Autumn 2022

Regional Water Resources Plan–Eastern and Midlands

Strategic Environmental Assessment

Appendix H: Study Area 9 – 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) the Eastern and Midlands (referred to as the Regional Plan). The Regional Plan includes nine individual study area reviews (SA1-9) as appendices.

This Study Area 9 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 9 within the Eastern and Midlands Region for the options and approaches considered and outlined in the Study Area 9 Technical Report (RWRP-EM Appendix 9). 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 will be undertaken for each study area and will 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.

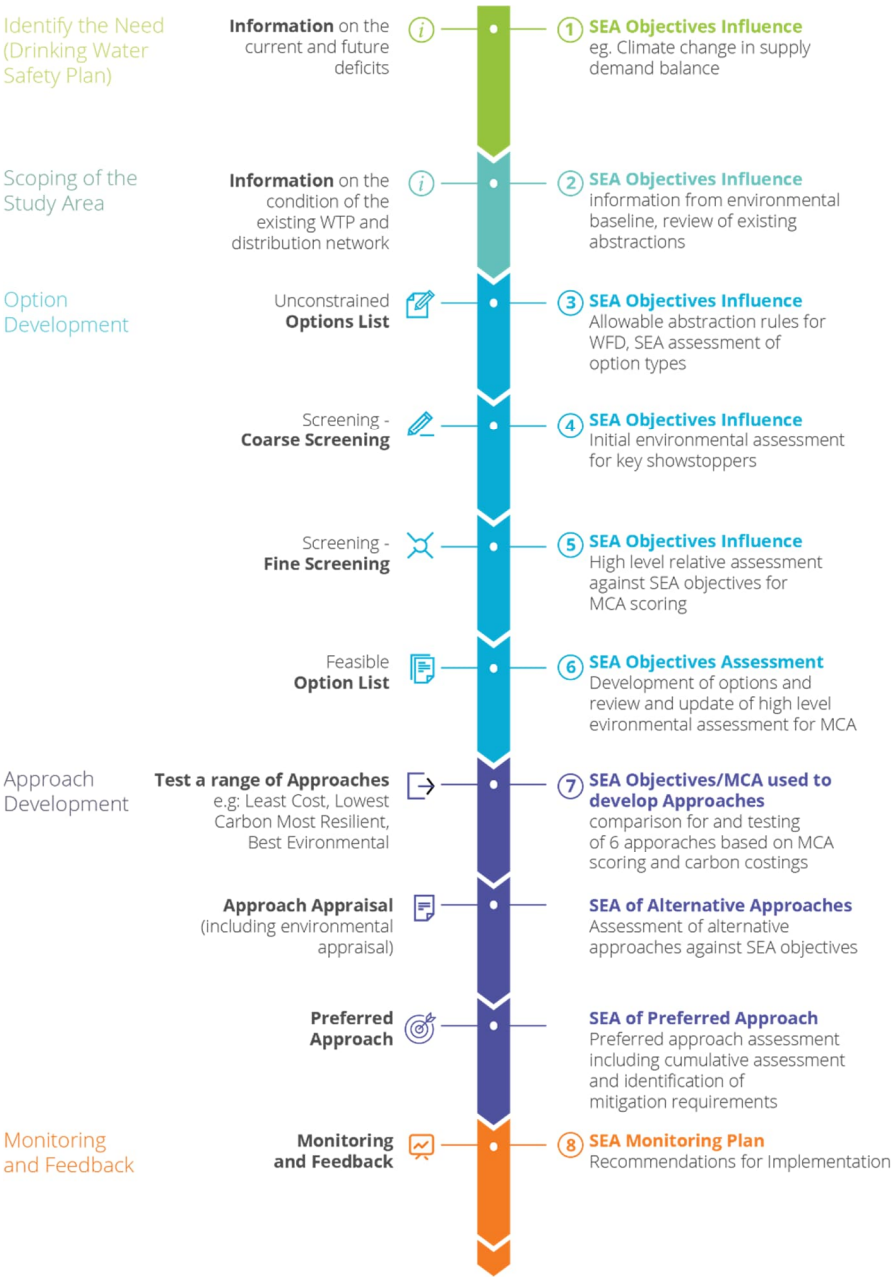

Figure 1.1 Option and Approach Development Process

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 will 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 selection of the study area 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 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.

SEA Topic	SEA Objective
	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 and 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 SA9 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 SA9 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 equally 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 the conclusions from the NIS for SA9 are provided in chapter 9 of this review.

1.6 Study Area 9

The Eastern and Midlands Region is subdivided into nine study areas based on factors such as:

- Groundwater body boundaries;
- Surface water sub-catchments;
- Geographical features;
- WRZ boundaries;
- Local authority functional areas; and
- Appropriate size for an efficient reporting structure.

This Appendix reports on SA9, the location of SA9 in relation to the Eastern and Midlands Region is shown in Figure 1.2.

Study Area 9 lies within the counties of: Dublin City, Dun Laoghaire-Rathdown, Fingal, Kildare, Meath, South Dublin, Wicklow, Laois and Offaly and its total area is approximately 3,313 km^2. The principal settlements (with a population of over 10,000) within SA9 are Balbrigggan, Bray, Celbridge, Droichead Nua (Newbridge), Dublin city and suburbs, Greystones-Delgany, Leixlip, Malahide, Maynooth, Naas, Skerries, Swords and Wicklow (CSO, 2016a), as shown in Figure 1.3.

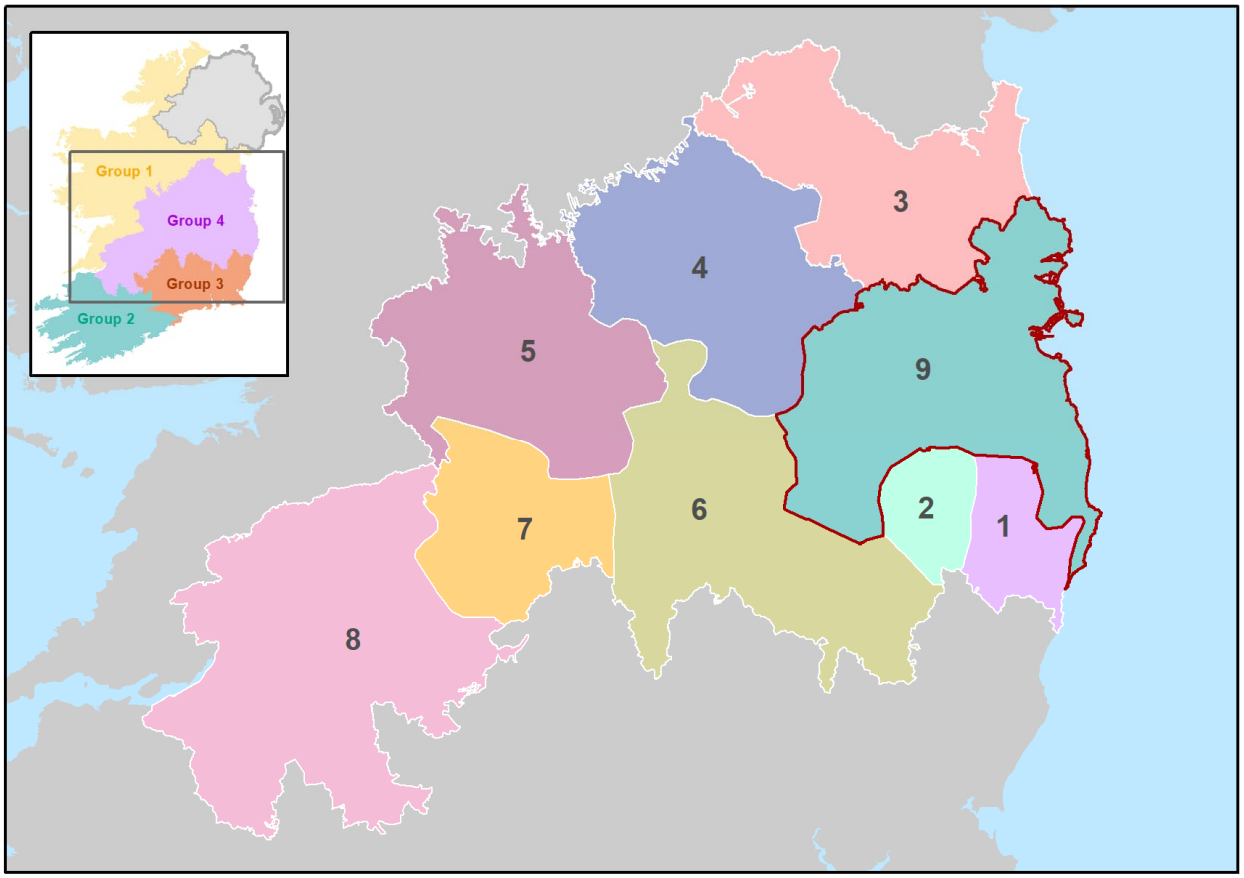

Figure 1.2 Eastern and Midlands Region Study Areas

Figure 1.3 Study Area 9

2

Study Area 9 Environmental Baseline Context

2 Study Area 9 Environmental Baseline Context

This chapter provides environmental baseline information for SA9 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 Regional Plan 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 Plan 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 WRZs 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 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 SA9

WRZ Reference and Name	Total Population Served (2019)*	% Population Change 2019-2044*
GDA - Greater Dublin Area	1,702,245	+24.5%

WRZ Reference 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

Part of SA9 lies within the Dublin region and part lies within the Mid-East region of Ireland. SA9 had an above average household disposable income per person in 2016 (CSO, 2016b), and an unemployment rate of 6.6% in the Dublin region and 7.5% in the Mid-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 1,303 for the Mid-East region and 1,145 for the Dublin region (CSO, 2020a).

2.1.3 Tourism and Recreation

Tourism in SA9 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 city of Dublin has been described as *"a vibrant, cool and hip capital city bursting with a variety of surprising experiences – with sea and mountains at its doorstep"* (Visit Dublin, 2020). It has also been identified as a priority segment and as one of Ireland's best prospects for growing tourism by the National Tourism Development Authority (2016).

Additionally, the study area is located within Ireland's Ancient East, one of Fáilte Ireland's tourism programmes in the country. Ireland's Ancient East, which is part of a tourism development strategy that covers the South, East and part of the Midlands, places emphasis on 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 SA9, the nature reserves and national park of note are Pollardstown Fen, North Bull Island, Knocksink Wood, Glen of the Downs, Deputy's Pass and Wicklow Mountains National Park. 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 Dublin and Mid-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 Dublin and Mid-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)
Dublin: Male: 76.7 Female: 81.2	**Dublin:** 61%	Good

Life Expectancy (CSO, 2017b)	Participation in Sports, Fitness or Recreational Physical Activities (% of Persons Aged 15+) (CSO, 2020b)	Air Quality (EPA, 2020a)
Mid-East: Male: 77.2 Female: 81.4	**Mid-East**: 49%	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 SA9.

Table 2.3 Areas Supplied by the WTPs in SA9

WTP	WRZ	Local Authority Supplied
Ballyboden WTP, Vartry WTP and Ballymore Eustace WTP	GDA	Dublin City
Brittas WTP	GDA	South Dublin
Leixlip WTP and Bog of the Ring Water WTP	GDA	Fingal
Roundwood Well WTP, Cronroe WTP and Glenealy WTP	GDA	Wicklow
Srowland WTP, Rathangan Wellfields WTP and Monasterevin WTP	GDA	Kildare

Currently for day-to-day operations, the GDA WRZ has a current and projected SDB deficit (based on a 'Do Minimum' approach – see section 4.5 for further clarification).

Poor water quality can be linked to risks to health. The Barrier Assessment identified ten of the twelve WTPs within the study area as being at high risk of failing to achieve Irish Water's conservative Barrier Assessment standards in relation to maintaining the chlorine residual in the network (Barrier 2.1). The "quality need" identified through the Barrier Assessment is not an indicator of compliance with the Drinking Water Regulations. It is an internal Irish Water 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. At present the Vartry supply is on the EPA Remedial Action List (RAL) and Irish Water is currently constructing a new WTP to remove this WTP from the RAL.

Irish Water is currently progressing immediate corrective action in relation to a number of supplies. Details of these are included in the SA9 Technical Report.

2.2 Water Environment

This topic covers geomorphology, WFD status, 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 SA9.

Table 2.4 provides a summary of the WFD catchments within SA9.

Table 2.4 Catchments within SA9 (EPA, 2020b)

WFD Catchments	Total Area (km^2)	Catchment Area within SA9 (km^2)
Avoca-Vartry	1,234	542
Barrow	3,016	827
Boyne	2,690	155
Liffey and Dublin Bay	1,624	1,435
Nanny-Delvin	708	353

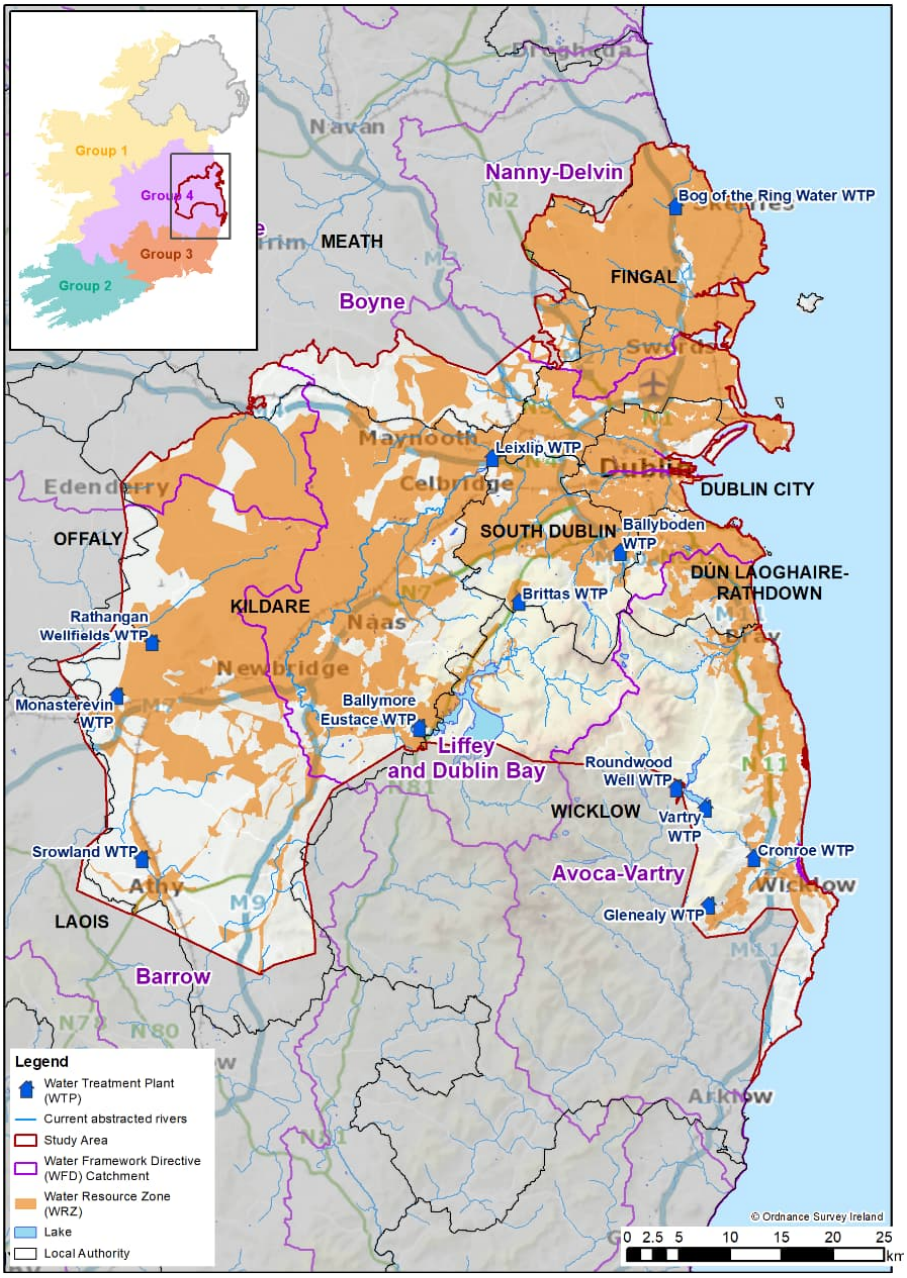

Figure 2.1 Water Environment of SA9

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 SA9 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 SA9 supplies, Irish Water have compared the compensation flows based on current operational agreements that are included within their water resources model against those that may be allowed by other jurisdictions' application of UKtag guidance. Irish Water have then adjusted the compensation flows within their model accordingly and assessed the resultant deployable output.

Based on this initial assessment, the volumes of water abstracted from Poulaphouca Reservoir (Upper Liffey), Leixlip (Middle Liffey), River Vartry and Bohernabreena Reservoir (River Dodder) may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, these compensation flow quantities will be adjudicated by the EPA who will have additional project level data available to them. Irish Water have assumed, given the need to maintain supplies, that a transition to new abstraction and compensation flow quantities would likely take place in the medium term. The potential impact of medium term regulatory changes at Irish Water's existing abstraction sites is summarised in the SA9 Technical Report.

Irish Water have taken a conservative approach in identifying sustainable abstractions for both surface and ground water resources for new options (described in section 3.2) and sensitivity assessment considers proposals against potential for future sustainability reductions (section 5.4).

The Department of Housing, Planning and Local Government (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 SA9 and the total number of surface and groundwater waterbodies within SA9 are provided in Table 2.5 below.

Table 2.5 WFD Waterbodies within SA9 (EPA, 2019b, 2019c, 2019d, 2019e and 2019f)

Waterbody Type	Water Catchments	Number of Waterbodies	Number of Waterbodies Rated Below Moderate
Rivers	Avoca-Vartry	40	3
	Barrow	43	12
	Boyne	6	1
	Liffey and Dublin Bay	71	24
	Nanny-Delvin	24	16
Lakes	Avoca-Vartry	5	0
	Barrow	0	0
	Boyne	0	0
	Liffey and Dublin Bay	6	0
	Nanny-Delvin	0	0
Transitional and Coastal	N/A	16	2

Waterbody Type	Water Catchments	Number of Waterbodies	Number of Waterbodies Rated Below Moderate
Groundwater	N/A	41	5

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:

- Avoca-Vartry: Other (54%) (including historically polluted sites, aquaculture, waste, atmospheric and anthropogenic pressures), Agriculture (31%) and Urban Runoff (23%);
- Barrow: Agriculture (75%) and Hydromorphology (31%);
- Boyne: Agriculture (68%) and Hydromorphology (41%);
- Liffey and Dublin Bay: Agriculture (51%), Urban Runoff (32%), Urban Wastewater Treatment Plants (23%) and Domestic Wastewater (23%); and
- Nanny-Delvin: Agriculture (79%), Hydromorphology (56%), Urban Wastewater (32%) and Domestic Wastewater (32%).

Table 2.6 includes a summary of the ‘at risk’ waterbodies within SA9.

Table 2.6 Summary of ‘At Risk’ Waterbodies in SA9 (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	Avoca-Vartry	15	4
	Barrow	20	
	Boyne	5	
	Liffey and Dublin Bay	43	
	Nanny-Delvin	18	
Lakes	Avoca-Vartry	0	0
	Barrow	0	
	Boyne	0	
	Liffey and Dublin Bay	1	
	Nanny-Delvin	0	
Transitional and Coastal	N/A	7	0
Groundwater	N/A	6	0
Total		**115**	**4**

* 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 SA9 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 SA9 (catchments.ie, 2021f)

Areas for Action	Key Reasons for Selection
Upper Boyne	• Drinking water protected area for the largest number of consumers (Water abstraction at Trim & Kishawanny boreholes which are the raw water for Edenderry Public supply) • Multiple pressures in multiple areas • Edenderry Area Drainage Plan due in 2021 so preparatory work could feed into it e.g. upgrades required for some pumping stations • Cross County project • Building on existing knowledge from works completed by Offaly County Council • Premier angling River
Blackwater (Longwood)	• Building on work completed by Kildare County Council • Opportunity to address spikes in ammonia from peat • Headwaters of Blackwater (Longwood) • Opportunity to work with Bord naMona and Office of Public Works (OPW)
Boycetown	• Build on work completed by Meath County Council – stream walks completed on the lower portion: ~80 cattle access points were identified • Two deteriorated waterbodies
Rogerstown Estuary	• Building on improvements, including sewer improvement in Turvey, installation of reed beds and discussion with Tesco on their facility • Building on monitoring completed by Fingal County Council • Discharges into two designated bathing waters (Portrane and Donabate) • Headwaters to Rogerstown Estuary • Sub catchment project
Ashbourne Diffuse Urban	• Pilot project to address urban diffuse pressures with focus on 500m stretch of Broadmeadow_020 • Building on work carried out by Meath and Irish Water to rehabilitate leaky sewers • Small and manageable area with single pressure (urban diffuse)
Dodder	• Will support improvement in the estuary • Building on knowledge gained from a study on the Merrion Strand where a management plan is currently in progress between DCC and EPA • Diffuse urban pilot that could be compared to results of Santry project • Possibility to study historic landfill in the upper reaches and apply knowledge elsewhere • Invasive species survey has been carried out which should be investigated further and include mitigation • Active community group (Dodder Action Group) • Flows into SAC and Dublin Bay Biosphere

Areas for Action	Key Reasons for Selection
	• Important trout fishery, recruitment. Salmon in lower and ongoing work for removal of weirs to allow salmon to pass • Important for recreation. Greenway proposed which would increase tourism • Ringsend agglomeration is on the Irish Water investment programme
pH (Wicklow) 1	• An acid water project in the east • Build on work completed by Wicklow County Council • Headwaters to reservoir • Important for recreation - active angling club in the area
Morell	• Pilot project to address issues and measures associated with quarries • Important for salmonid recruitment on the Liffey • Three potential quick wins. • Source of the Grand Canal. • Potential case study for considering the role of planning • Rathmore stream_010 is a headwater stream to the river • Morell and runoff in this area is resulting in bank erosion and siltation downstream • Two deteriorated waterbodies
Clonshanbo/Lyreen	• Building on existing work, including stream works, completed by Kildare County Council and Inland Fisheries Ireland • Building on existing measures that have been put in place – fencing to prevent cattle access issues. There is a procedure in place to monitor the effectiveness of the fencing. • Three potential 'quick wins' • One deteriorated waterbody. • A headwaters area
Santry River	• Multi-disciplinary, cross-agency project • DCC are looking to develop projects here for green infrastructure so would build on that existing investment • Building on Irish Water work - a drainage area study was recently completed for the catchment • Building on on-going work by Fingal County Council • Urban project - measures could be implemented elsewhere • Potential to work with fisheries for guidance on river restoration. • Includes a headwaters area • Santry is currently negatively impacting on North Bull Island (SPA, SAC, pNHA, RAMSAR site, nutrient sensitive waters, UNESCO. Biosphere). Improving status in the river will eliminate the impact of the river on North Bull Island. • Proposed Natural Heritage Area (Santry Demesne) • Contained within Dublin Bay Biosphere

Areas for Action	Key Reasons for Selection
	• Active community groups in area
Upper Tolka	• One 'Bad' status waterbody where the pressure is known • Headwaters of the river Tolka • Potential to apply the results of the Santry Project here • Building on decline in phosphate concentrations • Important fishery, huge amenity for youth engagement with the Tolka anglers • Four deteriorated waterbodies
Potters and Three Mile Water	• Building on improvements in Potters_010 – improved from Poor to Moderate between 2007-2009 and 2010-2015 • Building on existing knowledge in Wicklow County • Council regarding farms and quarries in the area • Building on improvements following completion of roadworks that were a pressure • Good community engagement - there are 3 Group Water Schemes • Discharges into Brittas Bay designated bathing waters • A drinking water abstraction in Potters_010 • Potential for 'quick wins' in both waterbodies
Dargle and Carrickmines	• Multi agency cooperation between Dun Laoghaire Rathdown, Irish Water, Inland Fisheries Ireland • Building on completed and planned assessments on the Carrickmines Stream_010 • Building on Drainage Area Plan completed by Irish Water on Carrickmines Stream_010 • Carrickmines Stream_010 is a headwater stream to Shanganagh_010, which is at 'Good' status • Dargle_010 is the headwaters to the River Dargle • Dargle_010 has a High Ecological Status objective and has deteriorated • Dargle_030 is a deteriorated waterbody with protected area objectives for salmonids.
pH (Wicklow) 2	• 2nd pH project to link to the other Wicklow pH project. • Four deteriorated waterbodies • Two High Ecological Status objective waterbodies • Headwaters to the Avonbeg and Avonmore rivers
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
Athy Stream	• Potential pilot project to examine high nitrates and siltation from tillage (Athy_020) • Protected area objectives not met (Crayfish)

Areas for Action	Key Reasons for Selection
	• Athy_010 declined between 10-12 and 13-15 • One potential 'quick win'
Portarlington	• Building on the 2017 upgrade of Portarlington Agglomeration (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

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 SA9.

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 subject to 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).

2.2.3 Marine Environment

Ireland has sovereign rights over one of the largest sea areas in Europe, Ireland's economy, culture and society is inextricably linked to the sea. The National Marine Planning Framework (Government of Ireland, 2021) sets out the framework for managing Ireland's marine activities to ensure the sustainable use of marine resources up to 2040. Any options with interaction with the marine environment will be considered against the objectives of the framework.

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 it 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

Summary	
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 SA9

County	Key Risk Areas
Dún Laoghaire-Rathdown Dublin City Fingal South Dublin (Dublin Climate Change, 2019)	• Sea level rise • Flooding • Extreme weather events
Meath (Meath County Council, 2019)	• Hot summers and warmer winters • Heatwaves and droughts • Extreme rainfall, wind speed/storminess and storm surges

County	Key Risk Areas
	• Coastal erosion and sea level rise • Flooding
Kildare (Kildare County Council, 2019)	• Extreme rainfall • Windstorms • Freezing conditions/heavy snow • Extreme heat/drought
Laois (Laois County Council, 2019)	• Heatwave and drought conditions • Risk of bog, gorse or forest fires • Extreme wind events • Extreme rainfall • Extreme cold and snow events
Offaly (Offaly County Council, 2019)	• Rising temperatures and drought • Wetter winters and drier summers • More intense rainfall and storm events • Increased flood risk
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 SA9, 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 SA9 there are a number of European, national and locally designated sites, including National Parks, Special Protected Areas (SPAs), Special Areas of Conservation (SACs), nature reserves, 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.

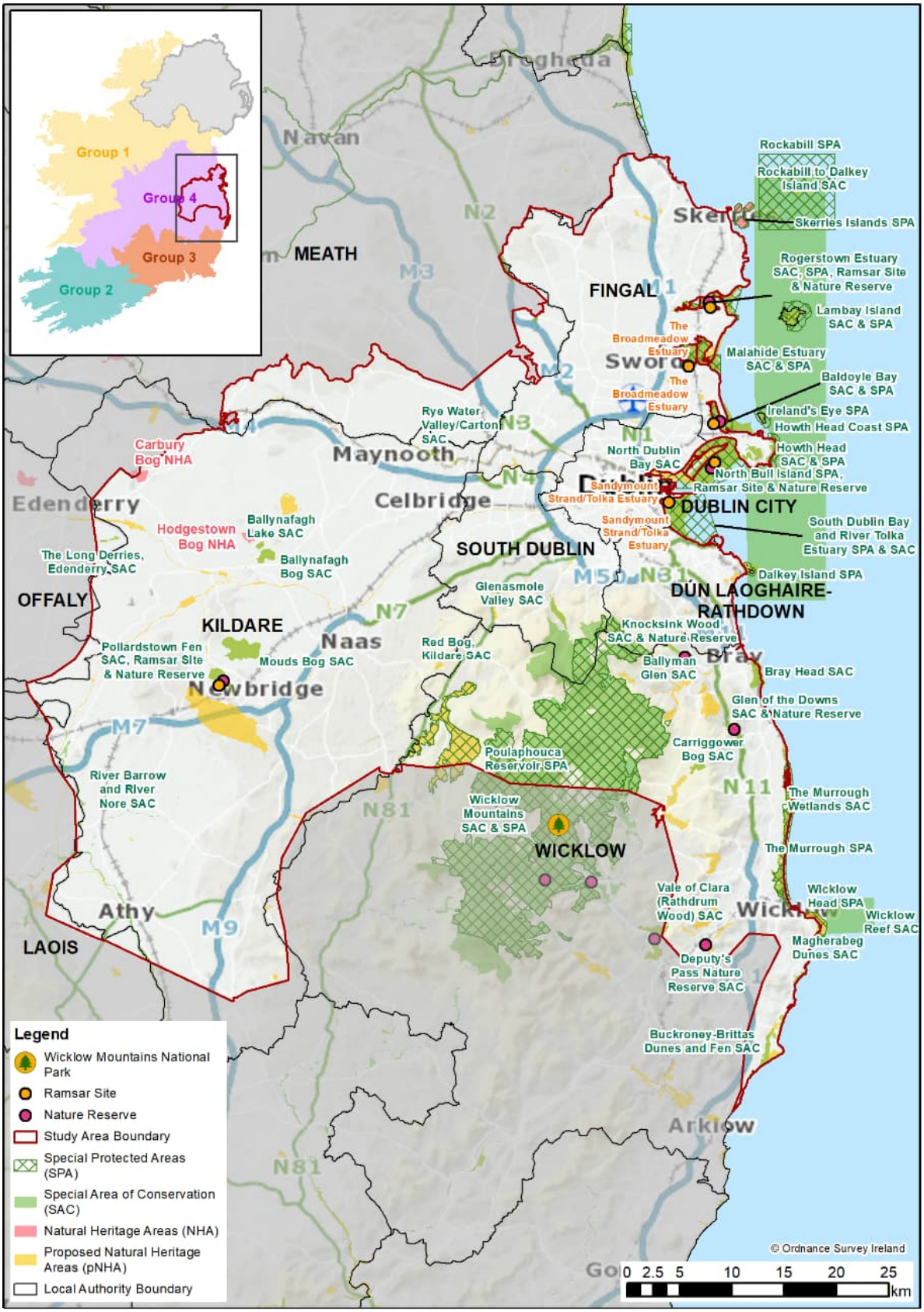

Figure 2.2 Designated Sites in SA9

Table 2.10 Designated Sites within SA9 (NPWS, 2019a)

Receptor	Name	Total Number
Special Protected Area (SPA)	Baldoyle Bay SPA	10
	Howth Head Coast SPA	

Receptor	Name	Total Number
	Malahide Estuary SPA	
	North Bull Island SPA	
	Poulaphouca Reservoir SPA	
	Rogerstown Estuary SPA	
	South Dublin Bay and River Tolka Estuary SPA	
	The Murrough SPA	
	Wicklow Head SPA	
	Wicklow Mountains SPA	
Special Area of Conservation (SAC)	Baldoyle Bay SAC	27
	Ballyman Glen SAC	
	Ballynafagh Bog SAC	
	Ballynafagh Lake SAC	
	Bray Head SAC	
	Buckroney-Brittas Dunes And Fen SAC	
	Carriggower Bog SAC	
	Deputy's Pass Nature Reserve SAC	
	Glen of the Downs SAC	
	Glenasmole Valley SAC	
	Howth Head SAC	
	Knocksink Wood SAC	
	Magherabeg Dunes SAC	
	Malahide Estuary SAC	
	Mouds Bog SAC	
	North Dublin Bay SAC	
	Pollardstown Fen SAC	
	Red Bog, Kildare SAC	
	River Barrow And River Nore SAC	
	Rockabill to Dalkey Island SAC	
	Rogerstown Estuary SAC	
	Rye Water Valley/Carton SAC	
	South Dublin Bay SAC	
	The Long Derries, Edenderry SAC	

Receptor	Name	Total Number
	The Murrough Wetlands SAC	
	Vale of Clara (Rathdrum Wood) SAC	
	Wicklow Mountains SAC	
Ramsar sites	Baldoyle Bay	6
	North Bull Island	
	Pollardstown Fen	
	Rogerstown Estuary	
	Sandymount Strand/Tolka Estuary	
	The Broadmeadow Estuary	
Nature reserves	Baldoyle Estuary Nature Reserve	7
	Deputys Pass Nature Reserve	
	Glen of the Downs Nature Reserve	
	Knocksink Wood Nature Reserve	
	North Bull Island Nature Reserves	
	Pollardstown Fen Nature Reserve	
	Rogerstown Estuary Nature Reserve	
National Parks	Wicklow Mountains National Park	1
Natural Heritage Areas (NHAs)	Carbury Bog NHA	2
	Hodgestown Bog NHA	
Proposed Natural Heritage Areas (pNHAs)	Shown in Figure 2.2	67

2.4.2 Habitats

Table 2.11 lists the percentage of the study area, and the number of hectares, covered by each habitat within SA9; as reported in the Corine land use dataset[1].

Table 2.11 Habitat Areas for SA9 (EPA, 2018)

Habitat	Ha	% of Study Area
Agricultural Land		
Pastures	142,734	43.09%
Non-irrigated arable land	59,556	17.98%

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

Habitat	Ha	% of Study Area
Land principally occupied by agriculture, with significant areas of natural vegetation	9,311	2.81%
Complex cultivation patterns	5,959	1.80%
Fruit trees and berry plantations	49	0.01%
Urban		
Green urban areas	2,757	0.83%
Natural Habitats		
Peat bogs	19,252	5.81%
Moors and heathland	10,242	3.09%
Water bodies	2,007	0.61%
Natural grasslands	1,892	0.57%
Inland marshes	1,034	0.31%
Salt marshes	413	0.12%
Beaches, dunes, sands	367	0.11%
Sea and ocean	117	0.04%
Intertidal flats	110	0.03%
Sparsely vegetated areas	28	0.01%
Estuaries	16	<0.01%
Coastal lagoons	10	<0.01%
Forest		
Coniferous forest	9,095	2.75%
Transitional woodland-shrub	6,846	2.07%
Mixed forest	4,710	1.42%
Broad-leaved forest	2,966	0.90%

Particularly relevant habitats that depend on the water quality and/or quantity in SA9 are:

- Oligotrophic and 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 SA9 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 and European eel);
- Waterbirds of 'qualifying interest' e.g. Brent goose and winter migratory waders;
- Other 'qualifying interest' bird species e.g. peregrine falcon and merlin;
- Protected whorl snails (*Vertigo geyeri* (particularly high sensitivity to changes), *Vertigo angustior* and *Vertigo moulinsiana*); and
- Freshwater white-clawed crayfish.

The key invasive species to consider (European Communities (Birds and Natural Habitats) Regulations, 2011) for developing options within SA9 include:

- Japanese knotweed;
- Himalayan balsam;
- Giant hogweed;
- Elodea spp.;
- Curly waterweed (*Lagarosiphon majo*r);
- Floating pennywort (*Hydrocotyle ranunculoide*s);
- Fringed water-lily (*Nymphoides peltata*);
- Himalayan knotweed (*Persicaria wallichii*);
- New Zealand pigmyweed (*Crassula helmsii*); and
- Parrot's feather (*Myriophyllum aquaticum*).

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 SA9 are listed in Table 2.12, such as agricultural land and bog areas.

Built assets include transport and communications infrastructure, and other developed areas, including existing water supply infrastructure (see 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 twelve WTPs in SA9, meeting the demand of 618.3 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. Key canals for SA9 are the Grand Canal and the Royal Canal.

There is a port of national significance in SA9, this being Dublin Port. There is also an airport of national significance, namely Dublin Airport.

Other significant transport infrastructure includes the main road (particularly the M1, M2, M3, M4, M7, M9, M11 and M50.) and rail network (DART, Dublin - Belfast, Dublin - Galway, Dublin - Cork, Dublin - Limerick and Ennis, Dublin - Sligo, Dublin - Waterford, Dublin - Drogheda and Dundalk, Dublin - Westport and Ballina, Dublin - Tralee, Dublin - Rosslare, Dublin - Tipperary and Dublin - Nennagh and Castleconnell.

Any new infrastructure considered for SA9 will need to take, existing as well as planned land zoning and local development into consideration.

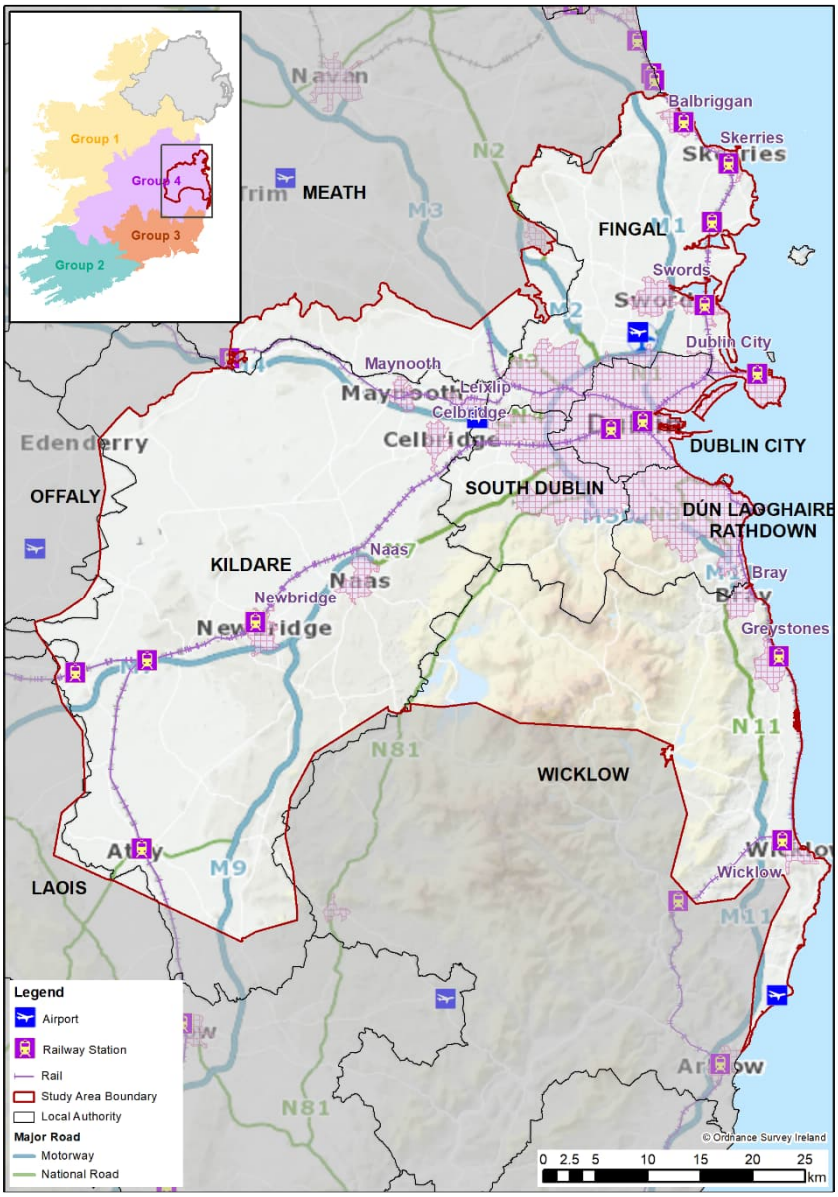

Figure 2.3 Transport Infrastructure in SA9

Table 2.12 Land Use within SA9 (EPA, 2018)[2]

Land use	Ha	% of Study Area	Comparison to Overall Eastern and Midlands Region %
Agriculture	217,608	65.69%	75.52%
Urban	46,483	14.03%	3.69%
Forest	35,489	10.71%	9.42%
Natural habitats	23,617	7.13%	10.61%
Industry	7,510	2.27%	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	566	0.17%	0.06%

Table 2.14 gives an overview of key nationally important projects highlighted by the NPF (Government of Ireland, 2018) for social and economic development that are located within SA9. Proposals for other strategic developments within SA9 are considered for the assessment. These are primarily identified from the National Planning Framework where any relevant project for the study area are included. Small scale housing and business development are not considered for this plan level assessment.

In addition, proposed developments identified from myProjectIreland (2021) have been considered[3]. Numerous developments are mapped within SA9, so these have been screened to identify potentially relevant developments for cumulative assessment and multiple developments within settlement areas are addressed as a group. For SA9, the individual projects are represented as and assessed as part of the NPF projects' settlements, such as Dublin, and major routes, such as the M50 and M11, in the table below due to the density of project clusters in those areas.

Table 2.13 Proposed New Developments

Development		
Ballycoolen Trunk Main (Ballycoolen/Kingstown)	M50 Enhancing Motorway Operation Services	O'Devaney Gardens Regeneration Programme
Beaumont Hospital Radiation Oncology Unit	MetroLink	Ringsend - Rathmines and Pembroke – Wastewater Network
Blanchardstown Sewerage Scheme	National Rehabilitation Hospital Redevelopment	Ringsend Wastewater Treatment Plant Upgrade Project
E3 Building Trinity College Dublin	National Train Control Centre	Saggart Reservoir
Greater Dublin Drainage	New Children's Hospital	Vartry Water Supply Scheme
Luas Green Line Capacity Enhancement	New Visual Control Centre at Dublin Airport	Water Supply Project – Eastern and Midlands Region
M11 Capacity Enhancement (Phase 1& Phase 2)	North Runway Project at Dublin Airport	

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.

[3] Note that the myProjectIreland dataset was taken at a fixed point in time to allow for assessment of cumulative effects. The date for SA9 being the 15//01/21.

The value of the landscape in SA9 is reflected in baseline data sections 2.1.3 (Tourism and Recreation), 2.4 (Biodiversity, Flora and Fauna) and 2.8 (Cultural Heritage) and designated sites including Wicklow Mountains National Park and the proposed National Heritage Areas listed in Table 2.10 and mapped in Figure 2.2. 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 LCA value or sensitivity information is available for the LCAs of the Dublin City, Dun Laoghaire-Rathdow and Laois counties. No LCA values are available from the counties of Kildare, Wicklow or Offaly[4].

Water supply infrastructure development 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 SA9 (Ordnance Survey Ireland. n.d.)

Landscape Character Area	Value	Sensitivity
County: Dublin City		
No LCA information available		
County: Dun Laoghaire-Rathdow (Dun Laoghaire-Rathdow County Council, 2004)		
No LCA values or sensitivities available		
County: Fingal (Fingal County Council, 2017)		
Rolling Hills Type	Modest	Medium
High Lying Type	High	High
Low Lying Type	Modest	Low
Estuary Type	Exceptional	High
Coastal Type	Exceptional	High
River Valley and Canal Type	High	High
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

[4] As with all the baseline information, the LCA information will be updated as part of regular reviews

Landscape Character Area	Value	Sensitivity
Chair of Kildare	-	Special
Northern Hills	-	Special
River Liffey	-	Special
River Barrow	-	Special
The Curragh	-	Unique
Pollardstown Fen	-	Unique
County: Meath (Meath County Council, 2016)		
Teervurcher Uplands	High	Medium
North Meath Lakelands	Moderate	Low
North Navan Lowlands	Moderate	Medium
Rathkenny Hills	Very High	High
Boyne Valley	Exceptional	High
Central Lowlands	High	Medium
Coastal Plain	Moderate	High
Nanny Valley	Very High	High
Bellewstown Hills	Very High	Medium
The Ward Lowlands	Low	High
South East Lowlands	Very High	Medium
Tara Skryne Hills	Exceptional	High
Rathmoylan Lowlands	High	High
Royal Canal	High	Medium
South West Lowlands	High	Medium
West Navan Lowlands	Moderate	Medium
South West Kells Lowlands	Moderate	Medium
Lough Sheelin Uplands	High	High
Loughcrew and Slieve na Calliagh Hills	Exceptional	High
Blackwater Valley	Very High	High
County: South Dublin (South Dublin County Council, 2015)		
Liffey Valley	High	High
Newcastle Lowlands	Medium to High	Medium
Athgoe and Saggart Hills	High	High
River Dodder and Glenasmole	High	Medium/hight to High

Landscape Character Area	Value	Sensitivity
Suburban South Dublin	Not available	Not 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
County: Laois (Laois County Council, 2017)		
No LCA values or sensitivities available		
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

Landscape Character Area	Value	Sensitivity
Archaeological and Historical Landscapes	-	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 SA9 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 M1, M2, M3, M4, M7, M9, M11 and M50.

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 SA9, 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 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.

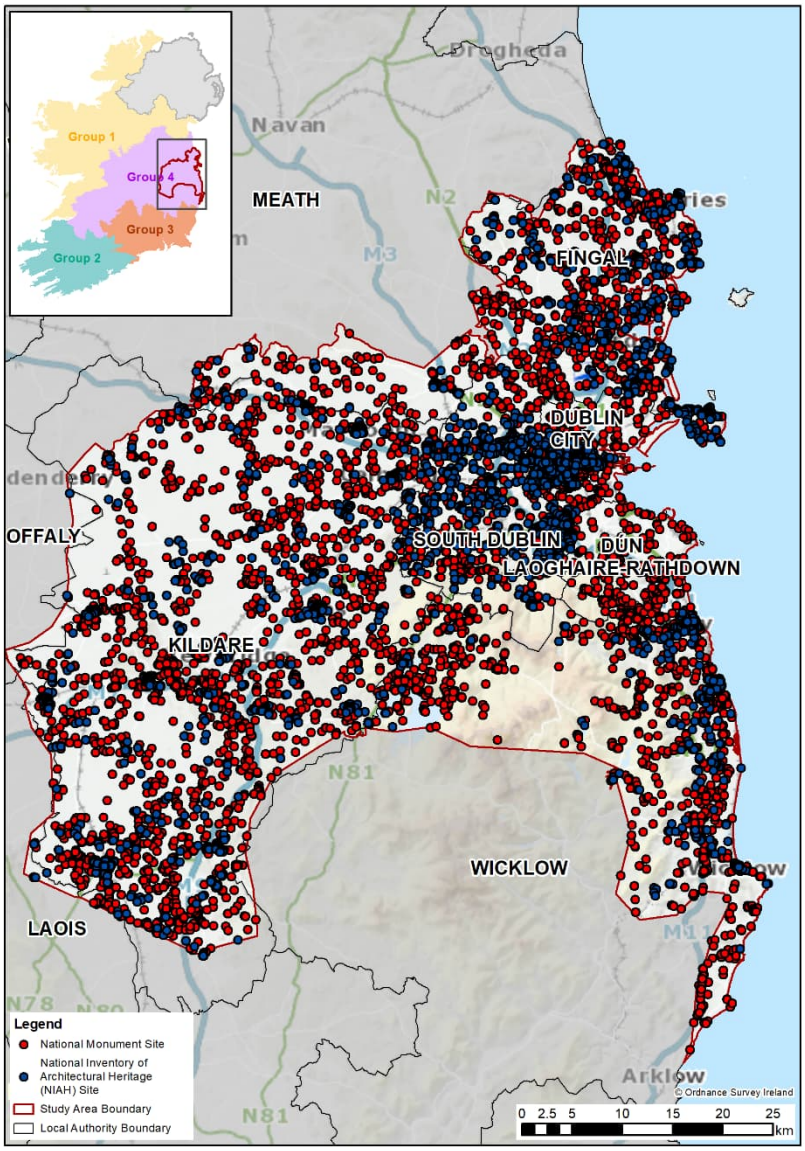

Figure 2.4 SA9 Cultural Heritage Assets

Table 2.15 Cultural Heritage Assets within SA9

Assets	Total Number
National Monuments Service sites	6,915
National Inventory of Architectural Heritage sites	7,680
Sites and Monuments Record Zones	1,921

2.9 Geology and Soils

Table 2.12 lists the land uses within SA9. SA9 has a wide variation of soil types, although there is a predominance of fine loamy soil type in the surrounds (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 SA9 are shown in Figure 2.5.

Dublin City and the area towards Wicklow have limited aquifer potential, underlain by the dark Calp limestones and granites which are moderately to poorly productive. Kildare has varied underlying geology and is prominent for its large gravel aquifer in the Curragh overlying the limestone bedrock. The eastern mountainous region is underlain by the Ordovician and Silurian aged shales and proximal to the Leinster Granite.

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, 102 of which have the potential to constrain water resource options in SA9.

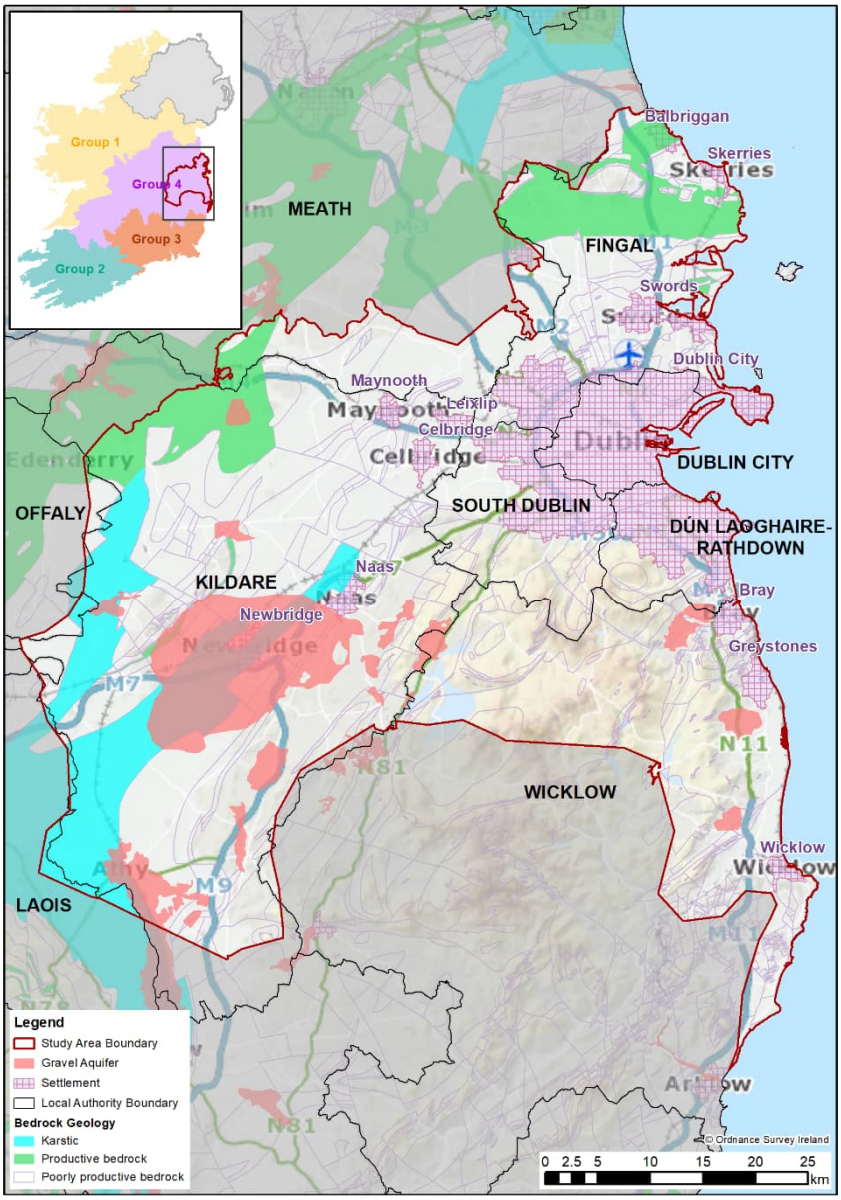

Figure 2.5 SA9 Hydrogeology

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 SA9 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, and Human Health	**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 and EM Regional plan. Irish Water has ongoing activities to improve the SDB in SA9, 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 the naturel environment, including water environment, for recreation is also important part of this.	Climate Change, Water environment, 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 SA9, 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 SA9 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 SA9.	Biodiversity and climate change
Biodiversity, Flora and Fauna	**Issues:** For SA9, over 85% of the treated water comes from a single source, the River Liffey. Approximately 10% comes from the River Vartry and the remainder comes from small surface water (River Dodder and River Barrow 4%) and additional groundwater sources (1%). It is considered especially important to avoid the loss of irreplaceable or rare habitats and avoid increasing pressure on vulnerable species; potentially through direct	Water resources, water quality and climate change

SEA Topic	Issues and Opportunities	Interrelated Topics
	or indirect land take, such as through increased abstraction pressure. **Opportunities:** to include biodiversity enhancement as part of infrastructure development and to seek opportunities for wider biodiversity improvements as part of catchment management and raw water quality improvement initiatives.	
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 SA9.	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. **Opportunities:** Additional management to minimise impact on supply and the environment, vulnerability to climate change, and drought is required. Opportunities for carbon sequestration through biodiversity enhancement and catchment management.	Biodiversity and water environment
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, soil quality and carbon sequestration, have the potential to provide wider benefits for environmental resilience and water supply; although not specifically studied in this study area it is identified as an area for future action.	

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 SA9 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 input to the needs and baseline assessments addressed in chapter 2 of this review. The key stages considered in this chapter for SA9 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 a 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 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 below for existing and new groundwater abstractions.

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 be 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 do 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.

3.2.4 Supply Options for SA9

The supply options to provide a long term sustainable treated drinking water supply for the GDA considered as part of the options development are unconstrained by distance from the GDA and include:

- Groundwater options, across the region, extending as far as supplies in Tullamore and Carlow;
- Upgrades to Irish Water's existing treatment plants;
- Surface water options extending as far as Limerick;
- Impoundment options in the Dublin and Wicklow Mountains;
- Treated effluent recycling options;
- Industrial water reuse options;
- Other smaller supplies;
- Desalination options in in North County Dublin and South County Dublin; and
- Network connectivity and transfers from other WRZs.

3.3 Stage 4: Coarse Screening

A total of 106 unconstrained options were identified for SA9 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 106 unconstrained options, 46 were rejected after being analysed against the coarse screening criteria of resilience, deliverability and environment.

Sustainability reasons for rejecting options were identified for 11 options. Table 3.2 provides the options that were rejected on a sustainability basis and not considered suitable to address the deficit for SA9.

Table 3.2 Coarse Screening Rejection Register

Option Reference	Option Description	Rejection Reasoning
SA9-001	Water transfer from the River Shannon. Water to be abstracted and treated on the eastern shore of Lough Ree before it is transferred to the GDA. Option proposed to provide full need of 330 Ml/d	Option A from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. On the review of the water available for abstraction it was noted that the ESB minimum normal operation levels for the Shannon at Lough Ree were not maintained during the 1995 drought without an abstraction, therefore any abstraction at this location would not be resilient as the yield is not available and would likely have a negative environmental impact. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was not progressed to the fine screening stage.
SA9-004	Water transfer from the River Shannon. Water to be abstracted and treated on the eastern shore of both Lough Derg and Lough Ree before it is transferred to the GDA. Option proposed to provide full need of 330 Ml/d	Option D from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. On the review of the water available for abstraction it was noted that the ESB minimum normal operation levels for the Shannon at Lough Ree were not maintained during the 1995 drought without an abstraction, therefore any abstraction at this location would not be resilient as the yield is not available and would likely have a negative environmental impact. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was not progressed to the fine screening stage.
SA9-007	Water transfer from the River Shannon. Raw water to be transferred and stored in an impoundment in the Wicklow Mountains where it will be treated before it is transferred to the GDA. Option proposed to provide full need of 330 Ml/d	Option G from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. On the review of the water available for abstraction it was noted that the ESB minimum normal operation levels for the Shannon at Lough Ree were not maintained during the 1995 drought without an abstraction, therefore, any abstraction at this location would not be resilient as the yield is not available and would likely have a negative environmental impact. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was rejected at coarse screening stage.

Option Reference	Option Description	Rejection Reasoning
SA9-005	Water transfer from the River Shannon. Water to be abstracted and treated on the eastern shore of Lough Ree before it is transferred to the GDA. Option proposed to provide full need of 330 Ml/d	Option E from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. On the review of the water available for abstraction it was noted that the ESB minimum normal operation levels for the Shannon at Lough Ree were not maintained during the 1995 drought without an abstraction, therefore, any abstraction at this location would not be resilient as the yield is not available and would likely have a negative environmental impact. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was not progressed to the fine screening stage.
SA0-06a	Water transfer from the River Shannon. Water to be abstracted from Lough Derg with raw water storage provided in a bog at Rochfortbridge. Option proposed to provide full need of 330 Ml/d	Option F1 from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. Raw water transfer across catchments is not feasible due to the risk of transfer of invasive species. Therefore, this option was not considered environmental viable and was rejected at coarse screening stage
SA0-06b	Water transfer from the River Shannon. Water to be abstracted from Lough Derg with raw water storage provided in a bog at Garryhinch. Option proposed to provide full need of 330 Ml/d	Option F2 from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. Raw water transfer across catchments is not feasible due to the risk of transfer of invasive species. Therefore, this option was not considered environmental viable and was rejected at coarse screening stage.
SA9-009	Groundwater abstraction. Various groundwater abstractions within 80km radius of Dublin. Option proposed to provide full need of 330 Ml/d	Option I from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered. Groundwater supply for the full 330 Ml/d is not achievable as the full yield is not available. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was rejected at coarse screening stage. Options considering smaller groundwater sources, to meet NWRP required demand, are considered.
SA9-010	Increased abstraction at the River Barrow.	Option J from the Water Supply Options Working Paper which was required to meet full need of 330Ml/d considered.

Option Reference	Option Description	Rejection Reasoning
	Increase of existing abstraction when more water is available in the winter/spring and combine and transfer for treatment at Ballymore Eustace to increase output. Option proposed to provide full need of 330 Ml/d.	Option does not provide full 330 Ml/d as the full additional yield is not available. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was rejected at coarse screening stage. Other version of the option, to meet NWRP required demand, providing some supply are considered.
SA9-016	New Surface Water abstraction from the River Dan. Abstract and treat water from the River Dan in Wicklow before transferring to the GDA. Option proposed to provide 5 Ml/d in Winter Critical Period	Option required the construction of a dam at Lough Dan for the provision on an additional supply of 5Ml/d. The proposed operational regime required the pumping of flow from the lake to maintain Q95 flow in the channel downstream. The option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA9-075	Increase surface water abstraction from the River Boyne and increase treatment at Staleen WTP. Option proposed to provide 10 Ml/d.	Option considered not feasible as full abstraction required for south Louth east Meath supply. Increase a further 10Ml/d is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA9-079	New Ground Water abstraction at Roberstown, Kildare. Option includes abstraction and associated WTP and connection to the GDA network. Option proposed to provide additional 4 Ml/d	Option considered not feasible as the abstraction was likely to have an impact on the SAC and the option is considered likely to result in the ground waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

3.4 Stage 5: Fine Screening

A total of 60 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.

At fine screening a further 9 options were rejected. Table 3.3 provides the options that were rejected from the fine screening and not considered suitable to meet the needs identified for the WRZ located in SA9.

Table 3.3 Fine Screening Rejection Register

Option Reference	Option Description	Rejection Reasoning
SA9-15a	New surface water abstraction from the River Ow. Abstract and treat water from the River Ow before transferring to the GDA. Dam is required at the River Ow to facilitate abstraction. Option proposed to provide 7 Ml/d	Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving WFD objectives. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA9-15b	New surface water abstraction from the River Ow and the River Aughrim. Abstract and treat water from the River Ow before transferring to the GDA. Dam is required at the River Ow to facilitate abstraction. Raw water transfer from the River Aughrim to the dam to increase volume of water available. Option proposed to provide 11 Ml/d	
SA9-053	New surface water abstraction from the River Slaney. Abstract and treat water at the River Slaney at Glen of Imaal. To obtain abstraction of 12 Ml/d an impoundment is also required.	

Option Reference	Option Description	Rejection Reasoning
	Option proposed to provide 12 Ml/d.	
SA9-18b	New abstraction from Lower Bohernabreena Reservoir. De-silting & Ballyboden WTP upgrade Option proposed to provide 25 Ml/d	On further review of this option at fine screening stage it was noted that the proposal would require raising the lower reservoir dam height by 25m and the purchase and demolition of houses, land purchase, including area of forestry and site prep to allow for flooding of valley. Therefore, this option did not meet the requirements of the deliverability environmental criteria and was rejected at fine screening stage.
SA9-031	New groundwater abstraction at Allenwood. Option includes abstraction and associated WTP and connection to the GDA network. Option proposed to provide additional 5 Ml/d	Option considered not feasible as uncertainty associated with the actual yield available. Given the status of the aquifer a significant number of boreholes would be required to achieve a limited supply if available. Therefore, this option did not meet the requirements of the Resilience or Deliverability criteria and was rejected at fine screening stage.
SA9-035	New groundwater abstraction at Lucan. Option includes abstraction and associated WTP and connection to the GDA network. Option proposed to provide additional 4 Ml/d	
SA9-068	Dublin City appraisal of industrial abstractions at TCD and Guinness (assess in a further step Bankside Filtration in Dublin, like at Budapest)	
SA9-56b	Reuse of treated effluent from Shanganagh WwTP. Treat effluent from Swords to a required standard for Nondomestic Customers. Options proposed to provide 30 Ml/d	This option would require significant network infrastructure to transfer water the treated effluent directly to non-domestic customers and keep the supply separate from domestic supply. Therefore, this option did not meet the requirements of the Resilience or Deliverability criteria.
SA9-081	Groundwater in North Meath - Combined volume of 20 Ml/d required between Platin and Kiltrough. Existing abstraction 2.7 Ml/d. Option proposed to provide 17.5 Ml/d to the GDA	The overall WFD status of the groundwater body at Kiltrough is considered poor therefore it was not considered viable to increase an abstraction from this source. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

3.5 Stage 6: Feasible Options List

Unlike in other study areas, no options have been rejected on the basis of failure to meet the SDB deficit in the SA9 area as a whole, therefore, all the options for SA9 are considered as possible options to be selected as part of an SA combination to meet the study area deficit. This is because the deficit in SA9 is such that there are few options that can meet the deficit in its entirety, and a combination of options is likely to be required. However, a combination which contains a large number of small options is unlikely to be optimal in terms of resilience provided, see section 3.4 of the SA9 Technical Report for further details.

A total of 51 options were included as feasible options, however, only three are capable of meeting the deficit in its entirety, and twenty-three can contribute in excess of 25 Ml/d of additional capacity but not meet the full deficit. These include many options similar in location and concept but varying in size. Thirteen of the feasible options are only capable of contributing less than 10 Ml/d (<1% of the deficit requirement). This reflects the lack of large feasible and sustainable water resources in the east of the country. These options have been retained as feasible in case they are of benefit in combination with a larger option.

Details of the feasible options identified for this study area, and the Preferred Approach identified, are provided in the SA9 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 the WRZ and across the study area as a whole. This chapter addresses Stage 7 in the assessment methodology.

A 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 identified as the best within each of 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
Most Resilient (MR)	This is the option or combination of options with the highest total score against the resilience criteria. (Link	National Adaptation Plan

SA Approaches Tested	Description	Policy Driver
	to SEA Objective for climate change adaptation for environment)	
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 for SA9

There are three stages in the Approach Development Process, for SA9 these stages are slightly different to the other study areas as it comprises of a single, large WRZ.

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 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 Adverse Effects on Site Integrity AESI with standard best practice project specific mitigation applied as these can be addressed with

[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).

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, also referred to as 'group options') that might resolve deficits across multiple WRZs within a study area. However, SA9 is treated as one large WRZ; hence, there are no SA options that cross multiple WRZs within the study area. No options have been rejected on the basis of failure to meet the SDB deficit in SA9 for the study area as a whole, therefore, all the options for SA9 are considered as possible options to be selected as part of an SA combination to meet the study area deficit. Section 4.3.1 summarises the combinations considered for SA9. Further details of the SA combinations considered are provided in the SA9 Technical Report.

The **Third Stage** compares the SA combinations using the Economic Balance of Supply and Demand (EBSD) tool to rank the SA combinations, meeting the SDB deficit, against the assessment criteria. The SA combinations are then compared to find the best performing approach overall using the 7-Step process in Figure 4.1 to generate the SA Preferred Approach.

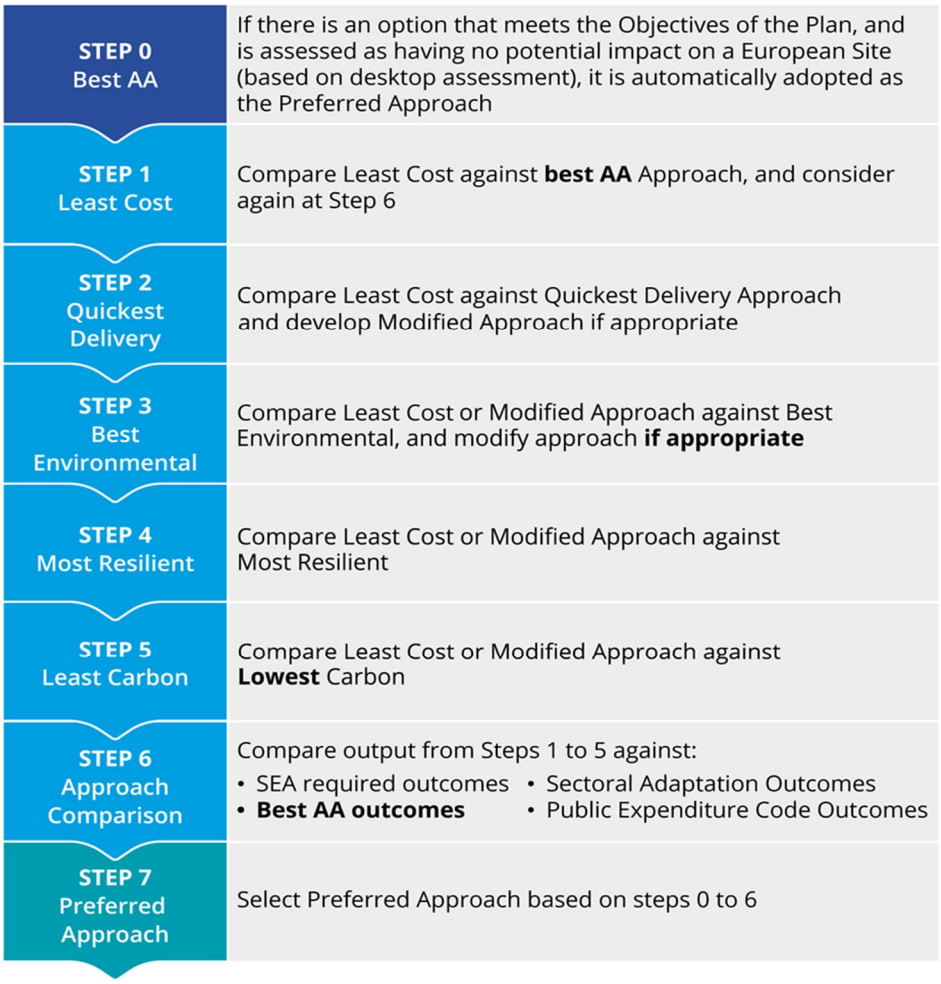

Figure 4.1 The 7 Step Process

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:

- Climate regulation – woodland;
- Traffic impacts – opportunity cost of time due to road congestion from roadworks;
- Food – crops and livestock; and
- 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) were initially 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.

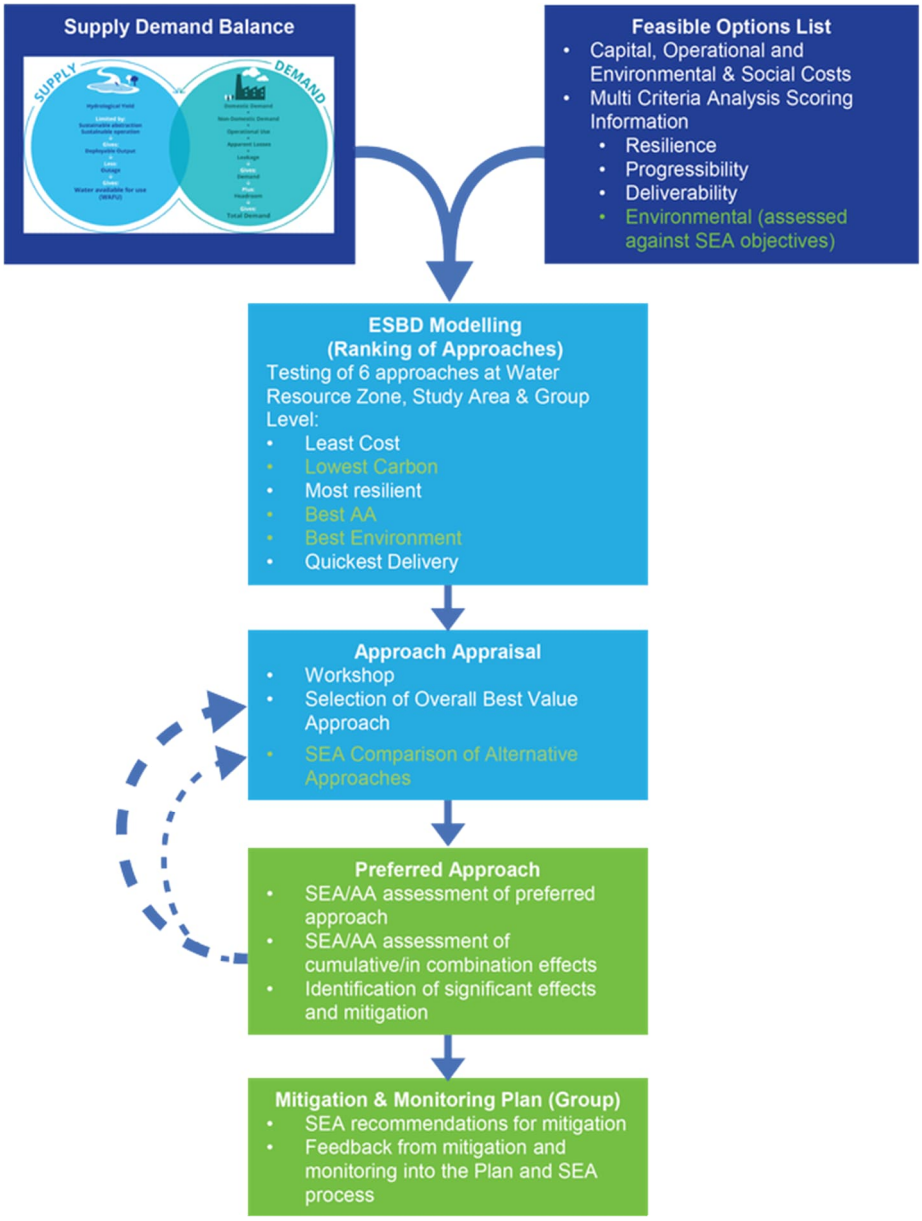

Figure 4.2 Approach Development Process

4.3 SA9 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 scale and complexity of the GDA WRZ means that there are a large number of options combinations to be considered. Due to the scale of the deficit that must be resolved (182 Ml/d by 2044) the only feasible options that could resolve the SDB deficit as a single project would be a transfer of treated water from the River Shannon at Parteen Basin. An option to provide desalinated water abstracted from the Irish Sea can make a substantial contribution to resolving the deficit but is limited by the requirement to blend this water with local sources. This is because desalinated water is low in minerals and can be aggressive to cementitious and metallic materials used in storage, distribution and plumbing; there are also taste issues associated with desalinated water. Therefore, desalinated water is required to be blended with water from local sources prior to entering the distribution network. Irish Water have adopted

a 2:1 (treated water:desalinated water) blending ratio to ensure protection of their existing network. Given the requirement to blend desalinated water with treated water, the maximum achievable output from a desalination plant for the GDA is 150Ml/d. Therefore, the option of desalination must be considered in combination with other options, as it cannot meet the deficit alone.

Once the SA combinations to meet the deficit were provided, a review of the options was carried out to determine if any additional works were required to ensure the combinations as a whole were comparable to each other and were fully functionable. This highlighted the need for additional trunk mains for six SA combinations. The cost of these additional trunk mains was added to the SA combinations before the comparison of the SA approaches was carried out.

4.3.1 SA9 Combinations

The possible SA combinations for SA9 are described in Table 4.2 identifying the options included and giving a brief description of the types of options and how they meet the deficit. Details on individual options can be found in Appendix A and further information regarding the SA combinations is also provided in the SA9 Technical Report.

Table 4.2 SA Combination Summary for SA9

SA Combination Number	Options Included	Combination Overview
1	-	Deficit not met
2	SA9-011 SA9-012 SA9-013 SA9-014 SA9-20e SA9-048 SA9-051 SA9-052 SA9-43a	This combination comprises an option to abstract 50 Ml/d from the River Liffey at Islandbridge and a desalination option to obtain and treat 100Ml/d from an abstraction from the Irish Sea at a location north of the city. These two options provide an additional 150 Ml/d supply. The remaining 33 Ml/d is provided by smaller options. These smaller options were chosen based on cost i.e. options which provide the lowest NPV per ML required were selected first. The combination involves the development of nine separate projects and requires three new groundwater abstractions, six new surface water abstractions and a desalination scheme with intake from and brine discharge to the Irish Sea.
3	SA9-013 SA9-022 SA9-23f SA9-43a SA9-048 SA9-052	This combination comprises an option which increases the deployable output during DYCP by 62 Ml/d through conjunctive use between Srowland and the Ballymore Eustace WTP, with additional storage at Srowland and a desalination option to obtain and treat 100 Ml/d from an abstraction from the Irish Sea at a location north of the City. These two options provide an additional 162 Ml/d supply. The remaining 21 Ml/d is provided by smaller options. These smaller options were chosen based on cost i.e. options which provide the lowest NPV per ML required were selected first. The combination involves the development of four separate options and requires one new groundwater abstraction, and one desalination scheme with intake from and brine discharge to the Irish Sea.
4	SA9-011	This combination is similar to SA combination 2. It comprises an option to abstract 50 Ml/d from the River Liffey at Islandbridge and a desalination option to obtain and

SA Combination Number	Options Included	Combination Overview
	SA9-012 SA9-013 SA9-014 SA9-20e SA9-048 SA9-051 SA9-052 SA9-74b	treat 100 Ml/d from an abstraction from the Irish Sea. However, in this combination the desalination intake from the Irish Sea is at a location south of the city. These two options provide an additional 150 Ml/d supply. The remaining 33 Ml/d is provided by smaller options. These smaller options were chosen based on cost i.e. options which provide the lowest NPV per ML required were selected first. The combination involves the development of nine separate options and requires three new groundwater abstractions, six new surface water abstractions and a desalination scheme with intake from and brine discharge to the Irish Sea.
5	SA9-022 SA9-23f SA9-052 SA9-74b	This combination is similar to SA combination 3. It comprises an option which increases the deployable output during DYCP by 62 Ml/d through conjunctive use between Srowland and the Ballymore Eustace WTP, with additional storage at Srowland and a desalination option to obtain and treat 100 Ml/d from an abstraction from the Irish Sea with the intake at a location south of the City. These two options provide an additional 162 Ml/d supply. The remaining 21 Ml/d is provided by smaller options. These smaller options were chosen based on cost i.e. options which provide the lowest NPV per ML required were selected first. The combination involves the development of four separate projects and requires one new groundwater abstraction, and a desalination scheme with intake from and brine discharge to the Irish Sea.
6	SA9-012 SA9-013 SA9-22a SA9-44a SA9-048 SA9-052	This combination looks at a larger desalination scheme abstraction from the Irish Sea with the intake at a location north of the city to provide an additional 150 Ml/d supply. The remaining 33 Ml/d is provided by smaller options. These smaller options were chosen based on cost i.e. options which provide the lowest NPV per ML required were selected first. The combination involves the development of six separate projects and requires two new groundwater abstractions, three new surface water abstractions and a desalination scheme with intake from and brine discharge to the Irish Sea.
7	SA9-012 SA9-013 SA9-22a SA9-048 SA9-052 SA9-74c	This combination looks at a larger desalination scheme abstraction from the Irish Sea with the intake at a location south of the city to provide an additional 150 Ml/d supply. The remaining 33 Ml/d is provided by smaller options. These smaller options were chosen based on cost i.e. options which provide the lowest NPV per ML required were selected first. The combination involves the development of six separate projects and requires two new groundwater abstractions, two new surface water abstractions and a desalination scheme with intake from and brine discharge to the Irish Sea.

SA Combination Number	Options Included	Combination Overview
8	SA9-20e SA9-44a	This combination comprises a desalination scheme abstraction from the Irish Sea (100 Ml/d) with the intake north of the city and a new abstraction from the River Liffey at Islandbridge (50 Ml/d). The combination involves the development of two separate projects and requires one new surface water abstraction and a desalination scheme with intake from and brine discharge to the Irish Sea.
9	SA9-20e SA9-74c	This combination is similar to SA combination 8. This combination comprises a desalination scheme abstraction from the Irish Sea south of the city (150 Ml/d) and a new abstraction from the River Liffey at Islandbridge (50 Ml/d). The combination involves the development of two separate projects and requires one new surface water abstraction and a desalination scheme with intake from and brine discharge to the Irish Sea.
10	SA9-082 SA9-085	This combination requires a new surface water source from the Parteen basin and looks to phase the project over a number of years. The first section of the project is to develop the mains and WTP with a 150 Ml/d capacity. The second phase is to upgrade this with an increase in treatment capacity at the source and the provision of a pump on the main to increase the capacity to the full 194 Ml/d. The combination involves the development of two projects and requires one new surface water abstraction.
11	SA9-083 SA9-086	This combination is similar to SA combination 10. This combination requires a new surface water source from the Parteen basin and looks to phase the project over a number of years. The first section of the project is to develop the mains and WTP with a 170 Ml/d capacity. The second phase is to upgrade this with an increase in treatment capacity at the source and the provision of a pump on the main to increase the capacity to the full 194 Ml/d. The combination involves the development of two projects and requires one new surface water abstraction.
12	SA9-084	This combination requires a new surface water source from the Parteen basin; however, this differs from SA combination 10 and SA combination 11 as the entire treatment plant and infrastructure is included in one project. The combination involves the development of one project and one new surface water abstraction.

The SA combinations were then ranked against the six approach categories (please see Table 4.3). Descriptions of the options are provided in Appendix A. For SA9, a total of 12 combinations were compared and this is summarised in Table 4.3 below. Note that combination 1 does not meet the full demand, therefore, it is not considered further as an approach. The Preferred Approach selected at the end of the process has been outlined in red throughout this section.

For SA9, combinations 4, 5, 10, 11 and 12 had a very similar ranking under the least cost category and are within a 5% NPV cost margin of one another. Combination 12 scored significantly better against the

Quickest Delivery, Best AA, Most Resilient and Environmental criteria than combinations 4 and 5 and was taken forward as the least cost approach.

Table 4.3 SA9 Summary of SA Combination of Performance against Approach Category

Category	Combination 1*	Combination 2	Combination 3	Combination 4	Combination 5	Combination 6	Combination 7	Combination 8	Combination 9	Combination 10	Combination 11	Combination 12
Least Cost								Worst				Best*
Quickest Delivery				Worst			Best*					
Number of -3 Biodiversity Scores	Five -3 scores	Four -3 scores	Two -3 scores	Four -3 scores	Two -3 scores	Two -3 scores	Two -3 scores	Two -3 scores	Two -3 scores	One -3 score	One -3 score	One -3 score
Lowest Carbon			Worst *							Best		
Most Resilient										Best	Best	Best
Best Environmental										Best	Best	Best

*Combination 1 was developed by selecting the options with the lowest NPV per Ml/d of additional supply, excluding any options that were mutually exclusive of the options already considered. Although, this combination provides an additional 149 Ml/d, it cannot provide the full deficit of 182 Ml/d. Therefore, SA combination 1 has not been considered for any of the approach categories in stage 3 of the approach development process.

Key															
Ranked order (best to worst)	Best														Worst

4.3.2 SA9 Approaches

The approach appraisal process was undertaken through structured workshops 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 resulting options were then taken through a sequential testing against the six SA categories (lowest carbon, best environmental, best AA, least cost, quickest delivery and most resilient) these were then used to identify the best overall options at each of the three spatial levels, the WRZ/study area and regional levels using the 7 step process detailed in section 4.2 above. The application of this 7 step process is included in section 5.2.3 of the SA9 Technical Report.

Through comparing all the potential SA combinations, the best SA approach for each of the six categories was identified (also see section 5 of the Study Area Technical Report) and for SA9; these aligned as three SA approaches (see Table 4.4) The options within each of the six SA approaches are set out in Appendix B. The two combinations that ranked the highest for each of the six SA approach categories are listed in Table 4.3.

Table 4.4 Study Area Approach Categories

Category	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 7) (QD)	SA Approach 3 (SA Combination 10) (LC)
Least cost (LCo)	✓	-	-
Quickest Delivery (QD)	-	✓	-
Best Environmental (BE)	✓	-	-
Most Resilient (MR)	✓	-	-
Lowest Carbon (LC)	-	-	✓
Best AA (BA)	✓	-	-

The options comprising the three approaches are listed in Table 4.5.

Table 4.5 Study Area Approach Options

Options Included	Least Cost, Best Environmental, Most Resilient, and Best AA (SA Combination 12) SA Approach 1	Quickest Delivery (SA Combination 7) SA Approach 2	Lowest Carbon (SA Combination 10) SA Approach 3
Options	084 Network Upgrade 1	012 013 22a 048 052 74c	082 085 Network Upgrade 1

* Note on option references - all options are part of SA9 e.g. SA9-084 is shown as 084 above

When reviewing the options in the SA combinations for SA9, it was determined that some additional network was required to ensure the combinations worked and were comparable to each other (see SA9 Technical Report for additional details). The cost of these additional trunk mains was added to the SA combinations before the comparison of the SA approaches was carried out.

Table 4.5 shows the three approaches selected in SA9 and the associated network requirements. SA approach 1 and 3 require the addition of a main from Peamount reservoir to the city centre (Network Upgrade 1).

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 SA9 Technical Report.

Within SA9, this resulted in three approaches being selected from the 12 SA combinations identified in Table 4.3, 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 two identified approaches against each other (representing the Stage 3 analysis for the selection of the Preferred Approach used in the workshop - see Table 4.6), their relative performance against categories they were not identified as “best” against in Table 4.3 may be different. This is because Table 4.3 compares all of the combinations to give a wider ranking, whereas Table 4.6 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 4.6 may not be the overall worst performing option when considered alongside all of the combinations in Table 4.3.

Table 4.6 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.

Table 4.6 Summary of the MCA Scoring for the SA Approaches

Category Criteria	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 7) (QD)	SA Approach 3 (SA Combination 10) (LC)
Least Cost	Best	Worst	
Quickest Delivery	Worst	Best	Worst
Number of -3 Biodiversity Scores	One -3 Biodiversity Score	Four -3 Biodiversity Scores	One -3 Biodiversity Score
Lowest Carbon		Worst	Best
Resilience Score	Best	Worst	Best
Best Environmental	Best	Worst	

Key		
Ranked order (best to worst) within the three approaches compared here		
Worst		Best

4.4 Comparison of SA9 Approaches

An overall summary of the SA approaches identified for SA9 is provided below in Table 4.7, covering the main components of each SA approach. Table 4.6 provides an overview of the environmental scores and comparison of approaches based on the MCA.

Table 4.7 Study Area Approach Components Summary

Infrastructure Summary	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 7) (QD)	SA Approach 3 (SA Combination 10) (LC)
New pipeline network (km)	194	54	194

Infrastructure Summary	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 7) (QD)	SA Approach 3 (SA Combination 10) (LC)
New WTPs	1	4	1
Desalination Plant	0	1	0
Marine intake	0	1	0
Marine outfall	0	1	0
Upgrade WTPs	0	3	1
New/upgraded abstractions	1	7	2
WTPs decommissioned	0	0	0
Abstractions abandoned	0	2	0
Raw Water Storage	0	0	0
Treated Water Storage	3	6	3

A comparative assessment of the three SA approaches based on the environmental option MCA scores is summarised in Table 4.8 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 4.8 Study Area Approach Comparison Summary

Topic	Total No. of	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 7) (QD)	SA Approach 3 (SA Combination 10) (LC)	Range (Difference between Lowest and Highest Score)
Population, health, economy and recreation	-3 scores	No Difference			0
	MCA score	Best	Worst		11
Water Environment: quality and resources	-3 scores	Best	Worst	Best	3
	MCA score	Best	Worst		14
	-3 scores	Best	Worst	Best	1

Topic	Total No. of	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 7) (QD)	SA Approach 3 (SA Combination 10) (LC)	Range (Difference between Lowest and Highest Score)
Biodiversity, Flora and Fauna	MCA score	Best	Worst		31
Material Assets	-3 scores	No Difference			0
	MCA score	Best	Worst	Best	6
Landscape and Visual	-3 scores	No Difference			0
	MCA score	Best	Worst	Best	5
Climate Change	-3 scores	No Difference			0
	MCA Score	Best	Worst		5
Culture, Heritage and Archaeology	-3 scores	No Difference			0
	MCA Score	Worst	Best	Worst	1
Geology and Soils	-3 scores	No Difference			0
	MCA Score	Worst	Best	Worst	1

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 12) (LCo, BE, MR, BA)

SA approach 1 (SA combination 12 - see Figure 4.3), key comparison points:

- Identified as the best in the Least Cost, Best Environmental, Most Resilient, and Best AA categories;
- Option types included: One New Shannon Source option and one network upgrade option;
- One -3 biodiversity score (higher risk options that could impact on European sites). This is associated with the following option:
    - SA9-084: This option abstracts directly from the Lower River Shannon SAC (Parteen Basin). This could result in direct and indirect impacts to habitat within the SAC. The pipeline route also crosses multiple river channels providing hydrological links to other European sites. However, the proposed abstraction is within sustainable limits and mitigation identified in the NIS would avoid significant effects on the Lower Shannon SAC and other European sites.
- SA approach 1 and SA approach 3 are very similar in terms of infrastructure. SA approach 1 requires nearly four times the length of pipeline compared with SA approach 2 due to the new pipeline needed to transfer water from the New Shannon Source to the GDA with the extensive construction associated with pipeline infrastructure. This will be buried pipeline with land use reinstatement. However, SA approach 1 has less above ground infrastructure requirements compared with the SA approach 2 which includes a desalination plant, 9 new WTPs and 12 increased or new surface water and groundwater abstractions.

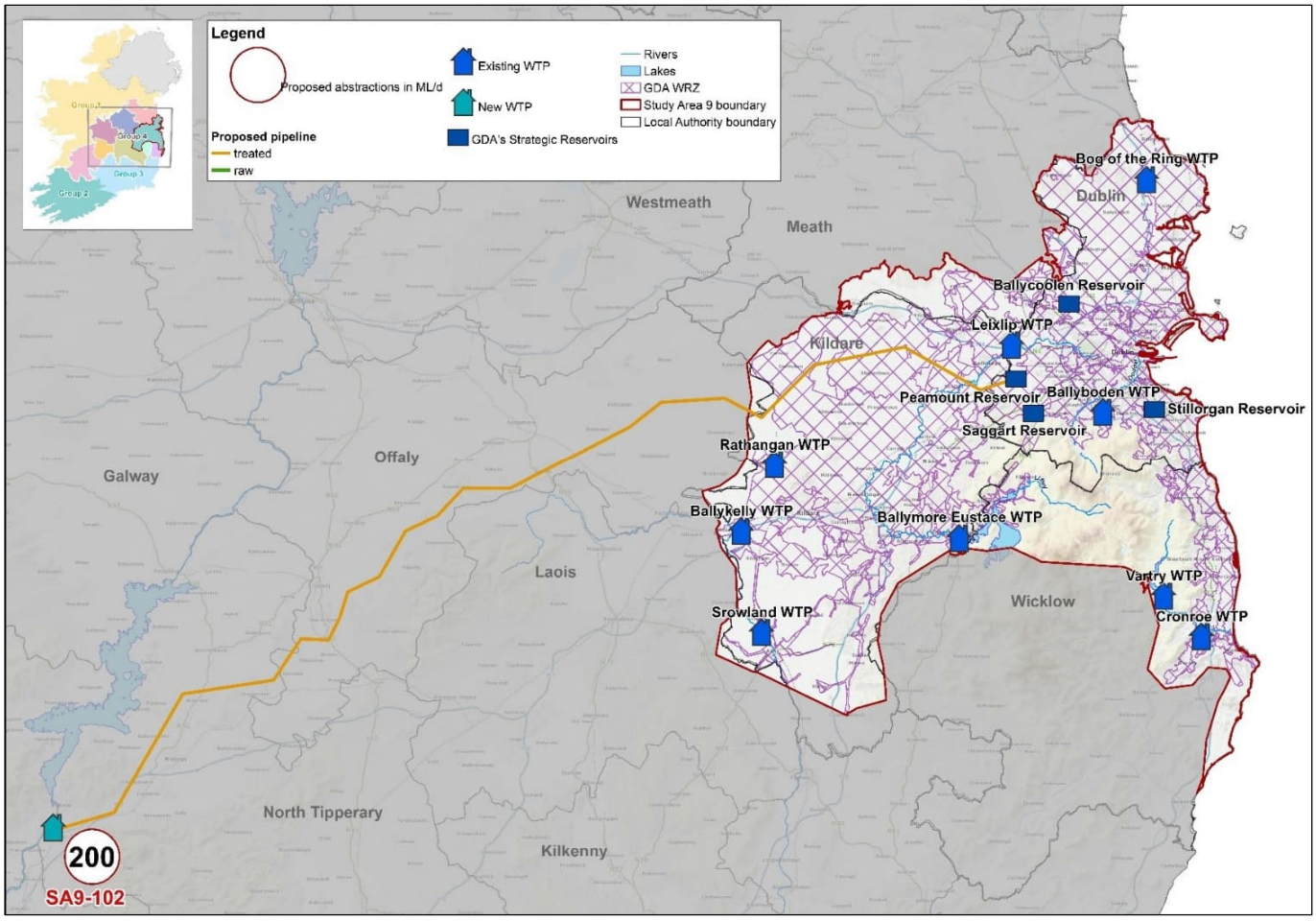

Figure 4.3 Combination 12

4.4.2 SA Approach 2 (SA Combination 7) (QD)

SA approach 2 (SA combination 2 - see Figure 4.4), key comparison points:

- Identified as the best approach in the Quickest Delivery category;
- Options include: Two groundwater abstraction options, three surface water abstraction options, one desalination option and one network upgrade option;
- Two -3 biodiversity scores (higher risk options that could impact on European sites). These are associated with the following options:
    - SA9-048: GW abstraction located within Curragh aquifer which directly contributes to Pollardstown fen SAC. GWDTE at Pollardstown fen are already at risk due to existing pressures and are highly sensitive to further reductions in GW availability;
    - SA9-74c: Several SACs/SPAs, including Dalkey islands SPA, South & North Dublin Bay, River Tolka Estuary, and North Bull Island SPA, will be within the zone of influence for the brine discharge. This may adversely affect qualifying habitats/species within the European sites and there will be ongoing operational discharges of brine and chemicals to marine biodiversity receptors as a result of the treatment of salt water. The full impact of brine release back into the sea is unknown but it is linked with potential adverse effects on biodiversity e.g. brine toxicity to some species. The long term effects of the brine discharge will require further survey assessment, particularly in relation to Harbour porpoise and marine birds.
- Three options were identified as high risk (-3) for potential impacts on water resources and WFD status. These are:
    - SA9-011 and SA9-013 which would both exceed 10% of Q95 for their associated abstraction;
    - SA9-22a which requires an abstraction from the River Liffey which, based on Irish Water's desktop assessment, is already over abstracted; and
    - SA9-048 which could risk unsustainable abstraction levels from the Curragh aquifer (further investigation would be required).
- One option was identified as high risk (-3) for impacts on landscape and visual amenity related to large scale above ground infrastructure. Namely, option SA9-74c which would require a new desalination plant in an area zoned as a green belt;
- SA approach 2 requires new infrastructure for the associated desalination plant, including the marine intake and outfall and also requires three more new WTPs, six more new/upgraded abstractions than SA approach 1 (seven more than SA approach 3), and three more treated water storage facilities than SA approach 1 and 3.

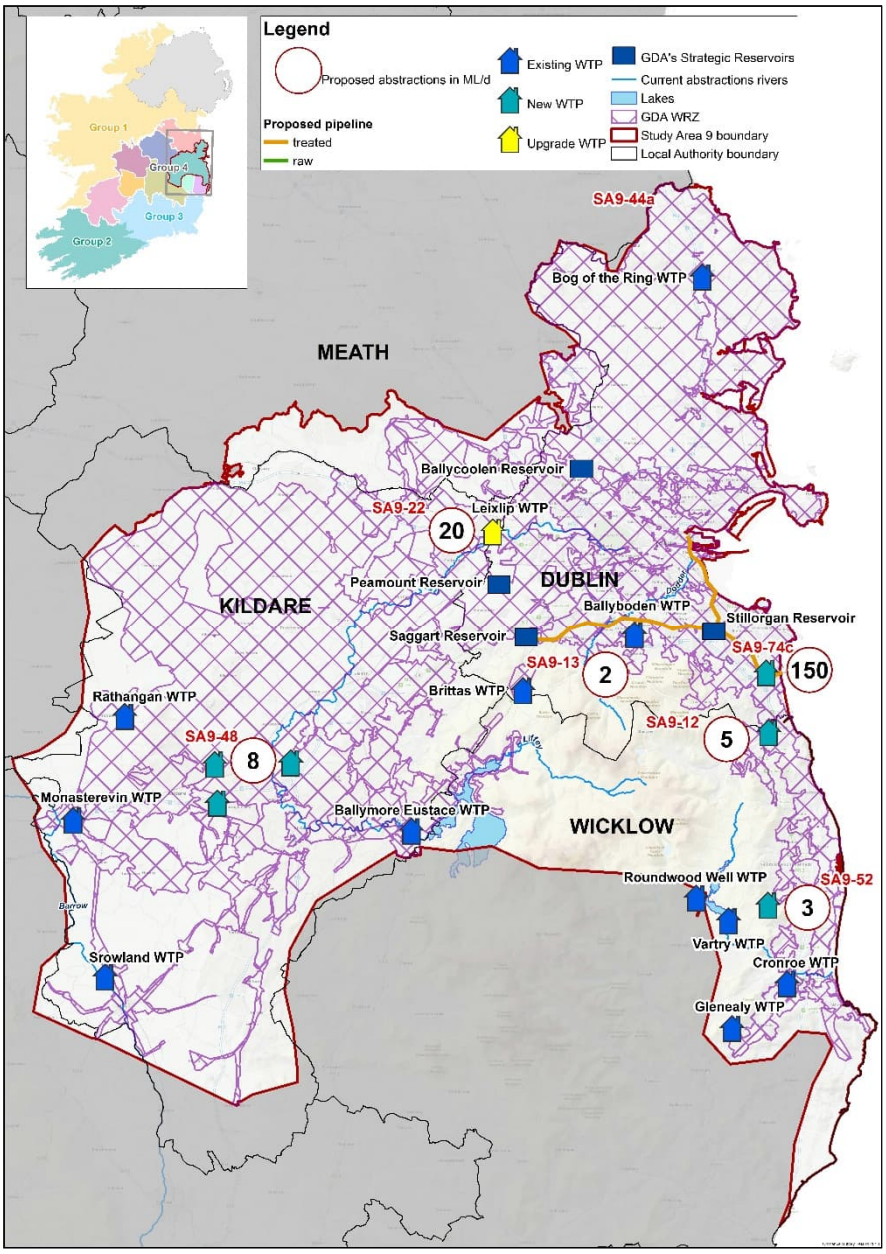

Figure 4.4 Combination 7

4.4.3 SA Approach 3 (SA Combination 10) (LC)

SA approach 3 (SA combination 10 - see Figure 4.5), key comparison points:

- Identified as the best in the Lowest Carbon category;
- Option types included: Two New Shannon Source options and one network upgrade option;
- One -3 biodiversity score (higher risk options that could impact on European sites). This is associated with the following option:
    - SA9-082: This option abstracts directly from the Lower River Shannon SAC (Parteen Basin). This could result in direct and indirect impacts to habitat within the SAC. The pipeline route also crosses multiple river channels providing hydrological links to other European sites. However, the proposed abstraction is within sustainable limits and mitigation identified in the NIS would avoid significant effects on the Lower Shannon SAC and other European sites.
- SA approach 1 and SA approach 3 are very similar in terms of infrastructure. However, SA approach 3 requires one more WTP upgrade and upgraded abstraction due to the scheme being separated into two phases.

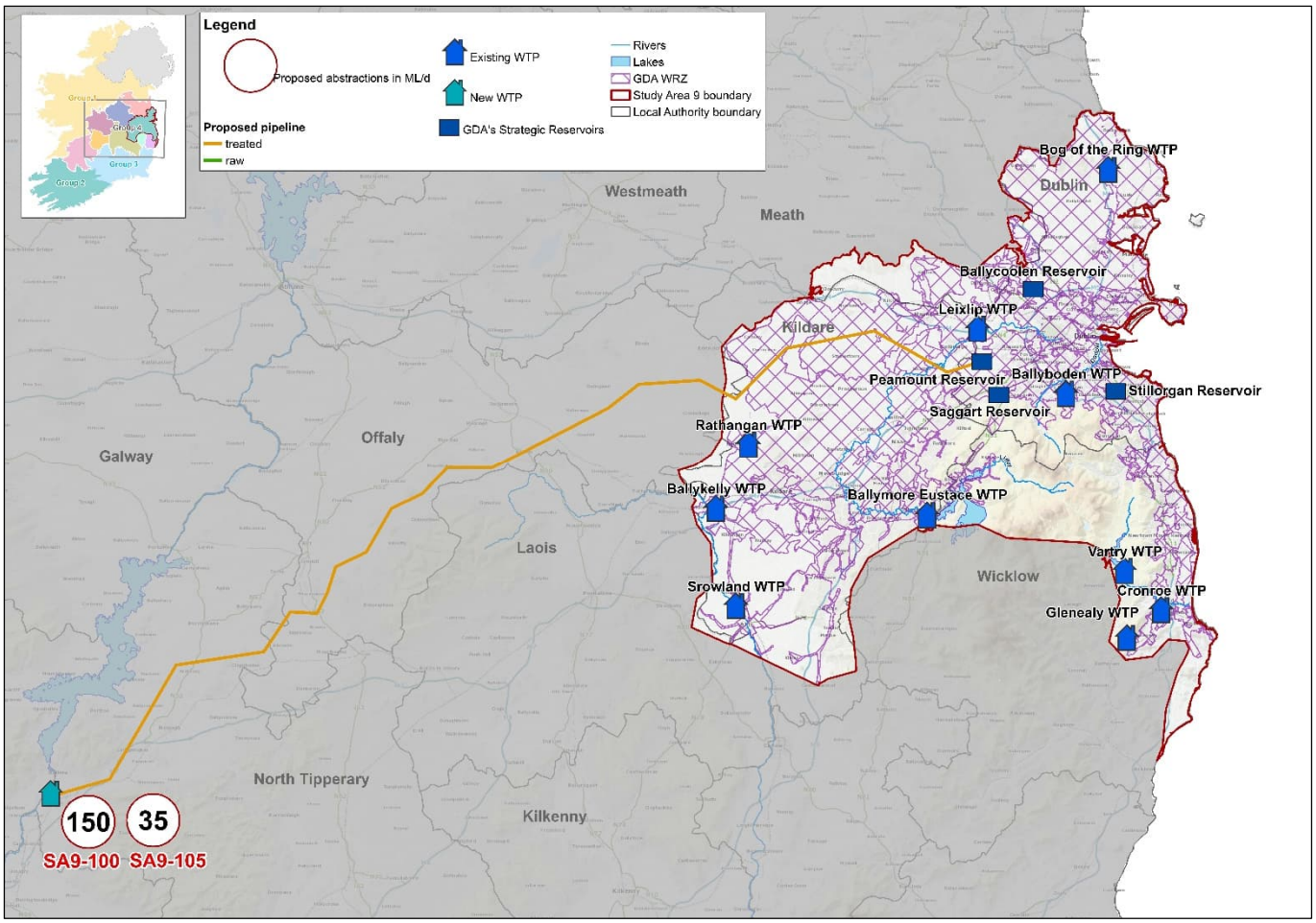

Figure 4.5 Combination 10

4.5 SA9 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 solutions 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 -132 Ml/d in 2019, to a projected maximum of -182 Ml//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 4.9 shows the SDB for the WRZs in SA9.

Table 4.9 Supply Demand Balance for SA9

WRZ Name	WRZ Code	Population	Maximum Deficit m^3/day*	
			2019	2044
Greater Dublin Area	GDA	1,702,245	-132,190	-182,991

*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 4.10 below. SA approach 1 and 3 are very similar, therefore, when they are compared with SA approach 2 in Table 4.10, their differences are not evident.

Table 4.10 Assessment of the SA Approaches and the 'Do Minimum' Approach

SEA Objectives	Phase (Construction (C)/ Operation (O))	Do Minimum	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 2) (QD)	SA Approach 3 (SA Combination 10) (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	--	-	--	-
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C	0	---	---	---
	O	--	-	--	-
5. Reduce greenhouse gas emissions	C	?	---	---	---
	O	?	---	---	---
6. Contribute to environmental climate change resilience	C	0	0	0	0
	O	---	++	+	++
	C	0	-	-	-

SEA Objectives	Phase (Construction (C)/ Operation (O))	Do Minimum	SA Approach 1 (SA Combination 12) (LCo, BE, MR, BA)	SA Approach 2 (SA Combination 2) (QD)	SA Approach 3 (SA Combination 10) (LC)
7. Protect and improve surface water and groundwater status	O	---	-	---	-
8. Avoid flood risk	C	0	-	0	-
	O	--	-	-	-
9. Protect and where appropriate, enhance cultural heritage assets	C	0	--	-	--
	O	-	0	0	0
10. Protect quality and function of soils	C	0	-	-	-
	O	0	0	0	0

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

The overall assessment of the approaches against the SEA objectives identifies SA approach 1 and 3 as the best performing, being better environmentally and being more resilient than the alternatives. SA approach 1 and 3 address the identified water supply quantity and quality requirements to secure a level of service important for public health and wellbeing and this is considered to be a major beneficial effect. SA approach 1 and 3 can also provide additional resilience and flexibility and relieve pressure on existing local sources in SA9.

SA approach 2 could potentially cause significant effects to several European designated sites including Dublin Bay SAC and SPA, Lambay Island SAC and SPA, Rockabill to Dalkey Island SAC and Pollardstown Fen SAC. There is also an unknown risk from chemical release during the pre-treatment and the full impact of brine release with desalination option. Brine may be toxic to some species in high concentrations, and this would be an operational and long term impact that may not be possible to mitigate. This approach also includes options with potential for major adverse effects to River Tolka and River Owendoher with abstractions exceeding 10% of Q95 and to the River Liffey which, based on desktop assessment, is already over abstracted.

There are high carbon emissions associated with all of the approaches for both construction and operation, resulting in the potential for major adverse effects. During operation, this is primarily due to the treatment of and pumping of additional water to meet demand but for SA approach 2 there is also the

energy intensive process involved with desalination. However, SA approach 3 is still the lowest carbon approach with lower lifetime carbon emissions estimated to be approximately 7,408,290 tCO_2e[6].

The 'Do Minimum' would involve a continuation of the existing situation which would involve a reactive response to issues as they arise on a short-term basis. This is assumed to include the leakage and demand management measures identified in section 5.2, the interim solution identified in section 5.3 and upgrades required to WTPs. However, this would not address the medium to long term supply demand deficit for the study area and the short fall is likely to require increased use of existing sources and more frequent use of types of measures used in drought conditions. These measures are likely to result in increased pressure on surface and ground water sources and groundwater dependent habitats and species and reduce resilience to impacts from climate change. Reliance on only interim solutions and short-term measure are also likely to involve increased carbon emissions to meet the supply or mitigate supply disruption.

SA approaches 1, 2 and 3 address the identified water supply quantity and quality requirements to secure a level of service important for public health and wellbeing. Although SA approach 2 is reliant on a number or smaller options which are potentially less sustainable and less resilient to climate change and therefore also less resilient for supply.

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 has one -3 Biodiversity score option which relates to the abstraction from the Parteen Basin which forms part of the Lower River Shannon SAC. A -3 biodiversity score identifies that an option may be harder to mitigate, or uncertainty remains, and further project level studies are required to rule out potential AESI, a -3 biodiversity score does not imply that AESI will occur, but that uncertainty remains. For such options, mitigation in the form of avoidance is provided for within the Plan. Further assessments will be required for the Preferred Approach to identify the project related impacts of this option on the Lower River Shannon SAC.

The approach for mitigation in the form of avoidance is provided in the NIS, for example. Therefore, no project arising from the Framework Plan with AESI identified at the project stage, would be progressed. This process is covered in detail in the NIS for the Regional Plan.

In terms of other environmental impacts, mitigation for the Preferred Approach is identified in chapter 5 through the individual options assessment and the chapter 6 cumulative assessment.

The GDA WRZ is experiencing acute problems with meeting the SDB at present. These problems are immediate, and demand can be higher than the volume of water that Irish Water can produce on a day to day basis. This SDB deficit issue will continue until a major new water source is developed for the region. Although a Preferred Approach has been identified above, an interim solution is also required for this WRZ until the long term, permanent solution is in place to alleviate the deficit.

As the interim solution will definitely be required for this study area, irrespective of the Preferred Approach, it has also been assessed for the SEA. The interim solution comprises two linked options,

[6] Note these are carbon dioxide emission equivalent estimates based on common assumptions used in the options assessment and costing so are relative estimates.

SA9-028 and SA9-046. These are temporary options and will not be operational in conjunction with the Preferred Approach. The interim solutions are described and assessed in section 5.3.

The Preferred Approach and the network upgrade and the common options required for SA9 are listed in Table 5.1.

5

SA9 Preferred Approach: Strategic Environmental Assessment

5 SA9 Preferred Approach Strategic Environmental Assessment

5.1 SA9 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.

Option SA9-087 is a group of interventions required to improved resilience and quality and includes upgrades to all WTPs in the WRZ along with network improvements. This has not been included in the approach development process as the interventions included within the option are essential for Irish Water to maintain quality and resilience standards, regardless of which approach was selected as the Preferred Approach (see Table 5.1 for further details). However, option SA9-087 is included as part of the assessment for cumulative effects in section 6 and as part of the Preferred Approach assessment in this section.

Option SA9-087 includes interventions required to resolve issues in SA9. As SA1 and other study areas look to connect to the GDA, network will be required to connect them to the GDA, hence, the network routes of the required connections will logically take the route of some of the network proposed for the GDA and appear to duplicate infrastructure. For example, in the SA1 Preferred Approach, SA option 3 proposes new network to connect to a WTP outside of SA1. This network has been assessed as part of SA1, therefore, to avoid duplication it has not been assessed as part of SA9-087. Additionally, Network Upgrade 1 has been included in SA9-087, however, Network Upgrade 1 has been assessed as part of the Preferred Approach for SA9. The components that have been assessed as part of other study areas/options have been greyed out in Figure 5.2 for those options not assessed as part of SA9-087.

The GDA has a critical SDB issue, however, the Preferred Approach is unlikely to be fully operational before the end of the decade. Therefore, the interim options (see section 5.3) are also assessed alongside the Preferred Approach for SA9.

Both the interim solutions (SA9-028 and SA9-046) and the common option (SA9-087) include a watermain between Ballymore Eustace and Saggart Reservoir. This is only assessed as part of the common option (SA9-087) in the SEA assessment to avoid duplication.

Table 5.1 gives a breakdown of the options in SA9 and the associated abstractions/demand.

Table 5.1 Preferred Approach Breakdown

WRZ Name and Option Reference	Option Description	Abstraction / Demand
SA9-084 GDA	New Shannon Source - EMR C Parteen Basin - +35Ml/d Upgrade Option (Based on 150 Ml/d to 185 Ml/d • WFD Status of proposed source Lough Derg LWB (Derg TN) 2013-2018 – Moderate	185 Ml/d
Networks Upgrade 1 GDA	New Shannon Source - Dublin City Trunk Mains - Option A	N/A

WRZ Name and Option Reference	Option Description	Abstraction / Demand
SA9-087 (Strategic Network Requirements) GDA	Option SA9-087 is a group of interventions required to improved resilience and quality regardless of the Preferred Approach selected to address the SDB deficit and includes: • An upgrade to all WTPs in the WRZ to meet the requirements of the Drinking Water Safely Plan. • Rationalisation of Glenealy and Roundwood Well WTPs (assessed as part of SA1 Preferred Approach) • New Storage and network in North Wicklow, Bray & Environs and Howth • New Storage at Saggart (works have commenced); • Trunkmain upgrades in Swords, Malahide, Donabate, Balbriggan, South City coast (Merrion Gates), North City coast and Wicklow • Pumps upgrade at Leixlip WTP to delivery an increased supply and network improvements in North Kildare • Delivery of new bulk transmission main between Ballymore Eustace WTP and Saggart Reservoir facility to address critical reliability and maintenance issues and remove the network capacity constraint between Ballymore Eustace and Dublin (also included in the interim solutions) • A new main from one of Irish Water's strategic reservoirs to provide 30-40 Ml/d to the city centre (assessed as part of Networks Upgrade 1)	N/A

The SA Preferred Approach options (SA9-084 and Network Upgrades 1) are shown in Figure 5.1 and the common option (SA9-087) is shown in Figure 5.2 in relation to key environmental designations.

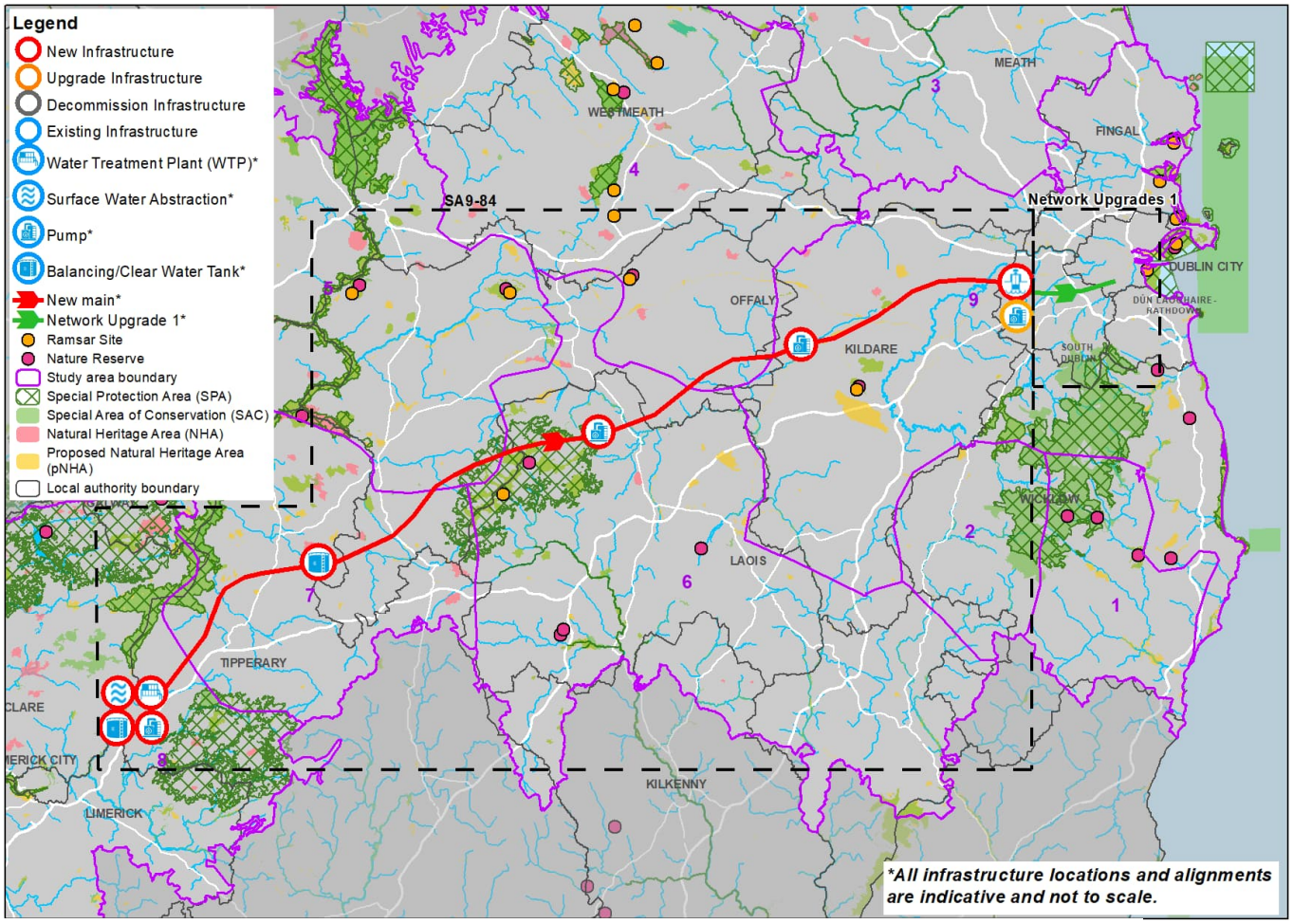

Figure 5.1 SA Preferred Approach and Key Environmental Designations

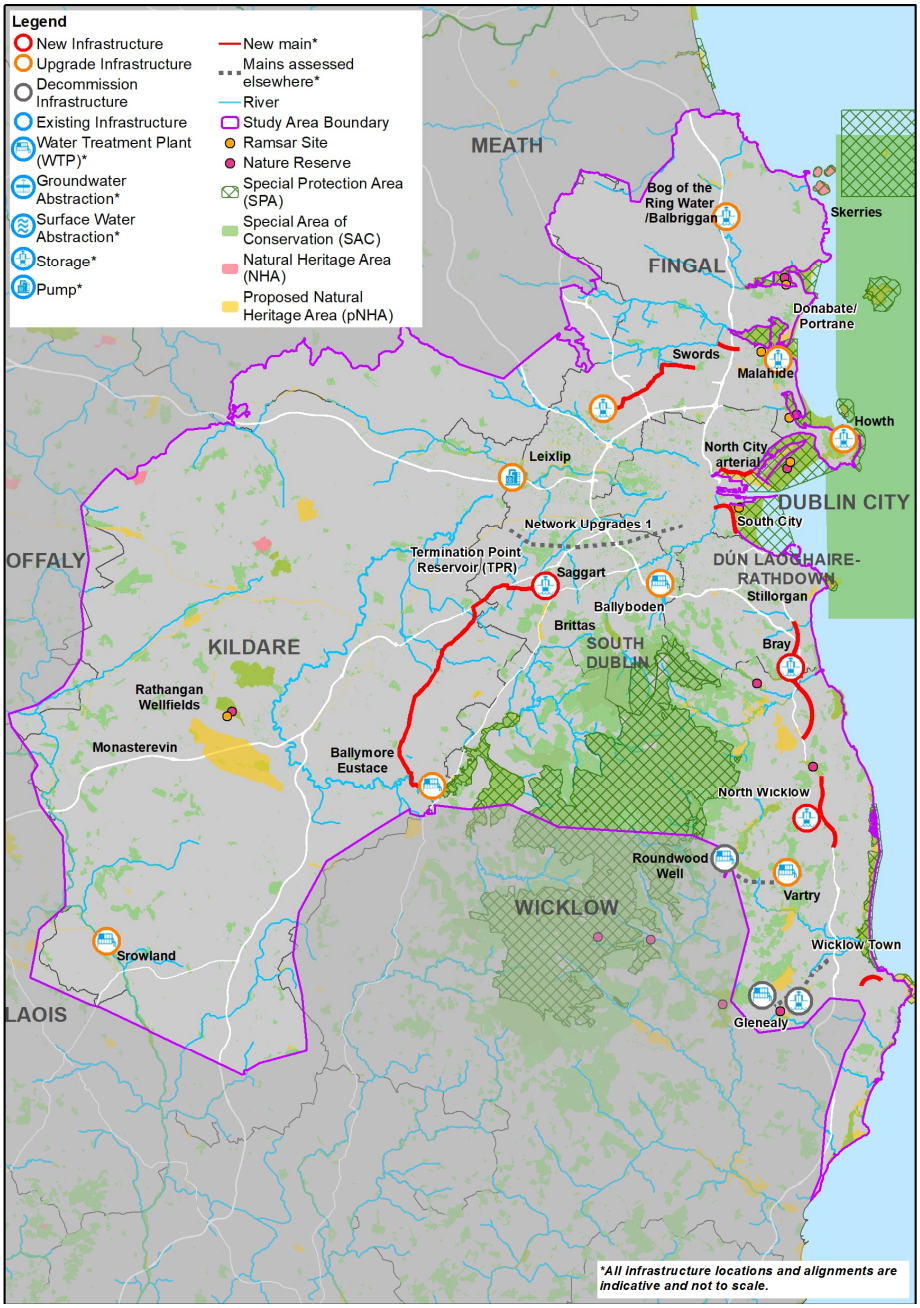

Figure 5.2 SA9-087 and Key Environmental Designations

The SA Preferred Approach options, common option and interim solutions 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 Preferred Approach and Common Option provides a breakdown of the infrastructural components and Table 5.3 provides an assessment summary of the options included in the SA Preferred Approach, common option and interim solutions. Individual options assessments are available on request. The overall Preferred Approach assessment, including the common option and the SA9 Preferred Approach (SA9-084 and Network Upgrade 1), is summarised in Table 7.1.

Table 5.2 Preferred Approach and Common Option Component Table

Option Reference	New / Refurbished Pipeline	New WTP	Desalination Plant	Marine Intake	Marine Outfall	Upgrade WTPs	New / Upgraded Abstractions	WTPs Decommissioned	Abstractions Abandoned	Raw Water Storage	Treated Water Storage
SA9-084	✓	✓	-	-	-	-	✓	-	-	-	✓
Networks Upgrade 1	✓	-	-	-	-	-	-	-	-	-	-
SA9-087	✓	-	-	-	-	-	-	✓	-	-	✓

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)
SA9-084	New Shannon Source - EMR C Parteen Basin - +35Ml/d Upgrade Option (Based on 150 Ml/d to 185 Ml/d	Construction	--	--	---	---	---	0	-	-	--	-
		Operation	+++	-	-	-	---	++	-	-	0	0
Network Upgrade 1	New Shannon Source - Dublin City Trunk Mains - Option A	Construction	--	--	-	-	---	0	-	-	--	-
		Operation	+++	0	0	0	---	++	-	-	0	0
SA9-087	Strategic Network Requirements	Construction	--	--	--	--	-	0	0	0	-	-
		Operation	++	-	0	0	-	+	0	0	0	0

* 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 SA9 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; and
- In the SA9 GDA, 92 Ml/d net leakage savings have been set into Irish Water's planning based on realistic stretch targets. These leakage targets have been built into the Supply Demand Balance for SA9.

5.2.2 Water Conservation

At present, Irish Water is conducting pilot studies in relation to water conservation stewardship in businesses and is actively pursuing Conservation Education Awareness Campaigns and partnerships. During drought conditions in 2018 and 2020, a Water Conservation Order was implemented, in order to protect Irish Water's 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

As outlined in more detail in section 8.3.7.6 of the Framework Plan, the NWRP provides for an "interim solution" approach, which allows shorter term interventions, separate from the Preferred Approach for the relevant WRZ, to be identified and prioritised. The purpose of these interventions is to ensure that Irish Water can continue delivering safe, secure and reliable water supplies in the near term, until Irish Water implements the Preferred Approach in full within the relevant WRZ.

The Preferred Approach for SA9, which includes a transfer of treated water from the River Shannon, is a significant project. It will be a significant challenge to progress a project of this scale and complexity through the necessary consent, procurement and construction phases to make it fully operational before the end of the decade.

At present the GDA has a critical SDB issue and even when accounting for heavy investment in leakage reduction, this deficit will increase further based on expected growth and economic development (aligned with the National Planning Framework).

As outlined in the SA9 Technical Report, Irish Water have a number of ongoing supply intervention projects, which alongside leakage and water conservation measures will allow them to maintain the existing Level of Service (LoS) to their customers while facilitating growth to 2025. Therefore, Irish Water need further supply interventions to meet the LoS and quality requirements until the Preferred Approach can be delivered.

A review of all feasible options was carried out to determine options or combinations of options which could provide some additional supply to the GDA region in the short term, this is discussed in more detail in the SA9 Technical Report.

The acceleration of leakage reduction activities to reduce demand has already been taken into account, therefore, due to the timeframe the only viable interim options involve optimising Irish Water's existing sources and asset base. No new WTPs works or abstractions are required for these options and they have the potential to be delivered prior to the Preferred Approach.

The recommended interim options for the GDA are:

- Option 46 - Leixlip WTP Upgrade - +50 Ml/d – Winter Critical Period and Normal Year Annual Average only
- Option 28 - Increase abstraction at BME by optimising storage at Poulaphouca Reservoir and provision of 24km main from BME to the Saggart Area.

In section 2.1 of the SA9 Technical Report, an upgrade at Leixlip WTP was noted under "quality need" and in section 2.3 "Security of supply from Ballymore Eustace to Saggart" was noted under "reliability need". The interim options resolve both these needs, therefore, while the requirement for additional supply provided by these options is temporary, the infrastructure required will increase long term security and reliability of the entire supply. The components required as part of the interim solutions are provided in Table 5.4.

Table 5.4 Interim Solutions Component Table

Option Reference	New / Refurbished Pipeline	New WTP	Desalination Plant	Marine Intake	Marine Outfall	Upgrade WTPs	New / Upgraded Abstractions	WTPs Decommissioned	Abstractions Abandoned	Raw Water Storage	Treated Water Storage
Interim solutions	✓	-	-	-	-	✓	✓	-	-	-	-

The interim options involve a temporary use of an increase in abstraction from the River Liffey and an increase in production at the Leixlip and Ballymore Eustace WTPs (see RWRP-EM section 7), subject to the appropriate statutory consents. It is noted that Irish Water's existing abstractions from the River Liffey are significant and there may be sustainability issues in relation to the WFD, in addition to reliability issues in drought periods. On that basis, any increases in abstraction from this water body would need to be carefully planned, be temporary in nature, and may need to be facilitated via exemption processes allowed for in legislation (with associated environmental assessments, as required). An environmental assessment of the interim solutions is provided in Table 5.5). Storage from Poulaphouca can be optimised by works to reduce the level of the abstraction inlet and/or by modifications to the storage curve. Consideration would need to be given to dam safety and a potential increase in flood risk along the Liffey if a proposal to change the storage curve was required. The feasibility of these interim options will be further investigated at a project level.

Both the interim solutions (SA9-028 and SA9-046) and the common option (SA9-087) include a watermain between Ballymore Eustace and Saggart Reservoir. This is only assessed as part of the common option (SA9-087) in the SEA assessment to avoid duplication.

Table 5.5 interim Solutions 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)
SA9-028 and SA9-046	Interim solutions	Construction	-	-	-	-	--	-	0	0	-	-
		Operation	+	+	0	0	--	---	---	0	0	0

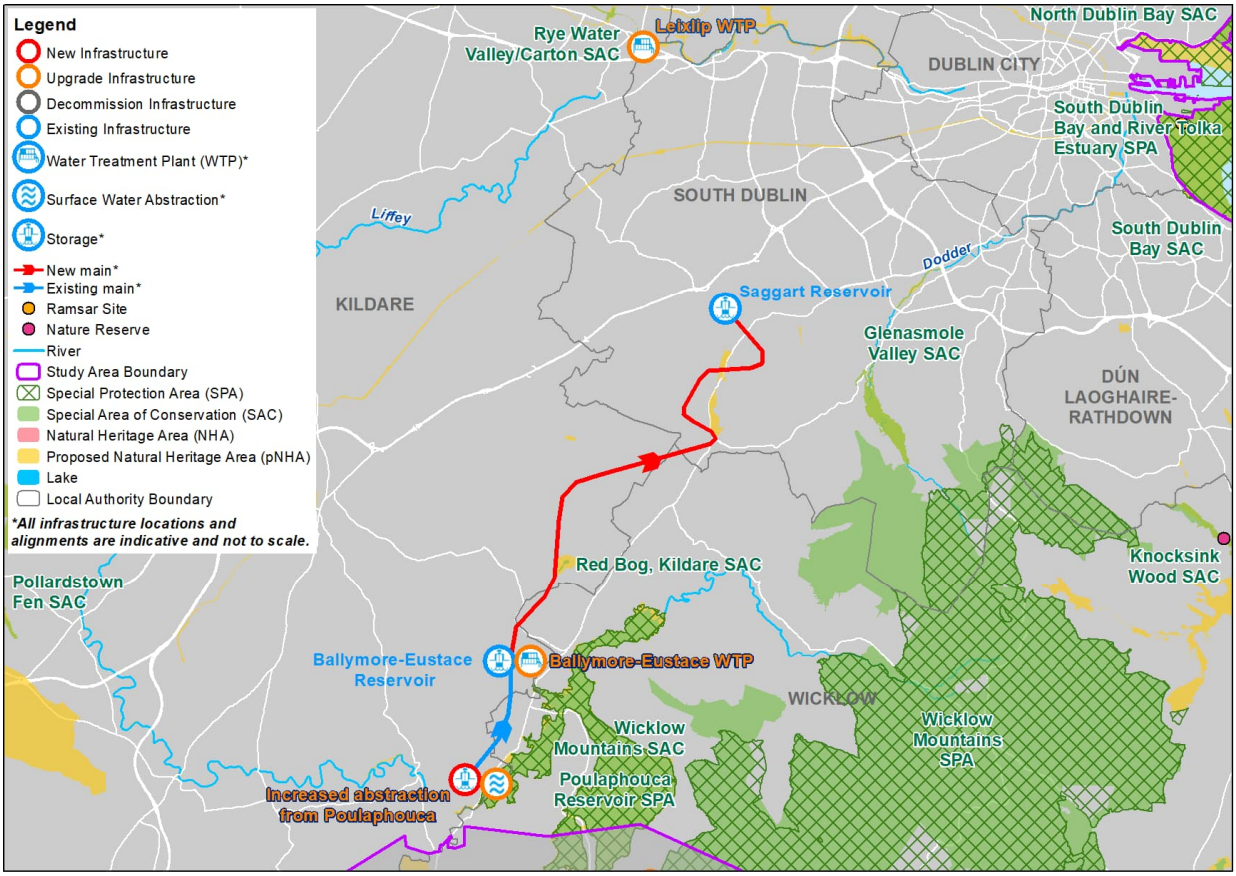

Figure 5.3 Interim Solutions for SA9

5.4 Approach Uncertainty and Adaptability

A summary of the adaptability criteria and sensitivity analysis Irish Water have undertaken for the SA9 Preferred Approach is provided in the SA9 Technical report. A high-level assessment of what this could mean for the SEA is shown in Table 5.6.

Table 5.6 SA9 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 our current abstractions are large compared to the water bodies from which they abstract)	+90 Ml/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. Although the likelihood of this scenario is high based on a desktop assessment of Irish Water's existing abstractions, potential impacts may be mitigated against by optimising their operations on a more environmentally sustainable basis across the range of supplies as the Preferred Approach will allow Irish Water to benefit from major sources, in areas of the country with differing climatic conditions. Also as the estimated sustainable abstraction available from the Lough

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Environmental Impacts Relative to Assessment of Preferred Approach Key: Green - Positive Amber - Negative
			Derg source is in excess of that required for the GDA therefore the Preferred Approach can be scaled up if required.
			The SA Preferred Approach addresses potential for some sustainability reduction, although additional sustainability reductions could add pressure for additional supply, the Preferred Approach provides flexibility to meet this within sustainability limits.
Climate Change	High (international climate change targets have not been met)	+10 Ml/d	The impact of increased 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 against by optimising their operations on a more environmentally sustainable basis across the range of supplies as the Preferred Approach will allow Irish Water to benefit from major sources, in areas of the country with differing climatic conditions
			Potential for additional abstraction pressure unless optimisation can address, however the Preferred Approach provides flexibility to meet this within sustainability limits.
Demand Growth	Low/Moderate (growth has been based on policy)	-40 Ml/d	The impact of lower than expected growth would reduce the SDB deficit and the overall need requirement. The SDB deficit is driven in equal parts by limitations in existing supplies and the reliability of the overall supply and demand.
			This could allow lower than expected energy use and carbon emissions and reduce expected abstraction requirements.
Leakage Targets	Moderate (the distribution network in the region is extensive at nearly 10,000 kilometres)	+92 Ml/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, they could potentially fail to achieve target leakage targets in the timeframes set out. However, as Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets as opposed to accepting lower targets.

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Environmental Impacts Relative to Assessment of Preferred Approach Key: Green - Positive Amber - Negative
			Increased energy and carbon associated with lower leakage reduction or to a lesser degree with delayed reduction.
Leakage Targets	Low (The distribution network in the region is extensive at nearly 10,000 kilometres and existing targets for the GDA are aggressive)	-62 Ml/d	The impact of reducing leakage to 10% of total demand would reduce the SDB deficit and the overall need requirement.
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements

6 SEA Cumulative Effects for SA9 Preferred Approach

6 SEA Cumulative Effects for SA9 Preferred Approach

Secondary, cumulative and the synergistic nature of the effects of the SA9 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 Framework 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 SA9

The potential 'within plan' cumulative effects for SA9 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 Framework 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 in the Preferred Approach and option 87 could be constructed at the same time and then all options would be operated at the same time (Table 6.1). However, this is very unlikely to be the case for construction impacts due to budget resources and regulatory constraints.

While the interim solution for SA9 would be temporary and would not be operated concurrently with the Preferred Approach the pipeline infrastructure for the interim options would be retained and would provide additional network resilience in the long term. This includes:

- Leixlip-Ballycoolen pipeline; and
- Ballymore Eustace-Saggart Reservoir pipeline.

Hence, the construction and use of these pipelines has been considered in the cumulative assessment for the SA9 Preferred Approach.

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

For SA9, there are two Preferred Approach options (SA9-084 and Networks Upgrade 1), the common option (SA9-087) and the construction and resilience use of the retained infrastructure from the interim options to consider.

In general, the SA Preferred Approach options are geographically spaced out with small scale construction works included. In terms of phasing it is also likely that construction works would take place at different times, therefore, there are unlikely to be many cumulative effect interactions during construction.

There could be cumulative effects associated with construction in terms of traffic, noise and dust for the options located in Leixlip (SA9-084, SA9-087 and the interim solutions) and Ballycoolen (SA9-087 and interim solutions) (see Table 6.1). 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 are not predicted to be any cumulative effects to European designated sites during construction. Standard good practice mitigations, such as having buffers along the edge of the river and having an emergency plan in place during construction will be implemented.

The impacts on the European designations are summarised in the NIS and in chapter 9 of this review.

Table 6.1 Potential In-Combination Effects between Preferred Options in SA9

Preferred Approach Option References	SA9-028 and SA9-046	SA9-087
SA9-084	L	L
SA9-087	L	
	B	

Key	
Construction Phase	
Operation Phase	

Key	
Construction and Operation	
Leixlip	L
Ballycoolen	B

6.1.2 Cumulative Effects during Operation

As for operation, the options are relatively remote from each other. Therefore, the SEA has not identified, at a plan level, any potential for cumulative effects during operation based on geography.

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). There are no groundwater abstractions associated with the SA9 Preferred Approach, SA9-087 or the interim solutions, see Figure 6.1 for the Preferred Approach abstractions in SA9.

There could 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 SA9 this averages as 4.39 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.

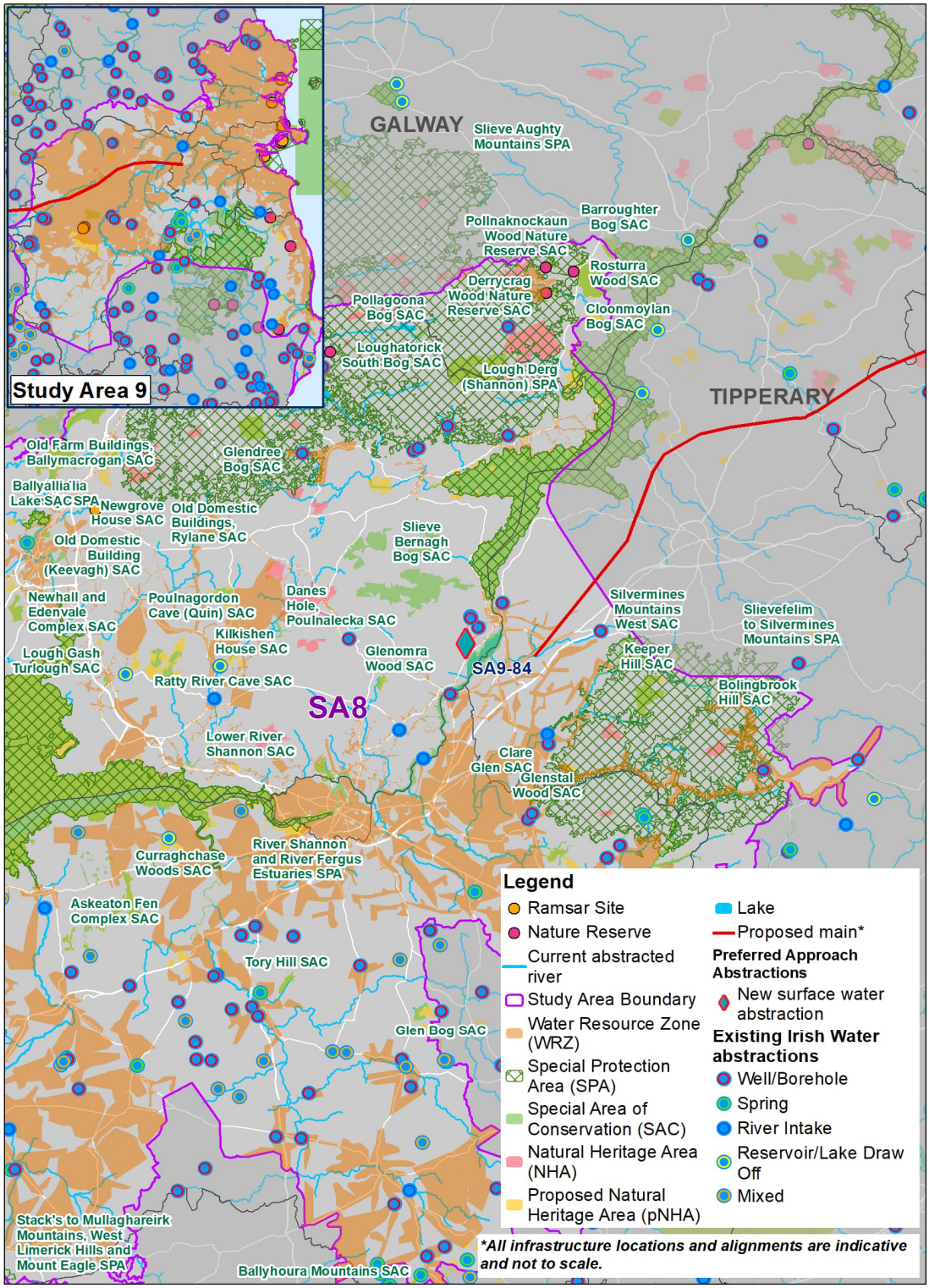

Figure 6.1 SA Preferred Approach Abstractions in SA9

6.2 Cumulative Effects with Other Developments

The SA9 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 SA9 there are a number of regeneration and construction projects clustered in and around greater Dublin. Other developments within SA9 can also be found on myProjectIreland (2021). These individual projects are considered in the cumulative assessment, however, they are represented as and assessed as part of the NPF projects' settlements, such as Dublin in the table below due to the density of project clusters in those areas.

The Preferred Approach (SA9-084), common option (SA9-087) and interim solutions combined cover a large geographical area, with the Preferred Approach extending beyond the greater Dublin area. There are a number of development and regeneration projects identified within Dublin but also in the towns within the wider study area.

6.2.1 Cumulative Effects during Construction

The plan level assessment indicates that there could be potential for cumulative effects from construction between the regeneration projects in Dublin and surrounding areas that could result in cumulative effects with the Preferred Approach if they were to be constructed at the same time (represented as 'D' in Table 6.2). However, these effects are unlikely to be significant given the geographical area over which the Preferred Approach options would be constructed and the relatively localised nature of the effects. There could be limited construction disturbance between the developments and the Preferred Approach such as noise and traffic effects. However, this is unlikely to be significant and could be mitigated by standard mitigation measures such as planning of construction traffic routes and movements with the developers and informing residents about the programme for 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 Potential Cumulative Effects between Preferred Options and Other Developments in SA9

<table>
<tr><th></th><th colspan="4">Preferred Approach Options</th></tr>
<tr><th>Project Developments</th><th>SA9-084</th><th>Network Upgrade 1</th><th>SA9-087</th><th>Interim solutions</th></tr>
<tr><td rowspan="8">Various developments and regeneration projects in Dublin (including Luas Green Line Capacity Enhancement, New Children's Hospital, MetroLink, North Runway Project at Dublin Airport)</td><td rowspan="8"></td><td rowspan="4">D</td><td>BB</td><td rowspan="8"></td></tr>
<tr><td>ME</td></tr>
<tr><td>NB</td></tr>
<tr><td>SE</td></tr>
<tr><td rowspan="4">M50</td><td>RE</td></tr>
<tr><td>D</td></tr>
<tr><td>M</td></tr>
<tr><td>M50</td></tr>
</table>

	Preferred Approach Options			
Project Developments	**SA9-084**	**Network Upgrade 1**	**SA9-087**	**Interim solutions**
Various developments in the surrounding areas (including M11 Capacity Enhancement (Phase 1 and 2), Saggart Reservoir and Vartry Water Supply Scheme)			M11 M NB SE	

Key	
Construction Phase	
Operation Phase	
Construction and Operation	
Baldoyle Bay SAC & SPA	BB
Malahide Estuary SAC & SPA	ME
North Bull Island SPA	NB
South Dublin Bay and River Tolka Estuary SPA	SE
Rogertown Estuary SPA	RE
The Murragh Wetlands SAC & SPA	M
Dublin	D
M50	M50
M11	M11

6.2.2 Cumulative Effects during Operation

Due to the relatively localised nature of most of the Preferred Approach options, there are unlikely to be significant cumulative effects during operation between other developments and the Preferred Approach in general.

There could be cumulative effects in terms of carbon, 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 SA9 Preferred Approach, 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 SA9 and a range of options and SA Approaches have been considered and assessed, including a 'Do Minimum' approach.

Key beneficial impacts assessed include major beneficial impacts for SA9-084 and Networks Upgrade 1, and moderate beneficial impacts for SA9-087 during operation associated with the resilience, reliability and quality of water supply for local communities and the subsequent benefits of this in terms of level of service and public health. Moderate beneficial impacts for SA9-084 and Networks Upgrade 1 and minor beneficial impacts for SA9-087 associated with increasing climate change resilience of supply through reducing reliance on abstraction from environmental resources that are potentially vulnerable to future climate change impacts and improvements and addition of needed infrastructure.

Key potential adverse impacts identified at plan level for SA9-084 and SA9-087 include:

- Potential minor adverse operational impacts for SA9-084 to nationally designated sites. Abstraction may impact water levels in Lough Derg (pNHA) which is an important area with its associated species richness, however abstraction will be set within allowable limits to avoid this;
- Potential moderate adverse construction impacts for SA9-084 on biodiversity as the transfer pipeline route crosses multiple river channels providing hydrological links to other sites and requires extensive hedgerow removal, which support Atlantic Salmon, Lamprey species and Otter. Section 6.3.3 of the NIS identifies general mitigation measures to avoid AESI for these sites;
- Potential moderate construction impacts for SA9-084 due to extensive tree and hedgerow habitat clearance which has the potential for short-term moderate adverse impacts to annex species and biodiversity disturbed by the works. There is also a risk to the conservation of aquatic species as a result of the large number of river crossings as well as the general impact to biodiversity during construction works. Section 6.3.3 of the NIS identifies general mitigation measures to avoid AESI for these sites;
- Potential moderate short-term adverse construction impacts to national designated sites for Networks Upgrade 1 for the Grand Canal and Liffey Valley pNHA due to watermains construction. It is assumed that standard mitigation measures will be implemented to avoid impacts at these sites, such as good practice measures as outlined in a CEMP, appropriate pre-construction ecological surveys, invasive species management measures, and reinstatement of all land uses and habitats following construction except where specifically identified within the assessment;
- Potential moderate adverse construction impacts for SA9-087 on biodiversity assuming recommended mitigation for avoiding AESI are applied to for construction and operation effects on the Baldoyle Bay SAC & SPA, Malahide Estuary SAC & SPA, North Bull Island SPA, South Dublin Bay and River Tolka Estuary SPA, Rogertown Estuary SPA and The Murragh Wetlands SAC & SPA. Section 6.3.3 of the NIS identifies general mitigation measures to avoid AESI for these sites;
- Potential moderate short-term adverse construction impacts to national designated sites for SA9-087 for the Royal Canal, Poulaphouca Reservoir, Baldoyle Bay, Rye Water Valley/Carton and Liffey Valley pNHAs due to watermains construction. Section 6.3.3 of the NIS identifies general mitigation measures to avoid AESI for these sites;

- Potential major adverse construction landscape effects from large scale pipeline and WTP construction works for SA9-084 and moderate adverse construction effects for SA9-087 from new network and assets; and
- Potential major adverse construction material effects from temporary loss of agricultural land and requirement for extensive pipeline and new WTP for SA9-084.

No potential cumulative effects have been identified for this study area other than combined effect of carbon emissions with other schemes. However, interaction with the interim solutions for water supply and competing uses for flood risk management and use as a renewable energy supply will need to be considered further at project level.

Cumulative effects assessment identifies potential significant effects in relation to carbon, the individual options are assessed as major adverse in relation to this SEA objective. 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 SA9 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 will change overall and per ML of water.

SEA mitigation identified to address the key adverse impacts identified above includes development of construction environmental management plans covering aspects such as soil management and reinstatement, public consultation with local residents on disruption during construction and consideration of the waste hierarchy in design. Measures to address the cumulative impact for carbon emissions include increasing the sourcing of energy supply from renewable sources. All developments will aim to achieve the requirements for no net loss in biodiversity and provide enhancement, as set out in the Biodiversity Action Plan (Irish Water, 2021) where possible. There may be potential to also provide opportunities for carbon sequestration, landscape and recreational benefits with biodiversity enhancement. In addition, there are opportunities within SA9 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 solutions 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 Moderate Adverse O Moderate Beneficial to Major Beneficial The PA is expected to improve overall drinking water quality reliability and sustainability through 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. Combined options support water supply for SA9 and also a number of WRZs in other study areas.	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 amenities are disrupted

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 Moderate Adverse O Neutral to Minor 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 Lough Derg (pNHA). Pipeline route crosses multiple river channels providing hydrological links to other European sites which support Atlantic Salmon, Lamprey species and Otter. It is however considered that temporary adverse effects associated with the pipeline construction can be mitigated.	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 Lough Derg (pNHA).	• Monitor construction activities to ensure compliance
3. To protect landscapes, townscapes	C Minor Adverse to Major Adverse O Neutral to Minor Adverse	Routing and siting to reduce tree loss and appropriate location and design of above ground structures with landscape planting.	• Total working area of pipelines non-designated landscapes	• Duration of construction works

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
and visual amenity	Construction landscape impacts and long term impacts from above ground structures, such as new WTPs.	Reinstatement of land use and vegetation.	• Land use/landscape features re-established for schemes over appropriate period – areas/km successfully restored to meet requirements	• Number of complaints received regarding visual impact of construction works
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C Minor Adverse to Major Adverse O Neutral to Minor Adverse New resources required for construction works, including extensive lengths of pipeline, pumps 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 gas emissions	C Minor Adverse to Major Adverse O Minor Adverse to Major Adverse Embodied and operational carbon contribute to national level carbon emission targets.	Design to minimise embodied carbon emissions and optimise operational efficiency. Seek renewable energy supply sources and optimise use of leakage and water efficiency measures to reduce carbon.	• Percentage of energy supply from renewable sources or reduced energy use • Carbon footprint (total tonnes) per year, predicted over plan period, lifetime of schemes	• Carbon footprint (total tonnes) during construction • Operational Carbon Intensity kgsCO2equic/Ml

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
	Leakage and water efficiency can contribute to reducing carbon.	Consider offsetting approaches with multiple benefits for water quality, carbon sequestration and linking with other objectives.	and carbon intensity of water resource options (tonnes/Ml/d)	
6. Contribute to environmental climate change resilience	C Neutral O Minor Beneficial 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.	Consider how operation can further reduce climate change pressure on at risk sources and associated designations. Sustainability review of sources taking account of groundwater and surface water interconnections.	• WFD waterbody status objectives at risk and designated site condition status • Frequency of drought orders requiring change to normal abstractions/ compensation releases	• None identified
7. Protect and improve surface water and groundwater status	C Neutral to Minor Adverse O Neutral to Minor Adverse New/increased abstractions are limited to allowable limits and have a low risk of adverse effect on WFD waterbody status objectives.	Further investigation to consider effects on groundwater abstraction on the surface water environment.	• WFD waterbody status objectives at risk	• Pollution incidents 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
8. Avoid flood risk	C Neutral to Minor Adverse O Neutral to Minor Adverse Potential loss of flood plain increasing flood risk from construction and location of above ground structures for Network Upgrade 1. Also, flood risk impacts on operations with effect on meeting supply.	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
9. Protect and where appropriate, enhance cultural heritage assets	C Minor Adverse to Moderate 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

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
10. Protect quality and function of soils	C 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 Preferred Options identified in SA9 are 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.

There are no groundwater abstractions selected in the SA9 Preferred Approach (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. However, 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 SA9, 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 SA9-087 on Baldoyle Bay SAC & SPA, Malahide Estuary SAC & SPA North Bull Island SPA, South Dublin Bay and River Tolka Estuary SPA, The Murragh Wetlands SAC & SPA, and Rogertown Estuary SPA. 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.

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 SA9

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
SA9-029	New Wellfield at Ballyadams - Milford									0	0	-12
SA9-030	New Wellfield at Tullamore									1	0	-15
SA9-032	New Wellfield at Monasterevin									2	0	-16
SA9-033	New Wellfield at Portarlington									1	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
SA9-040	New Wellfield at Monasterevin and Portarlington									1	0	-22
SA9-041	New Wellfield at Monasterevin, Tullamore & Portarlington									2	0	-24
SA9-048	Two Wellfields in Mid-Kildare: Curragh Camp & Clownings									2	0	-17
SA9-052	Vartry Tunnel Infiltration									0	0	-11
SA9-078	New Wellfield at Johnstown									0	0	-11

Table A.2 Fine Screening Summary of Conjunctive Use Options in SA9

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
SA9-23a	Increase Abstraction at River Barrow and WTP expansion to 50 Ml/d									1	0	-16
SA9-23b	Increase Abstraction at River Barrow and WTP expansion to 60 Ml/d									1	0	-17
SA9-23c	Increase Abstraction at River Barrow and WTP expansion to 75 Ml/d									1	0	-18
SA9-23d	Increase Abstraction at River Barrow and WTP expansion to 50 Ml/d with new bankside storage									2	0	-21
SA9-23e	Increase Abstraction at River Barrow and WTP expansion to 60 Ml/d with new bankside storage									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
SA9-23f	Increase Abstraction at River Barrow and WTP expansion to 100 Ml/d									1	0	-17

Table A.3 Fine Screening Summary of Optimisation Options in SA9

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
SA9-028	Optimising of Poulaphouca Reservoir operating regime in conjunction with ESB									1	1	-11

Table A.4 Fine Screening Summary of Desalination Options in SA9

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
SA9-20a	New abstraction from River Liffey at Islandbridge 40 Ml/d brackish water abstraction downstream of weir and new Brackish/Desalination Plant on site									4	0	-32
SA9-042	Desalination at Balbriggan – 50 Ml/d									4	0	-26
SA9-043	Desalination plant in Balbriggan									4	0	-26
SA9-044	Desalination plant in Balbriggan									4	0	-27
SA9-74a	South Dublin Desalination 50 Ml/d									4	0	-26
SA9-74b	South Dublin Desalination 100 Ml/d									4	0	-26

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
SA9-74c	South Dublin Desalination 150 Ml/d									4	0	-25

Table A.5 Fine Screening Summary of Surface Water Options in SA9

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
SA9-011	New SW abstraction from the River Tolka and new WTP									3	0	-28
SA9-012	New SW abstraction from the River Dargle and new WTP									0	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
SA9-013	New SW abstraction from the River Owendoher and raw water transfer to Ballyboden WTP									1	0	-16
SA9-014	New SW abstraction from the River Avonmore and new WTP									1	0	-20
SA9-017	Rehabilitation of existing Ballyboden WTP									0	0	-11
SA9-18a	Rehabilitation of existing Ballyboden WTP									0	0	-15
SA9-20b	New abstraction from River Liffey at Islandbridge 20 Ml/d abstraction upstream of weir and new WTP on site									2	0	-26
SA9-20c	New abstraction from River Liffey at Islandbridge									3	0	-29

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
	20 Ml/d abstraction upstream of weir and piped to Leixlip WTP											
SA9-20d	New abstraction from River Liffey at Islandbridge 50 Ml/d abstraction upstream of weir based on Ringsend WwTP re-use and new WTP on site									4	0	-31
SA9-20e	New abstraction from River Liffey at Islandbridge 50 Ml/d abstraction upstream of weir based on Ringsend WwTP re-use and piped to Leixlip WTP									2	0	-30
SA9-20f	New abstraction from River Liffey at Islandbridge. 40 Ml/d brackish water abstraction downstream of weir, new									4	0	-32

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
	Brackish/Desalination Plant on site and pump to Ballycoolen SR											
SA9-22a	Increase Leixlip WTP abstraction and treatment. Leixlip WwTP effluent re-circulation									1	0	-13
SA9-045	Leixlip WTP Upgrade +30Ml/d									1	0	-17
SA9-046	Leixlip WTP Upgrade +50Ml/d									1	0	-17
SA9-047	Leixlip WTP Upgrade +75Ml/d									1	0	-17
SA9-051	Impoundment in Fingal for local supply (3Ml/d)									1	0	-21

Table A.6 Fine Screening Summary of Wastewater Re-Use Options in SA9

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
SA9-021	Leixlip WwTP effluent re-use									0	3	-16
SA9-56a	Swords WwTP Effluent Re-Use for Non-Domestic									0	0	-13

Table A.7 Fine Screening Summary of New Shannon Source Options in SA9

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
SA9-002	Water Supply Project - EMR B Lough Derg – 295									4	0	-29

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
	Ml/d - GDA Trunk mains route 1											
SA9-003	Water Supply Project - EMR C Parteen Basin - 295 Ml/d - GDA Trunk mains route 1									4	0	-29
SA9-082	New Shannon Source - EMR C Parteen Basin – 150 Ml/d; Gravity supply from BPT (no PS BPT to TPR)									4	0	-29
SA9-083	New Shannon Source - EMR C Parteen Basin – 170 Ml/d; Gravity supply from BPT (no PS BPT to TPR)									4	0	-29
SA9-084	New Shannon Source - EMR C Parteen Basin – 185 Ml/d; Boosted supply (1PS to TPR)									4	0	-29

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
SA9-085	New Shannon Source - EMR C Parteen basin - +35Mld Upgrade Option (150Mld to 185Mld)									4	0	-29
SA9-086	New Shannon Source - EMR C Parteen basin - +50Mld Upgrade Option (170Mld to 220Mld)									4	0	-29

Table A.8 Fine Screening Summary of Network Upgrades in SA9

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and	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
Network Upgrade 1	GDA Trunk Main Route Option 1 - Peamount Reservoir to city									0	0	-16
Network Upgrade 2 and 3	Callow Hill to Giltspur watermain and storage requirement									0	0	-15

Appendix B SA Approaches for SA9

WRZ	Preferred Approach - SA Approach 1	Least Cost - SA Approach 1	Best Environmental - SA Approach 1
	Option Description	**Option Description**	**Option Description**
GDA	SA9-084 New Shannon Source - EMR C Parteen Basin – 185 Ml/d; Boosted supply (1PS to TPR)	SA9-084 New Shannon Source - EMR C Parteen Basin – 185 Ml/d; Boosted supply (1PS to TPR)	SA9-084 New Shannon Source - EMR C Parteen Basin – 185 Ml/d; Boosted supply (1PS to TPR)
	Networks Upgrade 1 New Shannon Source - Dublin City Trunk Mains - Option A	Networks Upgrade 1 New Shannon Source - Dublin City Trunk Mains - Option A	Networks Upgrade 1 New Shannon Source - Dublin City Trunk Mains - Option A

WRZ	Quickest Delivery - SA Approach 2	Most Resilient - SA Approach 1	Lowest Carbon - SA Approach 1
	Option Description	**Option Description**	**Option Description**
GDA	SA9-011 New SW abstraction from the River Tolka and new WTP	SA9-084 New Shannon Source - EMR C Parteen Basin – 185 Ml/d; Boosted supply (1PS to TPR)	SA9-082 New Shannon Source - EMR C Parteen Basin – 157.5 Ml/d
	SA9-012 New SW abstraction from the River Dargle and new WTP	Networks Upgrade 1 New Shannon Source - Dublin City Trunk Mains - Option A	SA9-085 New Shannon Source - EMR C Parteen Basin – 35 Ml/d upgrade option
	SA9-013		Networks Upgrade 1 New Shannon Source - Dublin City Trunk Mains - Option A

WRZ	Quickest Delivery - SA Approach 2	Most Resilient - SA Approach 1	Lowest Carbon - SA Approach 1
	Option Description	**Option Description**	**Option Description**
	New SW abstraction from the River Owendoher and raw water transfer to Ballyboden WTP		
	SA9-014 New SW abstraction from the River Avonmore and new WTP		
	SA9-017 Rehabilitation of existing Ballyboden WTP		
	SA9-20e New abstraction from River Liffey at Islandbridge		
	SA9-029 New Wellfield at Ballyadams - Milford (7 BHs; 3 Ml/d)		
	SA9-043 Desalination plant in Balbriggan		
	SA9-048 2No. Wellfields in Mid-Kildare (8 Ml/d): Curragh Camp (4 Ml/d) & Clownings (4 Ml/d)		
	SA9-051 Impoundment in Fingal for local supply (3 Ml/d)		

WRZ	Quickest Delivery - SA Approach 2	Most Resilient - SA Approach 1	Lowest Carbon - SA Approach 1
	Option Description	Option Description	Option Description
	SA9-052 Vartry Tunnel Infiltration (3 - 5Ml/d)		
	SA9-078 New Wellfield at Johnstown (7 BHs; 4 Ml/d)		
	Networks Upgrade 2 and 3 Callow Hill to Giltspur watermain and storage requirement		

WRZ	Best Appropriate Assessment - SA Approach 1
	Option Description
GDA	SA9-084 New Shannon Source - EMR C Parteen Basin – 185 Ml/d; Boosted supply (1PS to TPR)
	Networks Upgrade 1 New Shannon Source - Dublin City Trunk Mains - Option A