Autumn 2022

Regional Water Resources Plan–Eastern and Midlands

Strategic Environmental Assessment

Environmental Report

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 are 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

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1.1 Introduction

On the 1st of January 2014, through the Water Services Act (No. 1) 2013, Irish Water assumed statutory responsibility for the provision of public water services and management of water and wastewater investment. Irish Water's role is to provide public water and wastewater services throughout the country.

Irish Water is the custodian with the responsibility to manage the precious water resource and, with Local Authority partners, secure it for future generations. It is Irish Water's responsibility to ensure that all their customers receive a safe and secure supply of drinking water and have their wastewater collected, appropriately treated and returned to the environment. Irish Water support Ireland's social and economic growth in a sustainable manner through appropriate investment in water services.

Irish Water is regulated by:

- The economic regulator, the Commission for Regulation of Utilities (CRU), which is charged with protecting the interests of the customer. The CRU also approves funding requirements to enable the utility to deliver required services to specified standards in an efficient manner.
- The environmental regulator, the Environmental Protection Agency (EPA), which sets standards and enforces compliance with EU and National Regulations for drinking water supply and wastewater discharge to water bodies. The EPA liaises with the Health Services Executive in matters of public health.
- Irish Water, like all other developers, will also be constrained by planning and environmental legislation and building control regulations when delivering its infrastructure projects.

1.2 What is the National Water Resources Plan?

Effective water services, including the delivery of a sustainable and reliable clean water supply and safe disposal of wastewater, are essential for a modern country. Being able to understand and estimate how much water is required, where it is required, and the variability of requirements over the course of the year or over time, is essential to plan appropriately for the future of the public water supply.

A Water Resources Plan is a strategic plan used to identify deficiencies and need across a water supply and to develop Plan level solutions to address these issues.

Irish Water's National Water Resources Plan (NWRP) will be the first resources plan for the public water supply in the Republic of Ireland. It will allow Irish Water to integrate Government Policy, Legislation and external factors that have the potential to impact Irish Water supplies into the planning and operation of its existing and future supply asset base.

The objective of a NWRP is to manage customer and communities needs while meeting their requirements over the short, medium and long term by ensuring safe, secure, sustainable and reliable water supplies. The NWRP will:

- Enable Irish Water to address needs across our water supplies in the most effective way over time, by identifying and in turn, prioritising what needs to be included in regulated investment cycles;
- Ensure that there is a transparent framework to develop the most appropriate projects/programmes to meet statutory obligations in relation to water supply; and
- Provide a framework to track outcomes, allowing interventions to be prioritised to bring the water supply up to the required standards in the shortest possible timeframe.

As a basis for broad public and stakeholder engagement, the NWRP (the Plan) will be delivered in two phases. In the first Phase, the Framework Plan, Irish Water consulted on the methodologies they have developed in order to identify need and find solutions to address need across all of its supplies. The Framework Plan was adopted by Irish Water in May 2021. Irish Water also assessed the need across each of the 539 public water supplies nationally, in terms of:

- **Water Quantity** that Irish Water can provide;
- **Water Quality** that Irish Water can provide; and
- Performance of and operational efficiency of Irish Water's **Asset Base**.

Water Resources Plans are reviewed on a cyclical basis to take account of new information, data, policies and laws and are usually updated every 5 years in other jurisdictions. Irish Water know things will change over the next 25 years so within the NWRP they have considered a range of possible futures, some more challenging than others. This approach is called adaptive planning, and means Irish Water are ready and flexible whatever the future holds and will formally update the NWRP every 5 years.

The requirement for the NWRP was identified in Irish Water's Water Services Strategic Plan (WSSP) published in 2014 which sets out the company's objectives in relation to the provision of water services for the State over a 25 year period.

As this is Irish Water's first NWRP, it was considered necessary to divide the public water supply system into the regional groups (as more clearly outlined in the Framework Plan and the RWRP-EM). The regional boundaries are only relevant for the development of the first NWRP and have been identified as the most appropriate way to allow Irish Water to identify Preferred Approaches (water supply solutions) in an efficient and timely manner. Once the first NWRP has been finalised, while it is comprised of the Framework Plan and four Regional Water Resources Plans, together they will be treated as a unified plan. The relevant regional groupings will have no ongoing application for Water Supply in Ireland.

The WTPs feed water into supply areas known as Water Resource Zones (WRZ). Each WRZ is an independent water supply system serving a region, town or village and is also governed by topography or the extent of the water distribution network in an area. Within a WRZ most customers receive the same Level of Service (LoS), measured as a probability of interruption to services (for example one interruption to supply in 50 years). There are 539 WRZs in the Republic of Ireland. These range in size, serving populations of less than 30 people (small rural areas) up to 1.6 million people (Greater Dublin Area (GDA)).

The Republic of Ireland has a dispersed population and water supplies were historically developed in response to need in the immediate vicinity. As a result, some supplies were developed using surface or groundwater sources with limitations in terms of quantity available and/or variable raw water quality.

Also, due to long term under investment in water services many of Irish Water's water supply assets (WTPs, water mains etc.) are in need of upgrades or additional infrastructure is required.

As a result, there are a number of key issues that impact the quality, sustainability and reliability of our existing water supplies:

- **Single Source Supplies:** Many WRZs rely on a single source of supply, meaning they are more vulnerable to interruptions to supply;
- **Unsustainable Water Sources:** Current supplies often come from small local rivers. Abstractions from small rivers can have a large impact on flow rates during dry periods which has the potential to impact their status under the Water Framework Directive (WFD). Irish Water must ensure that

abstractions do not adversely impact the environment so that Ireland can comply with its obligations under the WFD. Abstractions from small watercourses may also be more likely to be impacted by water quality issues due to upstream wastewater discharges which proportionately have a greater impact on the receiving watercourse;

- **Treatment Capacity:** Rapid growth in some areas has meant that some WTPs are undersized and treat water in quantities that exceed the original design capacity of these facilities which could lead to lower treatment efficiencies;
- **Water Quality:** Although 99.6% of samples passed quality tests in 2019, some water treatment facilities and distribution systems do not function as effective barriers to reduce risk and may not consistently ensure safe drinking water at Customer's taps. A legacy of under-investment has exacerbated the problems with some water supply assets.
- **Network Performance**: The performance of the distribution networks does not meet European norms, and leakage and distribution losses are unacceptably high. Key issues include:
    - The average age of the water mains infrastructure in Ireland is estimated at between 65 and 85 years. This compares to an EU average of 36 years.
    - The cast iron mains in our cities and towns are often heavily corroded and vary in age from 50 to 160 years, giving rise to high leakage, rust discolouration and high risk of failure causing supply disruption.
    - Other pipe materials such as uPVC and Asbestos Cement laid between the 1960s and 1980s can also be problematic with high burst frequency.
- **Constrained Funding:** Due to long term underinvestment in water services many of Irish Water's assets are at risk of failing and are in need of significant capital investment. This issue, coupled with increasingly strict EU standards regarding treated water quality and protection of the environment, are together driving the need to increase as opposed to reduce expenditure.

1.3 Progress to Date

Irish Water has made positive progress in improving water quality for their customers by developing policies and strategies for water supply. Irish Water have progressed projects and programmes to deliver the requirements of these policies. Irish Water's Investment periods, (known as Revenue Control periods) set out how much Irish Water can spend on projects and programmes for that period.

The first Capital Investment Plan covered the period 2014-2016. The second investment plan covered 2017 to 2019. Irish Water are currently implementing the investment plan for 2020-2024.

Between January 2014 and December 2019 Irish Water invested €3.9 billion in public water and wastewater infrastructure, with a further projected spend of circa €5bn by 2024. Irish Water have invested in a range of water projects and programmes that will support and enable proper planning and sustainable development at a National, Regional and Local level. The objective of this approach has been to deliver a balanced portfolio of investment across the three themes of Quality, Conservation and Future Proofing.

1.3.1 Water Quality

Irish Water aims to lift Boil Water Notices (BWN) through targeted investment. Since 2014 Irish Water has lifted 243 BWN's impacting over 1.7 million people of which, over 40,000 of these people were on

BWN's for a period of over a year. Through investment in water assets and infrastructure, Irish Water has removed 87 public water schemes from the EPA's remedial action list (RAL) between 2014 and 2020 reducing the number of WTPs on the RAL from 140 to 53. This has improved the quality and quantity of water supplied to over 555,600 people in the Eastern and Midlands Region.

Through their National Disinfection Programme they have upgraded a total of 255 WTPs and under the National Lead Programme they have replaced a total of 38,414 lead services, representing a significant investment in protecting public health.

1.3.2 Water Conservation

Conservation is a key focus for Irish Water. Its National Leakage Reduction Programme is reducing leaks across the Republic of Ireland by fixing or replacing old, damaged pipes and removing lead service pipes from the network. Through this programme Irish Water have achieved total gross leakage savings of 154.2 Ml/d on the private side and 233.2 Ml/d on the public side of the water distribution network for the 2014-2019 period.

1.3.3 Future Proofing

Between 2014 and 2019 Irish Water has delivered key outcomes to support growth including constructing 11 new WTPs and upgrading 36 WTPs. They have also laid a total of 1,906km of new and rehabilitated water main. Major national strategic infrastructure water projects have also been progressed during this time, including the Vartry Water Supply Scheme and Lough Guitane WTP in Kerry. These projects are of vital importance and critical to meeting the Republic of Ireland's growing water needs.

Despite this progress, Irish Water will have further challenges to address. Therefore, it is essential that they put in place a NWRP in order to keep making progress in a strategic prioritised way for the next 25 years. Each cycle of the NWRP will then help Irish Water inform the Capital Investment Plans for each future investment cycle.

1.3.4 Opportunities for Environmental Protection, Restoration and Enhancement

Irish Water's long-term approach will increasingly include catchment management for drinking water source protection in partnership with key stakeholders. This approach is in accordance with Article 7(3) of the Water Framework Directive and has the joint benefit of protecting our water habitats and managing the risk to our drinking water sources.

In 2019, the Irish Government declared a National Climate Change and Biodiversity Emergency to highlight the significant concerns around Ireland's biodiversity and recognizing the urgency to act on these interconnected global crises. Irish Water recognises the need to urgently increase and accelerate efforts to halt the decline of biodiversity and are committed to ensuring that infrastructure is built and managed so that our ecosystems are protected, and where possible enhanced.

Biodiversity protection is a key part of Irish Water's Biodiversity and Sustainability Policies. The overall aim of Irish Water's Biodiversity Policy is that in association with the provision of water and wastewater services, biodiversity and the natural environment are conserved, protected and where practical enhanced through our responsible stewardship, sustainable water services and strong partnerships. Irish Water launched its Biodiversity Action Plan (BAP)[1] in 2021 to deliver on this aim. The options will be

[1] Irish Water, 2021. *Biodiversity Action Plan*. [online] Available at: Biodiversity Action Plan [Accessed 6 May 2021].

developed to ensure all potential opportunities that can be afforded by the solution are realised which might include an augmentation of the option in line with the BAP.

One of the key objectives of BAP is the promotion of biodiversity enhancement including nature-based solutions (NBS) for water protection and wastewater treatment, which have significant potential to deliver biodiversity. Nature Based Solutions are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes[2]. The main functions are to improve water quality, reduce flood risk, and create habitats. Nature Based Solutions have many additional benefits that include reduction in energy usage, carbon sequestration, and amenity use for local communities. They include a broad range of measures such as: wetlands, basins and ponds, reedbeds, buffer strips and hedges and forest riparian buffers.

Some examples of NBS being utilised by Irish Water in the Eastern and Midlands Region include:

- Working in partnership with Local Authorities to support biodiversity across many of its sites including Integrated Constructed Wetlands in Clonaslee, County Laois;
- Delivering Sludge Drying Reed beds at several sites in Co. Carlow by working alongside our Carlow County Council partners;
- Working in partnership with catchment stakeholders to support initiatives such as native tree planting and bog rehabilitation, which also help to protect and restore source waters; and
- Biodiversity enhancement measures which have been in place for several years, in Ballymore Eustace, the site of Ireland's largest water treatment plant occupying 56 hectares, with habitats including wildflower meadows and native woodland.
- Identifying opportunities for the incorporation of NBS, and catchment management activities within our abstraction catchments, will continue to be encouraged and promoted through the NWRP.

1.4 Future Challenges

Ireland has a temperate climate with relatively high annual average rainfall, so while it is easy to assume that there is plenty of water available for supply, this is not always the case. Rainfall is unevenly distributed across the country, with more falling in the west than the east. Figure 1.1 shows that the areas with lowest rainfall have the greatest population density, meaning resources in the most populated areas can become stressed.

[2] EU Commission, 2014. *Policy document on Natural Water Retention Measures*.

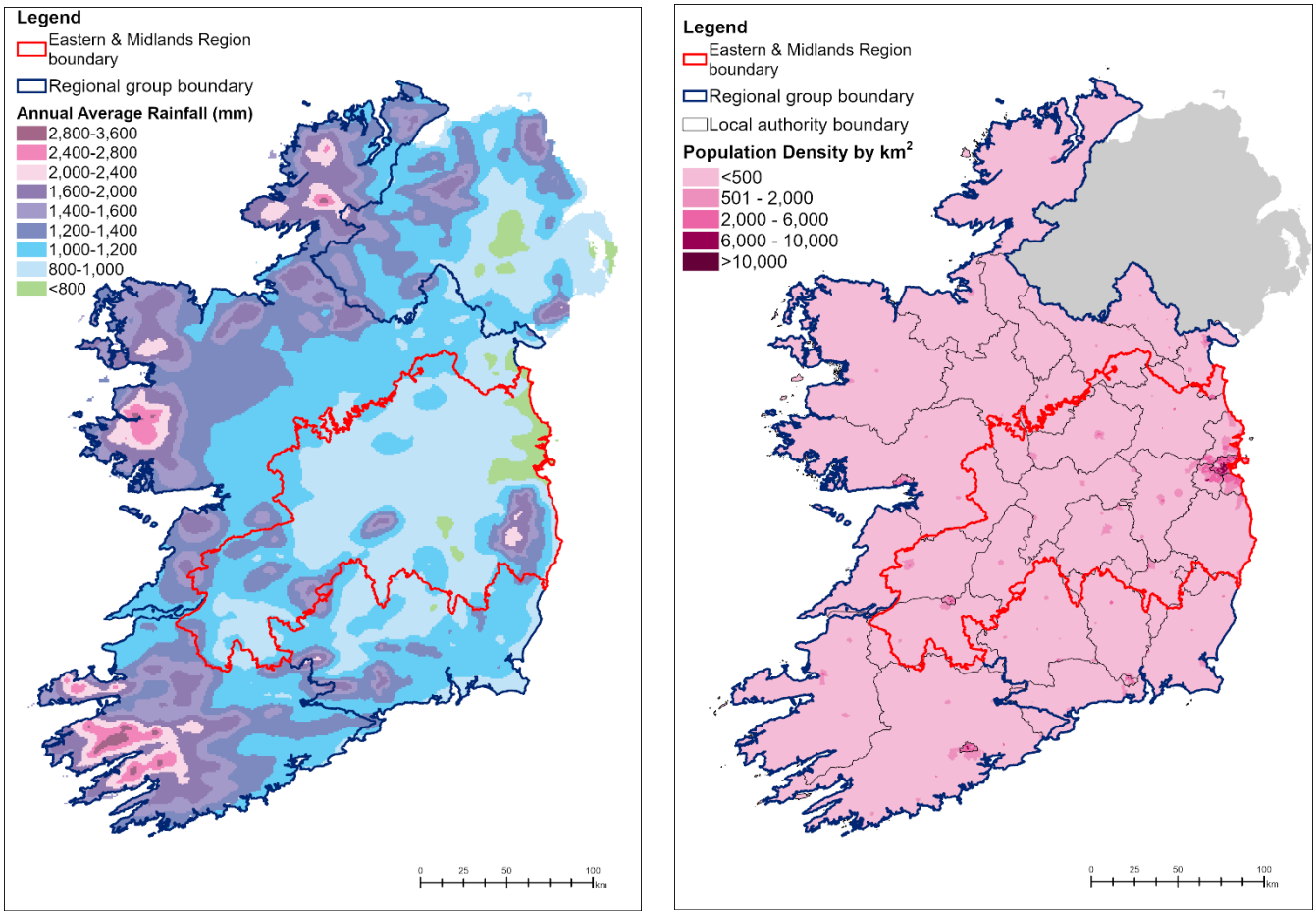


Figure 1.1 Rainfall in Ireland Compared to Population Density

In addition, Ireland also faces key challenges over the coming years, which have the potential to exacerbate the current problems with their water supplies:

- **A Growing Population:** The country's population is expected to increase by 21% or 1.2 million people over the next 25 years[3], this will impact on the demand for water;
- **Changes in Land Use and Emerging Contaminants:** Increasing pressure on the quality of water in the natural environment before it is treated, due to changes in land use, emerging contaminants and higher quality/supply standards required under the recast Drinking Water Directive;
- **A Changing Climate:** Changing weather patterns reducing available supplies and increasing the frequency of droughts and other extreme weather events that can result in interruptions to supply and impact on the demand for water; and
- **An Environment in Need:** Irish Water currently abstract water from rivers and groundwater aquifers for the purpose of water supply but we need to make sure they leave enough water in the environment to protect the health of rivers and wildlife. Forthcoming abstraction legislation, required to ensure that Ireland can meet its obligations under the Water Framework Directive, may reduce the amount of water Irish Water are able to abstract from some their sources in the future.

If Irish Water can address these challenges as part of its Plan, it will ensure that future infrastructure development is proportionate to identified need and is sustainable, reliable and resilient.

[3] See section 5.3.1 of this report on population growth and section 2.2.3 of the RWRP-EM for further explanation on estimating population growth

1.5 Development of the National Water Resources Plan

Water Resources Plans are standard practice for other utility companies across Europe that are involved in drinking water supply. However, Irish Water need to develop a plan that is specific to the Republic of Ireland which accounts for:

- Ireland's dispersed low-density population;
- The historical development of Irish Water's existing water supply system; and
- The condition of infrastructural assets and the associated risks in terms of safety and security of Irish Water's existing supplies.

Irish Water must also ensure that the NWRP aligns with current government policies, such as: Ireland 2040: the National Planning Framework, River Basin Management Plan (RBMP) second cycle (third cycle in consultation) and the Climate Change Adaptation Policy (see Appendix F: Policy Plan and Programme Review).

The NWRP covers the entire state, which is a larger geographic area than most water resource plans would consider. The content of the NWRP, which is summarised below, is consistent with a 'typical' Water Resource Plan from another jurisdiction.

As this is Irish Water's first NWRP it has been split into two distinct stages, summarised in Table 1.1.

Table 1.1 National Water Resources Plan Phases

NWRP Phases	NWRP Reports	Content
Phase 1: Framework Plan Completed	NWRP – draft Framework Plan	Need Identification including the Supply Demand Balance (SDB) Calculations NWRP Objectives Generic Options Types Options Assessment Methodology Published for consultation with an SEA Environment Report and Natura Impact Statement (NIS).
	Case Study - Study Area	Test of the Options Assessment Methodology against Study Area 5 provided as an example with the draft NWRP Framework to demonstrate the methodology. The outcomes were not part of the draft Framework Plan consultation.
	NWRP - final Framework Plan	Finalisation of the Framework Plan taking account of consultation comments. Framework Plan adopted and published with an SEA Statement and AA Determination in May 2021
Phase 2: RWRPs (Regional Plans)	Draft RWRPs (draft Regional Plans)	Application of Options Assessment Methodology and Identification of the Preferred Approach for the following regions: • North West (GA1[4]) • South West (GA2)

[4] Group Area (GA) is an alternative reference for the regional areas

NWRP Phases	NWRP Reports	Content
		• South East (GA3) • Eastern and Midlands (GA4)
	Final RWRPs (final Regional Plans)	Finalise and adopt each RWRP (Regional Plans) once their individual consultations are completed.

1.5.1 Phase 1: NWRP - Framework Plan

Phase 1 of the Framework Plan included:

- The methodology Irish Water used to develop the Plan:
- How Irish Water assess quantity need: Supply Demand Balance (SDB);
- How Irish Water assess quality and reliability need through Irish Water's Water Quality Risk Assessment - "The Barrier Assessment";
- How Irish Water addresses sustainability by ensuring that all new options for water supply must be based on conservative approaches to protecting water sources;
- Irish Water's Options Assessment Process; and
- Irish Water's Preferred Approach Development Process.
- An Assessment of Need in terms across each of our 539 public water supplies nationally in terms of:
- Water Quantity that Irish Water can provide;
- Water Quality that Irish Water can provide; and
- Performance and operational efficiency of Irish Water's Asset Base.

The Framework Plan is available online at https://www.water.ie/projects/strategic-plans/national-water-resources/

1.5.2 Phase 2: Four Regional Water Resources Plans

Phase 2 of the NWRP comprises the development of four (4) RWRPs each of which will be subject to SEA and AA. Each of the four (4) draft RWRPs and associated environmental reports will have their own public consultation phases. These public consultations will take place throughout 2021 and 2022. As this is our first NWRP, it was considered necessary to divide the public water supply system into the four (4) regional groups as shown in Figure 1.2. The regional boundaries are only relevant for the development of the first NWRP and have been identified as the most appropriate way to allow Irish Water to identify Preferred Approaches (water supply solutions) in an efficient and timely manner.

Each of the four RWRPs, together with their respective SEA Environmental Reports and Natura Impact Statement will ensure that consideration is given to the cumulative impacts and in-combination effects of the other RWRPs (this is explained further in section 6 on the methodology). Adjustments will be made to address those impacts to the fullest extent possible based on all available information.

The Regional Water Resource Plans (RWRPs) will be referred to as follows:

- Regional Water Resources Plan: North West (Group Area 1);
- Regional Water Resources Plan: South West (Group Area 2);
- Regional Water Resources Plan: South East (Group Area 3); and

- Regional Water Resources Plan: Eastern and Midlands (Group Area 4).

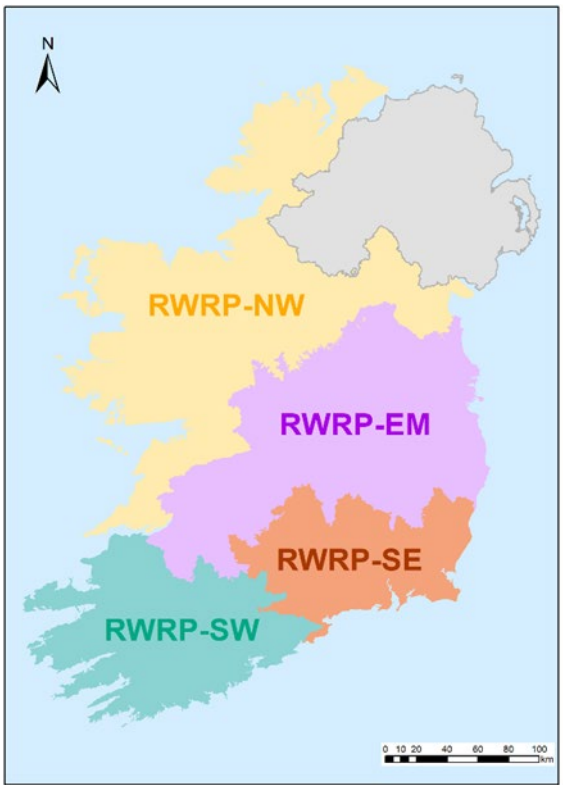


Figure 1.2 Regional Group Areas for Phase 2

These groupings reflect Irish Water's operational regions and water supply boundaries, with modifications to account for river catchments, as delineated by the EPA in the RBMP. For the purposes of preparing the RWRPs, each regional area has been subdivided into Study Areas (SAs) to assist in the identification of both need and solutions, with all of the SAs to be considered holistically in each RWRP. The SA boundaries comprise clusters of WRZs and are based on Water Framework Directive (WFD) catchments and WRZ location and type (urban and rural). This enables a coordinated approach to developing solutions to meet water quantity and quality deficits and facilitates consideration of WFD impacts.

The study area assessments follow the outline methodology established by the Framework Plan. The assessments are undertaken following SEA scoping and are informed by the scoping consultation responses. The SEA Environmental Reports will be published for consultation alongside the Regional Plans.

Each Regional Plan's SEA also comprises appendices, including a Study Area Environmental Review for each SA. These will demonstrate how the option assessment methodology has been applied for the SEA in the SAs and include:

- Introduction for SEA, WFD and AA applied at the SA level;
- Environmental baseline context;
- Environmental assessment for the options screening process and feasible options;
- Assessment of the alternatives considered and the Preferred Approach;
- Cumulative effects assessment between options within each SA and with other proposed developments within the SAs; and
- Recommendations for implementation, including mitigation and monitoring.

A summary of the whole NWRP process and the Regional Plan and environmental assessment components is provided in Figure 1.3 below. Current progress with the RWRP-EM is outlined in the red box.

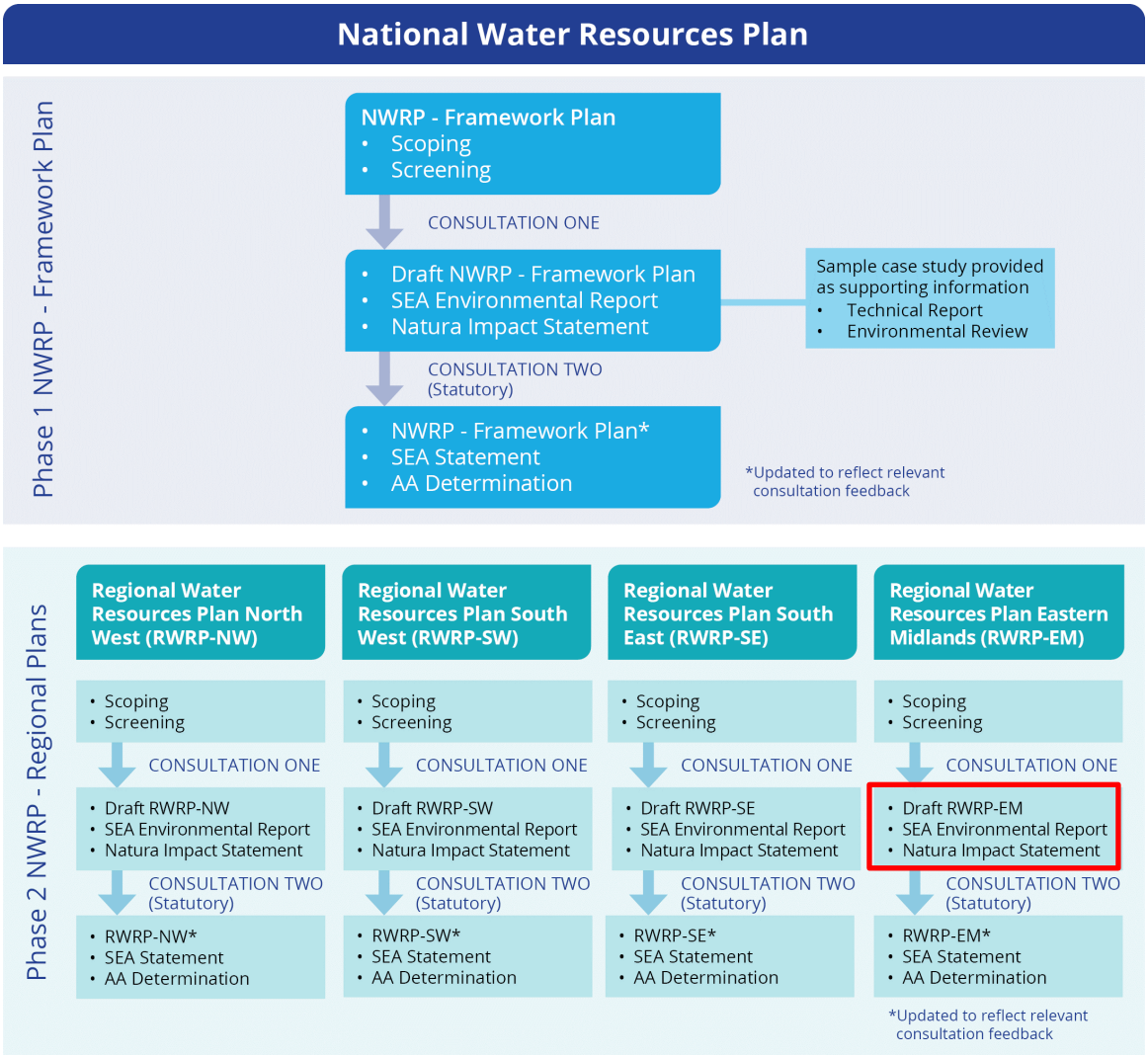


Figure 1.3 Components of the National Water Resources Plan

The SEA process including legislative requirements and influence on the Regional Plan's development are described in more detail in the sections below.

1.6 Strategic Environmental Assessment

1.6.1 This Report

This is the SEA Environmental Report which has been prepared to document the environmental assessment of the Regional Plan. This report has been prepared having regard to the SEA Directive (2001/42/EC) and its provisions that are transposed into Irish law by European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (S.I. No. 435 of 2004 as amended in 2011) (the "SEA Regulations"). This SEA Environmental Report, together with its appendices, will be published alongside the Regional Plan and notice given in accordance with Article 16 of the SEA Regulations.

1.6.2 Legislative Requirement

Council Directive 2001/42/EC of the European Parliament and of the Council of 27th June 2001 on the assessment of the effects of certain plans and programmes on the environment (the SEA Directive) established the statutory requirement for SEA as part of the development of certain plans and programmes. The SEA Directive is applicable to the Framework Plan and each of the Regional Plans of the NWRP.

The transposing Irish Regulations are the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (S.I. No. 435 of 2004) as amended by the European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011 (S.I. No. 200 of 2011).

In accordance with the overall objective of the SEA Directive as set out in Article 1, SEA is required to:

"Provide for a high level of protection to the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development…"

According to Article 2 of the Directive, "plans and programmes" means plans and programmes, including those co-financed by the European Community, as well as any modifications to them:

- Which are subject to preparation and/or adoption by an authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government; and
- Which are required by legislative, regulatory or administrative provisions.

Under Article 3(2), an environmental assessment:

"…shall be carried out for all plans and programmes, (a) which are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning or land use and which set the framework for future development consent of projects listed in Annexes I and II to Directive 85/337/EEC[5] ."

1.6.3 The Strategic Environmental Assessment Process

The purpose of SEA is to enable plan-making authorities such as Irish Water to incorporate environmental considerations into decision-making at an early stage and in an integrated way throughout the plan-making process. The SEA process is undertaken in four (4) stages. The progress for each stage of the SEA process for the Eastern and Midlands Regional Plan is summarised in Table 1.2. The SEA process for Phase 1 of the NWRP, the Framework Plan, has already been completed.

Table 1.2 Stages of SEA for the Eastern Midlands Regional Plan

Stage	Purpose and Requirements	Progress to Date / Current Status
Stage 1: Screening	Prior to starting the SEA process, a plan or programme undergoes "screening" to determine whether it requires an SEA.	SEA Screening Statement – Irish Water (as the responsible authority) determined that SEA was required for the NWRP when screening was carried out in August 2017 and was also included with

[5] Replaced by 2011/92/EU as amended by 2014/52/EU

Stage	Purpose and Requirements	Progress to Date / Current Status
		the Regional Plan EM SEA Scoping Report (June 2021).
Stage 2: Scoping	Consideration of the context and objectives of the SEA provides information on baseline data, identifies relevant environmental issues and trends, and defines the parameters of the scope of the SEA for the purpose of consultation.	SEA Scoping Report – The SEA Scoping Report set the geographical and temporal scope of the Regional Plan and SEA, the baseline environment, and a proposed framework of SEA objectives to inform the Stage 3 assessment. Formal statutory consultation was carried for 6 weeks ending in July 2021.
Stage 3: Identification, Prediction, Evaluation and Mitigation of Potential Effects	Within the context and parameters identified at the scoping stage. Identification and evaluation of likely significant effects of the Regional Plan is carried out, including consideration of alternatives and determination of measures to mitigate and monitor potential residual effects.	Environmental Report (SEA of the Regional Plan) – this report. Consultation took place alongside the Regional Plan consultation from December 2021 to April 2022.
Stage 4: Consultation, Revision and Post-Adoption	Consultation with statutory consultees and the public. This may require changes to the Regional Plan and SEA Environmental Report in light of responses. Implementation of the monitoring plan.	This stage follows on from stage 3 and involves responding to the consultation comments and incorporating into the Regional Plan, finalisation of the plan and publication of the Post-Adoption SEA Statement. **Current Stage in the SEA Process**

1.6.4 Appropriate Assessment

In addition to compliance with the SEA Directive, the preparation and implementation of the NWRP must meet the provisions of the Habitats Directive (92/43/EEC). The Habitats Directive has been transposed into Irish law by the Planning and Development Act, 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) (the “Habitat Regulations”). The Habitats Directive requires that if a plan, policy or programme is likely to have a significant effect on one or more European sites (that is, a Special Area of Conservation (SAC) or Special Protection Area (SPA), also referred to as the “Natura 2000” Network), either alone or in combination with other schemes, plans or projects, then it must be subject to Appropriate Assessment (AA).

The NWRP therefore falls under the governing legislation of the Habitat Regulations; and as a “competent authority”, Irish Water must ensure that their NWRP meets these requirements.

The Regional Plan is not directly connected with or necessary for the management of European sites. The screening for AA (Stage 1) concluded that there was potential for significant effects on one or more European sites to occur as a result of the Regional Plan. Therefore, in accordance with Article 6(3) of the

Habitats Directive, AA (Stage 2) of the Regional Plan was required. The AA screening focused on the potential for significant effects on European sites that may arise due to the implementation of the Regional Plan. A Natura Impact Statement (NIS) has been prepared and published for consultation alongside the SEA Environmental Report (and was subsequently amended in response to submissions received during the consultation process); however, the SEA and AA processes are clearly distinguished.

1.6.5 Development of the Regional Plan within the Framework Plan, the SEA and AA

The options development process which Irish Water propose to use to develop the Preferred Approach for all Regional Plans is described within the Framework Plan and was subject to a separate SEA process and finalised in May 2021. The options assessment methodology is outlined in chapter 6, with further detail available within the Framework Plan and the SEA Statement which accompanies the Framework Plan which can both be found at: https://www.water.ie/projects/strategic-plans/national-water-resources/.

SEA and AA requirements were incorporated into the development of the Framework Plan and have influenced the development of the options assessment methodology for this Regional Plan and future Regional Plans. Figure 1.4 shows how the SEA and AA reporting will align with each other and with development of the Regional Plan.

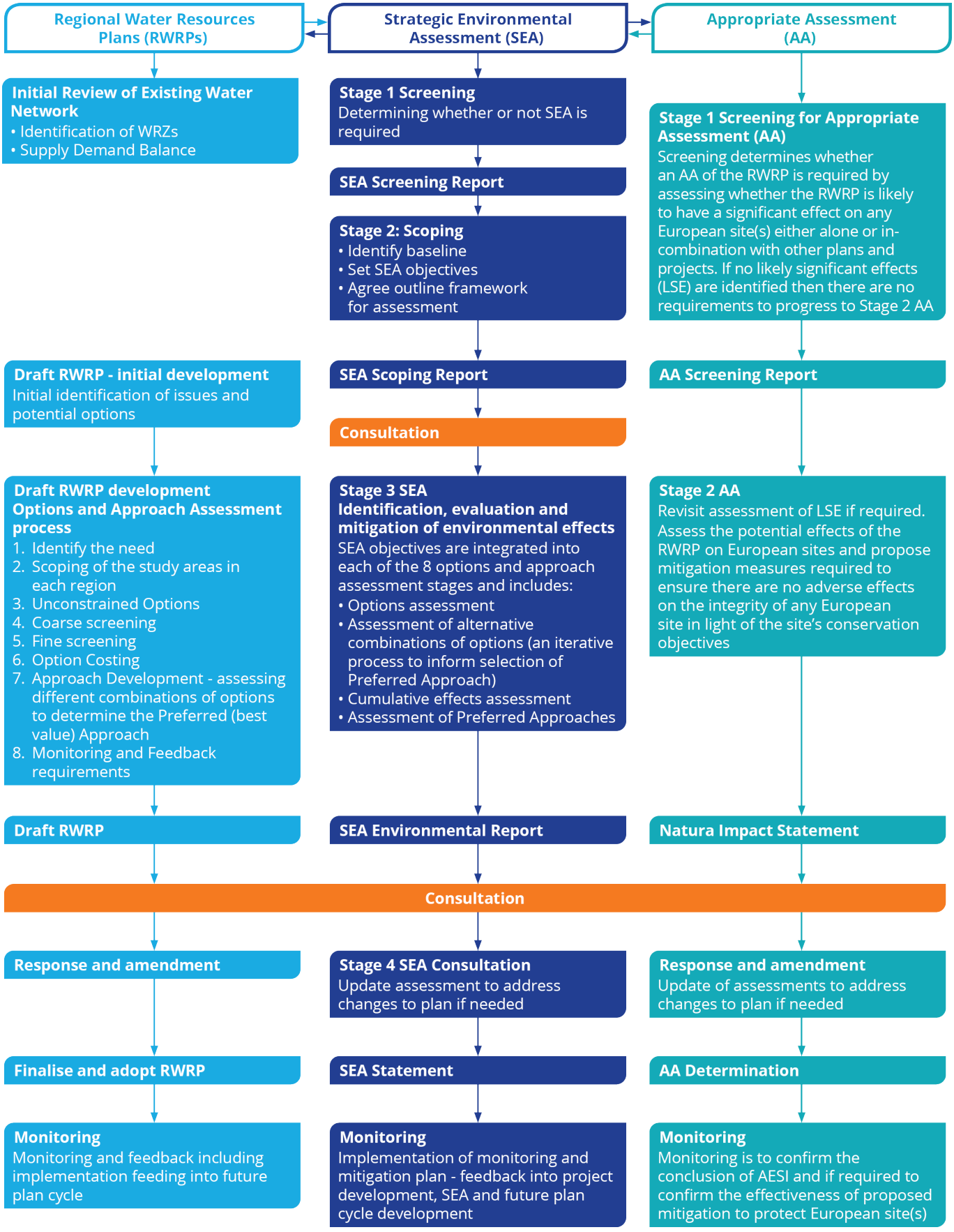


Figure 1.4 Regional Plan and Strategic Environmental Assessment Process

1.6.6 Consultation

This SEA Environmental Report has been published on the Irish Water website (https://www.water.ie/nwrp) alongside the Regional Plan and the NIS. This SEA Environmental Report outlines the assessment of the Regional Plan, including effects on the environment and proposed mitigation. In accordance with Article 11 of European Communities (Environmental Assessment of Certain Plans and Programmes (S.I. No. 435 of 2004), SEA environmental authorities, as well as any relevant transboundary authorities (for example, Northern Ireland Environmental Agency), have been notified so that they may make a submission or observation in relation to the SEA Environmental Report or the Regional Plan to Irish Water.

Irish Water have referred to this SEA Environmental Report and the NIS when preparing the Regional Plan for the Eastern Midlands area. The reports are now on display for a 12 week statutory public consultation. Further information on the consultation on the Regional Plan, SEA Environmental Report and NIS is provided in chapter 4 of this report.

2 Overview of Eastern and Midland Region

2 Overview of Eastern and Midland Region

Irish Water is planning to develop a national programme of proposed solutions for reducing and eliminating the Supply Demand Balance (SDB) deficits in their Water Resource Zones (WRZs), meet water quality requirements and bring greater resilience to the water supply network. The aim of the programme is based around the following three pillars, as shown in Figure 2.1.

- **Lose Less:** reducing water lost to the system through leakage;
- **Use Less:** reducing water use through efficiency measures; and
- **Supply Smarter:** improving the quality, resilience and security of Irish Water's supply through infrastructure improvements.

Figure 2.1 Three Pillar Approach to reduce or eliminate the SDB deficits

Together these pillars will enable Irish Water to optimise their capital and operational interventions to achieve the best outcomes and react to emerging issues.

There are 539 WRZs in Ireland. Although this is a national plan, Irish Water will review every WRZ. Due to their number, Irish Water are having to deliver the Regional Plans (and associated environmental assessments) on a phased basis and have split the country into the four (4) regional groups shown in Figure 1.2 and Figure 2.2.

The Eastern and Midlands Region was selected as the first regional group to be assessed for the following reasons:

- It includes a representative mix of small rural and large urban WRZ;
- It is the group area with the greatest overall SDB deficit;
- It is the group area with the largest population; and
- There are significant investments proposed in the region as part of the current Revenue Control 3 Investment Cycle.

Further information on the "three pillars" is detailed in section 5 of the RWRP-EM.

2.1 Eastern Midlands Region

There are 201 Water Treatment Plants (WTPs) in the Eastern and Midlands Region, which collectively serve 2.48 million people or 60% of the population of Ireland, via approximately 19,000 kilometres of distribution network. The size of these WTPs varies, with the largest two in the region producing on

average 49% of the water supplied and the remaining producing on average about 51% or 381.5 Ml/d of the total supply.

The WTPs feed water into supply areas known as Water Resources Zones (WRZs). Each WRZ is an independent water supply system serving a region, city, town or village and is governed by topography or the extent of the water distribution network in an area. Within a WRZ most customers receive the same Level of Service (LoS), measured as a probability of interruption to services (for example one interruption to the supply in 50 years).

The RWRP-EM summarises key issues that impact the quality, sustainability and reliability of our existing water supplies, in this region, including:

- Levels of Service
- Treatment Capacity;
- Water Quality;
- Network Performance;
- Abstractions potentially at risk of exceeding sustainable abstraction thresholds and;
- Constrained Funding.

In addition, Irish Water also face key challenges over the coming years, which have the potential to exacerbate the current problems in the region, including:

- A growing population;
- A changing climate;
- Changes in land use and emerging contaminants;
- Legislative changes; and
- An Environment in Need.

Addressing these challenges as part of the overall NWRP, ensures that future infrastructure development is proportionate to the identified need and is sustainable, reliable and resilient.

2.2 Eastern Midlands Study Areas

The Eastern and Midlands Region is further subdivided into nine study areas (SAs) based on Water Framework Directive (WFD) catchment and WRZ boundaries within the region, as shown in Figure 2.2.

An overview of the nine Eastern and Midlands SAs is provided in Table 2.1.

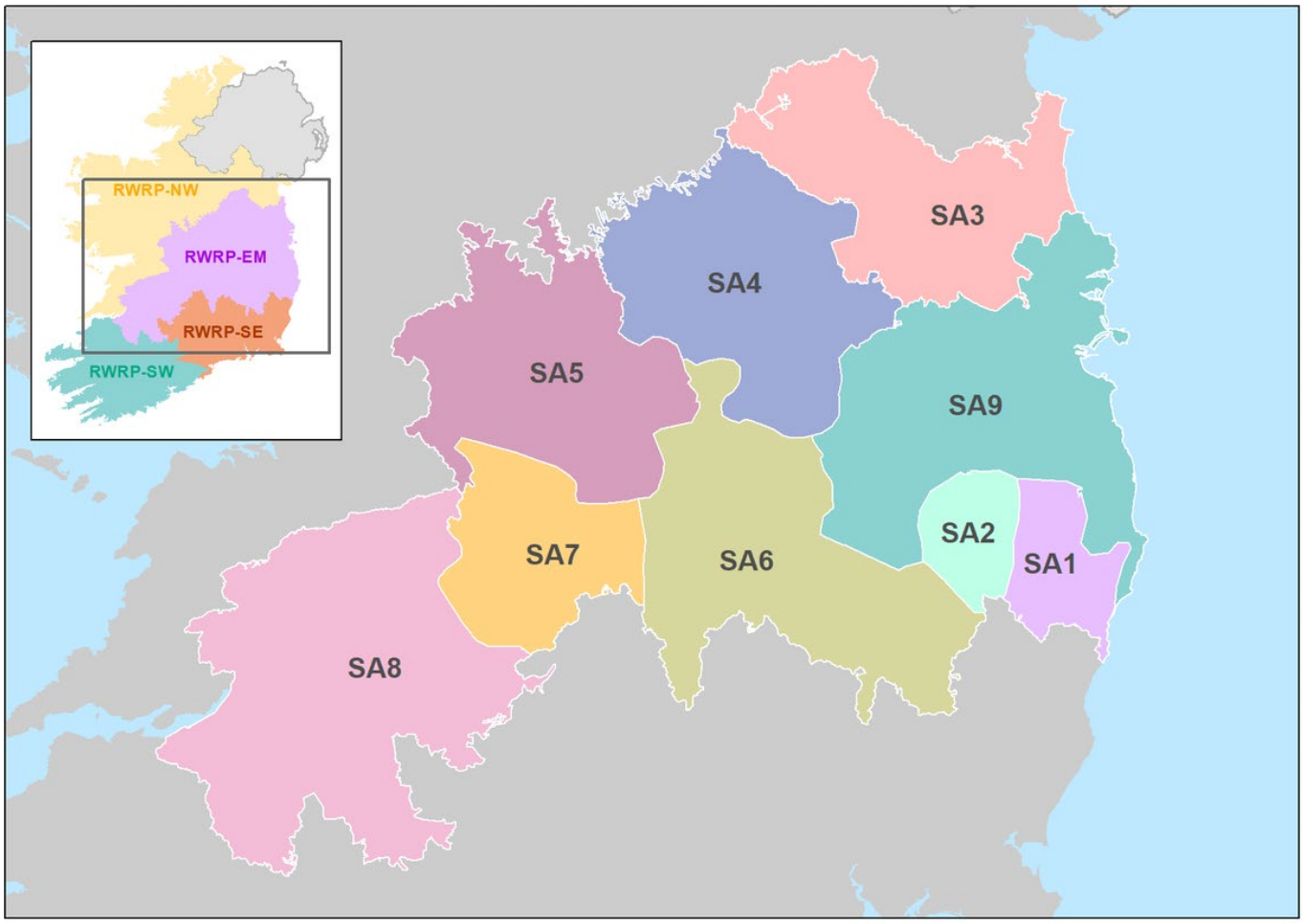


Figure 2.2 Eastern and Midlands Region Study Areas

Table 2.1 Overview of the Eastern and Midlands Study Areas

Study Area	Description
SA1	SA1 total area is approximately 681 km^2 and lies within the counties Wicklow and Wexford. The principal settlement (with a population of over 10,000) within SA1 is Arklow (CSO, 2016)
SA2	SA2 total area is approximately 545 km^2 and lies within the counties of Carlow, Kildare and Wicklow. There are no principal settlements (with a population of over 10,000) within SA2, the largest settlement is Baltinglass, with a population of 2,137 (CSO, 2016)
SA3	SA3 total area is approximately 2,402 km^2 and lies within the counties of Cavan, Louth, Fingal, Westmeath and Meath. The principal settlements (with a population of over 10,000) within SA3 are Navan, Drogheda, Laytown-Bettystown-Mornington-Donacarney and Ashbourne (CSO, 2016)
SA4	SA4 total area is approximately 2,637 km^2 and lies within the counties of Westmeath, Meath, Kildare, Longford, Cavan and Offaly. The principal settlement (with a population of over 10,000) within SA4 is Mullingar (CSO, 2016)
SA5	SA5 total area is approximately 2,589 km^2 and lies within the counties of Galway, Roscommon, Longford, Westmeath, Tipperary, Offaly and Laois. The principal settlement (with a population of over 10,000) within SA5 is Athlone (CSO, 2016)

Study Area	Description
SA6	SA6 total area is approximately 3,027 km^2 and lies within the counties of Carlow, Kildare, Kilkenny, Laois, Tipperary, Offaly, Westmeath, Wexford and Wicklow. The principal settlements (with a population of over 10,000) within SA6 are Carlow, Portlaoise and Tullamore (CSO, 2016)
SA7	SA7 total area is approximately 1,455 km^2 and lies within the counties of Clare, Galway, Laois, Tipperary, and Offaly. There are no principal settlements (with a population of over 10,000) within SA7. However, the main settlements (with a population of over 5,000) are Nenagh and Roscrea (CSO, 2016)
SA8	SA8 total area is approximately 4,176 km^2 and lies within the counties of Clare, Cork, Galway, Limerick City and County and Tipperary. The principal settlements (with a population of over 10,000) within SA8 are Limerick City and Suburbs, and Ennis (CSO, 2016)
SA9	SA9 total area is approximately 3,313 km^2 and lies within the counties of Dublin City, Dun Laoghaire-Rathdown, Fingal, Kildare, Laois, Offaly, Meath, South Dublin and Wicklow. The principal settlements (with a population of over 10,000) within SA9 are Arklow, Ashbourne, Balbriggan, Bray, Celbridge, Droichead Nua (Newbridge), Dublin City and suburbs, Greystones-Delgany, Leixlip, Malahide, Maynooth, Naas, Skerries, Swords and Wicklow (CSO, 2016)

3 Consultation

3 Consultation

3.1 Purpose of consultation and engagement

Public consultation and stakeholder engagement is a key element in ensuring stakeholders and members of the public have an opportunity to contribute to the development of plans and projects in Ireland. Irish Water is undertaking an accessible, meaningful, and accountable consultation and engagement process with stakeholders and members of the public throughout the development of the NWRP including the Regional Water Resource Plans (RWRPs).

There are two (2) main stages to the engagement and consultation relevant to the Regional Water Resource Plan Eastern and Midlands (RWRP-EM) and this SEA Environmental Report. The overall consultation process for the RWRP-EM is summarised in Figure 3.1 below:

- **Framework Plan SEA process and consultation** - including SEA scoping consultation and wider engagement on the developing options and approach assessment methodology and the publication of the draft Framework Plan and SEA Environmental report for consultation which focused on setting out the methodology to be applied through the Regional Plans. The NWRP Framework Plan Consultation adopted in Spring 2021 and it, along with the SEA Statement and AA Determination, are available on https://www.water.ie/projects/strategic-plans/national-water-resources/
- **RWRP-EM SEA process and consultation** - these apply the methodology from the adopted Framework Plan and as part of the SEA process, scoping consultation has been undertaken and responses have informed the SEA and RWRP-EM development.

In October 2017, a dedicated NWRP webpage went live on the Irish Water website at www.water.ie/nwrp, introducing the NWRP and the Consultation Roadmap. The NWRP Consultation Road map, as seen in Figure 3.1, set out the process in developing the Plan and detailed the two stages where formal consultation would be undertaken in the development of the NWRP.

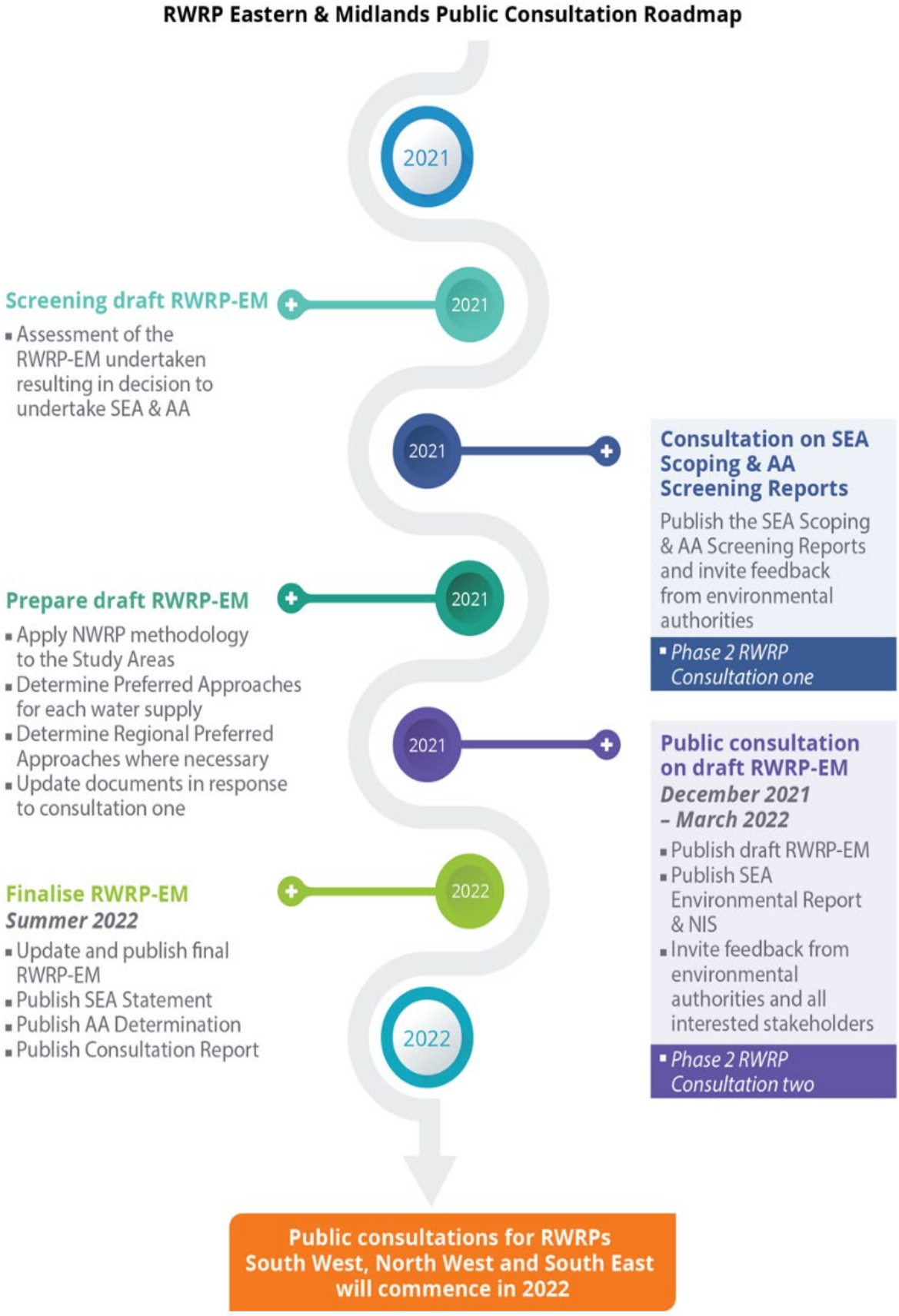


Figure 3.1 Consultation Roadmap

3.1.1 Pre-consultation 1 Engagement

The environmental authorities EPA, Department of Agriculture, Food and the Marine (DAFM), Inland Fisheries Ireland (IFI), National Parks and Wildlife Services (NPWS), Department of Culture, Heritage and the Gaeltacht (DCHG), Department of Housing, Planning and Local Government (DHPLG), Department of Communications, Climate Action and Environment (DCCAE) were invited to attend pre-consultation workshops to present key aspects of the NWRP including methodology for selecting and assessing water supply and demand management options. The workshop gave the environmental authorities a platform to feed into the development of the NWRP and SEA.

Workshop 6th December 2017 - to present an overview of the NWRP with particular focus on the Options Assessment Methodology. The workshop was attended by the EPA and involved general discussion around the scope and content to be included in the NWRP, and feedback on the scoping questions from the scoping report in relation to the NWRP and the SEA and AA process to assist the environmental authorities in making a formal submission on the Scoping Report.

Workshop 6th June 2018 - to present an update on the NWRP and case studies on the Options Assessment Methodology. Organisations that participated in this workshop included: EPA, Inland Fisheries Ireland (IFI), Department of Culture, Heritage and the Gaeltacht (DCHG), and Department of Housing, Planning and Local Government (DHPLG).

Workshop 4th December 2018 – to present the final approach for the NWRP. This was attended by EPA and IFI and covered an update to the proposed approach for the NWRP following the experience gained from storm and drought events in 2018 as well as emphasis on improving water efficiency and leakage reduction as integral to the plan approach

3.1.2 Consultation 1: Scoping Stage

The first stage of formal consultation was to inform the approach for the SEA and AA process for the NWRP. Consultation One commenced on Thursday 9 November 2017, ran for six weeks with the publication of the SEA Scoping Report, and concluded on Friday 22 December 2017. Members of the public, interested parties and environmental authorities were invited to contribute to the development of the NWRP, as part of the SEA and AA process, through public consultation.

The Scoping Report set the geographical and temporal scope of the NWRP and SEA and aimed to inform the development of the SEA Environmental Report and Natura Impact Statement (NIS). The report provided an outline of the NWRP, described the environmental characteristics of the Study Area and presented the initial understanding of the key environmental issues relating to the plan.

Irish Water invited environmental authorities to briefings and workshops to further inform them on the NWRP, SEA and AA process. Meetings were held between December 2017 to December 2018, including a briefing to the Irish Water National Stakeholder Forum, Industrial Development Authority (IDA) and the Commission for the Regulation of Utilities, Water and Energy (CRU) and a presentation made to the National Water Forum (An Fóram Uisce).

3.1.3 Pre-consultation 2 Engagement

Pre-consultation 2 workshops were held in autumn 2020 with stakeholders including the Environmental Protection Agency (EPA), Inland Fisheries Ireland (IFI), National Parks and Wildlife Services (NPWS), An Fóram Uisce (National Water Forum), Northern Ireland Environment Agency, Geological Survey Ireland and Northern Irish Water amongst others.

3.1.4 Consultation 2: Draft Framework Plan and Environmental Reports

Consultation 2 (a 10-week statutory public consultation) took place between 8 December 2020 until 16 February 2021. Irish Water facilitated two extensions to this statutory public consultation at the request of stakeholders, with consultation closing on 12 March 2021.

The draft Framework Plan SEA Environmental Report was published on the Irish Water website alongside the draft Framework Plan and the Natura Impact Statement (NIS). The Environmental Report outlined the assessment of the draft Framework Plan, including effects on the environment and proposed mitigation.

The final Framework Plan was adopted and published with the consultation Report and the SEA Statement and AA determination.

3.2 RWRP-EM Consultation

The RWRP-EM has been developed by applying the methodology from the adopted Framework Plan and SEA taking account of the consultation received through that process so there is a closely linked although a separate formal process followed for each Regional Plan.

3.2.1 Consultation 1 scoping stage

A SEA scoping report was consulted on in line with Article 9 (5) of the SEA Regulations (S.I. No. 435 of 2004), and was issued to the following authorities:

- The Environmental Protection Agency (EPA);
- Department of Housing, Local Government and Heritage (DHLGH);
- The Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media (DTACGSM)[6];
- The Department of Agriculture, Food and the Marine (DAFM);
- Department of the Environment, Climate and Communications (DECC); and
- Department of Agriculture, Environment and Rural Affairs (DAERA).

This SEA Scoping Report is available online at the following website: https://www.water.ie/nwrp.

The scoping consultation closed on the **23rd July 2021** and comments received have been considered. These comments and the responses to them are summarised in Appendix G. The main themes from the comments received were:

- Identification of recently published or forthcoming policy and legislation on abstraction licensing, climate change, and the Recast Drinking Water Directive to explain how these are taken into account and including additional consideration of the EPA's most recent State of the Environment Report (SOER 2020) (EPA, 2020) in the baseline.
- Water environment - providing an explanation on how ground water resources for supply are appropriately assessed and the standards and guidelines applied, including sufficient consideration of water quality as well as quantity, consideration of flood and drought risk.

[6] When scoping was undertaken for the Eastern and Midland Regional Plan the Minister for Minister for Tourism, Culture, Arts, Gaeltacht, Sport and Media was the appropriate Minister for the purposes of SEA and AA legislation. These functions has now been transferred to the Minister for Housing, Local Government and Heritage pursuant to the Heritage (Transfer of Departmental Administration and Ministerial Functions) Order 2021.

- Drinking water - recognition of importance of raw water quality for the environment and reducing treatment and risk to supply.
- Recommendations for collaboration and further engagement with the key stakeholders and the need to align on the RWRP with other key planning documents such as the RBMP, NPF and RSES.

Responses to the comments for the draft RWRP and SEA are provided in Appendix G and range from amendments to include additional policy in the PPP review, provision of additional explanation on how expected legislation will be addressed, provision of additional information the assessment of sustainability of surface and groundwater abstractions, commitments to improve data collection going forward, undertake ongoing monitoring and feedback within the 5 year plan cycle and for involvement in collaborative engagement for the plan development and implementation.

This SEA Environmental Report has been published on the Irish Water (https://www.water.ie/projects/strategic-plans/national-water-resources/rwrp/eastern-midlands/) alongside the Regional Plan and the NIS. This SEA Environmental Report outlines the assessment of the Regional Plan, including effects on the environment and proposed mitigation. In accordance with Article 11 of European Communities (Environmental Assessment of Certain Plans and Programmes (S.I. No. 435 of 2004), SEA environmental authorities, as well as any relevant transboundary authorities (for example, Northern Ireland Environmental Agency), have been notified so that they may make a submission or observation in relation to the SEA Environmental Report or the Regional Plan to Irish Water.

Irish Water have referred to this SEA Environmental Report and the NIS when preparing the Regional Plan of the NWRP. The reports are now on display for a 12-week statutory public consultation Further information on the consultation on the Regional Plan, SEA Environmental Report and NIS is provided in chapter 4 of this report.

3.2.2 Consultation 2: Draft RWRP-EM and Environmental Report

Consultation 2 (statutory 4-week public consultation) took place between December 2021 and April 2022. Irish Water facilitated extensions to this statutory public consultation at the request of stakeholders, with consultation closing on **8th April 2022.**

The draft RWRP-EM and the SEA Environmental Report were published on the Irish Water website alongside the NIS. The Environmental Report outlined the strategic environmental assessment of the draft RWRP-EM, including effects on the environment and proposed mitigation and monitoring proposals.

In accordance with Article 11 of the SEA Regulations, SEA environmental authorities, as well as any relevant transboundary authorities (for example, Northern Ireland Environmental Agency), were notified so that they could make a submission or observation in relation to the SEA Environmental Report or the draft RWRP-EM and NIS to Irish Water. Various communications tools were used in addition to this to promote the consultation and raise awareness and participation from the public and interested parties (see section 3.2 of the Phase 2 RWRP-EM Post Consultation Report (Irish Water, 2022a) for further details).

Responses to the consultation comments are set out in the RWRP-EM Post Consultation Report (Irish Water, 2022a). A summary of comments and responses relevant to the SEA are set out in RWRP-EM SEA Statement.

4 Review of Relevant Plans, Policies and Programmes

4 Review of Relevant Plans, Policies and Programmes

This section provides a summary of the plans, policies and programmes that have been identified as potentially important in development of the baseline environment and SEA objectives for the SEA of the Regional Plan for the Eastern and Midlands.

4.1 Review Requirements

The SEA Directive states in Article 5(1) of Annex 1 that the environmental assessment must identify

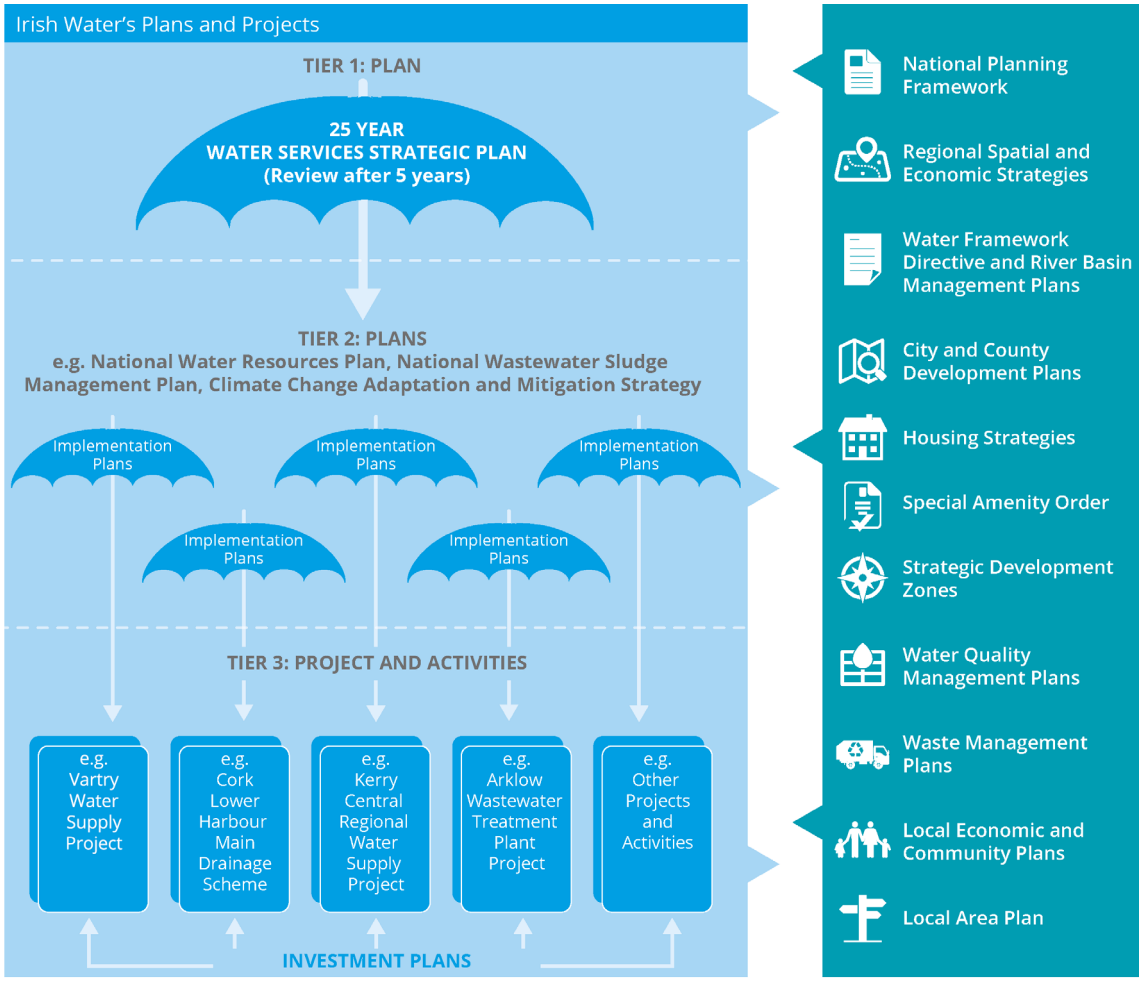
"…the environmental protection objectives, established at International, European Union or national level, which are relevant to the plan or programme, or modification to the plan or programme, and the way those objectives and any environmental considerations have been taken into account during its preparation".

In accordance with this requirement, the relationship with the relevant policy, plan programme and legislative framework was explored in order to inform the scope of the SEA and to provide a focus for identifying the baseline environment and development of the SEA objective.

4.2 Key Plans Policies and Programmes

A comprehensive review of relevant national and regional level policies, plans, programmes and legislative framework of relevance to water resource planning, including related Irish Water plans and strategies, has been undertaken and consulted upon within SEA Environmental Report for the Framework Plan available at www.water.ie/nwrp. The identified documents will also be directly relevant to the Regional Plan for the Eastern and Midlands and are provided in Appendix F (section F.1). Key influences identified at the national level which also apply to the Regional Plan include:

- UN Sustainable Development Goals (SDGs);
- EU WFD (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy);
- EU Drinking Water Directive (Directive 2020/2184 of the European Parliament and of the Council on the quality of water intended for human consumption (recast);
- River Basin Management Plan for Ireland 2018-2021 (the draft 2022-2027 Plan was published for consultation in September 2021);
- General Scheme on Water Environment (Abstractions) Bill 2018;
- National Planning Framework – Project Ireland 2040;
- National Adaptation Framework Sectoral Adaptation Planning;
- Regional Spatial and Economic Strategy (RSES) for the Eastern and Midlands Region, RSES for the Southern Region and RSES for the Northern and Western Regional Assembly; and
- Related Irish Water plans and strategies including the Water Services Strategic Plan (Tier 1 plan), National Wastewater Sludge Management Plan, Lead in Drinking Water Mitigation Plan, Sustainable Energy Strategy - Climate Change Mitigation and Adaptation Strategy, Leakage Reduction Programme and National Disinfection Programme.



It should be noted that the listing of the documents on the right of the graphic is not intended to show a hierarchy of plans or an alignment of the plans with the Irish Water Tier 1, Tier 2 and Tier 3 plans/ projects.

Figure 4.1 Interaction between the Planning System and Irish Water's Plans and Programs

A focussed list of additional local level plans policies and strategies relevant to Regional Plan for the Eastern and Midlands specifically is provided in section F.2 of Appendix F. Regional and local level plans likely to be key for the purposes of the SEA for the Regional Plan fall under five main groups as follows:

- County Development Plans, Local Area Plans and Town Development Plans - Planning Authorities are legally required to make County and City Development Plans which sets an agenda for development to make adequate provision for the scale of population growth projected;
- County Heritage Plans and County Biodiversity Action Plans - these plans help ensure targets for species and habitat conservation in the National Biodiversity and Heritage Plans are effective at a local level;
- County Climate Change Adaptation Strategies and Climate Action Plans - these strategies and plans establish future climate risks at a local level and propose actions to adapt to currently observed and future climatic changes;
- County Landscape Character Assessments - these assessments classify and describe the landscape in a county; and
- Regional Waste Management Plans.

Other relevant plans, policies and strategies considered and listed within Appendix F include Conservation Plans, Renewable Energy Strategies, Community Biodiversity Action Plans and Noise Action Plans.

These plans and policies have been taken into account in the development of the SEA objectives as described in the Framework Plan and RWRP-EM SEA Scoping Report and in the assessment criteria used to assess the options and alternatives considered in the development of the RWRP-EM. Figure 4.1 identifies how the NWRP relates to the key national, regional and local level plans, policies and strategies identified above.

4.3 Key Influences for the RWRP SEA

Key policies and plans relevant for the development of the RWRP-EM and shaping the approach for the SEA are summarised below.

4.3.1 Water Framework Directive and River Basin Management Plan

The EU WFD (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy) and the RBMP (required under WFD) are of particular relevance to the development of the Framework Plan as they set the framework for managing Irish waters from abstraction and pollution. They will strongly influence where and how much can be abstracted in creating new supplies and enhancing existing sustainable abstractions.

The WFD establishes a standard European wide strategic approach to managing surface water, groundwater, transitional and coastal water bodies, wetlands and to meeting common environmental objectives.

The WFD environmental objectives for surface waters include the following:

- Prevent deterioration;
- Aim to achieve good ecological status (or for Artificial or Heavily Modified Water Bodies, good ecological potential);
- Aim to achieve good chemical status[7];
- Aim to reduce/cease emissions, discharges and losses from priority substances and priority hazardous substances; and
- Meet protected area objectives where relevant.

The WFD environmental objectives for groundwater include the following:

- Prevent deterioration of status;
- Aim to achieve good quantitative status;
- Aim to achieve good chemical status;
- Prevent or limit the input of pollutants;
- Reverse significant upward trends in the concentration of pollutants; and
- Meet protected area objectives where relevant.

Under Article 4(1)(a) of the WFD, Ireland must adopt the necessary measures to achieve the objectives of non-deterioration, preservation and enhancement of the status of bodies of water by making the programmes specified in the RBMP operational for the achievement of the WFD environmental

[7] While WFD objective of Good Status or Good Ecological Potential exists, if a higher objective (high status) exists then that is the objective for the waterbody because of the no deterioration condition.

objectives. Both the obligations to enhance, and to prevent deterioration of the status of bodies of water, are designed to attain the qualitative objectives pursued by the EU legislature, namely the preservation or restoration of good status, good ecological potential and good chemical status of surface waters.

More details on the WFD and the current baseline and key trends for the water environment are presented in chapter 5 of this SEA Environmental Report.

The RBMP for Ireland sets out how organisations, stakeholders and communities will work together to improve the water environment and fulfil the requirements of the WFD. The RBMP is updated every six-years as part of the river basin planning cycle; the current RBMP is the second cycle and sets out what measures will be undertaken to protect and improve Irish waters (the third cycle draft RBWP was published for consultation in September 2021).

One of the key points which informed this current RBMP was the recognition that its implementation requires effective and efficient national, regional, and local structures, and thorough integration of some structures, to ensure effective co-ordination between scientific understanding of the problems to be addressed, and policy development and on-the-ground delivery. Such coordinated action is designed to protect public health, the environment, water amenities and to sustain water-intensive industries, including agri-food and tourism, particularly in rural Ireland.

Having learned lessons from the first RBMP cycle, the Government combined three River Basin Districts into one for the second RBMP, using a national and more integrated approach. The second RBMP aims to build on the positive aspects of the first cycle, and also to learn from those aspects which did not progress as well as they had expected to; for example:

- The structure of multiple River Basin Districts did not prove effective in terms of resource management and coherent management of similar challenges across the country;
- The governance and delivery structures in place were not effective and were overly complex; and
- The targets set were not realistic due to the concept of planning RBMP being new to EU member states and within the Irish context, and the level of ambition was not grounded on a sufficiently well-developed evidence base.

The Government has introduced new initiatives and policies to address many of Ireland's water quality challenges, building on the measures implemented during the first planning cycle, but also seeks to implement supporting measures on a prioritised basis; where necessary. A programme of key measures has been established, including:

- Local Authorities to put in place Support and Advisory Teams to carry out scientific assessments and to drive the implementation of mitigation measures at local level;
- Compliance with the Good Agriculture Practice Regulations will be improved through implementation of the enhanced Nitrates Action Programme for 2018–2021 and of the associated inspection regime. The Programme entails new strengthened water-protection measures, focused on intercepting and breaking nutrient transport pathways and preventing sediment and nutrient losses to water bodies; and
- Greater opportunities for public consultation and engagement.

The RBMP sets out the objectives, targets and measures to improve water bodies throughout Ireland. To improve water quality and achieve "Good" ecological status in waterbodies (rivers, lakes, estuaries and coastal waters) by 2027.

The third Cycle of the RBMP was published for consultation in September 2021 and identifies significant pressures in water bodies in relation to hydromorphology, land use planning, agriculture, siltation and hazardous chemicals. All of these pressures have the potential to reduce the amount of water which Irish Water can abstract, reduce water quality and or change suitable abstraction point infrastructure or locations. Any data that becomes available from the upcoming RBMP for the 2022-2027 period will be incorporated into the RWRP-EM as part of the plan review within the monitoring and feedback process as described in section 6.11.

4.3.2 Abstraction Licensing

In summer 2018, a draft Bill was published proposing alignment of abstraction licensing with the requirements of the Water Framework Directive. Irish Water has assessed their existing abstractions and has taken a precautionary approach based on their current understanding of how abstraction legislation might be applied, as outlined in section 3.7.2 and Appendix G Regulatory and Licensing Constraints of the Framework Plan. This suggests certain schemes may be subject to a reduction in abstraction.

As Irish Water do not have full visibility of the future regulatory regime and have not progressed through the licensing process on a site-by-site basis, they have not included their estimation of sustainable abstraction within the Supply Demand Balance (SDB) calculations. Instead, Irish Water use the hydrological yield, water treatment capacity and bulk transfer limitations in their calculation of deployable output. Irish Water use the sustainable abstraction assessment to assess the sensitivity of the Preferred Approaches (solutions) they develop as part of the NWRP.

Therefore, the Framework Plan and RWRP-EM assume that existing abstractions can continue on a transitional basis, subject to the regulatory requirements which may be outlined in any future abstraction legislation.

For these existing abstractions, further studies will be undertaken in conjunction with the EPA and appropriate stakeholders. Following investigation, if an abstraction is confirmed to be affecting a waterbody status the SDB will be updated, and solutions will be delivered through the future cycles of RBMPs and/or Regional Water Resources Plans.

As the objective of the NWRP is to achieve, safe, secure, reliable and sustainable supplies, all new abstractions developed by Irish Water as part of their Regional Water Resources Plans will be based on conservative assessments of sustainable abstraction. This will ensure that their water supplies continually improve in terms of environmental sustainability over time.

4.3.3 Drinking Water Directive ‘Recast’

The Drinking Water Directive which concerns the quality of water intended for human consumption has been revised with the adoption by the European Parliament in December 2020 of the ‘recast’ Drinking Water Directive with two years for Member States to implement. The new Directive aims to improve safe access to water and the highest standards in the world for drinking water, in line with the zero pollution ambition for a toxic-free environment announced in the European Green Deal. The new rules update quality standards and introduce a catchment level and risk-based approach. The Directive introduces the obligation for Member States to improve or maintain access to safe drinking water for all, with focus on vulnerable and marginalized groups. It also foresees better access to information for citizens regarding water suppliers, concerning for example the quality and supply of drinking water in their living area.

4.3.4 National Planning Framework – Project Ireland 2040

The National Planning Framework is a national document prepared by the DHPLG published on 16th February 2018. It will guide, at a high level, strategic planning and development for the country over the next 20 years and beyond, so that population growth is sustainable in economic, social and environmental terms.

The National Planning Framework is accompanied by the ten-year National Development Plan, together forming one plan to guide strategic development and infrastructure investment at a national level.

Irish Water have taken account of the National Planning Framework in the approach to the SEA assessment for the options required to support growth.

4.3.5 National Adaptation Framework Sectoral Adaptation Planning

Building on the work completed under the National Climate Change Adaptation Framework (NCCAF, 2012), the Department of Communications, Climate Action and Environment published Ireland's first statutory National Adaptation Framework (NAF) in January 2018. The NAF sets out the national approach to adaptation in Ireland in order to reduce the negative impacts of climate change. The framework requires each government department to develop a sectoral adaptation plan for their area of responsibility.

As part of this framework, the DHPLG produced the Adaptation Plan for Water Quality and Water Services Infrastructure. Figure 4.2 lists the acute priority impacts on water services and their associated risk controls and adaptation measures as stated in the Adaptation Plan. The NWRP is called out as an adaptation measure under all the identified acute priority impacts.

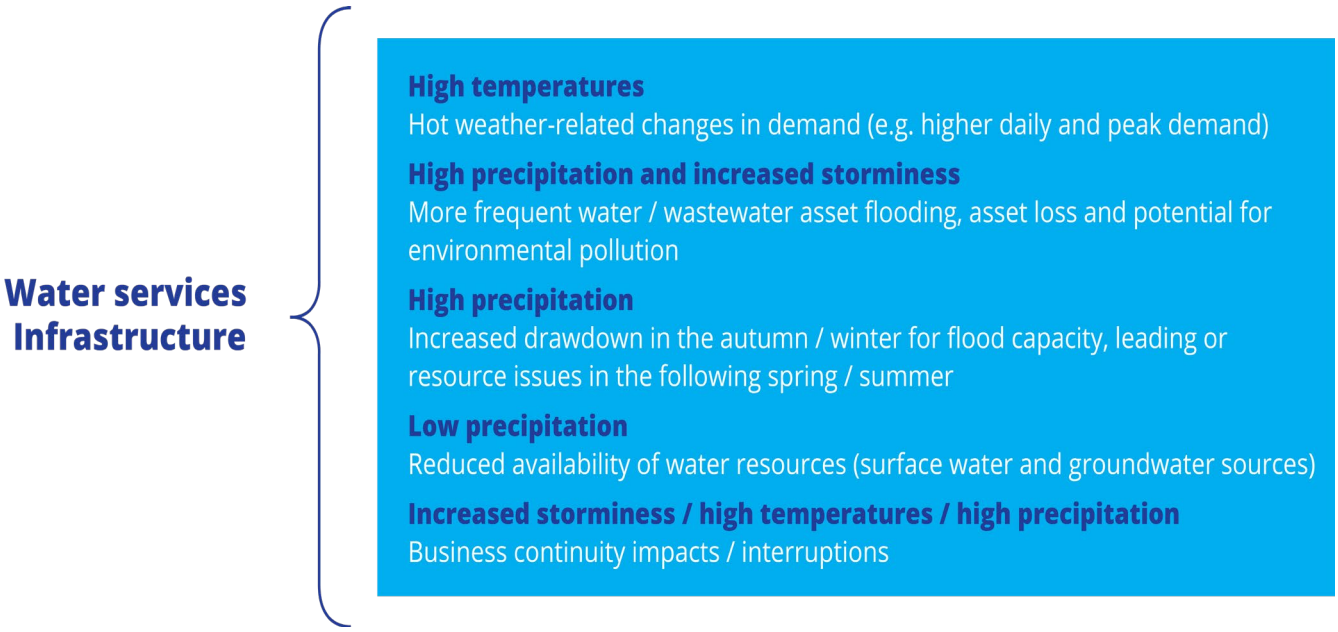


Figure 4.2 Adaptation Plan Acute Priority Impacts

4.3.6 The Climate Action and Low Carbon Development (Amendment) Bill 2021 and the Climate Action Plan 2021

The Climate Action and Low Carbon Development (Amendment) Act 2021 (Climate Act) sets out the legal framework for Ireland's transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy by no later than 2050. It provides for a 2030 interim target to halve greenhouse gas emissions, five-yearly carbon budgets, sectoral emissions ceilings, an annually updated Climate Action Plan and a Long-Term Climate Action Strategy. The 2021 Climate Action Plan was

published in November 2021 and updates the 2019 Climate Action Plan and will be updated on an annual basis going forward. The plan sets out the actions required to achieve the targets in the Climate Act in terms of the measures to cut emissions for sectors including electricity, agriculture, land use and forestry and identifying governance measures including carbon budgeting.

4.4 Related Irish Water Plans and Strategies

As illustrated in Figure 4.1, the NWRP falls into a wider hierarchy of plans and strategies. The relevance or scope of some of these plans and strategies is explained below.

4.4.1 Water Services Strategic Plan (Tier 1 plan)

The WSSP is the highest tier Irish Water asset management plan as illustrated in Figure 4.1. It sets the overarching framework for detailed Implementation Plans. The NWRP is just one of the Implementation Plans developed to achieve the objectives of the WSSP.

The WSSP has six strategic objectives; one of which is to 'ensure a safe and reliable water supply', and another to 'protect and enhance the environment'. A number of aims have been identified in order to achieve these objectives. Under the objective 'ensure a safe and reliable water supply', two of the aims to support the achievement of this are to "reducing drinking water quality problems" and to "manage the sustainability and quality of drinking water from source to tap to protect human health". Under the objective 'protect and enhance the environment', Irish Water intend to "operate our infrastructure to support the achievement of objectives under the Birds and Natural Habitats and WFDs" and "manage our residual waste in a sustainable manner". The NWRP will consider all strategic objectives and supporting aims within the WSSP during its development.

4.4.2 Other Related Tier 2 Plans

National Wastewater Sludge Management Plan

The National Wastewater Sludge Management Plan sets out the long-term strategy for the management of wastewater sludge produced at wastewater treatment plants (WwTPs) under the control of Irish Water. The siting of new wastewater sludge infrastructure has the potential to impact the same receptors affected by the NWRP, including aquatic habitats and water quality. There is the potential for opportunities and impacts in terms of how the biosolid/sludge by-product of the wastewater treatment process can be used as an organic fertiliser, which can improve agricultural soil quality. Where this replaces artificial fertilisers, there may be potential to support catchment management approaches within the Plan.

Lead in Drinking Water Mitigation Plan

In 2015, the Government published the National Strategy to reduce exposure to Lead in Drinking Water. The main aim of this strategy is to protect human health and solve the issue of lead in drinking water in Ireland. As the national public water utility, Irish Water developed the Lead in Drinking Water Mitigation Plan. Irish Water developed this to address the risk of failing to comply with the drinking water quality standard for lead due to lead pipework serving properties connected to the public water network, for which Irish Water are responsible. The Lead in Drinking Water Mitigation Plan identifies investment needs which, combined with needs from the NWRP, may influence the choice of an optimal approach.

The SEA will have to consider the potential for in-combination effects with the Lead in Drinking Water Plan. There is potential for in-combination effects on human health, biodiversity and water quality as a result of the orthophosphate treatment at Water Supply Zones where lead replacement is not feasible.

Sustainable Energy Strategy - Climate Change Mitigation and Adaptation Strategy

Improving energy efficiency is one of Irish Water's key sustainability measures for improving their carbon footprint and reducing greenhouse gas emissions. Irish Water is implementing a sustainable energy strategy to become a low carbon, energy efficient, sustainable water utility and improve energy efficiency. The strategy includes 36 business wide energy action plans and 255 discrete energy projects to improve energy efficiency, including Energy Efficient Design, Energy Innovation, Energy retrofit upgrades, Water Conservation, Renewable Energy, Lighting and Heating, Capital Maintenance, Transport and Process Optimisation. Significant progress has been made in implementing the sustainable energy strategy, in 2019, a 30% improvement in energy efficiency performance with a corresponding saving of over 75,000 tonnes of carbon was achieved. Irish Water are on track to meet their target of 33% energy efficiency improvement by the end of 2021, putting them in a strong position to meet the new target of 50% by 2030.

Energy efficiency improvement is a key mitigation measure of Irish Water's climate change policy to help ensure water and wastewater services are resilient to climate change, developing a low greenhouse gas emitting water and wastewater service. Irish Water is implementing a business wide climate mitigation and adaptation strategy, aligned with the Water Sector Adaptation Plan under the National Adaptation Framework. The strategy identifies the adaptation and mitigation actions to be undertaken to minimise the consequences of climate change on Irish Water, their customers and the environment.

4.4.3 Framework Plan Tier 3 Projects and Activities

Leakage Reduction Programme

Irish Water is undertaking a national programme of works to reduce leakage and improve water supply. This programme will see over €500 million invested in the public water network by the end of 2021. The National Leakage Reduction programme was established in 2017, as a long-term strategic initiative to sustainably tackle the leakage problem and maintain leakage savings. The programme involves finding and fixing damaged and shared water mains, pressure management and replacing the worst-performing mains in terms of leakage. Due to the implementation of this programme Irish Water are now saving 166 million litres of water every day. The programme supports the leakage reduction objectives of the NWRP and the committed and planned investments under it will need to be taken into account in the implementation of the Regional Plan. The same types of impacts identified by the Framework Plan SEA for leakage reduction options will also apply to the proposals under this programme.

National Disinfection Programme

Irish Water has developed a disinfection programme to improve the quality of drinking water across the country. The phased programme involves the upgrade and standardisation of disinfection systems currently installed in WTPs for the disinfection of contaminated sites across the country. The programme supports the quality objectives of the NWRP. The programme is complete in SA2, SA3, SA5 and SA6 and ongoing in the remaining study areas and progress will be taken into account in the baseline for the Regional Plans so that priorities for future investment can be considered in the options assessment process in the development of the Regional Plans.

5 Baseline Environment

5 Baseline Environment

This section sets the proposed geographical and temporal scope of the SEA for the Regional Plan, and provides environmental baseline information on key environmental topics including:

- 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; and
- Geology and Soils.

5.1 Scope of the Assessment

5.1.1 SEA Geographical Scope

At this stage of the assessment the core baseline area for the SEA of the Regional Plan for the Eastern and Midlands is the area covered by the nine (9) study areas which comprise the Eastern and Midlands Region (see Figure 5.1) and sites designated for nature conservation that are hydrologically connected to waterbodies in the core baseline area. The assessment process undertaken for the SEA and AA (see section 6.15) during evolution of the Plan will consider the potential for linkages of this type, and where necessary, the geographic scope of the core baseline area will be extended accordingly.

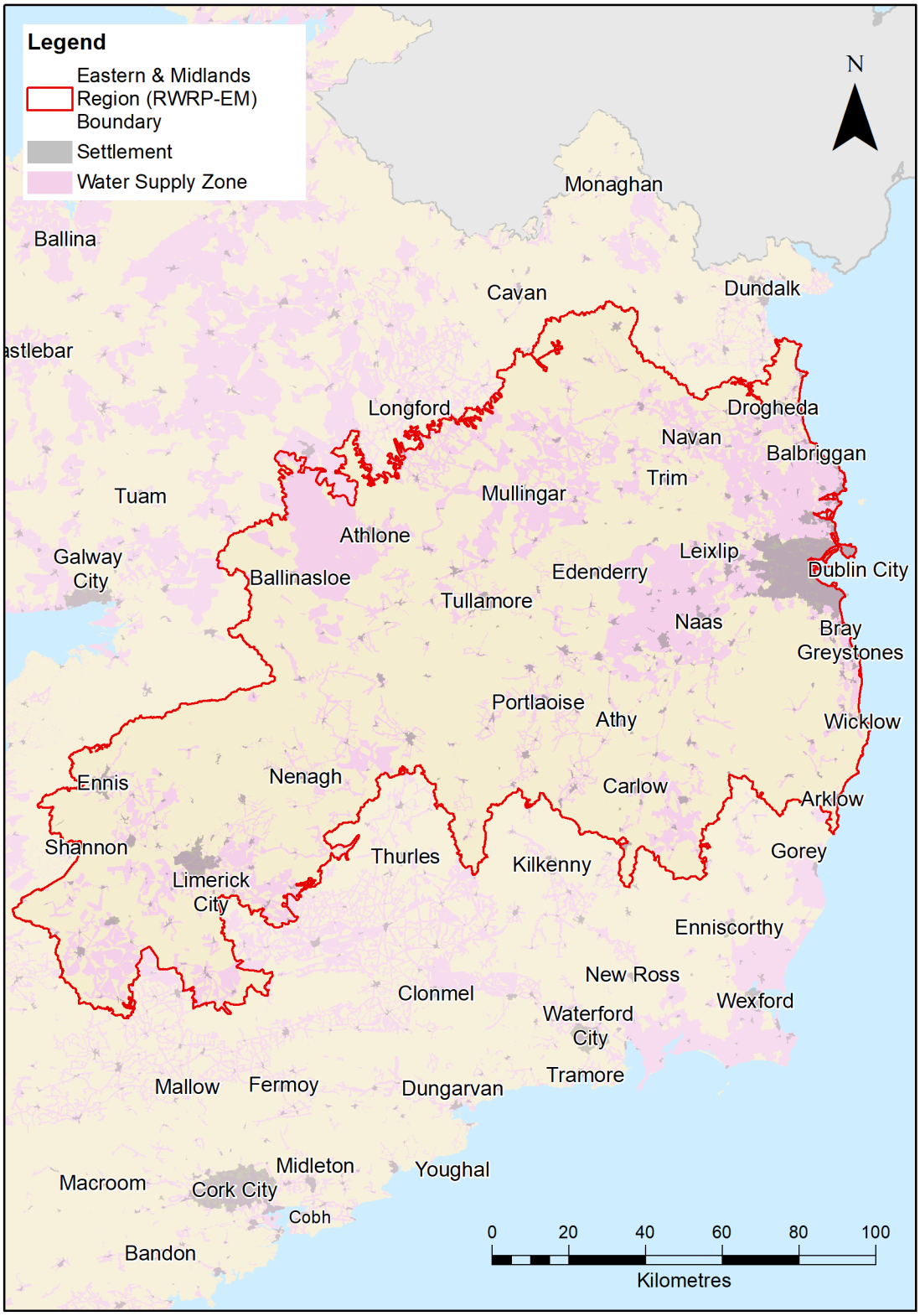


Figure 5.1 Water Supply Zones and Key Settlements in the Eastern and Midlands Region

5.1.2 Transboundary Effects

The RWRP–EM will solely cover Irish Water's operational area for the Eastern and Midlands which lies approximately 20km from the boundary between the Republic of Ireland and Northern Ireland (see Figure 5.1). Transboundary effects are not expected on the basis that the border with Northern Ireland is at the distance noted, there are no shared groundwater WFD water body units, and the one shared hydrometric area (area 06 Newry, Fane, Glynde and Dee - a small area north of Drogheda) predominantly discharges to Dundalk Bay. Transboundary policies and plans have been reviewed as

listed in Appendix F and potential for transboundary effects associated with plan proposals have been considered through the assessment process and findings are included in this Environmental Report. No transboundary effects have been identified through this process. The RWRP-EM, SEA Environmental Report and NIS will be provided to the relevant Northern Ireland agencies as part of the consultation process.

5.1.3 SEA Temporal Scope

The proposed temporal scope for the SEA is the 25-year period between 2019 and 2044 that is covered by the Framework Plan and RWRP-EM.

5.2 High Level Environmental Trends in the EM Region and Across Ireland

The EPA's latest State of the Environment Report (SOER 2020) (EPA, 2020) provides:

- An assessment of the overall quality of Ireland's environment;
- An outline of the pressures being placed on this environment; and
- The key actions that can address these pressures.

The following areas identified as challenges to address across Ireland within the SOER 2020 are particularly pertinent to development of the RWRP-EM:

- **Climate:** high greenhouse gas (GHG) emissions continue, and the scale and pace of GHG reductions must accelerate to meet 2019 Climate Action Plan targets;
- **Water:** deteriorating water quality trends over the last 20 years, particularly for rivers; and
- **Nature:** deteriorating protected habitat trends, with 85% of EU protected habitats having unfavourable status. Trends for EU protected species are mixed, however freshwater species are most at risk and some freshwater species are under threat.

Waste and the circular economy and air quality are also areas where further action is needed to meet long-term objectives and targets. Further detail regarding the baseline environment for each of these topic areas is provided in the following sections.

These three key challenges of relevance to the RWRP-EM are directly linked to the following UN Sustainable Development Goals (SDG):

- **SDG 13 Climate Action:** Take urgent action to combat climate change and its impacts;
- **SDG 14 Life Below Water:** Conserve and sustainably use the oceans, seas and marine resources for sustainable development; and
- **SDG 15 Life On Land:** Protect and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Significant population increase is anticipated over the coming two decades, which is an important consideration for water demand, and subsequently for the water environment and compliance with the WFD Directive and SDG 14. Section 3.2.5 of the RWMP-EM sets out the projected demand in this region over the next 25 years versus existing supply, taking into account where reductions in abstraction volumes are known to be required for sustainability reasons.

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

5.3.1 Population

The Eastern and Midlands Region falls within all three (Northern and Western, Eastern and Midlands, and Southern) Regional Assemblies areas in Ireland. Table 5.1 provides an overview of the population of the study areas (SAs) within the RWRP-EM region and the projected increases in population between 2019 and 2044. Each SA is divided into several (Water Resource Zones) WRZs, and the average percentage population increase during the Plan period anticipated across WRZs within each SA is also shown in Table 5.1.

Table 5.1 Overview of the Population within the RWRP-EM Area

SA No.	SA Name	Total Population[8]		Change in Population %
		2019	2044*	
SA1	Mid Wicklow	24,050	29,090	21.0
SA2	West Wicklow	6,840	7,890	15.3
SA3	Meath	189,980	230,580	21.4
SA4	Westmeath	87,870	107,080	21.9
SA5	Offaly/ Roscomon	71,940	90,960	26.4
SA6	Laois	126,670	153,500	21.2
SA7	North Tipperary	31,240	37,440	19.8
SA8	Limerick Clare	233,560	319,710	36.9
SA9	Greater Dublin Area	1,702,250	2,118,530	24.5
Total		**2,474,400**	**3,094,780**	**25.1**

*Growth projections used within the RWRP were based on best available data from the National Planning Framework (NPF) and the Regional Spatial and Economic Strategies (RSESs) at the time of compiling our RWRP, i.e. the growth projections for the cities were taken from the NPF and RSESs, with projections for the Regional Growth Centres and Key Towns taken from the RSESs. For all other areas, the growth projections were taken from the Draft NPF. In addition, Irish Water recognise the ongoing work between the Regional Assemblies and the local authorities over the course of the development of the Local Authority County/City Development Plans. As these plans are finalised, Irish Water will incorporate the increasingly refined growth rates into our demand forecasts.

The overall estimated regional population growth is 25% from 2019 to 2044. All SAs in the region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016. The Limerick Clare SA has the highest projected growth rate at 37%, which is driven by the Limerick City forecast growth of 61% by 2044.

5.3.2 Economy and Employment

Study areas or parts of SAs located within Dublin, the Mid-East and Mid-West regions had a household disposable income per person in 2016 that was above the average for Ireland. Household disposable income was below the Ireland average in those areas located in the West, Midland and South-East regions (CSO, 2020a).

Unemployment rates in 2017 were also highest in the Midlands (10.1%) and Mid-West (8.7%) regions, and lowest in Dublin and the South East (see Table 5.2). However, unemployment data for Q3 2020 shows a very different pattern, with highest rates of unemployment seen in the Dublin area followed by

[8] Population values are rounded to the nearest 10.

the South East (CSO, 2020b). Whilst the economic impact of COVID-19 has affected some employment sectors (for example tourism, hospitality, retail) more than others, it is uncertain how this trend might play out in the coming years.

Table 5.2 Unemployment Rates in 2017 and Q3 2020

Region	Unemployment rate 2017 (%) (CSO, 2017a)	Unemployment rate Q3 2020 (%) (CSO, 2020b)
Dublin	6.6	8.2
Mid-West	8.7	6.8
Midland	10.1	6.9
Mid-East	7.5	6.8
West	7.4	6.4
South-East	6.4	7.7

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 the aim to increase housing stock. New dwelling completions for Q3 2019 and Q3 2020 are shown in Table 5.3. Whilst there was a drop in new dwelling completions of 13.6% between 2019 and 2020 across Ireland, associated at least partly with COVID-19 restrictions on the construction industry, the regional trend in completions has not altered; with the highest numbers seen in Dublin and the Mid-East in Q3 of both years. However, the Mid-East did have a higher number of new dwellings than the Dublin region in 2020. New dwelling completions in Dublin and the Mid-East represented 47.8% of the completions in Ireland in Q3 2020.

Table 5.3 New Dwellings Completed Q3 of 2019 and 2020

Region	New dwellings completed in Q3 2019 (CSO, 2019)	New dwellings completed in Q3 2020 (CSO, 2020d)
Dublin	1,912	1,145
Mid-West	326	347
Midland	219	214
Mid-East	1,499	1,303
West	434	432
South-East	397	441

5.3.3 Non-Domestic Growth

Within the RSES and the NPF there are also projections of non-domestic growth. The precise nature of the business activity created to drive non-domestic growth can have a significant impact on water demand as non-domestic water demand varies enormously from sector to sector and property to property. Therefore, an allowance has been made in the RWRP-EM for non-domestic growth in towns and cities identified as strong growth areas in Project 2040. For other areas it has been assumed that there will be no significant increase in non-domestic demand.

5.3.4 Tourism and Recreation

Tourism has an important role in the core baseline area, particularly in rural locations, 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 core baseline area is located within Ireland's Ancient East, Hidden Heartlands and the Wild Atlantic Way, three of Fáilte Ireland's tourism programmes in the country. The Ancient East is part of a tourism development strategy that covers the South, East and part of the Midlands, emphasising the importance of historic sites in the area (National Tourism Development Authority, 2016). The Hidden Heartlands is located in the Mid-West, focussing on rural communities (Fáilte Ireland, 2020a), and Ireland's Wild Atlantic Way, which is Ireland's first long-distance touring route, aims to achieve greater visibility for the west coast of Ireland (Fáilte Ireland, 2020b).

Key tourist attractions located within the core baseline area are described below:

- The county of Wicklow (SA1 and SA2) has been described as *"the garden of Ireland"*, containing Ireland's largest national park (Wicklow National Park) and emphasising outdoor recreation as a key asset for the area (Visit Wicklow, 2020);
- Boyne Valley (SA3) has been described as *"Ireland's ancient capital"* and contains Ireland's UNESCO World Heritage Site at Brú na Bóinne (Newgrange and Knowth) as well as Ireland's largest Anglo-Norman castle at Trim (Meath County Council, 2020);
- The county of Westmeath (SA4) has been described as *"a county… where Ireland's Ancient East meets Ireland's Hidden Heartlands"* (Visit Westmeath, 2020) and Offaly as *"Ireland's hidden gem"* (Visit Offaly, 2020);
- The county of Roscommon (SA5) has been described as the *"Land of Memories"*, with emphasis placed on the county's cultural and historical attractions (Visit Roscommon, 2020); the county of Galway also emphasises these aspects (Visit Galway, 2020);
- The county of Laois (SA6) has been described as an *"outdoor enthusiasts paradise"* with emphasis also placed on the county's cultural and historical attractions (Laois Tourism, 2020); the county of Carlow also emphasises these aspects (Carlow Tourism, 2020);
- The county of Tipperary (SA7) has been described as the *"farming heartland of Ireland"* with emphasis also placed on the county's cultural and historical attractions (Tipperary Tourism, 2020). Additionally, the county of Offaly (SA7) highlights the importance of the county's natural assets, such as bog lands and mountains (Visit Offaly, 2020);
- The county of Limerick (SA8) includes Limerick City, the first city of culture, and emphasises the importance of sports in its touristic appeal (Limerick City and County Council, 2020). The county of Clare also emphasises the county's natural assets, particularly the rivers and lakes of East Clare (Visit Clare, 2020); and
- The city of Dublin (SA9) 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". 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).

Ireland's natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport (2019). Key natural heritage and outdoor recreation attractions within the core baseline area include:

- Study Area 1: Wicklow Mountains and Glenealo Valley National Parks, and the Glendalough and Vale of Clara Nature Reserves;
- Study Area 2: Wicklow Mountains National Park;
- Study Area 3: the two main rivers in Meath, the Boyne and the Blackwater, join at Navan and is the most historic waterway in Ireland, rich in aquatic life, and the salmon and trout are recognised as among the finest in Ireland;
- Study Area 4: Raheenmore Bog and Scragh Bog natures reserves, and the lakes of Westmeath;
- Study Area 5: Mongan Bog, Clara Bog and Redwood Bog nature reserves;
- Study Area 6: Slieve Bloom Mountains, Timahoe Esker, Grantstown Wood and Grantstown Lough, and Coolacurragh Wood nature reserves;
- Study Area 7: Lough Derg is the third largest Lough in Ireland and is particularly popular for recreational water activities;
- Study area 8: Dromore, Caher (Murphy), Pollnaknockaun Wood, Derrycrag Wood and Rosturra Wood nature reserves; and
- Study Area 9: Pollardstown Fen, North Bull Island, Knocksink Wood, Glen of the Downs and Deputy's Pass nature reserves, and Wicklow Mountains National Park.

The River Boyne in Meath (SA3), is a renowned angling waterway with extensive stocks of Wild Brown Trout and the Grand and Royal Canal and their associated greenways provide an amenity for navigation, walking and cycling. Lough Ree (SA5) and the River Shannon, one of the most scenic waterways in the region, are a key recreation and amenity attraction.Rivers, loughs and coastal areas across the core baseline area also all make an important contribution to tourism and recreational opportunities and support important fisheries.

5.3.5 Human Health

Table 5.4 provides well-being indicators for the core baseline area. Improvements in air quality, access to good quality drinking water and participation in recreation activity can all have a positive influence on health and well-being.

Table 5.4 Well-Being Indicators for the Core Baseline Area

Region	Life expectancy (CSO, 2017b)	Participation in sports, fitness or recreational physical activities (% of persons aged 15+) (CSO, 2020c)	Air quality (EPA, 2020)
Mid-East	Male: 77.2 Female: 81.4	49	Good
Midland	Male: 77.2 Female: 81.5	47	Good
Mid-West	Male: 76.3 Female: 80.4	52	Good

Region	Life expectancy (CSO, 2017b)	Participation in sports, fitness or recreational physical activities (% of persons aged 15+) (CSO, 2020c)	Air quality (EPA, 2020)
West	Male: 77.1 Female: 82.7	56	Good
South East	Male: 76.8 Female: 81.7	44	Good
Dublin	Male: 76.7 Female: 81.2	61	Good

Key issues for public health include reliable access to good quality drinking water. This has water quantity and water quality components.

Water resources for supply

Regulated water service providers have to ensure appropriate service standards of supply and be able to endure drought conditions, peak events, and maintenance downtime on their assets. This requires reserve capacity in supplies. At present, the supplies across the RWRP-EM region do not have the reserve capacity to meet these levels of service at all times. Due to the limited historical monitoring of these supplies, particularly in relation to groundwater, this will need to be studied further. Study Area 9 has a chronic capacity deficit and Irish Water's built assets are operating beyond their sustainable operating capacity on a daily basis and it is often necessary to depend on treated water storage to meet short term deficits.

Currently for day-to-day operations, the majority of WRZs within the RWRP-EM Study Areas suggest a Supply Demand Balance (SDB) deficit (based on a "do minimum" approach) under present and future scenarios (see Table 5.5 for a breakdown by study area). While sufficient in normal weather conditions, several would fail in drought.

During the drought in Summer 2018, all of Irish Water's groundwater supplies were being monitored due to falling groundwater levels and a number of Irish Water's supplies were impacted in terms of quality or quantity, including:

- Study Area 1: two supplies were severely impacted, namely, Barndarrig and Kirikee;
- Study Area 2: one of the larger supplies at Dunlavin was severely impacted;
- Study Area 3: demand in the South Louth East Meath WRZ increased to levels greater than the safe production capacity;
- Study Area 4: one of the supplies in SA4, Toberdaly, which abstracts from the Daingean groundwater body, was noted as having a significant reduction in water available for abstraction. The levels in two of the surface water abstractions in SA4, namely Lough Owel and Lough Lene, were also severely affected during the drought;
- Study Area 5: Ahascragh Spring and Rahan Tully boreholes, which abstract from the South Suck and Tullamore groundwater bodies respectively. The sources were noted as having a significant reduction in water availability during this period. The water levels in the River Suck, supplying

Ballinasloe, were also severely impacted during the drought and low flow interventions were required to maintain continuity of the public water supply;

- Study Area 6: Nanny's Well supplying Clogh-Castlecomer, Kilminchy boreholes supplying Portlaoise, Lough borehole supplying Portarlington, Knocks borehole supplying Mountrath, and Newgate well supplying Mountbolus. All of these groundwater sites were noted as having a significant reduction in water levels/availability during this period. A significant reduction in flow was recorded on the River Slaney supplying Rathvilly (Carlow) and low flow interventions were required on the River Burren, River Dinin, and Clodiagh River supplying Carlow Central, Clogh-Castlecomer and Clonaslee respectively, to ensure continuity of supplies;
- Study Area 7: Lorrha/Rathcabin, Dunkerrin and Cloughjordan supplies were severely impacted;
- Study Area 8: Pallasgreen, Oola and Hospital, were severely impacted and water had to be supplemented via tankered supplies for the duration of the drought. Significant reduction in surface water flow was also recorded on the River Maigue, supplying Adare and low flow interventions were required on the River Deel, supplying Foynes Shannon Estuary WRZ.
- Study Area 9: a Water Conservation Order was implemented in order to protect water supplies and reduce pressure on the natural environment during this period. Irish Water continue to promote 'Water Conservation Activities', collecting and monitoring data over a number of years to assess the benefits.

Demand for water was also higher than normal during this period, driven by high temperatures and while disruption to customers and environmental impacts were minimised as a result of emergency plans and activities carried out by Irish Water and Local Authorities customers experienced some impacts, including reductions in water pressure and some temporary loss of supplies, principally as a result as a lack of capacity in the existing infrastructure including for example:

Night-time restrictions in critical areas to conserve supplies;
Provision of alternative water supplies to customers (Bowsers, stand pipes and bottled water), attention to critical customers, healthcare customers and vulnerable customers.

Water quality for supply

The risk to drinking water quality in the Eastern Midlands region due to inadequate protection against key drinking water parameters (including bacteria and virus, protozoa and triahalomethanes) is high, with 181 out of the 201 water treatment plants assessed as high risk of not meeting for one or more of the water quality Barriers representing Irish Water's internal asset standards. These standards are not an assessment of compliance with Drinking Water Quality Regulations but rather an internal conservative gauge to indicate where works are required.

Barrier 1: 49% of WTPs in the Eastern and Midlands Region are classified as "high risk" of failing to achieve the required disinfection standard, while 42% are considered to be at "medium risk" of failing to achieve the required disinfection standard.

Barrier 2.1: More than half of the water supply system have a "low risk" of issues associated with maintaining residual chlorine through the network; however, 39% are at "high risk" of failing to maintain the required residual.

Barrier 3: 53% of WTPS are classified as "high risk" of failing to effectively remove protozoa, while 12% are considered to be at a "medium risk" of failure.

Barrier 6: Most of the WTPs in the Eastern and Midlands Region's (86%) have a "low risk" of issues associated with removing THMs. There are a small number (6%) that are at "high risk" of failing to maintain the required levels of THMs.

The reliability of the water supply system is impacted by deficiencies in the WTPs and critical infrastructure.

Poor water quality can be linked to risks to health, although this is more likely to be experienced as reduced levels of service and inconvenience in some cases due to 'notices to boil' or alternative supply provision., Many supplies in every Study Area within the Eastern and Midlands Region appear to have significant water quality treatment risks based on Irish Water's own barrier assessments (see Table 5.5). In addition, as shown in Table 5.5 a number of supplies are either on the EPA Remedial Action List (RAL) or are subject to an EPA direction, Irish Water are currently progressing corrective action in relation to many of these supplies in advance of the Regional Plans.

Table 5.5 Water Quality and Supply Risks

Study Area	Current number of WRZs with SBD deficit (total number WRZs)	Number of Supplies with Confirmed Significant Water Quality Risks (Irish Water barrier assessments)	Number of Supplies on EPA Direction or RAL
SA1	13	16	2
SA2	7	11	0
SA3	8	18	5
SA4	7	13	1
SA5	5	14	1
SA6	22	40	2
SA7	4	17	2
SA8	21	39	3
SA9	1	11	1

National programmes being implemented to address asset reliability and water quality issues include:

The **Source Protection Programme** which develops or upgrades groundwater sources.
The **Reservoir Cleaning Programme** which involves inspections of reservoirs and the development of a prioritised works (cleaning/repair) schedule for implementation. The programme aims to reduce network water Quality issues.
The **Disinfection Programme** which consists of chlorination upgrades and/or UV installations/upgrades to help resolve network water Quality issues.
The **Lead Mitigation Programme** which is a pilot programme that involves the addition of orthophospate (a food additive) to the water to prevent lead in domestic pipes dissolving into drinking water. This programme will run in parallel to the Targeted Lead Services Replacement of all lead pipework on the public parts of the distribution system and the Government National Lead Strategy.
Trihalomethane (THMs) Reduction works (Box 5.1)

Box 5.1 – Trihalomethanes

Trihalomethanes are a by-product that can be formed when Irish Water disinfects* water supplies that contain naturally occurring organic matter. Within the Drinking Water Regulations, the maximum permitted levels of THMs in drinking water is set at 100 mg/L. When Irish Water took over the public supply in Ireland in 2014 it was estimated that 74 water supply zones (WSZs) within the public water supply were at risk of exceeding the limits for THMs. The European Court of Justise initiated an infringement case against Ireland for failing to address this issue.

Since then Irish Water has invested in the water supplies and resolved the THM issues in 57 of the 74 WSZs originally listed as part of the infringement case. The remaining 17 WSZs cover a population of 181,000, and will be addressed as follows:

A further 8 supplies will be removed from this list by the end of 2021 (a reduction in impacted population of 129,000)

The remaining 9 supplies will be permanently resolved by 2024.

* It should be noted that the potential health risks associated with THMs are much lower than the risk of serious illness that could result from drinking water that has not been properly disinfected.

5.4 Water Environment

This topic covers water quantity and water quality and includes consideration of hydromorphology, WFD and flood risk from surface waterbodies and groundwater. Groundwater aquifers are discussed in section 5.11.2.

Relative to other European countries, Ireland has twice the EU average of lake coverage (12,000 lakes covering ~2% land area) (Kelly-Quinn and Reynolds, 2020). In the Eastern and Midlands Region there are 1,561 lakes covering 0.02 % of the region's land area (35,875 hectares) with six lakes making up ~75% of the area, Lough Derg, Lough Ree, Poulaphouca Reservoir, Lough Sheelin, Lough Ennell and Lough Owel. The larger known rivers within this region include the Shannon, the Boyne, the Liffey, the Avoca and the Barrow however, they represent only a fraction of the extensive 18,985 km network currently mapped by the EPA in the Eastern and Midlands Region. Parameters identified to reflect the sensitivity of riverine ecology to changes in flow and water level include geology, gradient and altitude. In the Eastern and Midlands Region the dominant river typology is represented by B1 - hard limestone and sandstone; low-medium altitude; and low-medium slope (720 river waterbodies). The most sensitive rivers are those within the A2, C2 and D2 categories which are representative of headwaters, low nutrient, low pH and salmonid spawning and nursery areas. The salmonid spawning and nursery areas are particularly sensitive to low flows and impounding structures. The surface water river systems are shown in Figure 5.2 below.

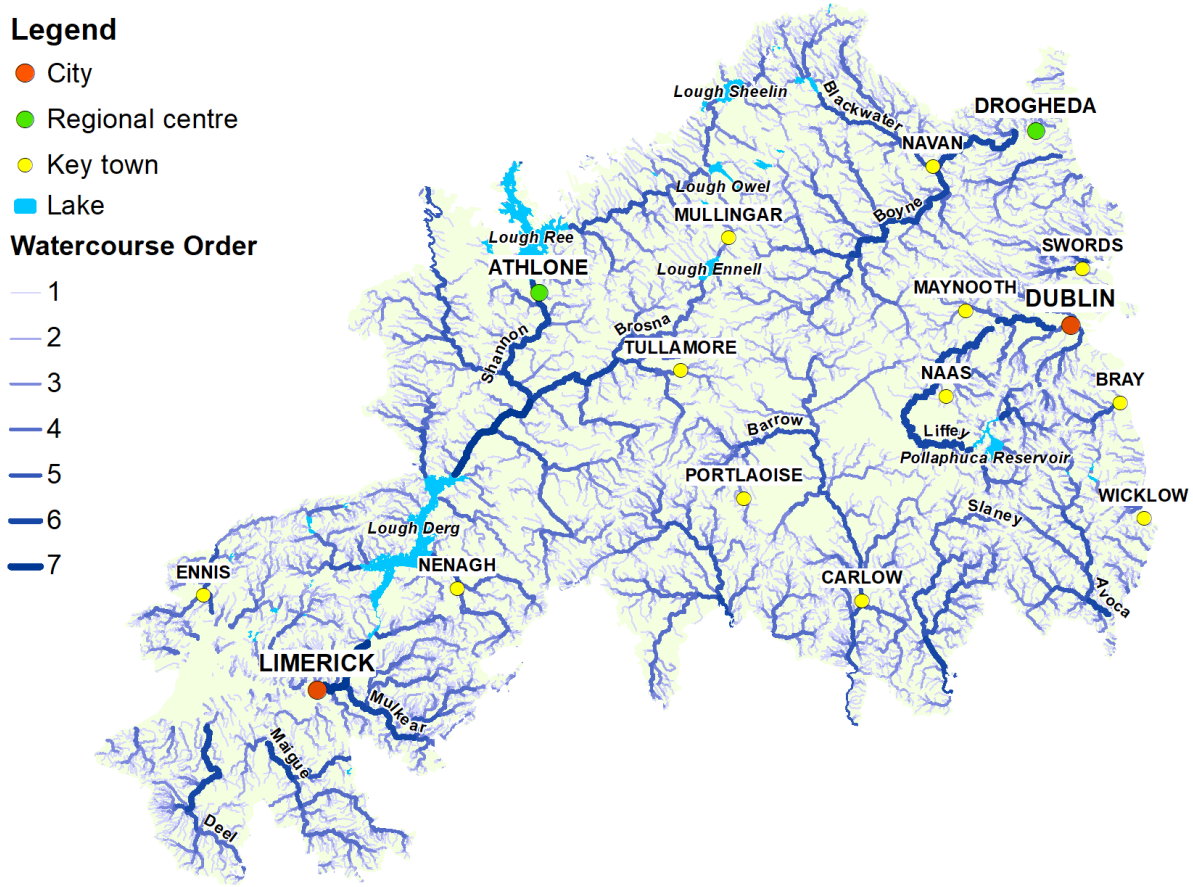


Figure 5.2 River Systems within RWRP-EM

5.4.1 Water Framework Directive

Under the Water Framework Directive (2000/60/EC), 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[9] or any of the quality elements[10]. Figures 5.2a and 5.3a (Appendix A) show the baseline water environment within the core baseline area, including the WFD catchment boundaries and WFD status of rivers, lakes, canals, transitional and coastal waterbodies and groundwater bodies.

Across Ireland there has been a decline in the number of high status surface waterbodies and increase in the number of surface waterbodies with poor ecological status over the last three WFD assessment cycles (2007-2009 relative to 2013-2018), with declines in ecological status between the last two assessment cycles primarily driven by changes in river waterbody status. The most significant pressures on surface water ecological health include nutrient pollution from agriculture, hydromorphological alterations associated with agricultural land drainage and flood protection work and urban wastewater discharges (amongst other causes). The chemical status of surface waterbodies has remained generally good, as has overall groundwater water quality (EPA, 2020). Failure to meet good chemical status in surface waterbodies is generally linked to elevated concentrations of priority substances such as mercury and polyaromatic hydrocarbons (PAHs), whereas failure to meet status objectives in groundwater bodies is generally associated with historical contamination from industrials sites although

[9] The ecological status assigned for surface water bodies is determined by the status of the poorest quality element. Overall status of groundwater bodies is assigned based on the combined chemical and quantitative element statuses.
[10] Surface water body status is assessed based on both ecological status or potential and chemical status. Ecological status includes various quality elements including biological elements, water chemistry and the physical condition of water bodies.

nitrogen leaching from agricultural soils is an emerging concern over the last decade. The EPA's State of Environment Report (SOER, 2020) highlights that significant progress is required to meet the legal requirements of the WFD Directive and transposing regulations (European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) as amended).

Water quality is an important consideration in relation to water supply. Whilst public water supplies in Ireland generally show high compliance with microbiological and chemical standards (EPA, 2020), there are a number of supplies within the Eastern and Midlands Region on the RAL list (see 5.3.5 for further detail). Key contaminants of concern include trihalomethanes (THM), lead, pesticides (particularly herbicides such as MCPA) and microbial contaminants such as *Cryptosporidium* and *Giardia*. Of emerging concern is the potential role of waterbodies as a reserve of antibiotic resistant microorganisms (AMRs) (e.g. Hooban et al., 2021) and the current Ireland's National Action Plan for Antimicrobial Resistance (iNAP) (due to be revised in 2021 for the period 2021-2025) includes an objective to develop AMR surveillance systems. Veterinary pharmaceutical residues in waterbodies are another emerging area of concern in Ireland specifically with regards to drinking water supply quality (e.g. Mooney et al., 2021).

Irish Water has adopted the Drinking Water Safety Plan approach. It seeks to protect human health by identifying, assessing and managing risks to both water quality and quantity; taking a holistic approach from source (catchment) to tap (consumer). The 'source' component of DWSPs is a key component and understanding the catchment characteristics is important to support the identification, assessment, and prioritisation of the risks. Irish Water is developing scientifically robust semi-quantitative methodologies using GIS to risk assess drinking water sources and carry out site-specific Source and Sanitary Surveys. A greater emphasis is being placed on the source-pathway-receptor (SPR) concept for contaminant delivery. The SPR approach requires an understanding of the sources of contaminants and the pathways that contaminants might travel. Contaminants being considered includes Drinking Water Directive regulated parameters such as Cryptosporidium, nitrate, ammonia and pesticides etc.

Irish Water is committed to working with public bodies and other stakeholders towards a common goal of the protection of drinking water sources. We have developed an Interim Pesticide Strategy for our drinking water sources (published in 2021). It will serve as an interim strategy whilst pilot projects are ongoing, and we develop our long-term approach for catchment management for drinking water source protection. The strategy will cover our collaboration with stakeholders in order to assess and manage the risk of pesticides in the catchment, with the DWSP forming a central role. The Interim Pesticide Strategy risk management framework consists of three key pillars with collaboration with stakeholders occurring during all stages of the risk management process.

The recast DWD updates quality standards for water intended for human consumption, in line with latest recommendations of the World Health Organisation and establishes a watch-list mechanism to allow for the monitoring of substances or compounds of public or scientific concern to health, such as endocrine disruptors, pharmaceuticals and microplastics. Irish Water sit on the DHLGH DWD expert group whose role is to provide advice to the Minister on the appropriate preparations and steps necessary for the successful transposition and implementation of the recast Drinking Water Directive.

Irish Water is involved Project Steering Committees/Groups for various ongoing research projects which focus on contaminants of emerging concern (CECs) and include Microplastics, Phthalates, Pharmaceuticals/Pesticides & Antimicrobial Resistance (EPA and UKWIR funded). Irish Water provides asset data and facilitates sampling of wastewater influent and effluent and raw drinking water. Irish Water also participates in iNAP 2 (2021-2025) meetings, where the main objective is to increase

environmental surveillance and monitoring for AMR to identify national levels and understand transmission routes.

Figures 5.2b and 5.3b (Appendix A) shows the locations of WFD 'at risk' waterbodies as identified from EPA data (EPA, 2019) within the core baseline area. The Department of Housing, Planning and Local Government's (DHPLG) (2019a) public consultation document regarding the significant water management issues has been considered by Irish Water. A total of 98 of the Areas for Action identified within River Basin Management Plan for Ireland 2018-2021 (DPHLG, 2018) fall within the core baseline area.

5.4.2 WFD and Abstractions within the Eastern and Midlands Region

In summer 2018, the Government published a General Scheme for the Water Environment (Abstractions) Bill, which proposed alignment of abstraction licencing with the requirements of the Water Framework Directive. The Government approved an amended General Scheme of the Abstractions Bill in September 2020. Irish Water are assessing existing abstractions, and have taken a precautionary approach, based on their current understanding of how proposed abstraction legislation might be applied, as outlined in Appendix G of the Framework Plan. This assessment suggests that certain schemes may be subject to reductions in abstraction.

As the Abstractions Bill is still being developed, Irish Water do not have full visibility of the future regulatory regime. They have therefore not progressed through a theoretical licencing process on a site by site basis and cannot reliably include an estimation of sustainable abstraction within the SDB calculations. Instead, Irish Water use the hydrological yield, water treatment capacity and bulk transfer limitations in their calculation of deployable output. Irish Water also use the sustainable abstraction assessment to assess the sensitivity of the Preferred Approaches (solutions) they develop as part of the NWRP.

Therefore, Irish Water's Framework Plan assumes that existing abstractions can continue on a transitional basis, subject to the registration and/or licensing requirements as outlined in the General Scheme of the Abstractions Bill approved by the Government in September 2020.

For these existing abstractions, further studies will be undertaken in conjunction with the EPA and appropriate stakeholders. Following investigation, if an abstraction is confirmed to be affecting a waterbody status the SDB will be updated, and solutions will be delivered through future cycles of the River Basin Management Plans and/or RWRPs.

In parallel, Irish Water will also consider other hydromorphological impacts as part of this process.

As the objective of Irish Water's NWRP is to achieve safe, secure, reliable and sustainable supplies, any new abstractions proposed to be developed by Irish Water as part of their RWRPs will be based on conservative assessments of sustainable abstraction. This will ensure that their water supplies continually improve in terms of environmental sustainability. Irish Water has been an active participant in the characterisation process for the 3rd cycle River Basin Management Plan 2022-2027 and liaised closely with the EPA during the development of the Framework Plan. Therefore, although the proposed Abstractions Bill is still under development and there may be some uncertainty in their calculations of sustainable abstraction, the assessments used as part of the development of the Regional Plan have followed the same principles as those that will likely be used by the regulatory authorities (based on the legislation as currently envisaged).

Irish Water has also assessed surface water abstractions across the core baseline area with respect to potential conflicts with sustainability guidelines and WFD targets, with sources identified as surface water abstractions which exceed sustainable abstraction thresholds being at potential risk in Table 5.6 below.:

Table 5.6 Surface Water Abstractions Potentially At Risk of Exceeding Sustainable Abstraction Thresholds

Study Areas	Surface Water Abstractions Potentially At Risk of Exceeding Sustainable Abstraction Thresholds	
	Number of Abstraction Sites	Site Name (WRZ) / WFD Waterbody Name
SA1	4	Derry River (Tinehely Regional Supply) / Derry River Tributary of Avonberg Ballinder (Rathdrum Public Supply) / Mill Glen Stream Three Wells Stream (Aughrim Annacurra Public Supply) / Three Wells Stream Tributary of Avonberg River (Avoca Ballinclash Public Supply) / Avonbeg Tributary
SA2	0	n/a
SA3	3	Lough Skeagh (Bailieboro RWSS) / Lough Skeagh River Blackwater – Liscarton (Navan-Mid Meath) / River Blackwater Lough Bane (Kells-Oldcaslte) / Lough Bane
SA4	2	Lough Lene (Ballany) / Lough Lene Lough Owel (Mulliingar Regional) / Lough Owel
SA5	1	Gageborough River (Clara/Ferbane/Moyclare) / River Gageborough
SA6	2	Clodiagh River (Tullamore) / River Clodiagh Burren River (Carlow Central Regional) / River Burren
SA7	1	Little Brosna River (Roscrea) / Little Brosna
SA8	3	River Deel (Shannon Estuary Water Supply) / River Deel Loobagh River (Glenosheen/Jamestown/Kilmallock) / River Loobagh Mulkear River (Newport RWSS) / River Newport
SA9	4	River Liffey - impoundment (Greater Dublin Area) / Leixlip Reservoir Dodder River (Greater Dublin Area) / Glenasmole Upper Vartry River (Greater Dublin Area) / River Vartry River Liffey (Greater Dublin Area) / Poulaphouca

Groundwater abstractions will also need to conform to the proposed new abstraction licencing regime. These abstractions will be assessed in two ways:

- Impacts on the groundwater bodies from which they abstract; and
- Impact of the groundwater abstraction on the base flow in surface waterbodies.

The 2013 – 2018 WFD Risk associated with the Ground Water Bodies (GWB) in the RWRP-EM indicates that 103 are currently ‘under review’, 73 are ‘not at risk’ and 40 GWBs are ‘At Risk’ (see Figure 5.3b (Appendix A)). Of the GWB ‘At Risk’ the predominant pressure associated with them is Agriculture, followed by historically polluted mine sites, forestry, waste facility and other.

The sustainable management of groundwater abstraction is challenging due to the difficulties in developing large abstractions due to the Regions' hydrogeological conditions.

Over the coming years, Irish Water will work with the environmental regulator, the EPA and the Geological Survey of Ireland (GSI), to develop desktop and site investigation systems to better understand the sustainability of their groundwater sources (informed by data gathered as part of GSI's ongoing GW3D project).

5.4.3 Groundwater – Surface Water Interaction

Surface water and groundwater interactions are an important consideration when considering both the quality and quantity of groundwater which may be abstracted, identifying options to support increased water demands and in managing the water quality we supply. As mentioned above interaction between surface water and groundwater can impact groundwater recharge rates and therefore sustainable abstraction rates as well as water quality through interactions with sources of pollution.

Groundwater and surface water are closely linked at certain karst features such as springs and swallow holes. For example, Westmeath in Study Area 4, is characterised by karst topography (where soluble rocks such as limestone, dolomite and gypsum dissolve) which can form sinkholes, caves and underground river systems. In Westmeath, mapping and tracing has shown a connection between Lough Lene (surface water) and the springs at Fore (groundwater). In these karstified environments any surface water contaminants can be easily transported to groundwater and vice versa. Similarly, to the west of the region in the Shannon basin, the Suck catchment is dominated by a flat undulating topography underlain by karstified limestone where the groundwater and surface water drainage systems are highly interlinked throughout.

In the case of the Bog of the Ring in North Dublin, the degree of groundwater surface water interconnection is dependent on the nature of the subsoil. Where the bog is underlain by till there is no or very limited interconnection between the surface water and groundwater and therefore little or no reduction in water level caused by abstraction pumping. In areas where there are gravel deposits there is a direct connection, and therefore abstraction from the groundwater leads to surface water features drying out completely[11]. Similarly, to the west of the region in the Shannon basin, the Suck catchment is dominated by a flat undulating topography underlain by karstified limestone where the groundwater and surface water drainage systems are highly interlinked throughout. These groundwater surface water interactions are of importance for Groundwater Dependent Terrestrial Ecosystems (GWDTEs).

5.4.4 Hydropower

The Eastern and Midlands Region is drained by several major river catchments - the Inny, Suck, and Brosna feeding into the Shannon in the west of the region, and the Barrow, Boyne and Liffey in the eastern area. In addition to providing public water supply and sector demands such as agriculture, the Shannon and Liffey rivers support hydropower generation.

The River Shannon is the longest river traversing the Eastern and Midlands Region (360.5 km) and has three lakes that are formed along its length – Lough Allen, Lough Ree and Lough Derg. Lough Ree and Lough Derg are located within Eastern and Midlands Region, while Lough Allen is situated near the headwaters in the North Western Region. The flows of the Shannon River are used to power the largest

[11] K T Cullen & Co Ltd, 2000. *Bog of the Ring Groundwater Development Drilling and Testing Programme*.

river hydroelectric power station in the country, the Ardnacrusha power plant. It harnesses the 30-metre fall between Lough Derg and the Shannon Estuary.

The River Liffey is the largest system in the east, consisting of more than 100 smaller rivers and streams. It drains from the Wicklow mountains and flows through the counties of Wicklow, Kildare and Dublin, entering the Irish Sea at Dublin Bay. Poulaphouca, the largest artificial reservoir in Ireland supplies three power stations along the River Liffey – Poulaphouca, Golden Falls and Leixlip. The Poulaphouca Reservoir is one of the two major sources of Dublin's water supply and is owned and operated by the Electricity Supply Board (ESB).

As some of Irish Water's abstractions are reliant upon the hydropower generation infrastructure, Irish Water maintain ongoing cooperation with the ESB to facilitate both water supply and energy generation.

5.4.5 Flood Risk

Flooding is becoming a bigger issue in Ireland in the years; the frequency of flood events has been increasing and, with climate change, is expected to increase further. Increased flooding can cause pressure on drains and sewers and can affect water quality.

The Floods Directive (2007/60/EC) required member states to develop Flood Risk Management Plans for areas of existing and future potentially significant flood risk. The Floods Directive was transposed into Irish law by the EU (Assessment and Management of Flood Risks) Regulations 2010 and sets out the responsibilities of the Office of Public Works (OPW). The OPW has been implementing the Directive mainly through the Catchment Flood Risk Assessment and Management (CFRAM) Programme, through which 29 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. CFRAMS mapping for all Areas for Further Assessment is available to view on the CFRAMS website (OPW, 2018).

Areas adjacent to the Lough Ree in Athlone, adjacent to the Shannon as far as Limerick, and adjacent to the Triogue, Figile and Barrow in and around Portlaoise and Kildare are considered to have high probability (10% Annual Exceedance Probability (AEP)) of fluvial flooding. The Boyne Estuary between Drogheda and Slane is considered to have high probability of both coastal and fluvial flooding, as are many of the smaller estuaries.

As well as considering surface water flooding, there are ongoing efforts to better understand the role of karst groundwater systems in flooding within the Flood Risk topic (McCormack et al., 2020). Figure 5.4 (Appendix A) presents areas with high and medium probability of pluvial, fluvial, coastal and groundwater flooding.

Guidelines for Planning Authorities on flood risk management (November 2009)[12] highlight that flooding of the water supply network (this includes pumping stations electricity substations and water treatment works) can result in a loss of supply over large areas and magnify the effects of flooding beyond the immediate community directly affected. Irish Water has considered the number of WTPs within areas of flood risk, where vulnerability to the effects of flooding need to be considered and for WTPs that are known to be at risk, are under review and where needed, protection measures will be considered for sites at risk. All new options will be reviewed in terms of their risk from flooding and this will be taken into account in the detailed siting and design to ensure improved flood risk resilience for the supply network.

[12] The Planning System and Flood Risk Management: Guidelines for Planning Authorities OPW November 2009

5.4.6 Drought Risk

Droughts occur when a period of lower than average rainfall causes a shortage of water. The shortage of water affects both the natural environment and sectors such as agriculture and water supply to our customers. The duration, timing and intensity of a drought can vary considerably.

The late spring and early summer of 2018 saw some of the lowest rainfall totals on record leading to drought conditions. Low rainfall levels resulted in low river flows and stress to water supplies.

Drought can cause low-flow conditions and higher water temperatures that lead to reduction of oxygen concentrations in the water. These environmental effects of drought contributed to fish kills seen in the summer of 2018. The fish kills caused by 2018 drought event may have increased the vulnerability of fish to acute pollution events as well as underlying levels of pollution.

Environmental pressures caused by drought are less likely to affect resilient waterbodies that are in good ecological health (EPA, 2020). The ecological health of waterbodies can also be negatively impacted by over-abstraction of water which can lead to reduction in river flows and lake levels. Irish Water's active management of some at risk abstractions is needed to avoid negative impacts on waterbodies during drier periods. However, in general during none-drought periods abstractions in Ireland do not put significant environmental pressures on both surface water and groundwater resources (EPA, 2020).

Drought risk to water supplies within the baseline area is discussed in 5.3.5 and this section identifies experience with specific existing water supply assets at risk of failure or reduced levels of service during drought conditions.

5.5 Biodiversity, Flora and Fauna

5.5.1 Designated Sites

European, national and local designated sites within the core baseline area Eastern & Midlands Region include 39 Special Protected Areas (SPAs), 144 Special Areas of Conservation (SACs), 16 sites designated as Wetlands of International Importance (Ramsar sites), one national park, 62 Natural Heritage Areas and numerous proposed Natural Heritage Areas and nature reserves. There are also are a further two marine SACs and five marine SPAs that are not within the core baseline area but are hydrologically linked to it. The location of these sites in relation to the core baseline area is shown in Figure 5.5 (Appendix A).

5.5.2 Habitats

Figure 5.6 (Appendix A) illustrates the distribution of different habitat types across the core baseline area as reported in the Corine land use dataset. Agricultural land uses dominate all SAs, with SA1 having a relatively high degree of woodland land cover and SA2 having a relatively high degree of wetland type habitats. There are also numerous small areas of Commonage Land located in the far southeast of the core baseline area between Dublin, Wicklow and Kildare, and also a smaller number of sites between Tullamore and Portlaoise and between Limerick, Shannon and Nenagh in the southwest (EPA, n.d.).

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

- Turlough ecosystems;
- Oligotrophic, hard oligo-mesotrophic and natural eutrophic 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, calcerous fens, and blanket bogs.

The EPA OSI national land cover map, currently under development, will be considered for further habitats information, once available.

5.5.3 Species

The key species and habitats of concern within the core baseline area (Nelson et al., 2019) include:

- Otter;
- Bat species - Daubenton's bat along the waterways. The most common species in the baseline study area are Common and Soprano pipistrelles and Leisler's bat;
- Fish species (Lamprey, Atlantic salmon and European eel);
- Fresh-water pearl mussel;
- Waterbirds of 'qualifying interest' e.g. Greylag goose (Anser anser), Brent goose, Greenland white-fronted goose (Anser albifrons flavirostris), whooper swan and winter migratory waders;
- Other 'qualifying interest' bird species e.g. kingfisher, peregrine falcon (Falco peregrinus), merlin (Falco columbarius) and hen harrier (Circus cyaneus);
- Protected whorl snails e.g. Vertigo geyeri (particularly high sensitivity to changes), Vertigo angustior and Vertigo moulinsiana;
- Freshwater white-clawed crayfish;
- Slender green feather-moss (Hamatocaulis vernicosus);
- Marsh Fritillary (Euphydryas aurinia); and
- Killarney fern.

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

- Japanese knotweed;
- Himalayan balsam;
- Giant hogweed;
- Elodea spp.;
- Himalayan knotweed (Persicaria wallichii);
- New Zealand pigmyweed (Crassula helmsii);
- Parrot's feather (Myriophyllum aquaticum);
- Zebra mussel (Dreissena polymorpha);
- Fringed water-lily (Nymphoides peltata);
- Curly waterweed (Lagarosiphon major); and
- Floating pennywort (Hydrocotyle ranunculoides).

5.6 Material Assets

Material assets are considered to be the natural and built assets (non-cultural assets) required to enable society to function as a place to live and work, in giving them material value. Some of the natural assets within the core baseline area are shown on Figure 5.6 (Appendix A) such as, agricultural land, urban and forest areas.

Built assets include transport and communications infrastructure, and other developed areas, including existing water supply infrastructure. These assets all need to be taken into account in new water resource planning and infrastructure.

Key road, rail and air transport infrastructure within core baseline area are shown in Figure 5.1 (Appendix A). Key water transport infrastructure includes Dublin Port (SA9) which is a 'Port of National Significance'. Ireland's canals once played a significant role as a transport network; however, the main uses are now for recreational and heritage purposes. Canals of regional or national significance within the core baseline area include the Royal Canal (within SA4 and SA9), the Shannon Navigation Canal (SA8) and the Grand Canal (within study areas SA5, SA6, SA7 and SA9).

Figure 5.1 (Appendix A) also shows locations of WTPs within the core baseline area. The Study Area Technical Reports appended to the RWMP-EM https://www.water.ie/nwrp provide further information regarding the source capacity, quality and quantity and reliability of abstractions at each WTP, along with any sustainability concerns.

Any new infrastructure considered for the Eastern and Midlands Region will need to take existing, planned, land zoning and local development into consideration. At the time of review (August 2021) there were 381 developments in the core baseline area listed on myProjectIreland (2020) with the significant majority located in SA9 in and around the GDA or in SA8 near Limerick City. The review will be updated and examined in further detail for schemes taken forward as part of Project Level assessment including any additional developments initiated in the intervening period.

Water resources and water quality are also influenced by urban, agricultural and forestry activity within river and groundwater catchments. This can affect the availability and quality of water for supply. Current land use within core baseline area is set out below:

- Agriculture – 75.52%;
- Urban – 3.69%;
- Natural habitats – 10.61%;
- Forest – 9.42%;
- Industry – 0.70%; and
- Other – 0.06%.

5.7 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 which will be taken into account when identifying landscape character areas and protected areas at the Project Level in the future.

The value of the landscape in the Eastern and Midlands Region is reflected in the baseline data provided in sections 5.3.3 (tourism and recreation), and the designated sites identified in 5.5 (biodiversity, flora and fauna) and 5.10 (cultural heritage).

Key landscape features within the core baseline area include Wicklow Mountains National Park, which comprises more than 20,000 hectares including mountains, upload blanket bog, lakes, wooded valleys and forestry plantations. Landscape Character Areas (LCAs) with high sensitivity in the RWRP-EM area are located to the north and south of Dublin such as the Tara Skyrne Hills LCA and surrounding lowland in Meath and Louth and Mountain Uplands LCA in Wicklow, as well as Castlecomer Plateaux in Kilkenny and areas between Athlone and Roscommon (EPA, n.d).

Further information on landscape character assessments is provided in the Study Area Environmental Reviews (SAs 1-9).

5.8 Air Quality and Noise

5.8.1 Air Quality

Air quality is monitored and managed using Air Quality Zones and air monitoring sites. The majority of the core baseline area falls within Air Zone D: Rural Ireland (EPA, n.d.), and the air quality index rating of the core baseline area is rated as 'good' (EPA, 2020).

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.

5.8.2 Noise

The main areas within the core baseline area that experience noise pollution are located along M and N roads as shown in Figure 5.1 (Appendix A). 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.

5.9 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).

Climate change will have significant effects on the availability of water at our sources in the future. Mean annual temperatures for Ireland are expected to increase by 0.5°C to 1.7°C by 2050, with increases closer to 3°C in the east of the country. The projected increase in temperature will affect the amount, timing and intensity of local precipitation. In Ireland, this is expected to mean wetter winters but also drier springs and summers. Climate change simulations for Ireland show the precipitation in the autumn and winter months could increase by between 5% to 35%, while summer precipitation could decrease by a range of 0% to -30%. Under the medium to high carbon emissions scenarios dry periods are projected to increase in frequency, duration and/or magnitude from between 12% to 40% for the spring and

summer months[13]. The historical analysis of average rainfall data undertaken by Murphy (2018)[14] confirms a continued trend of drier summers and wetter winters.

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 Irish Water, 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) [15] 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 setting targets for agriculture and forestry and improving land management to support carbon sequestration.

The Climate Change Sectoral Adaptation Plan for Water Quality and Water Services Infrastructure (2018), identifies the following key priority impacts of climate change for the water services infrastructure sector:

- Hot-weather related changes in demand.
- Increased drawdown in the autumn/winter for flood capacity, leading to resource issues in the following spring/summer.
- Reduced availability of water resources (surface and groundwater sources).

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

- Mainstream Adaptation: That climate change adaptation is a core consideration and is mainstreamed in all functions and activities across the Local Authority. Ensure that Local Authority is well placed to benefit from economic development opportunities that may emerge through commitment to proactive climate change adaptation and community resilience;
- Informed decision making: That effective and informed decision making is based on 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;

[13] Projected changes in precipitation are referred to in Section 2.2.5.2 of the Climate Change Sectorial Adaptation Plan.
[14] Murphy, Conor, 2020. *A 305-year continuous monthly rainfall series for the island of Ireland (1711-2016).* Climate of the Past. pp.413-440.
[15] Department of the Environment, Climate and Communications (2021) Climate Action Plan 2021. [Available at: https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/]. Accessed 04/11/2021

- 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 5.7.

Table 5.7 Climate Change Risks Identified by Counties in the Core Baseline Area

County	Key risk areas									
	Flooding (Pluvial, Fluvial, Groundwater or Coastal or Marine)	Extreme Rainfall	Rising Sea Levels and Storm Surges	Storm Frequency and Intensity	Extreme Cold/Heavy Snowfall and Ice	Extreme Heat/Drought Conditions	Bog, Sand, Dune, Gorse or Forest Fires	Coastal Erosion	Wind Speeds	Air Quality or Pollution
Wicklow (Wicklow County Council, 2019)	✓	✓	✓	✓	-	-	-	-	✓	-
Wexford (Wexford County Council, 2019)	✓	✓	✓	✓	✓	✓	✓	-	-	-
Carlow (Carlow County Council, 2019)	✓	✓	-	-	✓	✓	-	-	-	-
Kildare (Kildare Country Council, 2019)	-	✓	-	✓	✓	✓	-	-	✓	-
Cavan (Cavan County Council, 2019)	-	✓	-	-	✓	✓	-	-	✓	-
Meath (Meath County Council, 2019)	✓	✓	✓	✓	-	✓	-	✓	✓	-
Louth (Louth County Council, 2019)	✓	✓	✓	✓	✓	✓	✓	-	-	-
Fingal (Dublin Climate Change, 2019)	✓	✓	✓	✓	✓	✓	-	-	-	-
Westmeath (Westmeath County Council, 2019)	✓	✓	-	-	✓	✓	-	-	✓	-
Longford (Longford County Council, 2019)	-	✓	-	-	✓	✓	-	-	✓	-
Offaly (Offaly County Council, 2019)	-	✓	-	-	✓	✓	-	-	✓	-

County	Key risk areas									
	Flooding (Pluvial, Fluvial, Groundwater or Coastal or Marine)	Extreme Rainfall	Rising Sea Levels and Storm Surges	Storm Frequency and Intensity	Extreme Cold/Heavy Snowfall and Ice	Extreme Heat/Drought Conditions	Bog, Sand, Dune, Gorse or Forest Fires	Coastal Erosion	Wind Speeds	Air Quality or Pollution
Roscommon (Roscommon County Council, 2019)	-	✓	-	-	✓	✓	-	-	✓	-
Tipperary (Tipperary County Council, 2019)	✓	-	-	-	-	✓	-	-	-	-
Laois (Laois County Council, 2019)	-	✓	-	-	✓	✓	✓	-	✓	-
Kilkenny (Kilkenny County Council, 2019)	✓	✓	✓	✓	✓	✓	-	-	-	✓
Clare (Clare County Council, 2019)	✓	✓	-	✓	-	✓	-	-	-	-
Cork (Cork County Council, 2019)	✓	-	-	✓	✓	✓	-	✓	✓	-
Galway (Galway County Council, 2019)	✓	✓	✓	✓	-	✓	-	-	-	-
Limerick City and County (Limerick City and County Council, 2019)	✓	-	-	✓	✓	✓	-	✓	✓	-
Dún Laoghaire-Rathdown (Dublin Climate Change, 2019)	✓	✓	✓	✓	✓	✓	-	-	-	-
Dublin City (Dublin Climate Change, 2019)	✓	✓	✓	✓	✓	✓	-	-	-	-
South Dublin (Dublin Climate Change, 2019)	✓	✓	✓	✓	✓	✓	-	-	-	-

In addition, Ireland has a sectoral climate adaptation plan for the 'Water Quality and Water Services Infrastructure' sector. A summary of this report's findings is included in Table 5.8. Whilst not specifically identified in county level plans, climate change induced risk of water contamination through changes such as increased sediment loads and release of nutrients from catchment soils is a further issue and particularly relevant for approaches that can address these such as through catchment management and nature-based solutions.

Table 5.8 Summary of Key Points from the 'Water Quality and Water Services Infrastructure' Sectoral Climate Change Plan (Department of Housing, Planning and Local Government, 2019b)

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

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. Across the core baseline area there are many supplies which do not meet the required levels of reserve capacity. As evidenced in the 2018 drought, there is the potential for these deficits to effect access to water in the future. Supporting environmental resilience to climate change will also be an important consideration for the future with additional benefits for supply resilience.

5.9.1 Climate Sensitive Catchments Project

Whilst there is recent work on potential climate effects on rainfall, there is less work on the projected impacts of climate change to river flow regimes across Ireland. There is also no Ireland-wide guidance available at present outlining the effects of future climate change on flows. Recognising this, Irish Water

commissioned the Climate Sensitive Catchments Project *Project Partner: Maynooth University Irish Climate Analysis and Research Units (ICARUS)*

The Climate Sensitive Catchments research project improved our understanding of how river flows may change due to climate change and how best to prepare for a hotter climate. This research concluded in April 2019.

The 206 river catchments included in this research were characterised into 5 catchment sensitivity types (a) to (e) as illustrated below. The research concluded that catchment types (a) are the least sensitive to changes in seasonality of wetter winters and drier summers due to high groundwater storage in these catchments. Catchment types (b) and (c) have lower natural water storage and see the greatest decreases in flow due to wetter winters and drier summers. Catchment types (d) and (e) lose more water due to evaporation and are mostly drier catchments in the midlands and east. Catchment types(d) are most sensitive to changes in annual mean precipitation. When changes in seasonality and mean quantity are considered together, catchment type (d) are also the most sensitive and types (b) the least. Catchment type (e) experience less evaporative losses than (d) and while sensitive to changes in seasonality and mean amount are less sensitive to these changes than catchment type (d).

This research projected low flow allowances for each of the 5 catchment sensitivity types. These low flow allowances provide resilience for lower river flows in the future due to climate change. The project concluded that in some instances an allowance for a 30% reduction in low flow would be insufficient to avoid future climate change impacts.

The findings of this research project will address the water quantity aspects of climate change, but because of changes either to temperature or flow regimes, changes in water quality will also have a bearing. In addition, climate change may result in land use changes which may compound the observed effects.

5.10 Cultural Heritage

There is one UNESCO World Heritage Site (WHS) within the core baseline area, Bru Na Boinne in Drogheda, a further nine sites which are listed on the Tentative List and a small number of Irish Landmark Trust sites located in Dublin, Celbridge and Wicklow (EPA, n.d.) (see Figure 5.3). There are also numerous designated and non-designated cultural heritage assets inventoried in the Record of Monuments and Places, the Sites and Monuments Record (SMR), the Record of Protected Structures, and the National Inventory of Architectural Heritage (NIAH). In total there are 43,390 sites recorded by the National Monuments Service and 18,585 sites recorded on the NIAH. Given the number of small sites across the core baseline area, these are best viewed on the Department of Arts, Heritage and the Gaeltacht's (2020) 'Historic Environment Viewer' website.

There are also potentially unknown, undesignated archaeological and architectural remains, throughout Ireland.

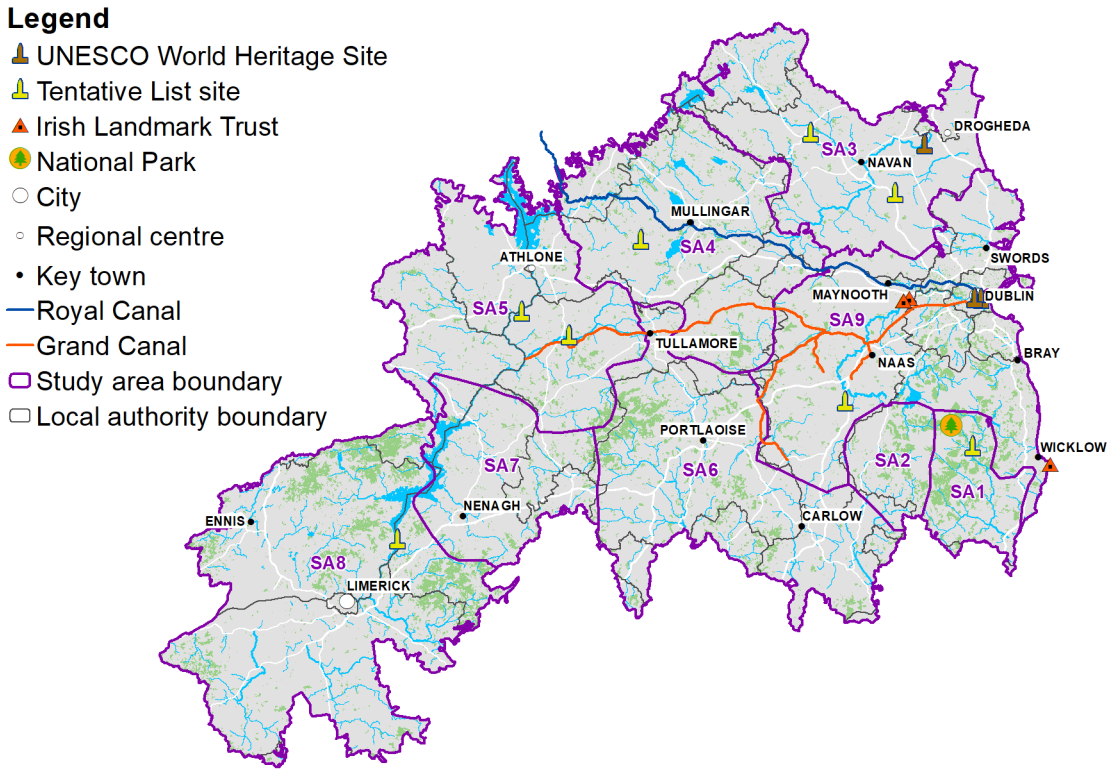


Figure 5.3 Cultural Heritage Site in the Eastern Midlands Region

5.11 Geology and Soils

The geology and soils in the environment can impact the quality and quantity of water in the area through differences in drainage, chemical composition, filtration and resultant land use; which can also have a significant impact. The water supply can be heavily impacted by the type of aquifer in the area, as they impact the system's ability to store and transmit groundwater.

5.11.1 Geology

Figure 5.7 (Appendix A) shows the geology of the core baseline area, with particular reference to potential aquifers.

Understanding the geology of our catchments is vital to the provision of clean water. Geology is responsible for shaping mountain ranges, defining river network systems and determining their character, i.e. slope and erosivity. The bedrock geological maps developed by the GSI are the foundation maps upon which groundwater protection and vulnerability maps have been constructed and upon which WFD groundwater bodies and monitoring programmes have been established by the EPA. In general, the topography and its associated geological deposits can be broadly split into topographic highs and lowland valleys. Considering the extent of glaciation during the last ice age the Irish landscape can be considered a glacial one. Bedrock outcrop often prevails in the mountainous areas, while the remainder of Ireland's bedrock is generally overlain by glacial material or glacially influenced materials (river alluvium, peat or coastal deposits).

The oldest geology of the core baseline area comprises marine sedimentary rocks such as greywackes, slates and quartzites formed during the Cambrian Period, 545 – 495 million years ago (mya), and represents 1% of the geology of the Eastern and Midlands Region. Bands can be found on Howth Head

to the north of Dublin Bay, around Bray Head and the Sugarloaf in northeast Wicklow. The Ordovician and Silurian Periods, when present, in northwest and southeast Ireland lay along the margins of separate continental masses and divided roughly along the Shannon Estuary and are represented by 15% of the geology of the Eastern and Midlands Region. During the closure of the Lapetus Ocean, the subduction of oceanic crust was responsible for the formation of a volcanic island arc. These volcanic rocks were erupted and intruded into the Silurian marine sedimentary sequences, which include greywackes, mudstones, lavas and tuffs. The rhyolitic volcanic rock as Avoca, Co. Wicklow contain ore bodies of copper, lead, zinc and gold (Sleeman et al., 2004). Six percent (6%) of the geology belongs to the Caledonian Orogeny, also known as the mountain building era and associated granite intrusion. It was caused by the collision of the two continents during the closure of the Lapetus Ocean between 420 – 390 mya. In the Eastern and Midlands Region large granite bodies were intruded in Carlow – Wicklow. The Devonian period – 'old red sandstone rivers and desert' is also represented by ~6% in the Eastern and Midlands Region, most notable in the north and east of Munster in upland areas such as the Slieve Bloom, Slieve Aughty and Slieve Phelim. They comprise a widespread and relatively thin (<300 m) sequence of conglomerate, sandstone, siltstone and mudstone.

Most of the bedrock geology of the Eastern and Midlands Region (64%) falls into the Lower Carboniferous period (350 mya), characteristic of limestones which are sediments derived from the breakdown and disintegration of calcareous shells of invertebrate animals. The limestones of the East Midlands stretch from the River Shannon to the Irish Sea and from Monaghan to Kilkenny and because they are overlain by glacial and recent sediments, their landscape is represented by eskers, drumlins, raised bogs and river flood plains. The Upper Carboniferous is represented by 5% of the Eastern and Midlands Region, dominated by deep water shales such as at Foynes in Limerick. In the Paleogene period (66 – 34 mya) the Irish Sea Basin formed due to faulting and this was accompanied by the development of new drainage systems tied to the marine basin, i.e. the Boyne, Glendalough and Glenmacnass.

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, including 295 within the core baseline area (see Figure 5.5, Appendix A).

5.11.2 Groundwater Aquifers

Resource protection areas are delineated according to the value of the groundwater resources/aquifer category. They describe both resource potential/value (Regionally or Locally important, or Poor) and groundwater flow type (through fissures, karst conduits or intergranular). Regionally important bedrock aquifers are defined as those that can service public water supplies or that have excellent yields (>400 m^3/d). The aquifer area is >25 km^2 and flow is predominantly though fractures, fissures and joints. Locally important bedrock aquifers are defined as those that can service more local public water supplies/group schemes or that have good yields (100-400 m^3/d). Flow is predominantly though fractures, fissures and joints. Poor bedrock aquifers are defined as those that can service smaller abstractions (domestic supplies/small group schemes) or that have moderate-low yields (<100 m^3/d). Flow is predominantly though a limited and poorly-connected network of fractures, fissures and joints. Sand and gravel aquifers are classed as an aquifer if the deposit is highly permeable, more than 10 m thick and greater than one square kilometre in areal extent. The thickness is more often used than the more relevant saturated thickness as the data for this is often not available.

The predominant aquifer type of the Eastern and Midlands Region (52%) is made up of poorly productive bedrock, with a relatively even split among the remaining categories of gravel (18%), karstic (17%), productive fissured (13%) aquifers. The poor bedrock aquifers are represented mostly by Granites to the east in Carlow and Wicklow and the Silurian metasediments and volcanic in North Tipperary. Groundwater flow will mainly occur laterally through the upper weathered zone of the aquifer in poorly productive bedrock. There are also large swathes of Dinantian (Lower Carboniferous) Upper Impure Limestones across North Dublin, Westmeath and to a lesser extent in North Limerick. The limestones are often characterised by a high shale content and these dark, very impure thin-bedded limestones are often described as 'Calp' limestone. These are noted for their higher shale content in less productive regions and are primarily of moderate permeability, although localized zones of enhanced permeability do occur, most notably where fracturing is higher as seen in the productive fissured aquifers of North Dublin.

Large parts of the Midlands (Portlaoise, Offaly and Roscommon) karst forms a key regionally important aquifer, particularly around the towns of Ballinasloe, Athlone and Tullamore. These Dinantian Pure Bedded Limestones are mostly composed of pure and dolomitised limestone. The dominant secondary permeability of dolomite means groundwater flow occurs mainly through fissures developed by the solution of bedding planes and joints. The Midlands is predominantly characterised by a more diffuse network of flow pathways (Rkd type aquifers), where the distribution of permeability, and hence yield, is more homogenous.

The differing spatial extents and permeabilities of sand/gravel aquifers results in a variable development potential. They act as areas for groundwater filtration owing to the intergranular flow mechanics, which offers good protection against microbial contamination. Kildare is noted for a large gravel aquifer in the Curragh overlying the limestone bedrock. The sand/gravel deposits, when overlying areas of bedrock aquifers, can improve the overall flow and storage to the aquifer and also protect against pollution.

The productive fissured aquifers are most dominant in the northeast and can be found in large swathes across much of Meath, North Dublin and North Kildare. The high-yielding and high-productivity wells are largely clustered in a relatively small area, likely associated with a particular major fault zone. The aquifer classification for this area of upper impure limestones is a "locally important aquifer which is generally moderately productive" (Lm). In general, optimum well yields from these upper impure limestones will be from wells that penetrate to a depth at least 50-100m and which encounter one of the many fault zones of the region.

The degree of karstification is a large factor in controlling groundwater and surface water interaction. This is of importance in Groundwater Bodies (GWB) with protected ecosystems. Karst mapping and tracing in Westmeath has shown a connection between Lough Lene and the springs at Fore, considering the lack of surface water input. In these karstified environments any surface water contaminants can be easily transported to groundwater and vice versa. Groundwater and surface water are more closely linked at certain karst features such as springs and swallow holes. In the case of the Bog of the Ring in North Dublin, the degree of interconnection is dependent on the nature of the subsoil. Where the bog is underlain by till there was little or no reduction in water level caused by pumping. In areas where there are gravel deposits there was a direct connection with some monitored locations drying out completely. Similarly, to the west of the region in the Shannon basin, the Suck catchment is dominated by a flat undulating topography underlain by karstified limestone where the groundwater and surface water drainage systems are highly interlinked throughout.

5.11.3 Soils

A fine loamy soil type is dominant across the majority of the core baseline area, interspersed with small areas of peaty soils, and transitioning towards clayey drift to the far south of SA8.

5.12 Baseline Topic Interactions, Issues and Opportunities

5.12.1 Interrelationships between SEA topics

In accordance with the SEA Directive, it is a requirement to recognise the interrelationships between environmental topics, as changes to one environmental aspect can directly or indirectly influence others. Table 5.9 below indicates the potential interrelationships between SEA topics demonstrating most topics interact to some level in a range in some circumstances. Key interactions are highlighted.

Table 5.9 Interrelated SEA topics

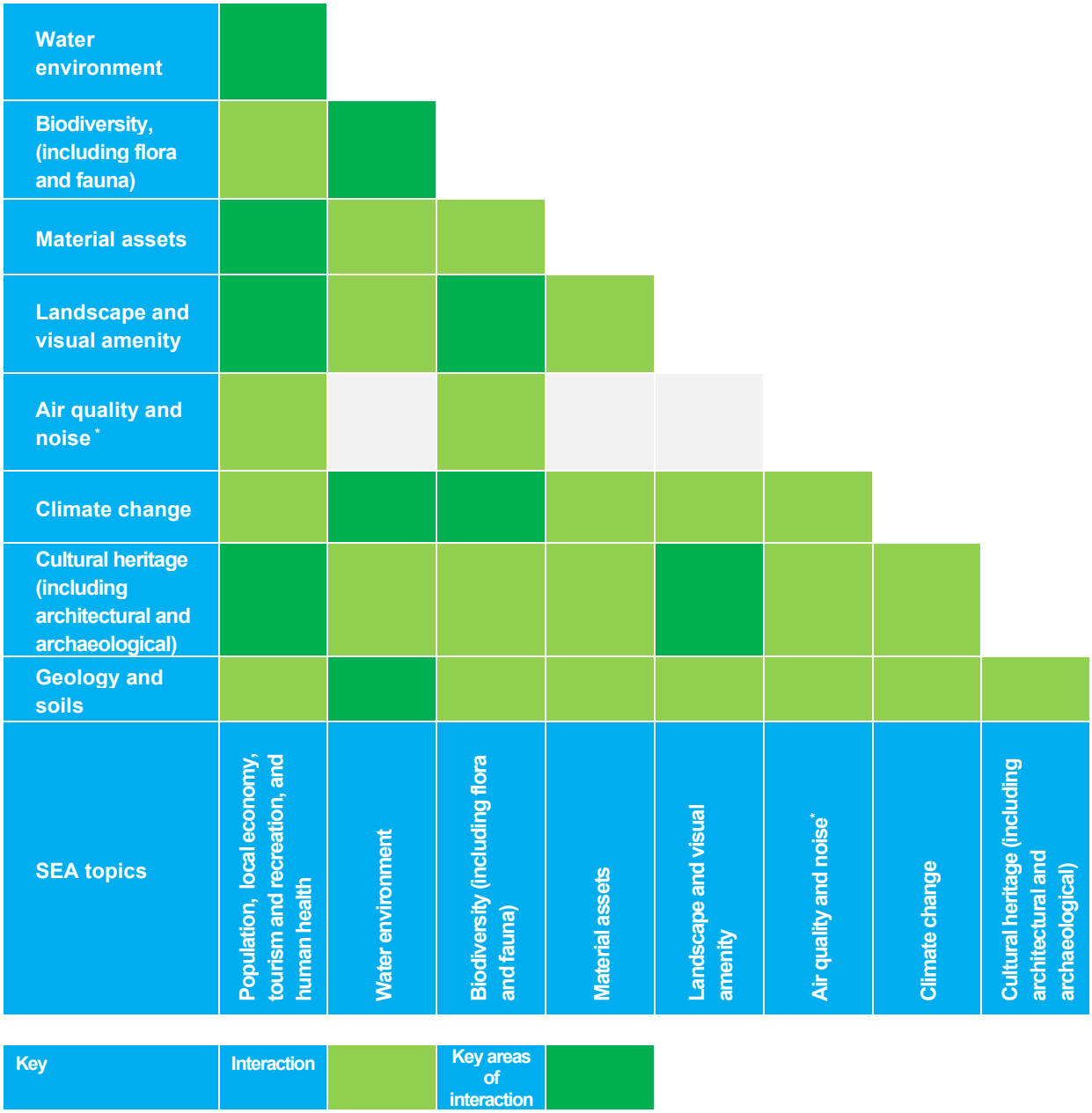


Table 5.10 Key Issues and Opportunities

SEA Topic	Issues and opportunities
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 put in place measures to address risks as part of the NWRP. Irish Water has ongoing activities to improve the Supply Demand Balance across the Eastern and Midlands Region, 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 along with valuing water as part of access to environment for recreation.

SEA Topic	Issues and opportunities
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 at associated sites. Across the Eastern and Midlands Region some of the existing abstractions are potentially unsustainable in the medium term; specifically, during drought periods. Irish Water will need to update their sustainability analysis and impact on their baseline SDB calculations when regulatory assessment for new legislation is undertaken. Groundwater and flood risks and vulnerability are potential issues for water supply and environment but detailed siting and design through the more project development stages is expected to take account although the plan assessment aims to identify strategic level risk. Opportunities: to take account of identified pressure on the water environment in the selection of solutions for individual Study Areas and opportunities for reducing pressures on resource and improving water quality.
Biodiversity, Flora and Fauna	Issues: it is considered especially important to avoid the loss of irreplaceable or rare habitats and increasing pressure on vulnerable species; potentially through direct land take or indirect such as through increased abstraction pressure Opportunities: potential for enhancement through reducing pressure on sensitive sites or building in requirements such as habitat enhancement in to schemes and identifying potential for nature-based solutions and catchment management
Material Assets	Issues: WTP assets and network infrastructure requiring improvement or replacement. Opportunities: improvements to support reliability of access to good quality water
Landscape and Visual Amenity	Issues: potential for climate change to affect land use and influencing landscape character, quality and amenity
Air Quality and Noise	No specific issues identified for the baseline for the Eastern and Midlands Region related to the types of options and combinations under consideration for the Regional Plan. Disturbances related to construction impacts are addressed in terms of receptors within the population and health topic.
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.
Cultural Heritage	Issues: known cultural heritage and archaeological assets and potential unknown archaeological assets could be affected by construction works or change to setting or access. Potential for hydrological changes to affect heritage and archaeological assets.

SEA Topic	Issues and opportunities
Geology and Soils	Issues – potential loss of soils or pollution from runoff - general need for good soil conservation and retention of nutrients and carbon in soil resources. Opportunities to improve soil carbon and retention of nutrients contributing to improving water quality
Interactions between topics	Key interactions include links between biodiversity and water resources and climate change and between soils, land management, water quality, biodiversity, flood risk, and climate change

Key issues, trends and opportunities are addressed in each of the Study Area Environmental Reviews 1-9 (Appendix H).

6 Options and Approach Assessment Methodology

6 Options and Approach Assessment Methodology

6.1 SEA Approach Summary

The set of SEA objectives developed at the Phase 1 scoping stage have been refined and finalised following consultation (see Table 6.1). These 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 chapter 6 of the SEA Environment Report for the Framework Plan and the SEA Scoping Report for RWRP-EM and consultation comments.

The methodology for the assessment was developed in accordance with the following EPA guidance:

- Developing and Assessing Alternatives in Strategic Environmental Assessment (SEA);
- Guidance on SEA Statements and Monitoring;
- Integrating Climatic Factors into Strategic Environmental Assessment in Ireland - A Guidance Note; and
- Good practice guidance on Cumulative Effects Assessment in SEA.

Table 6.1 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 relating to the provision of water services.
Water environment	Water quality and quantity Prevent deterioration of the WFD status of waterbodies with regard to quality and quantity due to Irish Water's activities. Contribute towards the "no deterioration" WFD condition and, where possible, to restore and improve waterbody status for rivers, lakes, transitional and coastal waters, and groundwater to at least 'Good' status related to the provision of water services.
	Flood risk Protect and, where possible, reduce risk from flooding as a result of Irish Water's provision of water services.
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 as well as future water abstractions.
Landscape and visual amenity	Protect and, where possible, enhance designated landscapes in relation to the provision of water services.
Climate change	Climate change mitigation

SEA Topic	SEA Objective
	Minimise contributions to climate change emissions to air (including greenhouse gas emissions) as a related to the provision of water services.
	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 related to provision of water services.
Geology and soils	Protect soils and geological heritage sites and, where possible, contribute towards the appropriate management of soil quality and quantity.

Table 6.2 SEA Criteria

SEA Topic	SEA Criteria
Population, economy, tourism and recreation, and human health	Will the option impact public health and quality of life, during construction? Will the option impact public health and quality of life, during operation? What is the impact on recreational amenities?
Water environment	Would the option or associated construction activities affect WFD Status of water body status, in terms of quantity and quality for surface water? Would the option or associated construction activities affect WFD Status of water body status, in terms of quantity and quality for groundwater? Would the option or associated construction activities affect WFD Status of water body status, in terms of hydromorphology? Would this option reduce pressure on the water environment through water savings? Is there a potential for this option to increase flood risk – e.g. increase base flow or result in loss of flood plain? Will navigation be affected?
Biodiversity	Would the option have potential to result in adverse effects on the integrity of a European site? Is there potential for the option to impact Annex I (Birds Directive) and/or Annex I, II & IV (Habitats Directive) outside a European site? Is there potential for the option to impact on national designated sites? Would the option impact biodiversity in any other areas (local biodiversity risk)? Does the option have the potential to increase or reduce risk of Invasive Non-Native Species (INNS) spread?
Material assets	Will the option make effective use of existing assets? Or reduce water abstraction? Will this option conflict with critical infrastructure, or does the option conflict with existing business, planned land use or valuable agricultural land?
Landscape and visual amenity	Could this option impact the landscape character areas, townscape character areas or important views – detract or improve?

SEA Topic	SEA Criteria
Climate change	What is the level of construction and operational carbon emissions associated with the option – tonnes?
	Will the option support climate change adaptation and resilience for the environment?
Cultural heritage	Does this option avoid direct damage to, or detract from the setting of, designated cultural heritage assets, or does this contribute to protecting them?
Geology and soils	Would any designated or non-designated geological features, valuable soils, or contaminated land sites be affected?

6.2 Options and Approach Assessment Summary

The options assessment methodology is outlined in chapter 9 of the Framework Plan. The methodology applied and how the SEA objectives and environmental assessment has been integrated into the application of the methodology, is summarised below.

The methodology is based around an option development process consulted upon and finalised in the Framework Plan. The process aligns with the seven standard steps set out in the Department of Public Expenditure and Reform (2019) guidance document "Public Spending Code: A Guide to Evaluating, Planning and Managing Current Expenditure". For the NWRP methodology, there are eight key stages to the options assessment methodology which is applied:

- Identifying need - based on Supply Demand Balance (SDB) and/or Drinking Water Safety Plan Barrier Assessment.
- 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.
- Identifying potential options for consideration relevant to the Study Area.
- Coarse screening – assess the unconstrained options and eliminate any that will not be viable
- Further option definition, information collection and preliminary costing.
- 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 (including environmental and social costs and benefits) and scoring assessment update.
- Approach appraisal – comparison and assessment of combinations of options identified to meet the predicted supply demand deficit at WRZ, Study Area and Regional Group area level using Multi-Criteria Analysis (MCA) to determine the Preferred Approach. Approaches tested include:
    - Least Cost;
    - Best Appropriate Assessment (Best AA);
    - Quickest Delivery;
    - Best Environmental;
    - Most Resilient; and
    - Lowest Carbon.

- Monitoring and Feedback into Plan – a feedback mechanism to ensure that the Framework Plan continuously adapts to changes such as evolving scientific data, understanding, and policy change in relation to the natural environment.

The SEA process has been applied across each of these steps as identified in Figure 6.1 below. In the description of the methodology in this chapter, key elements of the process relevant for the SEA process and supportive of SEA objectives are identified in green text boxes.

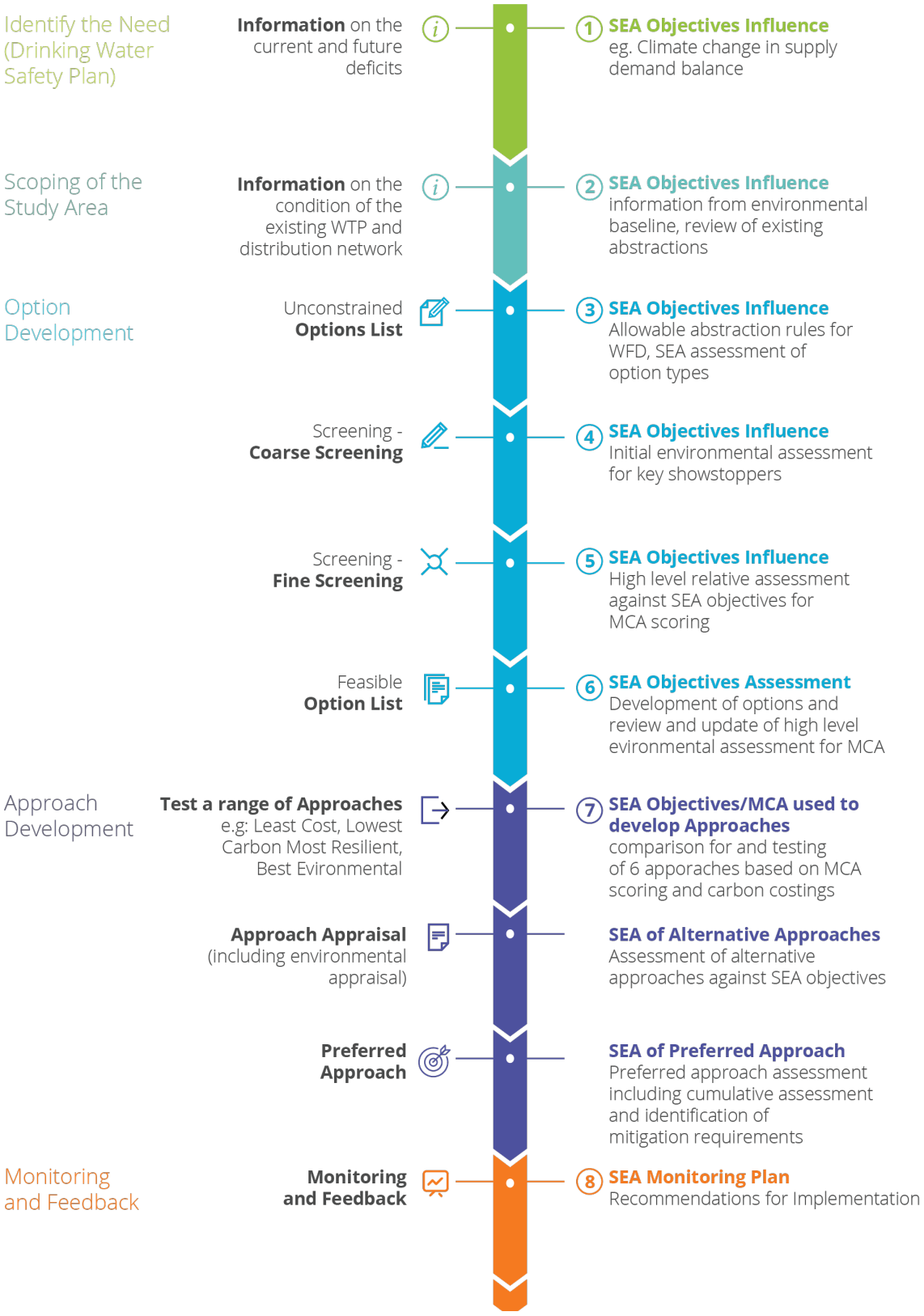


Figure 6.1 Options Assessment and Preferred Approach Methodology

The methodology is focused on ensuring that Irish Water promote solutions that are resilient, environmentally and socially sustainable, and flexible to the changing environment and demands.

Irish Water's options assessment methodology is based around the following five criteria:

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

Options Development and Assessment

SEA and AA requirements have been integral to the methodology development, so the environmental aspects that influence options identification and assessment are based on a) SEA objectives and b) include risk of likely significant effects on European sites for AA. Options development is set out in Steps 1- 6 of Figure 6.2.

Approach Development and Assessment

Information on performance against SEA objectives and AA requirements is used to identify alternative combinations of options referred to as approaches meeting SDB deficits at the Water Resource Zone, Study Area and Regional Group level for consideration and comparison to determine the best overall approach in Step 7.

The SEA process covers assessment of the alternative approaches meeting plan objectives, including a comparison with the 'do minimum' scenario and identification of the basis for selecting the Preferred Approach for the Water Resource Zone, Study Area and Regional Group.

SEA of the Preferred Approach considers requirement for mitigation and identifies significant residual adverse and beneficial, direct and indirect, short term, temporary, long term and permanent effects. In combination and cumulative effects both within the plan and with other proposed developments, plans and programmes are assessed and additional mitigation identified for potential significant effects.

AA is undertaken on the Preferred Approach, including Stage 1 identification of likely significant effects (LSE) and Stage 2 assessment of Adverse Effects on Site Integrity (AESI), as reported in the NIS for the Framework Plan and the Regional Plan.

The results of the SEA and AA also feed back into Step 7 of the assessment, where any significant effects are identified that cannot be addressed through mitigation or a high level of uncertainty remains. The SEA and AA also influence the mitigation and monitoring measures to be taken forward as part of Step 8 of the Plan.

Key aspects for integration of SEA objectives are outlined for each step in the process below.

6.3 Stage 1: Identify the Need

The process starts with the 'need identification' (quantity, quality, reliability and sustainability) as described in Section 3 of the RWRP-EM. The identification of all these needs provides context for the Options Assessment Methodology and informs the scale of the solutions required. The options, approaches and Preferred Approach to address the identified needs for each WRZ will form part of the four (4) RWRPs.

Environmental aspects related to SEA Objectives considered in Stage 1:

- Climate change affecting future water supply; and
- Public health requirements for access to good quality drinking water.

6.4 Stage 2: Scoping of the Study Area

In order to manage the roll-out of the Options Assessment Methodology and delivery of Phase 2 of the NWRP (the four (4) RWRPs), Irish Water has split the public water supply into the four (4) regional areas. These regional areas are further subdivided into clusters of WRZs termed "Study Areas".

Grouping WRZs into Study Areas means that:

- Options can be developed that address multiple problematic supplies, which prompts Irish Water to consider regional solutions to resolve local needs in more than one supply; and
- Broader strategic decisions can be made.

The Study Area boundaries are based on WFD catchments and WRZ locations and types (urban and rural).

The SEA recommendation, based on the SEA objectives, considers environmental constraints and opportunities as part of this needs study and links to other initiatives and ongoing projects, such as the climate sensitive catchments, drinking water quality assessments and WTP residuals disposal management.

6.4.1 Identify Needs for the Study Area

The first stage of the options assessment process is to understand the Study Area and the existing condition of the assets. A detailed programme of consultation and workshops has been conducted with Irish Water's Local Authority partners and stakeholders, to ensure a full and comprehensive understanding of need across the given Study Area, including essential maintenance, refurbishment work or issues with the distribution networks. For example, if a WTP in the Study Area is coming to the end of its lifecycle, requiring a complete refurbishment within the next 10 years, this should be allowed for in any proposed option, either as a WTP refurbishment or a replacement of the supply from other WTP(s).

6.4.2 Abstraction Sustainability

At this stage Irish Water consider the status of their existing abstractions as well as identify opportunity to improve abstraction process and water quality. As mentioned in chapter 1, current water supplies often come from small local rivers where abstraction may be unsustainable. Irish Water must ensure that their abstractions will not adversely impact the environment over the next 5 to 25 years so that Ireland complies with its obligations under the Water Framework Directive. At this stage, Irish Water builds this information into the SDB to ensure any considered options allow them to plan for a reduction of supply from these sources.

This stage includes consideration of abstraction sustainability for surface water in relation to identifying the likely level of allowable abstraction (related to the SEA objective on water). It takes into account WFD waterbody status through a review of existing abstractions and the identification of new options. This is applied as a rule so that new options meet allowable abstraction criteria. Sustainability of groundwater abstractions are also considered based on a high-level desk study of the zone of contribution and aquifer recharge where more detailed information is not available.

6.5 Stage 3: Unconstrained Options

The SDB and the Barrier Assessment inform the type and scale of options that Irish Water must consider. Key option types are shown in Figure 6.2. Sub-variants of each option type are also considered.

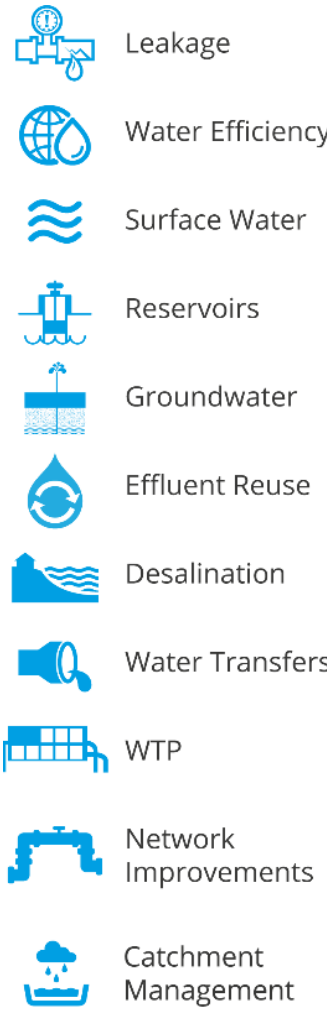


Figure 6.2 Option Types

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 10% or 5% of Q50 in line with this guidance (the NIS sets out the approach in relation to Appropriate Assessment).

In the future, Irish Water are likely to have to reduce or remove their unsustainable existing abstractions.

A sensitivity analysis is conducted for each WRZ, to allow to stress test the sensitivity of the Preferred Approach against potential sustainability driven reductions to existing abstractions (taking a conservative and precautionary approach as to the level of reductions that may be required). This is undertaken to ensure that decision making is robust, and the Preferred Approaches are adaptable and compatible with future potential regulatory regimes, in so far as this can be anticipated at this stage. These and other aspects considered are explained in section 6.10.1 of this report and further detailed in RWRP section 6.

Based on these desk assessments, 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.

Whilst options are considered individually, an approach to meet identified need may be provided from a combination of these options. For example, rather than seeking to meet a deficit of 10 million litres per day by increasing abstraction from an existing source by that amount, the Preferred Approach (solution) could achieve the same result by increasing an abstraction from an existing source by only 6 million litres per day but reducing leakage by 3 million litres per day and reducing consumption through demand management measures by 1 million litres per day (aligned with the Three Pillar approach outlined in Section 3 of the Framework Plan).

The Unconstrained Options constitute all of the possible solutions, which either fully or partly resolve a water supply deficit, regardless of cost, environmental or social constraints. In developing the Unconstrained List, Irish Water identify options that are applicable to meet the needs of the Study Area. This includes:

- A review of any options identified by Irish Water that have not been committed to in the current Investment Plan;
- A review of options previously considered by Local Authorities;
- A review of options identified in other strategy documents, approaches, and projects[16]; and
- Ideas generated at workshops with regional operational staff drawing on their knowledge and experience of the supply system and the geographical area.

The Unconstrained Options list can include solutions at a WRZ, Study Area, Regional Group Area or even National level.

6.5.1 Option Scale

Options to address the water supply deficits are developed at three different spatial scales:

WRZ Options comprised of single or multiple options that can resolve the water supply deficit of a **single WRZ only**. For example, a WRZ Option could include a new abstraction bore and/or an import from an adjacent supply system. Each WRZ is reviewed individually to assess options that might address water resource or water quality Need in that supply area.

SA Options (Grouped Options) comprised of single or multiple options that can resolve the water supply deficit of **more than one WRZ within a single Study Area**. These options are generally dependent on each other and operate in an integrated way to meet the demands of a number of WRZs. For example, two WRZs could be interconnected, and an additional water source developed that

[16] Projects include those identified in pre-planning and in-flight projects.

supplies the newly integrated supply systems. This may involve the decommissioning of infrastructure, such as one of the existing WTPs and associated abstraction site. An assessment is made as to whether there are any larger options that might be able to address the Need for multiple WRZs (generally within the same Study Area (SA); although in some circumstances the solution at this level may involve a transfer from outside the SA in which the relevant WRZ is located).

Regional Level - Feasible Options are assessed at the Regional Area level to see if there are any options (or combinations of options) that can be applied across the entire Region.

The approach to developing options at the three different scales is described in further detail in Section 6.1 of the RWRP-EM.

6.5.2 Option Types

The Supply Demand Balance (SDB) and Barrier Assessment (outlined in Section 3 of the RWRP-EM) inform the type and scale of options that Irish Water must consider. The main Option Types are shown in Figure 6.2.

For this iteration of the NWRP, Catchment Management option types are not selected. However, Nature-based solutions and catchment management measures will be considered as part of the Drinking Water Safety Plans (DWSPs) that aim to reduce risk to our supplies; and where possible, will be incorporated at Project Level. The DWSPs include a comprehensive risk assessment process of our supplies from water sources (catchment) to consumer (tap).

Irish Water identified **1132 unconstrained options** for the RWRP - EM.

Forty-six percent (46%) of the 1132 unconstrained options identified for the RWRP-EM are local abstractions of which 30% are groundwater and 16% are surface water. These are either an expansion of an existing abstraction site or the development of new sites to meet the needs of WRZs within close proximity. These options are usually combined with Water Treatment Plant (WTP) capacity upgrades.

Twenty-six percent (26%) of the options involve rationalisation, which refers to the merging of water supply systems and the subsequent decommissioning of the obsolete water infrastructure and associated abstractions. These options may require a new or enhanced supply source - for example, a new or enhanced groundwater or surface water abstraction or a water transfer from another supply system. The upgrade and/or expansion of existing WTPs may be carried out as part of a rationalisation process.

Water transfers make up thirteen percent (13%) of options. About one percent (1%) of these are transfers from an existing supply system in surplus. Others require an additional or upgraded source; for example, the option to supply Mullingar Regional (located in SA4, Westmeath) involves a transfer from a new source in SA8 (Limerick Clare).

Three percent (3%) of the options are WTP upgrades that have been identified for WRZs that are not in supply deficit but require water quality improvements only.

The remaining twelve percent (12%) of options comprise:

- Network improvements that can include interconnections to another supply system, operational changes, strategic trunk mains and/or other critical infrastructure improvements that enhance supply capacity and increase resilience.

- Reuse options in SA3 (Meath) and SA9 (Greater Dublin Area), which involve the provision of compensation flows downstream of abstraction sites using treated wastewater effluent or quarry discharge.
- Desalination plants to supply North County Dublin and South County Dublin, Mullingar Regional (in SA4) via a connection to the desalination option in North Dublin, and Meath and Louth in SA3 involving a trunk main through Drogheda.
- A reservoir (raw water storage) in SA3, situated bank-side of the Staleen WTP to store water during low flows.

Advanced Leakage Reduction for addressing the deficit for SA5 (Offaly/Roscommon) and SA8 (Limerick/Clare). Leakage reduction associated with these options is additional to the reduction achieved through our national Leakage Reduction Programme (as outlined in Section 3.2.6.6 of the RWRP-EM), which aims to meet our Sustainable Economic Level of Leakage targets (SELL). The Advanced Leakage Reduction options will go beyond the SELL targets and reduce the calculated SDB deficit.

6.6 Stage 4: Coarse Screening

The unconstrained options list is refined using a coarse screening assessment, which enables Irish Water to rule out any non-viable options. The remaining options known as "Constrained Options" are then carried forward for more detailed Multi Criteria Assessment (MCA) at the Fine Screening stage (see section 6.7).

The Coarse Screening assessment uses the criteria listed in Table 6.3 with options scored against a red, amber or green (RAG) traffic light system, as shown in Table 6.4.

Any option which scores "red" against a question has a fundamental issue that would be difficult to mitigate and is discounted on the basis that it is unlikely to ever be delivered.

An amber rating across any of the Coarse Screening criteria will not rule out an option, however, it will highlight that this option may require mitigation. For example, a surface water abstraction from a source which is designated as a European site will obtain an amber rating (assuming that it meets the allowable abstraction limits) against the Deliverability and Flexibility criterion and the Sustainability (Environmental and Social impacts) criterion. However, such an option will most likely require mitigation in relation to construction related impacts, which will take time to develop. Therefore, Irish Water must allow for consideration of the likely environmental site assessments and studies that will need to be carried out within Irish Water Plan level costing for an option.

A 'Rejected Options Register' is produced to record and explain all options that are screened out on the basis of a red rating. Details of the rejected options and the justification for their rejection are outlined in Annex B of the Study Area Technical reports (Appendices 1 – 9 of the RWRP-EM).

Removal of options which are clearly likely to conflict with SEA objectives through coarse screening is supportive of the SEA objectives. The environmental grounds for removing options are clearly recorded.

Table 6.3 Unconstrained Options Assessment Criteria

Criteria	Unconstrained Option Assessment Questions	
Resilience	Q1	Does the option address the supply-demand problem?

Criteria	Unconstrained Option Assessment Questions	
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?

Table 6.4 Red, Amber and Green Decision Matrix

RAG matrix	Red	Amber	Green
Resilience	Does not address the supply-demand problem at all.	May address part of the supply-demand problem (with due consideration on the size of the deficit).	Fully addresses the supply-demand problem.
Deliverability & Flexibility	Option is not technically feasible. Associated risks and uncertainties are not viable and will result in a failure of the option.	There are some risks and uncertainties associated with the option but are not considered to be insurmountable at this stage.	Option is technically feasible. There are no associated risks or uncertainties which are unacceptable.
Sustainability (Environmental and Social Impact)	Likely significant impacts on European designated sites or WFD objectives* or important biodiversity, landscape designations, cultural heritage or community assets which cannot be avoided through design or where proposed mitigation is not feasible	There are some impacts identified. However, they are not considered to be prohibitive at this stage due to the potential for improved design and/or mitigation.	No major issues or sensitivities identified at this stage.

*options that cannot meet sustainable abstraction limits are removed unless more detailed study information provides a basis for different thresholds.

6.7 Stage 5: Fine Screening

Fine screening involves an analysis of the Constrained Options against a range of detailed criteria, through a process known as Multi-Criteria Analysis (MCA). 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. It involves dividing the decision into smaller, more understandable parts and analysing each part before integrating those parts to produce a meaningful assessment.

The MCA process allows a combination of issues to be considered together. This can help indicate if one option will be more: cost effective, environmentally acceptable, sustainable, resilient or feasible when compared to other options. This process requires a more detailed analysis of the options and their

potential benefits and impacts against the key criteria. Additional information on the potential benefits and impacts will be collated at this stage. This information may highlight issues with options which were considered to be feasible at the coarse screening stage but now are not considered viable. If Irish Water have a Study Area where there are a significant number of options, the fine screening process allows Irish Water to rule out options which do not perform well over a range of criteria.

The MCA methodology has been tailored to provide a structured and transparent approach to inform the decision-making process and to remove subjectivity, as far as reasonably possible. This also recognises that both monetary and non-monetary objectives may influence decisions.

The MCA approach applies a common set of questions to determine the relative merits of each option across the key criteria. The questions are developed by dividing the criteria from the Coarse Screening stage into detailed sub-criteria against which options can be assessed. Table 6.5 lists the criteria and sub-criteria environmental questions that are applied at the Fine Screening stage.

The SEA topics and objectives are the basis for identifying key questions and developing the criteria for the environmental assessment and for scoring of options in the Fine Screening/ MCA as listed in Table 6.5.

Table 6.5 SEA Option/Approach and Fine Screening Environmental Questions

SEA Theme	SEA Objectives and Scope of Assessment	SEA Option/Approach Assessment Questions* (these questions are used to inform assessment against the objectives for individual options, combinations of options and at plan level)	Fine Screening Options Questions** (to inform numeric scoring for the MCA)
Population, economy, tourism and recreation, and human health	Protect and, where possible, contribute to enhance human health and wellbeing and to prevent restrictions to recreation and amenity facilities relating to the provision of water services.	Will the construction and operation of the option/approach impact public health and quality of life in terms of improved supply security or access to water? For example, will the construction or operation of the option/approach cause significant disturbance to sensitive receptors from dust, noise and/or traffic? Or does the option address drinking water quality issues that are identified on the EPA remedial action list?	Will the option impact public health and quality of life, during construction?
			Will the option impact public health and quality of life, during operation?
		Will the option/approach result in loss of recreational amenity, footpaths, or access to recreational amenity (including water based recreation and navigation)?	What is the impact on recreational amenities?
		Does the option/approach help to raise public awareness of the need for water conservation?	
	Water quality and resources		

SEA Theme	SEA Objectives and Scope of Assessment	SEA Option/Approach Assessment Questions* (these questions are used to inform assessment against the objectives for individual options, combinations of options and at plan level)	Fine Screening Options Questions** (to inform numeric scoring for the MCA)
Water environment	Restore and improve WFD status and of waterbodies with regard to quality and quantity due to Irish Water's activities and contribute towards the "no deterioration" WFD condition and where possible, the improvement of waterbody status for rivers, lakes, transitional and coastal waters and groundwater to at least good status related to the provision of water services.	Would the option/approach operation or associated construction activities create the potential for deterioration of waterbody status/quantitative status or conflict with or contribute to potential to achieve RBMP/WFD objectives for achieving good status (groundwater and surface water)? (covering surface water, groundwater and river channel/hydro-morphological aspects). For example, related to impacts from additional abstraction pressure on sources or does the option/approach address risk to the water environment from drinking water treatment residuals?	Would the option or associated construction activities affect WFD Status of water body, in terms of quantity and quality for surface water?
			Would the option or associated construction activities affect WFD Status of water body, in terms of quantity and quality for groundwater?
			Would the option or associated construction activities affect WFD Status of water body, in terms of hydro morphology?
		Would the option/approach reduce pressure on the water environment through water savings or improvements to water quality?	Would this option reduce pressure on water environment through water savings?
	Flood Risk		
	Protect and where possible reduce risk from flooding as a result of Irish Water's provision of water services	Is there a potential for this option/approach to increase flood risk, for example increase base flow or result in loss of flood plain?	Is there a potential for this option to increase flood risk – e.g. increase base flow or result in loss of flood plain?
Biodiversity	Protect and where possible, enhance terrestrial, aquatic and soil biodiversity, particularly EU designated sites and protected species resulting from Irish	Is there potential for the option/approach to result in significant adverse or beneficial effects on European or nationally designated sites (for example, by undermining the European sites' conservation objectives through direct or indirect effect pathways, including but not limited to direct loss of habitat, changes	Is there potential to result in adverse effects on the integrity of a European site?

SEA Theme	SEA Objectives and Scope of Assessment	SEA Option/Approach Assessment Questions* (these questions are used to inform assessment against the objectives for individual options, combinations of options and at plan level)	Fine Screening Options Questions** (to inform numeric scoring for the MCA)
	Water's provision of water services	in hydrology) and/or terrestrial and aquatic populations of European or nationally protected species?	
		Is there potential for this option/approach to result in significant adverse or beneficial effects national, county or local, designated sites or biodiversity interest (for example flora and fauna protected under the Flora Protection Order, Salmonid Regulations, 1988 and/or the Wildlife Act, 1976), for example through loss of significant areas of ecologically valuable habitat (woodlands/hedgerows/wetlands) and in particular irreplaceable habitats (ancient or long-established woodlands) or by undermining biodiversity objectives outlined in the National Biodiversity Action Plan or local county development/biodiversity action plan?	Is there potential to impact on an Annex species outside designated areas? Is there potential to impact on National designated sites?
		Could this option/approach contribute to a significant increased risk in spreading Invasive Non-Native Species (INNS)?	Is there a risk of spreading Invasive Non-Native Species?
Material assets	Minimise resource use and waste generation from the provision of 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.	Will this option/approach conflict with critical infrastructure, or does the option conflict with existing business, planned land use or result in the loss of significant area of valuable agricultural land?	Will this option conflict with critical infrastructure, or does the option conflict with existing business, planned land use or valuable agricultural land?
		Does the option/approach make use of suitable existing assets?	Will the option make effective use of existing assets?
		Does this option/approach increase resource use and waste production, including waste to landfill, or does it promote waste treatment efficiency and waste reuse, for example improvements	(Waste management good practice application assumed on individual option basis so not used for fine screening scoring)

SEA Theme	SEA Objectives and Scope of Assessment	SEA Option/Approach Assessment Questions* (these questions are used to inform assessment against the objectives for individual options, combinations of options and at plan level)	Fine Screening Options Questions** (to inform numeric scoring for the MCA)
		to the management of drinking water treatment residuals?	
	Minimise impacts on other material assets and existing and future water abstractions.	Would this option/approach affect other water users, for example through effects on existing groundwater abstractions*** or navigation?	(see question on navigation in water section above)
Landscape and visual amenity	Protect and, where possible, enhance designated landscapes related to the provision of water services.	Could this option impact landscape character areas, townscape character areas or important views – detract or improve?	Could this option impact the landscape character areas, townscape character areas or important views (detract or improve)?
Climate change	**Climate change mitigation**		
	Minimise contributions to climate change emissions to air (including greenhouse gas emissions) as a result of Irish Water provision of water services.	What is the level of construction and operational carbon emissions associated with the option/approach – using indicator of level of emissions such as scale of construction or energy use or estimated tonnes?	What is the level of construction and operational carbon emissions associated with the option (tonnes)? (Overlaps with information considered for MCA questions on supply resilience)
	Climate change adaptation		
	Promote the resilience of the environment, water supply and treatment infrastructure to the effects of climate change.	Does the option/approach increase climate change vulnerability for the environment or add resilience?	
Cultural heritage	Protect and where possible, enhance cultural heritage interests.	Does this option have potential to damage, or detract from the setting of, designated cultural heritage assets or result in the loss of potential	Does this option avoid direct damage to, or detract from the setting of, designated cultural

The Fine Screening environmental assessment is undertaken against SEA Objectives and sub-criteria as Fine Screening can be used to identify options for rejection at this stage. These are recorded in the rejection register and any environmental grounds for removal clearly stated.

SEA Theme	SEA Objectives and Scope of Assessment	SEA Option/Approach Assessment Questions* (these questions are used to inform assessment against the objectives for individual options, combinations of options and at plan level)	Fine Screening Options Questions** (to inform numeric scoring for the MCA)
		archaeological interest, or does this option contribute to protecting them?	heritage assets, or does this contribute to protecting them?
Geology and soils	Protect soils and geological heritage sites and where possible contribute towards the appropriate management of soil quality and quantity.	Would any designated or non-designated geological features be damaged by an option, or is there a risk to significant areas of valuable soils or are there risks from contaminated land? Or could the option support improvement to soil quality and reduce erosion risks.	Would any designated or non-designated geological features, valuable soils, or contaminated land sites be affected?

The questions are used in the SEA options and approach assessments against the objectives and are used as the basis for the MCA scoring - the Fine Screening assessment can identify additional showstoppers and reasons for removing options. All questions can be responded to by recording either negative adverse or positive beneficial effects/risk.

Finally, the scoring guide for the evaluation against the Sustainability (Environmental and Social Impacts) criteria is set out in Appendix B. The guide aims to support consistency in the assessment across different option types.

The general aim is to keep options in for further consideration and to only remove options where there is a clear justification for doing so and to avoid unnecessary further option development and assessment work on unfeasible options. Where there is uncertainty or potential for issues to be addressed through design or mitigation options are retained.

6.8 Stage 6: Feasible Options List – Option Costing

The output of the Fine Screening stage is called the Feasible Options List. An outline design and estimated cost is developed for each option on the list. Summary option dossiers are produced for each feasible option.

It should be noted that assessments at this stage are high level desk-based and Plan Level assessments. Environmental impacts and costing of projects are further reviewed at Project Level where

Environmental performance against the SEA objectives as reflected in the MCA scoring against environmental criteria are reviewed and updated to reflect the option dossier information following outline design and scoring rules updated to reflect the assessment applied.

alternatives will require to be considered as part of the environmental impact assessment process in the usual way. No statutory consent or funding consent is conferred by inclusion of any option in the RWRP. Any projects that are progressed following identification in this plan will require individual environmental assessments, including where appropriate, Environmental Impact Assessment and Appropriate Assessment. These will be obligatory in support of planning applications (where a project requires planning permission) or in support of licensing applications (for example, for new or increased surface or groundwater abstractions). Any such applications will also be subject to public consultation.

6.8.1 Environmental and Social Valuation

In addition to the construction and operational cost estimates and qualitative environmental options assessment, an environmental and social valuation of the option is undertaken to provide monetised values to feed directly into the approach appraisal process.

SEA methodology is based primarily on qualitative assessment to consider if potential effects are likely to be significant, but this is informed by quantitative information such as GIS based analysis. In addition, where possible the valuation of environmental and social costs and benefits (including carbon) are used to inform options appraisal. This involves monetising societal impacts and benefits and can be undertaken through a range of environmental economics tools, including natural capital accounting and ecosystems services assessment methodologies. These approaches are new and are still being developed but are likely to be increasingly used in the future.

The areas covered for the environmental and social costings are:

- Climate regulation – woodland;
- Traffic impacts – opportunity cost of time due to road congestion from roadworks;
- Food – crops and livestock; and
- Carbon emissions (calculated alongside the construction and operational costs for the options).

The aim of the calculations is to capture and value significant residual impacts in relation to the categories examined for each option and this can be especially valuable for providing information on combinations of options. However, the categories that can be used depend on the option and environmental information available to allow quantification metrics and valuation.

The approach for valuation of environmental and social costs and benefits is applied using information available. Insufficient information on option sites and pipeline routes is available to apply a Natural Capital assessment approach fully at this stage and an initial high-level quantification of potential land uses affected by the plan proposals is provided at a regional level as a starting point to be developed further as options are developed further and more detailed information is available on option impacts on habitat and land use types, areas and condition and the ecosystems they support. The approach applied aims to avoid double counting with the qualitative assessment undertaken for the SEA.

6.8.2 Selection of Options for the Approach Appraisal

The screening process provides MCA scores for the options which will or will not progress through for further consideration in the approach appraisal. As with the Coarse Screening the justification for rejecting options will be recorded and these can be reviewed in the future.

Where there are very large numbers of constrained options covering a range of option types providing sufficient choice for the approach appraisal, screening is useful for identifying the worst performing

options. These can be removed or placed on a reserve list and the better performing options taken forward for further consideration in the feasible list. Any options which are discounted at this stage are recorded on the Rejected Options Register (Annex B of Technical appendices 1 - 9 of the RWRP-EM). Better performing options are taken forward for further consideration in the feasible list. This method can be appropriate for large WRZs or Study Areas.

For more limited numbers of constrained options within any WRZ or Study Area, screening is best used as a check. This is considered an appropriate method where options are likely to have been identified with some constraints and requirements already considered. Only options identified as clearly unfeasible, unsustainable or unviable will be removed. Where options perform poorly against specific sub-criteria, the potential for design or mitigation to address effects will be considered. If there is any doubt as to whether a particular option should be classified as feasible or not, then that option will be carried forward to the feasible list for further consideration.

Each option is subject to an objective assessment with uniform scoring criteria, based on best publicly available datasets. Options are scored using a seven-point Likert scale, from major adverse scoring -3 through to major beneficial 3, as set out in in the scoring guidance provided in Appendix B.

The screening process provides MCA scores for each of the Feasible Options which then pass through to the Approach Appraisal stage for further consideration.

6.8.3 Summary of Options Appraisal and SEA

These steps provide a valuable process for collecting information on the options and refining both the option design and capturing environmental assessment information which can be built upon in the next stage.

The environmental MCA criteria are based on the SEA objectives from the SEA Scoping Report and consulted on with environmental stakeholders. Some criteria/screening questions may be more relevant to some options types than others.

Habitats Directive considerations have been integrated into the Options Assessment Methodology at a number of points to ensure both robust assessment and protection are integrated into the Plan. In particular, this is demonstrated through the MCA/Fine Screening scoring for the European sites and biodiversity question (see Best AA approach, Table 6.6) and again through consideration of mitigation measures to avoid adverse effects that have been identified.

Summary of how the options appraisal process incorporates consideration of SEA objectives:

Pre-option screening application of allowable abstraction rules to new options to meet WFD requirements for good and high status water bodies. (Note: these are precautionary rules and, in some cases, available hydrological/hydrogeological studies or appropriate assessment may provide more specific information on the relevant thresholds).

Screening out of options considered with reasonable certainty as likely to have significant effects on the environment that are considered unlikely to be mitigatable.

Improving the options by making use of an iterative process which will allow potential significant environmental issues for an option to be identified and the potential to address these to be considered. For example:

- Further option definition to address the concern, such as including information on allowable abstraction limits and operating principles;
- Highlighting aspects where further design, siting, routing or embedding mitigation measures in design or operation rules is required for the next stage;
- Identifying further information required to reduce the assessment uncertainty, such as aspects of design, option components, environmental information, or information on nearby abstractors; or
- Providing an opportunity to build mitigation measures and risk issues into option costings.

6.9 Stage 7: Approach Development

6.9.1 Test a Range of Approaches

The purpose of the Plan is to examine all potential options that could be used to meet the need and then to eliminate those that are not feasible or that have identifiable environmental issues (at a desktop level).

After Fine Screening the Feasible Options are assessed individually or as option combinations forming different potential approaches to identify the preferred option or combination of options to meet the need for each WRZ, Study Area and Regional area.

A defined process has been identified to develop the Preferred Approach at the three spatial scales shown in Figure 6.3.

The final stage is to assess any inter-regional options and potential cumulative or in combination effects and determine if any adjustment is required (this will be addressed sequentially in each of the Regional Plans in turn).

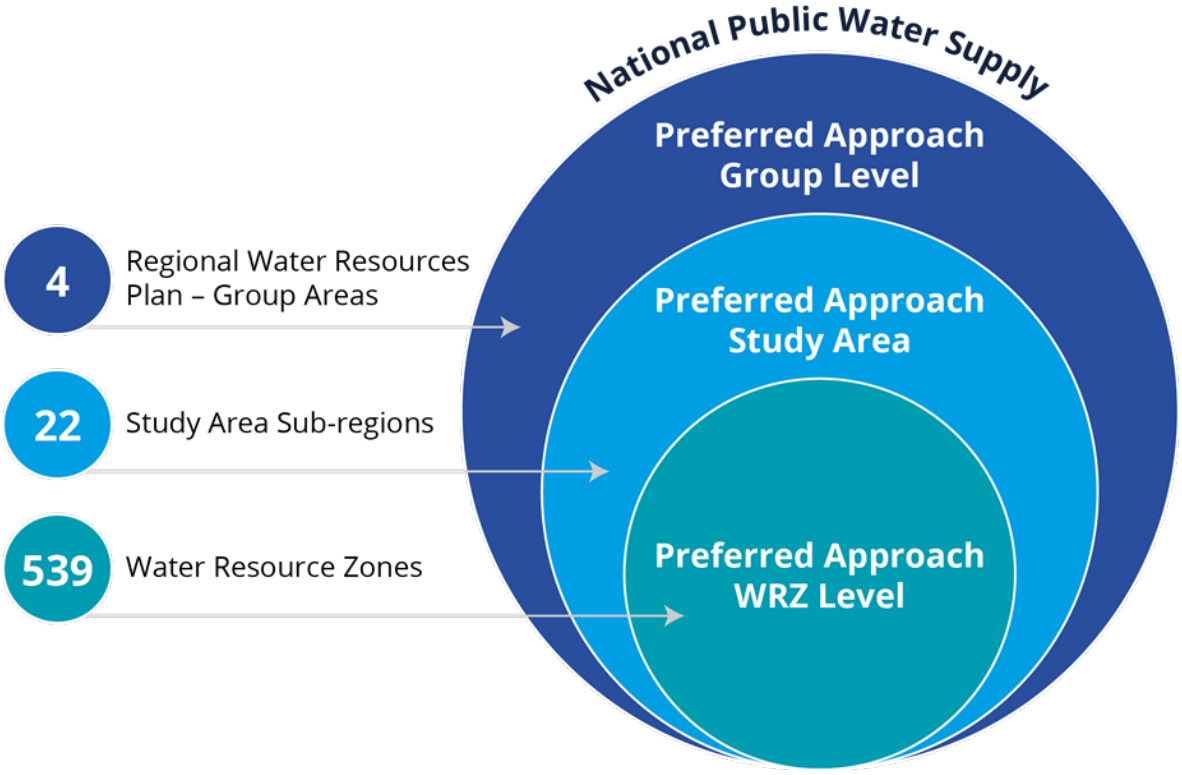


Figure 6.3 National Water Resources Plan Spatial Scale of Assessment

The Feasible Options, individually and in-combination are tested to determine the Preferred Approach to meet the need across the three spatial scales. The options are tested against six Approach Categories which were selected to align the Framework Plan with all relevant Government Policy. The six Approach Categories are summarised in Table 6.6 and discussed in further detail below.

Table 6.6 The Six Approach Categories

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

Approaches Tested	Description	Policy Driver
Best Environmental (BE)	This is the option or combination of options with the highest total score across the 19 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 to SEA Objective for climate change adaptation for environment)	National Adaptation Framework and Climate Action Plan
Lowest Carbon (LC)	This is the option or combination of options with the lowest embodied and operational carbon cost	Climate Action Plan

Least Cost Approach

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

Best Appropriate Assessment Approach

The Best AA Approach gives maximum consideration to the options with no potential for impacts (no Likely Significant Effects (LSEs)) on European Designated sites or options with LSEs that can be addressed with general/standard mitigation measures at the Project Level. This can equally be described as giving maximum consideration to the options with the Least Impact on European Sites. It puts avoidance of impacts on European sites at the forefront taking account of the fact that options with a high likelihood of significant effects which could lead to adverse effects on a European Site have already been removed at Coarse Screening stage.

This approach prioritises the avoidance of impacts on European sites, taking account of options likely to have a higher risk of significant effects and more likely to require mitigation to avoid significant effects.

Quickest Delivery Approach

The Quickest Delivery Approach is based on the estimated time for an option to be brought into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening. This approach allows Irish Water to potentially optimise the Preferred Approach by minimising the time taken for an option to become operational. This could be appropriate in a WRZ with a critical water quality issue that might impact on public health, as this approach would identify the option

that could potentially be delivered in the shortest possible timeframe. As the NWRP does not confer funding or statutory consent for any project, and the identified needs across the Eastern and Midlands Region must be considered. Irish Water would be unlikely to modify an approach based on Quickest Delivery unless there is a critical driver.

Best Environmental Approach

The Best Environmental Approach is the option or combination of options with the highest total score from the SEA objectives and environmental sub-criteria MCA questions, assessed as part of the Fine Screening assessment described in Stage 5. The purpose of this approach is to consider overall performance across the SEA objectives and potential to minimise overall potential impacts in the options assessment and approach selection process.

For each option or combination of options, the MCA includes assessment across all 19 SEA objectives and sub-criteria, using the sum of positive scores and the sum of negative scores separately and avoiding combining positive and negative scores.

The scoring is also reviewed against:

- Individual criteria to identify where high negative or positive scores indicate potential for significant adverse or beneficial effects (for example the number of -3 scores); and
- How the assessment reflects important differences between options focusing on where these relate to potential operational or long-term effects and also the range of difference in the scoring.

This provides a basis for reviewing each option and the option combinations on a relative performance basis.

When the combination with the lowest environmental score also scores any -3 score under the Best AA criteria, we review the other combinations to determine if there are any combinations with a no -3 biodiversity score. The Best Environmental is the Combination with the best performing environmental score with the least no of -3 scores against the best AA criteria.

The potential approaches are also assessed in terms of overall performance against the SEA objectives against a 'do minimum' scenario.

Most Resilient Approach

The Most Resilient Approach is the option or combination of options with the highest scores from the four (4) MCA screening questions relating to Resilience criteria. This approach is aligned to the NWRP objective to ensure a safe and secure water supply in the short, medium and long term.

Lowest Carbon Approach

The Lowest Carbon Approach is the option or combination of options with the lowest embodied and operational carbon costs. This approach is aligned with Irish Waters carbon reduction policies and the National Adaptation Framework (NAF)[17] in relation to climate change.

[17] Department of Communications, Climate Action and Environment, 2018. *National Adaptation Framework. Planning for a Climate Resilient Ireland*. [online] Available at National Adaptation Framework.[Accessed 24 October 2021].

6.9.2 Approach Assessment Ranking

The EBSD (Economics of Balancing Supply and Demand) method is applied to rank the options in order of lowest to highest NPV cost and with regard to their applicable MCA scores for the six Approach Categories. The EBSD method determines an optimum combination of options to address the future Need, balancing across the range of NWRP and SEA objectives outlined above. Further detail on the method applied is outlined in Section 7.2.1 of the RWRP-EM.

In some instances, options may achieve similar, although not exactly identical, scores within an Approach Category. In these circumstances, and to ensure that options which perform better overall are not excluded from the approach development process, Irish Water takes a wider look at the combination to consider which of these comparable options to categorise as the “Best” approach within each category. In particular, Irish Water takes into account whether the option or combination of options meets the SEA and Habitats objectives outlined in the Framework Plan.

The Approach development process is designed to determine the “Best Value” approach to meet the need and this is then identified as the Preferred Approach. “Best value” is identified as the approach that provides the best performance overall, balancing across the range of NWRP and SEA objectives.

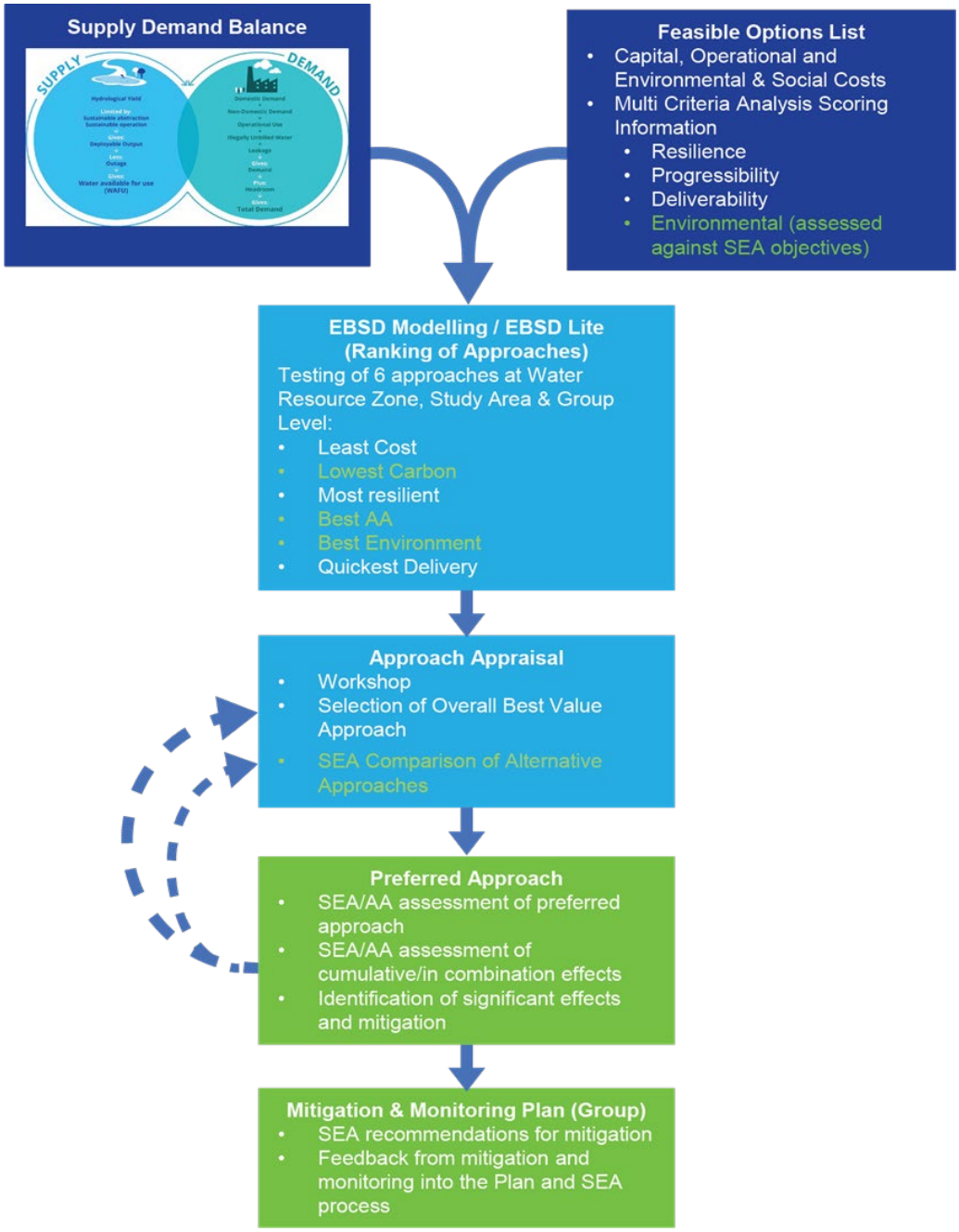


Figure 6.4 Approach Development Process

6.9.3 Approach Appraisal

Irish Water then compare the options identified for each of the six (6) Approach Categories (Least Cost, Best AA, Lowest Carbon, Best Environmental, Most Resilience and Quickest Delivery) against each other to come up with a Preferred Approach that meets the objectives of the Plan and aligns with all relevant Government Policy.

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

The identification of a Preferred Approach at a Plan level does not confer any consent to develop a project, nor does it preclude other options being considered subsequently at the Project level. Assessments at this stage are desk based and Plan level assessments. Environmental impacts and costing of projects are further reviewed at Project level where alternatives will need to be considered as part of the Environmental Impact Assessment process in the usual way. No statutory consent or funding consent is conferred by inclusion of any option in the NWRP. Any projects that are progressed following this plan identification as a Preferred Approach in the Regional Plans, will require individual environmental assessments, including Environmental Impact Assessment and Appropriate Assessment (as required), in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions).

The Approach Development Process contains three tiers. This starts with WRZ level and is then applied sequentially to each Study Area and then the Region as follows:

Stage 1 – the WRZ is assessed individually to develop an initial Preferred Approach, the - WRZ Preferred Level approach - for all of the supplies in the Study Area

Stage 2 – The potential to use any larger options that might resolve deficits across multiple WRZs that are located within the same Study Area. We then develop combinations of these options (SA Combinations).

Stage 3 –The SA Combinations and the WRZ Level approach are assessed in order to determine the best performing combination across the six Approach Categories. This is known as the Preferred Approach at SA Level. The seven step Preferred Approach Development Process is summarised in Figure 6.5.

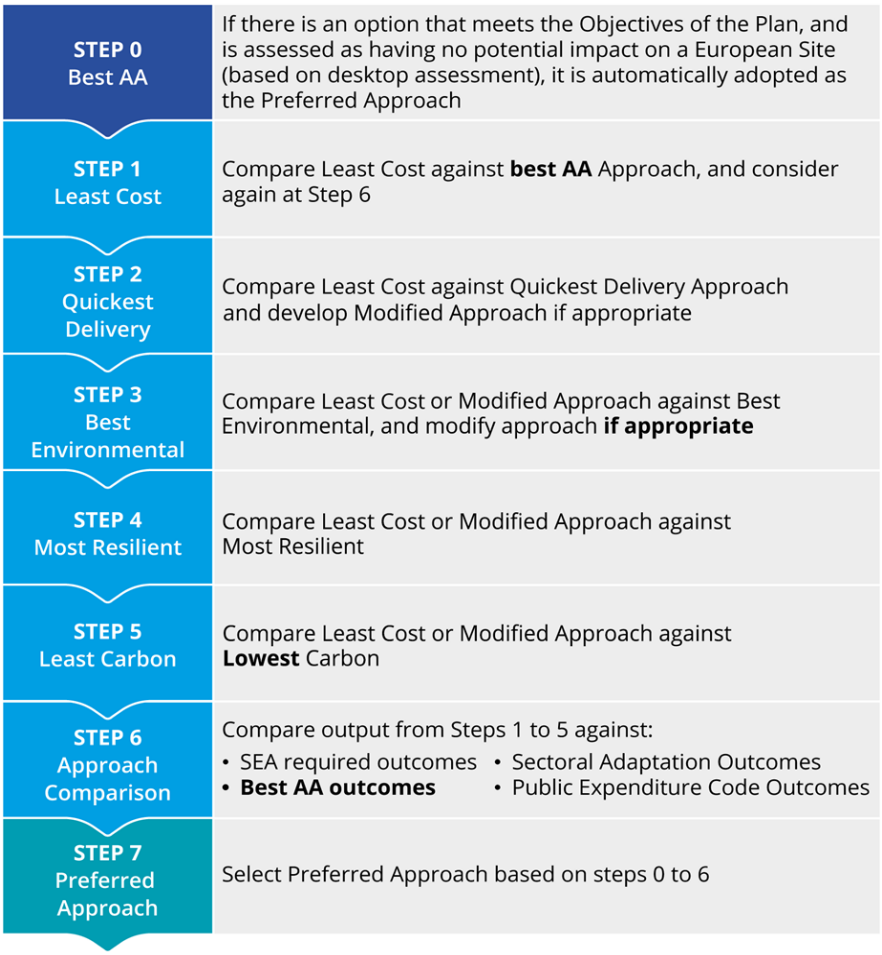


Figure 6.5 The 7 Step Process

6.10 Selection of Preferred Approach

The Preferred Approach to meet the need for each WRZ is identified using the Approach Assessment Process set out in Figure 6.5. As noted in Figure 6.3, this process is then repeated at the Study Area and Regional scales.

Figure 6.6-Figure 6.8 represent this process schematically.

Figure 6.6 Preferred Approach Development Stage 1

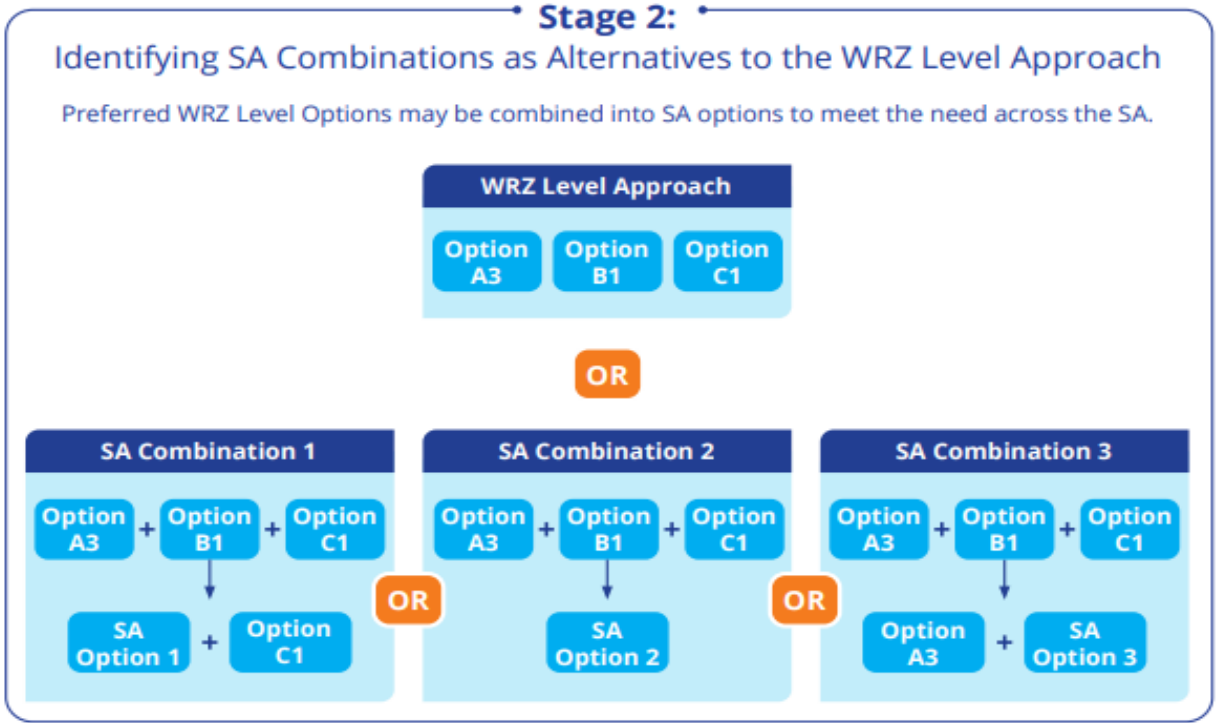


Figure 6.7 Preferred Approach Development Stage 2

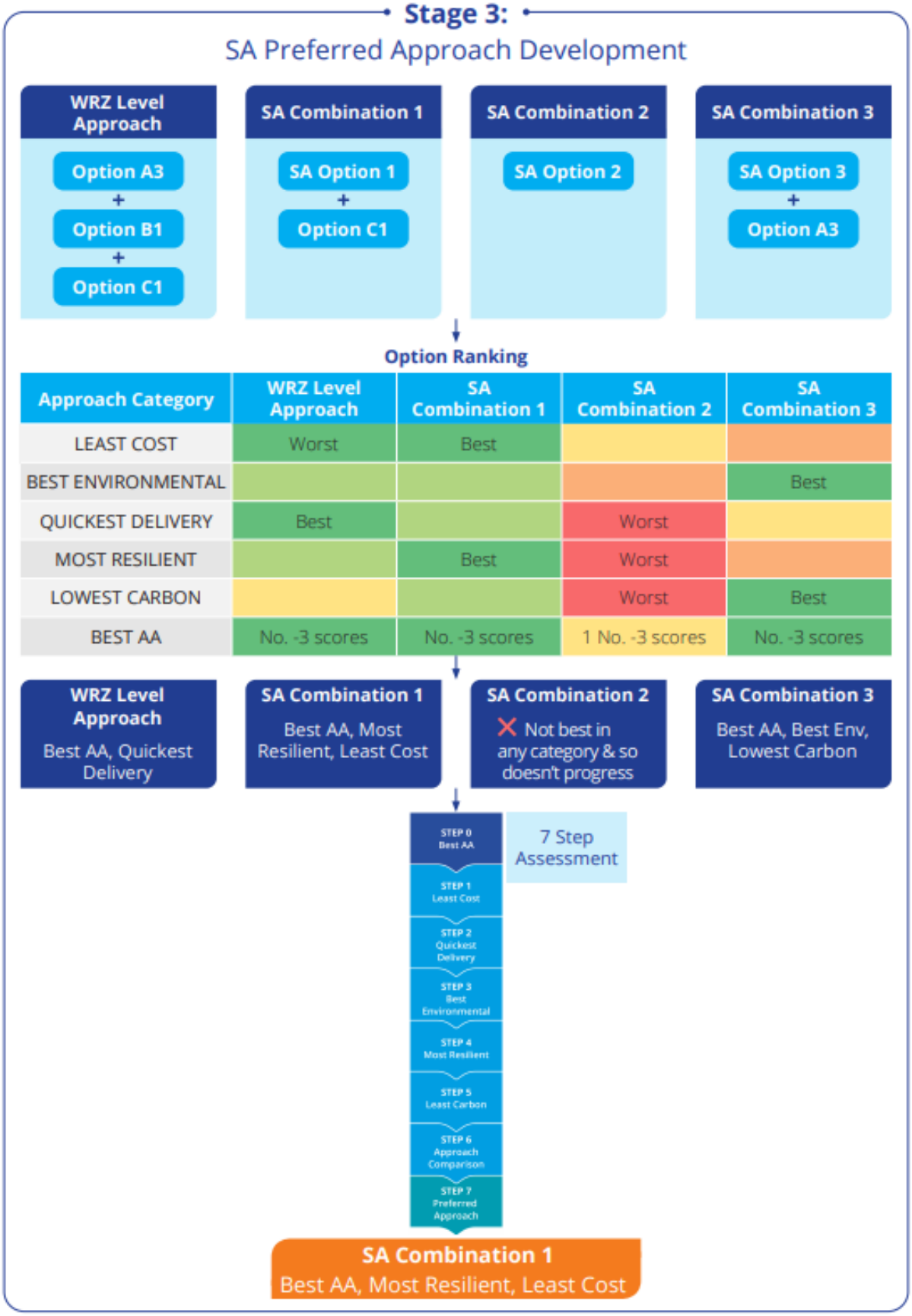


Figure 6.8 Preferred Approach Development Stage 3

Figure 6.8 illustrates how the Preferred Approach is selected from the options performing best against one or more of the approach criteria (assessed using the MCA scores and cost information) using the 7 step process that compares the possible approaches. The process is further described in RWRP-EM section 7.2.5, using an example.

6.10.1 Sensitivity Analysis

Irish Water's supply demand forecast has been developed using the best available information and the application of best practice methods where they have the data to do so. Irish Water has identified areas where they will focus improvements in data to improve the certainty of their forecasts. However, all long-term forecasts are subject to uncertainty.

Therefore, Irish Water incorporates a sensitivity analysis check in their Approach Assessment Process to test the sensitivity of the Preferred Approach to a range of futures which could alter the SDB and impact on need. This will ensure that their decision making is robust and that the approaches developed are adaptable. Table 6.7 summarises the types of factors Irish Water uses to test the sensitivity of Preferred Approaches developed in the RWRPs.

Table 6.7 Summary of Irish Water Sensitivity Assessment

Uncertainty Factor	Likelihood	Impact on SDB	Impact on Deficit	Discussion
New abstraction legislation introducing sustainability limits on quantities to be abstracted	High (as Irish Water current abstractions are large compared to the water bodies from which they abstract)	Reduction in Deployable Output (DO)	Larger SDB deficit	Although the likelihood of this scenario is high based on a desktop assessment of their existing abstractions, potential impacts may be mitigated against by optimising their operations on a more environmentally sustainable basis across the range of supplies.
Climate change impacts on supplies are greater than anticipated	Moderate (central climate change estimate used)	Reduction in water availability at certain times of the year	Larger SDB deficit	Although the likelihood of this scenario is moderate based climate change allowances made in this Plan, potential impacts may be mitigated against by optimising their operations on a more environmentally sustainable basis across the range of supplies.
Domestic demand is lower than expected and/or Non-domestic demand is lower than expected	Low/Moderate (growth has been based on policy)	Growth in demand is lower than estimated	Smaller SDB deficit	The SDB deficit is driven by many factors including limitations in existing supplies, the reliability of the overall supply and assumptions on demand growth. If demand does not grow as significantly as Irish Water forecast there will still be a supply demand deficit in many WRZs. The

Uncertainty Factor	Likelihood	Impact on SDB	Impact on Deficit	Discussion
				required intervention to resolve the deficit may be smaller.
Irish Water achieve good levels of effectiveness and efficiency in reducing leakage	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	Leakage reduces to below SELL within the period of the plan	Smaller SDB deficit	Irish Water will strive to be progressive in leakage reduction plans. However, due to the supply and reliability issues Irish Water have this will not negate the need for other interventions to address the supply demand deficits.
Ability to reduce leakage in accordance with targets, due to, lengths of networks, access to assets, need to maintain and budget constraints.	Moderate (the distribution network is extensive)	Leakage does not reduce to SELL within the period of the plan	Larger SDB deficit	Due to the length and condition of the networks, Irish Water could potentially fail to achieve 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 reductions as opposed to accepting lower targets.

A scenario where growth is higher than forecast, is not tested as Irish Water considers the projections that are used in the Supply Demand Balance calculation reflect an optimistic growth forecast. Furthermore, the scenario of higher than forecast growth would have the same impact as a scenario where Leakage targets are not met.

In reality a combination of these scenarios may occur together. For example, Irish Water may find growth in demand is lower and they achieve greater leakage reductions at the same time as the abstraction licensing regime limits their water availability. In this case reductions in demand would offset some of the increasing deficit due to abstraction sustainability reductions.

Should an outcome of the Sensitivity Assessment find that a preferred option will not be resilient or adaptable to changing future scenarios, Irish Water will reassess it against the options identified for the six (6) Approach Categories during the Approach Appraisal phase and consider if an alternative should be progressed.

As data and models improve over time Irish Water will incorporate a more extensive approach to sensitivity analysis in the shape of Adaptive Planning. Adaptive Planning provides the flexibility to respond to uncertainty when it occurs (e.g. climate change impact increases).

6.10.2 Interim Solutions

As outlined in in Section 8.3.7.6 of the Framework Plan, the NWRP provides for an “interim solution” approach, which allows shorter term interventions to be identified and prioritised, when needed. The

Preferred Approach for each WRZ, Study Area and Region will be delivered on a phased basis subject to budget and regulatory constraints. It will take many investment cycles to deliver the Preferred Approach across all WRZs, therefore, Irish Water must have a means to continue delivering safe, secure and reliable water supplies (on a short to medium term basis) while we deliver our Preferred Approach.

On this basis, interim, short term capital maintenance solutions have been identified for all WTPs and will be utilised when needed. These solutions will allow Irish Water time to deliver the Preferred Approach, while at the same time, maintaining a sustainable water supply. These interim solutions are generally smaller in scale and rely on making best use of already existing infrastructure. A decision to progress any interim solution will be based on urgent or priority need to address water quality risk or supply reliability e.g. RAL, drought issues or critical need. The RWRP-EM does not confer funding availability for any project and any interim measures will be subject to budget availability, relevant environmental assessment and other required consents in the normal way. These solutions, in most cases, will only be used to allow time to deliver the longer-term solution. The interim solutions are determined in line with the Preferred Approach and as such, they are considered “no regrets” infrastructure investment.

The RWRP will not confer funding availability or statutory consent on any interim solution. If an interim option is deemed necessary, funding approval in addition to all applicable consents would need to be obtained for it to progress.

6.11 Stage 8: Monitoring and Feedback into Plan

The Public Water Supply in Ireland is a live asset base and is subject to continuous change. New assets such as WTPs, storage reservoirs, trunk and distribution mains are continuously developed and upgraded. Knowledge and data relating to assets are improving and operational procedures are being standardised.

External factors can also influence the performance of water supplies, including:

- Changes in legislation and policy that impact the way Irish Water operate their asset base or their interface with the natural environment;
- Reductions in water supply availability due to climate disruption and environmental impacts;
- Growth in demand for water for domestic and non-domestic use; and
- Funding availability and requirements to improve Levels of Service to water users.

All of these factors influence the need in terms of Quality, Quantity, Sustainability and Reliability, therefore the SDB, Barrier Scores in the Plan represent a snapshot in time of live metrics.

Similarly, the development of the Preferred Approaches as part of the Regional Plans is influenced by evolving scientific data, understanding, and policy change in relation to the natural environment.

Irish Water must be able to continuously adapt to these changes, which may be minor or material in nature. The RWRP-EM therefore commits to undertaking continuous monitoring and ensuring that there is a feedback mechanism within the Framework Plan and Regional Plans. The Regional Plans will be subject to formal review every five years; however, this continuous monitoring process will ensure that material amendments are assessed for significant impacts on the environment.

An SEA Environmental Action Plan and Monitoring Plan were finalised following the consultation and are provided in section 10 of this report. They are also provided in the SEA Statement with a commitment to implement included in the RWRP-EM.

6.12 SEA and Consideration of Alternatives

This Section focuses on the SEA requirements for the assessment of alternatives as well as cumulative effects which are addressed as part of the options and approach development methodology applied at each spatial level.

Option level assessment: all feasible options have been assessed as part of the MCA and scored against the SEA objectives set out in Table 6.1. These are used to inform the selection of options and the approach comparisons.

SEA option assessment summaries, which will record assessment against SEA objectives using a matrix-based approach, is undertaken for all Preferred Approach options for each Study Area and also for any regional level preferred options or alternatives. The nature of effects (temporary, permanent, short term or long term), significance of effects and level of certainty in assessment outcomes will be recorded as shown in Table 6.8. The significance of effect is determined in accordance with Table 6.9 and moderated by professional judgement where required. The assessment takes into account the value/sensitivity of affected receptors, as well as the magnitude of the impacts anticipated.

Table 6.8 Significance of Effect and Assessment Certainty (Option Level Assessments)

Type of effect		**Potential significance of effect**			
Long term (>15 years)	L	Major beneficial	+++	Major adverse	---
Short term (<5 years)	S	Moderate beneficial	++	Moderate adverse	--
Permanent	P	Minor beneficial	+	Minor adverse	-
Temporary	T	Neutral	0		
Assessment certainty		Low/Medium/High			

Table 6.9 Determination of Significance

Magnitude of impact	**Baseline** value/sensitivity					
	Low		**Medium**		**High**	
Major loss or change to receptor(s)	Minor adverse	-	Moderate adverse	--	Major adverse	---
Moderate loss or change to receptor(s)	Minor adverse	-	Moderate adverse	--	Moderate adverse	--
Minor loss or change to receptor(s)	Minor adverse	-	Minor adverse	-	Moderate adverse	--
No impact or impact does not affect	Neutral	0	Neutral	0	Neutral	0
Minor enhancement to receptor(s)	Minor beneficial	+	Minor beneficial	+	Moderate beneficial	++
Moderate enhancement to receptor(s)	Minor beneficial	+	Moderate beneficial	++	Moderate beneficial	++

Magnitude of impact	Baseline value/sensitivity					
	Low		Medium		High	
Major enhancement to receptor(s)	Minor beneficial	+	Moderate beneficial	++	Major beneficial	+++

Value/sensitivity of receptors

Low value receptors(s) = locally important and/or resilient to losses and substitution and/or limited capacity for enhancement

Medium value receptor = regionally important and/or with some resilience or capacity to accommodate losses of substitution or enhancement

High value receptor = nationally important and/or with very limited resilience or potential to accommodate losses or substitution or substantial capacity for enhancement

All feasible options are assessed as part of the MCA and scored against SEA objectives and sub criteria using the scoring guide (Appendix B). This is a high-level assessment undertaken for each feasible option. The feasible options assessment information is fed into the approach workshop process.

- **Study Area Level Assessment**: an assessment of each approach, including the 'Do Minimum' approach, will be prepared for each Study Area. Differences between the approaches will be explained and justification for the selected Preferred Approach will be set out. Mitigation measures associated with the individual options in the Preferred Approach will be provided.
- **Study Area Level Cumulative Effects**: the potential for cumulative effects against the SEA objectives will be considered. This will include 'within plan' cumulative effects (i.e. between options or groups of options included within the Preferred Approach) and 'with other developments' cumulative effects (i.e with other developments within the Study Area).
- **Regional Level Assessment**: an assessment of the potential cumulative effects arising from the Preferred Approaches identified at Study Area Level, as well as any Regional Level options, will be undertaken. The assessment will be presented in matrix format, with the significance of effect recorded against each SEA objective as per Table 6.10.
- **Regional Level Cumulative Effects** - the SEA Environmental Report for the Framework Plan also refers to a further step which involves assessment of potential cumulative effects associated with either i) inter-regional options (such as transfers between regions) or ii) cumulative effects between Regional/Group Area Preferred Approaches. The RWRP-EM is the first Regional Plan to be developed, and therefore limited information is likely to be available regarding approaches included in Regional Plans for other regions. An inter-regional level assessment will be carried out to the extent possible, based on information currently available regarding approaches for the other regions. As subsequent Regional Plans are developed, the Environmental Report which accompanies them will consider the inter-regional cumulative effects with all preceding Regional Plans including the RWRP-EM.
- **Inter-Regional Level Assessment**

  In addition to assessing combined effects from options across all the Study Areas within the Preferred Approaches in a region/group area, the Regional Plans will need to consider potential for:

- Inter-regional options such as transfers between regions. These will be part of alternative approaches under consideration in Regional Plans; and
- Cumulative effects between regional Preferred Approaches.
- Inter-regional options, these will need to be identified as the Regional Plans are prepared and will be addressed through the assessment of alternative approaches.

Where Regional Plans are prepared in parallel, cumulative effects of the Preferred Approaches can be considered together but where the Regional Plans are prepared sequentially cumulative effects will need to be addressed for any preceding plans and reported in the SEA Environmental Report.

As the RWRP-EM is the first Regional Plan there are no other NWRP Regional plans to consider at this stage.

Table 6.10 Significance of Effects (Regional Level Assessment)

Key			
Likely to have a positive effect	+	Likely to have a mixed positive and negative effect	+/-
Likely to have a negative effect	-	Likely to have mixed neutral and negative effect	0/-
Effects are uncertain or not applicable	? or N/A	Likely to have mixed neutral and positive effect	0/+
Likely to have a neutral effect	0		

6.13 Transboundary Issues

The potential for transboundary effects and cumulative effects with key relevant plans and proposed developments in Northern Ireland is included as part of the options and approach assessment and results of these assessments are to be reported where these are identified based on potential pathways for effects. As the borders of the Eastern and Midlands Region are shared with other NWRP regions within the Republic of Ireland potential effects are not considered likely but are reviewed as part of the assessment of the Regional Plan Preferred Approach.

6.14 Summary of Approach Appraisal and SEA

The Approach Appraisal incorporates SEA and AA requirements through:

- Comparison of the different approaches including three (3) environmentally led approaches - Best AA, Best Environmental and Low Carbon - to determine the Preferred Approach through a structured, transparent and fully recorded process;
- Assessment of the alternative approaches including the three environmental approaches, most resilient, least cost and do minimum and quickest delivery approaches using a relative MCA based comparison and overall absolute assessment against SEA objectives;
- Process of avoiding high risk European sites or WFD options where possible and where needed identification of possible back up options. (These are options that could be brought forward if project level studies on preferred options identify that AESI cannot be avoided or WFD water body status deterioration is likely, and time limited derogation is not available);
- Assessment of the selected Preferred Approaches through SEA and AA, including individual options assessment of the combined options within each approach (cumulative effects assessment and in combination assessment) within each Study Area and within Regional Plan and also with other proposed plans or developments. Feedback and reconsideration are included in the process if needed and the assessment involves identification of mitigation measures to be taken forward addressing individual option mitigation and mitigation for cumulative and in combination effects.

Overall, the process provides an iterative process allowing testing and consideration of environmental performance and mitigation requirement at WRZ, Study Area, Regional and inter-Regional Level; and

The assessment provides a systematic and tracked process which can be applied consistently across the four (4) Regional Group areas and will facilitate input from internal and external stakeholders.

6.15 Appropriate Assessment

The methodology for undertaking screening for AA can be applied at both a project and plan level assessment. The suitability of the data and information used and any decisions flowing from its use in the RWRP-EM assessment have to meet the provisions and requirements of the Habitats Directive. The strategic assessments at the plan level will inevitably be undertaken at a higher level than would be the case for projects. However, the RWRP-EM does not provide consent for any future projects arising from it or future iterations of the plan but, demonstrates that the protection for the European site network is suitably considered and achievable in the context of the remit of the plan. Also, any future project level AA screenings and/or NIS will have regard for the plan level AA screening as the projects have been identified or specified from the RWRP-EM. To note, all of Irish Water's projects are screened for AA. Therefore, all projects arising from the RWRP-EM will additionally be required to go through individual

environmental assessments (including AA screening and if needed AA). These will be obligatory in support of planning applications (where a project requires planning permission) or in support of licensing applications (for example, for new or increased surface or groundwater abstractions).

The NIS for the RWRP-EM describes how the identification of Likely Significant Effects (LSE) has been applied through the options assessment process. For the Fine Screening MCA the scoring for the European sites (biodiversity) question identifies at a high-level potential for LSEs from an option (screening for AA - Stage 1 of the AA process). Any option with a score of -1 to -3 has identified LSEs and is taken forward to AA (Stage 2 of the AA process) and assessed within the NIS. The score essentially identifies LSEs with varying implications for European sites.

6.16 Limitations and Assumptions for the SEA

Given the high-level nature of a regional plan there are also uncertainties and limitations for the environmental assessment. These are recognised and summaries below:

Limitations include:

- High level nature of the assessment based on preliminary option concepts where locations of sites and routes for infrastructure are not defined and will be subject to further detailed studies and design.
- Yield assessments are based on estimated flows which will require further assessment at project level. Furthermore, at Plan level information on all other non-Irish Water abstractions may not be available therefore yield assessments undertaken as part of the Plan are based on the best information available to Irish Water.
- For many of the groundwater abstractions potential impacts from existing abstractions are not known or fully understood, while guidance for allowable abstraction limits from groundwater sources do not currently exist, therefore more uncertainty remains around the potential impacts from such options. An initial assessment on the potential cumulative impacts on groundwater bodies from groundwater abstractions proposed as part of the RWRP-EM, has been undertaken (Irish Water, 2022b). The assessment considered the likely cumulative effects of groundwater abstractions on meeting WFD objectives; however, it did not consider potential impacts on European sites, in particular groundwater dependent habitats. In-combination effects on European sites from groundwater abstraction that are considered as part of the SEA and NIS, is based solely on the information available at Plan level.

Assumptions include:

- Application of standard and accepted good practice mitigation through design and construction management (see Appendix D).
- Detailed site assessments will be required for all options where groundwater abstractions are proposed, to identify and define the Zone of Contribution (ZOC) and potential impacts on the ground.
- Environmental assessments will be required to be undertaken on all options taken forward for feasibility studies and to inform detailed siting and routing and design alternatives and then to meet licensing and consenting requirements as well as commitments for performance and feedback identified through this SEA.

These limitations and uncertainties are built into the recommendations for mitigation and monitoring outlined in chapter 10 and these feed into the monitoring and feedback process for the implementation of the RWRP-EM.

7 Study Area Assessment Summaries

7 Study Area Assessment Summaries

This section provides a summary of the assessment for each Study Area. The individual assessments are provided in the Study Area Environmental Reviews provided as appendices to this Environmental Report (Appendix H: SA Environmental Reviews 1-9). The numbers and codes for the SEA objectives referred to throughout are provided in Table 7.1 below. A summary of the Preferred Approaches for each Study Area is provided in Appendix C.

Table 7.1 SEA Objectives and Reference Codes

SEA Objectives	Code
1. Protect public health and promote wellbeing	Public Health
2. Protect and enhance biodiversity and contribute to resilient ecosystems	Biodiversity
3. To protect landscapes, townscapes and visual amenity	Landscape and Visual
4. Protect and where appropriate enhance, built and natural assets and reduce waste	Materials
5. Reduce greenhouse gas emissions	Greenhouse Gas
6. Contribute to environmental climate change resilience	Climate Change
7. Protect and improve surface water and groundwater status	Surface Water/Groundwater
8. Avoid flood risk	Flood Risk
9. Protect and where appropriate, enhance cultural heritage assets	Cultural Heritage
10. Protect quality and function of soils	Geology and Soils

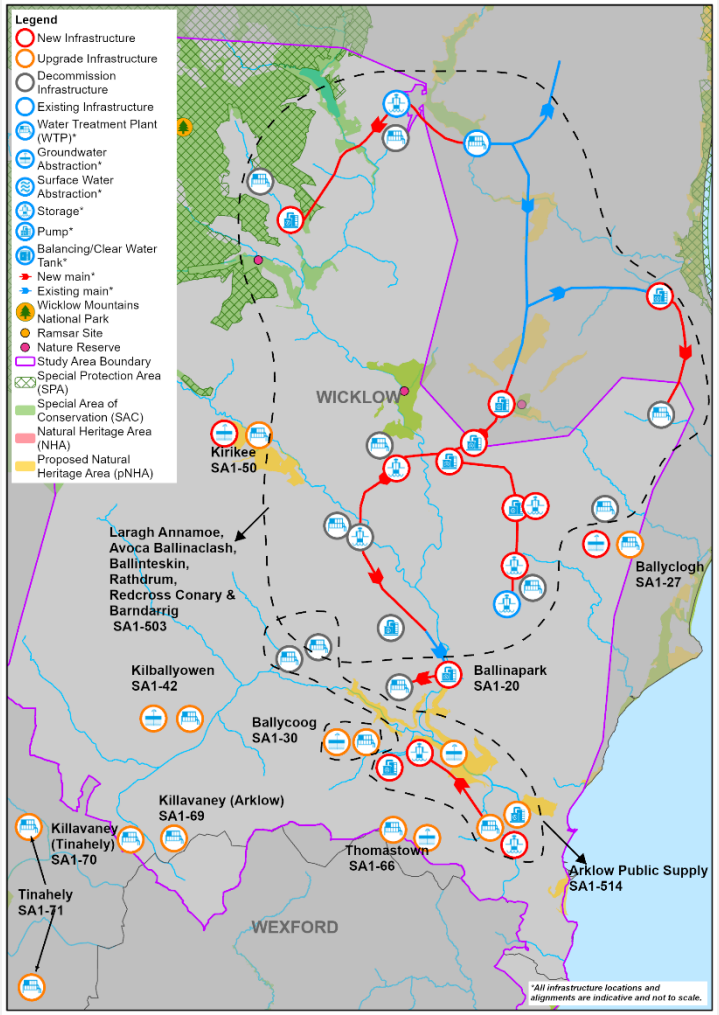
7.1 Study Area 1 Summary of Assessment

The assessment undertaken for SA1 is summarised in Table 7.2 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA1 Environmental Review.

Table 7.2 Study Area 1 Summary of Assessment

Study Area 1	
SA1 lies within the counties of Wicklow and Wexford and has a total area of approximately 681 km2. The principal settlement (with a population of over 10,000) within SA1 is Arklow (CSO, 2016).	
Unconstrained	109 options
Coarse & Fine Screening	54 options (55 rejected; four rejected on sustainability reasons)
Feasible Options	54 options
Approach Development	
SA1 had 20 feasible combinations and were ranked from Best to Worst. The Best in each category was identified and brought forward for further comparison. Combinations which scored Best in a category were brought forward for further comparison and assessment. For SA1 this aligned as three approaches which were then ranked against each other (see table below).	

Approach Development			
Category	**SA Approach 1**	**SA Approach 2**	**SA Approach 3**
Least cost (LCo)		Best	Worst
Quickest Delivery (QD)		Worst	Best
Best AA (BA)	No -3 Biodiversity Scores	No -3 Biodiversity Scores (Best)	No -3 Biodiversity Scores
Lowest Carbon (LC)	Best		Worst
Most Resilient (MR)	Best	Worst	
Best Environmental (BE)	Worst	Best	



Summary	SA approach 2 has been selected as the best performing approach overall across the different categories and is therefore the SA1 Preferred Approach. It scored best under LCo, BA and BE categories.

Alternative Approach

An additional alternative approach was assessed for each study area in the SEA Environmental Reviews to consider an approach with no transfers from the SA9 Regional option. For SA1, the alternative approach options were assessed as worse against the public health, biodiversity, landscape, materials, climate change resilience and surface water/groundwater SEA objectives compared with the SA1 Preferred Approach and was not assessed as being better overall against all of the other SEA objectives.

Preferred Approach Assessment

SEA objectives	Potential Construction Impact	Potential Operational Impact
11. Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
12. Biodiversity	Minor Adverse	Neutral to Minor Adverse
13. Landscape and Visual	Neutral to Moderate Adverse	Neutral to Moderate Beneficial
14. Materials	Neutral to Moderate Adverse	Neutral
15. Greenhouse Gas	Neutral to Moderate Adverse	Neutral to Moderate Adverse
16. Climate Change	Neutral to Moderate Adverse	Moderate Adverse to Moderate Beneficial
17. Surface Water/ Groundwater	Neutral to Minor Adverse	Neutral
18. Flood Risk	Neutral	Neutral
19. Cultural Heritage	Neutral to Minor Adverse	Neutral
20. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for nine of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. The SA Preferred Approach includes two SA grouped options, these being SA grouped option 3 for six WRZs, namely Avoca Ballinaclash, Redcross Conary, Ballinteskin, Rathdrum, Barndarrig and Laragh Annamoe, and SA grouped option 14 for three WRZs, namely Arklow, Aughrim Annacurra and Ballymorris.

SA grouped option 3 involves improving the interconnection between the five WRZs. SA grouped option 14 involves an increased groundwater abstraction, a WTP upgrade and improved interconnection between the three WRZs. The SA Preferred Approach for the remaining WRZs involves WTP upgrades, new and increased groundwater abstractions, and improved interconnection.

Summary of Assessment findings

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

Key potential adverse impacts identified include:

- Moderate adverse effects on rural and urban areas near Avoca, Ballinteskin, Rathdrum and Roundwood from visual impacts and increase in traffic, noise and dust during construction of SA grouped option 3. Option includes rationalisation of water between six WRZs, construction of approximately 48km of new network, service reservoirs and pumps, and decommissioning of numerous existing infrastructures;
- Moderate adverse effects to material assets with SA grouped option 3 due to the significant construction of new infrastructures required; and
- Moderate adverse effects to environmental climate change resilience with options SA1-050 and 028 due to the requirement of new groundwater abstractions.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to moderate adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA1 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network.

Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

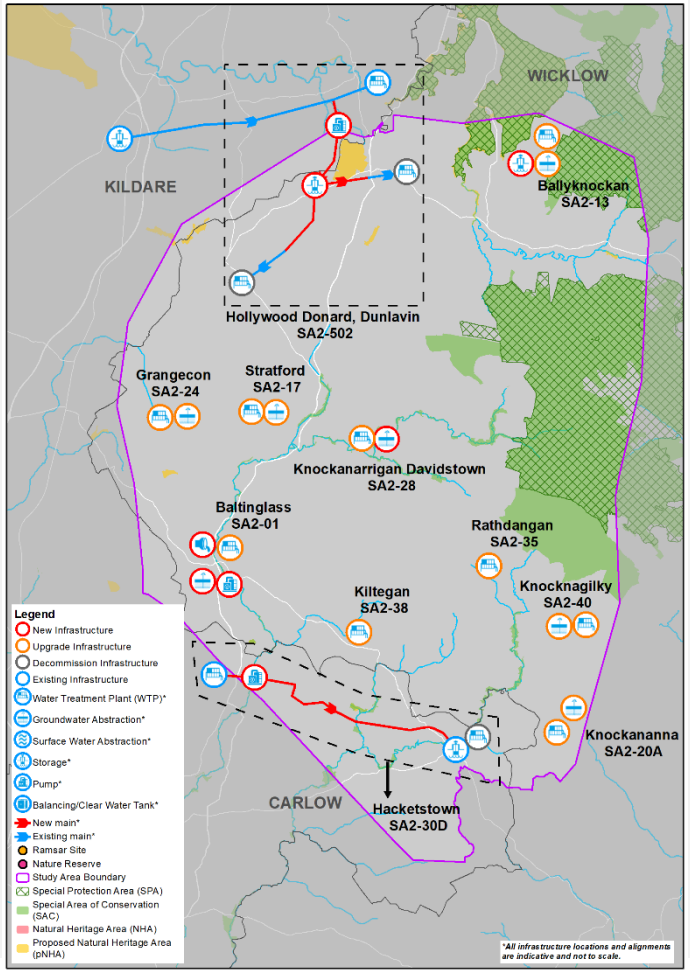
7.2 Study Area 2 Summary of Assessment

The assessment undertaken for SA2 is summarised in Table 7.3 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA2 Environmental Review.

Table 7.3 Study Area 2 Summary of Assessment

Study Area 2	
SA2 total area is approximately 545 km^2 and lies within the counties of Carlow, Kildare and Wicklow. There are no principal settlements (with a population of over 10,000) within SA2. The largest settlement is Baltinglass, with a population of 2,137 (CSO, 2016).	
Unconstrained	50 options
Coarse & Fine Screening	17 options (33 rejected; 14 rejected on sustainability reasons)
Feasible Options	17 options
Approach Development	
For SA2 only two feasible combinations were identified for SA2 which were then ranked against each other (see table below).	

Approach Development		
Category	**SA Approach 1**	**SA Approach 2**
Least cost (LCo)	Best	Worst
Quickest Delivery (QD)	Worst	Best
Best AA (BA)	No -3 Biodiversity Scores	No -3 Biodiversity Scores
Lowest Carbon (LC)	Worst	Best
Most Resilient (MR)	Best	Worst
Best Environmental (BE)	Best	Worst



Summary	SA approach 1 has been selected as the best performing approach overall across the different categories and is therefore the SA2 Preferred Approach. It scored best under LCo, BA, MR and BE categories.

Alternative Approach

An additional alternative approach was assessed for each study area in the SEA Environmental Reviews to consider an approach with no transfers from the SA9 Regional option. For SA2, the alternative no transfers approach options were assessed as performing worse against the public health, biodiversity, landscape, materials, climate change resilience and surface water/groundwater SEA objectives compared with the SA2 Preferred Approach. The alternative approach performed better against the carbon emissions and cultural heritage SEA objectives in the assessment.

Preferred Approach Assessment

SEA objectives	Potential Construction Impact	Potential Operational Impact
1. Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
2. Biodiversity	Minor Adverse to Moderate Adverse	Neutral to Minor Adverse
3. Landscape and Visual	Neutral to Moderate Adverse	Neutral to Minor Beneficial
4. Materials	Neutral to Minor Adverse	Neutral
5. Greenhouse Gas	Neutral to Moderate Adverse	Neutral to Moderate Adverse
6. Climate Change	Neutral to Moderate Adverse	Moderate Adverse to Moderate Beneficial
7. Surface Water/Groundwater	Neutral	Neutral to Minor Adverse
8. Flood Risk	Neutral	Neutral
9. Cultural Heritage	Neutral to Minor Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for all but two of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For the other two WRZs, Hollywood - Donard Public Supply and Dunlavin Public Supply, SA grouped option 2 (SA2-07b and SA2-11b) involves rationalising these two WRZs. The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, upgrades to existing WTPs, and the decommissioning of Hacketstown WTP.

Summary of Assessment Findings (Residual Effect Following Mitigation)

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

Key potential adverse impacts identified include:

- Moderate adverse effects during construction and minor adverse effect during operation for options SA2-30d, 001 and 028 which involve pipeline crossings of the Derreen River (hydrologically linked to the River Slaney SAC) and River Slaney SAC;
- Moderate adverse effects during construction of option SA2-001 associated with the visual impact to rural and urban areas of Baltinglass;
- Moderate adverse effects to environmental climate change resilience with options SA2-001 and 028 due to the requirement of new groundwater abstractions.
- Minor adverse effects during operation for options SA2-001, 013, 017, 20a, 024, 028 and 040 as a result of potential risks to groundwater quality and quantity and WFD status of hydrologically linked groundwater waterbodies from new or increased environmental abstractions; and
- Minor adverse effects (with SA grouped option 2 being moderate adverse) arising from noise and visual disturbance for residents (including within Baltinglass Park), temporary loss of agricultural land, disturbance or loss of potentially valuable soils and/or risks of loss or truncation of unknown archaeological remains during construction of options which include considerable lengths of new supply pipeline, including SA2-001, 30d, 013 and SA grouped option 2.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA2 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network.

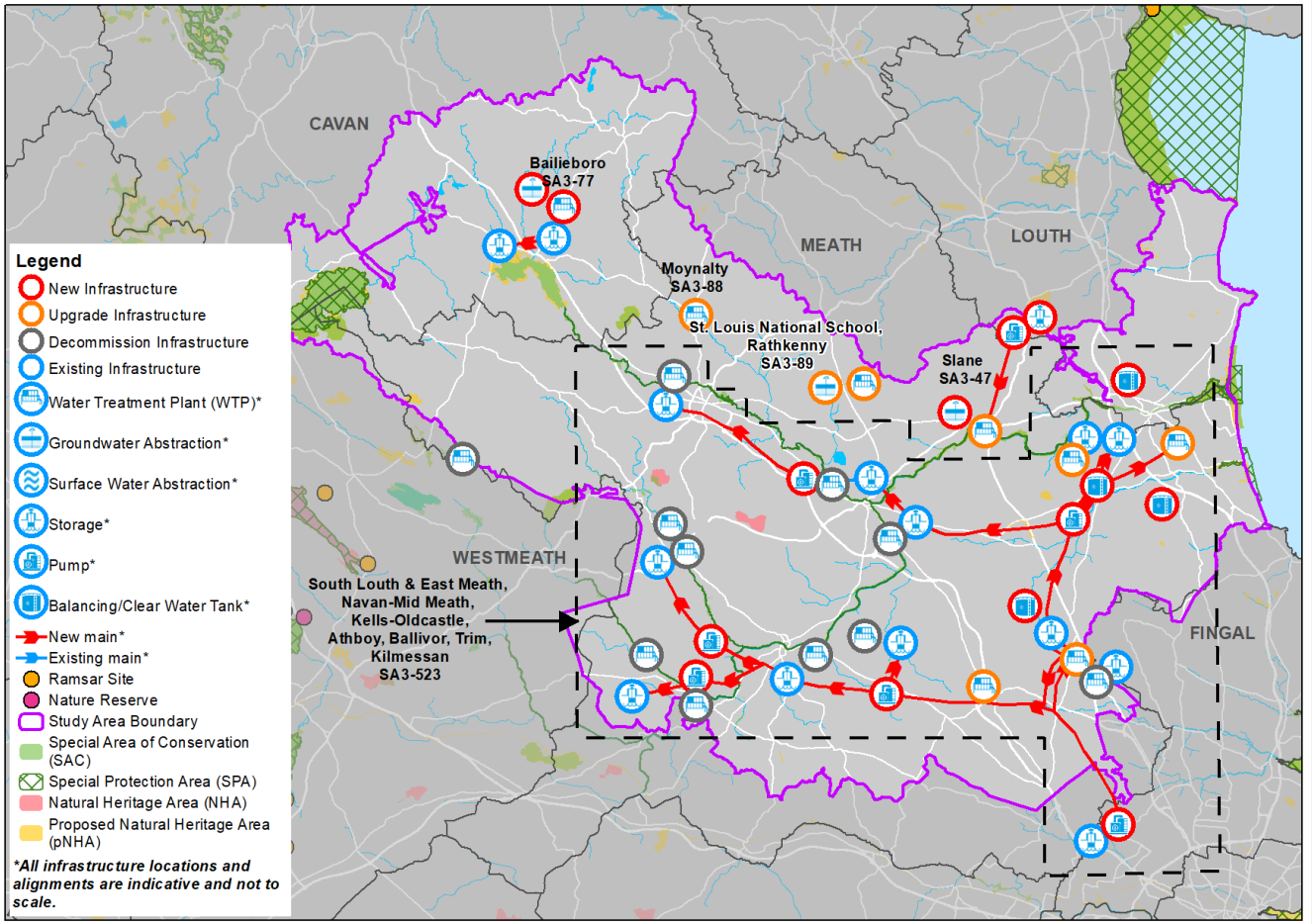
Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.3 Study Area 3 Summary of Assessment

The assessment undertaken for SA3 is summarised in Table 7.4 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA3 Environmental Review.

Table 7.4 Study Area 3 Summary of Assessment

Study Area 3	
SA3 total area is approximately 2,402 km^2 and lies within the counties of Cavan, Louth, Fingal, Westmeath and Meath. The principal settlements (with a population of over 10,000) within SA3 are Navan, Drogheda, Laytown-Bettystown-Mornington-Donacarney and Ashbourne (CSO, 2016).	
Unconstrained	101 options
Coarse & Fine Screening	77 options (24 rejected; 13 rejected on sustainability reasons)
Feasible Options	77 options
Approach Development	
For SA3 14 feasible combinations were identified and were ranked from Best to Worst. Combinations which scored Best in a category were brought forward for further comparison and assessment. For SA3 this aligned as four approaches which were then ranked against each other (see table below).	



Approach Development				
Category	**SA Approach 1**	**SA Approach 2**	**SA Approach 3**	**SA Approach 4**
Least cost (LCo)	Best*		Worst	
Quickest Delivery (QD)		Worst	Best	
Best AA (BA)	No -3 Biodiversity Scores	No -3 Biodiversity Scores	One -3 Biodiversity Score	No -3 Biodiversity Scores
Lowest Carbon (LC)			Worst	Best
Most Resilient (MR)		Worst		Best
Best Environmental (BE)		Best	Worst	
*As set out above and in more detail in section 5 of the SA3 Technical Report, SA Approach 1 (combination 12) was brought forward as the best least cost approach.				
Summary	SA approach 1 has been selected as the best performing approach overall across the different categories and therefore is the SA3 Preferred Approach. This approach was assessed as best under LCo and better than approach 4 for BE and not the worst in any of the other categories.			

Alternative Approach

An additional alternative approach was assessed for each study area in the SEA Environmental Reviews to consider an approach with no transfers from the SA9 Regional option For SA3, the alternative approach options performed worse against the public health, biodiversity (during operation), landscape, climate change resilience, surface water/groundwater, flood risk and cultural heritage SEA objectives compared with the SA3 Preferred Approach. However, the alternative approach performed better against the biodiversity SEA objective in the assessment for the construction phase.

Preferred Approach Assessment		
SEA objectives	**Potential Construction Impact**	**Potential Operational Impact**
1. Public Health	Minor Adverse to Moderate Adverse	Minor Adverse to Moderate Beneficial
2. Biodiversity	Minor Adverse to Moderate Adverse	Neutral to Moderate Adverse
3. Landscape and Visual	Neutral to Moderate Adverse	Minor Adverse to Moderate Beneficial
4. Materials	Minor Adverse to Moderate Adverse	Neutral
5. Greenhouse Gas	Neutral to Major Adverse	Neutral to Major Adverse

6. Climate Change	Neutral to Major Adverse	Moderate Beneficial to Major Adverse
7. Surface Water/Groundwater	Neutral	Neutral to Major Adverse
8. Flood Risk	Neutral to Minor Adverse	Neutral to Minor Adverse
9. Cultural Heritage	Neutral to Minor Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for four of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For seven of the WRZs, namely Athboy, Ballivor, Kells-Oldcastle, Kilmessan, Navan-Mid Meath, South Louth & East Meath, and Trim, SA grouped option 23 was selected. SA grouped option 23 involves improved interconnection between WRZs, decommissioning of existing WTPs and supply from a New Shannon Source. The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, along with WTP upgrades.

Summary of Assessment Findings (Residual Effect Following Mitigation)

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

Key potential adverse impacts identified include:

- Moderate adverse impacts on the River Boyne and River Blackwater SAC and SPA as the new abstraction of option SA3-047 is directly adjacent and hydrologically linked to the site. New abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact on QI species or habitats. Therefore, there is potential for impacts on aquatic QI species utilising this European site through a reduction in flows/water levels. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts on the River Boyne and River Blackwater SAC and SPA, and Lough Bane and Lough Glass SAC associated with the extensive construction of new infrastructures required for SA grouped option 23. There is potential for some loss of/damage to QI/Annex 1 habitats during construction works given that the works are immediately within or adjacent to the designated sites boundary. Pollution of water courses during demolition and construction (associated with sediment runoff, or accidental spillage) could impact fish and restrict access to spawning habitat. Potential changes in water quality from pollution during construction could also affect hydrologically connected habitats. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse effects on rural and urban areas near Navan, Kells, Trim, Ratoath and Drogheda from visual impacts and increase in traffic, noise and dust during construction of SA grouped option 23. Option includes rationalisation of water from the GDA to six WRZs, construction of 154km of new network, service reservoirs, pumps and pumping station, upgrade of WTPs and decommissioning of numerous existing WTP and abstractions;

- Moderate adverse impacts to the resilience of Trim and Bailieborough groundwater bodies to climate change as new abstractions are required with options SA3-077 and 047. Both of the groundwater bodies currently have a good quantitative status, but Trim groundwater is currently at risk of failing the WFD objectives. However, with the relatively small increase of demand the likelihood that the new abstractions will impact the WFD objectives is low; and
- Moderate adverse effects to built and natural assets with SA grouped option 23 due to the significant construction of new infrastructures required.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA3 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network.

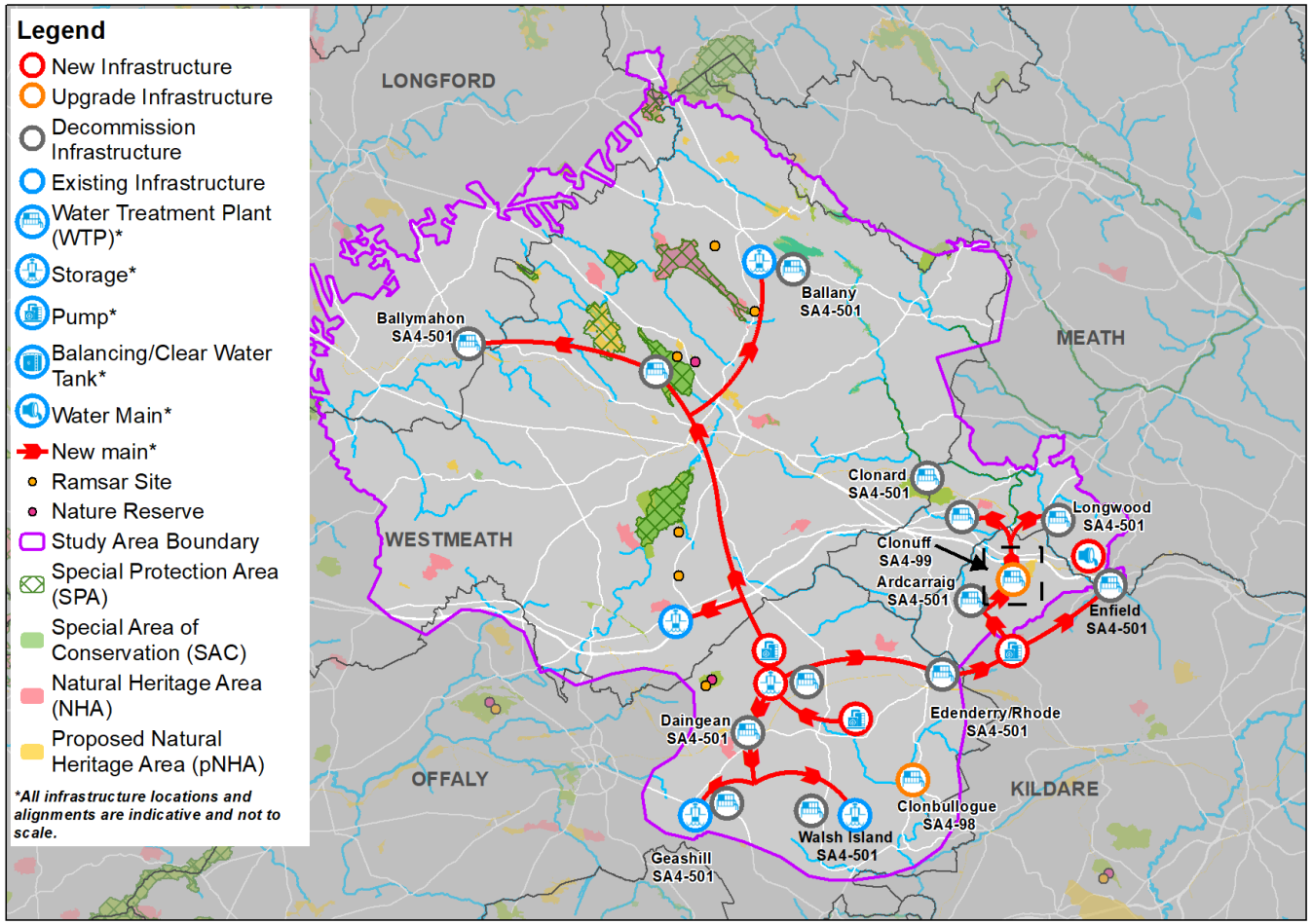
Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.4 Study Area 4 Summary of Assessment

The assessment undertaken for SA4 is summarised in Table 7.5 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA5 Environmental Review.

Table 7.5 Study Area 4 Summary of Assessment

Study Area 4	
SA4's total area is approximately 2,637 km^2 and lies within the counties of Cavan, Kildare, Longford, Meath, Offaly and Westmeath. The principal settlement (with a population of over 10,000) within SA4 is Mullingar (CSO, 2016).	
Unconstrained	113 options
Coarse & Fine Screening	81 (32 rejected; four for sustainability reasons) 74 options (seven rejected)
Feasible Options	74 options
Approach Development	
Nine feasible combinations were identified for SA4 and were ranked from Best to Worst. Combinations which scored Best in a category were brought forward for further comparison and assessment. For SA4 this aligned as two approaches which were then ranked against each other (see table below).	



Approach Development		
Category	**SA Approach 1**	**SA Approach 2**
Least cost (LCo)	Best	Worst
Quickest Delivery (QD)	Best	Worst
Best AA (BA)	No -3 Biodiversity Scores	No -3 Biodiversity Scores
Lowest Carbon (LC)	Worst	Best
Most Resilient (MR)	Best	Worst
Best Environmental (BE)	Best	Worst

SA approach 1 has been selected as the best performing approach overall across the different categories and therefore is the SA4 Preferred Approach. It scored best under LCo, QD, BA, MR and BE categories.

Alternative Approach

An additional alternative approach was assessed for each study area in the SEA Environmental Reviews to consider an approach with no transfers from the SA9 Regional option alternative approach options for each study area are assessed in the SEA Environmental Reviews. For SA4, the alternative approach options performed worse against the public health, biodiversity, landscape, materials, greenhouse gas emissions, climate change resilience, surface water/groundwater and geology SEA objectives compared with the SA4 Preferred Approach. The alternative approach did not perform better against any of the SEA objectives in the assessment.

Preferred Approach		
SEA objectives	**Potential Construction Impact**	**Potential Operational Impact**
1. Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
2. Biodiversity	Minor Adverse to Moderate Adverse	Neutral to Moderate Adverse
3. Landscape and Visual	Neutral to Minor Adverse	Neutral to Minor Beneficial
4. Materials	Neutral to Moderate Adverse	Neutral
5. Greenhouse Gas	Neutral to Major Adverse	Neutral to Major Adverse
6. Climate Change	Moderate Adverse to Moderate Beneficial	Moderate Adverse to Moderate Beneficial

7. Surface Water/Groundwater	Neutral	Neutral to Minor Adverse
8. Flood Risk	Neutral	Neutral
9. Cultural Heritage	Neutral to Minor Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for all of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. The SA Preferred Approach involves rationalising neighbouring WRZs, upgrades to WTPs, new and increased groundwater abstractions, and new and increased surface water abstractions.

Summary of Assessment Findings

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

Key potential adverse impacts identified include:

- Potential temporary moderate adverse impacts during construction as a result of direct pipeline crossings of the River Athboy (SA4-005) and River Boyne (SA4-054) which each have hydrological linkages to the River Boyne and Blackwater SAC and SPA. The designated sites are important nursery habitats for Annex II aquatic species including otter and salmonids. There are also temporary moderate adverse impacts during construction of option SA4-36d given that the works are within the Lough Ennell SAC and Lough Owel SAC boundaries. There is potential for some loss of/damage to QI/Annex 1 habitats during construction works. The NIS identifies mitigation measures to avoid AESI for these sites;
- Potential long term or permanent moderate adverse impacts to the River Boyne and Blackwater SAC (SA4-049) and River Barrow and River Nore SAC (SA4-65b) associated with new groundwater abstractions. Further hydrological assessment is required to ensure no impacts to these designated sites. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts to the resilience of Longwood, Trim and Geashill groundwater bodies to climate change as new/increase abstractions are required with options SA4-049, 059, 062 and 65b. All of the groundwater bodies currently have a good quantitative status, therefore the likelihood of the abstractions affecting their WFD objectives is low;
- Moderate adverse effects on rural and urban areas near Mullingar (SA4-36d) and Enfield (SA4-054) from visual impacts and increase in traffic, noise and dust during construction of the SA4 Preferred Approach. Options involve rationalisation of water between the GDA to Mullingar and Enfield, respectively; and
- Moderate adverse effects to build and natural assets with options SA4-005 and 36d due to the construction of more than 20km of new pipeline required.

Summary of Cumulative Effects

Cumulative effects assessment has identified potential significant effects in relation to carbon emissions, individual options are assessed between neutral to major adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA4 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.

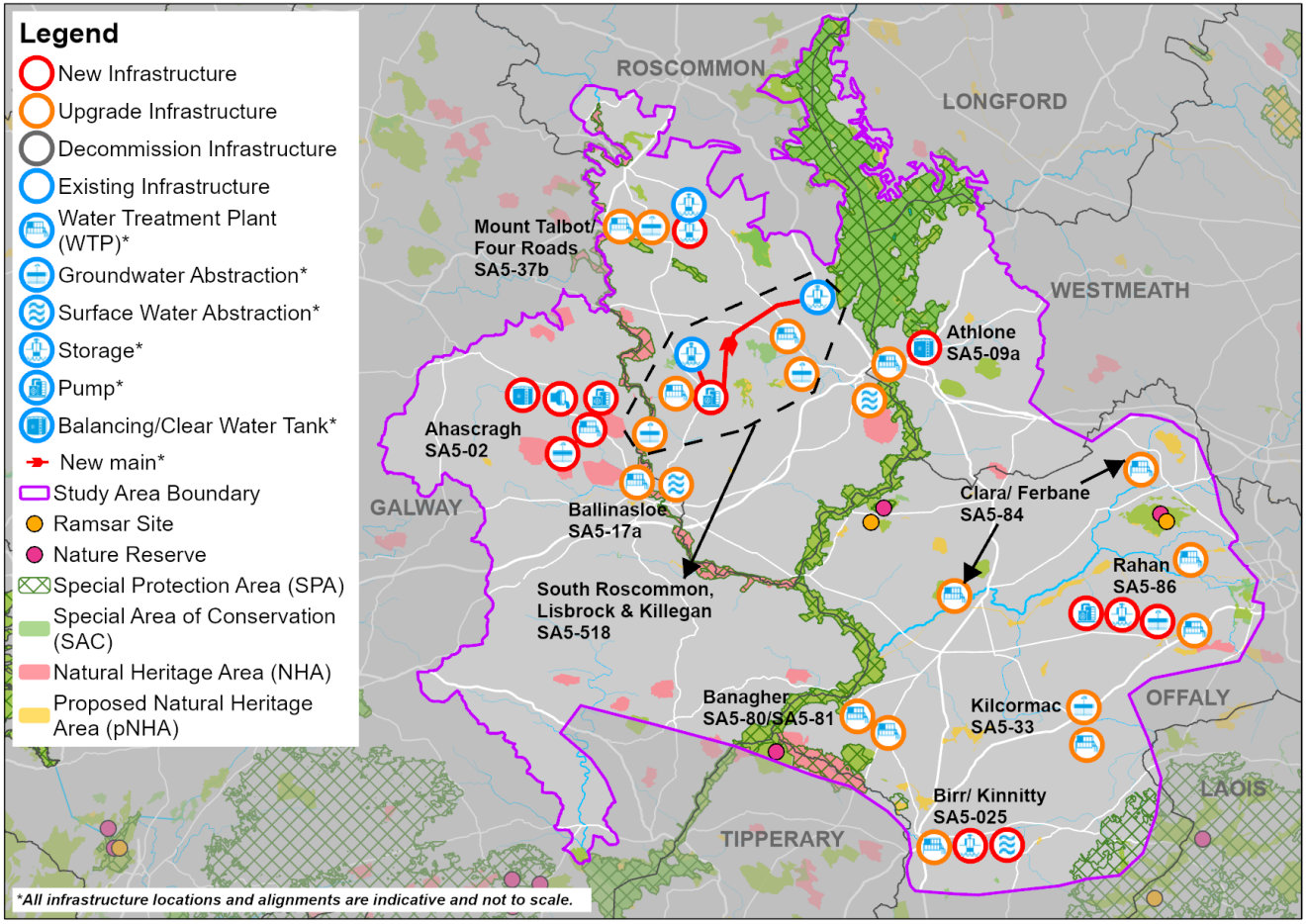
Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.5 Study Area 5 Summary of Assessment

The assessment undertaken for SA5 is summarised in Table 7.6 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA5 Environmental Review.

Table 7.6 Study Area 5 Summary of Assessment

Study Area 5	
SA5 lies within the counties of Galway, Roscommon, Longford, Westmeath, Tipperary, Offaly and Laois and its total area is approximately 2,589 km^2. The principal settlement (with a population of over 10,000) within SA5 is Athlone (CSO, 2016).	
Unconstrained	103 options
Coarse & Fine Screening	63 options (40 rejected; four for sustainability reasons) & 58 options (five rejected)
Feasible Options	58 options
Approach Development	
14 feasible combinations were identified for SA5 and were ranked from Best to Worst. Combinations that were identified as the best in a particular category were brought forward for further assessment. For SA5 this aligned as five approaches which were then ranked against each other (see table below).	



Approach Development					
Category	**SA Approach 1**	**SA Approach 2**	**SA Approach 3**	**SA Approach 4**	**SA Approach 5**
Least cost (LCo)	Best	Worst			
Quickest Delivery (QD)	Worst	Best			
Best AA (BA)	No -3 Biodiversity Scores	Two -3 Biodiversity Scores	No -3 Biodiversity Scores	One -3 Biodiversity Score	No -3 Biodiversity Scores
Lowest Carbon (LC)		Worst			Best
Most Resilient (MR)				Best	Worst
Best Environmental (BE)	Worst		Best*		
Summary	*Best BE overall taking account of -3 biodiversity scores SA approach 1 has been selected as the best performing approach overall based on a significant lower cost compared to the other approaches and not being significant worse in terms of environmental issues taking into account temporary nature of some of the construction impacts. SA approach 1 is therefore the SA5 Preferred Approach.				

Alternative Approach
The SA5 Preferred Approach does not benefit from regional transfers and uses local options, therefore no additional alternatives were considered.

Preferred Approach Assessment			
SEA objectives		**Potential Construction Impact**	**Potential Operational Impact**
1	Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
2	Biodiversity	Minor Adverse	Neutral to Moderate Adverse
3	Landscape and Visual	Neutral to Minor Adverse	Neutral to Minor Adverse
4	Materials	Neutral to Major	Neutral to Minor Adverse
5	Greenhouse Gas	Neutral to Major Adverse	Neutral to Major Adverse
6	Climate Change	Neutral to Moderate Adverse	Neutral to Moderate Adverse
7	Surface Water/Groundwater	Neutral	Neutral to Minor Adverse

8	Flood Risk	Neutral	Neutral
9	Cultural Heritage	Neutral to Minor Adverse	Neutral
10	Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for all of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For one of the larger demand areas, South Roscommon (Lisbrock & Killeglan), the SA Preferred Approach involves increasing the existing groundwater abstraction at Killeglan and Lisbrock, upgrading the associated WTPs and providing new/upgraded network to allow for the additional supply. The SA Preferred Approach for the remaining WRZs involves a new WTP, new and increased groundwater abstractions, along with increased surface water abstractions and WTP upgrades.

Summary of Assessment Findings

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

Key potential adverse impacts identified include:

- Moderate adverse impacts on the River Shannon Callows SAC and Middle Shannon Callows SPA given the direct increased abstraction of water (SA5-09a) from the River Shannon. There is a risk that this abstraction will reduce water flow in the River Shannon, which could impact protected species such as otters. There is also potential for impacts on otters utilising watercourse hydrologically linked to this European site through a reduction in flows/water levels. Abstraction is however assessed as being within sustainable limits and the NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts on River Suck Callows SPA associated with direct increase of abstraction from the River Shannon (SA5-17a) and new and increase groundwater abstractions that are hydrologically linked to the River Suck Callows SPA (SA5-002, 37b and SA grouped option 18). During operation phase, abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species. There is potential for impacts on aquatic QI species utilising watercourse hydrologically linked to this European site through a reduction in flows/water levels. Groundwater abstraction points of option SA5-018 and SA grouped option 18 are also within a karstic aquifer which connects to other designated sites such as Four Roads Turlough SAC and SPA, and Ballynamona Bog and Corkin Lough SAC and Castlesampson Esker SAC, respectively. The NIS identifies mitigation measures to avoid AESI for these sites; and
- Moderate adverse effects on Athlone's health and wellbeing from increase in traffic, noise and dust during construction as the upgrade of WTP and increase abstraction from River Shannon are within the town centre.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA5 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network. Insufficient information is available for the cumulative effects assessment to consider how total study area carbon emissions will change overall and per ML of water.

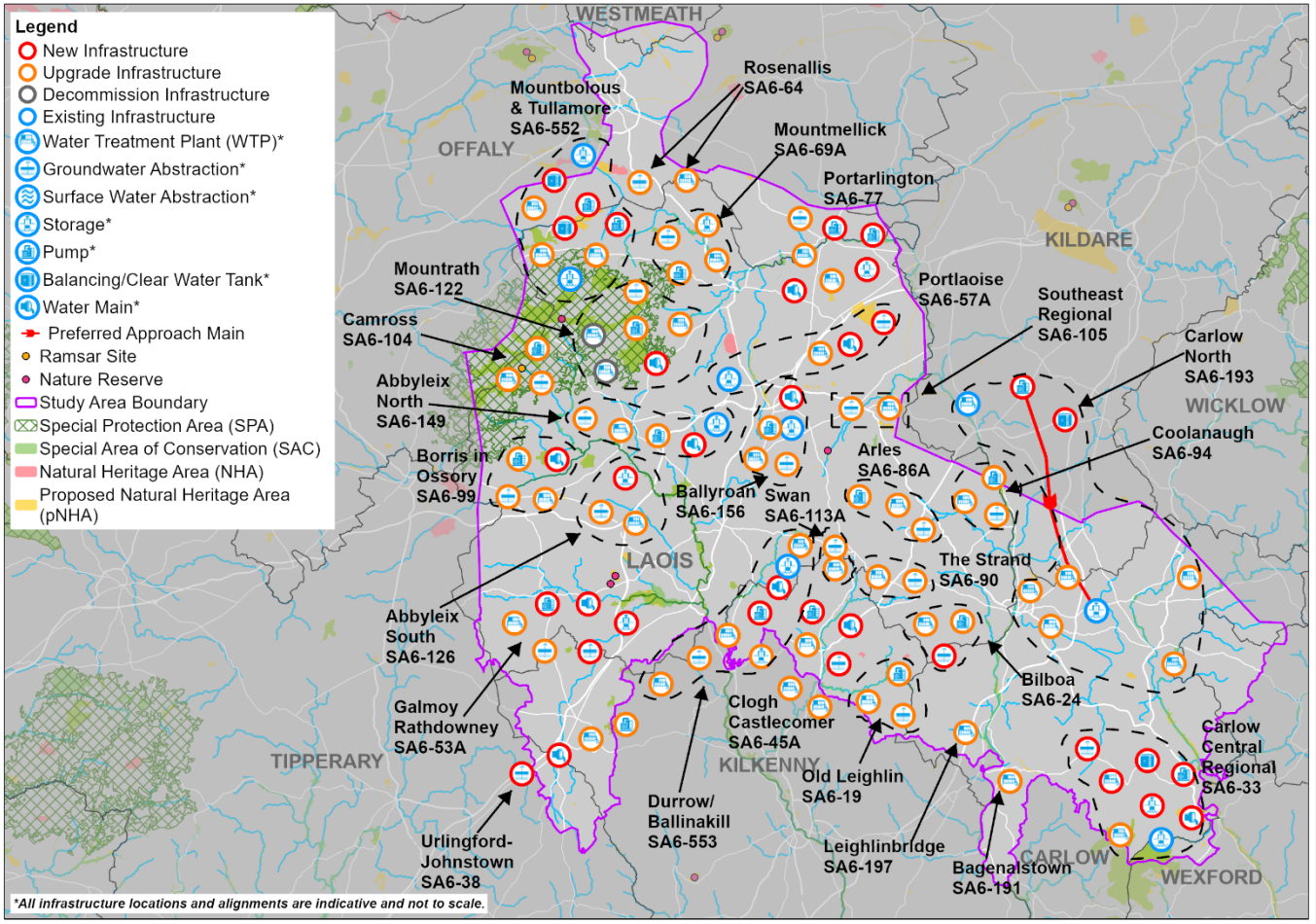
Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.6 Study Area 6 Summary of Assessment

The assessment undertaken for SA6 is summarised in Table 7.7 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA6 Environmental Review.

Table 7.7 Study Area 6 Summary of Assessment

Study Area 6	
SA6 lies within the counties of Carlow, Kildare, Kilkenny, Laois, Tipperary, Offaly, Westmeath, Wexford and Wicklow. The total area is approximately 3,027 km^2. The principal settlements (with a population of over 10,000) within SA6 are Carlow, Portlaoise and Tullamore (CSO, 2016).	
Unconstrained	254 options
Coarse & Fine Screening	110 options (144 rejected; 31 for sustainability reasons)
Feasible Options	110 options
Approach Development	
18 feasible combinations were identified for SA6 and were ranked from Best to Worst. Combinations that were identified as the best in a particular category were brought forward for further assessment. For SA6 this aligned as five approaches which were then ranked against each other (see table below).	



Approach Development					
Category	**SA Approach 1**	**SA Approach 2**	**SA Approach 3**	**SA Approach 4**	**SA Approach 5**
Least cost (LCo)	Best*	Worst			
Quickest Delivery (QD)		Worst	Best		
Best AA (BA)	No -3 Biodiversity Scores	No -3 Biodiversity Scores	One -3 Biodiversity Score	One -3 Biodiversity Score	One -3 Biodiversity Score
Lowest Carbon (LC)		Worst			Best
Most Resilient (MR)		Worst		Best	
Best Environmental (BE)		Best	Worst		
Summary	*Identified as Best for least cost as cost was within 5% of approaches 3, 4 and 5 and was without -3 biodiversity scores SA approach 1 has been selected as the best performing approach overall across the different categories and therefore is the SA6 Preferred Approach. It scored best under LCo and does not score the worst in any of the other categories.				

Alternative Approach
An additional alternative approach was assessed to consider an approach with no transfers from the SA9 Regional option. For SA6, the alternative approach options performed worse against biodiversity (during operation), landscape, climate change resilience and surface water/groundwater SEA objectives compared with the SA6 Preferred Approach. However, the alternative approach performed better against the biodiversity and cultural heritage objectives in the assessment for the construction phase.

Preferred Approach Assessment		
SEA objectives	**Potential Construction Impact**	**Potential Operational Impact**

1. Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
2. Biodiversity	Minor Adverse to Moderate Adverse	Neutral to Moderate Adverse
3. Landscape and Visual	Neutral to Minor Adverse	Neutral to Minor Beneficial
4. Materials	Neutral to Moderate Adverse	Neutral
5. Greenhouse Gas	Neutral to Major Adverse	Neutral to Major Adverse
6. Climate Change	Neutral to Moderate Adverse	Moderate Adverse to Moderate Beneficial
7. Surface Water/Groundwater	Neutral	Neutral to Major Adverse
8. Flood Risk	Neutral	Neutral
9. Cultural Heritage	Neutral to Minor Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

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

Summary of Assessment Findings

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

Key potential adverse impacts identified include:

- Potential temporary moderate adverse impacts during construction as a result of the SA Preferred Approach being within (SA6-45a and 193) or near (SA6-033) and is hydrologically linked to designated sites including River Barrow and River Nore SAC, Slieve Bloom Mountains SPA, Clonaslee Eskers and Derry Bog SAC and Slaney River Valley SAC. There is potential for loss of/damage to QI/Annex 1 habitats during construction works given that the works are within or near the sites. Pollution of water courses during construction (associated with sediment runoff, or accidental spillage) could affect hydrologically connected habitats and impact fish and restrict access to spawning habitats. There is also potential for the spread of invasive non-native species given that the works are hydrologically linked to the European designated sites. The NIS identifies mitigation measures to avoid AESI for these sites;

- Potential long term or permanent moderate adverse impacts to the River Barrow and River Nore SAC (SA6-45a, 57a, 077, 104, 105, 126, 149, 156 and SA group option 53), Lisbigney Bog SAC (SA6-126, 149 and SA group option 53); Loughans SAC (SA6-080) and Galmoy Fen SAC (SA6-53a) associated with new or increase groundwater abstraction. At some abstraction point, there is likely a high association between surface water and groundwater flows; a high Baseflow Index (BFI). Therefore, there is potential for impacts to QI species utilizing watercourses hydrologically linked to the European site and further study on ground water and surface water links are required. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts to the resilience to climate change of Athy-Bagnelstown Gravels, Bagenalstown, Ballingarry, Castlecomer, Coolrain, Portlaoise, Rathdowney, Shanragh and Timahoe Gravels groundwater bodies as new/increase abstractions are required with the SA Preferred Approach (SA6-024, 033, 038, 45a, 53a, 57a, 64, 69a, 86a, 094, 104, 105 and 156). All of the groundwater bodies currently have a good quantitative status. However, options 45a, 53a, 064, 69a, 86a, 094, 104, 105 and 106 are assessed as having potential for major adverse impact against the seventh SEA objective 'protect and improve surface water and groundwater status'. However, additional groundwater assessment identifies that an impact on groundwater body quantitative status would be unlikely.
- Moderate adverse effects on rural and urban areas near Carlow (SA6-033) from visual impacts and increase in traffic, noise and dust during construction of the SA6 Preferred Approach. Option SA6-033 include new groundwater abstraction, WTP, storage pumps and approximately 18km of pipeline; and
- Moderate adverse effects to built and natural assets with options SA6-193 and SA option 52 due to the construction of more than 20km of new pipeline required.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA6 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network.

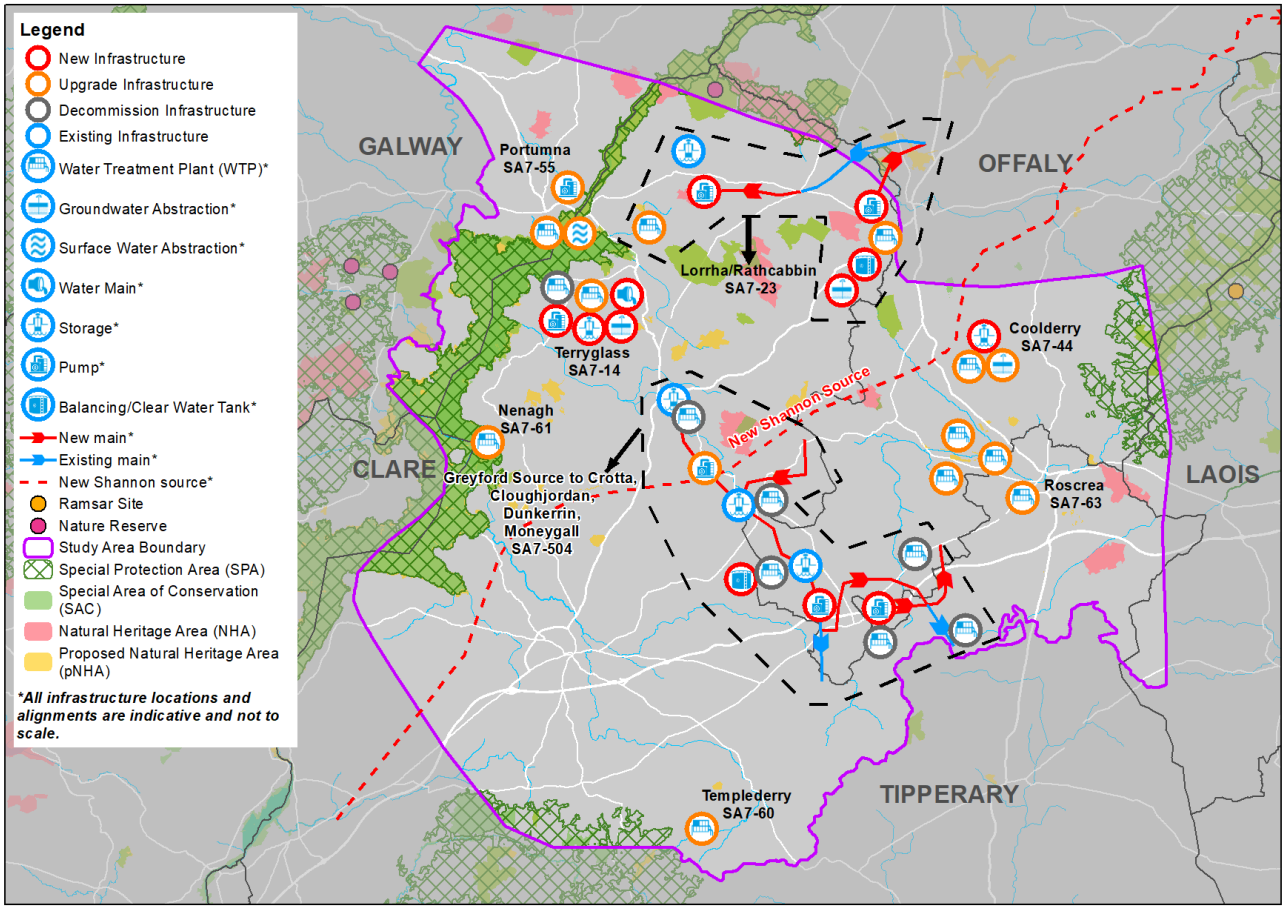
Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.7 Study Area 7 Summary of Assessment

The assessment undertaken for SA7 is summarised in Table 7.8 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA7 Environmental Review.

Table 7.8 Study Area 7 Summary of Assessment

Study Area 7	
SA7 has a total area of approximately 1,455 km^2 and lies within the counties of Clare, Galway, Laois, Tipperary, and Offaly. There are no principal settlements (with a population of over 10,000) within SA7. However, the main settlements (with a population of over 5,000) are Nenagh and Roscrea (CSO, 2016).	
Unconstrained	82 options
Coarse & Fine Screening	34 options (48 rejected) & 32 options (2 rejected)
Feasible Options	32 options
Approach Development	
Five feasible combinations were identified for SA7 and were ranked from Best to Worst. Combinations that were identified as the best in a particular category were brought forward for further assessment. For SA7 this aligned as three approaches which were then ranked against each other (see table below).	



Approach Development			
Category	**SA Approach 1**	**SA Approach 2**	**SA Approach 3**
Least cost (LCo)		Worst	Best
Quickest Delivery (QD)	Worst	Best	
Best AA (BA)	No -3 Biodiversity Scores	No -3 Biodiversity Scores	No -3 Biodiversity Scores
Lowest Carbon (LC)		Worst	Best
Most Resilient (MR)	Best		Worst
Best Environmental (BE)	Best	Worst	
Summary	SA approach 1 has been selected as the best performing approach overall across the different categories and therefore is the SA7 Preferred Approach. It scored best under BA, MR and BE categories.		

Alternative Approach
An additional alternative approach was assessed to consider an approach with no transfers from the SA9 Regional option. For SA7, the alternative approach options performed worse against the public health (during operation), biodiversity (during operation), landscape, climate change resilience and surface water/groundwater SEA objectives compared with the SA7 Preferred Approach. However, the alternative approach performed better against the public health, biodiversity and landscape SEA objectives in the assessment for the construction phase.

Preferred Approach Assessment		
SEA objectives	**Potential Construction Impact**	**Potential Operational Impact**

1. Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
2. Biodiversity	Minor Adverse to Moderate Adverse	Neutral to Minor Adverse
3. Landscape and Visual	Neutral to Minor Adverse	Neutral to Moderate Beneficial
4. Materials	Neutral to Minor Adverse	Neutral
5. Greenhouse Gas	Neutral to Major Adverse	Neutral to Major Adverse
6. Climate Change	Neutral to Moderate Adverse	Moderate Adverse to Moderate Beneficial
7. Surface Water/Groundwater	Neutral	Neutral to Minor Adverse
8. Flood Risk	Neutral	Neutral
9. Cultural Heritage	Neutral to Minor Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for seven of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For three of the WRZs, namely Dunkerrin/Moneygall, Greyford Source to Crotta and Cloughjordan, the SA Preferred Approach involves improving the interconnection between these three WRZs. The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, along with increased surface water abstractions and WTP upgrades.

Summary of Assessment Findings

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

Key potential adverse impacts are identified as:

Moderate adverse impacts on Lough Derg, North-east Shore SAC and Lough Derg (Shannon) SPA during operation of option SA7-055 because of the increased direct abstraction from Lough Derg and the likely high association between surface water and groundwater flows at the abstraction point. River Shannon Callows SAC is also approximately 0.53km away from the option and is hydrologically linked to the abstraction.. There is potential for impacts on aquatic QI species utilising watercourse hydrologically linked to these European sites through a reduction in flows/water levels. Abstractions are however assessed as being within sustainable limits and the NIS identifies mitigation measures to avoid AESI for these sites;

Moderate adverse impacts on Scohaboy Bog SAC and Ballintemple Bog pNHA during construction as the proposed pipeline of SA grouped option 4 will be routed adjacent to these sites. Construction of a number of river crossings are also required with this option with hydrological links and potential impacts to Lough Derg SAC and SPA. The NIS identifies mitigation measures to avoid AESI for these sites;

Moderate adverse impacts to the resilience of Bir and Nenagh groundwater bodies to climate change as new abstractions are required with options SA7-023 and 014. However, both of the groundwater bodies currently have a good quantitative status with low likelihood that the proposed increase abstractions will impact their respective WFD objectives; and

Moderate adverse effects on routes connecting Greyford Source to Crotta, Cloughjordan and Moneygall, and the adjacent residential and commercial properties from visual impacts and increased traffic, noise and dust during the construction of SA grouped option 4. SA option 4 includes construction of extensive new pipelines, pumps and a new storage reservoir as well as upgrading of an existing pump and demolition of six WTPs.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA7 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network.

Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

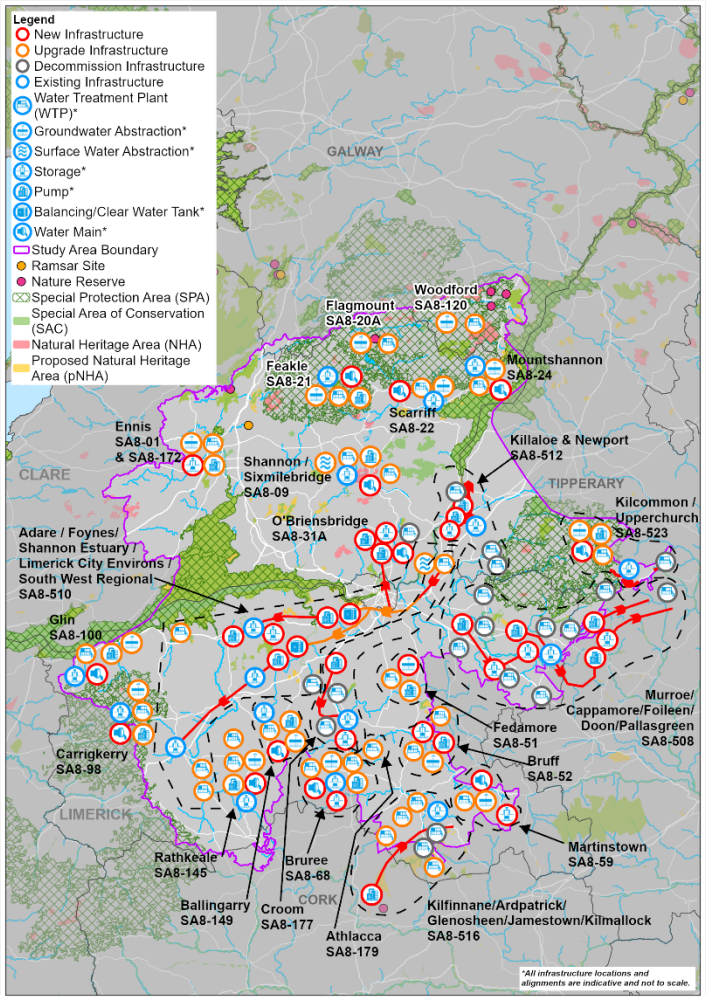
7.9 Study Area 8 Summary of Assessment

The assessment undertaken for SA8 is summarised in Table 7.9 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA8 Environmental Review.

Table 7.9 Study Area 8 Summary of Assessment

Study Area 8	
SA8 lies within the counties of Clare, Cork, Galway, Limerick, Limerick City and Tipperary and the total area is approximately 4,176 km^2. The principal settlements (with a population of over 10,000) within SA8 are Limerick City and Suburbs, and Ennis (CSO, 2016).	
Unconstrained	214 options
Coarse & Fine Screening	121 options (93 rejected; 11 for sustainability reasons)
Feasible Options	121 options
Approach Development	
20 feasible combinations were identified for SA8 and were ranked from Best to Worst. Combinations that were identified as the Best in a category were brought forward for further comparison. For SA8 this aligned as four approaches which were then ranked against each other (see table below).	

Approach Development				
Category	**SA Approach 1**	**SA Approach 2**	**SA Approach 3**	**SA Approach 4**
Least cost (LCo)	Best	Worst		
Quickest Delivery (QD)		Best	Worst	
Best AA (BA)	One -3 Biodiversity Score	One -3 Biodiversity Score	Two -3 Biodiversity Scores	One -3 Biodiversity Score



Lowest Carbon (LC)		Worst		Best
Most Resilient (MR)		Worst	Best	
Best Environmental (BE)	Best		Worst	

Summary	SA approach 1 has been selected as the best performing approach overall across the different categories and is therefore the SA8 Preferred Approach. It scored best under LCo and BE categories.

Alternative Approach

An additional alternative approach was assessed for each study area in the SEA Environmental Reviews to consider an approach with no transfers from the SA9 Regional option. For SA8, the alternative approach options performed worse against the public health, landscape, materials, greenhouse gas emissions, climate change resilience and surface water/groundwater SEA objectives compared with the SA8 Preferred Approach. However, the alternative approach performed better against the biodiversity, cultural heritage and geology SEA objective in the assessment.

Preferred Approach Assessment

SEA objectives	Potential Construction Impact	Potential Operational Impact
1. Public Health	Minor Adverse to Moderate Adverse	Neutral to Moderate Beneficial
2. Biodiversity	Minor Adverse to Moderate Adverse	Neutral to Moderate Adverse
3. Landscape and Visual	Neutral to Moderate Adverse	Neutral to Moderate Beneficial
4. Materials	Neutral to Moderate Adverse	Neutral
5. Greenhouse Gas	Neutral to Major Adverse	Neutral to Major Adverse
6. Climate Change	Neutral to Moderate Adverse	Minor Beneficial to Major Adverse
7. Surface Water/Groundwater	Neutral	Moderate Beneficial to Moderate Adverse
8. Flood Risk	Neutral to Minor Adverse	Neutral to Minor Adverse
9. Cultural Heritage	Neutral to Minor Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The SA Preferred Approach consists of WRZ options for nineteen of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For some of the larger demand areas, the SA Preferred Approach used SA grouped options to rationalise and provide spare capacity to neighbouring WRZs, these being:

- SA option 8: Supplies spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore/Murroe/Foileen, Pallasgreen and Doon;
- SA option 10: Increases SW abstraction/WTP capacity and supplies spare capacity from Limerick City to neighbouring WRZs, South West Regional, Foynes Shannon and Adare;
- SA option 12: Rationalises Killaloe and Newport to the New Shannon Source;
- SA option 16: Supplies spare capacity from Glenosheen/Jamestown/Kilmallock to KilfinaneArdpatrick; and
- SA option 23: Increases GW abstraction at Kilcommon and rationalises Upperchurch to Kilcommon.

The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, along with increased surface water abstractions, WTP upgrades, improved connectivity between WRZs and an advanced leakage reduction programme for the Ennis WRZ.

Summary of Assessment Findings

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

Key potential adverse impacts identified, include:

- Potential temporary moderate adverse impacts during construction as a result of the SA Preferred Approach being within/adjacent (SA8-001 and 098 SA option 8 and SA option 12) or near (SA8-20a, 120 and 177, and SA option 23) designated sites including Lower River Shannon SAC, Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lough Derg (Shannon) SPA, Slievefelim to Silvermines Mountains SPA and Slieve Aughty Mountains SPA. There is potential for disturbance and loss of/damage to QI/Annex 1 habitats during construction works given that the works are within or near the sites. Potential pollution of watercourses during construction could also affect hydrologically connected habitats. The NIS identifies mitigation measures to avoid AESI for these sites;
- Potential long term or permanent moderate adverse impacts to the Lower River Shannon SAC associated with increase groundwater (SA8-001) and surface water (SA option 10, including SA option 8, 31a and 177) abstractions. There is the potential for changes in water quality (hydrological changes) and changes to the water table availability during operation of the SA Preferred Approach that could impact QI species and habitats of the SAC. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts to the resilience of Charleville, Ballingarry, Bruree, Fedamore and Knockaderry groundwater bodies to climate change as new (SA8-051) and increase (SA8-059, 068, 145 and 149) abstractions are required with the SA Preferred Approach. All of the groundwater bodies currently have a good quantitative status. Options SA8-059, 068, 145 and 149 were initially assessed as having potential for major adverse impact against the SEA objective ‘protect and improve surface water and

groundwater status' based on a conservative high level assessment indicated that groundwater abstraction of these options would be greater than 30% of the recharge Ml/d. However, additional groundwater assessment identifies that an impact on groundwater body quantitative status would be unlikely taking account of additional groundwater information;

- Moderate adverse effects on rural and urban areas near Moroe and Doon (SA option 8) and Limerick and Kildimo (SA option 10) from visual impacts and increase in traffic, noise and dust during construction of the SA8 Preferred Approach. Both of the options include construction of more than 30km of new pipeline; and
- Moderate adverse effects to built and natural assets with SA options 8 and 10 due to the construction of more than 30km of new pipeline.

Summary of Cumulative Effects

Cumulative effects assessment identified potential significant effects in relation to carbon emissions, although the individual options are assessed only as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA8 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing infrastructure, treatment technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network.

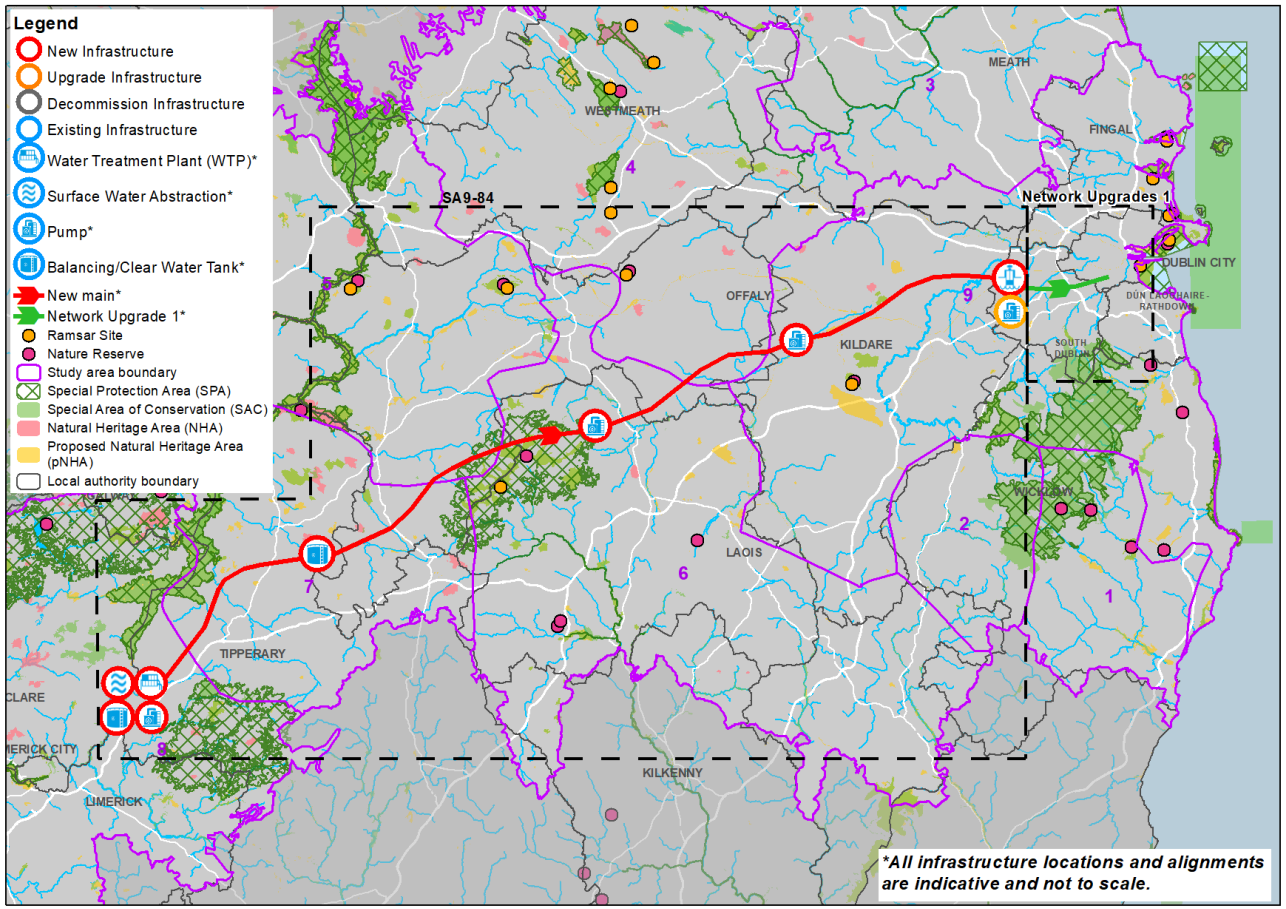
Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.10 Study Area 9 Summary of Assessment

The assessment undertaken for SA9 is summarised in Table 7.10 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA9 Environmental Review.

Table 7.10 Study Area 9 Summary of Assessment

Study Area 9	
SA9 has a total area of approximately 3,313 km^2 and lies within the counties of Dublin City, Dun Laoghaire-Rathdown, Fingal, Kildare, Meath, South Dublin, Wicklow, Laois and Offaly. The principal settlements (with a population of over 10,000) within SA9 are Arklow, Ashbourne, Balbrigggan, Bray, Celbridge, Droichead Nua (Newbridge, Dublin city and suburbs, Greystones-Delgany, Leixlip, Malahide, Maynooth, Naas, Skerries, Swords and Wicklow (CSO, 2016).	
Unconstrained	106 options
Coarse & Fine Screening	60 options (46 rejected; 11 for sustainability reasons) & 51 options (nine rejected)
Feasible Options	51 options
Approach Development	
12 feasible combinations were identified for SA9 and were ranked from Best to Worst. Combinations that were identified as the Best in a particular category were taken forward for further assessment. For SA9 this aligned as three approaches which were then ranked against each other (see table below).	



Approach Development			
Category	**SA Approach 1 (including New Shannon Source (NSS) option)**	**SA Approach 2 (including Desalination option)**	**SA Approach 3 (including New Shannon Source (NSS) option)**
Least cost (LCo)	Best	Worst	
Quickest Delivery (QD)	Worst	Best	Worst
Best AA (BA)	One -3 Biodiversity Score	Four -3 Biodiversity Scores	One -3 Biodiversity Score
Lowest Carbon (LC)		Worst	Best
Most Resilient (MR)	Best	Worst	Best
Best Environmental (BE)	Best	Worst	
Summary	SA approach 1 has been selected as the best performing approach overall across the different categories and therefore is the SA9 Preferred Approach. It scored best under LCo, BA, MR and BE categories.		

Preferred Approach		
SEA objectives	**Potential Construction Impact**	**Potential Operational Impact**
1. Public Health	Minor to Moderate Adverse	Minor to Major Beneficial
2. Biodiversity	Minor to Moderate Adverse	Neutral to Minor Adverse
3. Landscape and Visual	Minor to Major Adverse	Moderate Adverse
4. Materials	Minor to Major Adverse	Neutral to Minor Adverse
5. Greenhouse Gas	Minor to Major Adverse	Minor to Major Adverse
6. Climate Change	Minor Adverse	Minor Adverse to Moderate beneficial
7. Surface Water/Groundwater	Neutral to Minor Adverse	Minor Adverse
8. Flood Risk	Neutral to Minor Adverse	Neutral to Minor Adverse
9. Cultural Heritage	Neutral to Moderate Adverse	Neutral
10. Geology and Soils	Neutral to Minor Adverse	Neutral

Preferred Approach

The Preferred Approach includes SA9-084 with a new surface water source from the Parteen basin, new water treatment plan and construction of 173km of pipeline. A network upgrade will also be required from Peamount reservoir to the city centre. A number of measures are also required to upgrade the WTPs and the network in SA9 which will need to be undertaken irrespective of the approach chosen.

Summary of Assessment Findings

Key beneficial impacts assessed include, up to, moderate beneficial impacts for all options associated with increasing resilience and the quality of water supply for local communities; and the subsequent benefits of this for public health. The NSS Transfer will help ensure future security of supply to SA9 and a number of WRZs within study areas 1, 2, 3, 4, 6, 7 and 8, with major beneficial impacts for the increased resilience and quality of water supply and subsequent benefits to public health long-term.

Moderate beneficial impacts for climate change resilience are also assessed for options SA9-84 NSS transfer and Network Upgrade 1. These reduce reliance on abstraction from environmental resources that are potentially vulnerable to future climate change impacts. They will also replace competing uses associated with the interim measures relating to flood risk management and operation as a renewable energy supply.

Key potential adverse impacts identified include:

- Potential moderate construction and operational adverse impacts on biodiversity assuming recommended mitigation for avoiding AESI are applied to for construction and operation effects on the Lower River Shannon SAC (Parteen Basin). The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts to nationally designated sites. Abstraction may impact water levels in Lough Derg (pNHA) which is an important area with its associated species richness although abstraction will be set within allowable limits;
- Potential moderate adverse construction impacts on biodiversity as the transfer pipeline route crosses multiple river channels providing hydrological links to other European sites such as: Lough Derg North-East Shore SAC; Lisduff Fen SAC; River Barrow and River Nore SAC; Charleville Wood SAC; Rye Water Valley/Carton SAC; River Shannon Callows SAC; and River Boyne and River Blackwater SAC, which support Atlantic Salmon, Lamprey species and Otter. The NIS identifies mitigation measures to avoid AESI for these sites;
- Potential moderate construction impacts from extensive tree and hedgerow habitat clearance has the potential for short term moderate adverse impacts to annex species and biodiversity disturbed by the works;
- Potential major adverse temporary landscape effects from large scale pipeline and WTP construction works, the pipeline will be underground and land use reinstated above. Medium to long term impacts on landscape are assessed as minor.
- Major adverse effects on material assets during construction including temporary loss of agricultural land, including minor adverse effects from disturbance or loss of potentially valuable soils and/or risks of loss or truncation of unknown archaeological remains during construction.

Summary of Cumulative Effects

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 measures for water supply and competing uses for flood risk management and use as a renewable energy supply will need to be considered further.

SEA mitigation identified to address the key adverse effects identified above includes further desktop investigations to inform detailed pipeline routing such that effects on designated sites, habitats and archaeology are minimised or avoided, potentially supplemented by the use of techniques such as directional drilling where appropriate. Further hydrological and hydrogeological modelling is required to better understand the linkages between proposed new abstractions and surface waterbodies and supported habitats. In addition, further siting studies would help minimise the loss of agricultural and other land uses where new above ground infrastructure is required.

Cumulative effects assessment identified potential significant effects in relation to carbon emissions. The individual options for SA9 are assessed minor to major adverse reflecting the as neutral to minor adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. Mitigation of carbon emissions associated with technology or potential for mitigation, such as increased use of renewable energy sources in relation to the whole network as well as the preferred approach.

Recommendations are provided on mitigation and monitoring of potential effects, including cumulative effects, in Appendix D and the Environmental Action Plan and Monitoring Plan in section 10.

7.11 Comparison of Study Area Preferred Approaches with the WRZ approaches

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

Based on the Preferred Approaches for the Study Areas, the 134 WRZs across the Eastern and Midlands Region will be supplied by 85 WRZ options and 13 grouped supply systems (see Table 7.11). This creates interconnected supplies and is accompanied by rationalisation of infrastructure which provides a more resilient supply for customers. There is also the benefit of moving away from some of the potentially unsustainable abstractions by reducing abstraction points.

Table 7.11 SA Preferred Approach

Study Area	Number of WRZs	SA Preferred Approach		Number of WRZs benefitting from a SA Option (Grouped Option)
		WRZ Option	SA Option (Grouped Option)	
SA1	18	9	2	9
SA2	12	10	1	2
SA3	11	4	1	7
SA4	13	2	1	11
SA5	10	10	-	-
SA6	28	24	1	4
SA7	10	7	1	3
SA8	31	18	5	13
SA9	1	1*	n/a	n/a
Region Total	**134**	**85**	**13**	**49**

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

Option types include new and increased groundwater (GW) and surface water (SW) abstractions, new and upgraded water treatment plants (WTPs), rationalisations (connection of WTPs and/or WRZs, usually accompanied by decommissioned abstractions and WTPs) and transfers from sources within or outside of the Study Area.

7.3.2 Assessment against the Six Approach Categories

Table 7.12 compares the relative Multi Criteria Assessment (MCA) scores of the Preferred Approaches at Study Area level against the WRZ Level Approach for each of the six Approach Categories. Further justification for the selection of the SA Preferred Approach is set out in detail in the supporting Study Area Technical Reports (Appendix 1 - 9).

Table 7.12 SA Preferred Approach (PA) and WRZ Level Approach Assessment – MCA Scores

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

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

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

7.12 Cross Study Area interconnections

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

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

Where WRZs depend on the development of the Preferred Approach for the GDA, alternative options have been identified in the event that the Preferred Approach for the GDA cannot advance. The alternative options for the relevant Study Areas are described in the SA Technical Reports (Appendices 1-9 of the RWRP-EM) and assessed in the Environmental Reviews and the results of this assessment are included with each Study Area summary in The assessment undertaken for SA1 is summarised in Table 7.2 below and more detailed information is provided in Appendix H: Study Area Environmental Review: SA1 Environmental Review.

Table 7.2 to 7.10 above.

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

Full details of the environmental assessment undertaken for each SA Preferred Approach development are included in Appendix H Study Area 1-9 Environmental Reviews.

7.13 Summary of Preferred Approach selection

An overall summary of the Study Area Preferred Approach and performance against the three environmentally focussed approach categories is provided below.

7.13.1 Appropriate Assessment (AA)

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

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

7.13.2 SEA Objectives

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

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

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

7.13.3 Least Carbon

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

8

SEA Regional Level Assessment

8 SEA Regional Level Assessment

8.1 Regional Level Alternatives

During the Study Area level assessment process summarised in Section 7, the Feasible Options were compared to see whether any SA or Regional Options were available to meet the need across multiple WRZs. For some Study Areas this led to the identification of Preferred Approaches which involve an external transfer i.e. from a supply in another Study Area.

For the Regional Level assessment, the potential Preferred Approach has been reviewed further to consider how alternative combinations perform in the round at this level. Only one Regional Option has been identified for the Eastern and Midland Region. This consists of a transfer from the Shannon River, referred to as the New Shannon Source (NSS), which has the potential to supply multiple Study Areas. No other source with as large a potential, both in terms of quantity and distribution of supply, was identified. The Preferred Approach for SA9, which includes the development of the NSS, will need to be modified to allow for this additional required demand.

For the purposes of the RWRP-EM, the combined Study Area 1-9 Approaches including the modification to SA9 Preferred Approach to support the Study Area transfers has been considered alongside two alternative regional approaches that do not involve cross Study Area transfers. The Combinations considered are listed below with the 'do minimum' or 'without RWRP-EM' alternative as part of the SEA.

For the Regional Level assessment, the Regional Approach is compared with potential alternatives for the whole region as set out below:

- Combination 1: **Regional Approach with Transfer** - a combination of the Preferred Approach for all Study Areas taking into account the additional capacity NSS option to support the transfers to Study Areas outside SA9. This Approach is detailed further in Section 8.2 of the RWRP-EM.
- Combination 2: **Regional Approach One without Transfers** - This approach retains the NSS as the Preferred Approach for SA9; however, it utilises Local Options instead of Study Area transfers. These Local Options are identified in each of the Technical Appendices for Study Areas 1-8. This Approach is detailed further in Section 8.3 of the RWRP-EM.
- Combination 3: **Regional Approach Two without Transfers** - This approach considers a scenario where the Preferred Approach for SA9 does not progress and an alternative option, which comprises a Desalination option, is considered for SA9. This approach does not support regional transfers, Study Areas 1-8 are supplied by Local Options. This Approach is detailed further in Section 8.3 of the RWRP-EM.
- Do minimum approach - continuation of the current programme without new investment identified in the RWRP-EM. Assumes SA1-9 interim measures would be implemented.

The Regional Approaches that can meet the regional wide deficit are compared based on the MCA scores and NPV financial and carbon costs and are also assessed in terms of comparative performance against each SEA objective. This assessment focuses on the differences between the approaches.

The overall Preferred Approach for the Eastern and Midlands Region is then compared with a 'do minimum' based on the evolution of the baseline without the RWRP-EM investment.

8.1.1 Combination 1 Regional Approach with Transfers

This is a combination of the Preferred Approach for all Study Areas taking into account the additional capacity NSS option to support the transfers to Study Areas outside SA9. In total there are 36 WRZs across SA1 to SA9 where the Preferred Approach at Study Area level is to obtain supply either directly from the GDA or from the NSS on route to the GDA.

There are 18 WRZs where the Preferred Approach at Study Area level is to obtain supply directly from the GDA and there are 18 WRZs which lie close to the route of the proposed pipeline transferring treated water from the NSS to the GDA, the Preferred Approach for SA9. The Preferred Approach for these WRZs is to obtain supply from the NSS via four (4) transfers from the pipeline connecting the NSS to the GDA. These are all described in the RWRP-EM section 8.2 along with how the regional DYCP demand is calculated taking account of the additional network resilience from the transfers, and the following:

- Assets expected to be decommissioned as part of the Preferred Approach.
- Asset expected to be in operation in 2044.
- Contribution of additional supply delivered through projects in the current investment cycle, including the new WTP at Vartry and the Srowland extension project.
- Reduction in demand growth from 2023 to 2034 reflecting the ambitious leakage reduction programme to achieve the national SELL targets.

Table 8.1 Breakdown of Regional Deficit

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

Table 8.1 lists the resulting SDB deficit for each proposed WRZ to provide the 1 in 50 LoS in the DYCP scenario. When the proposed transfers as mentioned above are taken into account, the required demand from the NSS increases from 183 Ml/d to 266 Ml/d.

8.1.2 Comparison of Combinations 1, 2 & 3 Regional Approaches

Combinations 2 and 3 are as described in section 8.1.

A detailed comparison of the three combinations is provided in the RWRP-EM section 8.3 for each WRZ. A summary is included here in Table 8.2 below covering the types and numbers of new, increased or decommissioned abstractions.

Table 8.2 Summary of Abstractions for the Regional Approaches

	Combination 1 Regional Approach with Transfers	Combination 2 Regional Approach One without Transfers	Combination 3 Regional Approach Two without Transfers
Abstractions Decommissioned	33 GW abstractions 14 SW abstractions including 6 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction.	4 GW abstractions 2 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction.	4 GW abstractions 2 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction.
Abstractions Maintained	4 GW abstractions 4 SW abstractions	32 GW abstractions 16 SW abstractions	32 GW abstractions 16 SW abstractions
Increase Existing Abstractions		12 GW abstractions 7 SW abstractions	12 GW abstractions 7 SW abstractions
New Abstractions	1 SW abstraction from the River Shannon.	9 GW abstractions 5 SW abstractions including new abstraction from the River Shannon.	12 GW abstractions 11 SW abstractions including new abstraction from the River Shannon. 1 abstraction from the Irish Sea for desalination via a sea intake and with a brine effluent outfall.

A comparison of the Combinations in terms of their respective infrastructure components is provided in Table 8.3 below.

Table 8.3 Comparison of the Alternative Regional Approaches against Infrastructure Components

Study Area	Combination Number	Infrastructure Components						
		New Pipeline (km)	New WTPs	Upgrade WTPs *	New/ upgraded abstractions	Decomm. WTPs	Decomm. Abstractions	Water Storage
SA1	1	62	0	10	6	10	10	5
	2 and 3	23	2	18	14	0	0	5
SA2	1	27	0	9	7	3	3	3
	2 and 3	4	3	12	10	0	0	2
SA3	1	160	1	8	3	11	12	7
	2 and 3	67	3	11	10	4	0	6
SA4	1	174	0	2	0	13	13	2

Study Area	Combination Number	Infrastructure Components						
		New Pipeline (km)	New WTPs	Upgrade WTPs *	New/ upgraded abstractions	Decomm. WTPs	Decomm. Abstractions	Water Storage
	2 and 3	74	1	14	9	2	0	7
SA5	1, 2 and 3	25	1	15	9	0	0	6
SA6	1	81	1	36	23	6	7	10
	2 and 3	63	1	36	25	2	0	9
SA7	1	36	0	11	4	7	7	4
	2 and 3	20	0	14	6	3	0	4
SA8	1	177	0	29	26	18	4	13
	2 and 3	161	1	32	19	6	0	12
SA9	1 and 2	194	1	0	1	0	0	3
	3	79	11*	2	13	0	2	15
Total	**1**	**936**	**4**	**120**	**79**	**68**	**56**	**53**
Total	**2**	**601**	**13**	**153**	**102**	**17**	**0**	**53**
Total	**3**	**507**	**24**	**155**	**112**	**17**	**2**	**65**

*one of the 11 new WTPs within SA9 combination 3 is a new desalination plant which will require a new marine intake and outfall

8.2 SEA Assessment of Regional Level Alternatives

The three approaches are compared in terms of their performance against the six approach categories in Table 8.4 and Table 8.5 below.

Table 8.4 Best Performing Combination for each Approach Category

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

Regional Approach Two does not perform best against any category and is not taken forward in the RWRP-EM but is included for further comparison for the purposes of the SEA to consider the best without NSS alternative.

Table 8.5 Comparison of the Alternative Regional Approaches against MCA scores

	Regional Approach with Transfer	Regional Approach One without Transfers	Regional Approach Two without Transfers
Least cost (LCo)	Best*		Worst
Quickest Delivery (QD)	Worst	Best	
Best AA (BA)	Two No. -3 Biodiversity Scores Best	Four No. -3 Biodiversity Scores	Seven No. -3 Biodiversity Scores Worst
Lowest Carbon (LC)	Best		Worst
Most Resilient (MR)	Best		Worst
Best Environmental (BE)	Best		Worst

*The three approaches were within 5% of each other on cost so further comparison was undertaken to select the best least cost

A comparison of the Combinations against each of the SEA objectives is provided in Table 8.6 below. This includes consideration of the scale and infrastructure components, the environmental assessment in the MCA, and comparing likely level of impacts or risk against each SEA objective.

A do minimum approach is also considered for comparison. This takes account of the following:

- 67% of the WRZs are in deficit at present and do not provide adequate reliability to customers in normal conditions based on the 1 in 50 Level of Service adopted.
- Across all weather scenarios, the water available for use (WAFU) from existing supplies is not sufficient to balance the current demand for water (there are a number of factors affecting water available for use and this is explained in more detail in section 3 of the RWRP-EM).
- Total Demand is forecast to increase by about 10% for all Weather Planning Scenarios despite the estimated overall regional population increase of 25%. This comparatively small increase in Total Demand is attributed to:
    - ambitious leakage reduction targets; and
    - significant high-water demand growth is confined within a small number of WRZs, which mitigates the effect of such increases, when using regional averages.

  By 2044, the net Deficit across the Eastern and Midlands Region is forecast to increase by 141% in a normal year, 68% in a dry year, 58% in the Dry Year Critical Period and 43% for the Winter Critical Period. The largest Deficit occurs for the Dry Year Critical Period at 312Ml/d.

Table 8.6 Comparison of the Alternative Regional Approaches against SEA objectives

Objective	Approaches			
	Do Minimum	Regional Approach with Transfers	Regional Approach One without Transfers	Regional Approach Two without Transfers
1. Protect public health and promote wellbeing	---	+++	++	+
Comparison	• The Do Minimum approach would address short term water quality needs through the interim solutions including required water treatment upgrades but would not address the increasing supply deficit in the medium to long term. • All three Regional Approaches provide additional resilience and flexibility and relieve pressure on the existing local sources. The Regional Approach with Transfers provides scope for more rationalisation options. • The Regional Approach with Transfers provides scope for more rationalisation options and involves large scale infrastructure construction, but potentially less long-term operational impacts and greater benefits associated with this approach in comparison to the other two approaches. • Regional Approach One without transfers provides less scope less rationalisation of options than the 'with transfer' approach reduced large scale construction but also reduced operational benefits. • Regional Approach Two without Transfers include potential greater construction impacts in urban areas and the construction of new desalination plant on the coast which could have permanent operational impacts depending on detailed siting.			
2. Protect and enhance biodiversity and contribute to resilient ecosystems	--	-	--	---
Comparison	• Regional Approach with Transfers includes two higher risk options that could impact European sites. One being the New Shannon Source abstraction directly from the Lower River Shannon SAC and the other an increased abstraction at the Clareville WTP which could impact the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. • Regional Approach One without Transfers includes both of the higher risk options associated with the Regional Approach with Transfers. However, there are also an additional two higher risk options. One being the risk of pollution to the River Boyne SAC due to treated effluent discharge and the other a new groundwater abstraction that could impact the Holdenstown Bog SAC and the Slaney River SAC. • The Regional Approach Two without Transfers includes all of the higher risk options included in the other two approaches (except for the New Shannon Source abstraction option associated with SA9). Regional Approach Two without Transfers uses a desalination approach in SA9 which has four higher risk options associated with it. These are associated with new surface water abstraction from the River			

	Tolka that could impact the South Dublin Bay and River Tolka Estuary SPA, and North Dublin Bay SAC; a new abstraction from the River Liffey at Islandbridge and a new desalination plant resulting in brine discharge and marine outfall to the Irish Sea that could impact the SACs and SPAs that are hydrologically linked e.g. Dublin Bay SAC/SPA, Rockabill to Dalkey Island SAC, and Lambay Island SAC/ SPA; and a groundwater abstraction located within the Curragh aquifer that directly contributes to Pollardstown Fen SAC.			
3. To protect landscapes, townscapes and visual amenity	-	-	-	--
Comparison	• The Regional Approach Two without Transfers requires the most new above ground infrastructure when compared with the other two approaches. This could have long term impacts on landscape and visual amenity. The approach include desalination plant at the coast, additional new WTPs and over 3km of brine return pipeline alone.			
4. Protect and where appropriate enhance, built and natural assets and reduce waste	---	--	--	--
Comparison	• The Regional Approach Two without Transfers requires the most new above-ground infrastructures, including additional new SW and GW abstractions and WTPs required to supplement the desalination process (Table 8.2). This results in land take for areas important for recreational use. (Desalination also involves generation of brine waste for discharge to the marine environment which is covered in the water and biodiversity assessment). • Although the Regional Approach with Transfer requires extensive new pipeline, the approach include the most decommissioned abstractions with scope for reuse materials and fewer above ground assets. Most land disrupted during construction can also be reinstated.			
5. Reduce greenhouse gas emissions (NPV carbon)	?	(Best)	---	(Worst)
Comparison	• All the approaches are associated with high embodied carbon and operation carbon although the Regional Approach with Transfers has the lowest carbon cost and Regional Approach Two without Transfers has the highest carbon. • The carbon cost that would be associated with the do minimum is not known and dependent on how water need is addressed from existing and replacement sources.			
6. Contribute to environmental climate change resilience	---	++	+	--

Comparison	• Regional Approach Two without Transfers is assessed as worst out of the three approaches. Although the desalination option itself can be considered resilient, the approach also requires a number of new and increased abstractions from sources that are already at risk and have higher vulnerability to climate change. • The Regional Approach with Transfer is assessed as the best overall as it allows the rationalisation of currently vulnerable sources to a larger and more resilient source across the study areas and reduces reliance on sources considered at risk.			
7. Protect and improve surface water and groundwater status	---	++	-	---
Comparison	• Both the Regional Approaches One and Two without Transfers require more new and increased abstractions which could result in over abstraction at these sources. The Regional Approach Two without Transfers include more new and increased abstractions including abstractions from sources already at risk of over abstraction. • Regional Approach with Transfers is assessed as the best because the rationalisation made possible by the NSS transfer to the different study areas allows Irish Water to decommission at some abstractions that have been assessed as potentially at risk from current abstraction.			
8. Avoid flood risk and vulnerability	--	-	-	-
Comparison	• Regional Approach with Transfers is assessed the best because there is less above ground infrastructure within flood plain/higher flood risk areas - however detailed design and siting could address flood risk and vulnerability for components with in all the approaches.			
9. Protect and where appropriate, enhance cultural heritage assets	-	-	-	--
Comparison	• Regional Approach Two without Transfers approach requires the most new above-ground infrastructure close to cultural heritage sites with potential setting effects. • Regional Approach with Transfer is considered the best because majority of infrastructures will be underground and routed along existing roads, posing less risk to cultural heritage assets. Overall, the comparative archaeological risk is difficult to assess as all the approaches include significant below ground pipeline construction and a level of risk associated with works in undisturbed ground			
10. Protect quality and function of soils	0	-	-	-
Comparison	• The Regional Approach Two without Transfers requires more above-ground infrastructure located close to geological heritage sites. • All approaches will involve extensive underground pipeline involving soil disturbance and reinstatement where the infrastructure is not routed along existing road			

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

8.2.1 Selection of the Preferred Regional Approach

The Regional Approach with Transfers is assessed as the best overall approach, providing the highest level of resilience for reliable supply with the flexibility provided by the new transfers, using only sustainable new sources and allowing the ultimate decommissioning of 33 GW abstractions, 14 SW abstractions including 6 SW abstractions where the abstraction is potentially greater than the estimated sustainable abstraction with potential benefits in terms of associated biodiversity and reducing risk to WFD water body status. The risk to European sites is considered lowest with the Regional Approach with Transfers with 2 higher risk options identified both assessed as mitigatable in the NIS. This compares to the 7 higher risk options Regional Approach Two without Transfers which includes the potential operational impact from the brine effluent discharge to Dublin Bay with potential to affect marine biodiversity and fisheries.

The proposed abstraction required to provide the 266 Ml/d output to supply the 36 WRZs, including the GDA, is well within the estimated sustainable abstraction available.

This contrasts with Regional Approach One without Transfers which reduces the required output from the NSS from 266 Ml/d to 183 Ml/d by abstracting 126 Ml/d additional supply from existing sources, increasing existing sources and new sources.

Regional Approach Two without Transfers requires a significantly greater number of new abstractions including abstractions considered likely to be above sustainability limits and an effluent reuse option.

The embodied and operational carbon emissions associated with all the approaches is considered high and the Regional Approach with Transfers is the highest of the three. However, there is considered to be scope to address this through energy efficient design including reducing embodied carbon and potential for including renewable energy sources for operational supply.

The Regional Approach with Transfers is assessed as the best overall approach and identified as the Regional Preferred Approach.

8.2.2 Sensitivity testing of the Preferred Regional Approach

Table 8.7 Sensitivity Analysis

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
Sustainability	Moderate/High (current abstractions are large compared to the water bodies from which they are abstracted)	+115 Ml/d	The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the supply demand balance deficit.
			While sustainability reductions would be expected to provide additional benefit to sensitive sources and this could add pressure on other sources, the additional connectivity provided by Regional Preferred Approach is expected to provide additional operational flexibility. Some at risk sources will have already been decommissioned for the Regional Preferred Approach.
Climate Change	High (international climate change targets have not been met)	+18 Ml/d	The impact of increased climate change scenarios would impact our existing supplies and result in decreased water availability at certain times of year.
			Additional connectivity provided by Regional Preferred Approach is expected to provide additional operational flexibility and will allow Irish Water to relieve pressure on existing sources at risk by supplying from more resilient new surface water and groundwater sources. The Preferred Approach involves the decommissioning of several river and small lake sources that are most vulnerable to the impacts of increased climate change scenarios in the future.
Demand Growth	Low/Moderate (growth has been based on Government policy documents)	-53 Ml/d	The impact of lower than expected growth would reduce the supply demand balance deficit and the overall need requirement.
			Benefits of reduced demand include reduced energy and associated carbon emissions and reduced abstraction pressure however new there is still a need for a new source of water

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Impact on Preferred Approach
Leakage Targets	Moderate (the distribution network in the region is extensive at nearly 10,000 kilometres)	+87 Ml/d	The impact of lower than expected leakage savings would increase the supply demand balance deficit and the overall need requirement.
			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.
	Low (Existing leakage targets of 20% leakage in WRZ where demand is greater than 1.5 Ml/d are ambitious)	-159 Ml/d	The impact of reducing leakage to 10% of total demand across all WRZs would reduce the supply demand balance deficit and the overall need requirement.
			Even if 10% leakage targets were achieved, there is still a need for a new source of water. This would provide energy and carbon benefits and allow reduced pressure on abstractions

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

8.3 Regional Preferred Approach Summary

The Regional Preferred Approach selected for the RWRP-EM is outlined in Table 8.8 below. The options included in the Preferred Approach are listed in Appendix C for each Study Area.

Table 8.8 SA Preferred Approach Description

Study Area	Description
SA1	The Preferred Approach for SA1 Mid Wicklow, consists of 10 local WRZ options and 2 SA options. The WRZ options involves WTP upgrades, new and increased groundwater abstractions, and improved interconnection. There are two SA options: The first rationalises six WRZs to Vartry WTP in SA9, improving resilience through interconnections: Avoca Ballinaclash, Redcross Conary, Ballinteskin, Rathdrum. Laragh Annamoe, Barndarrig. The option will require new pumps and approximately 48km of new/upgraded network to connect the WRZ's and allow for the additional supply. New service reservoirs or upgrades to existing reservoirs will be required at Rathdrum. The second SA option involves an increased groundwater abstraction at an existing wellfield at Woodenbridge, Arklow Ballyduff WTP upgrade, new WTP at Woodenbridge, new storage and BPT,

Study Area	Description
	new/upgraded pumps and approximately 13km of new/upgraded network to allow for the additional supply. 10 WTPs and 10 abstractions will be decommissioned.
SA2	The PA for SA2, West Wicklow, consists of WRZ options for all but two of the WRZs in the study area. The WRZ options involve new and increased groundwater abstractions, upgrades to existing WTPs, a new connection to the existing network at Rathvilly and the decommissioning of Hacketstown WTP. The connection to Rathvilly (SA6) will require additional supply from the New Shannon Source to Carlow. The option includes new pump/s and approximately 11.4 km of new/upgraded network to allow for the additional supply. For the other two WRZs, Hollywood - Donard Public Supply and Dunlavin Public Supply, the SA Option involves rationalising these two WRZs to Ballymore Eustace WTP (SA9) via a new connection to the Ballymore Eustace - Old Kilcullen trunk main. This option includes a new pumping station, a new service reservoir and approximately 15km of new/upgraded network to allow for the additional supply. 3 WTPs and 3 abstractions will be decommissioned.
SA3	The PA for SA3, Meath, consists of WRZ options for four of the WRZs in the study area. The options involve new and increased groundwater abstractions, along with WTP upgrades. A single SA option resolves the deficit for seven of the WRZs, namely Athboy, Ballivor, Kells-Oldcastle, Kilmessan, Navan-Mid Meath, South Louth & East Meath, and Trim. This involves improved interconnection between WRZs, and supply from a New Shannon Source. New storages, new pumps and watermain network of approximately 154km will be required as part of this option. Six WTPs will be upgraded for water quality purposes only. 11 WTPs and 12 abstractions will be decommissioned.
SA4	The PA for SA4, West Meath, consists of two WRZ options and one SA Grouped Option. The WRZ Options relate to WRZs that do not have a supply deficit. The options therefore maintain existing groundwater sources and upgrade two WTPs for water quality only. The SA Grouped Option interconnects 11 of the 13 WRZs and supplies the merged WRZs from the proposed New Shannon Source. 13 WTPs and 13 abstractions will be decommissioned.
SA5	The PA for SA5, Offaly/Roscomon, consists of WRZ options for all of the WRZs in the study area. For one of the larger demand areas, South Roscomon (Lisbrock & Killeglan), the SA Preferred Approach involves increasing the existing groundwater abstraction at Killeglan and Lisbrock, upgrading the associated WTPs and providing new/upgraded network to allow for the additional supply. The SA Preferred Approach for the remaining WRZs involves a new WTP, new and increased groundwater abstractions, along with increased surface water abstractions and WTP upgrades. No decommissioned WTPs or abstractions.
SA6	The PA for SA6, Laois, consists of WRZ options for 24 of the 28 WRZs in the study area. For the larger demand area, namely Carlow Town, the SA Preferred Approach involves a cross SA transfer from the GDA to Carlow Town (Browneshill reservoir) via Srowland WTP (SA9). This option will require the provision of new storage, new pumps and lay approximately 28.6 km of new network.

Study Area	Description
	There are two SA options: Ballinakill and Durrow WRZs will be interconnected. This will include an increase GW abstraction and WTP upgrades. Tullamore and Mountbolus will be supplied via a connection to the proposed NSS. This includes balancing storage at NSS connection, new reservoir, new/upgraded pumps and approximately 25.5km of new/upgraded network to allow for the transfer of the additional supply. 4 WTPs and 7 abstractions will be decommissioned.
SA7	The PA for SA7, North Tipperary, consists of WRZ options for 7 of the 10 WRZs in the study area. One of the options is a new GW abstraction at Crossanagh, including an upgrade to Crossanagh WTP, new/upgraded pumps and approximately 500m of new/upgraded network to allow for the additional supply. New service reservoir or upgrades to existing reservoir will be required in Terryglass. The remaining WRZ options involve increased groundwater or surface water abstractions and WTP upgrades. One SA option improves the interconnection between three WRZ, namely Dunkerrin/Moneygall, Greyford Source to Crotta and Cloughjorda. A new supply will be provided from the proposed NSS. This option includes new/upgraded pumps, new storage at Jones Well WTP and approximately 29km of new/upgraded network to allow for the transfer of additional supply between WRZ's. 7 WTPs and 7 abstractions will be decommissioned.
SA8	The PA for SA8, Limerick Clare, consists of WRZ options for 18 of the 31 WRZs in the study area. For some of the larger demand areas, the SA Preferred Approach used 5 SA options to rationalise and provide spare capacity to 13 WRZs: Supplies spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore/Murroe/Foileen, Pallasgreen and Doon. This option includes new/upgraded pumps, new reservoirs and approximately 37.7km of new/upgraded network to allow for the transfer of the additional supply. Rationalisation of Adare, South West Regional and Limerick City Environs PWS to Limerick and Upperchurch to Kilcommon. Supplies spare capacity from Glenosheen/Jamestown/Kilmallock to KilfinaneArdpatrick. Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell borehole). The option includes a new pumps and approximately 6.8km of new network to allow for the transfer of the additional supply. Ballygaddy, Glenosheen, Kilmallock and Jamestown WTPs will be upgraded for water quality purposes One interconnection from the NSS to Newport and Killaloe whilst decommissioning of 3 WTPs. The option includes new storage, new pumps and approximately 11km of watermain. The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, along with increased surface water abstractions, WTP upgrades, improved connectivity between WRZs and an advanced leakage reduction programme for the Ennis WRZ. The leakage reduction programme needs to be implemented in conjunction with a local GW option to meet the full WRZ deficit. 16 WTPs and 19 abstractions will be decommissioned:
SA9	The PA for SA9, Greater Dublin Area, include a new SW abstraction of 210MLD from The Parteen Basin. The option also includes a new WTP at Birdhill with an output capacity of 200MLD, twin rising mains from

Study Area	Description
	abstraction to WTP (2km), a new break pressure tank, two clear water tanks, new pumping station & booster pumping station and new termination point reservoir in Peamount. The supply will be transferred approximately 41km from the WTP to the break pressure tank via a new 1600mm pumped pipeline. From the break pressure tank the supply will flow by gravity for the first 170Ml/d and pumped when demand goes above 170Ml/d. The pipeline from the Break pressure tank to the termination point reservoir will be 1600mm diameter with an approximate length of 130km A network upgrade will be required to pipeline from Peamount to Dublin. Other network improvements are also part of the Preferred Approach for SA9 but are required independently of the supply options selected. Two WTPS and 2abstractions will be decommissioned.

As part of the Preferred Approach, a number of sources and WTPs are proposed to be decommissioned as part of the rationalisation. These sources and WTPs are listed in Table 8.9.

Some of these closures will provide an environmental benefit where pressures are removed especially from waterbodies identified as exceeding the potential sustainable abstraction thresholds by Irish Water. For example, the removal of the Lough Owel abstraction will remove the conflict with the simultaneous need for water for navigation purposes. Rationalisation also provides opportunities for improved efficiency in terms of energy use and waste management and associated reduced carbon emissions for the supply provided. Additionally, many of Irish Water's existing abstractions are facilitated by the presence of structures such as a weir or dam and these can create obstacles for fish passage. When decommissioning abstractions facilitated by structures the possibility of removing these structures will be considered; however, many of these structures are not owned or operated by Irish Water. Figure 8.1 shows the surface water abstraction sites that will benefit from proposed decommissioning.

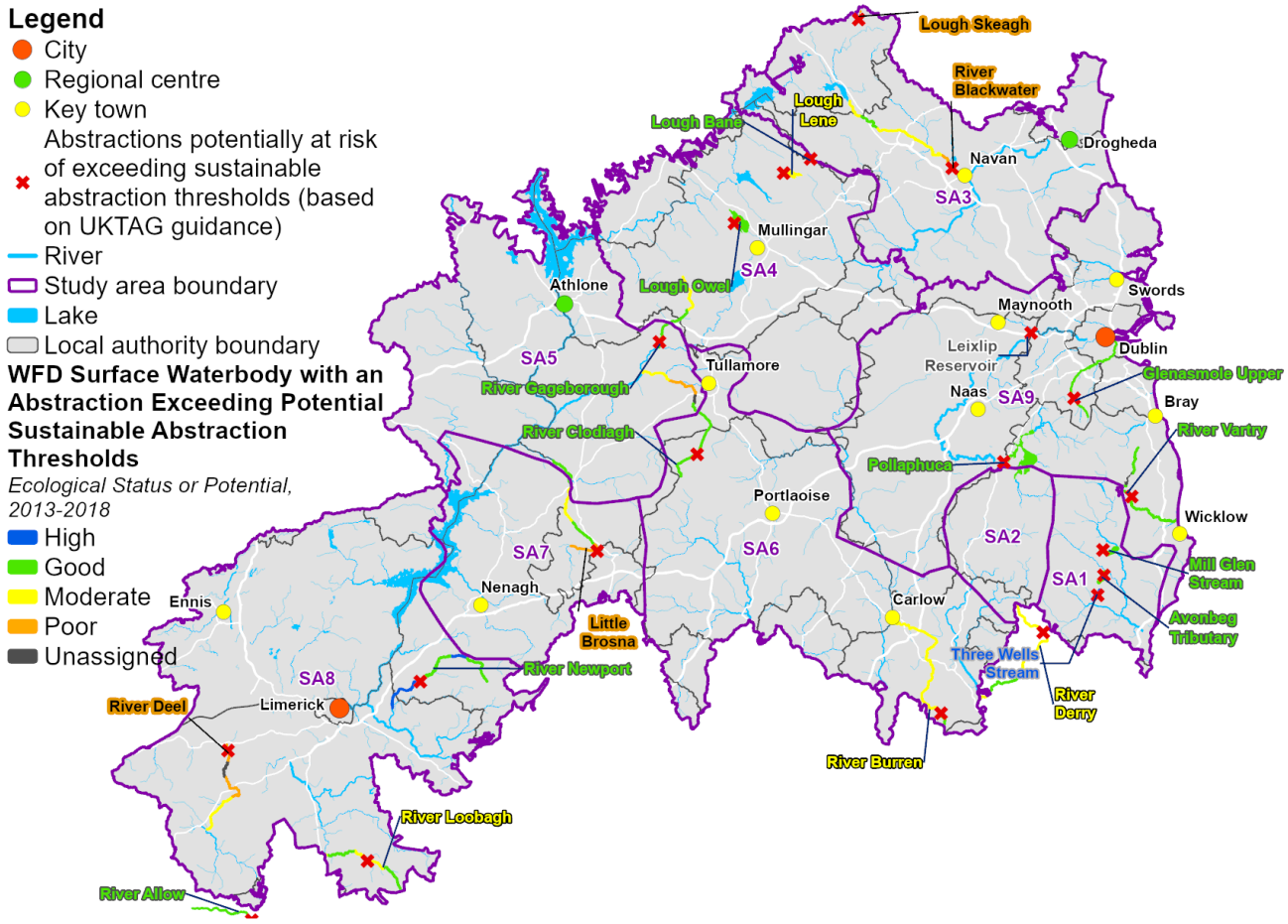


Figure 9.1 The Ecological Status of Abstraction Sites that will Benefit from Proposed Decommissioning

All the abstractions and WTP to be decommissioned once the replacement sources and rationalisation required as part of the Regional Preferred Approach is in place, are listed in Table 8.9 below.

Table 8.9 Proposed closures of WTPs and sources following the Regional Approach implementation

SA	WRZ Code	Current WRZ	WTP plant proposed to be decommissioned	Abstractions proposed to be decommissioned
SA1	3400SC0007	Avoca Ballinaclash Public Supply	Avoca Ballinaclash WTP	SW - Tributary of Avonbeg River
SA1	3400SC0012	Redcross Conary Public Supply	Redcross WTP	GW - Redcross Well No1 & No2
SA1	3400SC0025	Ballinteskin Public Supply	Ballinteskin WTP	GW - Ballinteskin BH
SA1	3400SC0027	Ballinapark Public Supply	Ballinapark WTP	GW - Ballinpark BH
SA1	3400SC0046	Rathdrum Public Supply	Rathdrum WTP	SW - Tributary of Avonbeg Ballinder
SA1	3400SC0047	Laragh Annamoe Public Supply	Glenmacnass WTP Raheen WTP	SW - Glenmacnass Intake GW - Raheen Borehole
SA1	3400SC0033	Ballymorris Public Supply	Ballymorris WTP	GW – Ballymorris Borehole

SA	WRZ Code	Current WRZ	WTP plant proposed to be decommissioned	Abstractions proposed to be decommissioned
SA1	3400SC0017	Barndarrig Public Supply	Barndarrig WTP	GW – Barndarrig Well
SA1	3400SC0006	Aughrim Annacurra Public Supply	Aughrim/Annacurragh WTP	SW – Three Wells Stream
SA2	3400SC0004	Dunlavin Public Supply	Dunlavin WTP	SW - Boherboy Spring.
SA2	3400SC0005	Hollywood Donard Public Supply	Slievecorragh WTP	GW - Slievecorragh Old Reservoir Site Windeye Source
SA2	0100SC0005	Hacketstown	Hacketstown WTP	SW - River Derreen Mill Run (Hacketstown)
SA3	2100SC0001	South Louth & East Meath	Rath WTP	GW – Rath Borehole and McCabe Borehole
SA3	2300SC0005	Kells-Oldcastle	Lough Bane WTP Clavin's Bridge WTP	SW – Lough Bane SW – River Blackwater
SA3	2300SC0006	Athboy	Athboy WTP Coill Dios WTP	GW - Trim Road Borehole GW – Coill Dios Borehole
SA3	2300SC0007	Ballivor	Kilmurry WTP Earlsmill WTP	GW – Kilmurry Borehole GW – Earlsmill Borehole
SA3	2300SC0011	Kilmessan	Kilmessan Swainstown WTP	GW – Kilmessan Borehole
SA3	2300SC0014	Trim	Trim WTP	SW – River Boyne
SA3	2300SC0055	Navan-Mid Meath	Liscartan WTP Kilcarn WTP	SW – River Blackwater SW – River Boyne
SA4	2300SC0018	Enfield	Enfield Borehole WTP	GW – Enfield Borehole & Old Well
SA4	3200SC0001	Mullingar Regional	Portloman WTP	SW – Lough Owel
SA4	3200SC0003	Ballany	Ballany WTP	SW – Lough Lene
SA4	2300SC0012	Clonard/Abbeysfields Housing Estate	Abbeysfields Estate WTP Meadowview Estate WTP	GW - Abbeysfield Boreholes GW – Clonard Borehole
SA4	2300SC0016	Longwood Water Supply	Longwood WTP	GW – Longwood Borehole
SA4	1400SC0004	Ardcarraig Clogherinkoe	Ardcarraig WTP	GW – Ardcarraig Borehole

SA	WRZ Code	Current WRZ	WTP plant proposed to be decommissioned	Abstractions proposed to be decommissioned
SA4	2500SC0005	Edenderry & Rhode	Toberdaly WTP	GW – Pool Borehole & Heavys Well
			Edenderry WTP	GW – Edenderry Borehole
SA4	2500SC0014	Daingean	Daingean WTP	GW – New Well 2003 Borehole
SA4	2500SC0006	Walsh Island	Walsh Island WTP	GW – Coolagarry Boreholes
SA4	2000SC0003	Ballymahon	Abbeyshrule WTP	SW – River Inny
SA4	2500SC0004	Geashill	Geashill WTP	GW – Dalgan Spring
SA6	1600SC0016	Mountrath	Drim WTP	GW – Drim Borehole
			Cloonin WTP	GW - Cloonin Borehole
SA6	2500SC0002	Tullamore	Clonaslee WTP	GW – Clarahill & Brittas Forest
			Arden WTP	SW - Clodiagh River
				GW – Sillogue Well & GW – Ardan Borehole
SA6	2500SC0013	Mountbolus PWS	Newgate Well WTP	GW – Newgate Well
			Reservoir WTP	GW – Village Well
SA7	2500SC0010	Dunkerrin / Moneygall	Lisduff Spring WTP	GW – Lisduff Spring
			Jones Well WTP	GW – Jones Well
			Dunkerrin WTP	GW – Dunkerrin Well
			Bushertown WTP	GW – Bushertown Spring
SA7	2900SC0045	Borrisokane	Kylebeg WTP	GW - Greyford Source
SA7	2900SC0046	Cloughjordan	Matty's Well WTP	GW - Matty's Well
SA7	2900SC0051	Terryglasss	Terryglass Old School WTP	GW – Terryglass School Borehole
SA8	2900SC0066	Newport RWSS	Newport WTP	SW – Mulkear River
			O'Gorman's Well WTP	GW – Gormans Well
SA8	0300SC0024	Killaloe PWS	Creeveroe WTP	GW - Garraunboy Intake/Creverore reservoir
SA8	0300SC0019	O'Briensbridge Public Supply	Montpellier WTP	GW - O'Briensbridge Borehole
SA8	1900SC0037	Murroe Public Supply	Murroe WTP	GW - Murroe Borehole

SA	WRZ Code	Current WRZ	WTP plant proposed to be decommissioned	Abstractions proposed to be decommissioned
			Murroe Reservoir WTP	GW - Murroe Reservoir Borehole
SA8	1900SC0037	Cappamore Foileen Water Supply	Foileen WTP	GW – Foileen Spring
SA8	1900SC0004	Doon Water Supply	Lacka Doon Borehole WTP Cooga Spring WTP	GW – Lacka Borehole GW - Cooga Spring
SA8	1900SC0005	Pallasgreen Water Supply	Pallasgreen WTP Oola WTP Caherconlish WTP	GW – Pallasgreen Spring GW – Oola Spring GW – Caherconlish Spring
SA8	1900SC0028	Croom Public Supply	Croom Bypass WTP Skagh Well WTP	GW – Croom Bypass Well GW – Skagh Well
SA8	1900SC0029	Adare	Adare WTP	GW – Adare Borehole SW – River Maigue
SA8	1900SC0034	Kilfinnane Ardpatrick Water Supply	Kilfinnane WTP Ardpatrick WTP	GW – The Ballyhoura Mountain Borehole GW - Kilfinnane Borehole
SA8	2900SC0068	Upperchurch	Upperchurch WTP	GW - Upperchurch Borehole

9 Cumulative Effects at Regional Level

9 Cumulative Effects at Regional Level

Article 3(5) of the SEA Directive states that it should be determined "*whether plans or programmes … are likely to have significant environmental effects".* Annex II (2) details the criteria for determining the likely significance of effects referred to in Article 3(5), including the need to take into consideration "*the cumulative nature of the effects*".

The EPA (2020) describes cumulative effects in SEA as "*effects on the environment that result from incremental changes caused by strategic actions together with other past, present, and reasonably foreseeable future actions. These effects can result from individually minor but collectively significant actions taking place over time or space*."

A cumulative effects assessment for a water resource management plan should include:

- Effects of measures/options proposed within a plan or programme; and
- Effects between the measures/options proposed within the plan or programme and other projects, plans and programmes.

At the Regional Level, cumulative effects need to be considered in relation to the combined effects from proposals in the nine (9) component Study Areas of the Eastern and Midlands regional group area.

For cumulative effects to occur, there needs to be an overlap of temporal periods in some way for the impacts and/or the effect. For example, two strategic-level schemes being constructed at the same time could result in cumulative traffic movements, while two schemes being operated together could result in a drawdown of groundwater levels. A precautionary approach has been taken for the cumulative effects assessment, which assumes that all options could be constructed at the same time and then all options would be operated at the same time.

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

- Biodiversity – for example, a cumulative loss or fragmentation of habitats or changes to a habitat quality through changes in water quality or groundwater levels. Across the Eastern and Midlands Region, there are approximately 126,778 ha of peat bogs, 34,074 ha of water bodies and 1,607 ha of water courses – some of the habitats associated with these could be vulnerable to changing water levels or water quality changes;
- Water environment (surface water and ground water WFD status) – for example changes to water quality due to multiple construction projects;
- People and health – for example, nuisance or physical health impacts caused by 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 reported here also to identify potential requirements for mitigation. Combined effects on climate change adaptation are also considered.

9.1 Cumulative Effects 'Within Plan'

9.1.1 Overview

The Preferred Approaches across the nine (9) Study Areas are shown in relation to environmental constraints in Figure 9.1 and Figure 9.2 This identifies option locations and transfer routes.

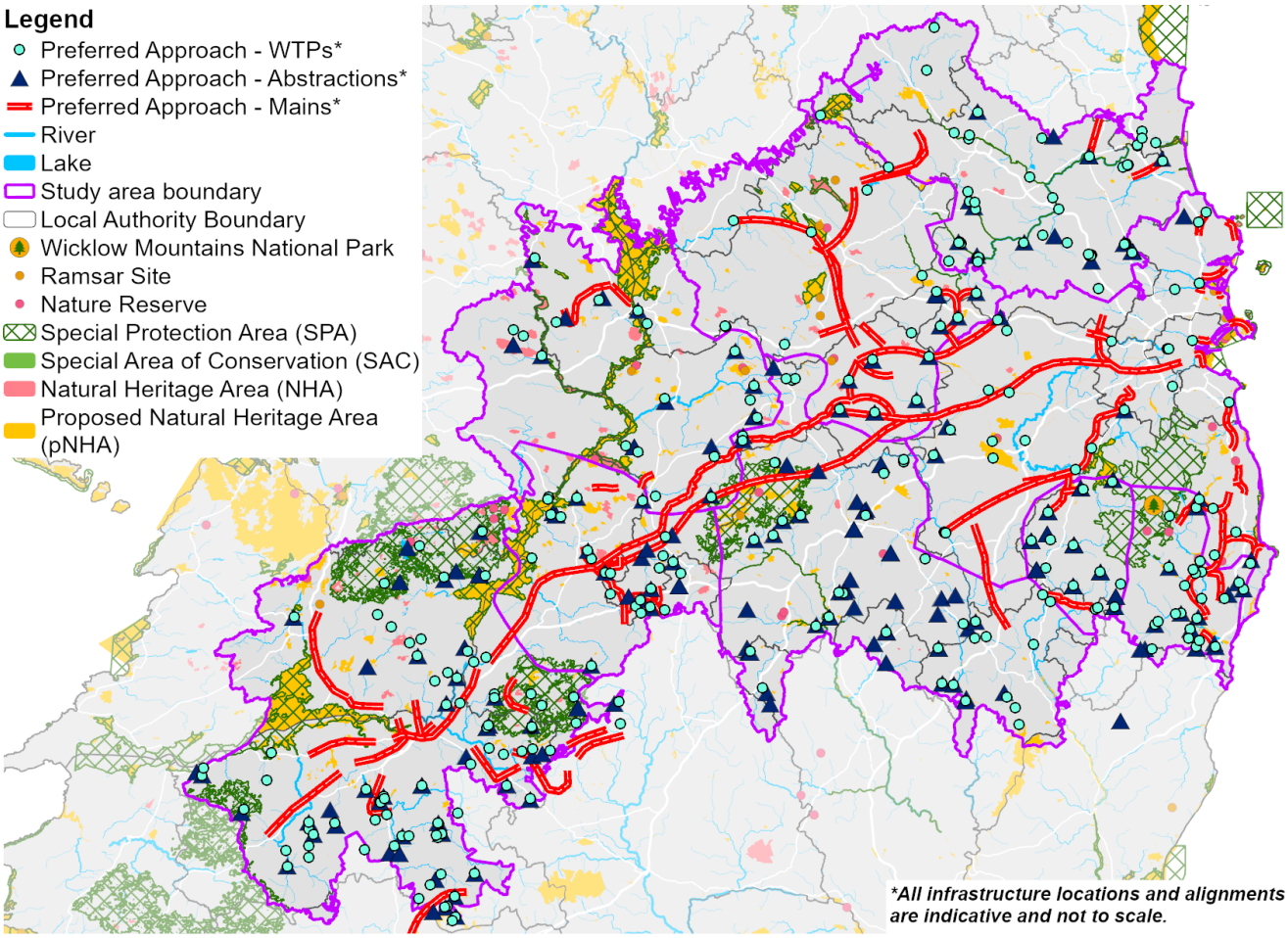


Figure 9.1 Environmental Designations for the Eastern and Midlands Region

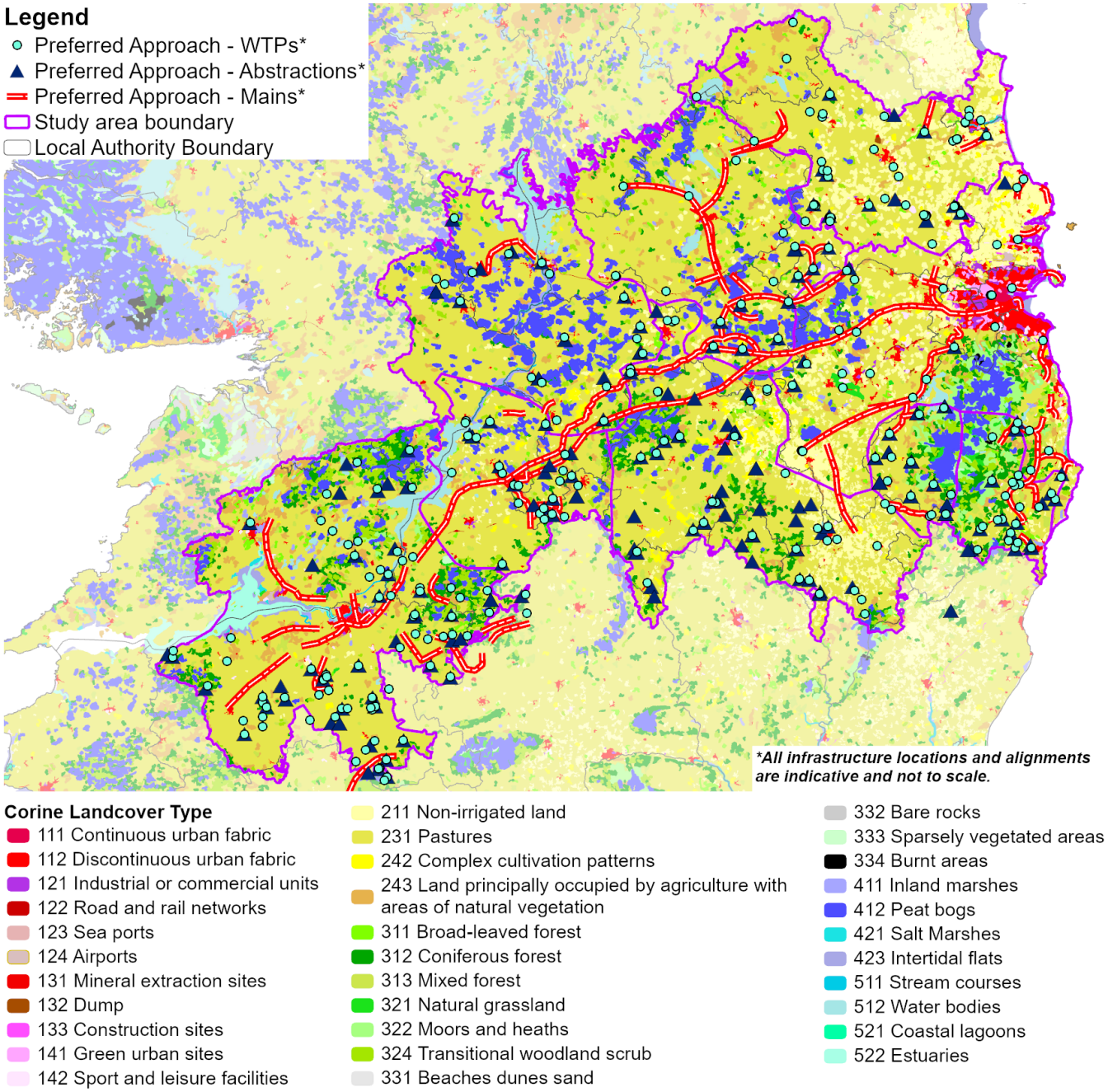


Figure 9.2 Corine Land Cover Analysis for the Eastern and Midlands Region

The Corine land analysis, as shown on Figure 9.2, shows that the largest land uses across the Eastern and Midlands Region potentially affected by options within the Study Area Preferred Approaches are agriculture, natural habitats and forest. All of these land uses could be temporarily disturbed, for example, through vegetation clearance in the 15m buffer zone around pipelines and site areas. Some land uses will also be permanently lost within construction footprints

The EPA OSI national land cover map, currently under development, once available will be considered for further land use information and analysed for potential effects by Preferred Approaches.

The Preferred Approaches most likely to lead to within-plan cumulative effects are the construction of pipelines and associated works, such as new WTPs and pumping stations. The pipelines for smaller water transfers are likely to be road-based. The pipelines will vary in size but there is a large pipeline transfer proposed across the Eastern and Midlands Region, as shown on Figure 9.1 and Figure 9.2.

The 'within-plan' cumulative effects across the nine (9) Study Areas are summarised in Table 9.1 below.

Table 9.1 'Within-Plan' Cumulative Effects Across the Study Areas

Study Area	Population, Economy, Tourism and Recreation, and Human Health	Water Environment	Biodiversity, Flora and Fauna	Material Assets	Landscape and visual amenity	Climate change	Cultural heritage	Geology and soils
SA1								
SA2								
SA3								
SA4								
SA5								
SA6								
SA7								
SA8								
SA9								

Key	
Construction Phase	
Operation Phase	
Construction and Operation	

The most significant cumulative effects identified in Table 9.1, in relation to each SEA topic, are described in sections 9.1.2 to 9.1.7.

9.1.2 Cumulative Effects on Population, Economy, Tourism and Recreation, and Human Health

Potential cumulative effects include possible combined effects for disruption to traffic if the construction of the options associated with the Preferred Approaches were to occur at the same time and affect the same location, with potential secondary impacts on local businesses and tourism in some locations. There could also be cumulative effects on air quality and noise disturbance should this occur. However, all of these effects are unlikely to be significant at the Eastern and Midlands Region level as the implementation of the Preferred Approaches will be temporally and spatially distant from each other.

Rationalisation and improvements to WTPs across the Eastern and Midlands Region (to meet WFD objectives) are likely to have a positive cumulative effect on access to water quality, with associated improvements to levels of service and drinking water quality and benefits to wellbeing and human health.

9.1.3 Cumulative Effects on Water Environment

Cumulative construction works activities could affect water quality through increasing surface water runoff or increasing the risk of pollution (accidental spillage) during works but application of standard

mitigations measures should minimise risk. The rationalisation of abstraction and WTPs is in some cases likely to result in a positive cumulative effect on water quantity and reduce pressure on some sources identified through Irish Water's assessment on sustainable abstraction as being potentially at risk.

The cumulative effects on groundwater and water body quantity status from abstraction are expected to meet WFD objectives for water quality and water resource quantity. However, the interaction between groundwater and surface water cannot be taken into account at this level as more detailed studies would be required where risks are identified.

9.1.4 Cumulative Effects on Biodiversity, Flora and Fauna

The construction of new infrastructure could have impacts on water quality and hence aquatic biodiversity and SACs. Operational impacts from groundwater abstraction may occur to groundwater dependent habitats, such as peat bogs. Operational impacts of surface water abstraction may occur on aquatic habitats such as SAC designated rivers. Across the Eastern and Midlands Region, there are approximately 126,778 hectares of peat bog (6% of all land use), 34,074 ha of waterbodies and 1,607 ha of water courses.

The water used for all transfers will be treated as this is part of the design. Raw water transfers were ruled out before or during Coarse Screening, therefore, no cumulative effects are identified for INNS transfer during scheme operation and mitigation measures for managing INNS risk during construction will avoid cumulative effects for spreading INNS.

Improvements through rationalisation of the network including decommissioning of local abstractions across the Eastern and Midlands (to meet WFD objectives) are likely to have a positive cumulative effect on water quantity, with associated benefits to water quality and water-dependent biodiversity. This includes benefits for surface and groundwater abstractions and associated protected sites that identified as under pressure or at risk based on initial sustainability reviews.

9.1.5 Cumulative Effects on Climate Change

There are potential cumulative effects on greenhouse gas emissions across the Eastern and Midlands Region's Preferred Approaches for the construction and operational periods (whole life carbon).

This includes the embodied carbon associated with construction materials, greenhouse gas emissions associated with construction and maintenance vehicle traffic and the energy and emissions required for water pumping. The carbon emissions are based on estimates from individual schemes, however, the overall carbon footprint for the Study Areas and the Eastern and Midlands Region will also be influenced by the replacement of less efficient infrastructure and WTPs and potential improvements to operational efficiency and the extent demand management measures are applied across the region. There is considerable scope to reduce carbon emissions especially associated with energy use from sustainable sources and also potential for contribution to carbon off setting initiatives with biodiversity and soil nutrient, flood risk reduction and raw water quality benefits.

9.1.6 Cumulative Effects on Landscape

There may be potential cumulative effects on landscape and visual amenity during the construction phase if groups of Preferred Approach options are constructed concurrently. However, these are unlikely to be significant cumulative effects as they are likely to be spatially and temporally separate. Many of the preferred options involve upgrades to existing WTPs and would therefore likely not represent a significant new impact on landscape or visual amenity. The proposed large water transfer from the GDA

(shown on Figure 10.2) could represent a significant cumulative effect on landscape and visual amenity during the pipeline construction phase. Site surveys would be required to inform specific mitigation measures for this option, including appropriate route alignment.

9.1.7 Cumulative Effects on Cultural Heritage

There may be potential cumulative effects on the visual setting of cultural heritage assets (such as heritage buildings) during the construction phase if clusters of Preferred Approach options are constructed concurrently. However, these are unlikely to be significant cumulative effects as they are likely to be spatially and temporally separate. Many of the preferred options are also upgrades to existing WTPs and would therefore not represent a new impact on the setting of heritage assets.

The proposed large water transfer from the GDA (shown on Figure 9.1) could represent a significant cumulative effect on cultural heritage during the pipeline construction phase. The most significant risk from this and all other construction works is potential construction footprint or other construction works impacts (loss, damage or disturbance) on archaeological assets, some of which are likely to be unknown or unrecorded. Appropriate consultation with heritage bodies, including the Department of Culture, Heritage and the Gaeltacht, will be required in order to avoid and mitigate any such impacts.

9.2 Cumulative Effects with Other Plans and Programmes

There are a range of plans and programmes that apply to the Eastern and Midlands spatial area. The ones that set a framework for future development projects could potentially have cumulative effects with this Plan. However, this is only likely to occur if they are developed at the same time (e.g. construction impacts) or affect the same local area and have similar effects on environmental receptors. For example, the development of a new reservoir or WTP could theoretically be in a similar location to a new housing development and both could lead to habitat fragmentation through their respective construction footprints. However, the precise locations of the Eastern and Midlands Region's options have not been determined yet and it is therefore not yet possible to determine cumulative construction-related effects with other plans and programmes.

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. Mitigation to address cumulative effects on carbon emissions will include application of energy efficient design, use of renewable sources of energy and investigation of low carbon initiatives.

The strategic plans and programmes assessed for significant cumulative effects (positive and negative) are shown in Table 9.2.

Table 9.2 Cumulative Effects with Other Plans and Programmes

Plan/Project	Population, economy,	Water environment	Water environment	Biodiversity	Material assets and waste	Landscape and visual amenity	Climate change (mitigation)	Climate change (adaptation)	Cultural heritage	Geology and soils
Ireland 2040: Our Plan, National Planning Framework (Government of Ireland, 2018)	**+**	**+/-**	**+/-**	**+/-**	**+/-**	**+/-**	**+/-**	**+/-**	**+/-**	**+/-**

Plan/Project	Population, economy,	Water environment	Water environment	Biodiversity	Material assets and waste	Landscape and visual amenity	Climate change (mitigation)	Climate change (adaptation)	Cultural heritage	Geology and soils
Regional Spatial and Economic Strategies	+	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
River Basin Management Plan (RBMP) (2018 -2021) and draft RBMP 2022-2027		+		+			+/-	+/-		
Climate Action Plan 2021		+		+			+	+/-		
Forestry Programme 2014 – 2020: IRELAND (as extended for 2021		+		+			+	+/-		
National Marine Planning Framework (NMPF) Consultation	No direct interaction with the Regional Preferred Approach - potential for RWRP to support in the future with catchment management measures to improve water quality									
County and City Development Plans	+	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
Local Area Plans	+	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
Food Wise 2025	+	+/-		+/-			+/-			+/-
Draft Agri-Food Strategy 2030	+	+/-		+/-			+/-			+/-
EU Biodiversity Strategy for 2030	+	+		+						
National Biodiversity Action Plan	+	+		+		+	+	+		+
All Ireland Pollinator Plan 2021 – 2025	+	+		+		+	+			+
National Waste Action Plan for a Circular Economy 2020 – 2025					+	+				
Catchment Flood Risk Management (CFRAM) Programme (2011 onwards)	+		+							
Flood Risk Management Plans (2016)	+		+							
Offshore Renewable Energy Development Plan							+			
National Adaptation Framework (NAF)							+	+		
Tourism Development and Innovation 2016 – 2022	+	+/-		+/-		+			+	
Water Services Strategic Plan (WSSP)	+	+/-								

Plan/Project	Population, economy,	Water environment	Water environment	Biodiversity	Material assets and waste	Landscape and visual amenity	Climate change (mitigation)	Climate change (adaptation)	Cultural heritage	Geology and soils
National Wastewater Sludge Management Plan (NWSMP) 2016-2021		+			+					+/-
Lead in Drinking Water Mitigation Plan (LDWMP)	+									
Northern Ireland Water (NI Water) Water Resource and Supply Resilience Plan and all other NI plans and strategies included in the PPP review list	No interaction with the Regional Preferred Approach for the RWRP was identified with the NI WRSRP									

There are no additional mitigation measures identified from the assessment of interactions with other plans. The requirement to review and take account of relevant plans and policies in the implementation and future iterations of the RWRP-EM, is built into the monitoring and feedback step and embedded in the Environmental Action Plan provided in section 10.

9.3 SEA Summary for the Regional Preferred Approach

An overall assessment summary of the Preferred approach compared to the do minimum against SEA objectives is provided in Table 9.3 below.

Table 9.3 Regional Preferred Approach and Do Minimum Comparison

Population, economy, tourism and recreation and human health	Water environment (quality and resources)	Water environment (flood risk)	Biodiversity	Material assets	Landscape and visual amenity	Climate change (mitigation)	Climate change (adaptation)	Cultural heritage	Geology and soils
-	-	0	-	-	0/-	0/-	-	0/-	0

Do Minimum Approach

- The 'Do Minimum' approach is the 'without plan' approach, meaning that this is the approach that would occur without the RWRP-EM. As a result, the 'Do Minimum' approach would only include reactive, unplanned interim measures to address likely failures in infrastructure.
- 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.
- While there would not be major construction works there would likely to be increased pressure on existing abstractions including abstractions likely to be currently above sustainable levels and increasing issues with unreliable or inefficient network infrastructure.

Population, economy, tourism and recreation and human health	Water environment (quality and resources)	Water environment (flood risk)	Biodiversity	Material assets	Landscape and visual amenity	Climate change (mitigation)	Climate change (adaptation)	Cultural heritage	Geology and soils
+	+/-	0/+	+/-	0/-	+/-	-	+	0/-	0/-

Regional Preferred Approach

- Focus on three pillars of using less, losing less, and supplying smarter and a planned rather than a reactive approach and a resilient system with more reliable sources.
- Implementation of the Regional Preferred Approach including the Study Area Preferred Approaches 1-9 (including the amendment to the SA9 Preferred approach NSS option to support the transfers) with the mitigation identified in the SEA Environmental Report Appendix D Environmental Action Plan and the Monitoring Plan and the Study Area Environmental Reviews SAs 1-9.
- Construction impacts from large scale pipeline and associated infrastructure, but reinstatement of land uses and mitigation and enhancement to minimise long term landscape, land use and biodiversity effects.
- Network improvements adding flexibility and resilience.
- Decommissioning of inefficient infrastructure and abstractions including from sources at risk.
- Improving Irish Water's understanding of future risks, including climate change and efficient water use.
- Increasing routine monitoring and operational planning allowing Irish Water to proactively manage and forecast resourcing and operational trends.

Justification

The RWRP-EM Regional Preferred Approach includes a commitment to work to a 1:50 year level of service across all locations and actions in place to achieve this target. The RWRP-EM Regional Preferred Approach will provide the basis for developing an investment programme providing greater security of supply and a more resilient supply since options will address the SDB over extreme weather planning scenarios.

The Preferred Approach identifies strategic inter-study area, regional and local WRZ schemes which can have both positive and negative potential effects on the water environment, biodiversity, and landscape and visual amenity. Therefore, mitigation measures and a monitoring framework will be developed alongside recommended developments.

In the long-term, the plan will bring benefits in terms of greater security of water supply to the population, tourism industry and recreational amenities, human health and the local economy. Additionally, the newer, or upgraded, more reliable assets within the system will result in it being more adaptable to the impacts of climate change; with benefits from replacement of abstractions identified as potentially unsustainable for meeting WFD or protected area obligations and greater flexibility to respond to future sustainability reductions.

The SEA and AA embeds environmental considerations into the plan making process and sets a framework for identifying mitigation and monitoring so that these can be part of decision-making and can inform option design and costing as schemes developed and studied further prior to consenting and licencing. Further consideration of alternative options and variants to options is expected to be part of the process of taking options forward.

Key			
Likely to have a positive effect	+	Likely to have a mixed positive and negative effect	+/-
Likely to have a negative effect	-	Likely to have mixed neutral and negative effect	0/-
Effects are uncertain or not applicable	? or N/A	Likely to have mixed neutral and positive effect	0/+
Likely to have a neutral effect	0		

9.4 AA Summary for the Eastern and Midlands Region

As set out in Section 6 of the SEA Environmental Report for the RWRP EM, each option is subject to an objective assessment with uniform scoring criteria, based on best publicly available datasets. Options are scored using a seven-point Likert scale, from major adverse scoring -3 through to major beneficial 3, 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 require additional mitigation.

There were no Likely Significant Effects (LSE) identified with the higher risk -3 scores for Preferred Approach options for SA1 to SA7 however there were -2 and -1 scores and as such there is potential for LSE on European Sites. The SA Preferred Approaches for SA8 and SA9 include one -3 biodiversity score each. SA9 -3 score relates to the abstraction from Parteen Basin which forms part of the Lower River Shannon SAC and SA8 -3 score relates to the increase SW abstraction at Clareville from the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. However, all LSE identified at plan level can be addressed by mitigation measures as set out in full the NIS. No Adverse Effect on Site Integrity (AESI) are identified at Plan level. Whilst the Preferred Approaches for SA8 and SA9 are assessed to have potential LSEs (-3 scores), other approaches were assessed as less favourable overall as they have higher environmental impacts and are less resilient.

9.4.1 AA In-Combination Summary

In summary, potential in-combination effects were identified at the Eastern and Midlands Region's level for the following European sites:

<u>In-combination effects between Preferred Approaches only within a Study Area</u>

- Wicklow Mountains SAC
- Poulaphouca Reservoir SPA
- River Little Brosna Callows SPA
- Dovegrove Callows SPA
- Lower River Shannon SAC
- Slieve Aughty Mountains SPA
- Slievefelim to Silvermines Mountains SPA
- River Boyne and River Blackwater SPA
- River Barrow and River Nore SAC
- River Shannon and River Fergus Estuaries SPA
- Slieve Bloom Mountains SPA
- Lisbigney Bog SAC
- Slaney River Valley SAC

<u>In-combination effects between Preferred Approaches and other projects within a Study Area</u>

- Lough Ennell SAC
- Lough Ennell SPA
- The Murrough Wetlands SAC
- The Murrough SPA
- Lough Owel SAC
- Lough Owel SPA

- Lough Derravarragh SPA
- Slaney River Valley SAC
- River Barrow and River Nore SAC
- River Suck Callows SPA
- River Boyne and River Blackwater SAC
- River Barrow and River Nore SPA
- Lough Ree SAC
- Lough Ree SPA
- Slieve Bloom Mountains SPA
- River Shannon Callows SAC
- Middle Shannon Callows SPA
- All Saints Bog SPA
- Lough Derg, North-east Shore SAC
- Lough Derg (Shannon) SPA
- Sharavogue Bog SAC
- Lower River Shannon SAC
- River Shannon and River Fergus Estuaries SPA
- Blackwater River (Cork/Waterford) SAC
- Charleville Wood SAC
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA
- Baldoyle Bay SAC
- Malahide Estuary SAC
- Malahide Estuary SPA
- North Bull Island SPA
- South Dublin Bay and River Tolka Estuary SPA
- Baldoyle Bay SPA
- Rogertown Estuary SPA

However, potential in-combination effects (construction and/or operational) would only occur where options within each Study Area are progressed concurrently with one another or with projects, and in the absence of mitigation. With the implementation of mitigation as outlined in the NIS Chapter 6.3 and Appendix E there will be no adverse effects on the integrity of the European sites, either alone or in-combination with other plans or projects as a result of progressing the Preferred Approach options associated with the RWRP-EM.

The conclusion of the NIS for the RWRP-EM is that, based on a plan-level assessment, and with implementation of appropriate mitigation for protecting European sites, there will be no adverse effects on the integrity of any European site(s), either alone or in-combination with other plans or projects as a result of progressing Preferred Approach options within the RWRP-EM.

9.5 WFD Summary for the Eastern and Midlands Region

Application of estimated allowable abstraction constraints on new options means that only options that are expected to meet sustainability requirements are considered. Individual options within the Regional Preferred Approach have been assessed and are expected to be sustainable, based on Plan Level desk-based assessment, in terms of avoiding deterioration of WFD status or avoiding conflict with meeting WFD objectives.

All surface water abstractions proposed within Preferred Approaches are within the expected sustainable abstraction limits of 10% or 5% of Q95 for good and high WFD river waterbody status sources and 10% or 5% of Q50 for good and high WFD lake waterbody sources respectively. Abstraction impacts on groundwater bodies have been assessed through a separate technical study which considered cumulative effects on WFD ground water quantitative status. Based on the available information this concluded that there is no indication of cumulative impact or impact on WFD quantitative status of the groundwater bodies (Irish Water, 2022b).

However, cumulative effects also need to be considered, in terms of both sustainability for connected surface waterbodies and groundwater dependent habitats and protected areas. Further studies are identified in the Study Area Environmental Reviews for specific options where risks are identified.

9.6 Transboundary effects for the Regional Preferred Approach

The types of options and their location, proximity and pathways for environmental effects have been considered through the process in relation to possible environmental effects for the Northern Ireland environment including any shared groundwater and river catchments and the marine environment. For the combination of options included in the Regional Preferred Approach, no potential transboundary adverse environmental effects have been identified at the Study Area level or the Regional level for the RWRP-EM.

10 Mitigation and Monitoring Plans

10 Mitigation and Monitoring Plans

The Mitigation and Monitoring Plans for the RWRP-EM are based on the plan outlined in Section 8.3.8 of the Framework Plan and include three elements:

- Mitigation Measures including recommendations to incorporate into project development as options are taken forward through feasibility assessments, design, consenting and implementation;
- Environmental Action Plan identifying actions to be taken to integrate environmental requirements into process and related areas so that mitigation recommendations implemented.
- Monitoring Plan identifying the targets and indicators to be measured or recorded to determine progress to meeting SEA objectives.

Commitment to implementing the Environmental Action Plan and the Monitoring Plan is provided in Section 9 of the RWRP-EM which also sets out the wider context and process for monitoring and feedback to inform the implementation of the plan and future cycles of review and updating.

10.1 Mitigation Measures

SEA options assessment assumes the implementation of standard mitigation measures, such as operation of water sources in line with regulatory requirements and the use of good construction practice. Examples of standard measures expected to be embedded in the design and development of infrastructure options are listed in Appendix D which identifies the mitigation measures that specifically respond to the significant environmental effects identified for each SEA topic in the RWRP-EM SEA SAs 1-9 Environmental Reviews. Standard and specific mitigation measures include recommendations for further environmental assessment work to be undertaken at project stage to further inform mitigation development, as well as mitigation to be implemented directly at project stage.

10.2 Environmental Action Plan

The Environmental Action Plan (EAP) set out in Table 10.1 summarises the actions and areas of further study identified in this Environmental Report. The EAP provides a basis for tracking recommendations from the SEA during the NRWP implementation.

The EAP provided in Table 10.1 focuses on two sections, the first being the options and approach appraisal process and the second integrating environmental considerations with others supporting areas.

Table 10.1 Environmental Action Plan

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
Identifying the Need – Quantity, Quality and Reliability					
Quantity – Supply Demand Balance					
Abstractions and Supply Side Yield Assessments					
EAP1	Options and Approach Development Process and Supporting Measures	**EAP1.1** Link investigation on supply risks to environmental resilience and avoiding damage to vulnerable habitats and protected areas; especially European designated sites, and threats to WFD water body objectives.	Environmental issues to be included in risk assessments for supply shortages or drinking water quality issues.	Study area scoping, risk assessments and prioritisation as part of the Regional Plan development and SEA 2021/2022	Y - completed for the RWRP-EM
Demand Side Data Improvements: Planning for Future Developments					
EAP2	Options and Approach Development Process and Supporting Measures	**EAP2.1** Reviews of WRZ configuration can consider potential environmental benefits from rationalisation opportunities to improve operational efficiency for waste and energy use and also reduce need for developing new sources.	Optimised WRZs/study areas	Study area scoping, risk assessments and prioritisation as part of the Regional Plan development and SEA 2021/2022	Y - completed for the draft RWRP-EM

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
		EAP2.2 Feed information on potential for water efficiency improvements to provide savings into future options identification			
Linking SEA and Future Development of Schemes					
EAP3	Options and Approach Development Process and Supporting Measures	**EAP3.1** Understanding causes of water quality issues for drinking water can support catchment management actions. Link clean water element (RC3) on water quality compliance and ongoing programmes on improving drinking water quality to potential for long term solutions through to long term catchment management and nature based solutions opportunities to reduce pollution in groundwater and surface waters and water treatment issues. Including stakeholder engagement with the environment authorities and LAWPRO, Teagasc and the Agricultural Sustainability and Advisory Programme (ASSAP) in relation to source protection measures.	Source risk assessments and drinking water safety plans linked to the NWRP process.	Regional Plan SEA Environmental Reports 2021/2022 and Source risk assessments and drinking water safety plans ongoing – consider progress in Annual reviews	Y - Plan level assessment completed for the RWRP-EM R - project level assessments for water sources

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
		EAP3.2 Link Drinking Water Safety Plans to scoping of study areas, prioritisation and options development process including consideration of catchment management opportunities.		Study area scoping, risk assessments and prioritisation	R
		EAP3.3 Link ongoing projects with the supply demand assessments, scoping area studies and prioritisation for new investment. Consider as part of investment proposals for water treatment works – wider rationalisation opportunities with opportunities to reduce abstraction pressure on stressed sources and potential for improvements to residuals management (see also EAP 11.1)	Existing programmes and projects coordinated with the NWRP	Study area scoping, risk assessments, prioritisation and application of options development methodology	Y - completed for the RWRP-EM
		EAP3.4 Value environmental and social benefits as well as costs in options development process (using environmental economics tools) to value long term solutions such as catchment management.	CBA and MCA supported by environmental valuation as well as qualitative assessment	Take froward into project development Include in next cycle of Regional Plans 2022 onwards	R
Delivering Solutions – Approach					
Climate Change					

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
EAP4	Options and Approach Development Process and Supporting Measures	**EAP4.1** Take account of effects of climate change effects on protected areas and WFD objectives as well as water supply.	Environmental resilience as part of the climate change risk assessment informing long-term solutions.	Regional Plan SEA Environmental Reports 2021/2022 and implementation of projects. Catchment management to be considered in source risk assessment where appropriate - ongoing. Progress to be considered in Annual review .	R
		EAP4.2 Results completed, and ongoing climate change studies should be used to inform future scoping of study areas/WRZs, and the types of solutions considered and prioritisation for investment.			R
		EAP4.3 Long term actions to improve water retention in upper catchments as well as catchment wide water quality initiatives could be considered as responses. Catchment management and nature based solution benefits linking improvements to water quality reducing treatment and opportunities for improving carbon sequestration in soils and through woodland planting (also linking to biodiversity objectives)			R
		EAP4.4 Investigate opportunities to reduce carbon emissions in construction and operational phases reflecting importance of energy efficient and low carbon emission considerations in design	Identify how construction and operational carbon can be reduced across project	P Progress to be considered in Annual review	R

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
		and construction methods and considering opportunities for use of renewable energy sources,	development, construction and operation		
Lose less: Leakage Reduction					
EAP5	Options and Approach Development Process	**EAP 5.1** Take forward studies and actions supporting meeting leakage targets and include consideration of relieving pressure on existing deficit areas and abstractions with sustainability issues and drought risks.	Develop information to support and improving leakage reduction	Progress to be considered in Annual review	R
Use Less: Water Conservation					
EAP6	Options and Approach Development Process and Supporting Measures	**EAP6.1** Link to raising awareness on environmental benefits of water conservation.	Improved awareness of benefits of conserving water (day to day and during extreme events)	Awareness campaigns Progress to be considered in Annual review	R
		EAP6.2 Consider customer research on the water supply and demand management including water efficiency options development along with local community and stakeholder views.		Customer consultation Progress to be considered in Annual review	R
		EAP6.3 As data is developed to support understanding on water conservation, develop water conservation/water efficiency options to be	Monitoring and feedback stage 8 of the options assessment methodology	Progress to be considered in Annual review	R

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
		considered as part of the Options Assessment Methodology for future plan cycles.			
Supply Smarter: Capital Investment and Improved Operations					
See **EAP3, 4 and 5** in relation to linking ongoing programmes and future water resource planning and **EAP10, 11 and 12** on implementing options and approach assessment methodology.					
Drought Planning					
Information for Assessing Drought Risks					
EAP7	Options and Approach Development Process	**EAP7.1** Identify the risks from potential drought actions for water sources designated for nature conservation value and supporting protected species - include lessons learned from the 2018 drought.	Drought -sources at risk identified	Drought management phased for each Regional Plan area 2022 onwards	R
lEnvironmental Mitigation of Drought Measures					
EAP8	Options and Approach Development Process	**EAP8.1** Assess potential impacts of drought restrictions on customers, especially vulnerable groups, to identify both communication requirements and exemptions on restrictions relevant for each management area.	Drought management avoiding causing temporary or long-term impacts on protected habitats and species as well as minimising restrictions to customers	Drought management - environmental reviews and communications strategy Drought management: • social/environmental reviews	R
		EAP8.2 Develop drought communication plans and identify approaches to avoid impacts on vulnerable water users, for example, through			R

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
		exemptions – plan to provide customers with information early so that voluntary measures can be effective in avoiding the need for additional measures in most cases, and taking forward the approaches from the 2018 summer drought and 2020 spring drought.		• communication strategy • Environmental assessment of sources at risk phased for each Region Plan area 2022 onwards	
		EAP8.3 Prepare environmental assessments (including AA) for sensitive water sources at risk from drought management actions. These should be available in advance of measures being needed. They should include consultation on the assessments with environmental authorities and identify specific monitoring or mitigation measures.			R
Residuals Approach					
EAP9	Options and Approach Development Process and Supporting Measures	**EAP9.1** Include consideration of residuals management in the options development process involving WTPs or rationalisation opportunities	Residuals approach linked to options development process	Regional Plan SEA Environmental Reports 2021/2022 and implementation of projects	Y
		EAP9.2 Apply the waste management hierarchy with any solid waste disposal limited to appropriate licensed sites.			R
Delivering Solutions: Options and Approach Assessment Methodology					

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
Integration of Environmental and Sustainability Considerations					
EAP10	Options and Approach Development Process	**EAP10.1** Study area scoping to include analysis of environmental baseline issues, risks, constraints and opportunities to inform identification of initial options as providing context for the option development process.	Context for identifying and assessment options is provided	Regional Plan SEA Environmental Reports 2021/2022 Risk assessments and prioritization	Y
		EAP10.2 Further development of the environmental and social impact valuation methodology as a tool for the approach appraisal process, based on ecosystems services assessment/natural capital assessment principles, can support cost benefit analysis and MCA methodologies and provide quantitative information supporting SEA in the future.	CBA and MCA supported by environmental valuation based on natural capital/ecosystems services approaches as well as qualitative assessment	Take forward into project development Include in next cycle of Regional Plans 2022 onwards	R R
		EAP10.3 Comparison of combinations of options (or approach) should include assessment of cumulative effects for each Study Area (groups of WRZs) and be considered in determining the best value approach. Justification for the approach selected will need to be provided.	Best environmental solutions considered in selection of preferred solutions with mitigation built into design and costing. Opportunities for enhancement to contribute to objectives to be considered	Regional Plan SEA Environmental Reports 2021/2022	Y
Transboundary Issues					

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
EAP11	Options and Approach Development Process	**EAP11.1** Ensure potential for transboundary impacts are considered during options assessment and early consultation is undertaken to inform the assessment process.	Avoid transboundary effects	Regional Plans SEA Environmental Reports 2021/2022 Consider in Annual review	Y R
Delivering Sustainable Solutions					
EAP12	Options and Approach Development Process	**EAP12.1** Link the options development information and SEA mitigation recommendations into the initial studies and designs for selected project level schemes so that assumptions and mitigation recommendations are taken forward. Develop a monitoring information template to capture key environmental information at key project development stages recording: • Project design/implementation stage and environmental assessment process applied and link to SEA and NIS recommendations • Data review and update at each key stage including reviewing current and draft policies and plans • Report on Monitoring Plan indicators • Identify potential for cumulative effects	Template developed and applied Preferred approach options taken to project stage subject to initial environmental review linking to information from the options development and assessment process and to good practice procedures and Monitoring Plan criteria.	Monitoring Plan/ scheme development - progress to be considered in Annual review	P

Ref no.	Focus	Recommended Action for Mitigation / Further Study	Target	Monitoring (Timescale)	Eastern and Midlands Region Progress summary: Completed: Y In progress: P Recommended: R
		EAP12.2 Development of procedures to integrate good practice approaches for avoiding/mitigating environmental impacts and identifying enhancement opportunities in future scheme design and development.			P
		EAP12.3 Ensure environmental mitigation and study requirements are covered in option costing and risk aspects are taken into account in scheme development.			P
		EAP12.4 Review monitoring framework and update to ensure environmental mitigation and study requirements are covered in option costing and risk aspects are taken into account in scheme development.			R

10.3 Monitoring Plan

The monitoring plan is a requirement under the SEA regulations to provide a basis of identifying significant environmental effects during the implementation of the Plan. This is required to review the predicted impacts of the Regional Plan, and the adequacy of the mitigation measures recommended so that additional mitigation can be applied if required. Performance against the monitoring plan targets will also inform the next cycle Plan and SEA process.

The Public Water Supply in Ireland is a live asset base and is subject to continuous change. Similarly, the development of Preferred Approaches, as part of the Regional Plans, is influenced by evolving scientific data, understanding, and policy change in relation to the natural environment.

Irish Water must be able to continuously adapt to these changes, which may be minor or material in nature. The Framework Plan setting out the overarching approach committed to undertaking continuous monitoring and ensuring that there is a feedback mechanism within the Framework Plan and Regional Plans. Given the scale of the assessments required and work to be undertaken, the first iteration of the NWRP consists of a Framework Plan and four Regional Plans. Once completed, the NWRP will be treated as a unified plan, and the regional boundaries established for the purposes of the development of the regional plans will have no on-going application. All preferred approaches identified in the NWRP will be prioritised on a national basis through Irish Water's regulated investment cycles. The intention is to review the NWRP every five years, and this continuous monitoring process will ensure that material amendments are assessed for significant impacts on the environment.

The Monitoring Plan for the RWRP-EM SEA takes forward and builds on the monitoring adopted for the Framework Plan.

The monitoring plan covers the integration of environmental and sustainability considerations throughout implementation of the Regional Plan and the options development methodology. It also provides a framework for future long-term monitoring. In most cases, more detailed baseline collection and project studies will be required to confirm the significance of environmental effects and ensure appropriate mitigation is included as part of the individual scheme designs.

In certain circumstances, monitoring and feedback will identify the need for a variation of the Regional Plan. Where a variation is required, Irish Water will screen the change against SEA and AA requirements in accordance with its legal obligations.

As part of the screening, Irish Water will consult with the EPA and relevant Government Departments as required by Article 9(5) of the EC (Assessment of Certain Plans and Programmes) Regulations 2004 (SI 435/2004). If, following screening, Irish Water determines that the change is likely to have significant effects on the environment, it will carry out a SEA before adopting the change. Irish Water will also carry out an AA if it determines, following screening, that the change is not directly connected with or necessary to the management of any European site and Irish Water cannot, on the basis of objective scientific information, exclude that the change, individually or in combination with other plans and projects, will have a significant effect on European sites, as required by Article 42(6) of the EC (Birds and Natural Habitats Regulations) 2011 (SI 477/2011).

In recognition of the importance of multi-stakeholder engagement and collaboration in managing shared natural resources, Irish Water are members of an expert group chaired by the Department of Housing Local Government and Heritage (DHLGH) to make recommendations to the Minister regarding a new approach to drinking water source protection as part of the transposition of the recast Drinking Water Directive. Other members of the group include the County and City Management Association (CCMA),

the Local Authority Waters Programme (LAWPRO), the National Federation of Group Water Schemes (NFGWS), the Environmental Protection Agency (EPA), Geological Survey of Ireland (GSI), the Health Service Executive, the Department of Agriculture, Food and the Marine (DAFM), the Irish National Accreditation Board (INAB), the National Standards Authority of Ireland (NSAI) and the Commission for Regulation of Utilities (CRU). Implementation of source protection measures will require further collaboration with several stakeholders including, riparian owners, industry groups, the agricultural and environmental sector forestry and Teagasc. These measures will complement existing ongoing works for example the works carried out by Teagasc under the Agricultural Sustainability and Advisory Programme (ASSAP) which looks to improve water quality through working with farmers.

The Monitoring Plan is provided in two parts Table 10.2 (plan level monitoring) and Table 10.3 (framework for project monitoring) and will be updated following consultation on this Environmental Report. The Monitoring Plan has been designed to provide a basis for the identification and continuous review of the positive, negative and cumulative impacts of the RWMP-EM, and it forms part of the SEA statement published with the final Regional Plan for the Eastern and Midlands.

Table 10.2 Monitoring Plan: Indicators and Targets – Eastern Midlands Regional Plan Level Monitoring

SEA topics	SEA indicators	SEA Targets	Source data	Responsibility
Reporting timescale: included in Regional Plan and SEA (developed during 2021-22)				
All topics and objectives	**RMP AT1** Application of the options and approach assessment process, as set out in the Framework Plan, to integrate environmental, social and sustainability SEA objectives alongside other criteria in the preparation in the Regional plans **RMP AT2** Application of methodology for SEA and AA in the comparison and selection of Preferred Approaches for the preparation in the Regional Plans **RMP AT3** Environmental and social valuation methodology developed further as a tool using natural capital /ecosystems services assessment **RMP AT4** Transparent documentation of the appraisal and selection process	• T1 Options and plan approach to find sustainable solutions that contribute to environmental objectives	Irish Water	Irish Water
All topics and objectives	**RMP AT5** Iterative approach to the identification of appropriate options meeting objectives, and mitigation measures incorporated into project costs or risks, as part of the development of options for the Regional Plans and as a basis for future project costing. **RMP AT6** Identification of process for undertaking the relevant options studies and feeding back where potential significant environmental effects are identified including engagement with relevant stakeholders.	• T2 Process implemented for iterative options assessment through identification, option design development stages and identification of mitigation measures and input to project costing • T3 Option development for Preferred Approach options built on the SEA and AA work and incorporating feedback to the	Irish Water	Irish Water

SEA topics	SEA indicators	SEA Targets	Source data	Responsibility
		next Framework Plan and adequate comparison with alternatives at key points		
Reporting timescale: to be phased for Regional Plan implementation 2022 onwards				
All topics and objectives	**RMP AT7** Environmental assessment, including AA, for designated international and national sites potentially affected by drought measures **RMP AT8** Communication plan for drought/freeze-thaw period actions	• T4 Source-specific environmental assessment and mitigation and monitoring measures agreed, avoiding long-term damage on designated sites and associated species from drought measures	Irish Water	Irish Water
Reporting timescale: annual reporting from each Regional Plan from 2022 onwards				
All topics and objectives	**RMP AT9** 1. Monitoring plan data collection implemented (see below for each topic) set up to support baseline information for the next Regional Plan, project level feedback, identification of cumulative effects, and providing the basis for monitoring future implementation 2. Review of the monitoring plan and update where needed to capture issues or unforeseen effects.	• T5 Monitoring plan data compiled for feeding into future Framework Plans and the Stage 8 Monitoring and Feedback process.	Irish Water	Irish Water
Population, economy, tourism and recreation, and human health	**RMP PH** 1. Level of Service achieved 2. Frequency and duration of droughts needing management actions 3. Number of days/hours when water supply to people is disrupted due to drought, freeze-thaw or other service/infrastructure issues 4. Awareness raising programmes on water conservation 5. Reduced water supply restrictions due to water quality risks	• T6 Maintained or improved access to reliable and safe drinking water meeting forecast demand • T7Reduced number of drought actions affecting supply • T8 Raised public awareness of actions to take for water	Irish Water	Irish Water

SEA topics	SEA indicators	SEA Targets	Source data	Responsibility
		conservation with reduced household /non domestic per customer demand		
	RMP RT 1. Level of service accommodating seasonal tourism demand	See T6		
Water environment	**RMP WE** 1. Number of investigations and area covered by catchment management schemes 2. Additional water quality and biological monitoring/data collection in addition to WFD monitoring data where needed 3. Number of demand management initiatives supporting water savings 4. Compliance with WSSP Strategy Objective to manage water supplies in an efficient and economic manner (WS3). Key indicator – Leakage expressed as a percentage of treated water put into the distribution system 5. Number of waterbody sources where WFD good status is not reached due to abstraction pressure 6. Number of waterbody sources benefiting from reduced abstraction or cessation in abstraction	• T9 Improved environmental resilience and water quality within water resource use catchments • T10 Contribution to restoration to "good" status of waters currently at "moderate", "poor" or "bad" status (WFD objective) • T11 Achieve leakage targets identified for the Eastern and Midlands	Irish Water and EPA	Irish Water
	RMP FI 1. Number of outages due to flood events or power or outages	• T12 No loss of supply due to flood events	IW and EPA	Irish Water
Biodiversity, flora and fauna	**RMP Bio** 1. Identification of existing abstractions or drinking water treatment residuals with risks to international or national designations	• T13 No adverse effects on integrity of European, national or regional level designations and, where feasible, seek to contribute	NPWS, EPA and IW	Irish Water

SEA topics	SEA indicators	SEA Targets	Source data	Responsibility
	2. Aquatic ecology - number of existing abstractions identified by Irish Water as potentially unsustainable in dry weather conditions where abstractions are reduced or abandoned 3. Number of waterbodies with improvements benefiting raw water quality/aquatic ecology due reduced or cessation of abstractions, catchment management, nature based solutions, river enhancement, migration barrier removal 4. Number of waterbodies sources where WFD good status is not reached due to abstraction pressure. 5. Regional information on net loss/gain of habitats collated from proposed and undertaken projects	to achieving favourable conservation status • T14 Improvement to aquatic biodiversity of existing waterbody sources • T15 region wide no net loss of high value habitats and improved habitat connectivity		
Material assets	**RMP MA** 1. Tonnes of residuals reused or recycled across region per year 2. Tonnes of waste disposed of to landfill for the region per year	• T16 No drinking water treatment residuals sent to landfill and no reduced abstraction to other users due to new schemes	Irish Water, EPA and Local Authorities (LAs)	Irish Water
Landscape and visual amenity	**RMP LV** 1. Total working area of pipelines through protected landscapes, outside protected areas, and urban areas 2. Development of protected landscape strategies to guide work in important and valued landscapes	• T17 Improvement or no net change in landscape quality	Irish Water	Irish Water
Climate change	**RMP CCM** 1. Percentage of energy supply from renewable sources and energy efficient improvement for the region. 2. Carbon footprint (total tonnes) per year, predicted over plan period, lifetime of schemes of water resource options (tonnesCO_2equiv)	Decarbonisation through the following: • T18 Increased contribution of renewable/low carbon energy sources for existing and new schemes including project-based sources.	Irish Water	Irish Water

SEA topics	SEA indicators	SEA Targets	Source data	Responsibility
	3. Operational Carbon Intensity kgsCO_2equiv/ML overall achieved for the region each year 4. Total carbon value from any carbon offsetting schemes linked to the Plan	• T19 Minimised the annual carbon emissions from operation and reduced carbon intensity of water supply • T20 Supported carbon offsetting schemes, including upper catchment schemes linked to biodiversity and water and population wellbeing (recreational) objectives		
	RMP CCA 1. Frequency of drought (including freeze thaw) orders requiring change to normal abstractions/compensation releases 2. Number of outages due to weather events and power loss	• T21 Improved resilience of environment to climate change	Irish Water	Irish Water
Cultural heritage	See project level monitoring	N/A		
Geology and soils	See project level monitoring	N/A		

The Monitoring Plan - Indicators and Targets - Project Level Framework for the project monitoring is set out below in Table 10.3. This is intended to provide a framework for project level monitoring which can be considered as part of the plan feedback and review process as the individual projects are developed and implemented.

Table 10.3 Monitoring Plan: Indicators and Targets - Project Level Framework

SEA topics	SEA Project level indicators	SEA Project targets	Source data	Responsibility
For monitoring individual projects. Monitoring results on individual projects also to be fed back to reporting for the Regional Plan and SEAs **Reporting timescale: across each project develop over plan implementation period**				
***Note: Not all indicators will be relevant for all types of projects**				
All topics and objectives	**PL AT1** Environmental screening applied for all projects to check appropriate level of study and assessment to address risks of environmental impacts but also opportunities for enhancements or reduction of and carbon emissions in construction and operation and application of waste hierarchy, including taking account of recommendations from the SEA and NIS. Include engagement with stakeholders.	• PT1 Project development to find sustainable solutions that contribute to environmental objectives	Irish Water	Irish Water
All topics and objectives	**PL AT2** Application of project level monitoring and feedback to identify potential significant environmental effects are identified at each stage of project development and implementation process and post project evaluation or audit.	• PT2 Process implemented for project level development feeding back information for project and regional level review	Irish Water	Irish Water
Population, economy, tourism and recreation, and human health	**PL PH** a) Number of complaints received relating to construction works b) Duration of works with traffic control /disruption c) Noise levels at receptors within recommended limits during construction and operation and mitigation provided where assessment indicated levels are exceeded. d) Dust management plan applied for construction	• PT3 Minimise extent and period of disruption to traffic related to construction • PT4 Minimise access restrictions and noise disturbance to people from construction and operation of schemes	Irish Water IW (project level information)	Irish Water

SEA topics	SEA Project level indicators	SEA Project targets	Source data	Responsibility
	PL Rec a) Number of footpath/access closures/diversions b) Length of public access paths created compared to loss c) Area of any amenity improvement provided or amenity area lost (ha)	• PT5 No net loss of important recreational amenity, improved access and support for new recreational amenity	Irish Water IW (project level information)	Irish Water
Water environment	**PL WE** a) Additional water quality and biological monitoring/data collection in to supplement WFD monitoring data where needed b) Sustainability of abstraction for surface or ground water c) Inclusion of supporting measures to safeguard or improve raw water quality where appropriate d) Design measures to contribute to remove or contribute to removing barriers to fish migration where appropriate and within Irish Water responsibility. e) Improvement to river morphology/aquatic ecology/water quality	• PT6 Avoids “No deterioration” in status of waters (WFD objective) • PT7 Contributes to restoration to “good” status of waters currently at “moderate”, “poor” or “bad” status and WFD objectives	Irish Water and EPA (project level information)	Irish Water
	PL FI a) Area of flood plain/flood storage loss and compensation provided b) Flood risk vulnerability to water supply change due to project c) Any significant increase in flood risk to property or assets due to project	• PT8 No net flood plain area lost as a result of the plan, and where possible increase functioning flood plain • PT9 Reduced flood risk or vulnerability to supply	IW (project level information) and EPA	Irish Water
Biodiversity, flora and fauna	**PL Bio** a) For designated nature conservation sites potentially affected by water resource options: b) Area of each designated site/type affected and the likely impact	• PT10 No adverse effects on integrity of European, national or regional level designations and, where feasible, seek to contribute	NPWS, EPA and Irish Water (including project level information)	Irish Water

SEA topics	SEA Project level indicators	SEA Project targets	Source data	Responsibility
	c) Area of site with a predicted or recorded change in condition (positive or negative) d) Plan for/measurement of enhancement - area/length of habitat loss or affected vs restored - (for example use of biodiversity metrics to compare before and after habitats area and condition) e) Improvement in habitat connectivity or loss of connectivity f) Improvement to aquatic habitats and fish migration where relevant g) Removal of residuals discharge to waterbodies h) Invasive species risk assessment i) Identification of potential for applying nature-based solutions or catchment management including opportunities for biodiversity enhancement	to achieving favourable conservation status • PT11 No net loss of valued habitats or habitat connectivity as a result of the works and, where possible, demonstrate habitat enhancement/creation • PT12 reduced invasive species risk • PT 13 Implementation of nature-based solutions or enhancement linked to catchment management		
Material assets	**PL MA** a) Area of permanent loss of greenfield land, including agricultural, forestry or other land uses or area returned to greenfield, habitat or community use. b) Materials and waste management plans used on all new schemes and including decommissioning of infrastructure c) Sustainability assessment including consideration of non Irish Water abstractions d) Residuals management for water treatment plant upgrades and new plant designed in accordance with Irish Waters Residuals Management Strategy	• PT14 Minimise permanent loss of greenfield land, including agricultural, forestry or other land uses • PT15 Minimise material consumption and waste during construction and operation of schemes • PT16 Increase investment in existing and new water treatment and wastewater management infrastructure • PT17 No drinking water treatment residuals sent to landfill	Irish Water, EPA and Local Authorities (LAs) (including project level information)	Irish Water

SEA topics	SEA Project level indicators	SEA Project targets	Source data	Responsibility
		and no reduced abstraction to other users due to new schemes		
Landscape and visual amenity	**PL LV** a) Total working area of pipelines through protected landscapes, outside protected areas, and urban areas b) Development of protected landscape strategies to guide work in important and valued landscapes c) Land use/landscape features re-established for projects over an appropriate period – areas/km successfully restored to meet requirements	• PT18 Improvement or no net change in landscape quality through landscape design and mitigation and enhancement	Irish Water (including project level information)	Irish Water
Climate change	**PL CCM** a) Carbon footprint (total tonnes) of construction and lifetime carbon tonnes including operational carbon calculated for the project b) Carbon intensity calculated of the project (kgsCO_2equiv/ML) based on lifetime carbon c) Inclusion of renewable energy sources as part of the project d) Decarbonisation plan to inform design, construction and operation e) Carbon offsetting opportunities through carbon sequestration such as woodland planting or peat bog restoration	Decarbonisation through the following: • PT19 Benchmarked reduced carbon emissions from construction • PT 20 Increased contribution of renewable/low carbon energy sources • PT21 Minimise the annual carbon emissions from operation and Improve energy efficiency of water services • PT 22 Scheme related carbon offsetting- such as upper catchment management initiative/collaboration linked to biodiversity and water and	Irish Water (including project level information)	Irish Water

SEA topics	SEA Project level indicators	SEA Project targets	Source data	Responsibility
		population wellbeing (recreational) objectives		
	PL CCA a) Flood, freeze thaw and drought risk vulnerability assessment including power outages to inform scheme design.	• PT 23 Improved project resilience to climate change	Irish Water	Irish Water
Cultural heritage	**PL CH** a) Number of designated sites or other important archaeological or architectural heritage sites and/or their settings adversely affected by water resource options including through hydrological change from abstraction b) Provision of access to/ or recording of assets and communication/interpretation of interest features where appropriate	• PT24 No unauthorised physical damage or alteration of the context of cultural heritage features due to Irish Water activities • PT25 All schemes developed applying best practice approaches for consultation, desk study and investigation and mitigation for cultural heritage and archaeological interest	Irish Water (including project level information) Archaeological Survey of Ireland Sites and Monuments Record	Irish Water
Geology and soils	**PL GS** a) Area of geological site affected by water resource options b) Total area of soil removed or reused on schemes c) Area of contaminated land restored, or soils removed d) Area within catchment management initiative where soil is to be improved for example by reducing soil loss/erosion, reducing artificial fertiliser use, increasing soil carbon and increasing native woodland planting	• PT26 No loss of statutory and non-statutory geological sites of interest • PT27 Minimal disturbance or loss of high-quality land as a result of the Framework Work and minimal net loss of soil resources • PT28 Catchment areas where raw water quality issues have been improved though soil and land management changes	Irish Water (including project level information)	Irish Water

11 Next Steps

11 Next Steps

This SEA Environmental Report (including the Study Area Environmental Review appendices), along with the Natura Impact Statement (NIS) and draft Regional Plan are available for comment and review during the current consultation period. The process and deadline for submitting observations are set out on the Irish Water website.

Following the completion of the consultation period, all comments will be reviewed and considered as part of finalising the Regional Plan. Responses to the consultation comments will be reported in a Consultation Report.

SEA requirements and consultation comments will be taken into account in finalising the Regional Plan. Consultation responses and how the SEA has been taken into account will be reported in the SEA Statement published with the final Regional Plan.

11.1 Further Information

For more information, please refer to one or more of the communication channels below:

- RWRP-EM webpage on the Irish Water website in English and Irish;
- Information leaflet available in English and Irish;
- RWRP-EM infographic;
- Press release to national and local media;
- Newspaper advert;
- Hard copies of the Regional Plan, environmental reports, Non-technical Summary and consultation leaflet made available at planning counters nationally;
- FAQs;
- Freephone number 1800 46 36 76;
- Social media; and
- Correspondence and briefings to:
    - Elected representatives;
    - Local authorities;
    - Environmental authorities;
    - Interested parties; and
    - Media.

This SEA Environmental Report has been prepared on behalf of Irish Water and is available online at the following website:

https://www.water.ie/projects/strategic-plans/national-water-resources/rwrp/eastern-midlands/

Further information requests and written submissions or observations can be sent to Irish Water:

By post:

National Water Resources Plan,

Irish Water,

PO Box 13216,

Glenageary,

Co. Dublin.

By email:

nwrp@water.ie

Glossary and Acronyms

Term	Definition
Abstraction	The process of taking water from any source, including rivers and aquifers
Appropriate Assessment (AA)	An assessment required under the Habitats Directive when a plan or project has the potential to affect a European site
Aquifer	A water-bearing rock that groundwater can be extracted from
Baseline condition	The state of the environment in the absence of the NWRP Framework
Catchment	The total area of land that drains into a watercourse
CFRAM	Catchment Flood Risk Assessment and Management
CRU	Commission for Regulation of Utilities
CSO	Central Statistics Office
Cumulative effect	The combined effects from several plans, programmes or policies
Deficit	The amount of water shortage between supply and demand
Desalination	The process of removing salt from seawater
DHPLG	Department for Housing, Planning, and Local Government
EBSD	Economics of Balancing Supply and Demand
EC	European Commission
Effluent	Liquid waste or sewage discharged into a river or the sea
Environmental Report (SEA Environmental Report)	The SEA report that documents the effects of measures outlined in a plan
EPA	Environmental Protection Agency
GIS	Geographical Information System
Gross Domestic Product (GDP)	Gross Domestic Product is a monetary measure of the market value of all goods and services produced in a period (in this case annually)
GSI	Geological Survey Ireland
IGH	Irish Geological Heritage
Invasive species	Non-native species that out-compete native species to the detriment of an ecosystem
LSEs	Likely Significant Effects
MCA	Multi-Criteria Analysis
Mitigation	The implementation of measures designed to reduce the predicted effects of a plan or project on the environment
Ml/d	Mega litres per day
NAF	National Adaptation Framework

Term	Definition
National Climate Change Adaptation Framework	National Climate Change Adaptation Framework
National Water Resources Plan (NWRP)	A plan developed by water companies to deliver a long-term provision of water to accommodate the impacts of population growth, drought, their environmental obligations and climate change uncertainty in order to balance supply and demand for water. These are produced cyclically, at least every five years, with a minimum 25-year planning horizon.
NHA	National Heritage Area
Natura Impact Statement (NIS)	The statement prepared following AA of European sites as required under the Habitats Directive, which presents information on the assessment and the process of collating data on a project and its potential significant impacts on European sites.
NIAH	National Inventory of Architectural Heritage
NPV	Net Present Value
NPWS	National Parks and Wildlife Service
OPW	Office of Public Works
PCC	Per Capita Consumption
pNHA	Proposed National Heritage Area
Ramsar site	An international designation for an important wetland site under the Ramsar Convention
RSES	Regional Spatial and Economic Strategies
River Basin District	The area of land and sea, made up of one or more neighbouring river basins together with their associated groundwater and coastal waters, which is identified under Article 3(1) as the main unit for management of river basins
River Basin Management Plan (RBMP)	A key element to the WFD, taking an integrated approach to the protection, improvement and sustainable use of the water environment; including all surface water and groundwater bodies
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
Special Area of Conservation (SAC)	An international designation for habitats and/or species under the Habitats Directive
Special Protection Area (SPA)	A site of international importance for birds, designated as required by the Birds Directive
Strategic Environmental Assessment (SEA) Objectives	Methodological measures against which the effects of the NWRP can be tested
Supply Demand Balance (SDB)	The SDB is the deficit or surplus between the supply and demand both now and over the 25-year horizon

Term	Definition
UKWIR	UK Water Industry Research
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WFD	Water Framework Directive
Water resource management	The management of water sources and demands to minimise any deficit between the two
Water Resource Management Plan	A plan designed to identify water deficits and outline measures that can reduce the deficit
Water Resource Zone (WRZ)	The largest possible zone in which all resources, including external transfers, can be shared and all customers experience a similar risk of supply failure from a resource shortfall
WSSP	Water Supply Strategic Plan
Water Supply Zone	The area supplied by an individual water supply scheme. This typically includes one or more abstractions (from a river, lake or groundwater), a treatment plant, storage in reservoirs and the distribution pipe network to deliver the water to each household or business.
WTP	Water Treatment Plant
WwTP(s)	Wastewater Treatment Plant

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