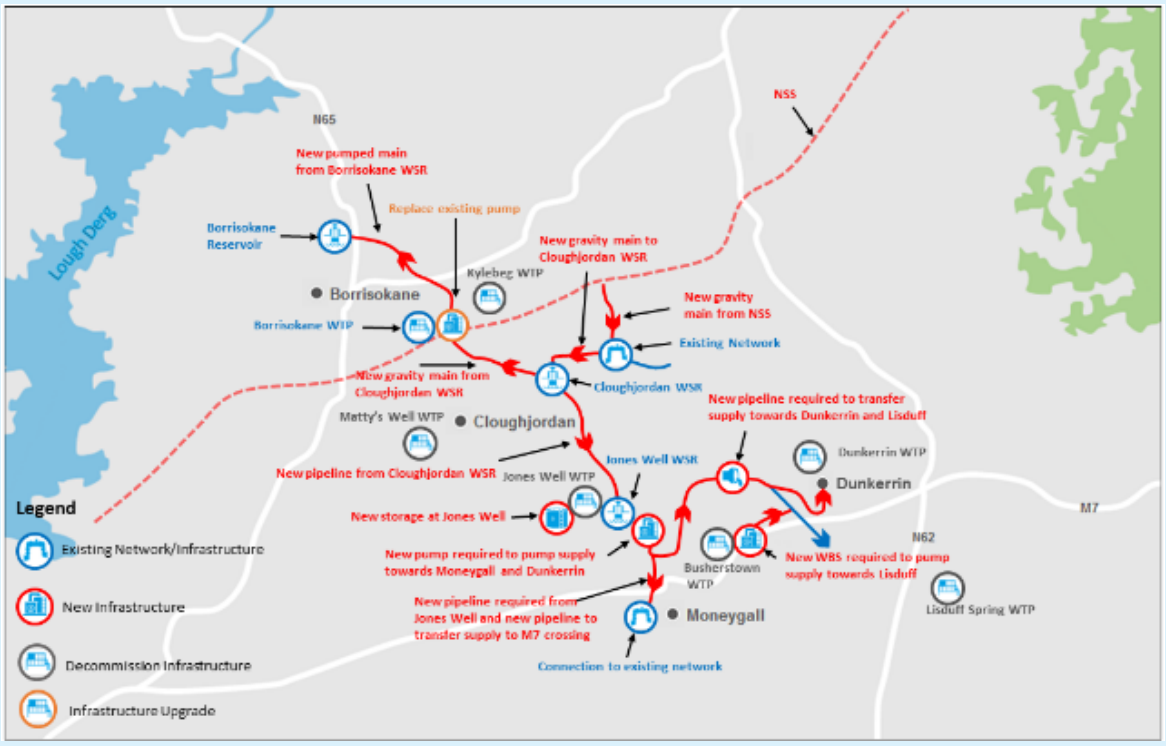
Option Code	WRZ Code	Current WRZ	DYCP Demand (m^3/day)	Leakage Targets (m^3/day)
SA8-512	2900SC0066	Newport RWSS	4,260	1,080
	0300SC0024	Killaloe	1,200	0
	Total		5,460	1,080



Box 8.4 – Transfer 2

The SA Preferred Approach for SA7, includes a SA Grouped Option (Group 4 or Option SA7-504) for three (3) WRZs as outlined in the table and figure below. In this proposed option all existing WTPs are to be decommissioned, due to the age and condition of the existing WTPs. The Total Demand for the WRZs is to be provided from the NSS via a connection to the proposed break pressure tank located on the pipeline transferring treated water from the NSS to the GDA WRZ. As the Preferred Approach for SA7 will result in the formation of one larger WRZ, rather than sum the demand from the three (3) WRZs individually, a merged WRZ is considered and the SDB recalculated. As previously noted, benefits for merging the WRZs include the reduction in supply required to provide the 1 in 50 LoS due to a reduction in headroom and peaking factors. The total additional demand required for the three (3) WRZs is 3.5 Ml/d if they remain isolated WRZs. This reduces to 3 Ml/d when the WRZs are merged, and leakage targets are considered.

Option Code	WRZ Code	Current WRZ	DYCP Demand (m^3/day)	Leakage Targets (m^3/day)
Group 4 SA7-504	2500SC0010	Dunkerrin / Moneygall	1,640	220
	2900SC0045	Borrisokane	1,060	-
	2900SC0046	Cloughjordan	850	-
	Total		3,550	220



Box 8.5 – Transfer 3

The SA Preferred Approach for SA7, includes a SA Grouped Option for two (2) WRZs - Tullamore and Mountbolus (Option SA6 -552) - which comprises a connection from the proposed Preferred Approach for SA9, as outlined in the table and figure below. In this proposed option the existing WTPs in Tullamore and Mountbolous are to be decommissioned and the Total Demand required for the WRZ is to be provided from the NSS via a connection to the proposed pipeline transferring treated water from the NSS to the GDA WRZ.

The 2044 DYCP demand for Tullamore and Mountbolus WRZs is approximately 8.9 Ml/d.

Option Code	WRZ Code	Current WRZ	DYCP Demand (m^3/day)	Leakage Targets (m^3/day)
SA6-552	2500SC0002	Tullamore	8,820	230
	2500SC0013	Mountbolus PWS	60	0
	Total		8,880	230

Box 8.6 – Transfer 4

The SA Preferred Approach for SA4, includes a SA Group option for 11 WRZs (Group 1 or Option SA4 -501) as outlined in the table and figure below. In this Option all existing WTPs are proposed to be decommissioned, due to the age and condition of the existing WTPs, and the Total Demand required for the WRZs is to be provided from the NSS via a connection to the pipeline transferring treated water from the NSS to the GDA WRZ.

As the Preferred Approach for SA4 will result in the formation of one larger WRZ rather than sum the demand from the 11 WRZs individually, a Mullingar Regional WRZ is considered and the SDB recalculated. As previously noted, benefits for merging the WRZs include the reduction in design capacity required to provide the 1 in 50 Level of Service due to a reduction in headroom and peaking factors given the improved resilience of a larger WRZ. If the WRZ's were to remain isolated, the total additional demand required for the 11 WRZs is 50 Ml/d. When merged and leakage targets are considered this reduces to 37 Ml/d.

Option Code	Code	WRZ	2044 DYCP Demand (m^3/day)	Leakage Targets (m^3/day)	Option Description
Group 1 SA4-501	3200SC0003	Ballany	7,130	2,340	Proposed new connection to the pipeline, transferring treated water from the River Shannon to the GDA WRZ eleven (11) WRZs.
	2000SC0003	Ballymahon	5,880	340	
	3200SC0001	Mullingar Regional	25,840	4,990	
	2300SC0012	Clonard/ Abbeysfields Housing Estate	80	-	
	2300SC0016	Longwood WS	590	-	
	2300SC0018	Enfield WS	1,660	-	
	1400SC0004	Ardcarraig Clogherinkoe	100	-	
	2500SC0004	Geashill	540	60	
	2500SC0005	Edenderry & Rhode	6,390	1,420	
	2500SC0014	Daingean	840	5	
	2500SC0006	Walsh Island	860	120	
	Total		49,910	9,280	

Box 8.6 – Transfer 4 continued

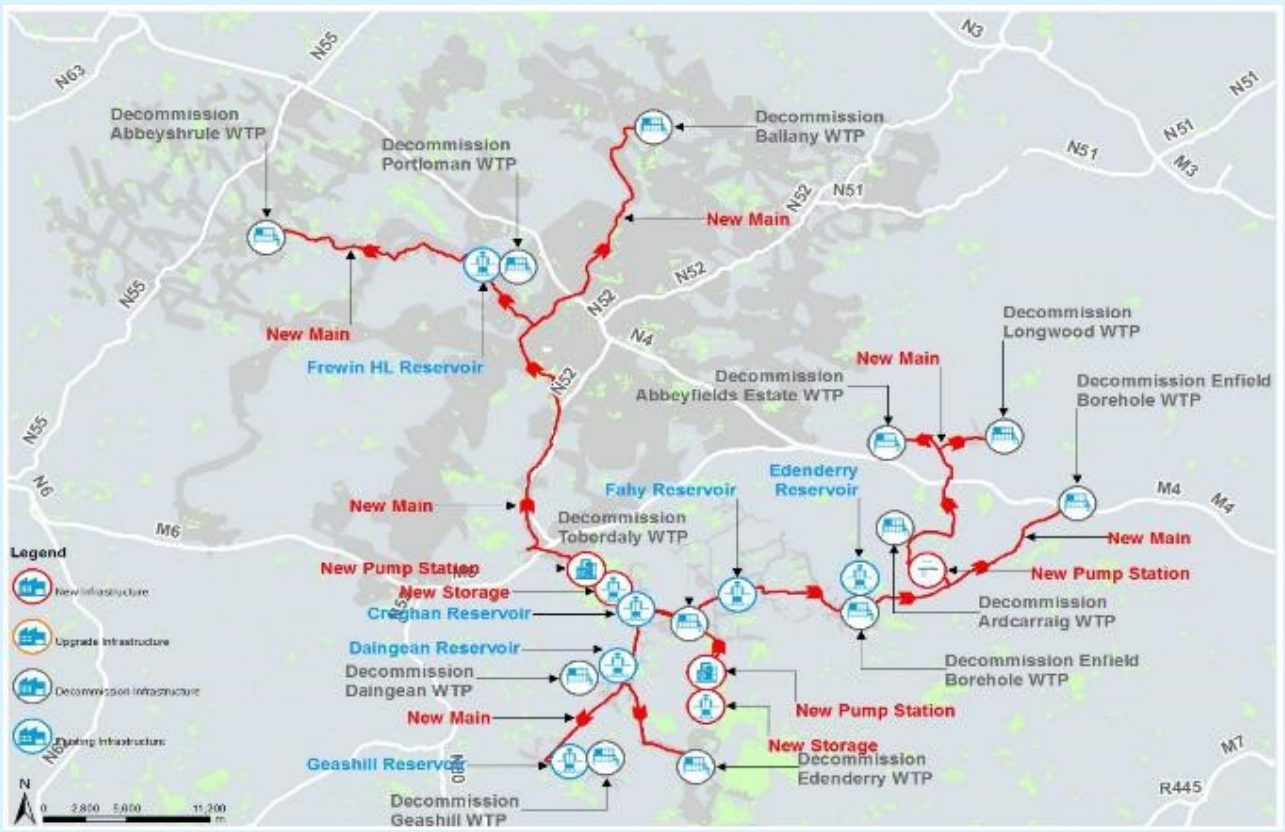


Figure 8.1 shows the WRZs benefitting from the NSS regional transfer including the:

- Greater Dublin Area;
- 18 WRZs merging to the GDA to form the GDA Regional WRZs, located in SA1, SA2, SA3 and SA6; and
- the four (4) transfers from the NSS providing supply to 18 WRZs in SA4, SA6 and SA8.

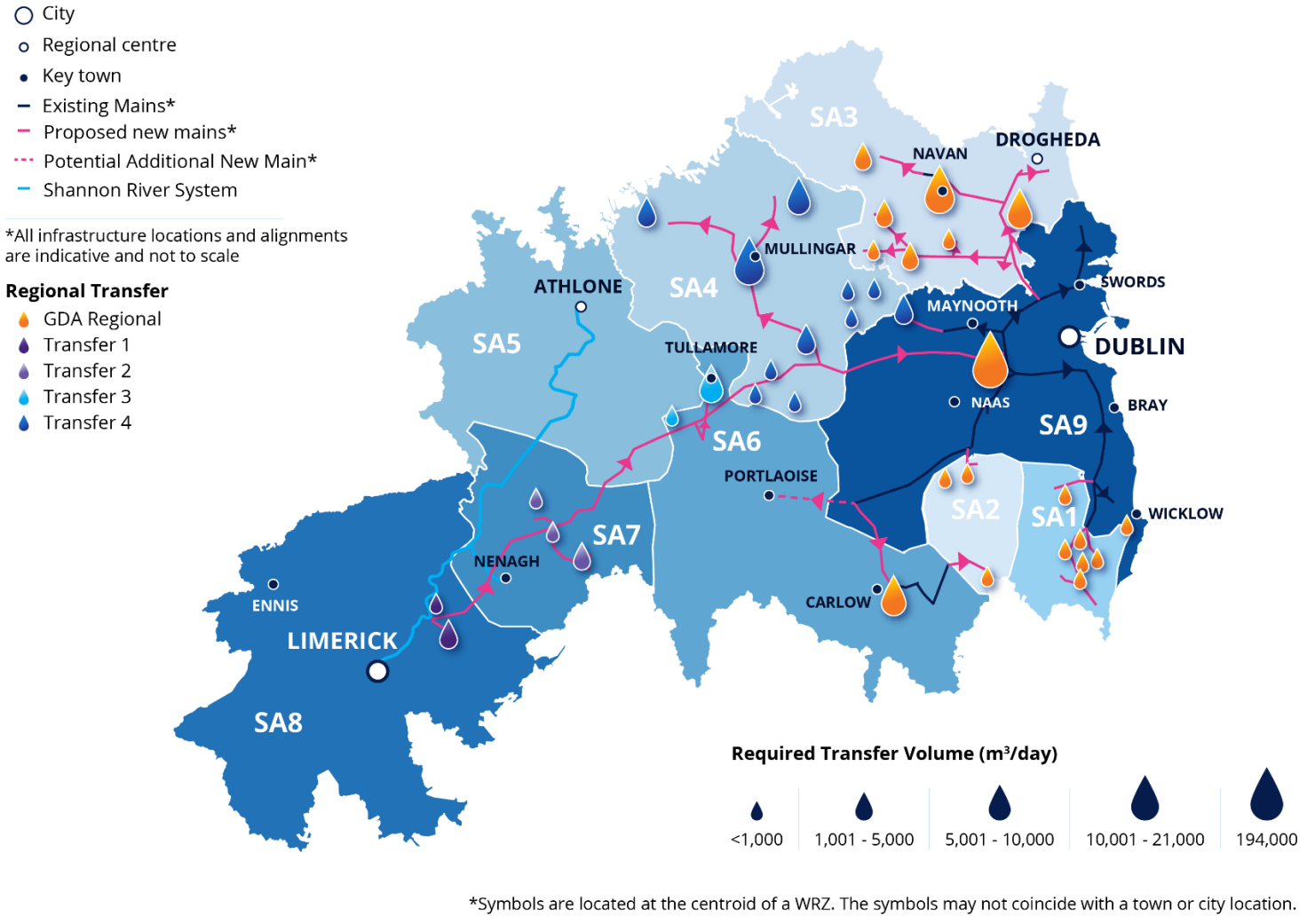


Figure 8.1 WRZ Merging to the GDA WRZ with Transfers from the NSS

8.2.3 Total Supply Required

Table 8.3 lists the resulting SDB Deficit for each proposed WRZ to provide the 1 in 50 LoS in the DYCP scenario. When the proposed transfers as mentioned above are taken into account, the required demand from the NSS increases from 183 Ml/d to 266 Ml/d. The revised demand summaries for the merged WRZs (GDA Regional WRZ, Dunkerrin/ Moneygall/ Borrisokane/ Cloughjordan, and Mullingar Regional WRZ), incorporating changed peak factors and headroom allowances, are presented in Appendix 10. The SDBs for all other WRZs remain the same as presented in the Framework Plan Appendix L.

Figure 8.2 shows the build-up of regional DYCP demand for the period to 2044, and the WAFU based on the assets expected to be in operation in 2044. It does not include the WAFU from existing WTPs proposed to be decommissioned as part of the Preferred Approach. The increase in the GDA regional WAFU between 2020 and 2021 represents the contribution of additional supply volume delivered through projects during the current investment cycle, including a new Water Treatment Plant (WTP) at Vartry and the Srowland extension project described in Section 4 of this Plan. The reduction in demand growth from 2023 to 2034 reflects the ambitions leakage reduction programme to achieve the national SELL targets (as outlined in Section 5).

Table 8.3 Breakdown of Regional Deficit

Proposed WRZ	DYCP Deficit 2044 (m^3/day)
GDA Regional WRZ	214 Ml/d
Transfer 1 – Newport WRZ	4 Ml/d
Transfer 2 - Dunkerrin/Moneygall/Borrisokane/Cloughjordan WRZ	3 Ml/d
Transfer 3 – Tullamore WRZ	9 Ml/d
Transfer 4 – Mullingar Regional WRZ	37 Ml/d
Total Required Supply	266 Ml/d

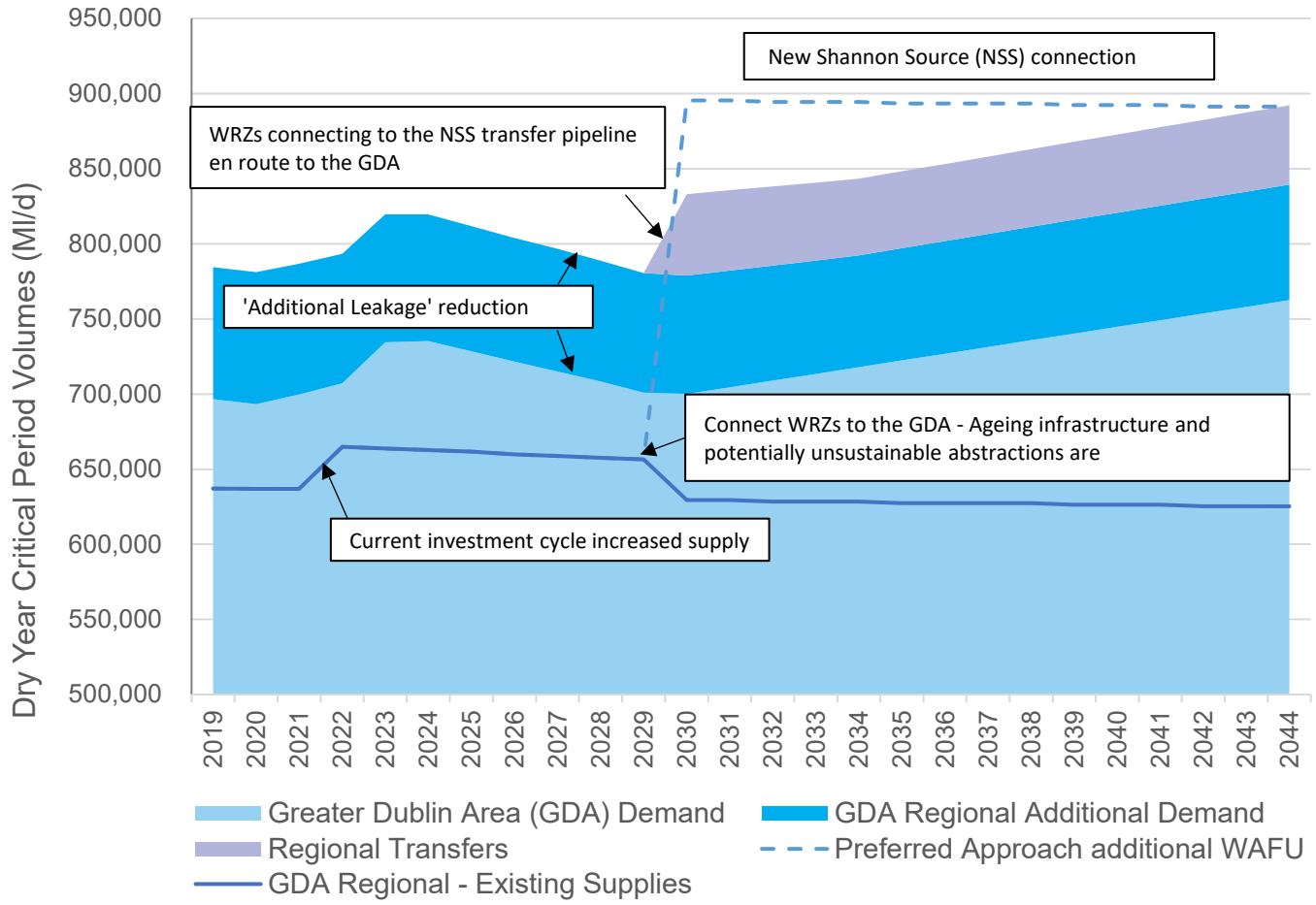


Figure 8.2 SDB Position for WRZs Requiring Regional Solution

8.2.4 Summary of Combination 1 – Regional Approach with Transfers

The Regional Approach with Transfers includes 33 WRZs for which their Preferred Approach is to obtain part or complete supply from the GDA or from a transfer from the NSS. The required demand for these WRZs is to be provided from the Preferred Approach for SA9, the GDA. Therefore, the Preferred Approach for SA9 is to be increased from 183 Ml/d output capacity to 266 Ml/d output capacity.

8.3 Combination 2 & 3 Regional Approaches without Transfers

As outlined in Section 8.1, for the purposes of the RWRP-EM, we have also looked at two (2) alternative Regional Approaches that do not allow Cross Study Area transfers. These Approaches are:

- Combination 2 - Regional Approach One without Transfers
    - This approach retains the NSS as the Preferred Approach for SA9; however, it utilises Local Options instead of Study Area transfers. These Local Options are identified in each of the Technical Appendices for Study Area 1-8.
- Combination 3 - Regional Approach Two without Transfers
    - This approach considers a scenario where the Preferred Approach for SA9 does not progress and an alternative option, which comprises a Desalination option, is considered for SA9. This approach does not support regional transfers. Study Areas 1-8 are supplied by Local Options.

The difference between the Regional Approach with transfers compared to the Regional Approaches without Transfers are outlined in Table 8.4 below.

Table 8.4 Comparison of Regional Approaches

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Avoca Ballinaclash Public Supply	Decommission existing WTP and abstraction from the River Avonbeg and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and abstraction and provide additional supply from a new SW abstraction from the River Avoca. (+111m^3/day)	Maintain and upgrade existing WTP and abstraction and provide additional supply from new a SW abstraction from the River Avoca. (+111m^3/day)
Redcross Conary Public Supply	Decommission existing WTP and local GW abstraction and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and increase existing GW abstraction. (+165m^3/day)	Maintain and upgrade existing WTP and increase existing GW abstraction. (+165m^3/day)
Ballinteskin Public Supply	Decommission existing WTP and local GW abstraction and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and increase GW abstraction. (+21m^3/day)	Maintain and upgrade existing WTP and increase GW abstraction. (+21m^3/day)
Ballinapark Public Supply	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and Increase GW abstraction (+20m^3/day)	Maintain and upgrade existing WTP and Increase GW abstraction (+20m^3/day)

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Rathdrum Public Supply	Decommission existing WTP and abstraction from the Mill Stream and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and New SW abstraction and New WTP from the River Avonmore (+744m^3/day)	Maintain and upgrade existing WTP and New SW abstraction and New WTP from the River Avonmore (+744m^3/day)
Barndarrig Public Supply	Decommission existing WTP and abstraction from a local GW source and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and Increase GW abstraction (+66m^3/day)	Maintain and upgrade existing WTP and Increase GW abstraction (+66m^3/day)
Laragh Annamoe Public Supply	Decommission existing WTPs and abstractions from a local GW source and the River Glenmacnass and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTPs and increase SW abstraction from the River Glenmacnass (+90m^3/day)	Maintain and upgrade existing WTPs and increase SW abstraction from the River Glenmacnass (+90m^3/day)
Hacketstown	Decommission existing WTP and abstraction from the River Derreen and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and abstractions and new GW abstraction local to the existing WTP (+112m^3/day)	Maintain and upgrade existing WTP and abstractions and new GW abstraction local to the existing WTP (+112m^3/day)
Dunlavin Public Supply	Decommission existing WTP and GW abstraction and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and new GW abstraction local to the existing WTP (+187m^3/day)	Maintain and upgrade existing WTP and new GW abstraction local to the existing WTP. (+187m^3/day)
Hollywood Donard Public Supply	Decommission existing WTP and GW abstraction and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and new GW abstraction local to the existing WTP. (+191m^3/day)	Maintain and upgrade existing WTP and new GW abstraction local to the existing WTP. (+191m^3/day)
Navan-Midmeath	Decommission existing WTPs and SW abstractions from the River Boyne and the River Blackwater and provision of a network connection to allow supply of full demand from GDA.	Maintain and upgrade existing WTP and increase existing SW abstraction from the River Boyne for the Kilcarn WTP. (+2,918m^3/day)	Maintain and upgrade existing WTP and increase existing SW abstraction from the River Boyne for the Kilcarn WTP. (+2,918m^3/day)

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
South Louth East Meath	Maintain Staleen, Dunshaughlin, Kiltrough and Curragha WTPs and their associated abstractions. Decommission Rath WTP and the associated local GW abstraction and provision of a network connection to allow supply of part demand from GDA.	Maintain existing WTPs and abstractions. Increase existing abstraction from the River Boyne and WTP capacity at Staleen WTP. Pump Treated Effluent from Drogheda WwTW downstream of Staleen abstraction as compensate flow to mitigate impact of increasing abstraction. (+13,057m^3/day)	Maintain existing WTPs and abstractions. Increase existing abstraction from the River Boyne and WTP capacity at Staleen WTP. Pump Treated Effluent from Drogheda WwTW downstream of Staleen abstraction as compensate flow to mitigate impact of increasing abstraction. (+13,057m^3/day)
Kells-Oldcastle	Decommission existing WTPs and SW abstractions from the Lough Bane and the River Blackwater and provision of network connection to allow supply of full demand from GDA.	Decommission existing WTPs and SW abstractions from the Lough Bane and the River Blackwater. New SW abstraction and WTP at Lough Ramor and provision of network to provide supply to the WRZ. (+5,491m^3/day)	Decommission existing WTPs and SW abstractions from the Lough Bane and the River Blackwater. New SW abstraction and WTP at Lough Ramor and provision of network to provide supply to the WRZ. (+5,491m^3/day)
Trim	Decommission existing WTP and SW abstraction from the River Boyne and provision of network connection to allow supply of full demand from GDA.	Increase SW abstraction from River Boyne and upgrade Trim WTP. (692 m^3/day)	Increase SW abstraction from River Boyne and upgrade Trim WTP. (692 m^3/day)
Athboy	Decommission existing WTPs and local GW abstractions and provision of network connection to allow supply of full demand from GDA.	Maintain existing WTPs and abstractions. New GW abstraction and associated WTP. (497 m^3/day)	Maintain existing WTPs and abstractions. New GW abstraction and associated WTP. (497 m^3/day)
Ballivor	Decommission existing WTPs and local GW abstractions and provision of network connection to allow supply of full demand from GDA.	Maintain existing WTPs and abstraction at Kilmurray WTP. Increase SW abstraction from Stoneyford River and treatment capacity at Earlsmill WTP. (+131 m^3/day)	Maintain existing WTPs and abstraction at Kilmurray WTP. Increase SW abstraction from Stoneyford River and treatment capacity at Earlsmill WTP. (+131 m^3/day)

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Kilmessan	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from GDA.	Increase existing abstraction and treatment plant capacity at Kilmessan WTP. (+141 m^3/day)	Increase existing abstraction and treatment plant capacity at Kilmessan WTP. (+141 m^3/day)
Carlow North	Maintain existing WTP and abstractions. Abstractions from the River Slaney and the River Burren to be reduced. Provision of network connection to allow supply of part demand from GDA.	Maintain existing WTP and abstractions. Abstractions from the River Slaney and the River Burren to be reduced. Increase output at Oak Park WTP with the provision of new GW abstraction. (+10,594 m^3/day)	Maintain existing WTP and abstractions. Abstractions from the River Slaney and the River Burren to be reduced. Increase output at Oak Park WTP with the provision of new GW abstraction. (+10,594 m^3/day)
Tullamore	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	New GW abstraction and increase output at the existing Arden WTP. (+6,620 m^3/day)	New GW abstraction and increase output at the existing Arden WTP. (+6,620 m^3/day)
Mountbolus PWS	Decommission two existing WTPs and local GW abstractions and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	New GW abstraction and increase output at the existing WTP. (+40m^3/day)	New GW abstraction and increase output at the existing WTP. (+40m^3/day)
Ballany	Decommission existing WTP and SW abstraction from Lough Lene and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain existing WTPs and abstraction from Lough Lene. New WTP and associated SW abstraction from Lough Sheelin. (+5,304 m^3/day)	Maintain existing WTPs and abstraction from Lough Lene. New WTP and associated SW abstraction from Lough Sheelin. (+5,304 m^3/day)

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Mullingar Regional	Decommission existing WTP and SW abstraction from Lough Owel and provision of network connection to allow supply of full demand from the NSS via the transfer Pipeline.	Decommission existing WTP and SW abstraction from Lough Owel Increased abstraction at Lough Ree and upgrade existing Athlone WTP to supply full demand to Mullingar. (+25,837 m^3/day)	Decommission existing WTP and SW abstraction from Lough Owel Increased abstraction at Lough Ree and upgrade existing Athlone WTP to supply full demand to Mullingar. (+25,837 m^3/day)
Clonard/ Abbeysfields Housing Estate	Decommission existing WTPs and local GW abstractions and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Increase GW abstraction to supply Deficit. (+46 m^3/day)	Increase GW abstraction to supply Deficit. (+46 m^3/day)
Longwood WS	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain existing WTP and abstraction and a new GW source. (+39 m^3/day)	Maintain existing WTP and abstraction and a new GW source. (+39 m^3/day)
Ardcarraig Clogherinkoe	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain existing WTP and increase GW abstraction. (+62 m^3/day)	Maintain existing WTP and increase GW abstraction. (+62 m^3/day)
Edenderry & Rhode	Decommission existing WTPs and local GW abstractions and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain existing WTPs and abstractions. New GW source to provide additional supply to Toberdaly WTP. (+4,646m^3/day)	Maintain existing WTPs and abstractions. New GW source to provide additional supply to Toberdaly WTP. (+4,646m^3/day)
Daingean	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Upgrade to existing WTP no increase in output required.	Upgrade to existing WTP no increase in output required.

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Walsh Island	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Upgrade to existing WTP no increase in output required.	Upgrade to existing WTP no increase in output required.
Ballymahon	Decommission existing WTP and SW abstraction from the River Inny and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain and increase existing WTP and SW abstraction from River Inny. (+1,110m^3/day)	Maintain and increase existing WTP and SW abstraction from River Inny. (+1,110m^3/day)
Enfield	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain and increase existing WTP and provide new GW abstraction. (+1,022m^3/day)	Maintain and increase existing WTP and provide new GW abstraction. (+1,022m^3/day)
Geashill	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain and increase existing WTP and provide new GW abstraction. (+124m^3/day)	Maintain and increase existing WTP and provide new GW abstraction. (+124m^3/day)
Dunkerrin / Moneygall	Decommission existing WTPs (4) and local GW abstractions and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Decommission 3 of the existing 4 WTPs (4) and increase GW abstractions at Jones Well WTP. (+400m^3/day)	Decommission 3 of the existing 4 WTPs (4) and increase GW abstractions at Jones Well WTP. (+400m^3/day)
Borrisokane	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the transfer pipeline.	Maintain and increase output at existing WTP by increasing GW abstraction. (+2 m^3/day)	Maintain and increase output at existing WTP by increasing GW abstraction. (+2 m^3/day)

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Cloughjordan	Decommission existing WTP and local GW abstraction and provision of network connection to allow supply of full demand from the NSS via the Transfer Pipeline.	Upgrade to existing WTP no increase in output required.	Upgrade to existing WTP no increase in output required.
Newport	Decommission existing WTPs and local GW abstraction and SW abstraction from the River Mulkear and provision of network connection to allow supply of full demand from the Birdhill WTP.	Maintains existing Newport WTP and existing SW abstraction from the River Mulkear. Decommission existing O'Gromans Well WTP and local GW abstraction. Provide new GW abstraction and WTP near Coolross. (+412 m^3/day)	Maintains existing Newport WTP and existing SW abstraction from the River Mulkear. Decommission existing O'Gromans Well WTP and local GW abstraction. Provide new GW abstraction and WTP near Coolross. (+412 m^3/day)
Killaloe	Decommission existing WTP and the two local GW abstractions and provision of network connection to allow supply of full demand from the Birdhill WTP.	Upgrade to existing WTP no increase in output required.	Upgrade to existing WTP no increase in output required.

WRZ	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
GDA WRZ	New SW abstraction from River Shannon at Parteen Basin, new WTP at Birdhill, and a transfer pipeline from the new Birdhill WTP to the GDA. (+266,000 m^3/day)	New SW abstraction from River Shannon at Parteen Basin, new WTP at Birdhill, and a transfer pipeline from the new Birdhill WTP to the GDA. (+183,000 m^3/day)	Combination 2 This combination includes; An option to abstract 50 Ml/d from the River Liffey at Islandbridge and provide treated WwTP effluent from Ringsend to downstream of the abstraction as compensation flow. An option to obtain 100Ml/d from an abstraction from the Irish Sea at a location north of the city. A number of smaller Options are also required to meeting the remaining 33 Ml/d Deficit. In summary, this combination includes the development of 9 separate additional projects and requires 3 new ground water abstractions and 6 new surface water abstractions and 1 abstraction from the Irish Sea.

While Table 8.4 outlines alternative Local Options considered for the 37 WRZs where the Preferred Approach is a Cross Study Area transfer, Table 8.5 provides a comparison of the existing abstractions maintained or required to be increased, and new abstractions required, with and without the Cross Study Area transfers. This impact is compared separately for surface water and groundwater abstractions in Figure 8.3 and Figure 8.4, respectively.

The comparison shows that the Cross Study Area transfers facilitate the decommissioning of a significantly greater number of existing abstractions; and include an additional four (4) decommissioned surface water abstractions where the existing abstraction is potentially greater than the estimated sustainable abstraction under the pending abstraction legislation[1].

Table 8.5 Summary of Abstractions for the Regional Approaches (37 Benefitting WRZs)

Abstraction Type	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Abstractions Decommissioned	33 GW abstractions 14 SW abstractions including 6 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction.	4 GW abstractions 2 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction.	4 GW abstractions 2 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction.
Abstractions Maintained	4 GW abstractions 4 SW abstractions	31 GW abstractions 16 SW abstractions	31 GW abstractions 16 SW abstractions
Increase Existing Abstractions	-	13 GW abstractions 7 SW abstractions	13 GW abstractions 7 SW abstractions
New Abstractions	1 SW abstraction from the River Shannon.	8 GW abstractions 5 SW abstractions including new abstraction from the River Shannon.	11 GW abstractions 11 SW abstractions including new abstraction from the River Shannon 1 abstraction from the Irish Sea.

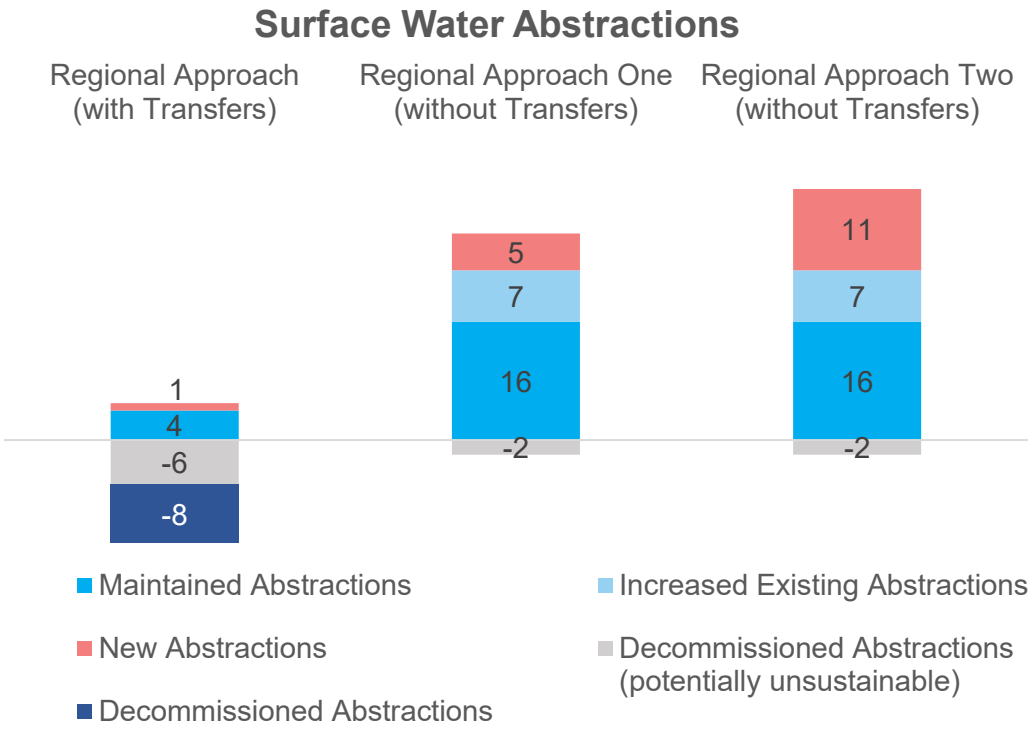


Figure 8.3 Comparison of Surface Water Abstraction Impact between Regional Approaches

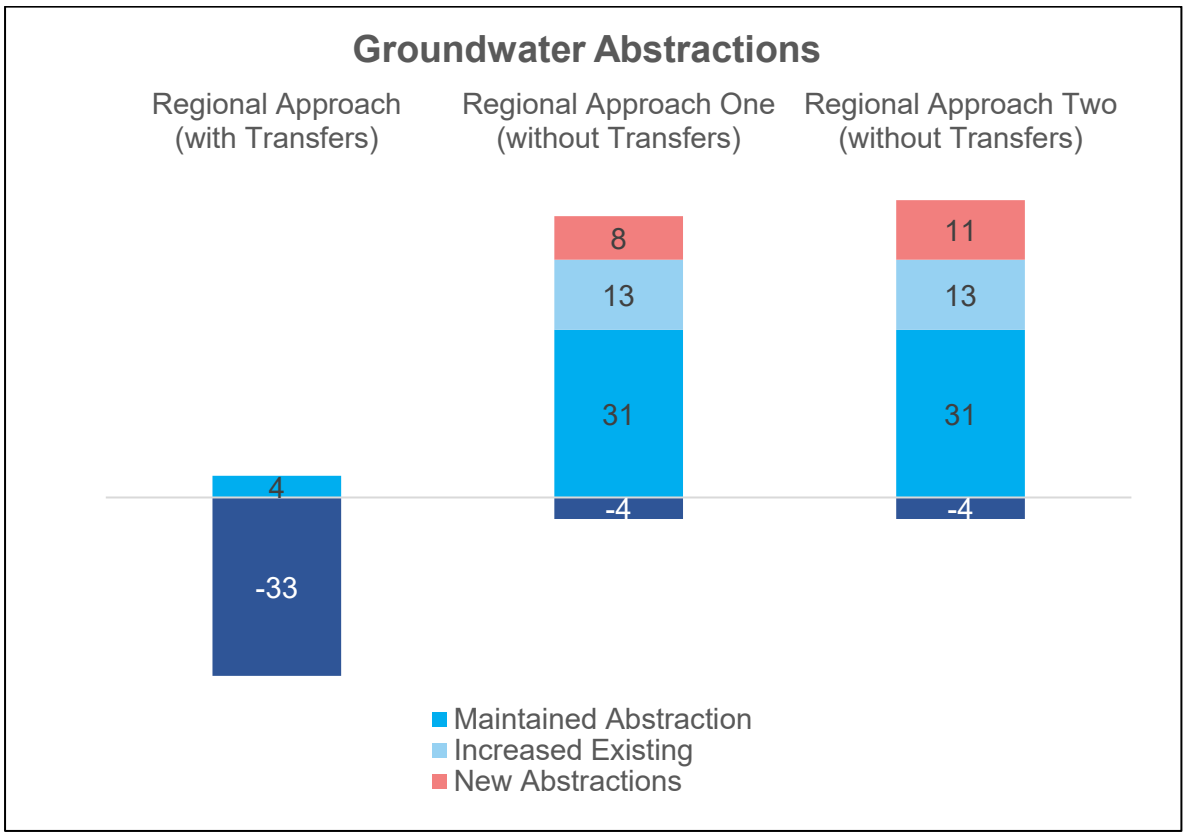


Figure 8.4 Comparison of Groundwater Abstraction Impact between Regional Approaches

For the remaining WRZs within the Regional Approach the Options remain the same across all combinations as the options will not influence the decision on the Preferred Approach. For example, the Preferred Approach for the Arklow Public Supply, Aughrim Annacurra Public Supply and Ballymorris Public Supply is a Study Area approach to interconnect these supplies and increase GW abstraction at Woodenbridge and treatment capacity at Arklow WTP. This Study Area approach is independent of the NSS option therefore will be the same across all combinations.

8.4 Approach Appraisal

The three (3) Combinations are then ranked against each of the six Approach Categories using the Economics of Balancing Supply and Demand (EBSD) model to generate Least Carbon, Least Cost, Best Environmental, Best AA, Most Resilient and Quickest Delivery Approaches. Table 8.6 summarises the relative scores of each combination for the six (6) Approach Categories.

The **EBSD** method determines an optimum combination of Options to address the future Need, balancing across the range of NWRP and SEA objectives outlined above. Further detail on the EBSD method is outlined in Section 8.3.7 of the Framework Plan

The Multi Criteria Assessment (MCA) included the following assessment criteria (as outlined in Section 8.2 of the Framework Plan):

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

The NPV Costs are based on four (4) criteria:

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

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

In accordance with Section 7.2.2 of this RWRP-EM, where Options or combinations of Options achieve similar, although not exactly identical scores under the six (6) Approach Categories, Irish Water takes a wider look at the comparable combinations/Options to consider which to categorise as the “Best” approach within each category. In particular, Irish

Water takes into account whether the option or combination of Options meets the SEA and Habitats objectives outlined in the Framework Plan. This is an example of the professional judgement from the multi-disciplinary teams, identified in Section 8.3.7.4 of the Framework Plan.

Combination 1, 2 and 3 had a very similar ranking under the Least Cost category. The Least Cost Approach is determined using an Irish Water Net Present Value (NPV) assessment tool. The NPV tool uses a strict set of requirements and is limited in what flexibility it offers. Therefore, as set out in further detail in Section 7.2.1 of this RWRP EM, where an Option or Combination of Options provide similar NPV costs; and in some circumstances, so as to ensure that no option is discounted at this early stage by reference only to "Least Cost" only, Irish Water has considered that all Options within a 5% NPV cost margin are in principle eligible to be identified as the "Least Cost" option. This approach recognises the desktop nature of the NPV assessment and the fact that the figures will almost certainly change at Project Level.

When we compare these three (3) combinations against each other to identify which should go forward as the Least Cost approach, Combination 1 scored significantly better against the Best AA and Environmental criteria and Combination 1 had the lowest NPV costs of the three (3) combinations. Combination 1 also scored better than the other combinations for the resilience criteria. Combination 2 performed better against the Quickest Delivery and Carbon criteria and is considered as the Best Approach of the three (3) combinations against these criteria. As Combination 1 scored best of the three (3) approaches against the Least Cost category and it also performed significantly better than the other combinations against the environmental and best AA criteria, Combination 1 was identified as the Preferred Least Cost option and was brought forward to the Approach Development Stage.

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" initiatives. 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.

Table 8.6 MCA Scores for Regional Approaches

Approach Category	Combination 1 Regional Approach With Transfers	Combination 2 Regional Approach One Without Transfers	Combination 3 Regional Approach Two Without Transfers
Least Cost	Best		Worst
Quickest Delivery	Worst	Best	
Best AA *no. of -3 scores against biodiversity	2 No. -3 scores Best	4 No. -3 scores	7 No. -3 scores Worst
Lowest Carbon	Worst	Best	
Most Resilient	Best		Worst
Best Environmental	Best		Worst

In accordance with the Options Assessment Methodology, the approaches which performed best in a category are then taken through and compared against each other using the 7-Step process in Figure 7.2 to generate the best value approach at Regional Level. Of the three (3) Regional Combinations, only Combinations 1 and 2 scored the "best" in an approach category. Combinations 1 and 2 were taken through the 7-step process, the outputs of which are summarised below.

Step 1 – We compared the Least Cost Approach against the Best AA Approach. The Least Cost Approach and the Best AA Approach are the same Approach. The Least Cost Approach was therefore retained at this stage.

Step 2 – We compared the Quickest Delivery Approach against the Least Cost Approach. The Quickest Delivery Approach does not deliver significantly better scores against the Quickest Delivery criteria and performs poorly against the environmental criteria compared to the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.

Step 3 - We compared the Least Cost against the Best Environmental Approach. The Least Cost Approach and the Best Environmental Approach are the same Approach - Combination 1. As outlined in Table 8.5, Combination 1 allows us to decommission a significant number of existing sources by the provision of one (1) new abstraction from a sustainable source. This is compared to Combinations 2 and 3 where existing sources are required to be maintained and supplemented by the provision of number of new sources. Therefore Combination 1 provides a significantly better environmental benefit, and it will assist in the achievement of objectives set out in the Water Framework Directive (WFD). It was therefore retained at this stage.

Step 4 – We compared the Least Cost against the Most Resilient Approach. The Least Cost Approach and the Most Resilient Approach are the same approach. The Least Cost Approach was therefore retained at this stage.

Step 5 - We compared the Least Cost Approach against the Least Carbon Approach. There was not a significant difference between the carbon costs for both approaches and the Least Carbon Approach performs poorly against the environmental criteria compared to the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.

Step 6 – A final assessment of the Least Cost Approach was completed against the Least Carbon, Best AA, Best Environmental and Most Resilient Approaches. The Least Cost Approach is the Best AA, Best Environmental and Most Resilient Approach. The Lowest Carbon and Quickest Delivery Approach did not perform significantly better against the carbon costs and Quickest Delivery criteria and performs poorly against the environmental criteria compared to the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.

Step 7 – The Least Cost Approach (which was also Best AA, Best Environmental and Most Resilient) was therefore selected as the Preferred Approach for the Water Resource and Study Area Levels.

Following this assessment, the Regional Approach with Transfers is confirmed as the Preferred Approach for the Eastern and Midlands Region. Table 8.7 summarises the Best Performing Combination against the six (6) Approach Categories.

Table 8.7 Best Performing Combination for each Approach Category.

Approach Categories	Best Performing Combination
Least Cost (LCo)	Regional Approach with Transfers (Combination 1)
Best Environmental (BE)	Regional Approach with Transfers (Combination 1)
Quickest Delivery (QD)	Regional Approach One without Transfers (Combination 2)
Most Resilient (MR)	Regional Approach with Transfers (Combination 1)
Lowest Carbon (LC)	Regional Approach One without Transfers (Combination 2)
Best AA (BA)	Regional Approach with Transfers (Combination 1)

Figure 8.5 compares the NPV costs for Combination 1 (the Preferred Approach) and Combination 2 (the Quickest Delivery and Lowest Carbon Approach). In terms of NPV Cost, both Approaches are comparable, however, the Regional Approach with transfers has the lowest NPV Cost) with the lowest total costs (CAPEX and OPEX) over the solutions lifetime.

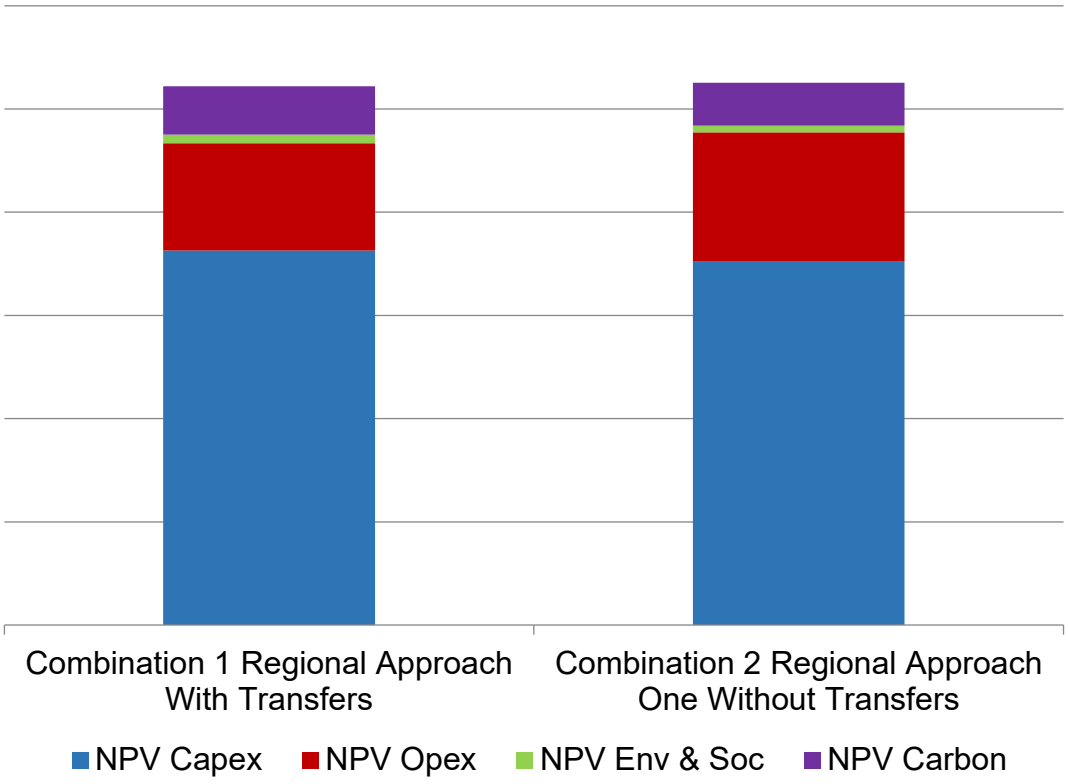


Figure 8.5 Comparison of NPV costs for Regional Approaches

8.5 The Regional Preferred Approach

The Regional Preferred Approach developed in this Plan provides a solution to supply a Deficit of 266 Ml/d to

- The GDA and 18 additional WRZs, which collectively would become the GDA Regional WRZ; and
- 18 WRZs via 4 transfers from the pipeline connecting the NSS to the GDA.

Therefore, 367 WRZs will be combined to form five (5) WRZs: Newport, North Tipperary, Tullamore, Mullingar Regional, and the Regional GDA WRZ. Due to the interconnected nature of these WRZs this system will be referred to as the Eastern and Midlands interconnected WRZs.

In addition to the transfers from the NSS, the overall Regional Preferred Approach comprises:

- Within Study Area Transfers, benefitting 17 WRZs. This includes the interconnection of eight (8) WRZs to the Limerick supply system (forming the Limerick Regional WRZ), and nine (9) WRZs interconnected to form four (4) new WRZs supplied from increased local groundwater sources;
- Local increased or new groundwater sources supplying 58 WRZs;
- Local increased or new surface water sources supplying five (5) WRZs; and
- WTP upgrades to reduce water Quality risks identified through our Barrier Assessments (including 18 WRZs that are not in supply Deficit).

The number of WRZs across the region is reduced from 134 to 89 through the development of the larger interconnected systems for the urban areas in the region. The systems are connected via 860 kilometres of trunk mains (>300 mm diameter) providing resilience to 50 existing supplies. The Regional Preferred Approach also involves:

- Upgrades to 131 existing water treatment plants, in terms of size and barrier performance.
- Four (4) new WTP.
- Decommissioning 71 WTPs.
- Maintaining 77 existing groundwater abstractions and 23 surface water abstractions.
- Abandoning 55 groundwater sources and 17 surface water sources, nine (9) of which may exceed sustainable abstraction thresholds.
- Thirty-three (33) new groundwater abstractions and one (1) new surface water abstraction (from the Shannon River).
- Increasing 30 existing groundwater abstractions and six (6) existing surface water abstractions.

Our approach to meeting the Needs across the Eastern and Midlands Region includes reducing leakage from the 2019 baseline (38% of regional demand) to 22% of regional demand. This represents a 45% reduction in leakage from 2019 to 2034. This is achieved through, pressure management, active leakage control, find and fix and asset replacement. Our leakage reduction commitments are described in Section 5 of this RWRP EM.

With the Regional Preferred Approach in place, sustainable surface water and ground water sources will provide 92% of the supply and will include:

- 78% from the new interconnected supply system with eight (8) WTPs, including the proposed New Parteen Basin WTP and abstractions from existing sources in the GDA, South Louth East Meath and Carlow North.
- 9% from the Limerick supply system via the Clareville WTP, securing supplies to smaller vulnerable WRZs in Limerick, Tipperary and Clare.
- 5% from surface water sources
- 8% of supply will be provided by local groundwater sources selected based on water availability, sustainability, natural storage and stable raw water quality.

Figure 8.6 presents the Regional Preferred Approach for the Eastern and Midlands Region in terms of new and upgraded WTPs and new mains. Figure 8.7 shows the surface water and groundwater supplies (excluding the proposed new Shannon River abstraction (NSS)).

The outcome of the Regional Preferred Approach, if all projects identified within it are delivered, is that

- All 89 WRZs in the Eastern and Midlands Region will meet a minimum 1 in 50 LoS during normal, dry, drought and winter conditions.
- All WRZs will include appropriate barriers to mitigate against water Quality risk.
- All WRZ’s will be Resilient with improved environmental Sustainability.

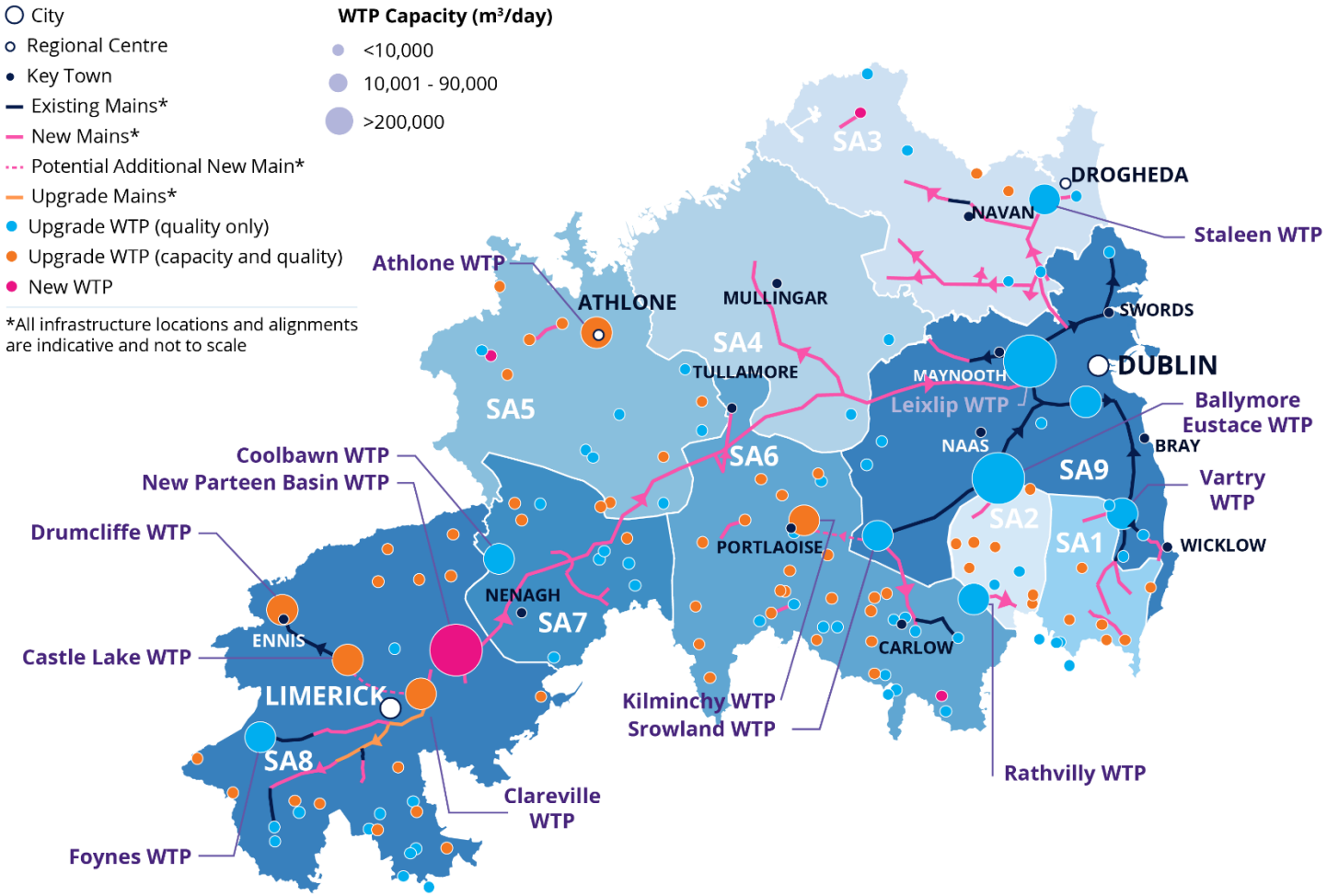


Figure 8.6 Regional Preferred Approach

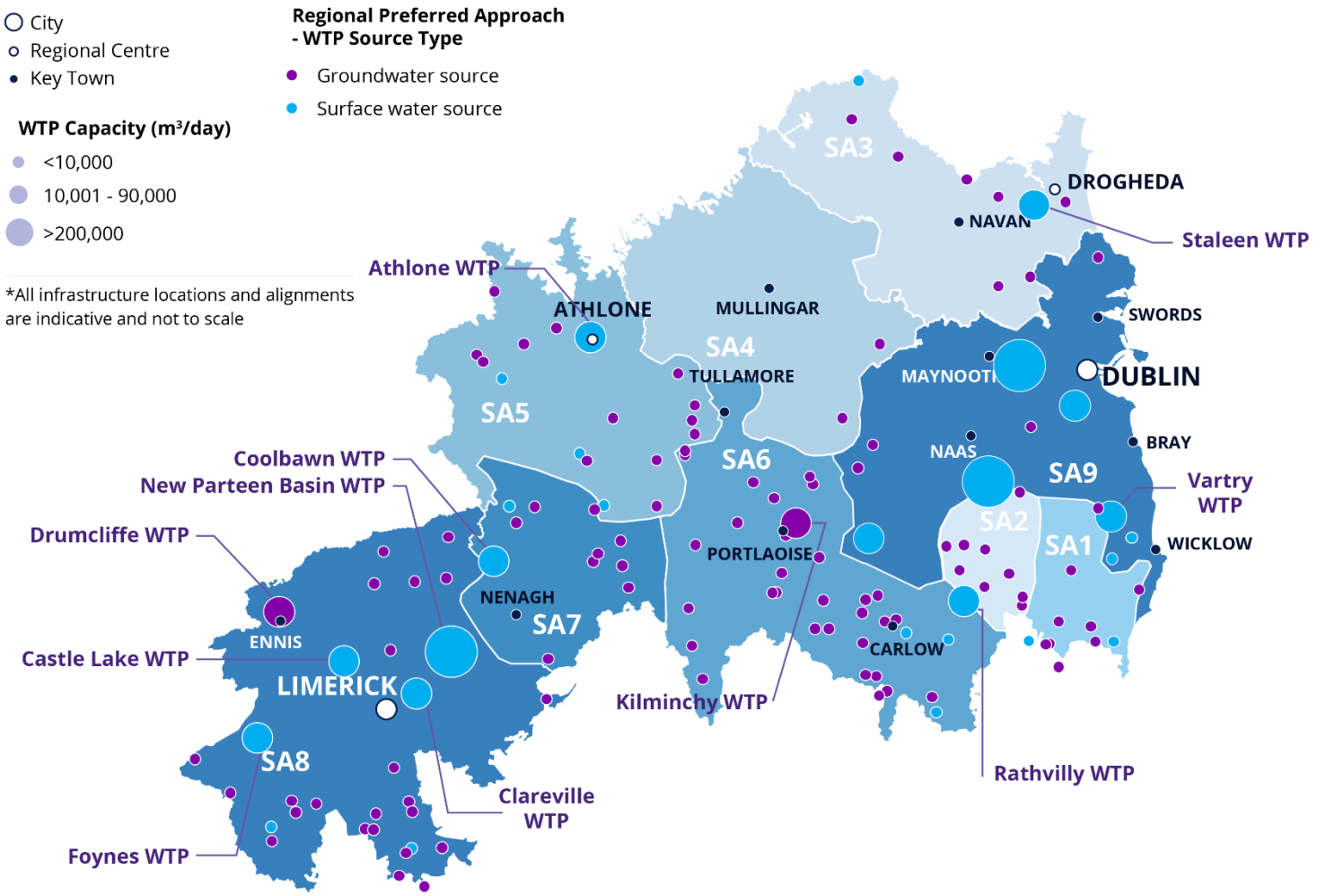


Figure 8.7 Regional Preferred Approach – Local Groundwater and Surface Water Supplies

8.6 Sensitivity Testing of Regional Approach

Our supply demand forecast and water Quality barrier deficit assessments have been developed using the application of best practice methods within the data available. We have identified areas where we will focus improvements in data to improve the certainty of our forecasts as discussed in Section 9 of this Plan. However, all long-term forecasts are subject to uncertainty. We have explored the sensitivity of our supply and demand forecasts to some of the key factors which influence them through a range of scenarios. This enables us to test the sensitivity of the Regional Preferred Approach to changes in Need, to ensure that our decision making is robust and that the approach is adaptable. We describe the factors which have been considered in Chapter 8 of the Framework Plan. In summary we test our Regional Preferred Approach against the following questions:

- What if the Deployable Output (DO) from existing supplies is reduced based on sustainability limits required by new water regulation and abstraction legislation resulting in a larger supply demand balance Deficit?
- What if climate change impacts on our existing supplies are greater than anticipated?
- What if our forecasts overestimate projected Demand and expected demand growth does not materialise resulting in a smaller supply demand balance Deficit?
- What if we are able to reduce leakage below SELL within the timeframe of the Plan resulting in lower Needs?
- What if leakage targets are not met?

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.

A summary of the adaptability criteria and analysis we have undertaken for the Regional Approach is shown in Table 8.8.

Table 8.8 Uncertainty Analysis

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
Sustainability	Moderate/High (current abstractions are large compared to the water bodies from which they are abstracted)	+115 Ml/d	**The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the supply demand balance Deficit.** Although the likelihood of this scenario is moderate/high based on a desktop assessment of our existing abstractions, potential impacts may be mitigated against by optimising our operations on a more environmentally sustainable basis across the range of supplies. For example, with the Preferred Approach in place we will be able to connect supplies across the country. The interconnection provides the operational flexibility to change output from our connected WTPs to manage our sources as rainfall patterns vary across the country. Therefore, the Preferred Approach remains the optimal solution.
Climate Change	High (international climate change targets have not been met)	+18 Ml/d	**The impact of increased climate change scenarios would impact our existing supplies and result in decreased water availability at certain times of year**. Although the likelihood of this scenario is high based on climate change adaptation to date, potential impacts may be mitigated against by optimizing our operations on a more environmentally sustainable basis across the range of supplies. The Preferred Approach for the Eastern and Midlands Region will allow us to relieve pressure on these existing sources at risk by supplying from more resilient new surface water and groundwater sources (e.g. the NSS). The Preferred Approach involves the decommissioning of several river

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
			and small lake sources that are most vulnerable to the impacts of increased climate change scenarios in the future. Therefore, the Preferred Approach remains the optimal solution.
Demand Growth	Low/Moderate (growth has been based on Government policy documents)	-53 Ml/d	**The impact of lower than expected growth would reduce the supply demand balance Deficit and the overall Need requirement.** The supply demand balance Deficit is driven in equal parts by limitations in existing supplies, the Reliability of the overall supply and demand. Therefore, even if there were no demand growth in the region, there is still a need for a new source of water and the Preferred Approach remains the optimal solution.
Leakage Targets	Moderate (the distribution network in the region is extensive at nearly 10,000 kilometres)	+158 Ml/d	**The impact of lower than expected leakage savings would increase the supply demand balance Deficit and the overall Need requirement**. Due to the length and condition of our networks, we could potentially not meet leakage targets in the timeframes set out. However, as Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets as opposed to accepting lower targets.

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
Leakage Targets	Low (Existing leakage targets of 20% leakage in WRZ where demand is greater than 1.5 Ml/d are ambitious)	-139 Ml/d	**The impact of reducing leakage to 10% of Total Demand across all WRZs would reduce the supply demand balance Deficit and the overall Need requirement.** The supply demand balance Deficit is driven in equal parts by limitations in existing supplies, the Reliability of the overall supply and demand. Therefore, even if 10% leakage targets were achieved, there is still a need for a new source of water and the Preferred Approach remains the optimal solution.

Based on the sensitivity assessment, the Regional Preferred Approach is highly adaptable to a broad range of future scenarios, and therefore represents 'no regrets' infrastructure.

8.7 Benefits of the Regional Preferred Approach

While the Regional Preferred Approach with Transfers requires the development of a number of new sources, including a new abstraction from the NSS, the available yield from new sources has been determined based on conservative assessments to ensure that they are sustainable. These yields will be further assessed when the projects identified within the Regional Preferred Approach advance to Project Level. For example, the proposed abstraction required to provide the 266 Ml/d output to supply the 36 WRZs, including the GDA, is well within our estimate of sustainable abstraction available.

The impact of this new source is balanced by the fact that the Regional Preferred Approach facilitates the decommissioning of several unsustainable abstractions outlined in Section 7.4.3.

This contrasts with Combination 2 which reduces the required output from the NSS from 266 Ml/d to 183 Ml/d by abstracting 125 Ml/d additional supply from existing sources, increasing existing sources and new sources as outlined in Table 8.5. Table 8.5 also notes that the Combination 3 - Regional Approach Two without Transfers - requires a significantly greater number of new abstractions.

The Regional Approach with Transfers allows us to decommission a significantly greater number of existing abstraction and facilitates the decommissioning of an additional four (4) surface water abstractions, where the existing abstraction is assessed to be potentially greater than the estimated sustainable abstraction under the proposed new abstraction legislation. Therefore, the Preferred Approach promotes sustainable abstraction and reduces

the risk to public supplies resulting from the implementation of the proposed new abstraction legislation.

8.8 Summary

The Regional Preferred Approach considers, at a Plan Level, what projects/solutions might work best to meet the overall Deficit in the Eastern and Midlands Region. Taking a holistic view of the region presents opportunities to improve the sustainable management of our water resources and increase operational flexibility and resilience.

The approach development process at Study Area Level, as outlined in Section 7, identifies a number of locations where a supply from outside the Study Area is likely to represent a better solution than relying on local supply sources. The Regional Preferred Approach builds upon the opportunities offered by the New Shannon Source – the Preferred Approach for SA9 - and allows Irish Water to move away from numerous dispersed, local, less sustainable water supply systems.

The robust option development and assessment process identified the Regional Approach with Transfers as the 'Best Value' regional solution to address the water supply Needs of the Eastern and Midlands Region. When compared against the Regional Approaches without Transfers, the Regional Approach with Transfers performs better in terms of four (4) of the six (6) Approach Categories. It was identified as the Least Cost, Best Environmental, Most Resilient and Best AA Approaches.

The Regional Preferred Approach developed in this Plan, provides a solution to supply a Deficit of 278 Ml/d to

- The GDA and 18 additional WRZs, which collectively would become the GDA Regional WRZ; and
- 18 WRZs via four (4) transfers from the pipeline connecting the NSS to the GDA.

These 37 WRZs will form five (5) WRZs, Newport, North Tipperary, Tullamore, Mullingar Regional and Regional GDA WRZ. Due to the interconnected nature of these WRZs this system will be referred to as the Eastern and Midlands interconnected WRZs.

The overall Regional Preferred Approach comprises:

- The transfers from the NSS, benefitting 37 WRZs (the Eastern and Midlands interconnected WRZs);
- Within Study Area Transfers, benefitting 17 WRZs, including the interconnection of eight (8) WRZs to the Limerick supply system (forming the new Limerick Regional WRZ) and nine (9) WRZs interconnected to form four (4) new WRZs supplied from local groundwater sources;
- Local new and increased groundwater sources supplying 58 WRZs;
- Local new and increased surface water sources supplying five (5) WRZs; and
- WTP upgrades to reduce water Quality risks identified through our Barrier Assessments (including 16 WRZs that are not in supply Deficit).

The projects and Options identified in the Regional Preferred Approach will be subject to their own planning and regulatory processes. As mentioned, the solutions identified in the NWRP will be delivered on a phased basis and will progress based on a risk-based

prioritisation of capital investment, allowing Irish Water to address Need accordingly. It will take a number of investment cycles to progress these projects and they may change in later iterations of the plan. Over time, the intention is to ensure the delivery of a more Sustainable, Resilient and cost-effective water supply service.

8.9 References

1. General Scheme for the Water Environment (Abstraction) Bill, approved by Government in September 2020. The Bill aligns abstraction licencing with the requirements of the WFD.