Autumn 2022

Regional Water Resources Plan–Eastern and Midlands

Strategic Environmental Assessment

Appendix H: Study Area 6 – Environmental Review

Tionscadal Éireann
Project Ireland
2040

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

Baseline data included in the RWRP-EM has been incorporated from numerous sources including but not limited to; National Planning Framework, Central Statistics Office, Regional Spatial and Economic Strategies, Local Authority data sets, Regional Assembly data sets and Irish Water data sets. Data sources will be detailed in the relevant sections of the RWRP-EM. 2019 was selected as the base year to align with the planning period (2019-2025) of the NWRP.

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1 Introduction and Background

1 Introduction and Background

This Study Area Environmental Review forms part of the SEA Environmental Report for the Regional Water Resources Plan (RWRP) for the Eastern and Midlands Region (referred to as the Regional Plan). The Regional Plan will include nine individual study area reviews (SA1-9) as appendices.

This Study Area 6 Environmental Review includes:

- Context for the study area Environmental Review;
- Environmental baseline context;
- Environmental assessment for the options screening process and feasible options;
- Assessment of the alternatives considered and the Preferred Approach;
- Cumulative effects assessment; and
- Recommendations for implementation, including mitigation and monitoring.

This Environmental Review summarises the environmental assessment undertaken for Study Area 6 within the Eastern and Midlands Region for the options and approaches considered and as outlined in the Study Area 6 Technical Report (RWRP-EM Appendix 6). This Environmental Review applies the Strategic Environmental Assessment (SEA) objectives and environmental assessment methodology set out in the NWRP Framework Plan (Framework Plan).

Environmental Reviews been undertaken for each study area and form Appendices to the SEA Environmental Reports for the Regional Plans which form Phase 2 of the National Water Resources Plan (NWRP). Phase 1 in the development of the NWRP was the preparation of the Framework Plan, which was adopted in Spring 2021 following SEA, Appropriate Assessment (AA) and extensive public consultation. The Framework Plan and supporting documentation are available at https://www.water.ie/projects/strategic-plans/national-water-resources/.

1.1 Options Assessment Methodology

The Options Assessment Methodology implemented as part of the RWRP-EM provides a framework to identify potential solutions to address identified need. The key stages of the process are illustrated in Figure 1.1 and summarised below:

1) Identifying need – based on SDB and/or Drinking Water Safety Plan Barrier Assessment;
2) Scoping of the study area (WRZs) – understanding the study area and the existing conditions of assets, supply and demand issues; as well as environmental constraints and opportunities;
3) Identifying potential options for consideration relevant to the study area;
4) Coarse screening – assessing the unconstrained options and eliminate any that will not be viable;
5) Further option definition, information collection and preliminary costing;
6) Fine screening – options assessment and scoring against the key criteria with further removal of options identified as unviable and development of feasible options for costing and scoring assessment update;
7) Approach appraisal – comparison and assessment of combinations of options identified to meet the predicted supply demand deficit to determine the Preferred Approach; and

8) Monitoring and Feedback – a process for monitoring the implementation of the plan and responding to changes to policy and guidelines and to information changes which will feed into the 5 year plan cycle and includes an annual review to identify actions required within the plan cycle.

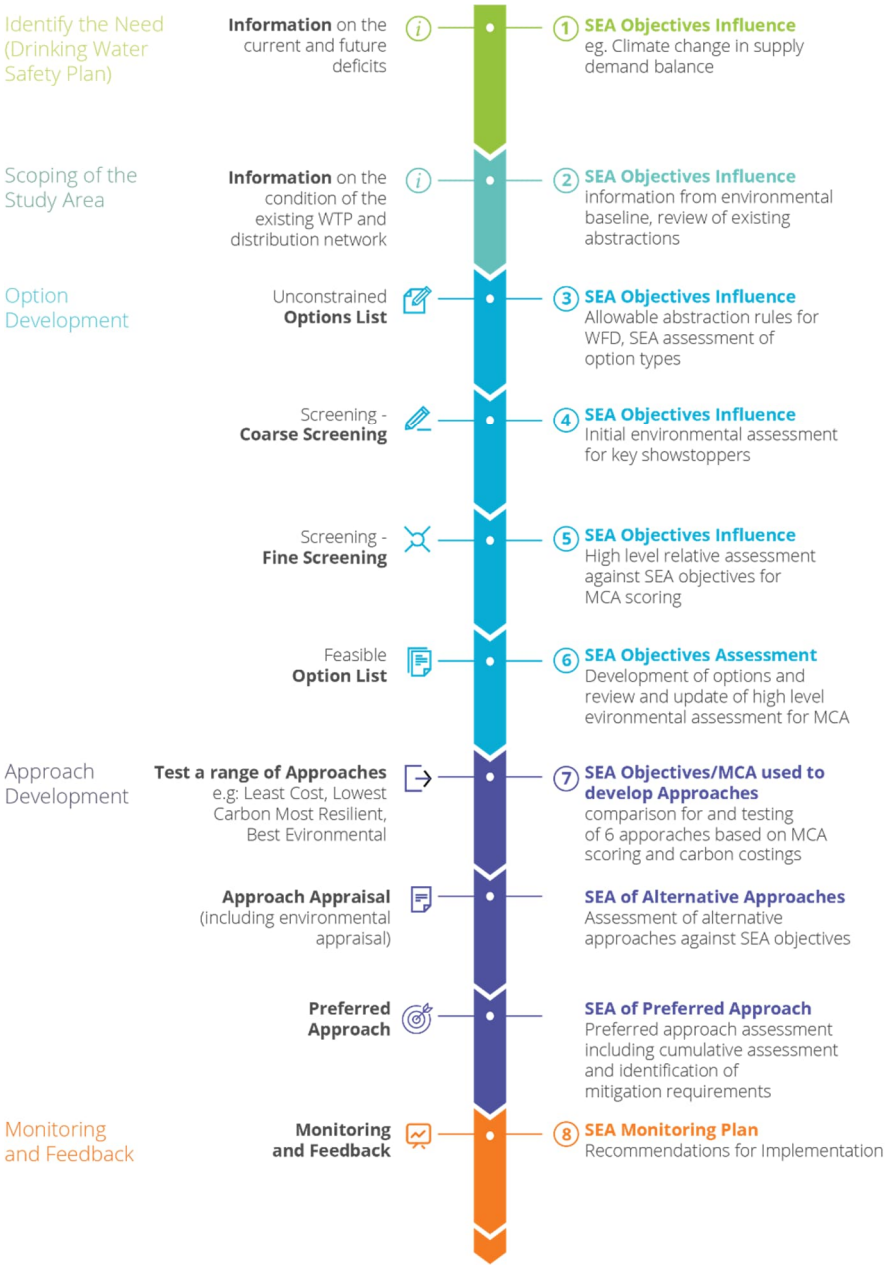

Figure 1.1 Option and Approach Development Process

1.2 Regional Plan Strategic Environmental Assessment

The four RWRPs, implementing Phase 2 of the NWRP, are each subject to a separate SEA process. The study area assessments follow the outline methodology established by the Framework Plan. The SEA Environmental Report was published for consultation alongside the draft Regional Plans for each of the four regions.

Each of the Study Area Environmental Reviews are presented as appendices to the SEA Environmental Reports and include:

- Introduction for SEA, Water Framework Directive (2000/60/EC) (WFD) and AA applied at the study area level;
- Environmental baseline context;
- Environmental assessment for the options screening process and feasible options;
- Assessment of the alternatives considered and the Preferred Approach;
- Cumulative effects assessment between options within each study area and with other proposed developments in the study area; and
- Recommendations for implementation, including mitigation and monitoring.

1.3 Study Area: Strategic Environmental Assessment

The set of SEA objectives developed at the Phase 1 scoping stage have been refined and finalised following consultation (see Table 1.1). These objectives have been influenced by the plans, policies and programmes review, the baseline trends and pressures identified, and the scope of the assessment as defined in the Regional Plan SEA scoping report.

Table 1.1 SEA Objectives

SEA Topic	SEA Objective
Population, economy, tourism and recreation, and human health	Protect and, where possible, contribute to enhancement of human health and wellbeing and to prevent restrictions to recreation and amenity facilities in providing water services.
Water environment	Water quality and resources Prevent deterioration of the WFD status of waterbodies with regard to both water quality and quantity due to Irish Water's activities. Contribute towards the "no deterioration" WFD condition and, where possible, to the improvement of waterbody status for rivers, lakes, transitional and coastal waters, and groundwater to at least 'Good' status.
	Flood risk Protect and, where possible, reduce risk from ground water and surface water flooding as a result of Irish Water's activities.
Biodiversity	Protect and, where possible, enhance terrestrial, aquatic and soil biodiversity; particularly regarding European sites and protected species in providing water services.
Material assets	Minimise resource use and waste generation from, new or upgraded, existing water services infrastructure and

SEA Topic	SEA Objective
	management of residuals from drinking water treatment - to protect human health and the ecological status of waterbodies. Minimise impacts on other material assets and existing water abstractions.
Landscape and visual amenity	Protect and, where possible, enhance designated landscapes in providing water services.
Climate change	Climate change mitigation Minimise contributions to climate change emissions to air (including greenhouse gas emissions) as a result of Irish Water's activities.
	Climate change adaptation Promote the resilience of the environment, water supply and treatment infrastructure to the effects of climate change.
Cultural heritage	Protect and, where possible, enhance cultural heritage resources in providing water services.
Geology and soils	Protect soils and geological heritage sites and, where possible, contribute towards the appropriate management of soil quality and quantity.

The SEA informs the development of the approaches and is undertaken on the various alternative approaches considered and the Preferred Approaches identified, along with cumulative impact assessment and identification of 'in-combination' effects.

The Regional Plan SEA Environmental Report was completed only after all study area reports for the Eastern-Midlands region were available. At that point, Irish Water conducted an exercise as part of the development of the overall relevant Regional Plan to assess the cumulative and in-combination impacts of the Preferred Approaches identified for each study area within the Eastern Midlands region. The conclusions of that cumulative assessment are presented in the SEA Environmental Report for the Eastern Midlands region.

If appropriate, the Preferred Approach identified for SA6 will have been modified prior to finalisation of the Regional Plan Technical Report and Environmental Review to take into account the conclusions of that cumulative assessment and identification of in-combination effects. The SEA for each of the Regional Plans in turn includes a cumulative assessment of the Preferred Approaches identified in the Regional Plan, in combination with the effects of the Preferred Approaches for each other region (to the extent that data was available and recognising that each Regional Plan is at a different stage of development).

1.4 Study Area: Water Framework Directive

Requirements under the WFD to avoid deterioration in waterbody status or objectives has been incorporated into the allowable abstraction constraints for new option abstractions. WFD requirements are also included in the SEA objectives for the assessment (see Table 1.1). Baseline data in relation to

the WFD is presented in section 2.2.1 and a summary of the assessment for SA6 is provided in chapter 8 of this review.

1.5 Study Area: Appropriate Assessment

An Appropriate Assessment was required for the Framework Plan to comply with the EU Habitats Directive (92/43/EEC) and is relevant to development of the Regional Plans, including the component study areas.

AA issues will be addressed in a separate Natura Impact Statement (NIS) for the Regional Plan, which will support the overall AA process that Irish Water is required to carry out. Habitats Directive requirements have been integrated into the Framework Plan options development process and conclusions from the AA for SA6 are provided in chapter 9 of this review.

1.6 Study Area 6

The Eastern and Midlands Region is subdivided into nine study areas based on WFD catchment and WRZ boundaries within the region. This Appendix reports on SA6, the location of SA6 in relation to the Eastern and Midlands Region is shown in Figure 1.2.

Study Area 6 lies within the counties of Carlow, Kildare, Kilkenny, Laois, Tipperary, Offaly, Westmeath, Wexford and Wicklow and its total area is approximately 3,027 km^2. The principal settlements (with a population of over 10,000) within SA6 are Carlow, Portlaoise and Tullamore (CSO, 2016a), as shown in Figure 1.3.

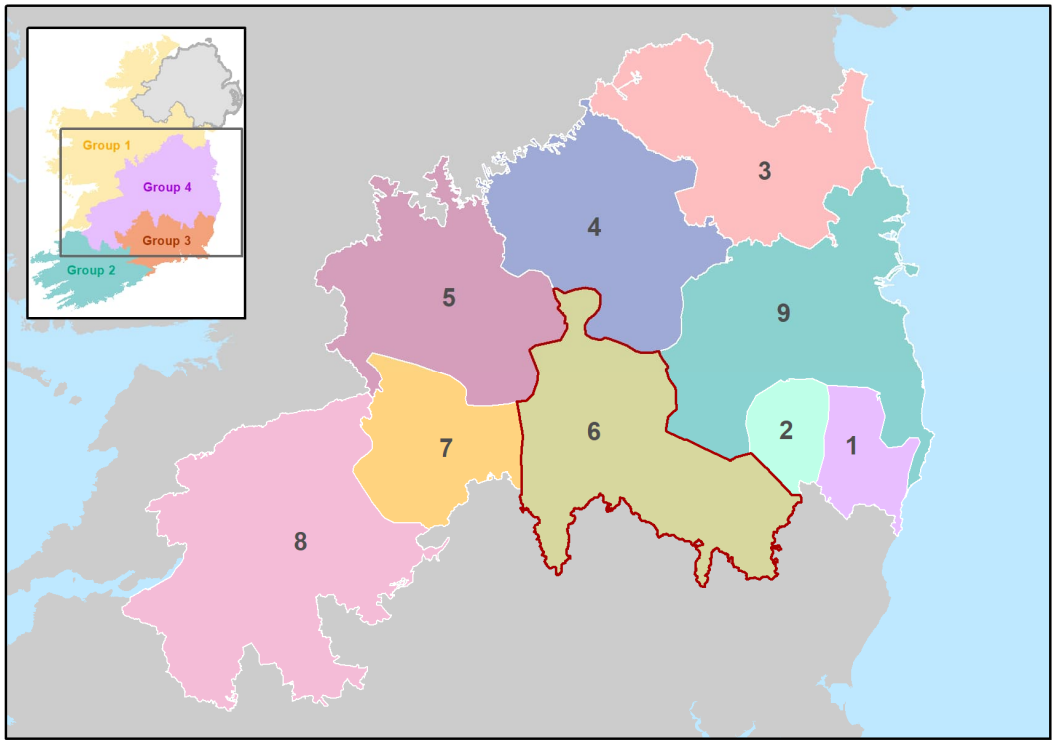

Figure 1.2 Eastern and Midlands Region Study Areas

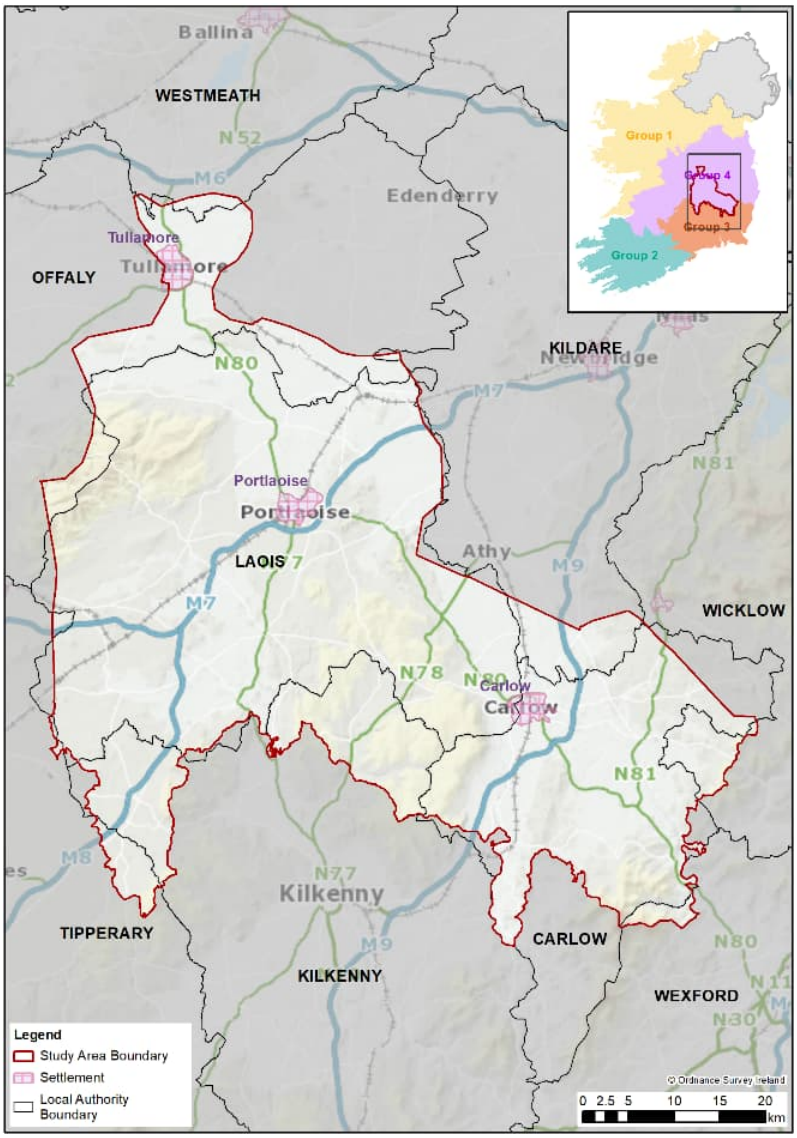

Figure 1.3 Study Area 6

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Study Area 6 Environmental Baseline Context

2 Study Area 6 Environmental Baseline Context

This chapter provides environmental baseline information for SA6 regarding the following key environmental topics in the SEA:

- Population, Economy, Tourism and Recreation, and Human Health;
- Water Environment;
- Biodiversity, Flora and Fauna;
- Material Assets;
- Landscape and Visual Amenity;
- Air Quality and Noise;
- Climate Change;
- Cultural Heritage;
- Geology and Soils; and
- Summary of Key Issues and Trends over the Plan Period within the study area.

The baseline environment considers key indicators characterising the current situation in the study area and how these aspects are likely to develop over the Framework Plan's planning period. This includes issues relating to pressures on the environment or the sensitivity of the environment to change. This chapter is intended to support and add to the baseline environmental information for the Regional Plans SEA Environmental Report, as context for the option appraisal and programme selection.

The baseline assessment also addresses the environmental aspects of Stages 1 and 2 of the options assessment methodology:

- Stage 1 Identifying need – based on SDB and/or Drinking Water Safety Plan Barrier Assessment; and
- Stage 2 Scoping of the study area (WRZs) – understanding WRZ's within the study area and the existing conditions of assets, supply and demand issues as well as environmental constraints and opportunities.

2.1 Population, Economy, Tourism and Recreation, and Human Health

2.1.1 Population

Table 2.1 provides a general overview of the WRZ's population and the projected percentage change in population between 2019 and 2044. The largest projected increases in population are expected in the WRZs Carlow North (0100SC0001), Portlaoise (1600SC0001) and Tullamore (2500SC0002). The estimated population currently living in each WRZ has been based on the 2016 Census data. The 2016 population was assigned to District Metering Areas (DMAs) by mapping the Central Statistics Office (CSO) data to DMA boundaries. Irish Water have projected the 2016 population forward to 2019 using the growth projections in the National Planning Framework, updated information from the Regional Spatial and Economic Strategies, and Local Authority Planning sections (where available).

Table 2.1 Overview of the Population within the WRZs of SA6

WRZ Reference Number and Name	Total Population Served (2019)*	% Population Change 2019-2044*
0100SC0001 - Carlow North	37,872	+24.9%

WRZ Reference Number and Name	Total Population Served (2019)*	% Population Change 2019-2044*
0100SC0002 - Leighlinbridge	1,165	+15.3%
0100SC0003 - Old Leighlin	83	+15.3%
0100SC0004 - Bilboa	37	+15.3%
0100SC0008 - Bagenalstown	2,956	+15.3%
0100SC0011 - Carlow Central Regional	3,797	+15.3%
1500SC0006 - Urlingford-Johnstown PWS	1,769	+15.3%
1500SC0009 - Clogh-Castlecomer	3,780	+15.3%
1500SC0018 - Galmoy Rathdowney PWS	1,685	+15.3%
1600SC0001 - Portlaoise	24,325	+24.5%
1600SC0003 - Rosenallis	188	+15.3%
1600SC0004 - Mountmellick	5,150	+15.3%
1600SC0005 - Portarlington	10,636	+15.3%
1600SC0006 - Arles	111	+15.3%
1600SC0007 - The Strand	6	+15.3%
1600SC0008 - Coolanaugh PWS	28	+15.3%
1600SC0010 - Borris In Ossory	613	+15.3%
1600SC0011 - Camross PWS	39	+15.3%
1600SC0014 - South East Regional PWS	4,769	+15.3%
1600SC0015 - Swan PWS	1,500	+15.3%
1600SC0016 - Mountrath	3,600	+15.3%
1600SC0017 - Abbeyleix South	569	+15.3%
1600SC0018 - Ballinakill	676	+15.4%
1600SC0019 - Durrow	1,309	+15.4%
1600SC0020 - Abbeyleix North	1,870	+15.3%
1600SC0021 - Ballyroan	1,281	+15.3%
2500SC0002 - Tullamore	16,700	+24.6%
2500SC0013 - Mountbolus PWS	152	+15.3%

WRZ Reference Number and Name	Total Population Served (2019)*	% Population Change 2019-2044*

*The estimated population has been based on the 2016 Census data. Irish Water have projected the 2016 population forward to 2019 using the growth projections in the National Planning Framework, Regional Spatial and Economic Strategies, and Local Authority Planning sections

2.1.2 Economy and Employment

SA6 lies within both the Midland region and the South-East region of Ireland. SA6 had a below average household disposable income per person in 2016 (CSO, 2016b), and an unemployment rate of 10.1% in the Midlands and 6.4% in the South-East region of the country (CSO, 2017a).

Population increase and expected economic growth has meant that housing and sustainable urban development have been made a priority for the National Development Programme; therefore, to supply the demand there is an aim to increase housing stock. The number of new dwellings completed in Q3 2020 was 214 for the Midland region and 441 for the South-East region (CSO, 2020a).

2.1.3 Tourism and Recreation

Tourism in SA6 has an important role, particularly in rural areas, with the National Planning Framework (NPF) stating that tourism is a key aspect of rural job creation now and in the future (Government of Ireland, 2018). The county of Laois has been described as an "*outdoor enthusiasts paradise*" with emphasis also placed on the county's cultural and historical attractions (Laois Tourism, 2020); the county of Carlow also emphasises these aspects (Carlow Tourism, 2020).

Additionally, the study area is located within Ancient East, which is part of a tourism development strategy that covers the South, East and part of the Midlands, and emphasises the importance of historic sites in the area (National Tourism Development Authority, 2016).

Ireland's natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport (2019). For SA6, the nature reserves of note are Slieve Bloom Mountains (also a National Park), Timahoe Esker, Grantstown Wood and Grantstown Lough, and Coolacurragh Wood. Rivers, loughs and coastal areas all make an important contribution to tourism and recreational opportunities and support important fisheries.

2.1.4 Human Health

Table 2.2 provides well-being indicators for the Midlands and South East regions within Ireland. Improvements in air quality, access to good quality drinking water and participation in recreational activities can all have a positive influence on human health and well-being.

Table 2.2 Well-Being Indicators for the Midlands and South East Regions within Ireland

Life Expectancy (CSO, 2017b)	Participation in Sports, Fitness or Recreational Physical Activities (% of Persons Aged 15+) (CSO, 2020b)	Air Quality (EPA, 2020a)
Midlands: Male: 77.2 Female: 81.5	**Midlands:** 47%	Good

Life Expectancy (CSO, 2017b)	Participation in Sports, Fitness or Recreational Physical Activities (% of Persons Aged 15+) (CSO, 2020b)	Air Quality (EPA, 2020a)
South-East Male: 76.8 Female: 81.7	**South-East:** 44%	Good

A key issue for public health is reliable access to good quality drinking water. Regulated water service providers have to ensure appropriate standards of supply and be able to cope with drought conditions, peak events, and maintenance of assets. This requires adequate reserve capacity in Irish Water's supplies to provide a 1 in 50 level of service. At present, not all supplies within this study area provide the required levels of reserve capacity. Due to the limited historical monitoring of these supplies, particularly in relation to groundwater, this will need to be studied further. Table 2.3 lists the areas supplied by the Water Treatment Plants (WTPs) in SA6.

Table 2.3 Areas Supplied by the WTPs in SA6

WTP	WRZ	Local Authority Supplied
Rathvilly WTP, Sion Cross WTP, Oak Park WTP, Tullow WTP and Derrymoyle WTP	0100SC0001 - Carlow North	Carlow
Leighlinbridge WTP	0100SC0002 - Leighlinbridge	Carlow
Old Leighlin WTP	0100SC0003 - Old Leighlin	Carlow
Bilboa WTP	0100SC0004 - Bilboa	Carlow
Bagenalstown WTP and Royal Oak WTP	0100SC0008 - Bagenalstown	Carlow
Mountfinn WTP	1500SC0006 - Urlingford-Johnstown PWS	Kilkenny
Clogh Castlecomer WTP, Nannys Well WTP and Gorteen WTP	1500SC0009 - Clogh-Castlecomer	Kilkenny
Glosha/Galmoy WTP	1500SC0018 - Galmoy Rathdowney PWS	Laois
Kilminchy WTP and Meelick WTP	1600SC0001 - Portlaoise	Laois
Rosenallis WTP	1600SC0003 - Rosenallis	Laois
Derryguille WTP	1600SC0004 - Mountmellick	Laois
Le Bergerie WTP and Lough WTP	1600SC0005 - Portarlington	Laois
Arles WTP	1600SC0006 - Arles	Laois
The Strand WTP	1600SC0007 - The Strand	Laois
Coolenaugh WTP	1600SC0008 - Coolanaugh PWS	Laois

WTP	WRZ	Local Authority Supplied
Donaghmore WTP	1600SC0010 - Borris In Ossory	Laois
Camross WTP	1600SC0011 - Camross PWS	Laois
Kyle WTP	1600SC0014 - South East Regional PWS	Laois
Swan WTP	1600SC0015 - Swan PWS	Laois
Cloonin Hill WTP, Knocks WTP and Drim WTP	1600SC0016 - Mountrath	Laois
Five Wells WTP	1600SC0017 - Abbeyleix South	Laois
Fermoyle (Ballinakill) WTP and Cloghoghue WTP	1600SC0018 - Ballinakill	Laois
Castle Durrow Convent WTP	1600SC0019 - Durrow	Laois
Aughafeerish WTP	1600SC0020 - Abbeyleix North	Laois
Ballyroan WTP	1600SC0021 - Ballyroan	Laois
Clonaslee WTP and Arden WTP	2500SC0002 - Tullamore	Laois
Newgate Well WTP and Reservoir WTP	2500SC0013 - Mountbolus PWS	Laois
Raheenleigh WTP	0100SC0011 - Carlow Central Regional	Carlow

Currently for day-to-day operations, twenty-five out of twenty-nine of the WRZs in the area have a current SDB deficit and twenty-five have a projected SDB deficit (based on a 'Do Minimum' approach – see section 4.5 for further clarification). However, under normal weather and demand conditions, the current deficit does not manifest as an interruption to supply for all WRZs.

Poor water quality can be linked to risks to health. Irish Water's Barrier Assessment identified forty of the forty two WTPs within the study area as being at high risk of failing to achieve the applicable Barrier Assessment standards in relation to bacteria and viruses (Barrier 1) and the effectiveness of Irish Water's protozoa removal processes (Barrier 3). The "quality need" identified through the Barrier Assessment is not an indicator of compliance with the Drinking Water Regulations. It is an assessment of the need to invest in areas of the Irish Water asset base through resource planning, to ensure that potential risks or emerging risks to supplies are addressed. Currently, there are no WRZs on the EPA Remedial Action List within SA6. Irish Water is currently progressing immediate corrective action in relation to a number of supplies in advance of the NWRP. Details of these are included in the SA6 Technical Report.

2.2 Water Environment

This topic covers geomorphology, WFD, flood risk, surface water quality and groundwater receptors. Figure 2.1 shows the water environment, including the WRZs, the WFD water catchment boundaries, the WTPs and the waterbodies in SA6.

Table 2.4 provides a summary of the WFD catchments within SA6.

Table 2.4 Catchments within SA6 (EPA, 2020b)

WFD Catchments	Total Catchment Area (km²)	Catchment Area within SA6 (km²)
Barrow	3,025	1,277
Lower Shannon (Brosna)	1,248	251
Lower Shannon (Little Brosna)	982	24
Nore	2,595	1,178

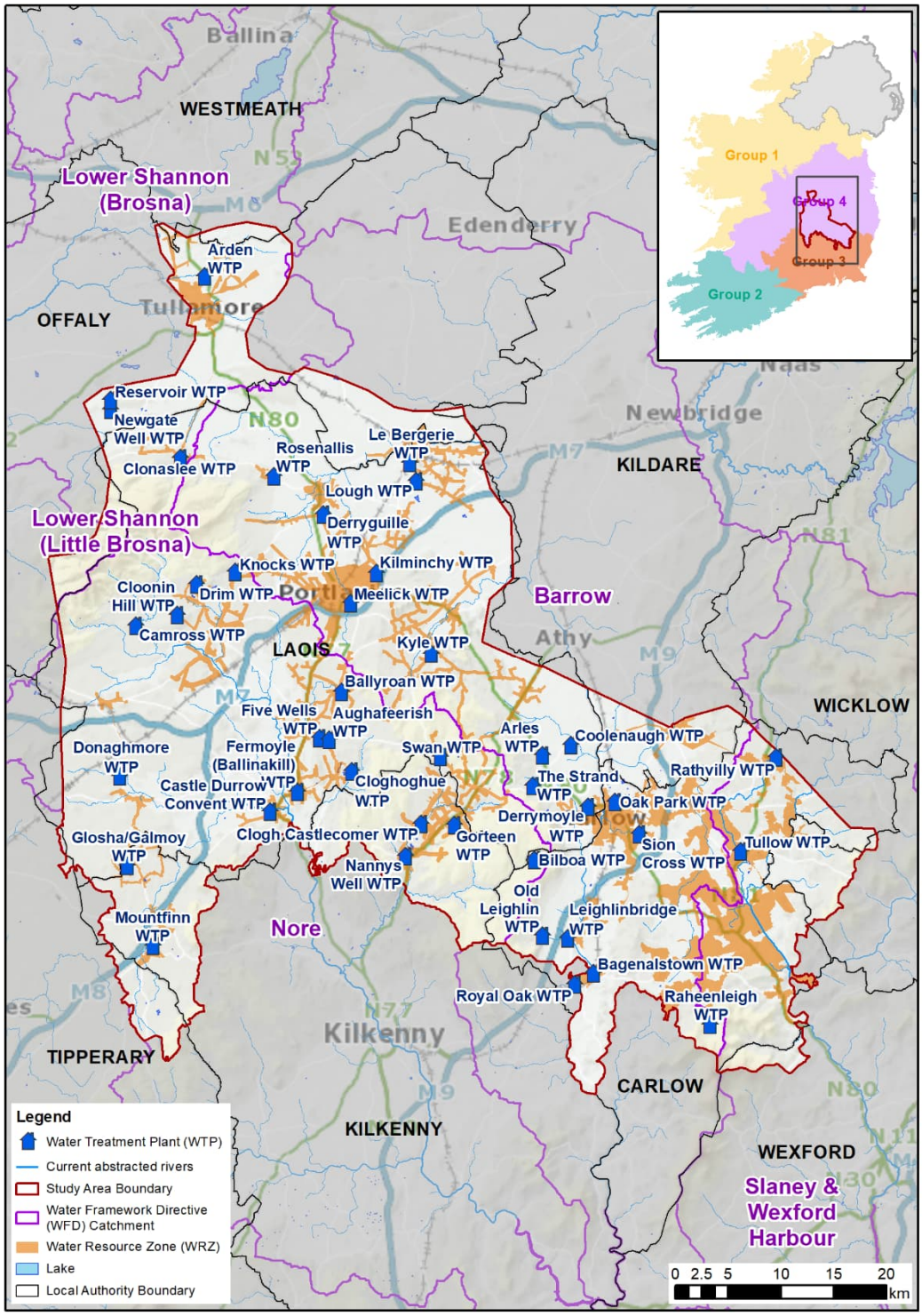

Figure 2.1 Water Environment of SA6

WFD Catchments	Total Catchment Area (km^2)	Catchment Area within SA6 (km^2)
Slaney & Wexford Harbour	1,981	299

2.2.1 Water Framework Directive

Under the WFD, Ireland must ensure that all waterbodies achieve 'Good' status by 2027. In addition, under the legislation, any modification to a WFD waterbody should not lead to deterioration in either the overall status or any of the WFD water quality parameters.

The General Scheme of the Water Environment (Abstractions) Bill 2018 (The Bill), to introduce abstraction licensing aligned to the WFD, was published in summer 2018. This legislation will set the amount Irish Water can take from the water supplies that it abstracts water from.

As there are very few long duration flow records for Irish Water's abstractions and for waterbodies within Ireland, Irish Water lacks comprehensive data to fully understand the impact of the new legislation on these sources. Information is not currently stored centrally as it was historically collected and collated by Local Authorities. Irish Water is building a telemetry system which will aid bringing all this data together, but this will take time. Therefore, improved monitoring and gathering better data is a priority.

On an interim basis, Irish Water has developed an initial desktop assessment based on available information (see SA6 Technical Report). Over the coming years, Irish Water will work with the environmental regulator, the EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of its groundwater sources.

To understand the potential impact of the Abstraction Legislation on the SA6 supplies, Irish Water has assessed its surface water abstractions and summarised the potential impact on the River Slaney (Rathvilly and Tullow), River Burren (Sion Cross and Raheenleigh), River Dinin (Castlecomer) and the River Clodiagh (Clonaslee). Based on this initial assessment, the volumes of water abstracted from the River Burren (Raheenleigh) and River Clodiagh (Clonaslee) may not meet sustainability guidelines during dry weather flows.

Irish Water has taken a conservative approach in identifying sustainable abstractions for new options (described in section 3.2) and has applied a sensitivity assessment that considers proposals against potential for future sustainability related reductions in volume (section 5.4).

The Department of Housing, Planning and Local Government's (2019a) public consultation document, regarding the significant water management issues, has been considered by Irish Water. Therefore, the pressures, and the relevant priority 'Areas for Action are provided below and in Table 2.7.

There are five WFD catchments in SA6 and the total number of surface and groundwater waterbodies within SA6 are provided in Table 2.5 below.

Table 2.5 WFD Waterbodies within SA6 (EPA, 2019b, 2019c, 2019d, 2019e and 2019f)

Waterbody Type	Water Catchments	Number of Waterbodies	Number of Waterbodies Rated Below Moderate
Rivers	Barrow	77	12
	Lower Shannon (Brosna and Little Brosna)	25	2

Waterbody Type	Water Catchments	Number of Waterbodies	Number of Waterbodies Rated Below Moderate
	Nore	62	8
	Slaney & Wexford Harbour	22	2
Lakes	Barrow	0	0
	Lower Shannon (Brosna and Little Brosna)	0	0
	Nore	0	0
	Slaney & Wexford Harbour	0	0
Transitional and Coastal	N/A	0	0
Groundwater	N/A	55	3

The predominant pressures, and the percentage of 'at risk' waterbodies impacted by them, in the latest catchment summaries (catchments.ie, 2021a, 2021b, 2021c, 2021d and 2021e) are:

- Barrow: Agriculture (75%) and Hydromorphology (31%);
- Lower Shannon (Brosna): Agriculture (56%) and Hydromorphology (38%);
- Lower Shannon (Little Brosna): Agriculture (80%);
- Nore: Agriculture (80%); and
- Slaney & Wexford Harbour: Agriculture (73%) and Other (including abstraction, waste and unknown anthropogenic) (22%).

According to the summaries, the following catchments also have waterbodies that are under significant pressure due to abstraction for water supply:

- Lower Shannon (Brosna) (catchments.ie, 2021b): Gorragh_010 (Tullamore Public Water Supply);
- Nore (catchment.ie, 2021d): Needleford Steam_010 (Mountrath No 1 Public Water Supply); and
- Slaney & Wexford Harbour (catchments.ie, 2021e): Kildavin Stream_010 (abstracting for two unnamed sand and gravel pits).

Table 2.6 includes a summary of the ‘at risk’ waterbodies within SA6.

Table 2.6 Summary of ‘At Risk’ Waterbodies in SA6 (EPA, 2019b, 2019c, 2019d, 2019e and 2019f)

Waterbody Type	Water Catchments	Number of Waterbodies Identified as ‘At Risk’	Surface Waterbodies Status ‘At Risk’ Due to Abstraction Pressure*
Rivers	Barrow	35	2
	Lower Shannon (Brosna and Little Brosna)	6	
	Nore	29	
	Slaney & Wexford Harbour	17	
Lakes	Barrow	0	0

Waterbody Type	Water Catchments	Number of Waterbodies Identified as 'At Risk'	Surface Waterbodies Status 'At Risk' Due to Abstraction Pressure*
	Lower Shannon (Brosna and Little Brosna)	0	
	Nore	0	
	Slaney & Wexford Harbour	0	
Transitional and Coastal	N/A	0	0
Groundwater	N/A	3	0
Total		**90**	**2**

* Based on Irish Water assessment of their current abstractions

To meet WFD objectives, it has been recognised that there is a need to prioritise and focus efforts to address issues through identifying 'Areas for Action'. The reasons for selection of the 'Areas for Action' within the sub-catchments of SA6 are listed in Table 2.7. Note that the 'Areas for Action' included in Table 2.7 are from the WFD cycle 2 River Basin Management Plan (RBMP), as the WFD cycle 3 RBMP was undergoing consultation at the time of writing.

Table 2.7 'Areas for Action' within SA6 (catchments.ie, 2021f)

Area for Action	Key Reasons for Selection
Derreen and Douglas (Kiltegan)	• Protected area objectives not met for Freshwater Pearl Mussel (19 catchments of S.I. 296 2009) • Build on WWTP upgrades at Hacketstown • Active community group • Three of the five water bodies are deteriorated waterbodies • One of the three deteriorated water bodies is a High Ecological Status objective water body • Three potential 'quick wins'
Slaney	• Building on planned Irish Water improvements at Rathvilly • Four deteriorated waterbodies • Failing protected area objective (salmon) • Water abstraction at Rathvilly • Three potential 'quick wins'
Portarlington	• Building on planned improvements at Portarlington WwTP (Barrow_080) • One deteriorated waterbody (Barrow_090) • Protected area objectives not met (Crayfish and salmonids) for two waterbodies (Barrow_080 and Barrow_090) • Community interest • One potential 'quick win'

Area for Action	Key Reasons for Selection
Athy Stream	• Potential pilot project to examine high nitrates and siltation from tillage (Athy_020) • Protected area objectives not met (Crayfish) • Athy_010 declined between 2010-2012 and 2013-2015 • One potential 'quick win'
Graney-Lerr	• Potential pilot project to examine nitrate sources from tillage • Addressing a large portion of the eastern Barrow catchment • Important Salmon run on this river • Castledermot tidy towns are very active, an interested community group
Mountain	• Two water bodies are failing to meet protected area objectives for Freshwater Pearl Mussel (19 of 27 catchments of S.I. 296 2009) • Important fish habitat • Recently formed community group • Strong local tidy towns • Native oak woodland at downstream end of the Mountain river • Woodland riparian scheme to improve riparian zone around the native woodland • Teagasc EIP looking at sheep farming practices • Building on completed and ongoing works by Blackstairs farming group • One deteriorated water body • One potential 'quick win'
Burren	• Flows into Carlow town - important for local amenity • Sub-catchment project • Building on improvement works completed by Inland Fisheries Ireland • One potential 'quick win' • One ‘At Risk’ High Ecological Status objective water body • One deteriorated water body
Dinin (South, Main and Muckalee)	• Active community groups in the area. • Important for salmon spawning • Three potential 'quick wins' • Three deteriorated waterbodies • One of the three deteriorated water bodies has a High Ecological Status objective
Owveg (Nore)	• One deteriorated waterbody • Will restore all water bodies in the sub catchment to Good status • One potential ‘quick win’

Area for Action	Key Reasons for Selection
Ballyroan	• Building on improvements at the plant (Ballyroan hydraulically overloaded and works are due to be completed on the inlet works) • Discrete area, would build on the improvements in the adjacent sub-catchment • Deteriorated water body (Ballyroan_010) • Both Owveg and Ballyroan discharge into Freshwater Pearl Mussel waterbodies
Erkina	• Groundwater abstraction at Durrow is failing for nitrates • Potential to work with active community groups • Important amenity – local groups are in the process of trying to establish a blueway • Potential to work with active group water schemes • Two deteriorated waterbodies
Boora	• Bog project to examine potential for improvement by rewetting, in collaboration with Bord na Mona • Long term challenge • Area important for tourism
Gageborough	• Joint County project • Potential 'quick wins' • Headwaters to river Gageborough • One deteriorated water body
Silver (Kilcormac)	• Building on existing work completed by Offaly County Council • Build on works completed by IFI, in conjunction with Bord na Mona • Headwaters to a High Ecological Status objective water body • Three potential 'quick wins' • Group water scheme in area • One deteriorated water body
Clareen	• Building on existing knowledge from works completed by Offaly County Council • Manageable area • Large group water scheme in the area

2.2.2 Flood Risk

Flood risk is considered as part of the options appraisal; however, many options are at a conceptual stage and there is insufficient information to differentiate between options on the basis of flood risk when design details, siting and routing are still to be determined. Both surface water and ground water flood risk will need to be considered further as part of the development of option design and for assessment at project level.

The OPW has been implementing the European Communities (Assessment and Management of Flood Risks) Regulations 2010 mainly through the Catchment Flood Risk Assessment and Management (CFRAM) Programme, through which draft Flood Risk Management Plans have been developed.

Approximately 300 Areas for Further Assessment have been established along with a range of measures to reduce or manage the flood risk within each catchment. CRFAMS mapping for all Areas for Further Assessment is available to view on the CFRAMS website (OPW, 2018). Figure 5.4 in the SEA Environmental Report (Appendix A) provides a summary of surface water and groundwater flood risk from the OPW CFRAMS data for the region including SA6.

For existing water infrastructure assets such as WTPs, flood risk vulnerability is considered in decisions on need to rationalise and decommission assets.

Any options which are progressed and require planning permission will require a Flood Risk Assessment to be completed in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009).

2.3 Climate Change

Ireland's climate is heavily influenced by the Atlantic Ocean. Consequently, Ireland has a milder climate that has less extreme temperature variation compared with other countries at a similar latitude. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence. Winters tend to be cool and windy, while summers are generally mild and less windy (Met Éireann, 2019).

In June 2019, the government agreed to support the adoption of a net zero target by 2050 at EU level, and to pursue a trajectory of emissions reduction nationally which is in line with reaching net zero in Ireland by 2050.

Section 15 of the Climate Action and Low Carbon Development Act 2015 (as amended in 2021) sets a new "national climate objective" for Ireland, which provides that:

"*The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy.*"

The amended Act requires public authorities, including IW, to take account of, so far as practicable, perform their functions in a manner consistent with the furtherance of the national climate objective and the relevant national and sectoral plans and strategies to mitigate greenhouse gas emissions and adapt to the effects of climate change.

The Department of the Environment, Climate and Communications' Climate Action Plan (CAP) published November 2021, replacing CAP 2019, commits to achieving a 51% reduction in overall greenhouse gas emissions by 2030 and reaching net zero carbon emissions by 2050. The aim is for more sustainable growth and to create a resilient, vibrant and sustainable country. The CAP defines a roadmap to this goal and initiates a set of policy actions to achieve this. A detailed sectoral roadmap has also been set out, which is designed to deliver a cumulative reduction in emissions, over the period 2021 to 2030. CAP 2021 updates existing targets with renewable energy to provide 80% of electricity by 2030 and sets targets for sectors including for agriculture and forestry such as woodland planting and improving land management to support carbon sequestration (Department of the Environment, Climate and Communications, 2021).

In addition, Ireland has a sectoral climate adaptation plan for the 'Water Quality and Water Services Infrastructure' sector. A summary of the report's findings is included in Table 2.8.

Table 2.8 Summary of Key Points from the 'Water Quality and Water Services Infrastructure' Sectoral Climate Change Plan (Department of Housing, Planning and Local Government, 2019b)

Summary	
Key Points	• Protecting and improving water quality and improving water services infrastructure are major challenges in Ireland • Climate change-induced threats will increase the scale of these challenges • Risks to water quality and water infrastructure arise from changing rainfall patterns and different annual temperature profiles. The frequency and intensity of storms and sea level rise are also considered
The challenges: Water services infrastructure	• Increased surface and sewer flooding leading to pollution, water and wastewater service interruptions • Reduced availability of water resources • Hot weather increasing the demand for water • Increased drawdown from reservoirs in the autumn/winter for flood capacity, leading to resource issues • Business continuity impacts or interruptions for water services providers
Primary adaptive measures	• Fully adopt the 'integrated catchment management' approach • Improve treatment capacity and network functions for water services infrastructure • Water resource planning and conservation – on both supply and demand sides • Include climate measures in monitoring programmes and research • Many of these proposed adaptation actions are already underway through existing and scheduled water sector plans and programmes

There are four aims that local authorities are required to include in their climate adaptation strategies (Department of Communications, Climate Action and Environment, 2018):

- Mainstream Adaptation: That climate change adaptation is a core consideration and is mainstreamed in all functions and activities across the local authority. In addition, ensure that local authority is well placed to benefit from economic development opportunities that may emerge due to a commitment to proactive climate change adaptation and community resilience;
- Informed decision making: That effective and informed decision making is based on a reliable and robust evidence base of the key impacts, risks and vulnerabilities of the area. This will support long term financial planning, effective management of risks and help to prioritise actions;

- Building Resilience: That the needs of vulnerable communities are prioritised and addressed, encourage awareness to reduce and adapt to anticipated impacts of climate change, and promote a sustainable and robust action response; and
- Capitalising on Opportunities: Projected changes in climate may result in additional benefits and opportunities for the local area and these should be explored and capitalised upon to maximise the use of resources and influence positive behavioural changes.

In addition to these high-level aims, each local authority is required to identify the key risks to their area; these are provided in Table 2.9.

Table 2.9 Climate Change Risks Identified by Local Authorities in SA6

County	Key Risk Areas
Carlow (Carlow County Council, 2019)	• Heatwaves/drought • Extreme rainfall events • Severe cold spells • Flooding
Laois (Laois County Council, 2019)	• Heat wave and drought conditions • Risk of bog, gorse or forest fires • Extreme wind events • Extreme rainfall • Extreme cold and snow events
Kildare (Kildare County Council, 2019)	• Extreme rainfall events • Windstorms • Extreme heat/drought events • Freezing/snow events
Kilkenny (Kilkenny County Council, 2019)	• Extreme weather events • Sea level rise • Heatwaves • Flooding • Air pollution and air quality
Offaly (Offaly County Council, 2019)	• Rising temperatures and drought • Wetter winters and drier summers • More intense rainfall and storm events • Increased flood risk
Tipperary (Tipperary County Council, 2019)	• Low level lands along rivers where fluvial flooding may increase • Bogs and peatlands that may be impacted by drought • Road Infrastructure in the upland areas
Westmeath	• Extreme rainfall

County	Key Risk Areas
(Westmeath County Council, 2019)	• Flooding • Windstorms • High temperatures - Heatwaves • Drought • Combination events • Low Temperatures
Wexford (Wexford County Council, 2019)	• Storm frequency and intensity • Flooding • Extreme cold events (snow) • Heavy rainfall • Extreme heat/drought conditions • Bog, sand dune, gorse or forest fires • Sea level rise and storm surges
Wicklow (Wicklow County Council, 2019)	• Flooding • Extreme rainfall and wind speed/storminess • Rising sea levels

Climate change is expected to influence weather conditions, such as frequency of droughts and extreme events such as storms, and is likely to affect habitats and species, water availability for supply and water demand and water quality. For SA6, not all supplies within the study area meet the required levels of reserve capacity. As evidenced in the 2018 drought, there is the potential for this deficit to affect access to water in the future. This situation will further deteriorate over time due to climate change driven reductions in water resources.

A key aspect of Irish Water's strategy is to 'Supply Smarter', by improving the quality, resilience and security of their supply through infrastructural improvements. One of the high-level goals taken from the national level is building resilience, with water services being a key factor.

Supporting environmental resilience to climate change will also be an important consideration for the future with additional benefits for supply resilience.

2.4 Biodiversity, Flora and Fauna

2.4.1 Designated Sites

Within SA6 there are a number of European, national and locally designated sites, including Special Protected Areas (SPAs), Special Areas of Conservation (SACs), Nature Reserves, National Parks, Natural Heritage Areas, and proposed Natural Heritage Areas (see Table 2.10 and Figure 2.2). The European sites (SPAs and SACs), and the potential impacts on them, are discussed in more detail in the NIS.

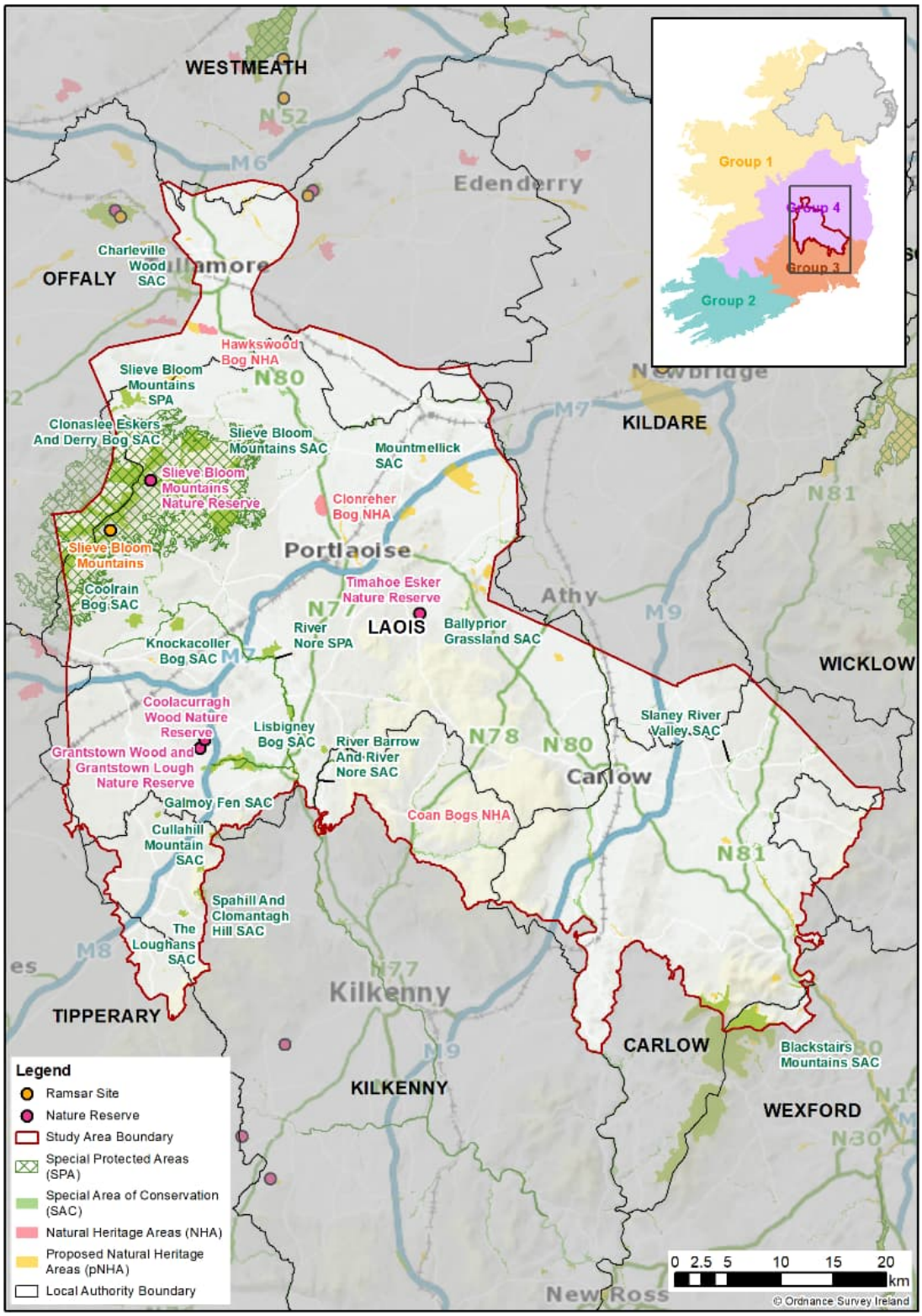

Figure 2.2 Designated Sites in SA6

Table 2.10 Designated Sites within SA6 (NPWS, 2019a)

Receptor	Name	Total Number
Special Protected Area (SPA)	River Nore SPA	2
	Slieve Bloom Mountains SPA	
Special Area of Conservation (SAC)	Ballyprior Grassland SAC	15
	Blackstairs Mountains SAC	
	Charleville Wood SAC	
	Clonaslee Eskers and Derry Bog SAC	
	Coolrain Bog SAC	
	Cullahill Mountain SAC	
	Galmoy Fen SAC	
	Knockacoller Bog SAC	
	Lisbigney Bog SAC	
	Mountmellick SAC	
	River Barrow and River Nore SAC	
	Slaney River Valley SAC	
	Slieve Bloom Mountains SAC	
	Spahill and Clomantagh Hill SAC	
	The Loughans SAC	
Ramsar sites	Slieve Bloom Mountains	1
Nature reserves	Coolacurragh Wood Nature Reserve	4
	Grantsown Wood and Granston Lough Nature Reserve	
	Slieve Bloom Mountains Nature Reserve	
	Timahoe Esker Nature Reserve	
National Parks	Slieve Bloom Mountains	1
Natural Heritage Areas (NHAs)	Clonreher Bog NHA	3
	Coan Bogs NHA	
	Hawkswood Bog NHA	
Proposed Natural Heritage Areas (pNHAs)	Shown in Figure 2.2	49

2.4.2 Habitats

Table 2.11 lists the percentage of the study area, and the number of hectares, covered by each habitat within SA6; as reported in the Corine land use dataset[1].

Table 2.11 Habitat Areas for SA6 (EPA, 2018)

Habitat	Ha	% of Study Area
Agricultural Land		
Pastures	190,789	63.02%
Land principally occupied by agriculture, with significant areas of natural vegetation	8,562	2.83%
Complex cultivation patterns	8,729	2.88%
Non-irrigated arable land	39,511	13.05%
Natural Habitats		
Peat bogs	12,275	4.05%
Water bodies	32	0.01%
Inland marshes	4,438	1.71%
Forest		
Transitional woodland-shrub	8,857	2.93%
Coniferous forest	17,127	5.66%
Mixed forest	6,166	2.04%
Broad-leaved forest	2,731	0.90%

Particularly relevant habitats that depend on the water quality and/or quantity in SA6 are:

- Turlough ecosystems;
- Hard oligo-mesotrophic lakes;
- Bog habitats – Active raised bogs, degraded raised bogs still capable of natural regeneration, Rhynchosporion depressions, transition mires and quaking bogs;
- Alkaline fens; and
- Groundwater dependant terrestrial habitats, such as petrifying springs with tufa formation, calcareous fens and blanket bogs.

2.4.3 Species

The key species and habitats (Nelson et al, 2019) of concern within SA6 include:

- Otter;
- Bat species - Daubenton's bat along the waterways. The most common species in the study area are Common and Soprano pipistrelles and Leisler's bat;
- Fish species (Lamprey, Atlantic salmon and European eel);

[1] The EPA land use dataset will be used once this is available

- ‘Qualifying interest’ bird species e.g. hen harrier and kingfisher;
- Protected whorl snails (*Vertigo geyeri* (particularly high sensitivity to changes) and *Vertigo moulinsiana*);
- Fresh-water pearl mussel; and
- Freshwater white-clawed crayfish.

The key invasive species to consider (European Communities (Birds and Natural Habitats) Regulations, 2011) for developing options within SA6 include:

- Japanese knotweed;
- Himalayan balsam;
- Giant hogweed;
- *Elodea* spp.;
- Himalayan knotweed (*Persicaria wallichii*);
- New Zealand pigmyweed (*Crassula helmsii*); and
- Zebra mussel (Dreissena polymorpha).

2.5 Material Assets

Material assets are considered to be the natural and built assets (non-cultural assets) required to enable a society to function as a place to live and work, in giving them material value.

Some of the natural assets within SA6 are listed in Table 2.12, such as agricultural land.

Built assets include transport and communications infrastructure, and other developed areas, including existing water supply infrastructure (see Figure 2.1 and Figure 2.3). These assets all need to be taken into account in new water resource developments.

In addition, water resources and water quality are influenced by urban, agricultural and forestry activity within river and groundwater catchments. This can affect the availability and quality of water for supply.

Irish Water has 28 WTPs in SA6, meeting the demand of 55.3 Ml/d in 2019.

Ireland’s canals once played a significant role as a transport network; however, their primary use is now for recreational and heritage purposes. The key canal within SA6 is the Grand Canal.

There are no ports or airports of national or regional significance within SA6. Although, there is one local airport, namely Abbeyleix.

Other significant transport infrastructure includes the main road (particularly the M7, M8, M9, N52, N80, and around the towns of Tullamore, Portlaoise and Carlow) and rail network (Dublin Heuston - Cork, Dublin Heuston - Galway, Dublin Heuston - Limerick and Ennis, Dublin Heuston - Limerick via Nenagh, Dublin Heuston - Tralee, Dublin Heuston - Westport and Ballina, Galway - Limerick, Grand Canal Dock and Dublin Heuston - Portlaoise).

Any new infrastructure considered for SA6 will need to take, existing as well as planned land zoning and local development into consideration.

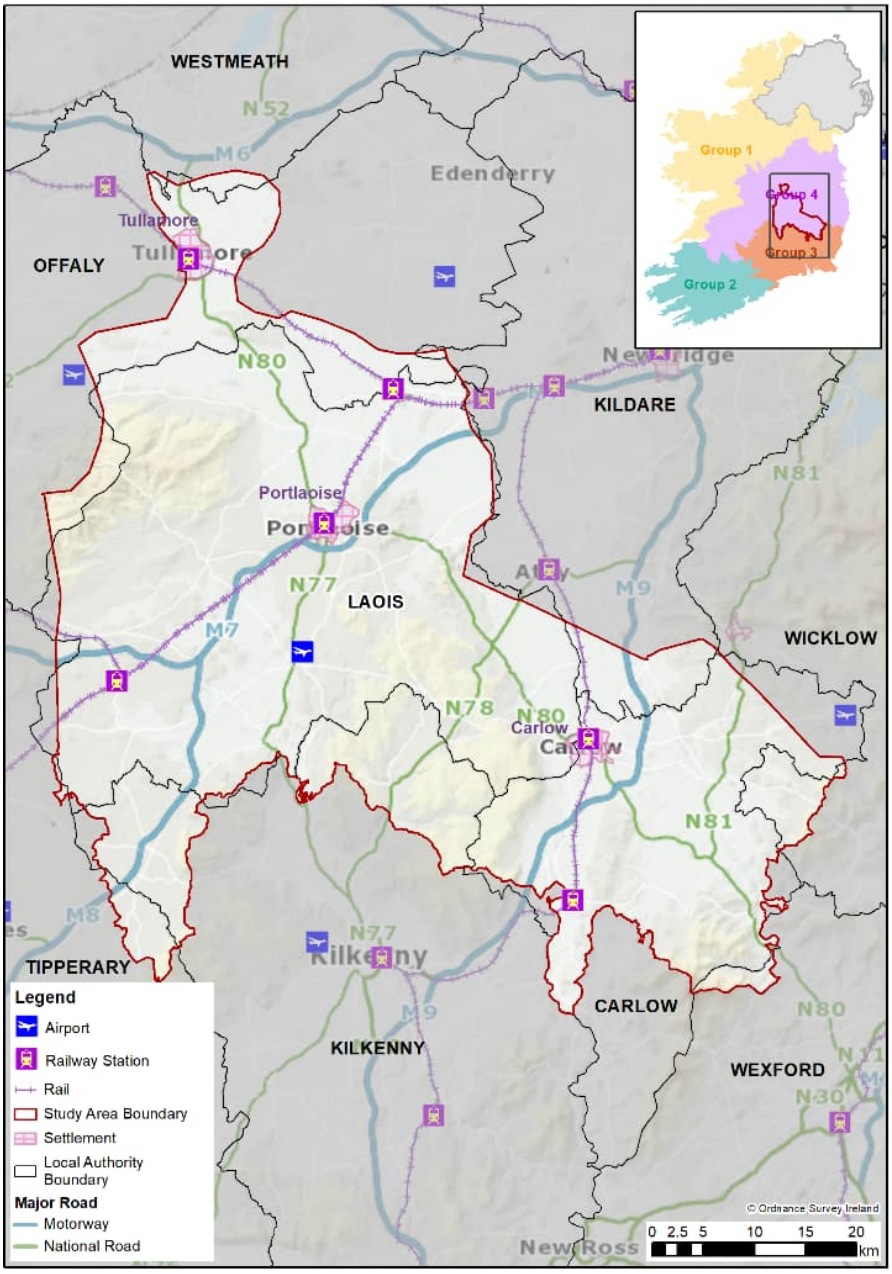

Figure 2.3 Transport Infrastructure in SA6

Table 2.12 Land Use within SA6 (EPA, 2018)[2]

Land use	Ha	% of Study Area	Comparison to Overall Eastern and Midlands Region %
Agriculture	247,590	81.78%	75.52%
Urban	5,832	1.93%	3.69%
Forest	13,604	4.49%	9.42%
Natural habitats	34,882	11.52%	10.61%
Industry	788	0.26%	0.70%

[2] The EPA land use dataset will be used once it has been made available

Land use	Ha	% of Study Area	Comparison to Overall Eastern and Midlands Region %
Other	51	0.02%	0.06%

Proposals for other strategic developments within SA6 are considered for the assessment. These are primarily identified from the National Planning Framework and from myProjectIreland, where any relevant projects for the study area are included (other local developments may also be included that are not listed in myProjectIreland if they are considered to be of an appropriate scale). Small scale housing and business development are not considered for this plan level assessment.

Table 2.13 gives an overview of the project developments which are available from myProjectIreland (2021) for SA6[3]. The myProjectIreland map focuses mainly on major projects with costs over €20 million. The map also includes all projects supported to date under the Government's Urban and Rural Regeneration Funds and reflects the full portfolio of projects in the pipeline at present.

Table 2.13 Proposed New Developments

Development		
Altamont House and Gardens	Kearney's Field, Tullamore, Co. Offaly	Residential Development at Clonminch Road, Tullamore
Carlow Town	Libraries Capital Programme - Portlaoise Library	Sacred Heart Hospital, Carlow
Carlow Wastewater Treatment Plant	Portlaoise 40 bed Residential Mental Health Unit	St Vincent's Hospital, Mountmellick
Carrigbrook, Tullow Road, Carlow	Portlaoise - A Cultural Quarter	Tullamore Urban Area
Emo Court	Portlaoise - A Low Carbon Town	
IT Carlow Science & Health Building	Presentation Convent & Lands, Portlaoise	

2.6 Landscape and Visual Amenity

The National Landscape Strategy 2015 - 2025 is in the process of being implemented and will be Ireland's vehicle for complying with the EU Landscape Convention. Landscape assessment guidance is also available from the local authorities. This will be taken into account when identifying landscape character areas and protected areas at the project level in the future. Table 2.14 shows the value and sensitivity of the Landscape Character Areas (LCAs) within each of the counties listed within the study area. No data is available for the values of the LCAs within the listed counties. No data is available for the values or the sensitivity of the LCAs within the counties of Laois and Westmeath[4].

The value of the landscape in SA6 is reflected in baseline data sections 2.1.3 (Tourism and Recreation), 2.4 (Biodiversity, Flora and Fauna) and 2.8 (Cultural Heritage).

[3] Note that the myProjectIreland dataset was taken at a fixed point in time to allow for assessment of cumulative effects. The date for SA6 being the 15//01/21.
[4] As with all the baseline information, the LCA information will be updated as part of regular reviews

Water supply infrastructure will need to take account of sensitive landscapes and views. This will need to include culturally important areas, townscapes, natural areas and areas and views of importance for tourism and recreation.

Table 2.14 Value and Sensitivity of Landscape Character Areas in the Counties of SA6. (Ordnance Survey Ireland. n.d.)

Landscape Character Area	Sensitivity
County: Carlow (Carlow County Council, 2015)	
Killeshin Hills	Medium
Central Lowlands	Low
Blackstairs and Mount Leinster Uplands	High
River Slaney - East Rolling Farmland	Medium
County: Kildare (Kildare County Council, 2017)	
North-western Lowlands	Low
Northern Lowlands	Low
Central Undulating Lands	Low
Southern Lowlands	Low
Eastern Transition Lands	Medium
South-eastern Uplands	Medium
Western Boglands	High
Eastern Uplands	High
Chair of Kildare	Special
Northern Hills	Special
River Liffey	Special
River Barrow	Special
The Curragh	Unique
Pollardstown Fen	Unique
County: Kilkenny (Kilkenny County Council, 2003)	
Slieveardagh Hills (North)	Low
Slieveardagh Hills (South)	Low
Slieveardagh Western Transition Zone	Low
Slieveardagh Central Transition Zone	Low
Slieveardagh Eastern Transition	Low
Slieveardagh Southern Transition Zone	Low

Landscape Character Area	Sensitivity
Castlecomer Plateaux	High
Castlecomer Southern Transition Zone	Low
Castlecomer Western Transition	Low
South Western Hills	Medium
South Western Hills Northern Transition	Low
South Western Hills Southern Transition	Low
Brandon Hill	High
Brandon Hill Transition Zone	High
South Eastern Hills	Medium
Kilkenny Northern Basin	Low
Kilkenny Western Basin	Low
Kilkenny Eastern Basin	Low
South Kilkenny Lowlands	Medium
Nore Valley (South)	High
Barrow Valley	High
Suir Valley	High
Kilkenny City	Low
County: Laois (Laois County Council, 2017)	
No LCA values or sensitivity information available	
County: Tipperary (Tipperary County Council, 2016)	
Urban and Fringe Areas	Low
Thurles Hinterland	Low
Nenagh Corridor	Low
River Suir Central Plain / Nenagh Corridor	Low
Templemore Plains	Low
West Tipperary Farmland Mosaic	Low
Borrisokane Lowlands	Dominant Moderate with some Low and High
Littleton Raised Bog	Dominant High with some Low and Moderate
Littleton Farmland Mosaic and Marginal Peatland	Dominant Low with some Moderate and High
Upper Lough Derg	Dominant High with some Low, Moderate, Special and Unique

Landscape Character Area	Sensitivity
The Shannon Callows	Dominant High with some Low, Moderate, Special and Unique
River Shannon - Newport	Dominant Special with some Low, Moderate, High and Unique
Arra Mountains – Lower Lough Derg	Dominant Special with some Low, Moderate, High and Unique
Slieveardagh Hills Farmland Mosaic	Dominant Moderate with some Low
Linguan Valley Marginal and Farmland Mosaic	Dominant Moderate with some Low
Slievenamuck Marginal Mosaic	Dominant High with some Moderate and Special
Upperchurch - Kilcommon / Hollyford Hills Mountain Mosaic	Dominant High with some Moderate and Special
Silvermines – Rearcross	Dominant High with some Low, moderate, Special and Unique
Slievenamon Mountain Mosaic	Dominant Unique with some Low, Moderate, High and Special
Glen of Aherlow Uplands	Dominant Unique with some Moderate, High and Special
Galtee Mountains Mosaic	Dominant Unique with some Moderate, High and Special
Devilsbit Uplands	Dominant Unique with some Moderate, High and Special
Knockmealdown Mountain Mosaic	Dominant Unique with some Moderate, High and Special
County: Offaly (Offaly County Council, 2014)	
Rural and Agricultural Areas	Low
Cutaway Bog	Moderate
The River Shannon and Callows	High
The Grand Canal Corridor	High
Wetlands	High
Slieve Bloom Upland Area	High
Croghan Hill and its Environs	High
Bogland Areas	High
The Esker Landscape	High
Archaeological and Historical Landscapes	High

Landscape Character Area	Sensitivity
County: Westmeath (Westmeath County Council, 2021)	
No LCA values or sensitivity information available	
County: Wicklow (Wicklow County Council, 2016)	
Western Corridor	Medium
Blessington LAP	Low
Poulaphouca Reservoir	High
Mountain Uplands	High
Glencree / Glencullen	High
Northern Mt. Lowlands	High
Bray Environs Masterplan	Low
Coastal Area	High
Greystones / Delgany LAP	Low
Eastern Corridor	Medium
Newtown Mount Kennedy LAP	Low
Ashford LAP	Low
Wicklow Town Environs	Low
Rural Area	Medium
Southern Hills	High
Rural Area	Medium
Southern Mt. Lowlands	High
Baltinglass Hills	High

2.7 Air Quality and Noise

2.7.1 Air Quality

Air quality is monitored and managed using Air Quality Zones and air monitoring sites, the air quality index rating of the area within SA6 is rated as ‘good’.

In general, the water industry is not a major contributor to air quality issues, although there is potential for local pollution through Irish Water vehicles, generator plants and drinking water residuals treatment facilities. There is a requirement to comply with air pollution regulations and also identify potential opportunities for reducing emissions. Air quality will be a consideration at the project level, for example, through scheme construction management and scheme design and operation.

2.7.2 Noise

The main areas that experience noise pollution are likely to be areas along the main roads, particularly around the M7, M8, M9, N52 and N80.

Water infrastructure development is not expected to add significantly to noise pollution. Construction noise will be considered through scheme construction management and design for local receptors and for sensitive receptors in close proximity. Noise pollution will also be managed through the planning process with conditions included in planning permissions.

2.8 Cultural Heritage

Within SA6, there are numerous designated and non-designated cultural heritage assets inventoried in the Record of Monuments and Places, the Sites and Monuments Record, the Record of Protected Structures, and the National Inventory of Architectural Heritage (NIAH) (see Table 2.15).

Figure 2.4 shows the location of the individual cultural heritage records from the National Monuments Service and the NIAH. Given the number of small sites, these can be better viewed on the Department of Culture, Heritage and the Gaeltacht's (2020) 'Historic Environment Viewer' website.

There are also potentially unknown, undesignated archaeological and architectural remains throughout Ireland. Water supply can affect cultural heritage through, direct loss or construction of infrastructure

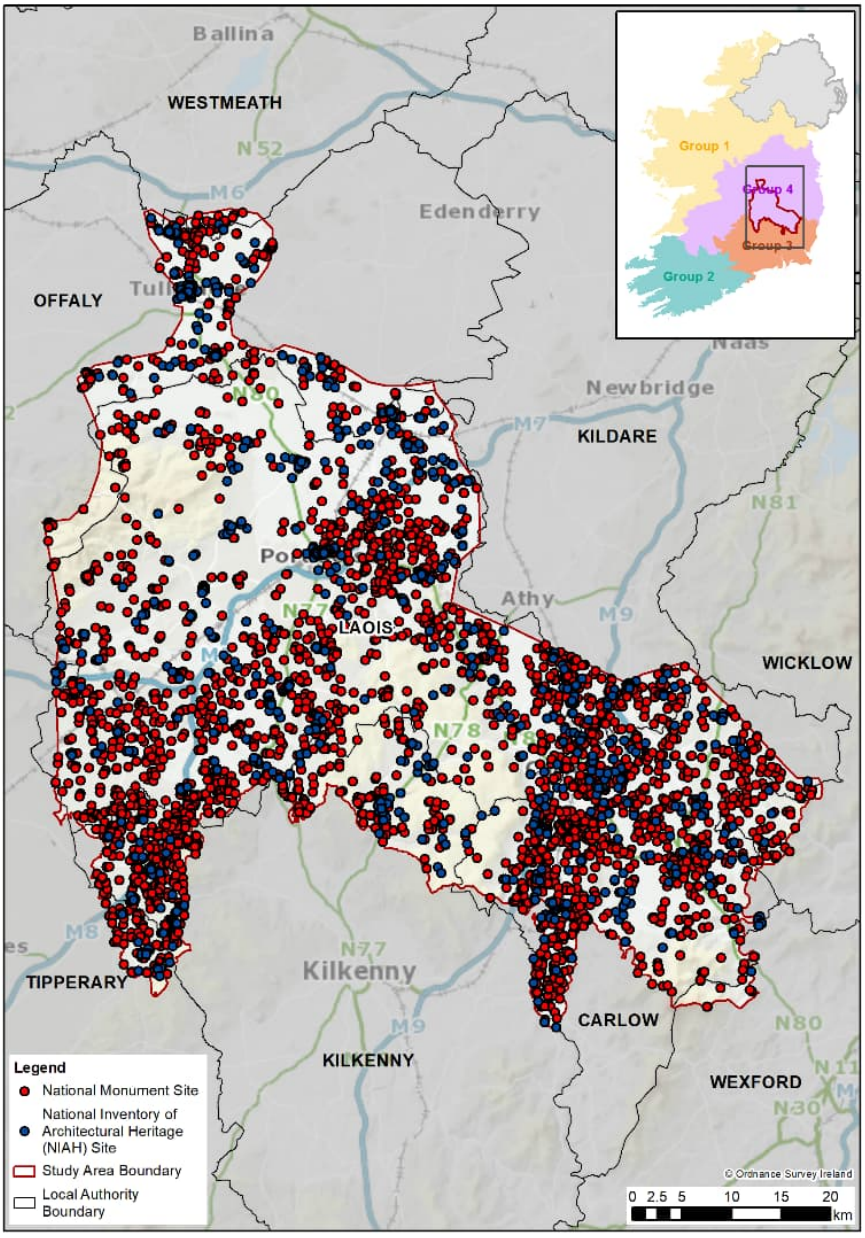

Figure 2.4 SA6 Cultural Heritage Assets

involving disturbance of soils, above ground structures close to existing heritage sites affecting setting or changes due abstraction changing drainage and affecting interests within wetland sites.

Table 2.15 Cultural Heritage Assets within SA6

Assets	Total Number
National Monuments Service sites	4,350
National Inventory of Architectural Heritage sites	1,437
Sites and Monuments Record Zones	2,278

2.9 Geology and Soils

Table 2.12 lists the land uses within SA6. SA6 predominantly has a fine loamy soil type with areas of peat to the north-west of the study area (EPA, 2019a).

The geology and soils in the environment are fundamental for the quality and quantity of water in the area through differences in drainage, chemical composition, filtration and soil type, topography and resultant land use. Land use has significant impact on water quantity and quality. Groundwater supply depends on the type of aquifers in the area, as they determine the system's ability to store and transmit groundwater. The regionally and locally important aquifers with resource potential for SA6 are shown in Figure 2.5.

The geology of the study area is dominated by widespread limestones lying as lowland topography covered in substantial thicknesses of overlying gravelly soils, with two topographic high points at the Slieve Bloom (Silurian) uplands to the northwest, and the Castlecomer Plateau (Leinster Coalfields) to the southeast at Carlow town. The limestone rock units in the lowlands form a key regionally important aquifer close to the towns of Tullamore, Portlaoise and Durrow, which feeds each town with significant volumes of groundwater.

Important geological and geomorphological sites could be identified for protection as NHAs, however, until designation is confirmed, these sites are classified as Irish Geological Heritage Sites (IGHS). There are over 900 IGHS identified around Ireland, 48 of which have the potential to constrain water resource options in SA6.

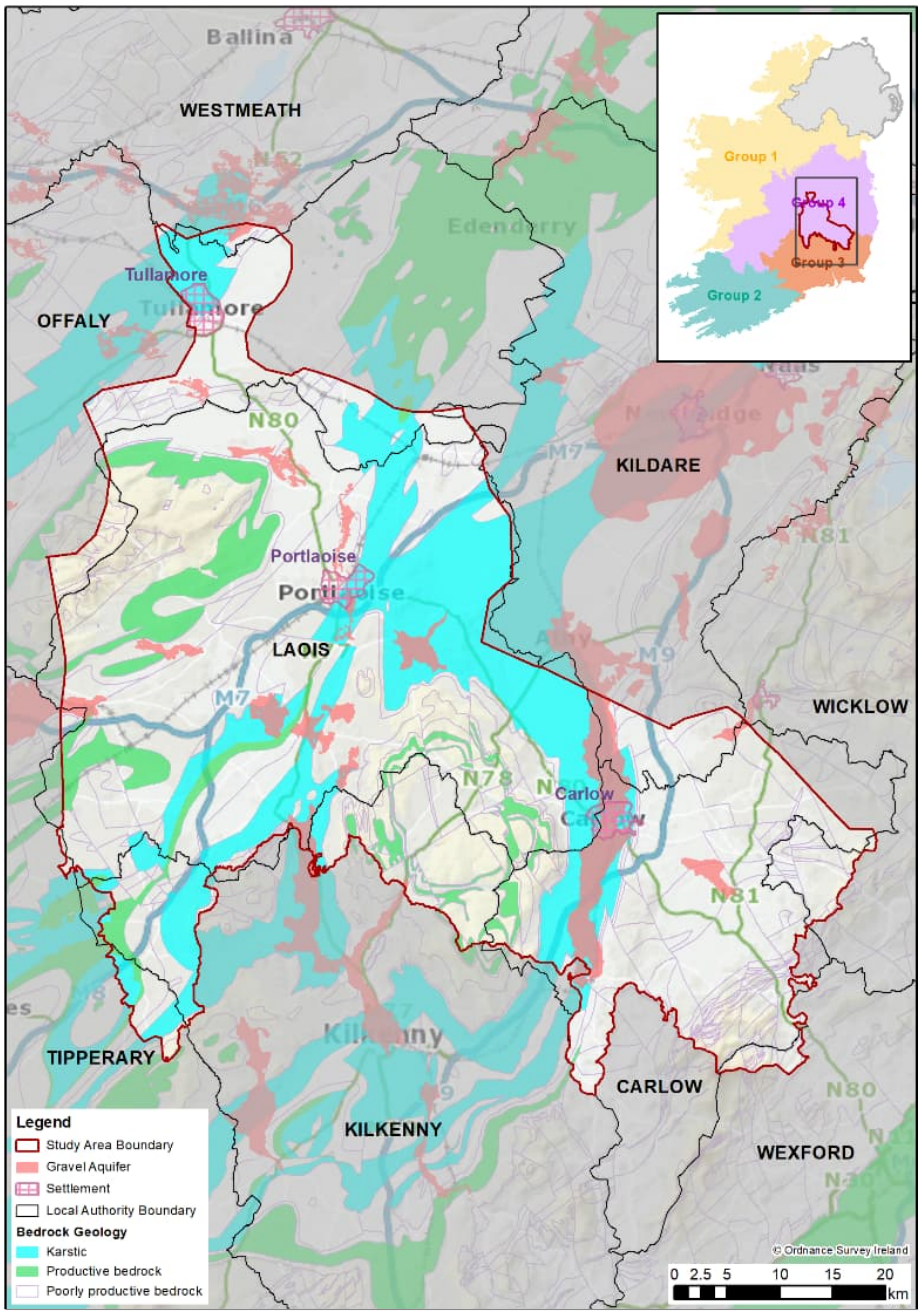

Figure 2.5 SA6 Hydrogeology

2.10 Summary of Key Issues and Trends over the Plan Period

All aspects of the environment will need to be considered as individual schemes are taken forward for further design and implementation. However, the key issues relevant for strategic water planning identified within SA6 are listed in Table 2.16.

Table 2.16 Summary of Key Issues and Trends Over the Plan Period

SEA Topic	Issues and Opportunities	Interrelated Topics
Population, Economy, Tourism and Recreation,	**Issues:** Increasing population and the increased stress of climate change on water quality and water resources could affect health and well-being. **Opportunities**: Irish Water will put in place plans to assess water quality and measures to address risks as part of the Framework Plan.	Climate Change, Water environment,

SEA Topic	Issues and Opportunities	Interrelated Topics
and Human Health	Irish Water has ongoing activities to improve the SDB in SA6, including, leakage management and water conservation measures. Raising awareness of the importance of water conservation and efficiency measures, and the value of the environment for health and wellbeing, can play an important part in water planning. Valuing access to environment for recreation.	Biodiversity, Material Assets and Landscape and visual amenity
Water Environment	**Issues**: The proposed abstraction licensing, aligned to WFD requirements, will require many current abstractions to be licensed and may limit future abstraction or involve significant conditions being imposed at associated sites. For SA6, some of the existing abstractions may not meet sustainability guidelines in the medium term; specifically, during drought periods. On an interim basis, Irish Water has developed an initial conservative assessment based on available information (see SA6 Technical Report). This has been used to inform options identification and appraisal. Irish Water will update its sustainability analysis and impact on their baseline SDB calculations when regulatory assessments for the new legislation is undertaken. **Opportunities:** To take account of identified pressure on the water environment in the selection of solutions for SA6.	Biodiversity and climate change
Biodiversity, Flora and Fauna	**Issues:** The following designated areas: Slieve Bloom Mountains SPA and SAC, River Nore SPA, River Barrow and River Nore SAC are located within SA6. It is considered especially important to avoid the loss of irreplaceable or rare habitats and avoid increasing pressure on vulnerable species; potentially through direct or indirect land take, such as through increased abstraction pressure.	Water resources, water quality and climate change
Material Assets	**Issues:** WTP assets and network infrastructure requiring improvement or replacement. **Opportunities**: Improvements to support reliability of access to good quality water.	Health and Wellbeing
Landscape and Visual Amenity	**Issues:** Potential for climate change to affect land use and habitats and influencing landscape quality and amenity.	Biodiversity and geology and soils, climate change, health and well being
Air Quality and Noise	No specific issues identified for the baseline for SA6.	Health and well being
Climate Change	**Issues**: Climate change issues regarding sea level rise, flooding, extreme weather events and changes in seasonal weather patterns. Climate change has been taken into account in supply forecasts and additional risks to infrastructure and operations will need to be taken into account in planning for drought and freeze/thaw events; and in detailed scheme design and network operation.	Biodiversity and water environment

SEA Topic	Issues and Opportunities	Interrelated Topics
	Opportunities: Additional management to minimise impact on supply and the environment, vulnerability to climate change, and drought is required.	
Cultural Heritage	**Issues:** Known cultural heritage and archaeological assets and potential unknown archaeological assets.	Health and wellbeing
Geology and Soils	No specific issues, although general need for good soil conservation and retention of nutrients and carbon in soil resources.	Biodiversity and Landscape and climate change
Additional interrelated aspects	**Issues**: Poor water quality requiring additional water treatment and affecting biodiversity. **Opportunities:** Potential for catchment management initiatives leading to habitat, water retention, water quality enhancement and soil quality have the potential to provide wider benefits for environmental resilience and water supply; although this has not been specifically studied in this study area.	

3 Environmental Assessment – Options Appraisal

3 Environmental Assessment – Options Appraisal

This chapter provides a summary of the environmental assessment of options considered in the study area, including the option identification and screening process, and assessment of options used in approach development.

3.1 Overview

Irish Water applied its Options Assessment Methodology from the Framework Plan to identify potential solutions to meet the needs identified in the SA6 WRZs.

The general methodology, and how environmental assessment is included, is outlined in the SEA Environmental Report prepared in relation to the Framework Plan. That report identifies SEA objectives and assessment criteria and provides a framework for integrating the environmental assessment of options and combinations of options into a phased appraisal process which also takes account of other criteria such as feasibility, deliverability, resilience and cost.

The Framework Plan Options Assessment Methodology covers eight stages. Stages 1 and 2 are covered through the needs and baseline assessments addressed in chapter 2 of this review. The key stages considered in this chapter for SA6 are Stage 3-6:

- Stage 3 Unconstrained options – to identify all the potential options to be considered to resolve water quality or quantity requirements;
- Stage 4 Coarse screening – to assess the unconstrained options and eliminate any that will not be viable and collect information to inform the next stage;
- Stage 5 Fine screening – options assessment and scoring against the key criteria to verify option feasibility and understand key risks and constraints; and
- Stage 6 Feasible option list – further option development encompassing costing and SEA assessment of options.

3.2 Stage 3: Unconstrained Options

Environmental and social assessment criteria are included at the earliest stages of the screening process. At the outset of the process, some fundamental rules are applied as part of option identification. For example, inter-catchment raw water transfers are excluded due to the high risk of transferring invasive non-native species (INNS) between catchments and potential conflict with WFD objectives.

WFD objectives have also been a key consideration at this stage through an internal sustainable abstraction risk review. This was a specialist review of groundwater bodies and surface water catchments that was undertaken as part of the option identification stage. UK Technical Advisory Group on the Water Framework Directive (UKtag) guidance (UKtag, 2013) on baseflows have been used for the purposes of this plan until Ireland specific standards come into place.

The application of these conservative abstraction standards to new options ensures that any new or increased abstractions from rivers are likely to support conservation objectives for the most sensitive environmental sites. For surface waterbodies, the allowable abstraction standard of 10% of Q95 has been applied, with the exception of waterbodies requiring ‘High’ status where a higher threshold of 5% of Q95 has been applied. Allowable abstraction standards for lakes are set at 5 or 10% of Q50 in line with

this guidance (the NIS prepared in relation to the Framework Plan, sets out the approach in relation to Appropriate Assessment).

As mentioned previously, these are estimates applied for the purpose of strategic planning and are based on a conservative approach to what new legislative regime might require. The EPA will be the authority adjudicating the sustainability or otherwise of abstractions, once the legislation is enacted and will have the benefit of more detailed site specific information.

For groundwater sources, the assessment includes a high level assessment taking account of a range of information available for existing site and in many cases limited information for new abstraction options This desktop assessment undertaken aimed to identify potential yield and the impact of the yield, including the steps described below.

3.2.1 Existing Groundwater Abstractions

Site specific data is taken into account where possible in identifying the potential sustainable yield at existing sources where abstraction is to be increased. In some cases however location, abstraction rate(s) and site configuration are often the minimum information available The operational data provides useful information on the yield, and assumptions can be made around the average production from each site. It can be assumed the average abstraction value is an initial estimate of the yield. Most local authorities in the case of development of groundwater sources would likely have drilled and sought the maximum yield possible through 72 hours pumping tests. This provides an initial yield. Additional information on performance in prolonged dry weather periods provides supporting information on yields. Data collected on site is used to improve the yield and impact estimates.

3.2.2 New Groundwater Abstractions

The Zone of Contribution (ZOC), the land area that contributes water to the well or spring, is defined and used to calculate a preliminary water balance for the source using the average abstraction rate and the annual average recharge rate as estimated from the Geological Survey Ireland (GSI) recharge maps. The water balance estimates the area needed to supply the yield and is then compared to the delineated ZOC. A WFD >30% recharge is applied as a guide for assessment in the fine screening assessment but is recognised to apply more to catchment scale abstraction impact assessments so at a very local abstraction scale it can overestimate the impacts for some sources.

Additional assessment is undertaken on potential preferred groundwater options to inform the SEA taking into account site specific information and consideration of likely impacts on WFD and cumulative effects with existing groundwater abstractions.

Further work will need to be undertaken for groundwater options taken forward as part of abstraction licensing and the development of Drinking Water Safety Plans. This will include establishing detailed geoscientifically robust zones of contribution in line with GSI's Groundwater Protection Schemes (Department of Environment, Community and Local Government, GSI and EPA, 1999) and the EPA Advice Note Number 7, Source Protection and Catchment Management (EPA, 2013). This work will provide in-depth hydrogeological information on the source that will establish reliable and sustainable yields.

3.2.3 Sustainable Abstraction in Options Assessment

The Government is currently developing new legislation dealing with water abstractions. As this legislation is still being developed, Irish Water does not have full visibility of the future regulatory regime. As the objective of the plan is to achieve safe, secure, reliable and sustainable supplies, any new

abstractions proposed to be developed by Irish Water as part of this plan will be based on conservative assessments of sustainable abstraction. This will ensure that water supplies continually improve in terms of environmental sustainability.

Based on initial desk-based assessments outlined above, Irish Water developed an initial list of unconstrained options for new supplies, increases and upgrades to existing supplies. An Unconstrained Options review workshop was held with Irish Water's Local Authority Water Services Partners to identify any additional unconstrained options that might be available based on local knowledge.

3.3 Stage 4: Coarse Screening

A total of 254 unconstrained options were identified for SA6 and subjected to coarse screening. The coarse screening process assessed the options against the criteria outlined in Table 3.1. This process is summarised in chapter 9 of the SEA Environmental Report for the Framework Plan. The process allows the assessment of the unconstrained options to eliminate any that will not be viable. The focus at this stage is on options that would be difficult to mitigate, those with likely significant effects on European or nationally important sites, or options likely to lead to deterioration of waterbody WFD status.

Table 3.1 Coarse Screening Assessment Criteria

Criteria	Unconstrained Option Assessment Questions	
Resilience	Q1	Does the option address the supply-demand problem?
Deliverability and Flexibility	Q2	Is the option technically feasible?
	Q3	Can the risks and uncertainties associated with the option be mitigated to avoid failure of the option?
Sustainability (Environmental and Social Impacts)	Q4	Can significant impacts on known high level environmental constraints for example European/ international or nationally designated biodiversity, landscape, cultural heritage sites, WFD objectives or community assets, be avoided or minimised? If not, is mitigation likely to be possible?

Of the 254 unconstrained options, 144 were rejected after being analysed against the coarse screening criteria of resilience, deliverability and environment.

Sustainability reasons for rejecting options were identified for thirty-one options. Table 3.2 provides the options that were rejected on an environmental basis and not considered suitable to address the deficit for the WRZs located in SA6. The full rejection register for both the coarse and fine screening (where applicable) is provided in Appendix C of the SA6 Technical Report.

Table 3.2 Coarse Screening Rejection Register

Option Reference	Option Description	Rejection Reasoning
SA6-001	Increase SW abstraction from River Burren to supply deficit to Carlow Town	The plan has identified that this option does not have available yield to meet the DYCP demand. The option is therefore unviable and was not taken through to the fine screening stage.
SA6-02a	Increase SW abstraction from River Slaney - Carlow North	
SA6-02b		

Option Reference	Option Description	Rejection Reasoning
SA6-02c	Regional abstraction - to supply deficit to Carlow Town	
SA6-02d		
SA6-02e		
SA6-02f		
SA6-02g		
SA6-03a	Increase SW abstraction from River Slaney - Tullow abstraction - to supply deficit to Carlow Town	
SA6-03b	Increase SW abstraction from River Slaney - Tullow abstraction - to supply deficit to Carlow Town	
SA6-025	Rationalise Bilboa to Carlow Town WRZ	
SA6-35a	Rationalise Carlow Central Regional to Carlow Town	
SA6-16a	Rationalise Leighlinbridge to Carlow town	
SA6-16b		
SA6-022	Rationalise Old Leighlin to Carlow town via Leighlinbridge	
SA6-010	Supply deficit at Carlow Town from neighboring GWS - Ballinabranna	This option requires pump tests to determine yield due to the need for a significant amount. It also involves transferring water via a significant length of pipeline, over 6km, for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of the water. Therefore, it was considered not feasible at coarse screening stage and not taken forward to fine screening.
SA6-012	Upgrade Sion Cross WTP	The plan identified that the calculated sustainable abstraction at this source is not sufficient enough to meet demand. The option is therefore unviable and cannot be considered at the coarse screening stage and would not be advanced to the fine screening stage.
SA6-047	Riverbank filtration from River Dinin for Clogh-Castlecomer	This option involves an abstraction close to the River Dinin has potential to undermine the conservation objectives of River Nore SAC. Impact on the conservation objectives of the River Nore SAC are likely to impact the River Slaney which is a high status WFD

Option Reference	Option Description	Rejection Reasoning
		water body. In addition, the option involves an abstraction above the plan identified sustainable abstraction limit. Making this a feasible option is considered likely to result in waterbody not achieving high WFD status and a greater risk of having adverse effects on this European site. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA6-048	New SW abstraction from River Dinin to supply deficit for Clogh-Castlecomer	New abstraction from the River Dinin has potential to impact with conservation objectives of River Nore SAC. In addition, the option involves an abstraction above the plan identified sustainable abstraction limit. Making this a feasible option is considered likely to result in waterbody not achieving high WFD status and a greater risk of having adverse effects on this European site. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA6-058	New SW abstraction from River Triogue for Portlaoise	The plan has identified that the sustainable action from the source in this option would only meet less than 20% of the deficit in the WRZ. The option was considered unviable and as a result was not taken forward to fine screening stage.
SA6-076	New river abstraction from the Owenass River (CFRAM study - flood alleviation scheme underway) for Mountmellick	This option is a high cost option requiring a new WTP that would not meet the WRZ deficit. It was therefore considered to be unviable and as a result was rejected at coarse screening stage and would not be taken forward to fine screening stage.
SA6-089	Rationalise Arles to Carlow Town WRZ	The plan has identified that this option does not have available yield at Rathvilly to meet the DYCP demand. The option is therefore unviable and was not taken through to the fine screening stage.
SA6-092	Rationalise the Strand to Carlow Town WRZ	
SA6-108	New SW abstraction from River Strandbally for South East Regional	The plan has identified that this option is likely to be above sustainable abstraction limits. Making this a feasible option is considered likely to result in the waterbody not achieving high WFD status and also to result in a greater risk of having adverse effects on this European site. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA6-146	Supply deficit at Durrow from neighbouring GWS - Cullahill GWS	The source is not productive, and it is unlikely that it can provide the required supply to resolve the full deficit. The option is therefore deemed unviable and as a result is not feasible at coarse screening stage and would not be taken forward to fine screening stage.

Option Reference	Option Description	Rejection Reasoning
SA6-171	Increase SW abstraction from Gorragh River to partly supply deficit in Tullamore	The desktop assessments undertaken in this plan identify that the sustainable abstraction for this source can only supply approximately less than 1% of the deficit. The option was therefore deemed unviable and as a result was rejected at coarse screening stage and would not be taken forward to fine screening stage.
SA6-172	Increase SW abstraction from Clodiagh River to partly supply deficit in Tullamore	
SA6-173	New SW abstraction from Tullamore U.D.C. to partly supply deficit in Tullamore	The desktop assessments undertaken in this plan identify that the sustainable abstraction for this source can only supply a small portion of the deficit. The option was therefore deemed unviable and as a result was rejected at coarse screening stage and would not be taken forward to fine screening stage.
SA6-192	New SW abstraction from River Burren to meet deficit for Carlow Central Regional, requiring new abstraction intake works and new WTP for 1 Ml/d supply, plus approx. new 3.5 km pipe to Ballon SR	Option involves abstracting above 10% of Q95 which is not within the design guidelines. It was therefore deemed not viable and as a result this option was rejected at coarse screening stage and was not taken forward to fine screening stage.
SA5-181	Increase GW abstraction at Newgate Well and upgrade Newgate Well WTP (poorly productive bedrock)	The existing source is not productive, and it is unlikely that it can provide the required supply to resolve the full deficit, particularly during critical periods. The option is therefore deemed unviable and as a result is not feasible at coarse screening stage and would not be taken forward to fine screening stage
SA5-182	Increase GW abstraction at Village Well and upgrade Mountbolus WTP (poorly productive aquifer)	

3.4 Stage 5: Fine Screening

A total of 110 options passed the coarse screening stage; these options were subjected to further consideration as part of a multi-criteria assessment (MCA) at the fine screening stage.

The objective of the MCA and the fine screening process is to determine the potential benefits and impacts of the options across a range of key criteria. The MCA process allows a combination of issues to be considered together. This process can help indicate if one option will be overall more cost effective, environmentally sustainable, progressible, resilient or feasible when compared with other options. This process requires a desk-based analysis of the options and their potential benefits and impacts against the key criteria.

The environmental criteria are based on the SEA objectives in the form of screening questions. These questions have been developed to allow the performance of each option to be assessed against the SEA objectives. The list of questions developed to assess the environmental and social effects of the options

and guidance on the MCA scoring for the fine screening is provided in the SEA Environmental Report Appendix B.

Summaries of the environmental assessment for options that passed the fine screening stage are grouped by option type and are included in Appendix A. These summaries combine the assessments against individual criteria to give an overall environmental topic score; this overall score is based on the worst score across each of the topic's criteria.

This is a high-level risk-based assessment intended to support a comparison of options. Likely beneficial effects are represented by positive scores and likely adverse effects are represented by negative scores based on a seven-point scale.

No options were rejected at fine screening.

3.5 Stage 6: Feasible Options List

A total of 110 options were included as feasible options and were taken forward for Approach Development. The next step was to use the information collected for the fine screening assessment to inform the development of approaches to resolve the SDB deficit within each WRZ and across the study area.

Details of the feasible options identified for this study area, and the Preferred Approach selected, are provided in the SA6 Technical Report.

4 Environmental Assessment – Approach Development

4 Environmental Assessment – Approach Development

This chapter describes how the SEA was integrated into the development of potential approaches/combinations for meeting the SDB deficit at the WRZ level, then at the study area level, and how alternative approaches were considered and assessed.

4.1 Introduction to Approach Development

After the feasible options for the study area were identified the next step was to assess a range of possible SA combinations to resolve the supply deficit within each WRZ and across the study area as a whole. This chapter addresses Stage 7 in the assessment methodology.

An SA combination is a way of configuring an option, or options, to meet either an SDB deficit or water quality requirements. As set out in the Framework Plan, Irish Water considers six SA approaches, which are the combinations rated as the best within the six categories summarised in Table 4.1. This process contributes to assessment of alternatives to meet plan objectives. Consideration of reasonable alternatives is an important part of meeting SEA regulatory requirements.

Table 4.1 The Six SA Approaches

SA Approaches Tested	Description	Policy Driver
Least Cost (LCo)	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) (BA)	Lowest score against the European Sites (Biodiversity) sub criteria question based on assessing the option as having either no LSEs, LSEs that can be addressed with general/standard mitigation measures or LSEs that may be more difficult to mitigate. For options scoring -3, potential alternative higher scoring options are sought where possible.	Habitats Directive
Quickest Delivery (QD)	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 (potential benefit for SEA Objective on population and public health).	Statutory Obligations under the Water Supply Act and Drinking Water Regulations
Best Environmental (BE)	This is the option or combination of options with the highest total score across the SEA objective criteria MCA questions. In addition, high risk -3 issues are considered against individual criteria focusing on long term operational effects.	SEA Directive and WFD

SA Approaches Tested	Description	Policy Driver
Most Resilient (MR)	This is the option or combination of options with the highest total score against the resilience criteria. (Link to SEA Objective for climate change adaptation for environment)	National Adaptation Plan
Lowest Carbon (LC)	This is the option or combination of options with the lowest embodied and operational carbon cost	Climate Change Strategy

These six SA approaches focus on different plan or environmental objectives. Three of the six SA approaches address environmental objectives;

- Best AA;
- Best Environmental; and
- Lowest Carbon approaches.

These are all focused on environmental criteria and are based on the environmental information and scoring undertaken for the MCA.

4.2 Stage 7: Approach Development Process

There are three stages in the Approach Development Process, these are summarised below and provided in more detail in section 7 of the RWRP-EM:

The **First Stage** is the Approach Appraisal at WRZ level. This stage assesses the feasible options for each WRZ and identifies the best performing option within each of the six Approach Types for the relevant WRZ. For example, the option or combination of options that would be classified as the Lowest Carbon Approach, would be that with the lowest carbon cost, based on comparative outline design. The best performing options within each Approach Category are then compared against one another using the 7-step process outlined in Figure 4.1. This process develops an initial Preferred Approach at WRZ level, for all of the individual WRZs in the study area (the "WRZ Level Preferred Approach").

For the Best AA Approach, the scoring on the European Sites (Biodiversity) sub-criteria question refers to the possibility for Likely Significant Effects (LSEs). A Score of 0 equates to no LSEs. If an option is identified that meets the “Objectives of the Plan” and is assessed as having no potential impact on a European Site (zero or neutral score based on desktop assessment), it is automatically adopted as the Preferred Approach at WRZ level. Furthermore, because it is possible that all of the potential impacts identified at Plan level can be entirely ruled out through project level investigation and analysis or avoided through project level mitigation, options with potential for LSEs (score of -1 to -3 for biodiversity) may be progressed as the Preferred Approach. If potential impacts cannot be ruled out or avoided, then mitigation in the form of avoidance is provided for within the NWRP to protect European site(s). Should potential adverse effects on European sites be identified at the project level from a given option/Preferred Approach the NWRP will have identified other options[5] that could be progressed at the project level if required. Therefore, no project arising from the NWRP, with Adverse Effects on Site

[5] These options may not have progressed as the Preferred Approach initially as they may have scored significantly worse against other environmental, resilience or feasibility criteria (e.g. the best AA approach may identify an option that results in four times more carbon being produced or is twice as expensive).

Integrity (AESI) identified at the project stage would be implemented. Scores of -1 to -3 equates to LSEs being identified. Scores of -1 to -2 are LSEs that will not result in AESI with standard best practice project specific mitigation applied as these can be addressed with general/standard mitigation measures. Scores of -3 equates to LSEs that may be difficult to mitigate or where uncertainty remains.

The NIS provides more detail in the LSE and the AESI Tables: Appendices C-D. Any option with a score of -1 to -3 is taken forward to AA (Stage 2 of the AA process) and assessed within the NIS for the Regional Plan.

The **Second Stage** assesses whether there are any larger options (SA options) that might resolve deficits across multiple WRZs within a study area. Combinations are then developed using these SA options and WRZ Preferred options to create “SA Combinations”.

The **Third Stage** compiles the SA Combinations that rank highest for each of the Six Approach Types to generate SA Approaches. The WRZ Level Approach and SA Approaches are then compared against each other using the 7-Step process in Figure 4.1 to generate the SA Preferred Approach

STEP 0 Best AA	If there is an option that meets the Objectives of the Plan, and is assessed as having no potential impact on a European Site (based on desktop assessment), it is automatically adopted as the Preferred Approach
STEP 1 Least Cost	Compare Least Cost against **best AA** Approach, and consider again at Step 6
STEP 2 Quickest Delivery	Compare Least Cost against Quickest Delivery Approach and develop Modified Approach if appropriate
STEP 3 Best Environmental	Compare Least Cost or Modified Approach against Best Environmental, and modify approach **if appropriate**
STEP 4 Most Resilient	Compare Least Cost or Modified Approach against Most Resilient
STEP 5 Least Carbon	Compare Least Cost or Modified Approach against **Lowest** Carbon
STEP 6 Approach Comparison	Compare output from Steps 1 to 5 against: • SEA required outcomes • Sectoral Adaptation Outcomes • **Best AA outcomes** • Public Expenditure Code Outcomes
STEP 7 Preferred Approach	Select Preferred Approach based on steps 0 to 6

Figure 4.1 The 7 Step Process

4.2.1 Environmental Assessment in the Approach Development process

Combinations of feasible options are identified to balance the water demand and predicted baseline supply and address the remaining deficit over the plan period. The Approach Development process

allows Irish Water to compare and optimise the options against different elements to create a range of approaches capable of meeting the deficit.

There are two strands of environmental information and assessment used in the Approach Development process. These are:

Environmental and social costs: these were based on a natural capital/ecosystems services framework and scoped to be relevant and achievable with the information available and to add to, rather than duplicate, the qualitative environmental assessment of the options. This included:

i. Climate regulation – woodland;
ii. Traffic impacts – opportunity cost of time due to road congestion from roadworks;
iii. Food – crops and livestock; and
iv. Carbon equivalent emissions tonnes (note total greenhouse gas emissions are expressed in terms of carbon equivalent emissions) including embodied and operational carbon were also calculated and costed.

The approach for calculating the elements i, ii, iii and iv are explained in the SEA Environmental Report Appendix E.

Carbon emissions (tCO_2e) and carbon costs are calculated alongside construction and operational costs. As part of the environmental assessment carbon efficiency has also been calculated to identify carbon emissions per ML of water supply.

Environmental assessment: this is qualitative assessment against the SEA objective for each option as part of the MCA scoring for the fine screening. These scores are based on assessing options in terms of potential adverse or beneficial effects and a seven-point scale is used from Major, Moderate or Minor Adverse, Neutral, to Minor, Moderate or Major Beneficial. These are reflected in numeric scores -3 to 0 to +3 and are used to assess option performance against the MCA scores. The scoring applied at fine screening is reviewed and updated based on the developed option descriptions and additional environmental analysis.

Carbon emissions (tCO_2e) initially were assessed through qualitative assessment for fine screening as this preceded option costing, however in the approach development process the carbon emissions as total Net Present Value (NPV) costs have been used to inform the Approach Development Process. Total life- time carbon emissions and carbon efficiency per ML have been used to inform the SEA assessment.

The general process is illustrated in Figure 4.2 below.

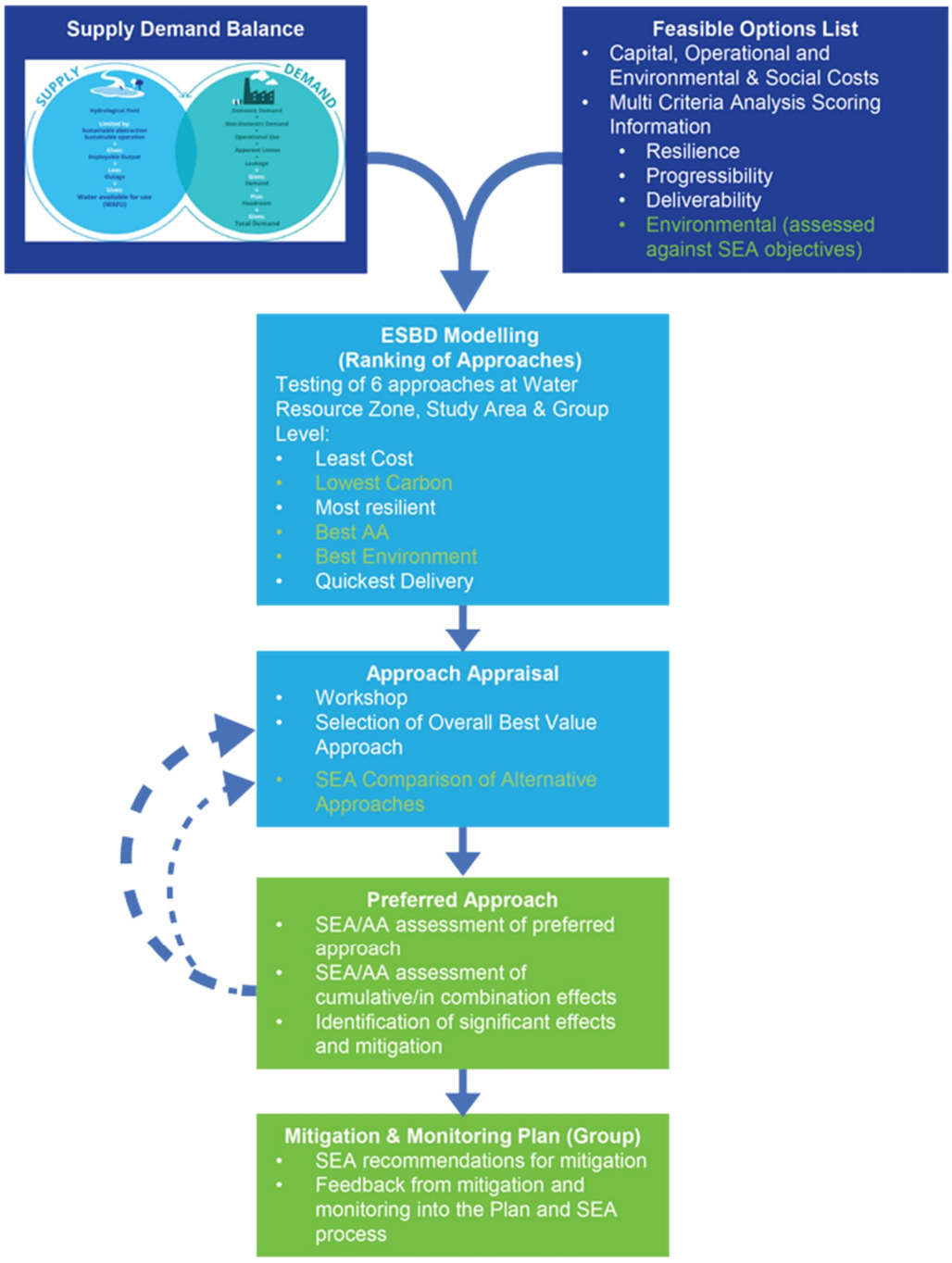

Figure 4.2 Approach Development Process

4.3 SA6 Approach Development Process

The approach appraisal process was undertaken through structured workshops and reviews involving relevant environmental expertise (including ecologists, hydrogeologists, hydrologists and environmental scientists) and included Local Authority involvement and feedback. This process was supported by information on the feasible options; including the environmental assessment against SEA criteria in the MCA and the option costings.

The options were then taken through the sequential testing (the 7 step process detailed in section 4.2, Figure 4.1 above) against the six SA categories (lowest carbon, best environmental, best AA, least cost, quickest delivery and most resilient) to identify the best overall options and combinations at WRZ and study area levels applying the three stages:

Stage 1 - comparing WRZ options and identify the preferred WRZ level approach. For SA6 there are 60 WRZ options and these are listed in Table 5.2 in the SA6 Technical Report, providing option reference numbers and the relevant WRZ. These options were taken through the 7 step process to identify the preferred WRZ approach.

Stage 2 - creating combinations of WRZ options and SA options (group options) for comparison. These are the possible SA combinations and are presented and ranked against the approach categories (see Table 4.2).

Stage 3 - selecting the Preferred Approach at study area level – this stage compares the WRZ level preferred approach and the SA combinations to determine the Preferred Approach that provides the best outcome for the study area. The best performing SA combinations under each of the six approach categories are identified and then compared using the 7 step process applied in the workshop to establish the Preferred Approach at study area level.

Performance ranking against the assessment criteria was based on the MCA scoring, including the fine screening environmental assessments, and costings. Further environmental assessment has also been undertaken to compare the alternative approaches in line with SEA requirements and this assessment is presented in Table 4.7 and Table 4.9 below.

For SA6, a total of 18 combinations were compared including the WRZ Level Approach; these are presented in Table 4.2. Note that the Preferred Approach selected at the end of the process has been outlined in red throughout this section.

Table 4.2 SA6 Summary of SA Combination of Performance against Approach Type

Category	WRZ level approach	SA combination 1 (SA option 12)	SA combination 2 (SA option 17)	SA combination 3 (SA option 18)	SA combination 4 (SA option 19)	SA combination 5 (SA option 23)	SA combination 6 (SA option 36)	SA combination 7 (SA option 38)	SA combination 8 (SA option 40)	SA combination 9 (SA option 42)	SA combination 10 (SA option 46)	SA combination 11 (SA option 50)	SA combination 12 (SA option 51)	SA combination 13 (SA option 52)	SA combination 14 (SA option 53)	SA combination 15 (SA option 54)	SA combination 16 (SA option 55)	SA combination 17 (SA option 52 & 53)
Least Cost													Worst					Best
Quickest Delivery	Best																	
Number of -3 Biodiversity Scores	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	No -3 scores	Two -3 scores	One -3 score	No -3 scores	One -3 score	One -3 score	No -3 scores	One -3 score	No -3 scores	One -3 score	Two -3 scores	No -3 scores
Lowest Carbon										Worst				Best				
Most Resilient												Best	Worst					
Best Environmental								Worst		Best						Worst		

Key															
Ranked order (best to worst)	Best														Worst

Through comparing all the potential SA combinations, the best SA approach for each of the six approach categories was identified; these aligned as five approaches (see Table 4.3). For SA6, there were eleven combinations within 5% of one another in the least cost category. Only three of the combinations had no -3 for biodiversity scores and were considered further. These three combinations were found to be comparable across all other approach categories; however, as combination 17 performed the best of the three combinations under the least cost and environmental criteria it was taken forward as the Least Cost Approach. See section 5 of SA6 Technical Report for further details.

Table 4.3 Study Area Approach Categories

Category	SA Approach 1 (SA Combination 17) (LCo)	SA Approach 2 (SA Combination 9) (BE, BA)	SA Approach 3 (WRZ Approach) (QD)	SA Approach 4 (SA Combination 11) (MR)	SA Approach 5 (SA Combination 13) (LC)
Least cost (LCo)	✓	-	-	-	-
Quickest Delivery (QD)	-	-	✓	-	-
Best Environmental (BE)	-	✓	-	-	-
Most Resilient (MR)	-	-	-	✓	-
Lowest Carbon (LC)	-	-	-	-	✓
Best AA (BA)	-	✓	-	-	-

The WRZ options and SA options (group options) that make up each SA approach are listed in Table 4.4. More detailed descriptions of the options are provided in Appendix A and a full list of options for each approach is given in Appendix B of this report.

Table 4.4 Study Area Approaches

Options included	Do Minimum	Least Cost Approach (SA Combination 17)	Best Appropriate Assessment Approach (SA Combination 9)	Quickest Delivery Approach (WRZ Approach)	Best Environmental Approach (SA Combination 9)	Most Resilient Approach (SA Combination 11)	Lowest Carbon Approach (SA Combination 13)
SA options	No options	**SA option 52:**	**SA option 42:**	N/A	**SA option 42:**	**SA option 50:**	**SA option 52:**

Options included	Do Minimum	Least Cost Approach (SA Combination 17)	Best Appropriate Assessment Approach (SA Combination 9)	Quickest Delivery Approach (WRZ Approach)	Best Environmental Approach (SA Combination 9)	Most Resilient Approach (SA Combination 11)	Lowest Carbon Approach (SA Combination 13)
(Group options)		180c, 184 **SA option 53:** 139, 144e	061,163, 164, 165, 166, 167, 168, 169, 170, 180b, 194, 195, 196		061,163, 164, 165, 166, 167, 168, 169, 170, 180b, 194, 195, 196	131, 150a	180c, 184
WRZ options	No options	019 024 033 038 45a 53a 57a 064 69a 077 86a 090 094 099 104 105 113a 122 126 149 156 191 193 197	019 024 033 038 053a 064 086a 090 094 099 104 191 193 197 198	019 024 033 038 45a 53a 57a 064 69a 077 86a 090 094 099 104 105 113a 122 126 134 143 149 156 180a 191	019 024 033 038 045a 053a 064 086a 090 094 099 104 156 191 193 197 201	019 024 033 038 45a 53a 57a 064 69a 077 86a 090 094 099 104 105 113a 122 134 143 156 180a 191 193 197	019 024 033 038 045a 053a 057a 064 069a 077 086a 090 094 099 104 105 113a 122 126 134 143 149 156 191 193

Options included	Do Minimum	Least Cost Approach (SA Combination 17)	Best Appropriate Assessment Approach (SA Combination 9)	Quickest Delivery Approach (WRZ Approach)	Best Environmental Approach (SA Combination 9)	Most Resilient Approach (SA Combination 11)	Lowest Carbon Approach (SA Combination 13)
				193 197 201		201	197

* For the option references - all options are part of SA6 e.g. SA6-139 is shown as 139 above

For the purposes of the Approach Development Process as set out in the SA Technical Report and for the purpose of the SEA comparison as set out in this Environmental Review, Irish Water has only considered the options that were identified as the "best" performing options for each approach category. The identification of the approaches and 7 step process are outlined in detail in section 5 of the SA6 Technical Report.

Within SA6, this resulted in five approaches being selected from the 18 SA combinations identified in Table 4.2, as they were identified as the best performing against the six approach categories - Least Cost, Best Environmental, Quickest Delivery, Most Resilient, Best AA and Lowest Carbon. This means that when comparing the five identified approaches against each other (representing the Stage 3 analysis for the selection of the Preferred Approach used in the workshop - see Table 4.5), their relative performance against categories they were not identified as “best” in in Table 4.2 may be different. This because Table 4.2 compares all of the combinations to give a wider ranking, whereas Table 4.5 only compares the best performing combinations that have been selected as approaches. For example, an option identified as the "worst" performer against a particular approach category in Table 4.5 may not be the overall worst performing option when considered alongside all of the combinations in Table 4.2.

Table 4.5 includes a summary of the MCA scoring and cost comparison used in the approach development for the each of the SA approaches identified as performing best against at least one of the approach categories.

The three stages identified above were applied through a final workshop with all of the background MCA and option costing information available for each option and the ranking from the Economic Balance of Supply and Demand (EBSD) tool. Table 4.5 shows both SA approach 1 and SA approach 2 as the best AA because they have the same number of -3 biodiversity scores (i.e. no -3 biodiversity scores). SA approach 2 was selected as the best AA approach in Table 4.3 after comparing the number of -2 and -1 biodiversity scores.

Table 4.5 Summary of the MCA Scoring Costing for the SA Approaches

Category Criteria	SA Approach 1 (SA Combination 17) (LCo)	SA Approach 2 (SA Combination 9) (BE, BA)	SA Approach 3 (WRZ Approach) (QD)	SA Approach 4 (SA Combination 11) (MR)	SA Approach 5 (SA Combination 13) (LC)
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	One -3 Biodiversity Score	One -3 Biodiversity Score
Lowest Carbon Score		Worst			Best
Most Resilient Score		Worst		Best	
Best Environmental Score		Best	Worst		

Key				
Ranked order (best to worst)				
Worst				Best

*As mentioned above, SA combination 17 was taken forward as the least cost approach as it is within 5% of the actual lowest cost and is the lowest cost combination that does not include any options which have a -3 biodiversity score

4.4 Comparison of SA6 Approaches

An overall summary of the infrastructure components and abstractions for each of the SA approaches identified for SA6 is provided below in Table 4.6 and has been used to inform the environmental assessment.

Table 4.6 Study Area Approach Components Summary

Infrastructure Summary	Do Minimum	SA Approach 1 (SA Combination 17) (LCo)	SA Approach 2 (SA Combination 9) (BE, BA)	SA Approach 3 (WRZ Approach) (QD)	SA Approach 4 (SA Combination 11) (MR)	SA Approach 5 (SA Combination 13) (LC)
New pipeline network (km)	0	81	243	109	110	108
New WTPs	0	1	1	1	1	1
Upgrade WTPs	0	36	22	38	38	36
New/upgraded abstractions	0	23	14	27	26	25
WTPs decommissioned	0	6	19	4	4	6
Abstractions abandoned	0	7	0	3	3	5
Raw water storage	0	0	0	0	0	0
Treated water storage	0	10	14	11	10	10

A comparative assessment of the five SA approaches based on the environmental option scores is summarised in Table 4.7 below. This covers:

- Scores across the options summed for all the sub-criteria against each SEA objective topic heading;
- Total numbers of -3 scores representing higher risk of effect, or likely greater requirement for mitigation, against each SEA objective topic heading; and
- Indication of the extent of difference in performance across the options to help identify if the differences between the SA approaches are small or large.

Table 4.7 Study Area Approach Comparison Summary

Topic	Total No. of	SA Approach 1 (SA Combination 17) (LCo)	SA Approach 2 (SA Combination 9) (BE, BA)	SA Approach 3 (WRZ Approach) (QD)	SA Approach 4 (SA Combination 11) (MR)	SA Approach 5 (SA Combination 13) (LC)	Range (Difference between Lowest and Highest Score)
Population, health, economy and recreation	-3 scores	No difference					0
	MCA score		Best	Worst			12
Water Environment : quality and resources	-3 scores		Best	Worst	Worst		6
	MCA score		Best	Worst			25
Biodiversity, Flora and Fauna	-3 scores	Best	Best	Worst	Worst	Worst	1
	MCA score		Best	Worst			62
Material Assets	-3 scores	Best	Worst	Best	Best	Best	1
	MCA score		Best		Worst		7
Landscape and Visual	-3 scores	No difference					0
	MCA score		Best		Worst		7
Climate Change	-3 scores	Best	Worst	Best	Best	Best	1
	MCA Score		Best	Worst			9
Culture, Heritage and Archaeology	-3 scores	No difference					0
	MCA Score	No difference					0

Topic	Total No. of	SA Approach 1 (SA Combination 17) (LCo)	SA Approach 2 (SA Combination 9) (BE, BA)	SA Approach 3 (WRZ Approach) (QD)	SA Approach 4 (SA Combination 11) (MR)	SA Approach 5 (SA Combination 13) (LC)	Range (Difference between Lowest and Highest Score)
Geology and Soils	-3 scores	No difference					0
	MCA Score	Best	Worst	Best	Best	Best	2

Key				
MCA/No. of -3 scores against each criterion				
Worst				Best

* approaches are showing similar level of risk on climate change adaptation and therefore represented as no difference. However, carbon mitigation is covered separately based on estimated emissions and carbon cost (NPV). See lowest carbon approach.

** approaches are showing similar level of risk on culture, heritage and archaeology. Routing and siting is only indicative at this stage. Most options involving new constructions include a level of risk to buried unknown archaeology, this would need to be investigated further at the project level.

4.4.1 SA Approach 1 (SA Combination 17) (LCo)

SA approach 1, key comparison points:

- Identified as the best in the Least Cost category;
- Option types included:
    - SA option: 1 groundwater abstraction option;
    - WRZ options: 21 groundwater abstraction options, 1 New Shannon Source option and 2 WTP upgrade options;
- No -3 biodiversity scores (higher risk options that could impact on European sites); and
- Similar in terms of infrastructure development to SA approaches 3, 4 and 5. Compared with SA approaches 3, 4 and 5, SA approach 1 has the shortest length of pipeline associated with it, the highest number of decommissioned WTPs (same number as SA approach 5) and abandoned abstractions.

4.4.2 SA Approach 2 (SA Combination 9) (BE, BA)

SA approach 2, key comparison points:

- Identified as the best in the following categories: Best Environmental and Best AA;
- Option types included:
    - SA option: 1 rationalisation option;

    - WRZ options: 12 groundwater abstraction options, 1 New Shannon Source option and 2 WTP upgrade options;

- No -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 2 has over double the length of pipeline, approximately three times the number of WTPs decommissioned and the highest number of treated water storages compared with the other approaches. SA approach 2 also has the fewest number of WTP upgrades, abstractions abandoned, and new/upgraded abstractions compared with the other approaches.

4.4.3 SA Approach 3 (WRZ Approach) (QD)

SA approach 3, key comparison points:

- Identified as the best in the Lowest Carbon and the Quickest Delivery categories;
- Option types included:
    - WRZ options: 24 groundwater abstraction options, 2 New Shannon Source options and 2 WTP upgrade options;
- One -3 biodiversity scores (higher risk options that could impact on European sites); and
- Similar in terms of infrastructure development to SA approaches 1, 4 and 5. Compared with SA approaches 1, 4 and 5, SA approach 3 has the lowest number of decommissioned WTPs and abandoned abstractions (same number as SA approach 4), and the highest number of new/upgraded abstractions and treated water storages.

4.4.4 SA Approach 4 (SA Combination 11) (MR)

SA approach 4, key comparison points:

- Identified as best in the Most Resilient category;
- Option types included:
    - SA option: 1 interconnection option;
    - WRZ options: 22 groundwater abstraction options, 2 New Shannon Source options and 2 WTP upgrade options;
- One -3 biodiversity scores (higher risk options that could impact on European sites); and
- Similar in terms of infrastructure development to SA approaches 1, 3 and 5. Compared with SA approaches 1, 3 and 5, SA approach 4 has the lowest number of decommissioned WTPs and abandoned abstractions (same number as SA approach 3).

4.4.5 SA Approach 5 (SA Combination 13) (LC)

SA approach 5, key comparison points:

- Identified as the best in the Lowest Carbon category;
- Option types included:
    - SA option: 1 New Shannon Source option;
    - WRZ options: 23 groundwater abstraction options, 1 New Shannon Source option and 2 WTP upgrade options;
- One -3 biodiversity scores (higher risk options that could impact on European sites); and
- Similar in terms of infrastructure development to SA approaches 1, 3 and 4. Compared with SA approaches 1, 3 and 4, SA approach 5 has the highest number of decommissioned WTPs and abandoned abstractions (same number as SA approach 1).

4.5 SA6 Approach Assessment Comparison

The 'Do Minimum' approach is the 'without plan' approach, meaning that this is the approach that would occur without the NWRP. As a result, the 'Do Minimum' approach would only include reactive, unplanned interim measures to address failures in infrastructure.

The SDB shows a current deficit, applying the level of service in the area with the corresponding requirements for reserves, indicating operation of supplies with an SDB ranging from -30,560 m^3/d in 2019, to a projected maximum of -35,720 m^3/d in 2044 during dry conditions under a 'Do Minimum' scenario. As a result, public water supplies in this area are vulnerable, particularly under drought conditions. In addition, there may be ongoing reliability issues with the supplies and the situation is expected to further deteriorate due to climate change driven reductions in water resources and increased demand growth within the area. Table 4.8 shows the SDB for the WRZs in SA6.

Table 4.8 Supply Demand Balance for SA6

WRZ Name	WRZ Code	Population	Maximum Deficit m^3/day*	
			2019	2044
Carlow North	0100SC0001	37,872	-8,590	-10,594
Leighlinbridge	0100SC0002	1,165	No Deficit	No Deficit
Old Leighlin	0100SC0003	83	-8	-10
Bilboa	0100SC0004	37	-4	-5
Bagenalstown	0100SC0008	2,956	No Deficit	No Deficit
Carlow Central Regional	0100SC0011	3,797	-521	-736
Urlingford-Johnstown PWS	1500SC0006	1,769	-216	-268
Clogh-Castlecomer	1500SC0009	3,780	-838	-915
Galmoy Rathdowney PWS	1500SC0018	1,685	-1,060	-1,139
Portlaoise	1600SC0001	24,325	-3,212	-4,180
Rosenallis	1600SC0003	188	No Deficit	-2
Mountmellick	1600SC0004	5,150	-559	-729
Portarlington	1600SC0005	10,636	-2,432	-2,573
Arles	1600SC0006	111	-7	-10
The Strand	1600SC0007	6	-3	-3
Coolanaugh PWS	1600SC0008	28	-5	-6
Borris In Ossory	1600SC0010	613	-232	-261
Camross PWS	1600SC0011	39	-6	-7
South East Regional PWS	1600SC0014	4,769	-2,380	-2,602
Swan PWS	1600SC0015	1,500	-210	-267

WRZ Name	WRZ Code	Population	Maximum Deficit m^3/day*	
			2019	2044
Mountrath	1600SC0016	3,600	-860	-1,025
Abbeyleix South	1600SC0017	569	-223	-259
Ballinakill	1600SC0018	676	-1,288	-1,344
Durrow	1600SC0019	1,309	-1,126	-1,204
Abbeyleix North	1600SC0020	1,870	-423	-528
Ballyroan	1600SC0021	1,281	-323	-393
Tullamore	2500SC0002	16,700	-5,999	-6,620
Mountbolus PWS	2500SC0013	152	-35	-40

*Based on the Dry Year Critical Period (DYCP) weather event planning scenario

An overall assessment and comparison of the SA approaches considered along with the 'Do Minimum' approach (a continuation of the current situation) is provided in Table 4.9 below.

Table 4.9 Assessment of the SA Approaches and the 'Do Minimum' Approach

SEA Objectives	Phase (Construction (C) / Operation (O))	Do Minimum	SA Approach 1 (LCo)	SA Approach 2 (BE, BA)	SA Approach 3 (QD)	SA Approach 4 (MR)	SA Approach 5 (LC)
1. Protect public health and promote wellbeing	C	0	-	-	-	-	-
	O	---	++	++	++	++	++
2. Protect and enhance biodiversity and contribute to resilient ecosystems	C	0	-	-	-	-	-
	O	--	--	-	--	--	--
3. To protect landscapes, townscapes and visual amenity	C	0	-	-	-	-	-
	O	0	+	+	+	+	+
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C	0	-	-	-	-	-
	O	-	-	-	-	-	-
	C	0	--	---	-	-	-

SEA Objectives	Phase (Construction (C) / Operation (O))	Do Minimum	SA Approach 1 (LCo)	SA Approach 2 (BE, BA)	SA Approach 3 (QD)	SA Approach 4 (MR)	SA Approach 5 (LC)
5. Reduce greenhouse gas emissions	O	-	--	---	-	-	-
6. Contribute to environmental climate change resilience	C	0	-	-	-	-	-
	O	--	--	-	--	-	--
7. Protect and improve surface water and groundwater status	C	0	0	0	0	0	0
	O	--	--	-	--	--	--
8. Avoid flood risk	C	0	0	0	0	0	0
	O	0	0	0	0	0	0
9. Protect and where appropriate, enhance cultural heritage assets	C	0	-	-	-	-	-
	O	0	0	0	0	0	0
10. Protect quality and function of soils	C	0	-	--	-	-	-
	O	0	0	0	0	0	0

Key			
Major beneficial	+++	Minor adverse	-
Moderate beneficial	++	Moderate adverse	--
Minor beneficial	+	Major adverse	---
Neutral	0		

The overall assessment of the approaches against the SEA objectives indicates that SA approach 2 is better environmentally and is likely to have lower biodiversity impacts as it avoids potential impacts that are indicated for the other approaches on the River Barrow. However, both SA approach 2 and SA approach 1 avoid potential impacts on the Owenbeg river part of River Barrow and Nore SAC. SA approach 2 also scores much worse than the other approaches in terms of carbon emissions and includes assets within a geological heritage site, resulting in a moderate adverse score during construction for geology and soils.

Mitigation for the Preferred Approach is identified in chapter 5 through the individual options assessment and the chapter 6 cumulative assessment. All the approaches address the identified water supply

quantity and quality requirements to secure a level of service important for public health and wellbeing compared with the 'Do Minimum'.

4.5.1 Selection of the SA Preferred Approach

SA approach 1 has been selected through the 7 step process as the best performing approach overall across the different categories.

The SA Preferred Approach does not include any -3 Biodiversity score options. Therefore, no higher risk options for effects on European Sites are included in the Preferred Approach. For options identified as having some level of risk for LSEs, mitigation measures to address these are set out in the NIS and no AESI are identified.

4.6 Without Regional Transfer Alternative

The approach development process at study area level 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 solutions only. The SA6 Preferred Approach includes options that are dependent on the development of the SA9 Preferred Approach. Alternatives for these options need to be considered in the event that the Preferred Approach for SA9 cannot advance, the alternative options are outlined in Table 4.10. Note that the options for the other WRZs that are not specified in Table 4.10 will remain the same as those in the current SA6 Preferred Approach.

Table 4.10 Alternative Options for WRZs Dependent on the SA9 Preferred Approach

WRZ	SA6 Preferred Approach Option	SA6 Alternative Option
Carlow Town	SA6-193 Connect to New Shannon Source via Srowland	SA6-09a 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 a new groundwater abstraction
Tullamore	SA Option 52 (SA6-180c) Supply Tullamore from New Shannon Source	SA6-177a New groundwater abstraction and increase output at the existing Arden WTP
Mountbolus	SA Option 52 (SA6-184) New connection point from new Shannon Source connecting to Mountbolus	SA6-201 New GW abstraction and increase output at the existing WTP

An overall infrastructure summary of the Preferred Approach options and the alternative options listed in Table 4.10 are provided in Table 4.11, covering the main components of the options.

Table 4.11 Alternative and Preferred Approach Options Infrastructure Summary

Infrastructure Summary	Preferred Approach Options	Alternative Approach Options
New pipeline network (km)	54	15

Infrastructure Summary	Preferred Approach Options	Alternative Approach Options
New WTPs	0	0
Upgrade WTPs	5	9
New/upgraded abstractions	0	2
WTPs decommissioned	4	2
Abstractions abandoned	5	0
Raw water storage	0	0
Treated water storage	3	3

Table 4.12 provides an overall comparative assessment between the SA6 Preferred Approach options and the alternative options listed in Table 4.10 against the SEA objectives.

Table 4.12 Assessment of the Preferred Approach Options and the Alternatives

SEA Objectives	Phase (Construction (C) / Operation (O))	Preferred Approach Options (PA)	Alternative Approach Options (Alt)	Summary
1. Protect public health and promote wellbeing	C	-	-	Both the PA and the Alt options have the potential to impact rural areas through short-term disruption from dust, noise and traffic during the construction phase.
	O	++	++	The PA options decommissions two more WTPs but the Alt options upgrade four more WTPs.
2. Protect and enhance biodiversity and contribute to resilient ecosystems	C	--	-	The PA options require extensive pipeline network that is routed adjacent to the River Barrow SAC and risks disturbance and water pollution during construction which could potentially impact qualifying interest species. The Alt options are nearby several European sites and further assessment is required to determine impacts.
	O	0	--	The Alt option abstractions are either nearby designated sites or require a high level of abstraction. In both instances, further assessment is required to determine the abstraction impacts. Due to the uncertainty this has been scored as moderate during operation.
3. To protect landscapes, townscapes and visual amenity	C	-	-	The PA options and Alt options both have the potential to cause visual impacts to rural areas during construction of the pipeline.

SEA Objectives	Phase (Construction (C) / Operation (O))	Preferred Approach Options (PA)	Alternative Approach Options (Alt)	Summary
	O	++	+	The PA options include the decommissioning of two more WTPs than the Alt options, this has the potential to cause beneficial long term visual impacts.
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C	-	-	The PA options requires over three times the length of pipeline. The Alt approach has the potential to result in temporary loss of access to agricultural land.
	O	0	0	The PA and Alt options require pipeline; however, land will be reinstated after construction and no long term impacts are predicted.
5. Reduce greenhouse gas emissions	C	---	---	There is a major level of carbon emissions associated with both the PA and Alt options in relation to the Deployable Output created.
	O	---	---	
6. Contribute to environmental climate change resilience	C	0	0	No construction impacts are predicted.
	O	+	-	The PA options use a large resilient supply whereas the Alt options utilises smaller supplies that are more vulnerable to climate change impacts. The PA options would also help to reduce pressure on existing environmental sources within these WRZs through rationalising the supply.
7. Protect and improve surface water and groundwater status	C	0	0	No construction impacts are predicted.
	O	0	--	The PA options does not include any new or increased abstractions whereas the Alt options include new abstractions. Further studies will need to be undertaken for the Alt option SA6-201 to determine the long term sustainability due to the level of abstraction required.
8. Avoid flood risk	C	0	0	No impediment to surface water flow paths or increase to flood risk anticipated.
	O	0	0	
9. Protect and where appropriate, enhance cultural heritage assets	C	--	-	One of the PA options is located where there are cultural heritage assets and known archaeology listed under the Record of Monuments/Record of Protected Structures and/or National Inventory of Architectural Heritage records. There is potential for

SEA Objectives	Phase (Construction (C) / Operation (O))	Preferred Approach Options (PA)	Alternative Approach Options (Alt)	Summary
				minor short-term visual impacts to assets during construction. However, the other Alt and PA options also have a minor risk due to unknown archaeology during construction of the new network.
	O	0	0	No operational impacts are predicted.
10. Protect quality and function of soils	C	-	-	The Alt and PA options are not located where there are any recorded geological features or valuable soil resources at risk. However, there is potential risk of minor damage to valuable soils with construction of the network.
	O	0	0	Soils will be reinstated after construction and no operation impacts are predicted.

Key			
Major beneficial	+++	Minor adverse	-
Moderate beneficial	++	Moderate adverse	--
Minor beneficial	+	Major adverse	---
Neutral	0		

The Preferred Approach options are assessed in Table 4.12 as performing better against four of the ten SEA objectives, a summary of the key reasoning behind this is also provided.

In the event that the SA9 Preferred Approach cannot progress, the alternatives above will be required to replace those options that are reliant on it. These alternatives will be subject to their own planning and regulatory processes and it will take a number of investment cycles to progress these projects; hence, they may change in later iterations of the plan.

5

SA6 Preferred Approach: Strategic Environmental Assessment

5 SA6 Preferred Approach Strategic Environmental Assessment

5.1 SA6 Preferred Approach Options

This chapter provides an environmental assessment of the proposed SA Preferred Approach as required by the SEA Directive and implementing Irish regulations. The environmental effects are considered for each option individually. Additional measures proposed to be taken forward along with these options are also considered. Cumulative effects for both the 'within plan' SA Preferred Approach and the cumulative effects with other proposed developments outside the Framework Plan are addressed in chapter 6.

The SA Preferred Approach consists of WRZ options for twenty-four of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For three of the WRZs, namely Carlow Town, Mountbolus and Tullamore, the SA Preferred Approach involves connecting to the New Shannon Source. The other WRZ options involve new and increased groundwater abstractions, rationalisation and WTP upgrades. The SA Preferred Approach for the remaining two WRZs (Ballinakill and Durrow) is SA option 53, which involves interconnecting the two WRZs, an increased groundwater abstraction and WTP upgrades.

Table 5.1 gives a breakdown of the options in SA6 and the associated abstractions/demand.

Table 5.1 Preferred Approach Breakdown

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
SA6-193 0100SC0001 Carlow Town	Connect to New Shannon Source via Srowland • Option to connect WRZ to Srowland WTP, (Preferred Approach for SA9). Dependent on new Shannon source (Lough Derg) supply to GDA. Existing Barrow abstraction to be maintained. • WFD status Derg highly modified waterbody 2013-2018 – Good	10,594 m^3/d
SA6-019 0100SC0003 Old Leighlin	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) - yield assessments required • Existing GW source (Bagenalstown Lower groundwater body) WFD status 2013-2018 – Good	28 m^3/d
SA6-024 0100SC0004 Bilboa	New GW abstraction • New GW abstraction to meet WRZ deficit (DYCP 2044) • Existing GW source (Castlecomer groundwater body) WFD status 2013-2018 – Good	16 m^3/d
SA6-191 0100SC0008 Bagenalstown	WTP upgrade • WRZ not in deficit, option to upgrade WTP for water quality purposes	N/A

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
	• Existing GW source (Athy-Bagnelstown Gravels groundwater body) WFD status 2013-2018 – Good	
SA6-033 0100SC0011 Carlow Central Regional	New GW abstraction to supply deficit • New GW abstraction to meet WRZ deficit (DYCP 2044). Existing SW abstraction from River Burren to be maintained • New GW source (Athy-Bagnelstown groundwater body) WFD status 2013-2018 – Good	1,693 m^3/d
SA6-45a 1500SC0009 Clogh-Castlecomer	New GW abstraction/wellfield to supply deficit • New GW abstraction to meet WRZ deficit (DYCP 2044). Current sources/WTPs to be maintained • New GW (Castlecomer groundwater body) WFD status 2013-2018 – Good	1,895 m^3/d
SA6-53a 1500SC0018 Galmoy-Rathdowney	Increase GW abstraction and new wellfield • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Rathdowney groundwater body WFD status 2013-2018 – Good	1,875 m^3/d
SA6-064 1600SC0003 Rosenallis	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Portlaoise groundwater body WFD status 2013-2018 – Good	43 m^3/d
SA6-69a 1600SC0004 Mountmellick	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Portlaoise groundwater body WFD status 2013-2018 – Good	2,470 m^3/d
SA6-077 1600SC0005 Portarlington	Increase GW abstraction to supply deficit • Develop groundwater close to existing abstraction to meet WRZ deficit (DYCP 2044). Option involves 5 new boreholes. Current GW sources/WTPs to be maintained – Lough WTP and Le Bergerie WTP. • Bagenalstown groundwater body WFD status 2013-2018 – Good	4,819 m^3/d
SA6-86a 1600SC0006 Arles	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) - yield assessments required	27 m^3/d

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
	• Shanragh groundwater body WFD status 2013-2018 – Good	
SA6-090 1600SC0007 The Strand	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Shanragh groundwater body WFD status 2013-2018 – Good	8 m^3/d
SA6-094 1600SC0008 Coolanagh	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Bagenalstown Upper groundwater body WFD status 2013-2018 – Good	12 m^3/d
SA6-099 1600SC0010 Borris in Ossory	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Rathdowney groundwater body WFD status 2013-2018 – Good	573 m^3/d
SA6-104 1600SC0011 Camross	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Coolrain groundwater body WFD status 2013-2018 – Good	12 m^3/d
SA6-105 1600SC0014 South East Regional	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Timahoe Gravels groundwater body WFD status 2013-2018 – Good	4,024 m^3/d
SA6-113a 1600SC0015 Swan	Increase GW abstraction to supply deficit • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Newtown groundwater body WFD status 2013-2018 – Good	822 m^3/d
SA6-122 1600SC0016 Mountrath	Rationalise Cloonin Hill, Drim and Knocks into one WTP to add resilience • Option involves decommissioning/rationalisation of Drim WTP and Cloonin Hill WTP and increased GW (4 new boreholes) at Knocks WTP to meet WRZ demand (DYCP 2044) • Rathdowney groundwater body WFD status 2013-2018 – Good	2,492 m^3/d
SA6-197 0100SC0002 Leighlinbridge	WTP upgrade only • WTP upgrade only (DYCP 2044)	N/A

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
SA6-038 1500SC0006 Urlingford-Johnstown	New GW abstraction to supply deficit • New GW abstraction to supply deficit and improve water quality DYCP (2044) • Durrow groundwater body WFD status 2013-2018 – Poor	726 m^3/d
SA6-057a 1600SC0001 Portlaoise	New GW abstraction/wellfield development • New GW abstraction/wellfield development DYCP (2044) • Bagenalstown Upper groundwater body WFD status 2013-2018 – Good	12,888 m^3/d
SA6-126 1600SC0017 Abbeyleix South	Increase GW abstraction to supply deficit • Increase GW abstraction to supply deficit DYCP (2044) • Abbeyleix Gravels groundwater body WFD status 2013-2018 – Good	629 m^3/d
SA6-139 and SA6-144e (SA option 53) 1600SC0018 Ballinakill and 1600SC0019 Durrow	Increase GW abstraction at Fermoyle WTP to supply deficit and interconnect with Ballinakill • Increase GW abstraction at Fermoyle WTP to supply deficit and interconnect with Ballinakill DYCP (2044) • Durrow groundwater body WFD status 2013-2018 – Poor	1,752 m^3/d
SA6-149 1600SC0020 Abbeyleix North	Increase GW abstraction to supply deficit • Increase GW abstraction to supply deficit DYCP (2044) • Abbeyleix Gravels groundwater body WFD status 2013-2018 – Good	1,315 m^3/d
SA6-156 1600SC0021 Ballyroan	Increase GW abstraction to supply deficit • Increase GW abstraction to supply deficit - Ballyroan Spring DYCP (2044) • Ballingarry groundwater body WFD status 2013-2018 – Good	1,004 m^3/d
SA6-180c (SA Option 52) 2500SC0002 Tullamore	Supply Tullamore from New Shannon Source • Supply Tullamore from New Shannon Source DYCP (2044). Dependent on new Shannon source (Lough Derg) supply to GDA • WFD status Derg highly modified waterbody 2013 -2018 – Good	8,859 m^3/d
SA6-184 (SA Option 52)	New connection point from Shannon Source to Mountbolus	62 m^3/d

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
2500SC0013 Mountbolus	• Supply Mountbolus from New Shannon Source DYCP (2044). Dependent on new Shannon source (Lough Derg) supply to GDA. • Existing GW source (Geashill groundwater body) WFD status 2013-2018 – Good	

* Note: SA Options are the same as Group Options

The SA Preferred Approach options are shown in Figure 5.1, in relation to key environmental

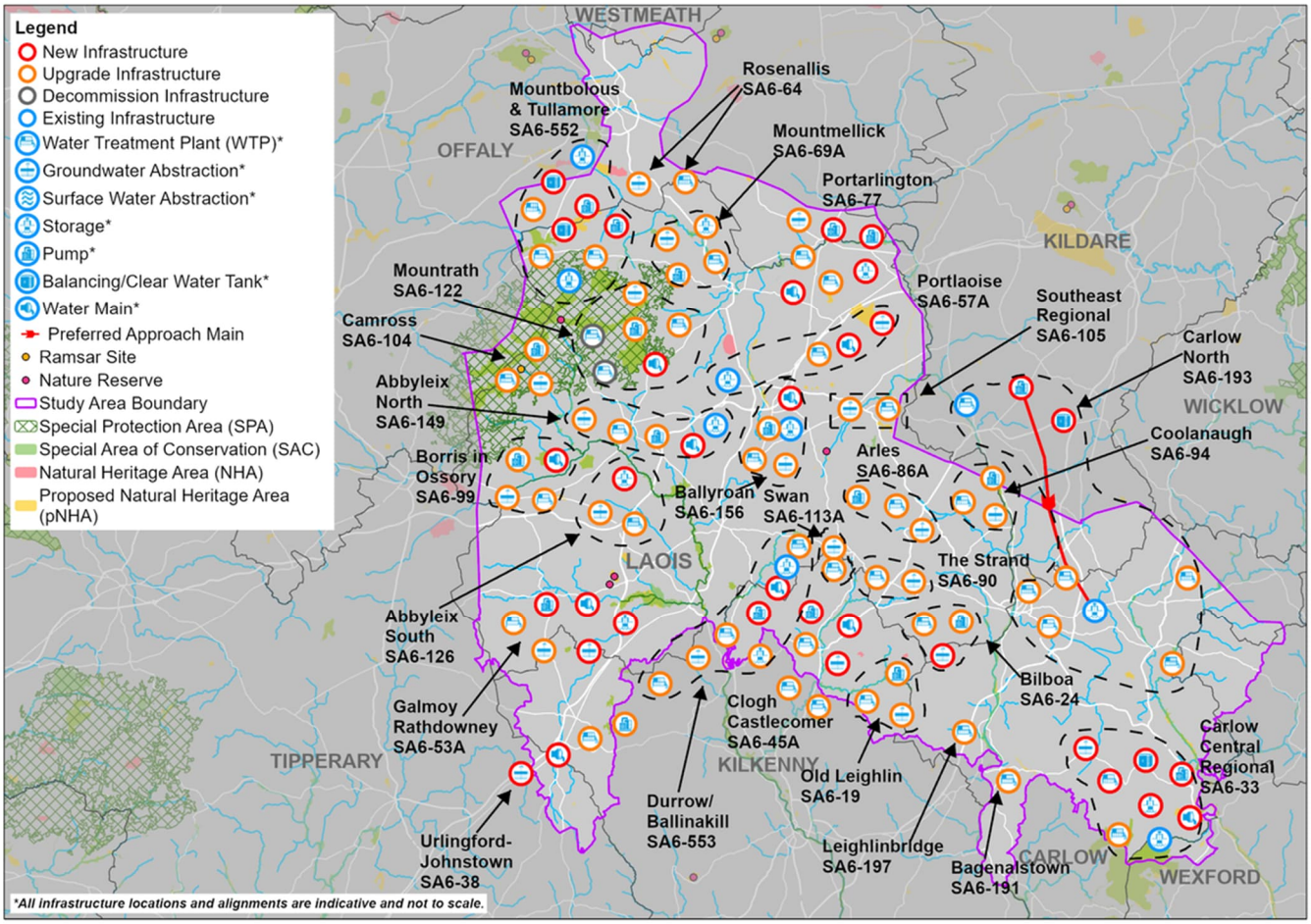

Figure 5.1 SA Preferred Approach and Key Environmental Designations

designations. Note that SA option 52 and 53 are labelled as SA6-552 and SA6-553.

The SA Preferred Approach options have each been assessed against the SEA objectives, taking account of construction and operational phases, long term and short term, permanent and temporary, and indirect and direct impacts. Mitigation requirements to avoid or reduce effects have also been taken into consideration.Table 5.2 provides a breakdown of the infrastructural components and Table 5.3 provides an assessment summary of the options included in the SA Preferred Approach. Individual options assessments are available on request. The overall Preferred Approach assessment, including all the options combined, is summarised in Table 7.1.

Table 5.2 Component Table

Option Reference	New / Refurbished Pipeline	New WTP	Upgrade WTPs	New / Upgraded Abstractions	WTPs Decommissioned	Abstractions Abandoned	Raw Water Storage	Treated Water Storage
SA6-019	-	-	✓	✓	-	-	-	-
SA6-024	-	-	✓	✓	-	-	-	-
SA6-033	✓	✓	✓	✓	-	-	-	✓
SA6-038	-	-	✓	✓	-	-	-	-
SA6-45a	-	-	✓	✓	-	-	-	-
SA6-53a	-	-	✓	✓	-	-	-	✓
SA6-57a	✓	-	✓	✓	-	-	-	-
SA6-064	-	-	✓	✓	-	-	-	-
SA6-69a	-	-	✓	✓	-	-	-	✓
SA6-077	✓	-	✓	✓	-	-	-	✓
SA6-86a	-	-	✓	✓	-	-	-	-
SA6-090	-	-	✓	✓	-	-	-	-
SA6-094	-	-	✓	✓	-	-	-	-
SA6-099	-	-	✓	✓	-	-	-	-
SA6-104	-	-	✓	✓	-	-	-	-
SA6-105	-	-	✓	✓	-	-	-	-
SA6-113a	-	-	✓	✓	-	-	-	-
SA6-122	✓	-	✓	✓	✓	✓	-	-
SA6-126	-	-	✓	✓	-	-	-	✓
SA6-149	-	-	✓	✓	-	-	-	-
SA6-156	-	-	✓	✓	-	-	-	-
SA6-180a	✓	-	-	-	✓	✓	-	✓
SA6-191	-	-	✓	-	-	-	-	-
SA6-193	✓	-	✓	-	-	-	-	✓
SA6-197	-	-	✓	-	-	-	-	-

Option Reference	New / Refurbished Pipeline	New WTP	Upgrade WTPs	New / Upgraded Abstractions	WTPs Decommissioned	Abstractions Abandoned	Raw Water Storage	Treated Water Storage
SA Option 52 (SA6-180c and SA6-184)	✓	-	-	-	✓	✓	-	✓
SA option 53 (SA6-139 and SA6-144e)	✓	-	✓	✓	-	-	-	✓

Table 5.3 Options Assessment Summary

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA6-193	Connect to New Shannon Source via Srowland	Construction	-	--	-	--	---	0	0	0	-	-
		Operation	++	-	0	0	---	++	0	0	0	0
SA6-197	WTP upgrade only	Construction	-	-	0	0	0	0	0	0	0	0
		Operation	+	0	0	0	0	0	0	0	0	0
SA6-019	Increase GW abstraction to supply deficit - yield assessments required	Construction	-	-	0	0	-	-	0	0	0	0
		Operation	0	-	0	0	-	-	-	0	0	0
SA6-024	New GW abstraction to supply full demand	Construction	-	-	0	0	-	--	0	0	0	0
		Operation	0	0	0	0	-	--	-	0	0	0

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA6-191	WTP Upgrade	Construction	-	-	0	0	-	0	0	0	0	0
		Operation	+	0	0	0	-	0	0	0	0	0
SA6-033	New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	Construction	--	--	-	-	---	--	0	0	-	-
		Operation	++	-	-	0	---	--	-	0	0	0
SA6-038	New GW abstraction to supply deficit and improve water quality	Construction	-	-	-	-	-	--	0	0	-	-
		Operation	0	--	0	0	-	--	-	0	0	0
SA6-45a	New GW abstraction/wellfield to supply deficit	Construction	-	--	-	-	-	--	0	0	-	-
		Operation	++	--	0	0	-	--	---	0	0	0
SA6-53a		Construction	-	-	-	-	---	--	0	0	-	-

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	Increase GW abstraction to supply deficit	Operation	++	--	0	0	---	--	---	0	0	0
SA6-57a	New GW abstraction/wellfield development	Construction	-	-	-	-	-	--	0	0	-	-
		Operation	+	--	0	0	-	--	--	0	0	0
SA6-064	Increase GW abstraction to supply deficit	Construction	-	-	0	0	0	--	0	0	0	0
		Operation	0	0	0	0	0	--	---	0	0	0
SA6-69a	Increase GW abstraction to supply deficit	Construction	-	-	0	0	---	--	0	0	0	0
		Operation	0	0	0	0	---	--	---	0	0	0
SA6-077		Construction	-	-	-	-	---	-	0	0	-	-

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	Increase GW abstraction to supply deficit	Operation	+	--	0	0	---	-	-	0	0	0
SA6-86a	Increase GW abstraction to supply deficit - yield assessments required	Construction	-	-	0	0	0	--	0	0	0	0
		Operation	0	0	0	0	0	--	---	0	0	0
SA6-090	Increase GW abstraction to supply deficit	Construction	-	-	0	0	0	-	0	0	0	0
		Operation	0	0	0	0	0	-	-	0	0	0
SA6-094	Increase GW abstraction to supply deficit	Construction	-	-	0	0	0	--	0	0	0	0
		Operation	0	0	0	0	0	--	---	0	0	0

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA6-099	Increase GW abstraction to supply deficit	Construction	-	-	-	0	0	-	0	0	-	-
		Operation	0	0	0	0	0	-	-	0	0	0
SA6-104	Increase GW abstraction to supply deficit	Construction	-	-	0	0	0	--	0	0	0	0
		Operation	0	--	0	0	0	--	---	0	0	0
SA6-105	Increase GW abstraction to supply deficit	Construction	-	-	0	0	-	--	0	0	0	0
		Operation	0	--	0	0	-	--	---	0	0	0
SA6-113a	Increase GW abstraction to supply deficit	Construction	-	-	0	0	-	-	0	0	0	0
		Operation	0	--	0	0	-	-	-	0	0	0

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA6-122	Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add resilience. Require source protection	Construction	-	-	-	-	-	-	0	0	-	-
		Operation	+	0	+	0	-	-	-	0	0	0
SA6-126	Increase GW abstraction to supply deficit	Construction	-	-	0	0	-	-	0	0	0	0
		Operation	0	--	0	0	-	-	-	0	0	0
SA6-149	Increase GW abstraction to supply deficit	Construction	-	-	-	0	-	-	0	0	-	-
		Operation	0	--	0	0	-	-	-	0	0	0
SA6-156	Increase GW abstraction to supply	Construction	-	-	-	0	-	--	0	0	-	-
		Operation	++	--	0	0	-	--	---	0	0	0

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	deficit - Ballyroan Spring											
SA6-180c	Supply Tullamore from New Shannon Source	Construction	-	-	-	--	---	0	0	0	-	-
		Operation	++	0	+	0	---	++	0	0	0	0
SA6-184	New connection point from New Shannon Source	Construction	-	-	-	--	---	0	0	0	-	-
		Operation	++	0	+	0	---	++	0	0	0	0
SA6-139 (SA option 53)	Interconnect Ballinakill with Durrow WRZ for increased resilience	Construction	-	-	-	0	--	-	0	0	-	-
		Operation	++	--	0	0	--	-	-	0	0	0
		Construction	-	-	-	0	--	-	0	0	-	-

Option Reference	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA6-144e (SA option 53)	Increase GW abstraction at Fermoyle WTP to supply deficit	Operation	++	--	0	0	--	-	-	0	0	0

* Note SA Option is the same as Group Option

** Total lifetime tCO_2e categories: minor beneficial = -ve negligible/neutral = <1000 minor = 1000 to <10,000, Moderate = 10,000 to <50,000, Major = 50,000+

5.2 Additional Measures

In addition to the SA Preferred Approach supply options, Irish Water is already implementing measures across the three pillars of Lose Less, Use Less and Supply Smarter to improve the level of service to their customers in this study area. These are described in the SA6 Technical Report and include leakage reduction and water conservation.

5.2.1 Leakage Reduction

The leakage reduction measures across the public water supply are based on what Irish Water assess to be both achievable and sustainable and include:

- Ongoing leakage management, including active leakage control, pressure management, and find and fix activities to offset Natural Rate of Leakage Rise;
- Net leakage reductions targets have been applied to the SDB deficit to move towards achieving the national Sustainable Economic Level of Leakage (SELL) target prioritised based on:
    - Supply demand deficit;
    - Existing abstractions with sustainability issues; and
    - Drought impacts.
- Additional leakage targets to achieve SELL and reduce leakage levels to 21% of demand in the WRZs: Carlow North, Clogh-Castlecomer, Portlaoise, Portarlington, Tullamore, Galmoy Rathdowney PWS, Borris In Ossory, South East Regional PWS, Mountrath, Abbeyleix South, Ballinakill, Durrow, Abbeyleix North, Ballyroan, Bilboa, Mountmellick, and The Strand.

5.2.2 Water Conservation

At present, Irish Water is conducting pilot studies in relation to water conservation stewardship in businesses and is actively progressing water conservation messaging campaigns. During drought conditions in 2018, a Water Conservation Order was implemented, in order to protect their water supplies and reduce pressure on the natural environment during this period. Irish Water will continue to promote 'Water Conservation Activities', collecting and monitoring data over a number of years to assess the benefits. As part of the Framework Plan, Irish Water have not applied reductions to the SDB for unquantifiable water conservation gains. However, they do assume that any gain will offset consumer usage growth factors.

5.3 Interim Solutions

The SA6 Technical Report identifies potential interim solutions that allow shorter term interventions to be identified and prioritised, when needed. These are expected to be small scale, within site works and are not likely to give rise to significant environmental effects. However, they would need to be subject to relevant assessments, including AA screening as and when they are required.

5.4 Approach Uncertainty and Adaptability

A summary of the adaptability criteria and sensitivity analysis Irish Water have undertaken for the SA6 Preferred Approach is provided in the SA6 Technical report. A high-level assessment of what this could mean for the SEA is shown in Table 5.4.

Table 5.4 SA6 Sensitivity Analysis and Environmental Impacts

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Environmental Impacts Relative to Assessment of Preferred Approach Key: Green - Positive Amber - Negative
Sustainability	Moderate/High (as Irish Water's current abstractions are large compared to the waterbodies from which they abstract)	+1,056 m^3/d	The impact of sustainability reductions would reduce the volumes that can be abstracted from Irish Water's existing sources; therefore, increasing the SDB deficit. Irish Water's outline sustainability assessments would mean a potential increase in deficit for SA6 based on reductions in the sustainable abstraction amounts from both the River Burren (Carlow Central Regional) and River Clodiagh (Tullamore) sources. However, the proposed options for Tullamore and Carlow Central are to connect to New Shannon Source and develop new groundwater options in these regions, reducing the stress on these sources. The majority of options considered in SA6 are groundwater supplies.
			The SA Preferred Approach addresses reduction, although additional sustainability reductions could add pressure for additional supply from outside the study area. Although the use of groundwater sources could reduce stress on the River Burren and River Clodiagh, groundwater sustainability is difficult to assess at study area level and will require regional/project level assessment to determine impacts.
Climate Change	High (international climate change targets have not been met)	+1,800 m^3/d	Higher climate change scenarios would impact Irish Water's 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 by optimising Irish Water's operations on a more environmentally sustainable basis across the range of supplies.
			Potential for additional abstraction pressure unless optimisation can address.
Demand Growth	Low/Moderate (growth has been based on policy)	-200 m^3/d	The impact of lower than expected growth would reduce the SDB deficit and the overall need requirement. The SDB deficit is currently spread across twenty-four of the twenty-eight WRZs in SA6 and is driven by quality and quantity issues. In this rural area, growth is relatively low.

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Environmental Impacts Relative to Assessment of Preferred Approach Key: Green - Positive Amber - Negative
			However, there are large growth centres such as Carlow Town and Portlaoise.
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements
Leakage Targets	Low (Irish Water is focused on sustainability and aggressive leakage reduction)	+823 m^3/d	The impact of lower-than-expected leakage savings would increase the SDB deficit and the overall need requirement. Due to the length and condition of Irish Water's networks, Irish Water could potentially fail to achieve target leakage reductions within 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.
			This could increase carbon and the effects of abstraction pressure on the environment
	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	-8,311 m^3/d	Increased leakage savings beyond SELL would reduce the SDB deficit and the overall need requirement. The need drivers in SA6 are across all of the WRZs and are driven by quality as well as availability issues.
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements

6

SEA Cumulative Effects for SA6 Preferred Approach

6 SEA Cumulative Effects for SA6 Preferred Approach

Secondary, cumulative and the synergistic nature of the effects of the SA6 Preferred Approach proposals are required to be considered as part of SEA. These include:

- 'Within plan' or 'in-combination' effects; and
- Interaction with other plans and programmes.

Cumulative effects are also considered for the proposals across the nine study areas within the Eastern and Midlands Region and reported in the SEA Environmental Report of the Regional Plan. Further consideration of any inter regional cumulative effects will be addressed in each Regional Plan SEA sequentially.

6.1 Cumulative Effects 'Within Plan' for SA6

The potential 'within plan' cumulative effects for SA6 are considered at the following different levels:

- Option level: Identification of mutually exclusive or dependent options – this was considered through the options screening and approach development process;
- SA approaches: Cumulative effects are taken into account in the selection of approaches for key aspects such as abstraction from the same waterbody through the sustainability rules applied for Irish Water abstractions (see section 3.2);
- SA Preferred Approach: The combined effect of options within the SA Preferred Approach – these are addressed in this chapter; and
- Eastern and Midlands Region level: Considering combined effects from proposals in the nine study areas (see the SEA Environmental Report of the Regional Plan).

For cumulative effects to occur, there needs to be an overlap of temporal periods in some way for the impact and/or the effect. For example, two schemes being constructed at the same time could result in cumulative traffic movements, while two schemes being operated together could result in additional drawdown of groundwater levels. A precautionary approach has been taken for the cumulative effects assessment, which assumes that all options could be constructed at the same time and then all options would be operated at the same time. However, this is very unlikely to be the case for construction impacts due to budget resources and regulatory constraints. (In general, the SA6 Preferred Approach options are geographically spaced out and most are small scale in construction works. Therefore, there are unlikely to be many cumulative effect interactions during construction).

The assessment has considered the cumulative effects across all environmental topics to identify those interactions that are likely to generate significant effects. These are likely to be around:

- Biodiversity – for example, a cumulative loss of habitats or changes to a habitat's quality through changes in water quality or groundwater levels;
- Water environment (surface water and groundwater WFD status) – for example, changes to water flow due to combined abstraction pressure;
- People and health – for example, disruption due to multiple construction works taking place at the same time;
- Landscape and visual – for example, if there are a number of options located close together that could alter the landscape character or views;
- Cultural heritage – for example if the same cultural heritage features are affected by above ground infrastructure in close proximity or the combined effect of loss to undesignated

archaeological assets or from combined impacts resulting in additional changes to water levels affecting archaeological resources; and

- Climate change – combined carbon emissions for the approach as a whole have been considered through the approach selection process and are also reported here to identify potential requirements for mitigation. Combined effects on climate change adaptation are also considered.

6.1.1 Cumulative Effects during Construction

In general, the SA Preferred Approach options are geographically spaced out and most are small scale in construction works. Therefore, there are unlikely to be many cumulative effect interactions during construction.

Table 6.1 Potential In-Combination Effects between Preferred Options in SA6

Preferred Approach option references	SA6-104	SA6-105	SA6-113a	SA6-122	SA6-126	SA6-149	SA6-156	SA Option 52 (SA6-180c &	SA6-019	SA6-191	SA6-193	SA6-197	SA6-198	SA6-024	SA6-033	SA6-038	SA6-45a	SA6-53a	SA6-57a	SA6-064	SA6-69a	SA6-077	SA6-86a	SA6-090	SA6-094	SA6-099
SA option 53 (Group option 53)	B&N	B&N	B&N	B&N	B&N LB	B&N LB	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
SA6-099	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	
SA6-094	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N		
SA6-090	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N			
SA6-86a	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N				
SA6-077	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N					
SA6-69a	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N	B&N						
SA6-064	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N	B&N							
SA6-57a	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N	B&N								
SA6-53a	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N									
SA6-45a	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N	B&N										
SA6-038	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N		B&N	B&N											
SA6-033	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N SRV CA	B&N		B&N												
SA6-024	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N														
SA6-198																										
SA6-197	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N															
SA6-193	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N																
SA6-191	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N																	
SA6-019	B&N	B&N	B&N	B&N	B&N	B&N	B&N																			
SA Option 52 (SA6-180c & SA6-184)				SBM																						
SA6-156	B&N	B&N	B&N	B&N	B&N	B&N																				
SA6-149	B&N	B&N	B&N	B&N	B&N																					

Preferred Approach option references	SA6-104	SA6-105	SA6-113a	SA6-122	SA6-126	SA6-149	SA6-156	SA Option 52 (SA6-180c &	SA6-019	SA6-191	SA6-193	SA6-197	SA6-198	SA6-024	SA6-033	SA6-038	SA6-45a	SA6-53a	SA6-57a	SA6-064	SA6-69a	SA6-077	SA6-86a	SA6-090	SA6-094	SA6-099
					AB																					
					LB																					
SA6-126	B&N	B&N	B&N	B&N																						
SA6-122	B&N	B&N	B&N																							
SA6-113a	B&N	B&N																								
SA6-105	B&N																									

Key	
Construction Phase	
Operation Phase	
Construction and Operation	
River Barrow and River Nore SAC	B&N
Slieve Bloom Mountains SPA	SBM
Lisbigney Bog SAC	LB
Slaney River Valley SAC	SRV
Abbeyleix	AB
Carlow	CA

There could be cumulative effects associated with construction in terms of traffic, noise and dust for the options located in Abbeyleix (SA6-149 and 126) and Carlow (SA6-193 and 033). These could be mitigated by standard mitigation measures such as planning of construction traffic routes and movements and engaging with local residents about the disruption. With these standard good practice measures in place, there are unlikely to be significant cumulative effects.

There could be cumulative effects from habitat loss, habitat degradation, mortality, disturbance and spread of invasive non-native species on the River Barrow and River Nore SAC if construction of all options within the SA Preferred Approach (excluding SA option 52 and 198) are concurrent. River Barrow and River Nore SAC is designated for its alluvial forest, petrifying springs with Tufa formations and old oak woodland. Similarly, there could be cumulative effects from habitat degradation, disturbance and spread of invasive non-native species on the Slaney River Valley SAC if construction of options SA6-193 and 033 are concurrent and disturbance impacts on the Slieve Bloom Mountain if construction of options SA6-122 and SA option 52 are concurrent. Potential pollution of watercourses during construction could affect QI species and hydrologically connected habitats of these sites. With standard good practice mitigations such as having buffers along the edge of the river and having an emergency plan in place during construction, cumulative effects are unlikely to be significant. The impacts on the European designations are provided in the NIS and also summarised in chapter 9 of this review.

6.1.2 Cumulative Effects during Operation

The SEA has identified that, at a plan level, there is potential for cumulative effects of the SA Preferred Approach to Lisbigney Bog SAC given that options SA6-126, SA6-149 and SA option 53 have the potential for impacts to the site from habitat degradation. There could also be cumulative effects from habitat degradation to the River Barrow and River Nore SAC if operation of options SA6-019, 45a, 57a, 69a, 077, 090, 094, 104, 105, 113a, 126, 149, 156 and SA option 53 are concurrent. All of these options include new or increase groundwater abstraction that could potentially cause hydrological changes and water table/availability impacts to the designated sites. See Figure 6.1 for the Preferred Approach abstractions in SA6. Note that SA option 53 is labelled as SA6-553.

The potential for cumulative effects on groundwater bodies have been considered in a hydrogeological assessment of the groundwater abstractions commissioned by Irish Water (Irish Water, 2022). This hydrogeological assessment considers the abstraction quantities and proximities and concludes that all 13 of the WFD groundwater bodies (Abbeyleix Gravels, Athy-Bagenalstown Gravels, Bagenalstown Lower, Bagenalstown Upper, Ballingarry, Castlecomer, Coolrain, Durrow, Newtown, Portlaoise, Rathdowney, Shanragh and Timahoe Gravels) affected by abstractions have a good quantitative status, therefore, the likelihood of affecting their WFD objectives is low. In addition, there are no groundwater body at risk of failing their objectives with the exception of Durrow groundwater body (SA option 53).

There could also be cumulative effects in terms of carbon across the SA Preferred Approach. The whole life carbon estimate (including construction and operation) for the SA Preferred Approach indicates increased contribution to carbon emissions related to carbon embodied in materials used for construction and through operational energy use and water treatment. Generally, in terms of carbon emissions, increase in carbon emissions can be considered a significant effect, as these add cumulatively across all developments and contribute to the national target for carbon. However, consideration also needs to be given to the additional water supply provided from the options and therefore the overall carbon efficiency in terms of carbon emissions per ML of supply is an appropriate metric and for SA6 this averages as 2.03 tCO_2e/ML (lifetime sum). Mitigation for carbon emissions could include increased sourcing of energy from renewable sources and improving energy efficiency. This could be undertaken alongside

leakage reduction and campaigns to raise awareness of measures to reduce water consumption (which in turn would reduce energy consumption). This could include the promotion of water efficient devices and working with planning authorities and developers to encourage new development to be water efficient.

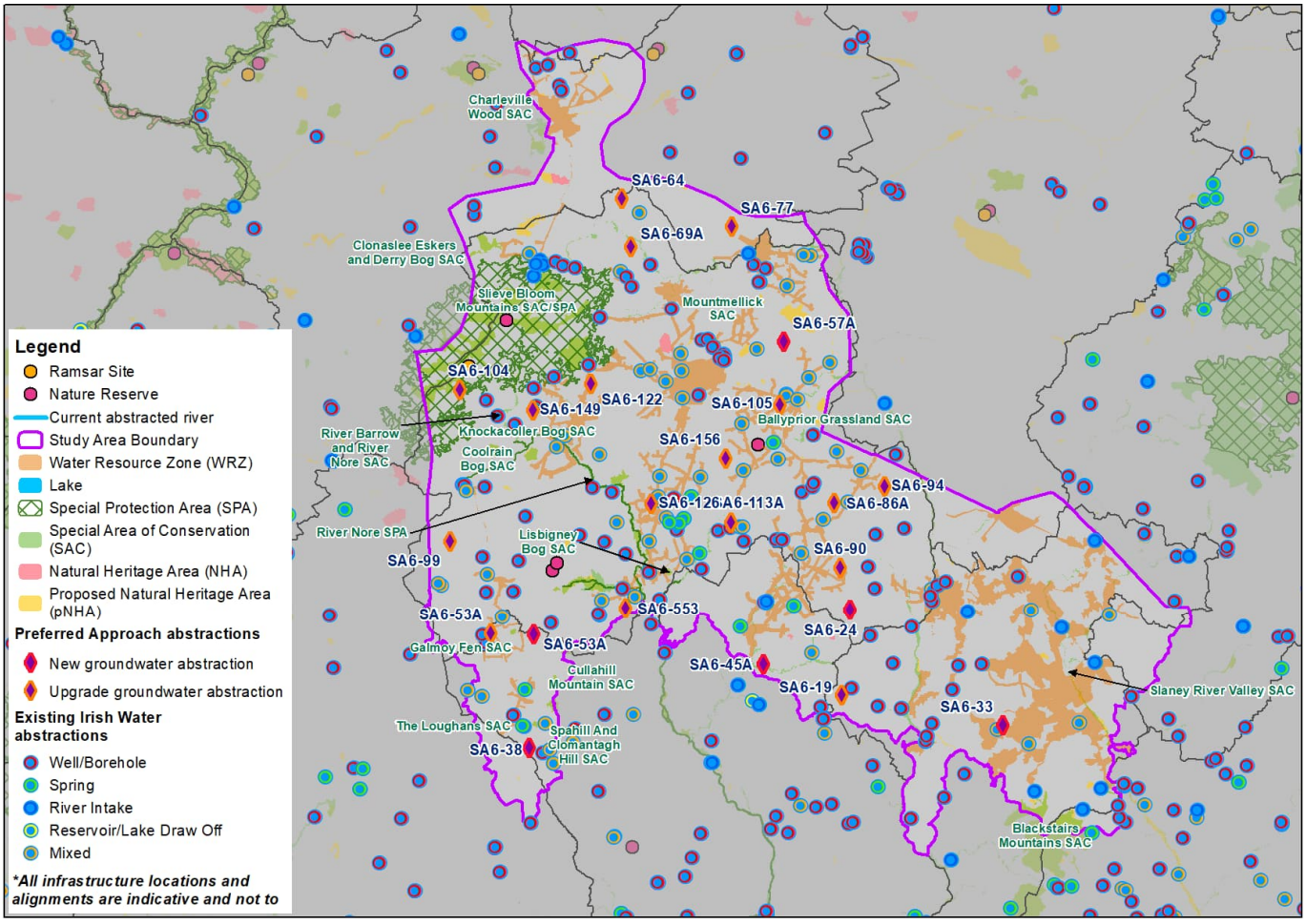

Figure 6.1 SA Preferred Approach Abstractions in SA6

6.2 Cumulative Effects with Other Developments

The SA6 Preferred Approach has been assessed alongside other developments that could occur within the plan area. Potential effects could include increased traffic and noise. These could be mitigated by standard mitigation measures, such as planning of construction traffic routes and informing local residents about the works. With these standard good practice measures in place, there are unlikely to be significant cumulative effects. There is potential for cumulative effects on cultural heritage assets including archaeological resources related to the total extent of the ground works required, this will need to be considered further as detailed route alignments and site locations are determined along with approaches for more detailed desk studies, investigation and mitigation.

Table 6.2 shows that within SA6 there are a number of regeneration and construction projects clustered around Carlow, Tullamore and Portlaoise. There are also projects located at Altamont, Emo and Mountmellick. Other developments that were not considered further due to the size and the distance of the developments from the SA Preferred Approach are Monasterevin Town Centre Regeneration and Moate Reservoir, Rathvilly.

6.2.1 Cumulative Effects during Construction

The regeneration projects in Carlow and Portlaoise, and to a lesser degree in Tullamore could result in cumulative effects with the SA Preferred Approach if they were to be constructed at the same time (represented in Table 6.2 as ‘CA’, ‘Pl’, ‘T’ and ‘Pa’, respectively). Potential effects could include increased traffic and noise to the towns. These could be mitigated by standard mitigation measures, such as planning of construction traffic routes and informing local residents about the works. With these standard good practice measures in place, there are unlikely to be significant cumulative effects.

The plan level assessment indicates that there is potential for cumulative effects from disturbance, spread of invasive species and habitat degradation impacts on the River Barrow and River Nore SAC if construction phase of all of the regeneration projects in Portlaoise, all projects in Carlow and the St Vincent's Hospital and Emo court projects are concurrent with the SA Preferred Approach (identified as B&N in Table 6.2). There is potential for cumulative effects from habitat degradation and spread of non-native species impacts on Charleville Wood SAC if construction phase of the SA Preferred Approach (SA Option 52) is concurrent with Tullamore projects. Charleville Wood SAC is within 100m of the scheme and therefore there may be cumulative effects from pollution and the spread of invasive non-native species. In addition to the two designated sites, there is also potential for cumulative effects on Slaney River Valley SAC if construction of the SA Preferred Approach (SA6-193 and 033) is concurrent with Altamont House and Gardens project. Slaney River Valley SAC is within 1km of the scheme and therefore there may be cumulative effects from disturbance, spread of invasive non-native species and pollution. With the implementation of mitigations as outlined in section 6.3.3 of the NIS, there will be no adverse cumulative effects on the integrity of any of the SAC.

Table 6.2 Potential Cumulative Effects between Preferred Options and Other Developments in SA6

	Preferred Approach Options																										
Project Developments	**SA6-104**	**SA6-105**	**SA6-113a**	**SA6-122**	**SA6-126**	**SA6-149**	**SA6-156**	**SA Option 52 (SA6-180c & SA6-184)**	**SA6-019**	**SA6-191**	**SA6-193**	**SA6-197**	**SA6-198**	**SA6-024**	**SA6-033**	**SA6-038**	**SA6-45a**	**SA6-53a**	**SA6-57a**	**SA6-064**	**SA6-69a**	**SA6-077**	**SA6-86a**	**SA6-090**	**SA6-094**	**SA6-099**	**SA option 53 (Group option 53)**
Residential Development at Clonminch Road, Tullamore								CW T																			
Tullamore Urban Area								CW T																			
Kearney's Field, Tullamore, Co. Offaly								CW T																			
Carlow Town	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N CA	B&N		B&N	B&N CA	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
Carlow Wastewater Treatment Plant	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N CA	B&N		B&N	B&N CA	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
Carrigbrook, Tullow Road, Carlow	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N CA	B&N		B&N	B&N CA	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
Sacred Heart Hospital, Carlow	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N CA	B&N		B&N	B&N CA	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
IT Carlow Science & Health Building	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N CA	B&N		B&N	B&N CA	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
Altamont House and Gardens											SRV				SRV												
St Vincent's Hospital, Mountmellick	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N			B&N	B&N	B&N	B&N		B&N	B&N		B&N	B&N	B&N	B&N	B&N
Emo Court	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N			B&N	B&N	B&N	B&N		B&N	B&N		B&N	B&N	B&N	B&N	B&N
Libraries Capital Programme - Portlaoise Library	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N			B&N	B&N	B&N	B&N	B&N PI	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N			B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N

	Preferred Approach Options																										
Project Developments	**SA6-104**	**SA6-105**	**SA6-113a**	**SA6-122**	**SA6-126**	**SA6-149**	**SA6-156**	**SA Option 52 (SA6-180c & SA6-184)**	**SA6-019**	**SA6-191**	**SA6-193**	**SA6-197**	**SA6-198**	**SA6-024**	**SA6-033**	**SA6-038**	**SA6-45a**	**SA6-53a**	**SA6-57a**	**SA6-064**	**SA6-69a**	**SA6-077**	**SA6-86a**	**SA6-090**	**SA6-094**	**SA6-099**	**SA option 53 (Group option 53)**
Portlaoise - A Cultural Quarter																			PI								
Portlaoise - A Low Carbon Town	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N			B&N	B&N	B&N	B&N	B&N PI	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N
Portlaoise 40 bed Residential Mental Health Unit	B&N	B&N	B&N	B&N	B&N	B&N	B&N		B&N	B&N	B&N	B&N			B&N	B&N	B&N	B&N	B&N PI	B&N	B&N	B&N	B&N	B&N	B&N	B&N	B&N

Key	
Construction Phase	
Operation Phase	
Construction and Operation	
River Barrow and River Nore SAC	B&N
Slaney River Valley SAC	SRV
Charleville Wood SAC	CW
Carlow	CA
Tullamore	T
Portlaoise	Pl

6.2.2 Cumulative Effects during Operation

The plan level assessment indicates that there could be cumulative effects on River Barrow and River Nore SAC from habitat degradation impacts during the operation phase of the SA Preferred Approach and all regeneration projects in Portlaoise, some projects in Carlow (Carlow Town; Carlow Wastewater Treatment Plant; and Carrigbrook, Tullow Road, Carlow) and Corrig Glen, Station Road project in Portarlington. However, with the implementation of standard good practice measures there will be no adverse effects on the integrity of this European site.

There could be cumulative effects in terms of carbon emissions, as all developments will generate carbon emissions from operation whether this is from routine maintenance activities to water treatment and the energy required for moving water. As outlined in section 6.1.2, any increase in carbon can be considered a significant effect, as these add cumulatively across all developments and contribute to the national target for carbon. The same mitigation measures suggested for the SA6 Preferred Approach apply, including increased sourcing of energy from renewable sources and raising awareness of measures to reduce water consumption (which in turn would reduce energy consumption). Working with third parties, including planning authorities and other developers, to identify water efficient measures and joint promotion of water issues would also further mitigate this effect.

7

Strategic Environmental Assessment Summary

7 Strategic Environmental Assessment Summary

SEA objectives have been taken into account at each stage of the approach development process for SA6 and a range of options and SA Approaches have been considered and assessed, including a 'Do Minimum' approach.

Key beneficial impacts assessed include, up to, moderate beneficial impacts for all options associated with increasing resilience and the quality of water supply for local communities; and the subsequent benefits of this for public health.

Key potential adverse impacts identified at plan level include:

- Potential temporary moderate adverse impacts during construction as a result of the SA Preferred Approach being within (SA6-45a and 193) or near (SA6-033) and is hydrologically linked to designated sites including River Barrow and River Nore SAC, Slieve Bloom Mountains SPA, Clonaslee Eskers and Derry Bog SAC and Slaney River Valley SAC. There are potential for loss of/damage to QI/Annex 1 habitats during construction works given that the works are within or near the sites. Pollution of water courses during construction (associated with sediment runoff, or accidental spillage) could affect hydrologically connected habitats and impact fish and restrict access to spawning habitats. There is also potential for the spread of invasive non-native species given that the works are hydrologically linked to the European designated sites. The NIS identifies mitigation measures to avoid AESI for these sites;
- Potential long term or permanent moderate adverse impacts to the River Barrow and River Nore SAC (SA6-45a, 57a, 077, 104, 105, 126, 149, 156 and SA option 53), Lisbigney Bog SAC (SA6-126, 149 and SA option 53); Loughans SAC (SA6-080) and Galmoy Fen SAC (SA6-53a) associated with new or increase groundwater abstraction. At some abstraction point, there is likely a high association between surface water and groundwater flows; a high Baseflow Index (BFI). Therefore, there is potential for impacts to QI species utilizing watercourses hydrologically linked to the European site and further study on ground water and surface water links are required. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts to the resilience of Athy-Bagnelstown Gravels, Bagenalstown, Ballingarry, Castlecomer, Coolrain, Portlaoise, Rathdowney, Shanragh and Timahoe Gravelsgroundwater bodies to climate change as new/increase abstractions are required with the SA Preferred Approach (SA6-024, 033, 038, 45a, 53a, 57a, 64, 69a, 86a, 094, 104, 105 and 156). All of the groundwater bodies currently have a good quantitative status. However, options 45a, 53a, 064, 69a, 86a, 094, 104, 105 and 106 are assessed as having potential for major adverse impact against the seventh SEA objective 'protect and improve surface water and groundwater status'. High level assessment indicated that groundwater abstraction of these options would be greater than 30% of the recharge. However, additional groundwater assessment identifies that an impact on groundwater body quantitative status would be unlikely taking account of additional groundwater information;
- Moderate adverse effects on rural and urban areas near Carlow (SA6-033) from visual impacts and increase in traffic, noise and dust during construction of the SA6 Preferred Approach. Option SA6-033 include new groundwater abstraction, WTP, storage pumps and approximately 18km of pipeline; and
- Moderate adverse effects to built and natural assets with options SA6-193 and SA option 52 due to the construction of more than 20km of new pipeline required.

Cumulative effects assessment identifies potential significant effects in relation to carbon emissions, although majority of the individual options with an exception of SA option 52 which is assessed as major are assessed only as neutral to major adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA6 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure or treatment technology or potential for mitigation such as use of renewable energy sources in relation to the whole network. Insufficient information is available for the cumulative effects assessment to consider how total study area carbon emissions will change overall and per ML of water.

SEA mitigation identified to address the key adverse impacts identified above include further hydrological or hydrogeological modelling (as appropriate) to further inform understanding of potential impacts on the European designated sites, particularly on the River Barrow and River Nore SAC and Lisbigney Bog SAC (see the NIS of the Framework Plan for further information). Measures to address the cumulative impact for carbon emissions include sourcing the energy supply from renewable sources. All developments will aim to achieve as far as possible requirements for no net loss in biodiversity or enhancement, as set out in the Biodiversity Action Plan (Irish Water, 2021). There may be potential to also provide opportunities for carbon sequestration with biodiversity enhancement. In addition, there are opportunities to reduce water demand (which in turn would reduce energy and carbon) by raising awareness of water issues, promoting water efficient devices and through leakage reduction.

In general, these are standard mitigation measures with some specific measures and additional requirements for further assessment or monitoring (see the SEA Appendix and the NIS Appendix for AA and SEA standard mitigation measures respectively).

An overall summary assessment, including potential for cumulative and in-combination effects and other measures, identified to be progressed alongside the supply side options is provided in Table 7.1. Key mitigation and proposed monitoring measures are also shown.

Table 7.1 SEA Summary

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
SA Preferred Approach with interim measures as required and a programme of leakage reduction and water conservation measures, taking an adaptive approach to address uncertainty				
1. Protect public health and promote wellbeing	C Minor Adverse to Moderate Adverse O Neutral to Moderate Beneficial The PA is expected to improve overall drinking water quality reliability and sustainability through the decommissioning of failing WTPs, the upgrade of failing WTPs and the replacement of abstractions vulnerable to drought conditions. The PA is expected to reduce risks to access of good quality water supply across different conditions and over the plan period.	Standard good construction practice and consultation Further assessment of risks to water quality and consideration of catchment management initiatives to improve water quality and reduce treatment cost. For example, working with landowners and managers on practices to reduce levels of sediment and pollution from entering water courses through run off.	• Level of service, and the frequency and duration of drought orders • Number of days/hours when water supply to people is disrupted due to drought, freeze-thaw or other service/infrastructure issues • Number of public rights of way closures/diversions and length of paths created compared to loss	• Duration of construction works, and number of complaints received regarding construction works • Duration of temporary closures of footpaths and other recreational assets • Number of days where recreational uses of the Haywood Gardens, Slieve Bloom Way, Brittas Loop and the sports ground nearby in Mountbolus are impeded

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
2. Protect and enhance biodiversity and contribute to resilient ecosystems	C Minor Adverse to Moderate Adverse O Neutral to Moderate Adverse Impacts from construction works for pipelines and service reservoirs on biodiversity. These can be minimised through careful routing and siting. Operational impacts on habitats of the River Burren, Crooked River, Owenbeg River, River Barrow and River Nore. Potential for construction and operational impacts on European and National designated sites, most notably the River Barrow & River Nore SAC, Loughan's Turlough SAC, Galmoy Fen SAC, Slieve Bloom Mountain SPA, Barrow Valley At Tankardstown Bridge NHA, Timahoe Esker	Routing/siting to avoid impacts. Standard good construction practice and specific measures as identified in the NIS of the Framework Plan. Design to meet no net loss biodiversity or achieve enhancement, where possible, on or off site and in line with the Biodiversity Action Plan objectives. Further hydrological/hydrogeological assessments to determine impacts on designated sites. Operating rules to limit impacts on European and National sites.	• Temporary and permanent habitats lost vs habitats created/enhanced • Site condition and population data for QI of European and National designated sites, including River Barrow & River Nore SAC, Loughan's Turlough SAC, Galmoy Fen SAC, Slieve Bloom Mountain SPA, Barrow Valley At Tankardstown Bridge NHA, Timahoe Esker NHA, Abbeyleix Bog NHA and Clonreher Bog NHA.	• Monitor construction activities to ensure compliance

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
	NHA, Abbeyleix Bog NHA and Clonreher Bog NHA.			
3. To protect landscapes, townscapes and visual amenity	C Neutral to Minor Adverse O Neutral to Minor Beneficial Construction landscape impacts and long term impacts from above ground structures, such as new WTPs.	Routing and siting to reduce tree loss and appropriate location and design of above ground structures with landscape planting. Reinstatement of land use and vegetation.	• Total working area of pipelines non-designated landscapes • Land use/landscape features re-established for schemes over appropriate period – areas/km successfully restored to meet requirements	• Duration of construction works • Number of complaints received regarding visual impact of construction works
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C Neutral to Moderate Adverse O Neutral New resources required for construction works, including extensive lengths of pipeline, service reservoirs and new/upgraded WTPs. Ongoing maintenance requirements.	Materials management to be integrated into design to optimise use of existing resources and minimise waste from construction and operation.	• Loss of greenfield land, including agricultural, forestry or other land uses • Disruptions to strategic infrastructure/services • Use of waste management plans • Volume of drinking water treatment residuals sent to landfill	• Construction wastes sent to landfill
5. Reduce greenhouse	C Neutral to Major Adverse O Neutral to Major Adverse	Design to minimise embodied carbon emissions and	• Percentage of energy supply from renewable sources or reduced energy use	• Carbon footprint (total tonnes) during construction

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
gas emissions	Embodied and operational carbon contribute to national level carbon emission targets. Leakage and water efficiency can contribute to reducing carbon.	optimise operational efficiency. Seek renewable energy supply sources and optimise use of leakage and water efficiency measures to reduce carbon. Consider offsetting approaches with multiple benefits for water quality, carbon sequestration and linking with other objectives.	• Carbon footprint (total tonnes) per year, predicted over plan period, lifetime of schemes and carbon intensity of water resource options (tonnes/Ml/d)	• Operational Carbon Intensity kgsCO2equic/ML
6. Contribute to environmental climate change resilience	C Moderate Adverse to Neutral O Moderate Adverse to Moderate Beneficial Abstractions generally reduce environmental resilience but overall improved flexibility for operation using regional schemes has the potential to reduce pressure on at risk local resources. All options, excluding	Consider how operation can further reduce climate change pressure on at risk sources and associated designations, particularly for SA6-024, SA6-033, SA6-038, SA6-45a, SA6-53a, SA6-57a, SA6-064, SA6-69a, SA6-86a, SA6-094, SA6-104, SA6-105 and SA6-156.	• WFD waterbody status objectives at risk and designated site condition status • Frequency of drought orders requiring change to normal abstractions/ compensation releases	• None identified

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
	SA6-193, SA6-197, SA6-191, SA6-180a and SA6-198, require further assessment to understand their sustainability in the longer term.	Sustainability review of sources taking account of groundwater and surface water interconnections.		
7. Protect and improve surface water and groundwater status	C Neutral O Neutral to Major Adverse Generally, new/increased abstractions are limited to allowable limits and have a low risk of adverse effect on WFD waterbody status objectives, with the potential exception of the River Burren (Carlow Central Regional) and River Clodiagh depending on groundwater interactions.	Further investigation to consider effects on groundwater abstraction on the surface water environment.	• WFD waterbody status objectives at risk	• Pollution incidents during construction • Additional monitoring of River Burren and River Clodiagh if needed
8. Avoid flood risk	C Neutral O Neutral	Siting and design of schemes to take account of flood risk and design for flood risk resilience.	• Number of options at risk of flooding at each AEP level	• Lost time to flooding • Lost time to power supply interruptions

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
9. Protect and where appropriate, enhance cultural heritage assets	C Neutral to Minor Adverse O Neutral Potential construction impacts on unknown archaeological interest. Impacts on known interests are expected to be avoided.	Standard good practice approaches to minimise potential impacts.	• Number of archaeological assets adversely affected by water resource options • Number of options that are rerouted to avoid cultural heritage impacts • Number of schemes including improvements to access recording of archaeological assets or communication/ interpretation of interest features	• Number of archaeological finds recorded during construction
10. Protect quality and function of soils	C Neutral to Minor Adverse O Neutral Potential for loss and damage to valuable soils during construction but impacts to geological assets are expected to be avoided.	Standard good practice to conserve and reinstate soils.	• Soil Management Plans implemented • Volume of contaminated land restored, or soils removed	• Total volume of soil removed or reused on site

8

Water Framework Directive Summary

8 Water Framework Directive Summary

Through the options identification and assessment process new options considered have been restricted to those expected to meet estimated sustainability requirements and all options have been assessed based on conservative allowable abstraction constraints. The options identified for SA6 are also expected to be sustainable, based on additional plan-level desk-based assessment, in terms of avoiding deterioration of WFD status or avoiding conflict with meeting WFD objectives.

All groundwater bodies used for the SA6 abstractions have good quantitative status (Irish Water, 2022). The abstractions are not located in close proximity and the risk of combined effects on groundwater body WFD objectives, or on existing abstractions, are considered low. In addition, there are no groundwater bodies 'at risk' of failing the objectives with the exception of the Durrow groundwater body associated with SA option 53.

The total increase in demand in the Timahoe Gravels groundwater body slightly exceeds the 30% (30.81%) abstraction/recharge ratio. However, considering Kyle spring is thought to issue from the Ballyadams Limestone Formation, not all abstraction pressure is taking place from the gravels. As such, any impact assessment should factor in the Bagenalstown Upper GWB also, which reduces the likelihood of failing to meet WFD objectives. Considering the scale of the abstraction however monitoring and reviewing of water level data/overflow and deployable output needs to be done in tandem as the schemes progress.

Impacts, including cumulative effects with non Irish Water abstractions, will need to be considered in further detail as part of project level consenting to demonstrate both sustainability for any connected surface waterbodies and groundwater dependent habitats and protected areas.

9 Appropriate Assessment Summary

9 Appropriate Assessment Summary

The NIS of the Regional Plan's conclusions for SA6, regarding 'In-combination effects with other plans and projects' and 'In-combination effects between Preferred Options', as set out below and are included in more detail in Appendix E of the NIS for the Regional Plan.

Potential in-combination effects with other projects and plans were identified for the preferred options on the River Barrow & River Nore SAC, Slaney River Valley SAC and Charleville Wood SAC. The potential effects include disturbance, habitat degradation, and spread of invasive non-native species. However, the assessment concluded that with the mitigation identified there will be no adverse effects on the integrity of the European site in-combination with other plans or projects.

Potential in-combination effects between preferred options were identified for Slaney River Valley SAC, Slieve Bloom Mountains SPA, Lisbigney Bog SAC and River Barrow & River Nore SAC if construction of options is concurrent. The potential impacts include water table/availability, habitat loss, habitat degradation, mortality of Qualifying Interest (QI) species, spread of invasive non-native species and disturbance. With the implementation of mitigation as detailed in Appendix E of the NIS, there will be no adverse effects on the integrity of European sites.

10 Recommendations for Implementation

10 Recommendations for Implementation

Environmental actions for the implementation plan and the draft Monitoring Plan are identified in:

- SEA Environmental Report of the Framework Plan – this includes general proposals and standard mitigation requirements (also see SEA Environmental Report Appendix); and
- SEA Environmental Report of the Regional Plan - this includes specific mitigation and monitoring requirements for Eastern and Midlands Region options and cumulative effects.

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Appendix A Fine Screening Summaries

Key			
0 Neutral	-1 Minor adverse	-2 Moderate Adverse	-3 Major adverse
	1 Minor beneficial	2 Moderate Beneficial	3 Major Beneficial

Table A.1 Fine Screening Summary of Groundwater Options in SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-007	Increase GW abstraction to supply deficit (Oak Park/Graigcullen)									0	0	-11
SA6-09a	New GW abstraction/wellfield									0	0	-14
SA6-09b	Abandon Sion Cross and supply from new GW abstraction/wellfield									0	0	-13

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-019	Increase GW abstraction to supply deficit - yield assessments required									0	0	-5
SA6-024	New GW abstraction to supply full demand									0	0	-5
SA6-27b	Increase GW abstraction to supply deficit									2	0	-15
SA6-033	New GW abstraction to supply deficit									0	0	-12
SA6-037	Increase GW abstraction to supply deficit									1	0	-13
SA6-038	New GW abstraction to supply deficit and improve water quality									0	0	-10
SA6-45a	New GW abstraction/wellfield to supply deficit									1	0	-19
SA6-53a	Increase GW abstraction to supply deficit									1	0	-13

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-056	Increase GW abstraction to supply deficit									1	0	-14
SA6-57a	New GW abstraction/wellfield development									1	0	-14
SA6-57b	New GW abstraction/wellfield development									0	0	-15
SA6-57c	Rationalise Mountrath to Portlaoise & new GW abstraction/wellfield development									1	0	-21
SA6-57e	New GW abstraction/wellfield development									1	0	-15
SA6-57j	New GW abstraction/wellfield development									0	0	-14

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-57l	New GW abstraction/wellfield development									1	0	-22
SA6-064	Increase GW abstraction to supply deficit									1	0	-8
SA6-066	New GW abstraction to supply deficit - Clonaslee groundwater body									0	0	-9
SA6-69a	Increase GW abstraction to supply deficit									1	0	-6
SA6-077	Increase GW abstraction to supply deficit									0	0	-12
SA6-078	New GW abstraction/ wellfield at Doolough to supply deficit and new WTP									0	0	-13
SA6-86a	Increase GW abstraction to supply deficit - yield assessments required									1	0	-5

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-090	Increase GW abstraction to supply deficit									0	0	-3
SA6-094	Increase GW abstraction to supply deficit									1	0	-6
SA6-099	Increase GW abstraction to supply deficit									0	0	-4
SA6-104	Increase GW abstraction to supply deficit									1	0	-7
SA6-105	Increase GW abstraction to supply deficit									1	0	-9
SA6-106a	New GW abstraction to supply deficit; replace existing spring with new BHs									0	0	-11
SA6-113a	Increase GW abstraction to supply deficit									1	0	-10
SA6-113c	Increase GW abstraction to supply deficit									1	0	-12

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-118a	Increase GW abstraction at Cloonin Hill WTP to supply deficit									0	0	-6
SA6-119	Increase GW abstraction at Drim WTP to supply deficit									0	0	-7
SA6-120	Increase GW abstraction at Knocks WTP to supply deficit									0	0	-4
SA6-122	Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add resilience. Require source protection									0	0	-11
SA6-126	Increase GW abstraction to supply deficit									0	0	-7
SA6-127a	New GW abstraction to supply deficit and abandon existing spring									0	0	-11

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-128	New GW abstraction, maintaining spring									0	0	-10
SA6-134	Increase GW abstraction to supply deficit									1	0	-6
SA6-142	Increase GW abstraction at Castle Durrow Convent WTP to supply deficit									2	0	-11
SA6-143	New GW abstraction at Castle Durrow Convent WTP to supply deficit, abandon existing spring source									0	0	-11
SA6-144a	Increase GW abstraction at Fermoyle WTP to supply deficit									0	0	-7
SA6-144b	Rationalise Abbeylix North & south to Durrow and increase GW abstraction at Fermoyle WTP									0	0	-14

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-144d	Increase GW abstraction at Fermoyle WTP									0	0	-12
SA6-144e	Increase GW abstraction at Fermoyle WTP to supply deficit									0	0	-12
SA6-149	Increase GW abstraction to supply deficit									0	0	-8
SA6-150a	New GW abstraction to supply deficit and abandon existing spring									0	0	-10
SA6-155	Increase GW abstraction to supply deficit and decommission existing spring source									0	0	-10
SA6-156	Increase GW abstraction to supply deficit, Ballyroan spring									1	0	-12

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-174	Increase GW abstraction from Clonaslee BHs and upgrade WTP									2	0	-14
SA6-175	New GW/wellfield from Clonaslee groundwater body to supply									2	0	-18
SA6-176	Increase GW abstraction from Ardan BH's and upgrade WTP to partly supply deficit									0	0	-8
SA6-177a	New GW abstraction/wellfield from Tullamore groundwater body									0	0	-12
SA6-185	Connection to Portlaoise									1	0	-22
SA6-186	Connection to Portlaoise									1	0	-22
SA6-187	Connection to Portlaoise									1	0	-22
SA6-188	Connection to Portlaoise									1	0	-22

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-201	New GW abstraction for Mountbolus and WTP Upgrade									1	0	-17

Table A.2 Fine Screening Summary of Surface Water Options in SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-04a	Upgrade Srowland WTP (GDS WRZ) and Supply Deficit to Carlow Town									1	0	-19
SA6-04c	Upgrade Srowland WTP and supply deficit to Carlow Town									1	0	-19

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-005	New SW abstraction from River Barrow and new WTP at Carlow Town									1	0	-23
SA6-008	New SW abstraction from River Derreen									2	0	-23
SA6-054	New SW abstraction from River Goul									0	0	-18

Table A.3 Fine Screening Summary of Surface Water/Groundwater Options in SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-72a	Riverbank filtration from River Barrow									0	0	-17

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-080	Riverbank filtration from River Barrow									0	0	-16
SA6-121	Riverbank filtration from River Nore									0	0	-16
SA6-145	Riverbank filtration from River Nore									1	0	-19

Table A.4 Fine Screening Summary of Group Water Scheme Options In SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-073	Supply deficit from the neighbouring GWS - The Rock									0	0	-13

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-135	Supply from neighbouring GWS -Ballypickas									1	0	-16

Table A.5 Fine Screening Summary of New Shannon Source Options In SA6

Option Reference	Name	Environmental								Total - 3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-061	New Shannon Source Connection									0	0	-16
SA6-166	New Shannon Source Connection									0	0	-16
SA6-167	New Shannon Source Connection									0	0	-16

Option Reference	Name	Environmental								Total - 3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-168	New Shannon Source Connection									0	0	-16
SA6-169	New Shannon Source Connection									0	0	-16
SA6-170	New Shannon Source Connection									0	0	-16
SA6-180a	Supply Tullamore from New Shannon Source									0	0	-15
SA6-180b	New Shannon Source Connection									0	0	-16
SA6-180c	Supply Tullamore from New Shannon Source									0	0	-14
SA6-184	New connection point from New Shannon Source connecting to Mountbolus									0	0	-14
SA6-193	Connect to New Shannon Source via Srowland									0	0	-15

Option Reference	Name	Environmental								Total - 3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-194	New Shannon Source Connection									0	0	-16
SA6-195	New Shannon Source Connection									0	0	-16
SA6-196	New Shannon Source Connection									0	0	-16

Table A.6 Fine Screening Summary of WTP Upgrade Options in SA6

Option Reference	Name	Environmental								Total - 3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-191	WTP upgrade at Bagenalstown									0	0	-12

Option Reference	Name	Environmental								Total - 3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-197	WTP upgrade at Leiglinbridge											

Table A.7 Fine Screening Summary of Conjunctive Use Options in SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-063	Conjunctive use of River Barrow (increase WTP capacity) during winter and local GW during summer									0	0	-12
SA6-75a	Conjunctive use of River Barrow (new SW									1	0	-23

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	abstraction or riverbank filtration) during winter and local GW during summer											
SA6-112	Conjunctive use of Srowland WTP during winter and local GW during summer									0	0	-13

Table A.8 Fine Screening Summary of Interconnection Options in SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-034	Improve interconnection of Carlow Central Regional with Carlow Town									1	0	-19
SA6-071	Improve interconnection of Mountmellick and Portlaoise for improved resilience									0	0	-17
SA6-131	Upgrade existing interconnection of Abbeyleix South and Abbeyleix North WRZs									0	0	-13
SA6-139	Interconnect Ballinakill with Durrow WRZ for increased resilience									0	0	-15

Table A.9 Fine Screening Summary of Rationalisation Options in SA6

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-017	Rationalise Leighlinbridge to Bagenalstown									2	0	-18
SA6-062	Supply deficit for Portlaoise from New Shannon Source WRZ, Srowland WTP									0	0	-14
SA6-091	Rationalise The Strand WRZ to Swan WRZ									1	0	-15
SA6-109	Rationalise south east regional PWS to Portlaoise WRZ									1	0	-17
SA6-123	Rationalise Mountrath to Portlaoise									0	0	-15
SA6-132	Rationalise Mountrath to Portlaoise & new GW abstraction/wellfield development									1	0	-18

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA6-133	Rationalise Abbeylix North & south to Durrow and increase GW abstraction at Fermoyle WTP									0	0	-17
SA6-138	Rationalise Ballinakill to Durrow WRZ									0	0	-15
SA6-152	Rationalise Mountrath to Portlaoise & new GW abstraction/wellfield development									1	0	-18
SA6-153	Rationalise Abbeyleix North & south to Durrow and increase GW abstraction at Fermoyle WTP									0	0	-17
SA6-154	Rationalise Abbeyleix North to Portlaoise WRZ									1	0	-20
SA6-157	Rationalise Mountrath to Portlaoise & new GW									1	0	-18

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	abstraction/wellfield development											
SA6-163	New Shannon Source Connection									0	0	-16
SA6-164	New Shannon Source Connection									0	0	-16
SA6-165	New Shannon Source Connection									0	0	-16
SA6-199	Supply surplus from Bagenalstown to meet deficit in Carlow Central Regional									2	0	-18
SA6-200	Supply surplus from Bagenalstown to meet deficit in Carlow Central Regional									2	0	-18

Appendix B SA Approaches for SA6

Note: SA Options are also referred to as 'Group' options

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 3	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
0100SC0001: Carlow Town	SA6-193 Connect to New Shannon Source via Srowland	-	SA6-193 Connect to New Shannon Source via Srowland	-	SA6-193 Connect to New Shannon Source via Srowland	-
0100SC0002: Leighlinbridge	SA6-197 WTP upgrade only	-	SA6-197 WTP upgrade only	-	SA6-197 WTP upgrade only	-
0100SC0003: Old Leighlin	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-
0100SC0004: Bilboa	SA6-024 New GW abstraction to supply full demand	-	SA6-024 New GW abstraction to supply full demand	-	SA6-024 New GW abstraction to supply full demand	-
0100SC0008: Bagenalstown	SA6-191 WTP Upgrade	-	SA6-191 WTP Upgrade	-	SA6-191 WTP Upgrade	-
0100SC0011: Carlow Central Regional	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 3	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1500SC0006: Urlingford-Johnstown WS	SA6-038 New GW abstraction to supply deficit and improve water quality	-	SA6-038 New GW abstraction to supply deficit and improve water quality	-	SA6-038 New GW abstraction to supply deficit and improve water quality	-
1500SC0009: Clogh-Castlecomer WS	SA6-45a New GW abstraction/wellfield to supply deficit	-	SA6-45a New GW abstraction/wellfield to supply deficit	-	SA6-45a New GW abstraction/wellfield to supply deficit	-
1500SC0018: Galmoy-Rathdowney PWS	SA6-53a Increase GW abstraction to supply deficit	-	SA6-53a Increase GW abstraction to supply deficit	-	SA6-53a Increase GW abstraction to supply deficit	-
1600SC0001: Portlaoise PWS	SA6-57a New GW abstraction/wellfield development	-	SA6-57a New GW abstraction/wellfield development	-	SA6-57a New GW abstraction/wellfield development	-
1600SC0003: Rosenallis PWS	SA6-064 Increase GW abstraction to supply deficit	-	SA6-064 Increase GW abstraction to supply deficit	-	SA6-064 Increase GW abstraction to supply deficit	-
1600SC0004: Mountmellick 1 PWS	SA6-69a Increase GW abstraction to supply deficit	-	SA6-69a Increase GW abstraction to supply deficit	-	SA6-69a Increase GW abstraction to supply deficit	-
1600SC0005: Portarlington 1 PWS	SA6-077 Increase GW abstraction to supply deficit	-	SA6-077 Increase GW abstraction to supply deficit	-	SA6-077 Increase GW abstraction to supply deficit	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 3	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1600SC0006: Arles 2 PWS	SA6-86a Increase GW abstraction to supply deficit - yield assessments required	-	SA6-86a Increase GW abstraction to supply deficit - yield assessments required	-	SA6-86a Increase GW abstraction to supply deficit - yield assessments required	-
1600SC0007: The Strand PWS	SA6-090 Increase GW abstraction to supply deficit	-	SA6-090 Increase GW abstraction to supply deficit	-	SA6-090 Increase GW abstraction to supply deficit	-
1600SC0008: Coolanagh PWS	SA6-094 Increase GW abstraction to supply deficit	-	SA6-094 Increase GW abstraction to supply deficit	-	SA6-094 Increase GW abstraction to supply deficit	-
1600SC0010: Borris in Ossory PWS	SA6-099 Increase GW abstraction to supply deficit	-	SA6-099 Increase GW abstraction to supply deficit	-	SA6-099 Increase GW abstraction to supply deficit	-
1600SC0011: Camross PWS	SA6-104 Increase GW abstraction to supply deficit	-	SA6-104 Increase GW abstraction to supply deficit	-	SA6-104 Increase GW abstraction to supply deficit	-
1600SC0014: South East Regional PWS	SA6-105 Increase GW abstraction to supply deficit	-	SA6-105 Increase GW abstraction to supply deficit	-	SA6-105 Increase GW abstraction to supply deficit	-
1600SC0015: Swan PWS	SA6-113a	-	SA6-113a	-	SA6-113a	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 3	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
	Increase GW abstraction to supply deficit		Increase GW abstraction to supply deficit		Increase GW abstraction to supply deficit	
1600SC0016: Mountrath	SA6-122 Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add resilience. Require source protection.	-	SA6-122 Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add resilience. Require source protection.	-	SA6-122 Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add resilience. Require source protection.	-
1600SC0017: Abbeyleix South	SA6-126 Increase GW abstraction to supply deficit	-	SA6-126 Increase GW abstraction to supply deficit	-	SA6-126 Increase GW abstraction to supply deficit	-
1600SC0018: Ballinakill	SA6-139 Interconnect Ballinakill with Durrow WRZ for increased resilience	53	SA6-139 Interconnect Ballinakill with Durrow WRZ for increased resilience	53	SA6-134 Increase GW abstraction to supply deficit	-
1600SC0019: Durrow	SA6-144e Increase GW abstraction at Fermoyle WTP to supply deficit	53	SA6-144e Increase GW abstraction at Fermoyle WTP to supply deficit	53	SA6-143 New GW abstraction (BH) at Castle Durrow Convent WTP to supply deficit, abandon existing spring source	-
1600SC0020: Abbeyleix North	SA6-149 Increase GW abstraction to supply deficit	-	SA6-149 Increase GW abstraction to supply deficit	-	SA6-149 Increase GW abstraction to supply deficit	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 3	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1600SC0021: Ballyroan	SA6-156 Increase GW abstraction to supply deficit - Ballyroan Spring	-	SA6-156 Increase GW abstraction to supply deficit - Ballyroan Spring	-	SA6-156 Increase GW abstraction to supply - deficit - Ballyroan Spring	-
2500SC0002: Tullamore	SA6-180c Supply Tullamore from New Shannon Source	52	SA6-180c Supply Tullamore from New Shannon Source	52	SA6-180a Supply Tullamore from New Shannon Source	-
2500SC0013: Mountbolus PWS	SA6-184 New connection point from New Shannon Source connecting to Mountbolus	52	SA6-184 New connection point from New Shannon Source connecting to Mountbolus	52	SA6-201 New GW abstraction for Mountbolus and WTP Upgrade	-

WRZ	Best Environmental - SA Approach 2		Most Resilient - SA Approach 4		Lowest Carbon - SA Approach 5	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
0100SC0001: Carlow Town	SA6-193 Connect to New Shannon Source via Srowland	-	SA6-193 Connect to New Shannon Source via Srowland	-	SA6-193 Connect to New Shannon Source via Srowland	-
0100SC0002: Leighlinbridge	SA6-197 WTP upgrade only	-	SA6-197 WTP upgrade only	-	SA6-197 WTP upgrade only	-

WRZ	Best Environmental - SA Approach 2		Most Resilient - SA Approach 4		Lowest Carbon - SA Approach 5	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
0100SC0003: Old Leighlin	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-
0100SC0004: Bilboa	SA6-024 New GW abstraction to supply full demand	-	SA6-024 New GW abstraction to supply full demand	-	SA6-024 New GW abstraction to supply full demand	-
0100SC0008: Bagenalstown	SA6-191 WTP Upgrade	-	SA6-191 WTP Upgrade	-	SA6-191 WTP Upgrade	-
0100SC0011: Carlow Central Regional	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-
1500SC0006: Urlingford-Johnstown WS	SA6-038 New GW abstraction to supply deficit and improve water quality	-	SA6-038 New GW abstraction to supply deficit and improve water quality	-	SA6-038 New GW abstraction to supply deficit and improve water quality	-
1500SC0009: Clogh-Castlecomer WS	SA6-194 New Shannon Source Connection	42	SA6-45a New GW abstraction/wellfield to supply deficit	-	SA6-45a New GW abstraction/wellfield to supply deficit	-

WRZ	Best Environmental - SA Approach 2		Most Resilient - SA Approach 4		Lowest Carbon - SA Approach 5	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1500SC0018: Galmoy-Rathdowney PWS	SA6-53a Increase GW abstraction to supply deficit	-	SA6-53a Increase GW abstraction to supply deficit	-	SA6-53a Increase GW abstraction to supply deficit	-
1600SC0001: Portlaoise PWS	SA6-061 New Shannon Source Connection	42	SA6-57a New GW abstraction/wellfield development	-	SA6-57a New GW abstraction/wellfield development	-
1600SC0003: Rosenallis PWS	SA6-064 Increase GW abstraction to supply deficit	-	SA6-064 Increase GW abstraction to supply deficit	-	SA6-064 Increase GW abstraction to supply deficit	-
1600SC0004: Mountmellick 1 PWS	SA6-170 New Shannon Source Connection	42	SA6-69a Increase GW abstraction to supply deficit	-	SA6-69a Increase GW abstraction to supply deficit	-
1600SC0005: Portarlington 1 PWS	SA6-195 New Shannon Source Connection	42	SA6-077 Increase GW abstraction to supply deficit	-	SA6-077 Increase GW abstraction to supply deficit	-
1600SC0006: Arles 2 PWS	SA6-86a Increase GW abstraction to supply deficit - yield assessments required	-	SA6-86a Increase GW abstraction to supply deficit - yield assessments required	-	SA6-86a Increase GW abstraction to supply deficit - yield assessments required	-
1600SC0007: The Strand PWS	SA6-090	-	SA6-090	-	SA6-090	-

WRZ	Best Environmental - SA Approach 2		Most Resilient - SA Approach 4		Lowest Carbon - SA Approach 5	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
	Increase GW abstraction to supply deficit		Increase GW abstraction to supply deficit		Increase GW abstraction to supply deficit	
1600SC0008: Coolanagh PWS	SA6-094 Increase GW abstraction to supply deficit	-	SA6-094 Increase GW abstraction to supply deficit	-	SA6-094 Increase GW abstraction to supply deficit	-
1600SC0010: Borris in Ossory PWS	SA6-099 Increase GW abstraction to supply deficit	-	SA6-099 Increase GW abstraction to supply deficit	-	SA6-099 Increase GW abstraction to supply deficit	-
1600SC0011: Camross PWS	SA6-104 Increase GW abstraction to supply deficit	-	SA6-104 Increase GW abstraction to supply deficit	-	SA6-104 Increase GW abstraction to supply deficit	-
1600SC0014: South East Regional PWS	SA6-168 New Shannon Source Connection	42	SA6-105 Increase GW abstraction to supply deficit	-	SA6-105 Increase GW abstraction to supply deficit	-
1600SC0015: Swan PWS	SA6-169 New Shannon Source Connection	42	SA6-113a Increase GW abstraction to supply deficit	-	SA6-113a Increase GW abstraction to supply deficit	-
1600SC0016: Mountrath	SA6-166 New Shannon Source Connection	42	SA6-122 Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add	-	SA6-122 Rationalise Cloonin Hill, Drim and Knocks into 1 WTP to add	-

WRZ	Best Environmental - SA Approach 2		Most Resilient - SA Approach 4		Lowest Carbon - SA Approach 5	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
			resilience. Require source protection.		resilience. Require source protection.	
1600SC0017: Abbeyleix South	SA6-167 New Shannon Source Connection	42	SA6-131 Upgrade existing interconnection of Abbeyleix South and Abbeyleix North WRZs	50	SA6-126 Increase GW abstraction to supply deficit	-
1600SC0018: Ballinakill	SA6-165 New Shannon Source Connection	42	SA6-134 Increase GW abstraction to supply deficit	-	SA6-134 Increase GW abstraction to supply deficit	-
1600SC0019: Durrow	SA6-164 New Shannon Source Connection	42	SA6-143 New GW abstraction (BH) at Castle Durrow Convent WTP to supply deficit, abandon existing spring source	-	SA6-143 New GW abstraction (BH) at Castle Durrow Convent WTP to supply deficit, abandon existing spring source	-
1600SC0020: Abbeyleix North	SA6-163 New Shannon Source Connection	42	SA6-150a New GW abstraction to supply deficit and abandon existing spring	50	SA6-149 Increase GW abstraction to supply deficit	-
1600SC0021: Ballyroan	SA6-196 New Shannon Source Connection	42	SA6-156 Increase GW abstraction to supply deficit - Ballyroan Spring	-	SA6-156 Increase GW abstraction to supply - deficit - Ballyroan Spring	-

WRZ	Best Environmental - SA Approach 2		Most Resilient - SA Approach 4		Lowest Carbon - SA Approach 5	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
2500SC0002: Tullamore	SA6-180b New Shannon Source Connection	42	SA6-180a Supply Tullamore from New Shannon Source	-	SA6-180c Supply Tullamore from New Shannon Source	52
2500SC0013: Mountbolus PWS	SA6-201 New GW abstraction for Mountbolus and WTP Upgrade	-	SA6-201 New GW abstraction for Mountbolus and WTP Upgrade	-	SA6-184 New connection point from New Shannon Source connecting to Mountbolus	52

WRZ	Best Appropriate Assessment - SA Approach 2	
	Option Description	SA Option
0100SC0001: Carlow Town	SA6-193 Connect to New Shannon Source via Srowland	-
0100SC0002: Leighlinbridge	SA6-197 WTP upgrade only	-
0100SC0003: Old Leighlin	SA6-019 Increase GW abstraction to supply deficit - yield assessments required	-
0100SC0004: Bilboa	SA6-024 New GW abstraction to supply full demand	-

WRZ	Best Appropriate Assessment - SA Approach 2	
	Option Description	SA Option
0100SC0008: Bagenalstown	SA6-191 WTP Upgrade	-
0100SC0011: Carlow Central Regional	SA6-033 New GW abstraction to supply deficit, to the Barrow gravels just south of Carlow Town	-
1500SC0006: Urlingford-Johnstown WS	SA6-038 New GW abstraction to supply deficit and improve water quality	-
1500SC0009: Clogh-Castlecomer WS	SA6-194 New Shannon Source Connection	42
1500SC0018: Galmoy-Rathdowney PWS	SA6-53a Increase GW abstraction to supply deficit	-
1600SC0001: Portlaoise PWS	SA6-061 New Shannon Source Connection	42
1600SC0003: Rosenallis PWS	SA6-064 Increase GW abstraction to supply deficit	-
1600SC0004: Mountmellick 1 PWS	SA6-170 New Shannon Source Connection	42
1600SC0005: Portarlington 1 PWS	SA6-195 New Shannon Source Connection	42
1600SC0006: Arles 2 PWS	SA6-86a	-

WRZ	Best Appropriate Assessment - SA Approach 2	
	Option Description	SA Option
	Increase GW abstraction to supply deficit - yield assessments required	
1600SC0007: The Strand PWS	SA6-090 Increase GW abstraction to supply deficit	-
1600SC0008: Coolanagh PWS	SA6-094 Increase GW abstraction to supply deficit	-
1600SC0010: Borris in Ossory PWS	SA6-099 Increase GW abstraction to supply deficit	-
1600SC0011: Camross PWS	SA6-104 Increase GW abstraction to supply deficit	-
1600SC0014: South East Regional PWS	SA6-168 New Shannon Source Connection	42
1600SC0015: Swan PWS	SA6-169 New Shannon Source Connection	42
1600SC0016: Mountrath	SA6-166 New Shannon Source Connection	42
1600SC0017: Abbeyleix South	SA6-167 New Shannon Source Connection	42
1600SC0018: Ballinakill	SA6-165 New Shannon Source Connection	42

WRZ	Best Appropriate Assessment - SA Approach 2	
	Option Description	SA Option
1600SC0019: Durrow	SA6-164 New Shannon Source Connection	42
1600SC0020: Abbeyleix North	SA6-163 New Shannon Source Connection	42
1600SC0021: Ballyroan	SA6-196 New Shannon Source Connection	42
2500SC0002: Tullamore	SA6-180b New Shannon Source Connection	42
2500SC0013: Mountbolus PWS	SA6-201 New GW abstraction for Mountbolus and WTP Upgrade	-