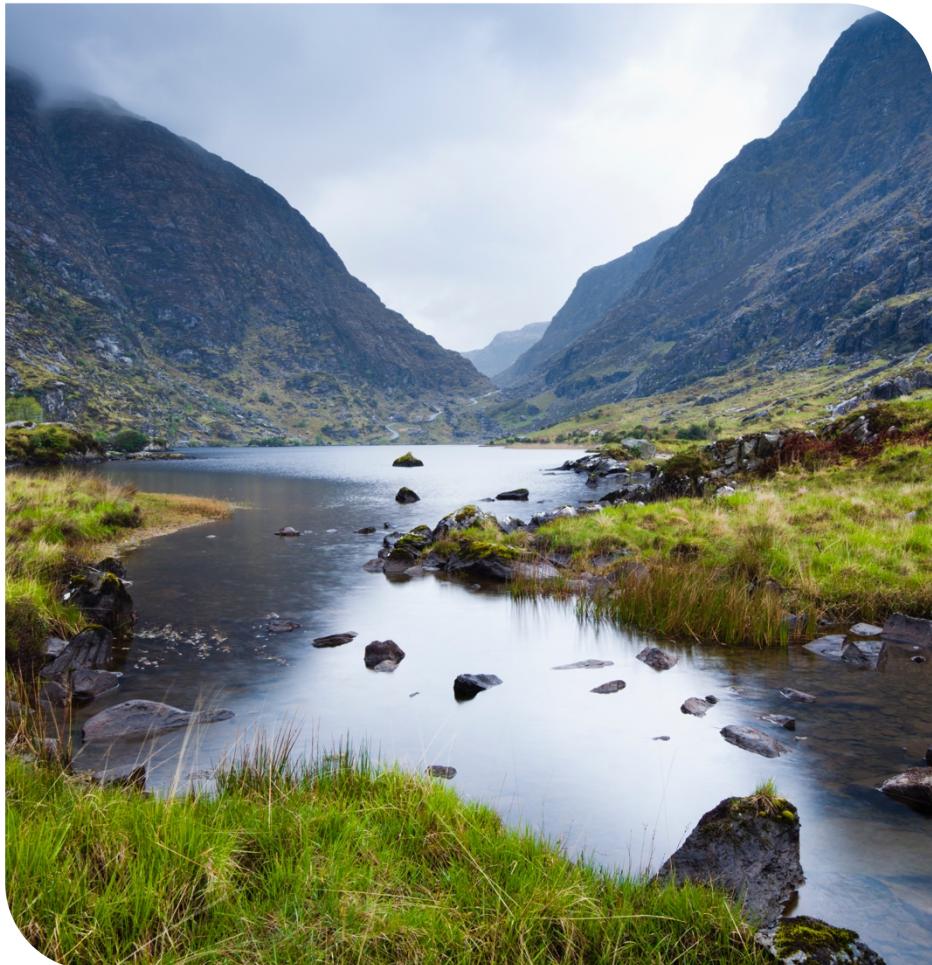


Case Study – Study Area 5 Environmental Review



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 the National Planning Framework.

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1

Introduction and Background

1 Introduction and Background

This sample Case Study Environmental Review is provided as an illustrative case study example of the application of the draft Framework Plan's options assessment methodology and environmental assessment.

The content of this report is draft and will be reviewed and updated to form part of the Strategic Environmental Assessment (SEA) and Natura Impact Statement (NIS) for the Regional Water Resources Plan (RWRP) (Regional Plan) for Study Area 5 (SA5) Group Area 4 East Midlands. The format and presentation of information may change in response to comments on the draft Framework Plan and as part of developing the Regional Plans and environmental assessments for consultation.

This Case Study Environmental Review includes:

- Context for the Study Area Environmental Review;
- Environmental baseline context;
- Environmental assessment for the options screening process and feasible options;
- Assessment of the alternatives considered and the Preferred Approach;

This is the Case Study Environmental Review of the application of the options assessment methodology applied to Study Area 5 within Group Area 4, as outlined in the sample Case Study Technical Report. This Environmental Review is provided as an example of how SEA objectives and environmental assessment are proposed to be integrated into the Study Area level of the Regional Plan process.

Environmental Reviews will be undertaken for each Study Area and will form Appendices to the SEA Environmental Reports for the Regional Plans which form Phase 2 of the National Water Resources Plan (NWRP).

1.1 Context

Irish Water are preparing the NWRP draft Framework Plan (draft Framework Plan), outlining how they will move towards an environmentally sustainable, safe, secure and reliable drinking water supply for everyone over the next 25 years whilst safeguarding the environment. The Draft Framework Plan identifies the need in terms of quantity, quality and reliability, and develops a methodology to develop interventions to address this need. The purpose of the Draft Framework Plan is to provide a mechanism to identify need across Irish Water's water supply system in relation to:

- The Water Quality that Irish Water can provide;
- The Water Quantity that Irish Water can provide; and
- The performance of, and operational efficiency of, Irish Water's Asset Base.

The Options Assessment Methodology provides a framework to identify potential solutions that align with Irish Water's overarching three pillar approach (see Figure 1-1) to:

- **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 1-1: Three Pillar Approach to reduce or eliminate the SDB deficits

The key stages of the Options Assessment Methodology process are illustrated in Figure 1-2 and summarised below:

- 1) Identifying need – based on SDB and/or Drinking Water Safety Plan Barrier Assessment;
- 2) Scoping of the Study Area (WRZs) – understanding the Study Area and the existing conditions of assets, supply and demand issues; as well as environmental constraints and opportunities;
- 3) Identifying potential options for consideration relevant to the Study Area;
- 4) Coarse screening – assess the unconstrained options and eliminate any that will not be viable;
- 5) Further option definition, information collection and preliminary costing;
- 6) Fine screening – options assessment and scoring against the key criteria with further removal of options identified as unviable and development of feasible options for costing and scoring assessment update;
- 7) Approach appraisal – comparison and assessment of combinations of options identified to meet the predicted supply demand deficit to determine the Preferred Approach; and
- 8) Monitoring and Feedback – a process for monitoring the implementation of the plan and responding to changes to policy and guidelines and to information changes which will feed into the 5 year plan cycle.

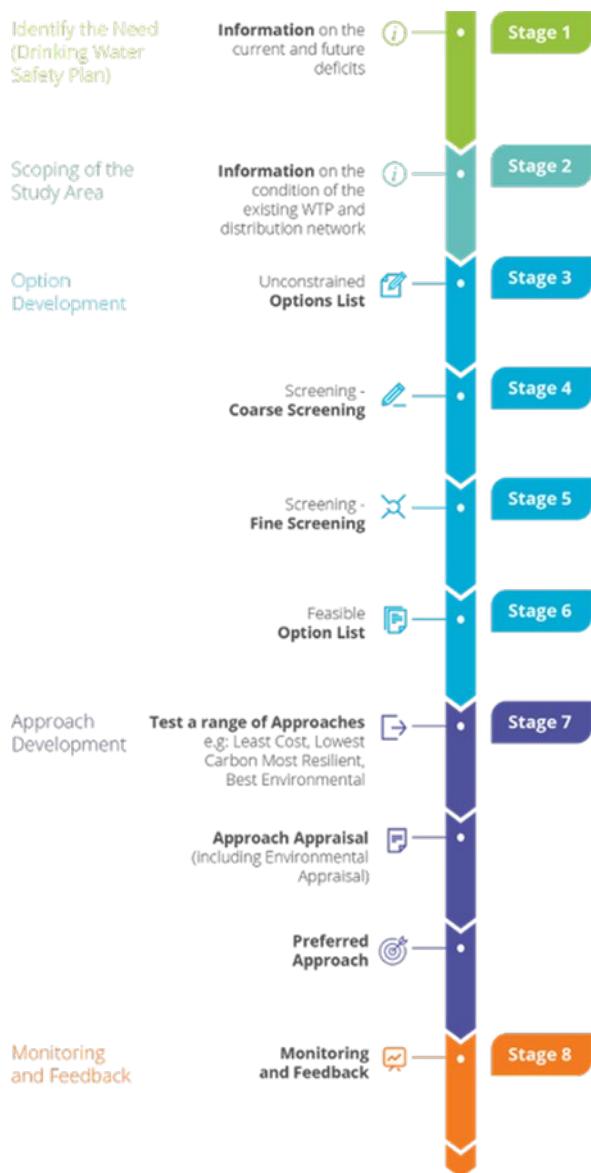


Figure 1-2: Option and Approach Development Process

1.2 Regional Plan SEA

The four RWRPs, implementing Phase 2 of the NWRP, are each subject to a separate SEA process. The Study Area assessments will follow the outline methodology to be established by the Draft Framework Plan once this is adopted. The assessments will be undertaken following SEA screening and scoping and will also be informed by these initial SEA stages. An Environmental Report will be published for consultation alongside the Draft Regional Plans for each of the four regions.

An outline of the content of the Environmental Report for each Draft Regional Plan is given below:

- National and regional level context including the environmental baseline and policy and plan framework. The environmental baseline will be a summary of the more detailed baseline information provided at the Study Area level;

- Identification of key trends and issues relating to the environment and potentially relevant for water supply demand solutions;
- Outline of the Regional Plan proposals covering the Regional Plan objectives and decision-making process;
- An outline of the methodology for integrating environmental assessment into options and approach appraisal - based on the Framework Plan and adapted based on SEA scoping responses where required;
- Standard mitigation measures taken into account in the assessment;
- Summary of all Study Area environmental assessments, including options screening, options appraisal, comparison and assessment of alternative approaches, cumulative assessment, and assessment of the Preferred Approaches;
- Regional level cumulative assessment of all the Study Area approaches combined and assessment of Regional alternatives;
- Assessment of the overall Regional Plan;
- Recommendations for environmental mitigation and enhancement measures to be taken through to project level design development and assessment, implementation of the plan, and a draft Monitoring Plan; and
- Monitoring of environmental effects from the implementation of the Regional Plan.

As an example, the RWRP for the East Midlands (Regional Plan EM (Group 4) (referred to as the Regional Plan in this report), will include nine individual Study Area reports (SA1-9) as Appendices to the Regional Plan. The SEA Environmental Report for the Regional Plan will also be supported by nine Study Area Environmental Reviews (SA1-9) as Appendices.

Each of the Study Area Environmental Reviews, as Appendices to the SEA Environmental Reports, will include:

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

1.3 Study Area: Strategic Environmental Assessment

The set of SEA objectives developed at the Phase 1 scoping stage have been refined and finalised following consultation (see Table 1-1). These 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 draft Framework Plan.

Table 1-1: SEA objectives

Strategic Environmental Assessment topic	SEA Objective
Population, economy, tourism and recreation, and human health	Protect and, where possible, contribute to enhancement of human health and wellbeing and to prevent restrictions to recreation and amenity facilities in undertaking water services.
Water environment	<u>Water quality and resources</u> 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 the improvement of waterbody status for rivers, lakes, transitional and coastal waters, and groundwater to at least 'Good' status.
	<u>Flood risk</u> Protect and, where possible, reduce risk from flooding as a result of Irish Water's activities.
Biodiversity	Protect and, where possible, enhance terrestrial, aquatic and soil biodiversity; particularly regarding European sites and protected species in undertaking water services.
Material assets	Minimise resource use and waste generation from, new or upgraded, existing water services infrastructure and management of residuals from drinking water treatment - to protect human health and the ecological status of waterbodies. Minimise impacts on other material assets and existing water abstractions.
Landscape and visual amenity	Protect and, where possible, enhance designated landscapes in undertaking water services.
Climate change	<u>Climate change mitigation</u> Minimise contributions to climate change emissions to air (including greenhouse gas emissions) as a result of Irish Water's activities.
	<u>Climate change adaptation</u> Promote the resilience of the environment, water supply and treatment infrastructure to the effects of climate change.
Cultural heritage	Protect and, where possible, enhance cultural heritage resources in undertaking water services.
Geology and soils	Protect soils and geological heritage sites and, where possible, contribute towards the appropriate management of soil quality and quantity.

The SEA objectives influence each stage in the options assessment process applied at the Study Area level, as outlined in Chapter 9 of the SEA Environmental Report for the draft Framework Plan. This includes a high-level assessment informing coarse screening and fine screening as part of the identification and development of the feasible options. This assessment then informs the development and testing of approaches to meet water resource zone (WRZ) and Study Area deficits. SEA is

undertaken on the alternative approaches considered and the selected Study Area Preferred Approach, along with identification of cumulative assessment and ‘in-combination’ effects. The assessment identifies potential significant effects and mitigation measures required.

1.4 Study Area: Water Framework Directive

Water Framework Directive (WFD) requirements to avoid deterioration in waterbody status or objectives has been incorporated into the allowable abstraction constraints for new option abstractions. WFD requirements are also included in the SEA objectives for the assessment (see Table 1-1). Baseline data in relation to the WFD is presented in Section 2.2.1.

1.5 Study Area: Appropriate Assessment

An Appropriate Assessment (AA) is required for the Framework Plan to comply with the EU Habitats Directive (92/43/EEC) at all stages of the Framework development and for all component Study Areas.

The AA will be addressed in a separate Natura Impact Statement (NIS) for the Regional Plan. Habitats Directive requirements have been integrated into the Framework Plan options development process and assessment and conclusions from the AA for SA5 are provided in Sections 7 and 10 of this report respectively.

1.6 Study Area 5

Region/Group 4 is subdivided into nine Study Areas based on WFD catchment and WRZ boundaries within the region. This Case Study reports on SA5, the location of SA5 in relation to Region/Group 4 is shown in Figure 1-3.

Study Area 5 lies within the counties of Galway, Roscommon, Longford, Westmeath, North Tipperary, Offaly and Laois and its total area is approximately 2,597 km². The principal settlement (with a population of over 10,000) within SA5 is Athlone (CSO, 2016a), as shown in Figure 1-4.

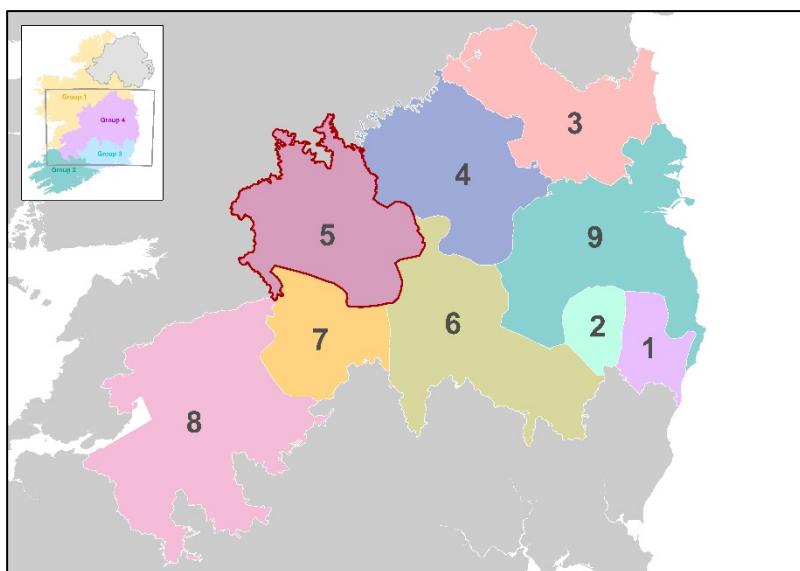


Figure 1-3: Region 4 Study Areas



Figure 1-4: Study Area 5

2

Study Area 5 Environmental Baseline Context

2 Study Area 5 Environmental Baseline Context

This Section provides environmental baseline information for SA5 regarding the following key environmental topics in the SEA:

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

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

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

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

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

2.1.1 Population

Table 2-1 provides a general overview of the WRZ's population and the projected percentage change in population between 2019 and 2040. The largest projected increases in population are expected in the WRZs Athlone (3200SC0002), SRRWS (2600SC0006) and Ballinasloe (1200SC0006).

Table 2-1: Overview of the population within the WRZs of SA5

WRZ reference number and name	Total population served (2019)	% population change 2019-2044
1200SC0005 - Ahscragh	770	+12.3%
3200SC0002 - Athlone	22,477	+33.8%
1200SC0006 - Ballinasloe	8,291	+22.8%
2500SC0001 - Banagher	3,492	+12.3%
2500SC0015 - Birr/Kinnity	5,742	+12.3%
2500SC0016 - Clara/Ferbane	8,665	+12.3%
2500SC0003 - Kilcormac	1,186	+12.3%
2600SC0001 - Mount Talbot/Four Roads	3,711	+12.9%
2500SC0017 – Rahan	3,684	+19.8%
2600SC0006 - South Roscommon (Lisbrock & Killeglan)	13,920	+25.9%

2.1.2 Economy and Employment

Half of SA5 lies within the Midlands region and half lies within the West region of Ireland. SA5 had a below average household disposable income per person in 2016 (CSO, 2016b), and an unemployment rate of 10.1% in the Midlands and 7.4% in the West region of the country (CSO, 2017a).

Population increase and expected economic growth has meant that housing and sustainable urban development have been made a priority for the National Development Programme; therefore, to supply the demand there is an aim to increase housing stock. The number of new dwellings completed in Q3 2019 was 219 for the Midlands region and 434 for the West region. This accounts for approximately 3.9% and 7.7% of the national total respectively (CSO, 2019).

2.1.3 Tourism and Recreation

Tourism in SA5 has an important role, particularly in rural areas, with the National Planning Framework (NPF) stating that tourism is a key aspect of rural job creation now and in the future (Government of Ireland, 2018). The county of Roscommon 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).

Additionally, the Study Area is located within Ireland’s Hidden Heartlands and Ireland’s Ancient East, two of Fáilte Ireland’s tourism programmes in the country. Ireland’s Hidden Heartlands is located in the Mid-West, focussing on rural communities (Fáilte Ireland, 2020). Ireland’s Ancient East, which is part of a tourism development strategy

that covers the South, East and part of the Midlands, places emphasis on the importance of historic sites in the area (National Tourism Development Authority, 2016).

Ireland's natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport (2019) and is a key aspect of county Offaly's tourism strategy (Visit Offaly, 2020). For SA5, the nature reserves of note are Mongan Bog, Clara Bog and Redwood Bog. Rivers, loughs and coastal areas all make an important contribution to tourism and recreational opportunities and support important fisheries.

2.1.4 Human Health

Table 2-2 provides well-being indicators for the Midlands and West region within Ireland. Improvements in air quality, access to good quality drinking water and participation in recreational activities can all have a positive influence on human health and well-being.

Table 2-2: Well-being indicators for the Midlands and West region within Ireland

Life expectancy (CSO, 2017b)	Participation in walking, sport and/or other physical activity (% of persons aged 15+) (CSO, 2015)	Air quality (EPA, 2019a)
Midlands: Male: 77.2 Female: 81.5	Midlands: 82.48%	Good
West: Male: 77.1 Female: 82.7	West: 85.5%	Good

A key issue for public health is reliable access to good quality drinking water. 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, not all supplies within this Study Area meet the required levels of reserve capacity. Due to the limited historical monitoring of these supplies, particularly in relation to groundwater, this will need to be studied further. Table 2-3 lists the areas supplied by the Water Treatment Plants (WTPs) in SA5.

Table 2-3: Areas supplied by the WTPs in SA5

WTP	WRZ	Towns supplied
Agall WTP	Rahan - Agall/Hollimshill P.W.S.	Tullamore, Mucklagh and Pollagh
Ahascragh WTP	Ahascragh P.S.	Ahascragh
Athlone WTP	Athlone PWS	Athlone, Glassan and Baylin
Ballinasloe Town WTP	Ballinasloe Public Supply	Ballinasloe and Eyrecourt
Banagher WTP	Banagher PWS	Clochan and Banagher

WTP	WRZ	Towns supplied
Birr WTP	Birr PWS	Birr and Crinkle
Clara WTP	Clara/Ferbane PWS	Clara, Ballycumber and Ferbane
Clontotin WTP	Banagher PWS	Cloghan and Banagher
Cloonlaughnan WTP	Mount Talbot_Four Roads WSS	Roscommon, Athleague and Ballyforan
Rahan - Holmshill WTP	Rahan - Agall/Holmshill P.W.S.	Tullamore, Mucklagh and Pollagh
Kilcormac WTP	Kilcormac P.W.S.	Kilcormac or Frankford
Killelgan Springs WTP	Killelgan WSS	Ballinasloe
Kinnitty WTP	Kinnitty P.W.S.	Kinnitty
Lisbrock WTP	South Roscommon (Lisbrock & Killelgan)	Athlone
Moyclare WTP	Moyclare RWSS	Shannonbridge and Belmont
Rahan - Tully WTP	Rahan - Tully P.W.S.	Tullamore

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

Poor water quality can be linked to risks to health. Based on the WTP assessments, nine of the sixteen WTPs within the Study Area appear to have significant water quality treatment risks. These deficits particularly relate to bacteria and virus (Barrier 1) and the effectiveness of Irish Water's protozoa removal processes (Barrier 3). Currently, there is one WRZ on the EPA Remedial Action List within SA5, namely Clara/Ferbane Regional Water Supply Scheme. There are no supplies within SA5 on an EPA Direction.

Irish Water is currently progressing immediate corrective action in relation to a number of supplies in advance of the Framework Plan. A national programme to improve disinfection standards (Barrier 1) at water treatment facilities across Ireland was initiated by Irish Water in 2016. Details of these are included in the Case Study SA5 Technical Report.

2.2 Water Environment

This topic covers geomorphology, WFD, flood risk, surface water quality and groundwater receptors. Figure 2-1 shows the water environment, including the WRZs, the WFD water catchment boundaries, the WTPs and the waterbodies in SA5.

Table 2-4 provides a summary of WFD catchments within SA5.

Table 2-4: Catchments within SA5 (catchments.ie, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f and 2018g)

Water Framework Directive Catchments	Total area (km ²)
Lower Shannon (Brosna)	1,248
Lower Shannon (Little Brosna)	982
Lower Shannon (Lough Derg)	1,820
Upper Shannon (Suck)	1,598
Upper Shannon (Lough Ree)	581
Upper Shannon (Mid Shannon)	383
Galway Bay South East	1,270

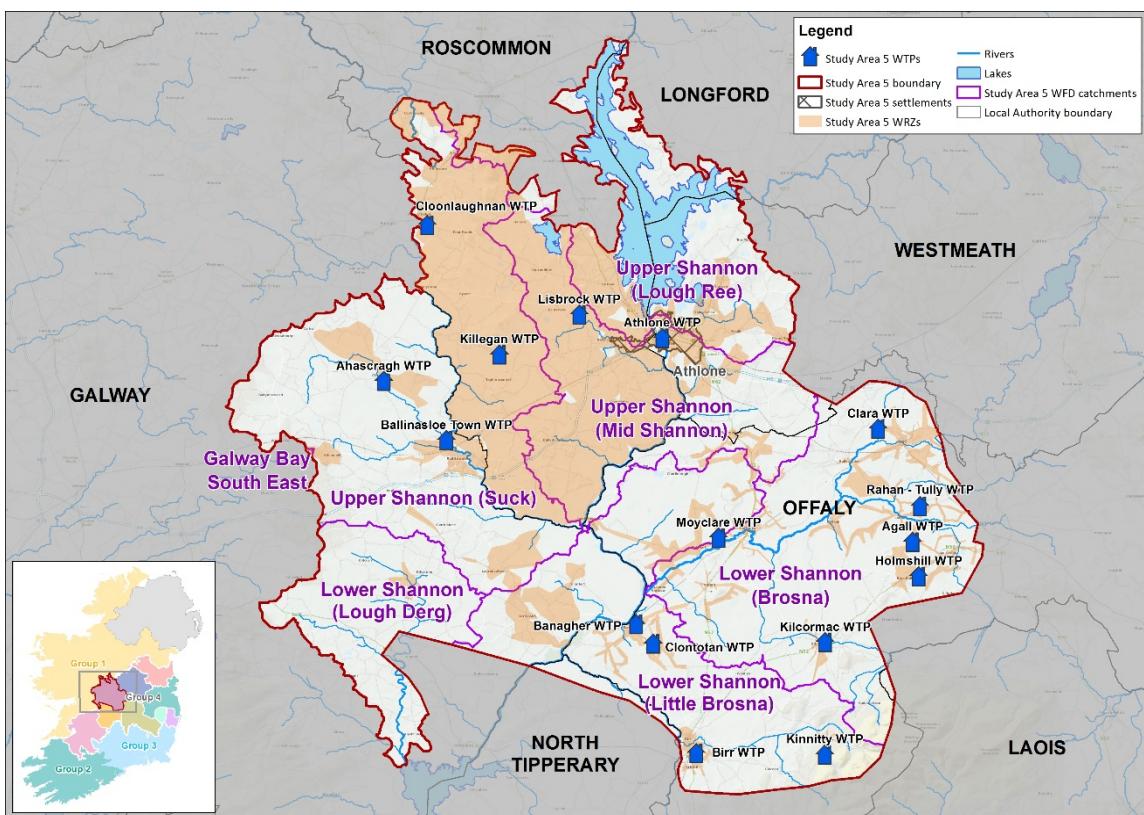


Figure 2-1: Water environment of SA5

2.2.1 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 or any of the WFD water quality parameters.

The General Scheme on Water Environment (Abstractions) Bill 2018 (The Bill), to introduce abstraction licensing aligned to the WFD, was published in summer 2018. This legislation will set the amount Irish Water can take from the water supplies they abstract the water from. This will require at least 18% of Irish Water's abstractions to be

licensed and may limit abstraction at these sites in future. With their current fragmented supply networks and lack of an alternative supply in many cases, this could result in immediate impacts.

Irish Water will need time to adapt their operations and deliver the investment required to provide replacement or auxiliary supplies and put measures in place to reduce demand, where appropriate. The Bill acknowledges this and recognises that an adaptation period will be necessary to help Irish Water transition to this new regulatory landscape. The Bill expressly provides for this under Head 20, which deals with transitional arrangements and provides that Irish Water may continue to take water from a source of water after the passage of this Act; provided that that abstraction itself is included on the EPA's register before the Act commences. The method of abstraction and quantity of water taken will remain as it was before this new regime was introduced, but this can be varied by an abstraction licence issued by the EPA.

As there are very few long duration flow records for Irish Water's abstractions and for waterbodies within Ireland; Irish Water lack comprehensive data to fully understand the impact of the new legislation on these sources. Therefore, improved monitoring and gathering better data is a priority.

On an interim basis, Irish Water has developed an initial assessment based on available information; see the Case Study SA5 Technical Report. Over the coming years, Irish Water will work with the environmental regulator EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of their groundwater sources.

To understand the potential impact of the Abstraction Legislation on the SA5 supplies, Irish Water have assessed their surface water abstractions and summarised the potential impact on the River Shannon, River Camcor, River Suck, Bunowen River and the Gageborough River. Based on this initial assessment, the volumes of water abstracted from the River Gageborough (Clara/Ferbane) may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, this will be adjudicated by the EPA.

The Department of Housing, Planning and Local Government's (2019a) public consultation document, regarding the significant water management issues, has been considered by Irish Water. Therefore, the pressures, and the relevant priority 'Areas for Action', described in the river basin management plans associated with SA5 are provided below and in Table 2-7.

There are seven WFD catchments in SA5 and the total number of surface and groundwater waterbodies within each WFD catchment are provided in Table 2-5 below.

Table 2-5: WFD waterbodies within the catchments of SA5 (catchments.ie, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f and 2018g)

Water catchment	Surface water			Groundwater	Number of waterbodies rated below moderate	
	Rivers	Transitional and Coastal	Lakes		Surface water	Groundwater
Lower Shannon (Brosna)	60	0	4	18	4	1
Lower Shannon (Little Brosna)	44	0	0	12	3	0
Lower Shannon (Lough Derg)	79	0	5	10	9	1
Upper Shannon (Suck)	58	0	1	8	6	0
Upper Shannon (Lough Ree)	18	0	9	6	4	0
Upper Shannon (Mid Shannon)	13	0	0	8	3	0
Galway Bay South East	33	29	6	17	7	3

Table 2-6 includes a summary of the 'at risk' waterbodies within the catchments of SA5. The predominant pressures, and the percentage of 'at risk' waterbodies impacted by them, are:

- Lower Shannon (Brosna): Hydromorphology (39%), Agriculture (29%) and Urban Wastewater Treatment Plants (23%);
- Lower Shannon (Little Brosna): Agriculture (53%), Hydromorphology (33%) and Urban Wastewater Treatment Plants (27%);
- Lower Shannon (Lough Derg): Agriculture (61%), Forestry (37%) and Hydromorphology (37%);
- Upper Shannon (Suck): Agriculture (48%) and Hydromorphology (38%);
- Upper Shannon (Lough Ree): Agriculture (44%) and Diffuse Urban Pressures (44%);
- Upper Shannon (Mid Shannon): Hydromorphology (67%) and Peat Drainage and Extraction (67%); and

- Galway Bay South East: Domestic Wastewater (39%), Agriculture (29%) and Urban Wastewater Treatment Plants (23%).

Table 2-6: Summary of ‘at risk’ waterbodies in the catchments of SA5 (catchments.ie, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f and 2018g)

WFD catchment	Surface water bodies identified as ‘at risk’			Groundwater bodies identified as ‘at risk’	Total
	Rivers	Transitional and Coastal	Lakes		
Lower Shannon (Brosna)	26	0	4	1	31
Lower Shannon (Little Brosna)	15	0	0	0	15
Lower Shannon (Lough Derg)	34	0	3	1	38
Upper Shannon (Suck)	20	0	1	0	21
Upper Shannon (Lough Ree)	8	0	1	0	9
Upper Shannon (Mid Shannon)	6	0	0	0	6
Galway Bay South East	19	4	3	5	31

To meet WFD objectives, it has been recognised that there is a need to prioritise and focus efforts to address issues. ‘Areas for Action’ within the sub-catchments of SA5 are listed in Table 2-7.

Table 2-7: Areas for Action within SA5 (catchments.ie, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f and 2018g)

Areas for Action	Number of waterbodies	Key reasons for selection
Gageborough - Lower Shannon (Brosna)	3	<ul style="list-style-type: none"> • Joint County project • Potential ‘quick wins’ • Headwaters to river Gageborough • Group water scheme in area • One deteriorated water body
Boora - Lower Shannon (Brosna)	2	<ul style="list-style-type: none"> • Bog project to examine potential for improvement by rewetting, in collaboration with Bord na Mona • Long term challenge • Area important for tourism

Areas for Action	Number of waterbodies	Key reasons for selection
Silver (Kilcormac) - Lower Shannon (Brosna)	4	<ul style="list-style-type: none"> Building on existing work completed by Offaly County Council. Build on works completed by Inland Fisheries Ireland, in conjunction with Bord na Mona Headwaters to a High Ecological Status objective water body Three potential 'quick wins' Group water scheme in the area One deteriorated water body
Clareen - Lower Shannon (Little Brosna)	2	<ul style="list-style-type: none"> Building on existing knowledge from works completed by Offaly County Council Manageable area Large Group water scheme in the area
Little Brosna_040 - Lower Shannon (Little Brosna)	1	<ul style="list-style-type: none"> Little Brosna_040 returned to 'good' status in 2010-2012 Sharavoge Bog is in the area (important raised bog) Riverstown drinking water abstraction in the area
Castlegar - Upper Shannon (Suck)	6	<ul style="list-style-type: none"> Building on proposed improvements at Mountbellew WWTP One deteriorated water body
Suck - Upper Shannon (Suck)	7	<ul style="list-style-type: none"> There is an MCPA issue at the drinking water abstraction on Suck_140. Need to rule out tributaries before entering the Suck to identify the sources of MCPA Two deteriorated waterbodies
Ballinure - Upper Shannon (Suck)	4	<ul style="list-style-type: none"> Recent deterioration Potential 'quick win' Manageable area
Jiggy/Hind - Upper Shannon (Lough Ree)	5	<ul style="list-style-type: none"> Building work completed by Roscommon County Council to address diffuse urban pollution Potential 'quick win' in the upper reaches of the sub catchment One deteriorated water body Headwaters flowing into Lough Rinn
Clooneigh - Upper Shannon (Lough Ree)	3	<ul style="list-style-type: none"> Manageable area to focus measures Two potential 'quick wins' Two deteriorated waterbodies Headwaters flowing into Lough Rinn
Radford - Galway Bay South East	2	<ul style="list-style-type: none"> Kilcolgan river ultimately flows into the Clarinbridge/Kinvarra shellfish area which failed to meet its protected area objectives Active community groups Two deteriorated waterbodies in the headwaters to the shellfish area

Areas for Action	Number of waterbodies	Key reasons for selection
		<ul style="list-style-type: none"> • Linked with sub catchment 29_9

2.2.2 Flood Risk

Flood risk is an important consideration, however, at this conceptual stage, it is not practicable to differentiate between options on the grounds of flood risk. This is because flood risk to a specific option can only be assessed in sufficient detail when the preferred site and given scope of works is known. Any options which are progressed and subject to planning permission will require a Flood Risk Assessment to be completed in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009).

2.3 Climate Change

Ireland's current 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).

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

- Mainstream Adaptation: That climate change adaptation is a core consideration and is mainstreamed in all functions and activities across the local authority. In addition, ensure that local authority is well placed to benefit from economic development opportunities that may emerge due to a commitment to proactive climate change adaptation and community resilience;
- Informed decision making: That effective and informed decision making is based on a reliable and robust evidence base of the key impacts, risks and vulnerabilities of the area. This will support long term financial planning, effective management of risks and help to prioritise actions;
- Building Resilience: That the needs of vulnerable communities are prioritised and addressed, encourage awareness to reduce and adapt to anticipated impacts of climate change, and promote a sustainable and robust action response; and
- Capitalising on Opportunities: Projected changes in climate may result in additional benefits and opportunities for the local area and these should be explored and capitalised upon to maximise the use of resources and influence positive behavioural changes.

In addition to these high-level aims, each local authority is required to identify the key risks to their area. These are provided in Table 2-8.

Table 2-8: Climate change risks identified by counties in SA5

County	Key risk areas
Galway (Galway County Council, 2019)	<ul style="list-style-type: none"> • Flood risk • Increased temperatures - Heatwaves and drought • Heavy rainfall events • Increased storm intensity • Changes to natural ecosystems • Ocean warming and acidification • Sea level rise and inundation
Laois (Laois County Council, 2019)	<ul style="list-style-type: none"> • Heatwave and drought conditions • Risk of bog, gorse or forest fires • Extreme wind events • Extreme rainfall • Extreme cold and snow events
Longford (Longford County Council, 2019)	<ul style="list-style-type: none"> • High temperatures - Heatwaves • Peat and forest fires • Flood risk • Increased intensity and frequency (in winter) of rainfall • Increased storm intensity
Offaly (Offaly County Council, 2019)	<ul style="list-style-type: none"> • Rising temperatures and drought • Wetter winters and drier summers • More intense rainfall and storm events • Increased flood risk
Roscommon (Roscommon County Council, 2019)	<ul style="list-style-type: none"> • Extreme rainfall • Strong wind • High Temperature - Drought • Low Temperature - Snowfall
North Tipperary (Tipperary County Council, 2019)	<ul style="list-style-type: none"> • Low level lands along rivers where fluvial flooding may increase • Bogs and peatlands that may be impacted by drought • Road Infrastructure in the upland areas
Westmeath (Westmeath County Council, 2019)	<ul style="list-style-type: none"> • Extreme rainfall • Flooding • Windstorms • High temperatures - Heatwaves • Drought • Combination events • Low Temperatures

In addition, Ireland has a sectoral climate adaptation plan for the 'Water Quality and Water Services Infrastructure' sector. A summary of the report's findings is included in Table 2-9.

Table 2-9: Summary of key point from the 'Water Quality and Water Services Infrastructure' sectoral climate change plan (Department of Housing, Planning and Local Government, 2019b)

Summary	
Key Points	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. For SA5, not all supplies within the Study Area meet the required levels of reserve capacity. As evidenced in the 2018 drought, there is the potential for this deficit to affect access to water in the future. This situation will further deteriorate over time due to climate change driven reductions in water resources.

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

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

2.4 Biodiversity, Flora and Fauna

2.4.1 Designated Sites

Within SA5 there are a number of European, national and locally designated sites, including Special Protected Areas (SPAs), Special Areas of Conservation (SACs), nature reserves, Natural Heritage Areas, and potential Natural Heritage Areas (see Table 2-10 and Figure 2-2). The European sites (SPAs and SACs), and potential impacts on them, are discussed in more detail in Appendix F.

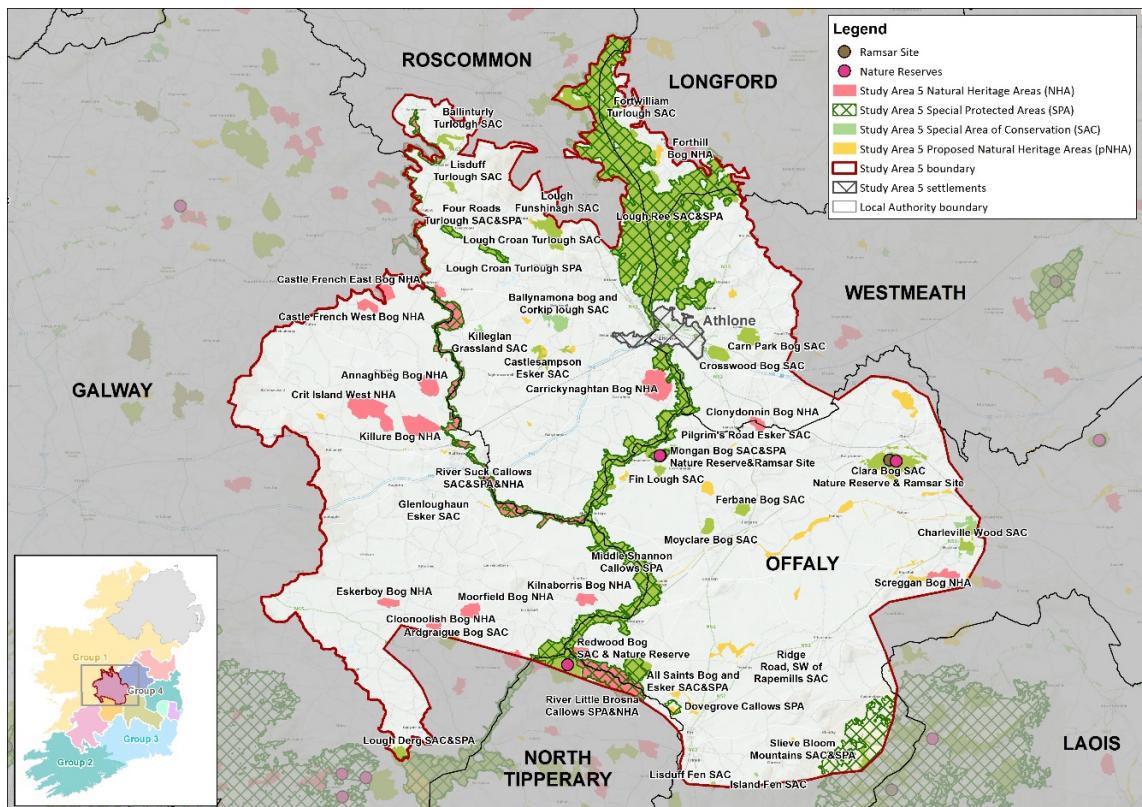


Figure 2-2: Designated sites in SA5

Table 2-10: Designated sites within SA5 (NPWS, 2019a)

Receptor	Name	Total number
Special Protected Area (SPA)	All Saints Bog SPA	11
	Dovegrov Callows SPA	
	Four Roads Turlough SPA	
	Lough Croan Turlough SPA	
	Lough Derg (Shannon) SPA	
	Lough Ree SPA	
	Middle Shannon Callows SPA	
	Mongan Bog SPA	

Receptor	Name	Total number
	River Little Brosna Callows SPA	
	River Suck Callows SPA	
	Slieve Bloom Mountains SPA	
Special Area of Conservation (SAC)	All Saints Bog and Esker SAC	31
	Ardgraigue Bog SAC	
	Ballinturly Turlough SAC	
	Ballynamona Bog and Corkip Lough SAC	
	Barroughter Bog SAC	
	Carn Park Bog SAC	
	Castlesampson Esker SAC	
	Charleville Wood SAC	
	Clara Bog SAC	
	Clonaslee Eskers and Derry Bog SAC	
	Crosswood Bog SAC	
	Ferbane Bog SAC	
	Fin Lough (Offaly) SAC	
	Fortwilliam Turlough SAC	
	Four Roads Turlough SAC	
	Glenloughaun Esker SAC	
	Island Fen SAC	
	Killeghan Grassland SAC	
	Lisduff Fen SAC	
	Lisduff Turlough SAC	
	Lough Croan Turlough SAC	
	Lough Derg, North-east Shore SAC	
	Lough Funshinagh SAC	
	Lough Ree SAC	
	Mongan Bog SAC	
	Moyclare Bog SAC	
	Pilgrim's Road Esker SAC	
	Redwood Bog SAC	
	Ridge Road, SW of Rapemills SAC	
	River Shannon Callows SAC	
	Slieve Bloom Mountains SAC	
Ramsar sites	Clara Bog	3
	Mongan Bog	

Receptor	Name	Total number
	Slieve Bloom Mountains	
Nature reserves	Clara Bog SAC	3
	Mongan Bog SAC	
	Redwood Bog SAC	
National Parks	N/A	0
Natural Heritage Areas (NHAs)	Annaghbeg Bog NHA	16
	Ballymacegan Bog NHA	
	Carricknaghtan Bog NHA	
	Castle Ffrench East Bog NHA	
	Castle Ffrench West Bog NHA	
	Clonydonnin Bog NHA	
	Cloonoolish Bog NHA	
	Crit Island West NHA	
	Eskerboy Bog NHA	
	Killure Bog NHA	
	Kilnaborris Bog NHA	
	Meeneen Bog NHA	
	Moorfield Bog NHA	
	River Little Brosna Callows NHA	
Proposed Natural Heritage Areas (pNHAs)	Screggan Bog NHA	58
	Suck River Callows NHA	
Proposed Natural Heritage Areas (pNHAs)	Shown in Figure 2-2	58

2.4.2 Habitats

Table 2-11 lists the percentage of the Study Area, and the number of hectares, covered by each habitat within SA5; as reported in the Corine land use dataset.

Table 2-11: Habitat areas for SA5 (EPA, 2018)

Habitat	Ha	% of Study Area
Agricultural land		
Pastures	176,592	68.01%
Land principally occupied by agriculture, with significant areas of natural vegetation	6,597	2.54%
Complex cultivation patterns	2,711	1.04%
Non-irrigated arable land	2,140	0.82%

Habitat	Ha	% of Study Area
Natural habitats		
Peat bogs	37,720	14.53%
Water bodies	10,871	4.19%
Inland marshes	4,438	1.71%
Water courses	696	0.27%
Natural grasslands	270	0.10%
Forest		
Transitional woodland-shrub	5,243	2.02%
Coniferous forest	3,710	1.43%
Mixed forest	3,265	1.26%
Broad-leaved forest	1,737	0.67%

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

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

2.4.3 Species

The key species and habitats of concern within the Study Area include:

- Otter;
- Bat species - Daubenton's bat along the waterways. The most common species in the Study Area are Common and Soprano pipistrelles and Leisler's bat;
- Fish species (Lamprey, Atlantic salmon and European eel);
- Waterbirds of 'qualifying interest' e.g. Brent goose and winter migratory waders;
- Other 'qualifying interest' bird species e.g. Peregrine falcon, Curlew and Kingfisher;
- Protected whorl snails (*Vertigo geyeri* (particularly high sensitivity to changes), *Vertigo angustior* and *Vertigo moulinsiana*);
- Fresh-water pearl mussel; and
- Freshwater white-clawed crayfish.

The key invasive species to consider for developing options within the Study Area include:

- Japanese knotweed;
- Himalayan balsam;
- Giant hogweed; and
- Elodea spp.

2.5 Material Assets

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

Some of the natural assets of SA5 are listed in Table 2-12, such as, agricultural land and bog areas.

Built assets include transport and communications infrastructure, and other developed areas, including existing water supply infrastructure (see Figure 2-3). These assets all need to be taken into account in new water resource developments.

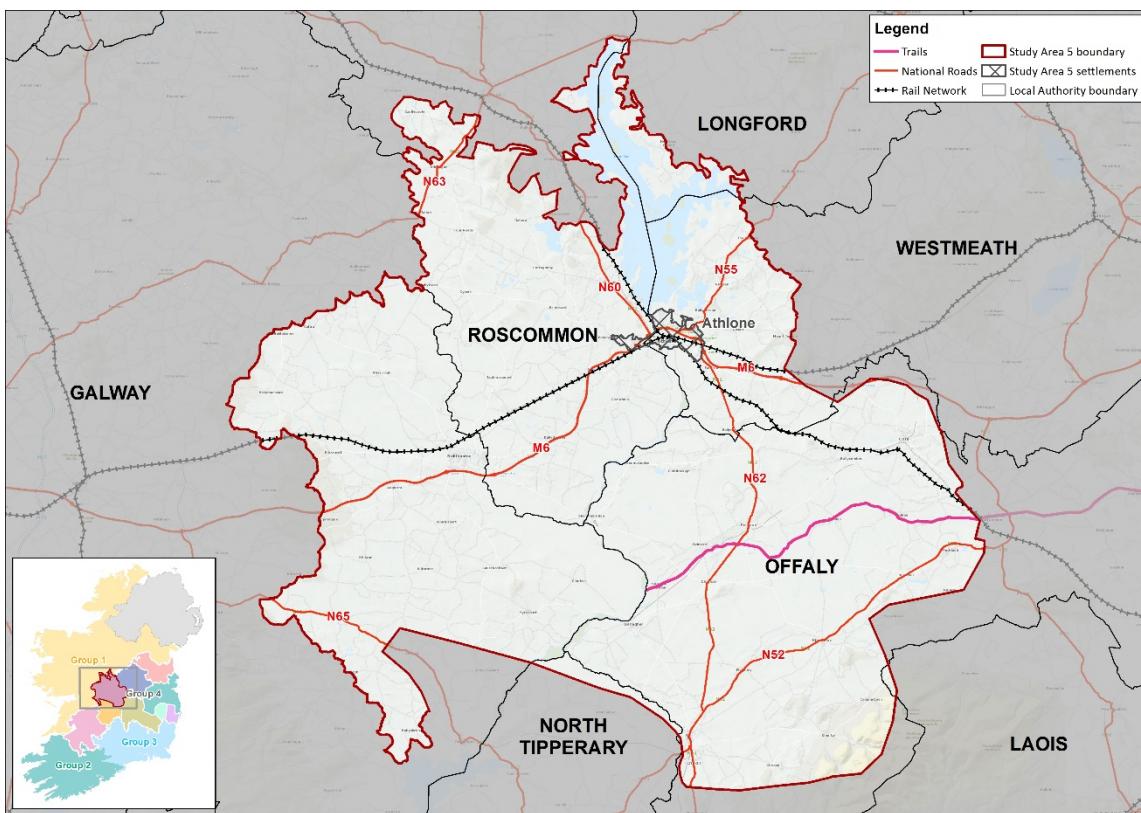


Figure 2-3: Transport infrastructure in SA5

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

Irish Water has seventeen WTPs in SA5, meeting the demand of 37.7 Ml/d in 2019.

Ireland's canals once played a significant role as a transport network; however, their primary use is now for recreational and heritage purposes. The key canal within SA5 is the Grand Canal.

There are no ports or airports of national or regional significance within SA5.

Other significant transport infrastructure includes the main road (particularly the M6 and N55) and rail network (Dublin Heuston - Galway, Dublin Heuston - Westport and Ballina, and Galway - Limerick).

Any new infrastructure considered for SA5 will need to take, existing and planned, land zoning and local development into consideration.

Table 2-12: Land use within SA5

Land use	Ha	% of Study Area	Comparison to overall Group 4 %
Agriculture	188,040	72.42%	75.80%
Urban	3,071	1.18%	3.70%
Forest	53,994	20.79%	10.35%
Natural habitats	13,954	5.37%	9.41%
Industry	606	0.23%	0.69%
Other	>1	>0.01%	0.06%

Table 2-13 gives an overview of the project developments in the Study Area which are available from myProjectIreland (2020).

Table 2-13: Proposed new developments

Development		
Life Sciences Innovation Hub and Soft Landing Space	Lissywollen, Athlone	Athlone Town Centre Regeneration and Enhancement
Portiuncula ward block	Athlone Sewerage Scheme	Athlone Tourism Cultural Quarter
Raheen, Clara	Loughanaskin	South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)
Athlone Institute of Technology STEM building		

2.6 Landscape and Visual Amenity

The National Landscape Strategy 2015-2025 is in the process of being implemented and will be Ireland's vehicle for complying with the EU Landscape Convention. Landscape assessment guidance is also available from the local authorities. This will be

taken into account when identifying landscape character areas and protected areas at the project level in the future.

The value of the landscape in SA5 is reflected in baseline data Sections 2.1.3 (Tourism and Recreation), 2.3 (Biodiversity, Flora and Fauna) and 2.8 (Cultural Heritage).

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

2.7 Air Quality and Noise

2.7.1 Air Quality

Air quality is monitored and managed using Air Quality Zones and air monitoring sites, the air quality index rating of the area within the Study Area is rated as 'good'.

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

2.7.2 Noise

The main areas that experience noise pollution are likely to be areas along the main roads, particularly around the M6 and N55.

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.

2.8 Cultural Heritage

Within SA5, there are 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) (see Table 2-14).

Figure 2-4 shows the location the individual cultural heritage records from the National Monuments Service and the NIAH. Given the number of small sites, these can be better viewed on the Department of Arts, Heritage and the Gaeltacht's (2020) 'Historic Environment Viewer' website.

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

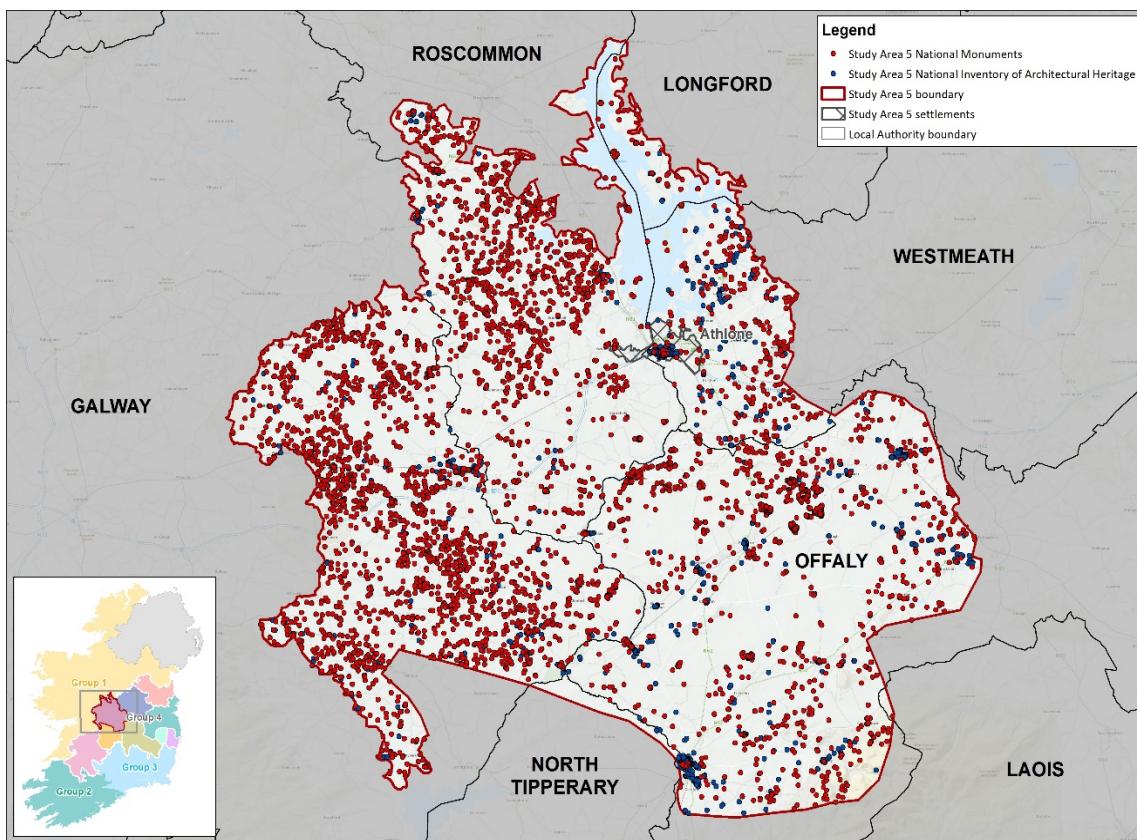


Figure 2-4: SA5 cultural heritage assets

Table 2-14: Cultural heritage assets within SA5

Assets	Total number
National Monuments Service sites	7,054
National Inventory of Architectural Heritage sites	1,707
Sites and Monuments Record Zones	2,755

2.9 Geology and Soils

Table 2-12 lists the land uses within SA5. SA5 has a wide variation of soil types, although there is a predominance of fine loamy soils and peat (EPA, 2019b).

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. The regionally and locally important aquifers with resource potential for SA5 are shown in Figure 2-5.

County Offaly forms part of the Central Lowland of Ireland, an area of low-lying rolling topography with higher ground at the Slieve Bloom Mountains. The higher topographic features have bedrock at, or close to, the surface. Most of the bedrock in County Offaly is masked by quaternary sediments and subsoils which form the irregular topographic features in the lowlands such as esker sand, gravel ridges and raised bogs. The

landscape of County Roscommon reflects the dominant underlying karstic carboniferous limestone and shales, much of it exposed as outcrop. This karst forms a key regionally important aquifer around the towns of Ballinasloe, Athlone and Tullamore.

Important geological and geomorphological sites could be conserved 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, 34 of which have the potential to constrain water resource options in SA5.

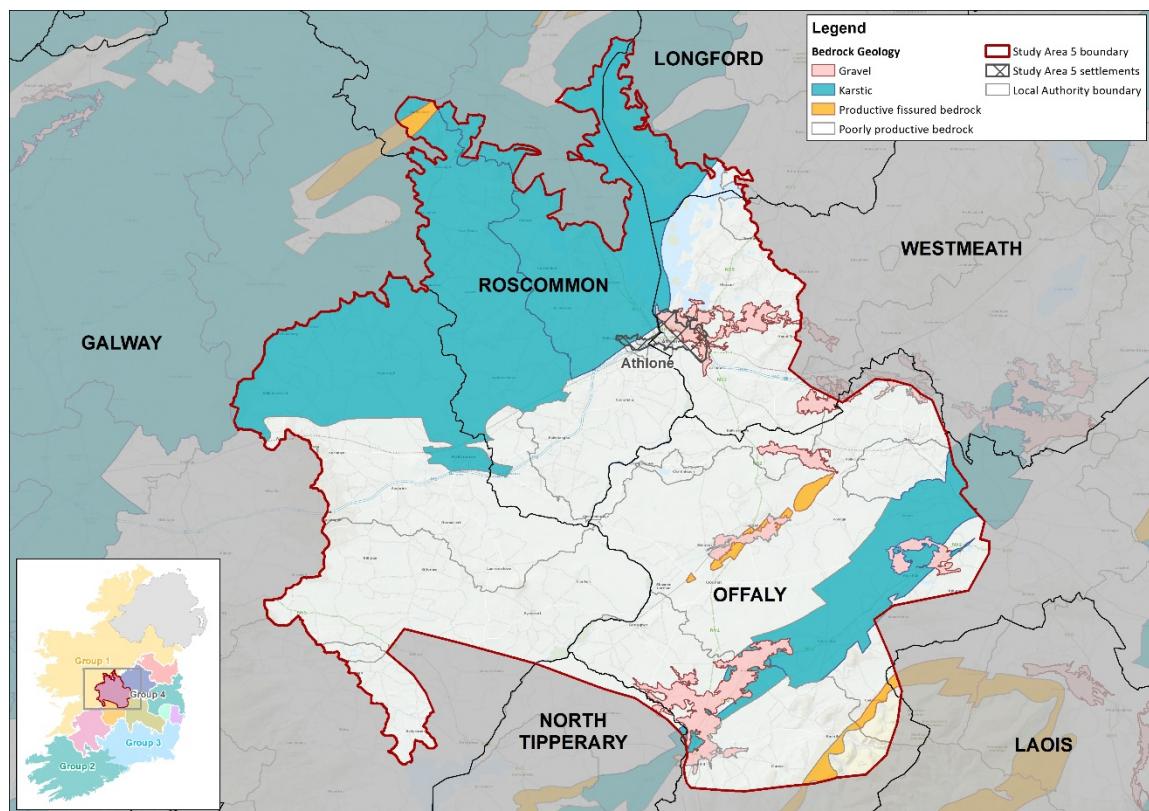


Figure 2-5: SA5 hydrogeology

2.10 Summary of Key Issues and Trends over the Plan Period

All aspects of the environment will need to be considered as individual schemes are taken forward for further design and implementation. However, the key issues relevant for strategic water planning identified within SA5 are listed in Table 2-15.

Table 2-15: Summary of key issues and trends over the plan period

SEA Topic	Issues and opportunities	Interrelated topics
Population, Economy, Tourism and Recreation, and Human Health	<p>Issues: Increasing population and the increased stress of climate change on water quality and water resources could affect health and well-being.</p> <p>Opportunities: Irish Water will put in place plans to assess water quality and measures to address risks as part of the Framework Plan.</p>	Climate Change, Water environment, Material Assets and Landscape and visual amenity

SEA Topic	Issues and opportunities	Interrelated topics
	<p>Irish Water has ongoing activities to improve the SDB in SA5, including, leakage management and water conservation measures.</p> <p>Raising awareness of the importance of water conservation and efficiency measures, and the value of the environment for health and wellbeing, can play an important part in water planning. Valuing access to environment for recreation.</p>	
Water Environment	<p>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. For SA5, some of the existing abstractions are potentially unsustainable in the medium term; specifically, during drought periods.</p> <p>Irish Water will need to update their sustainability analysis and impact on their baseline SDB calculations when regulatory assessments for new legislation are undertaken.</p> <p>Opportunities: To take account of identified pressure on the water environment in the selection of solutions for SA5.</p>	Biodiversity and climate change
Biodiversity, Flora and Fauna	Issues: For SA5, the majority of surface water sources are within designated areas, including the River Shannon Callows SAC, Lough Ree SAC/SPA, River Suck Callows SPA, Middle Shannon Callows SPA, and River Little Brosna Callows SPA. It is considered especially important to avoid the loss of irreplaceable or rare habitats and avoid increasing pressure on vulnerable species; potentially through direct or indirect land take, such as through increased abstraction pressure.	Water resources, water quality and climate change
Material Assets	<p>Issues: WTP assets and network infrastructure requiring improvement or replacement.</p> <p>Opportunities: Improvements to support reliability of access to good quality water.</p>	Health and Wellbeing
Landscape and Visual Amenity	Issues: Potential for climate change to affect land use and habitats and influencing landscape quality and amenity.	Biodiversity and geology and soils, climate change, health and well being
Air Quality and Noise	No specific issues identified for the baseline for SA5.	Health and well being
Climate Change	Issues: Climate change issues regarding sea level rise, flooding, extreme weather events and changes in seasonal weather patterns. Climate change has been taken into account in supply	Biodiversity and water environment

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

3

Environmental Assessment – Options Appraisal

3 Environmental Assessment – Options Appraisal

This Section provides a summary of the environmental assessment of options considered in the Study Area, including the option identification and screening process, and assessment of options used in approach development.

3.1 Overview

Irish Water applied their Options Appraisal Methodology to identify potential solutions to meet the needs identified in the SA5 WRZs.

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

The Draft Framework Plan options assessment methodology covers eight stages. Stages 1 and 2 are covered through the needs and baseline assessments addressed in Chapter 2 of this report. The key stages considered in this Chapter for SA5 are Stage 3-6:

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

3.2 Stage 3: Unconstrained Options

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

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

The application of these conservative abstraction standards to new options ensures that any new or increased abstractions from rivers are likely to support conservation objectives for the most sensitive environmental sites. For surface waterbodies, the allowable abstraction standard of 10% of Q95 has been applied, with the exception of waterbodies requiring 'High' status where a higher threshold of 5% of Q95 has been applied. Allowable abstraction standards for lakes are set at 50% of Q95 in line with this guidance (see the NIS of the Draft Framework Plan on application of the approach in relation to Appropriate Assessment).

Irish Water will have to reduce or remove their unsustainable existing abstractions over the next 5 to 25 years. At this stage, Irish Water will build this information into the SDB to ensure any considered options allow them to plan for a reduction of supply from these sources.

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.

3.3 Stage 4: Coarse Screening

A total of 97 unconstrained options were identified for SA5 and subject to coarse screening. The coarse screening process assessed the options against the criteria outlined in Table 3-1. This process is summarised in Chapter 9 of the SEA Environmental Report for the Draft Framework Plan. The process allows the assessment of the unconstrained options to eliminate any that will not be viable. The focus at this stage is on options that would be difficult to mitigate, those with likely significant effects on European or nationally important sites, or options likely to lead to deterioration of waterbody WFD status.

Table 3-1: Coarse screening assessment criteria

Criteria	Unconstrained Option Assessment Questions	
Resilience	Q1	Does the option address the supply-demand problem?
Deliverability and Flexibility	Q2	Is the option technically feasible?
	Q3	Can the risks and uncertainties associated with the option be mitigated to avoid failure of the option?
Sustainability (Environmental)	Q4	Can the impacts on known high level environmental constraints including at internationally designated sites be avoided?

Criteria	Unconstrained Option Assessment Questions	
and Social Impacts)		

Of the 97 unconstrained options, 37 were rejected after being analysed against the coarse screening criteria of resilience, deliverability and environment.

Environmental reasons for rejecting options were identified for four options. Table 3-2 provides an example option that was rejected on an environmental basis and not considered suitable to address the deficit for the WRZs located in SA5.

Table 3-2: Coarse screening rejection register

Option Ref.	Option Description	Rejection Reasoning
TG4-SA5-56	Increase abstraction from River Kinnitty and upgrade Birr WTP to supply deficit	It was determined that the sustainable allowable abstraction at this location is 0.27MI/d, not accounting for the existing abstraction. The deficit in the WRZ is approximately 1.3MI/d and could be greater, based on the calculated sustainable limits. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving 'good' WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

3.4 Stage 5: Fine Screening

A total of 60 options passed the coarse screening stage; these options were subject to further consideration as part of a multi-criteria assessment (MCA) at the fine screening stage.

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

The environmental criteria are based on the SEA objectives in the form of screening questions. These questions have been developed to allow the performance of each option to be assessed against the SEA objectives. The list of questions developed to assess the environmental and social effects of the options and general guidance on the MCA scoring for the fine screening is provided in Appendix A.

Summaries of the environmental assessment for options that passed the fine screening stage are grouped by option type and are included in Appendix C. These summaries combine the assessments against individual criteria to give an overall environmental

topic score; this overall score is based on the worst score across each of the topic's criteria.

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

At fine screening a further 5 options were rejected. Table 3-3 provides an example of an option that was rejected from the fine screening and not considered suitable to meet the needs identified for the WRZ located in SA5.

Table 3-3: Fine screening rejection register

Option Reference	Option Description	Rejection Reasoning
TG4-SA5-21	New connection point from Tuam Regional Water Supply Scheme connecting Ballinasloe	The option requires a significant length of pipeline of over 65km for a relatively small supply. Transferring small quantities of water over long distances can affect the quality of water. Therefore, as the WRZ is not in deficit and there were other viable options to address the needs in this WRZ, this option was not considered feasible at coarse screening stage.

3.5 Stage 6: Feasible Options List

A total of 55 options were included as feasible options and were taken forward for Approach Development. The next step was to use the information collected for the fine screening assessment to inform the development of approaches to resolve the SDB deficit within each WRZ and across the Study Area.

Further details of the feasible options identified for this Study Area are provided in the Case Study SA5 Technical Report.

4

Environmental Assessment – Approach Development

4 Environmental Assessment – Approach Development

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

4.1 Introduction to Approach Development

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

A SA combination is a way of configuring an option, or options, to meet either an SDB deficit or water quality requirements. As part of the Framework Plan, Irish Water considers six SA approaches, which are the combinations rated as the best within the six categories summarised in Table 4-1. This process contributes to assessment of alternatives to meet plan objectives. Consideration of reasonable alternatives is an important part of meeting SEA regulatory requirements. The terminology used to describe options/approaches at each spatial level of the Framework Plan is shown in Figure 4-1.

Table 4-1: The six SA approaches

SA Approaches Tested	Description	Policy Driver
Least Cost (LCo)	Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social costs and carbon.	Public Spending Code
Best Appropriate Assessment (Best AA) (BA)	Lowest score against the European Sites (Biodiversity) question. Options scoring -3 are given a high-risk score and better approaches for these options are identified where possible.	Habitats Directive
Quickest Delivery (QD)	Based on an estimate of project lead in time (including typical feasibility, consent and construction durations) as identified at Fine Screening. May be required for urgent Public Health issues.	Statutory Obligations under the Water Supply Act and Drinking Water Regulations
Best SEA Environmental (BE)	Best score across all environmental criteria focusing on sum of negative scores as the	SEA Directive and Water Framework Directive

SA Approaches Tested	Description	Policy Driver
	key indicator and also considering high-risk scores (-3 scores) and long term impacts.	
Most Resilient (MR)	Best resilience score against resilience criteria.	National Adaptation Plan
Lowest Carbon (LC)	Lowest embodied and operational carbon cost.	Sectoral Adaptation Change

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

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

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

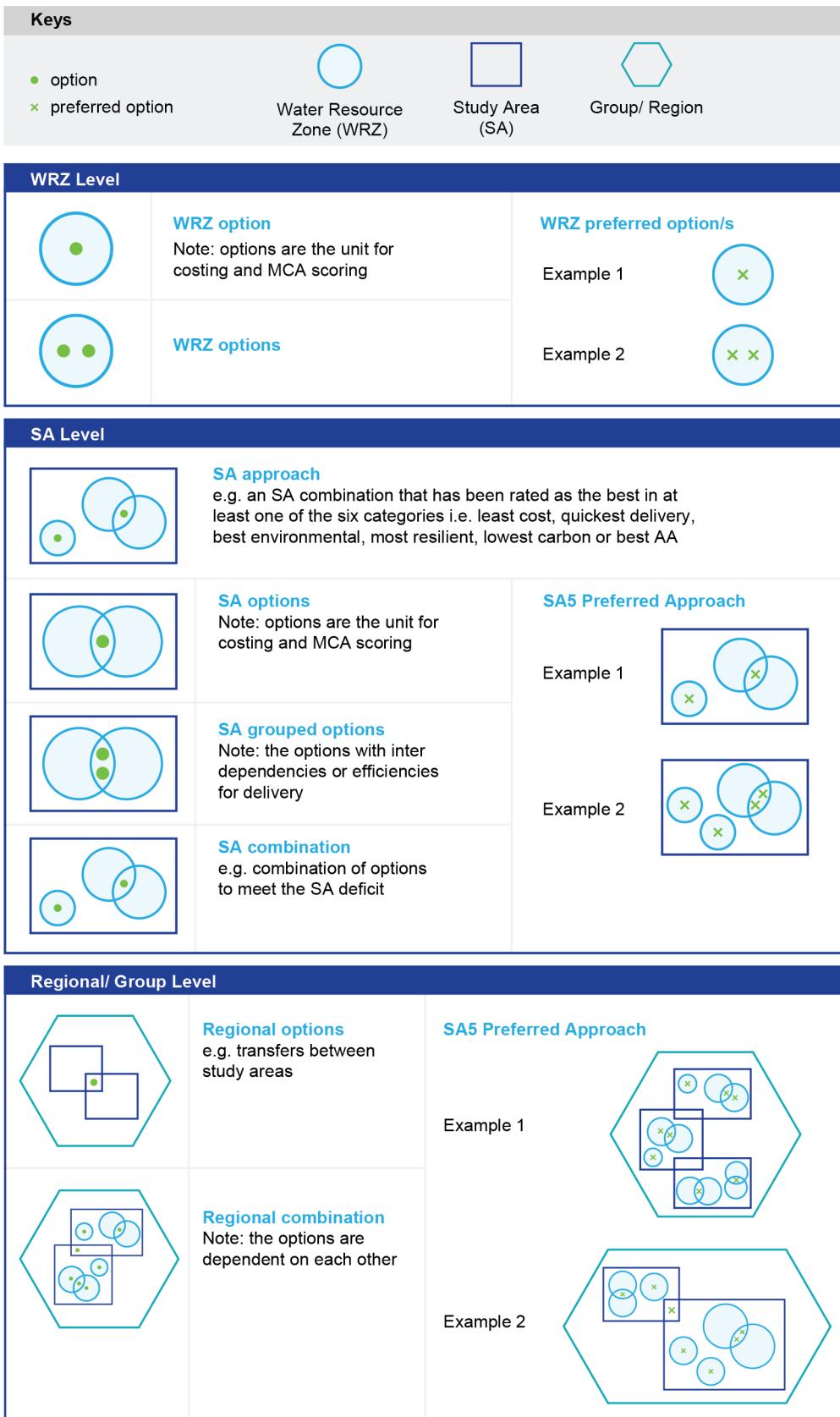


Figure 4-1: Approach development terminology

4.2 Stage 7: Approach Development Process

There are three stages in the Approach Development Process:

The **First Stage** is to compile the feasible options, or combination of options, that best conform with each of the six SA approach descriptions. For example, the option or combination of options that would be classified as the Lowest Carbon Approach, would be that with the lowest carbon cost, based on comparative outline design.

For the Best AA Approach, the scoring on the European Sites (Biodiversity) sub-criteria question refers to the possibility for Likely Significant Effects (LSEs). A Score of 0 equates to no LSEs. If an option is identified that meets the “Objectives of the Plan” and is assessed as having no potential impact on a European Site (zero or neutral score based on desktop assessment), it is automatically adopted as the Preferred Approach at WRZ level. Scores of -1 to -3 equates to LSEs being identified. Scores of -1 to -2 are LSEs that will not result in Adverse Effects on Site Integrity (AESI) with standard best practice project specific mitigation applied as these can be addressed with general/standard mitigation measures. Scores of -3 equates to LSEs that may be difficult to mitigate or where uncertainty remains.

Refer to Appendix E for the LSE Tables and Appendix F for the AESI Tables. Any option with a score of -1 to -3 is taken forward to AA (Stage 2 of the AA process) and assessed within the NIS for the Framework Plan.

The **Second Stage** in the Preferred Approach Development Process at Study Area level is to assess whether there are any SA options/grouped options that could replace WRZ approach options to improve the SA Preferred Approach.

The **Third Stage** assesses the approaches against each other using the 7 Step process applied at a multidiscipline workshop. This allows an initial assessment of the SA Preferred Approach for each WRZ within the Study Area individually. The seven step assessment is included in the SEA of the Framework Plan and the NIS for the Framework Plan.

4.2.1 Environmental assessment in the Approach Development process

Combinations of feasible options are identified to balance the water demand and predicted baseline supply and address the remaining deficit over the plan period. The Approach Development process allows Irish Water to compare and optimise the options against different elements to create a range of approaches capable of meeting the deficit.

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

Environmental and social costs: these were based on a natural capital/ ecosystems services framework and scoped to be relevant and achievable with the information

available and to add to, rather than duplicate, the qualitative environmental assessment of the options. This included:

- i. Climate regulation – woodland;
- ii. Traffic impacts – opportunity cost of time due to road congestion from roadworks;
- iii. Food – crops and livestock; and
- iv. Carbon emissions tonnes including embodied and operational carbon were also calculated and costed.

The approach for calculating elements i, ii and iii are explained in Appendix J.

Carbon emissions and tonnes and carbon costs are calculated alongside construction and operational costs.

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

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

The general process is illustrated in Figure 4-2 below.

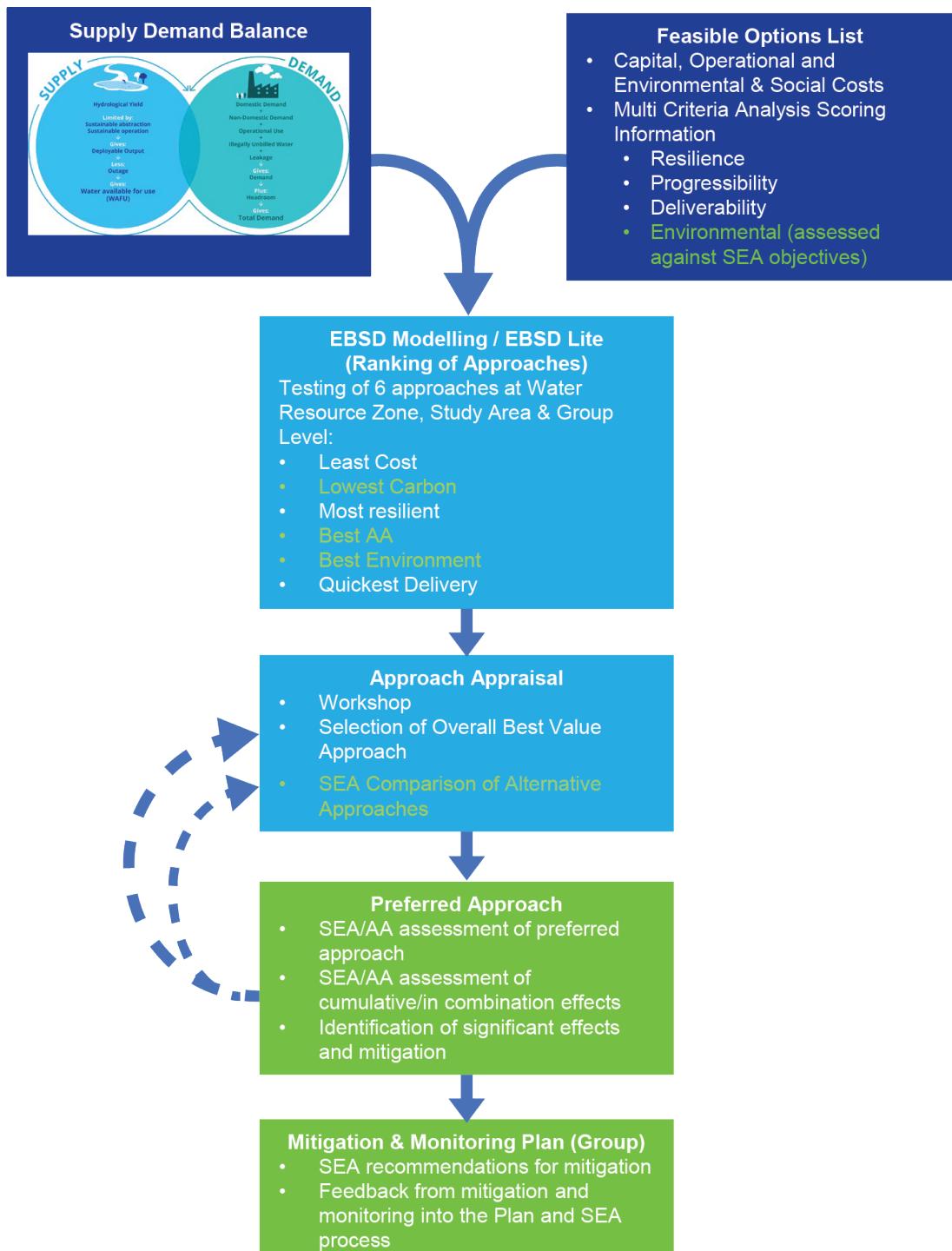


Figure 4-2: Approach development process

4.3 SA5 Approach Development Process

The approach appraisal process was undertaken through structured workshops involving relevant environmental expertise and information on the feasible options; including the environmental assessment against SEA criteria in the MCA and the option costings. This provides stepped testing of the six SA approaches to identify the best overall options at the WRZ, Study Area and Regional levels. The methodology applied to SA5 is detailed in the Case Study SA5 Technical Report.

The options that make up each SA approach are listed in Table 4-2.

Table 4-2: Study Area approach options

Options included	Do Minimum	SA Approach (Least Cost)	SA Approach (Best Appropriate Assessment)	SA Approach (Quickest Delivery)	SA Approach (Best Environment)	SA Approach (Most resilient)	SA Approach (Lowest Carbon)
SA grouped options	No options	SA grouped option 9 09b 51	SA grouped option 2 17c 39 45a	SA grouped option 15 04 42d SA grouped option 16 12b 19 27 30 36 41	SA grouped option 2 17c 39 45a	SA grouped option 15 04 42d SA grouped option 16 12b 19 27 30 36 41	SA grouped option 10 16 50a
WRZ options	No options	01 20 25 33 37b 67 75 75 80 81	01 13 25 33 67 75 80 81	37b 80 81	01 13 25 33 67 75 80 81	37b 80 81	01 20 25 33 37b 67 75 75 80 81

* all options are part of TG4-SA5 e.g. TG4-SA5-09b is shown as 09b above

Through comparing all the potential SA combinations, the best SA approach for each of the six categories was identified; these aligned as four SA approaches (see Table 4-3). The options within each of the six SA approaches are set out in Appendix D.

Table 4-3: Study Area approach categories

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

Table 4-4 includes a summary of the MCA scoring and cost information used in the approach development. The three stages were applied through a workshop with all of the background MCA and option costing information available for each option.

Key	Ranked order (best to worst)
Worst	Best

Table 4-4: Summary of the MCA scoring costing for the SA approaches*

Category Criteria	SA Approach 1 (LCo)	SA Approach 2 (BE, BA)	SA Approach 3 (QD, MR)	SA Approach 4 (LC)
Least Cost Score	Best		Worst	
Quickest Delivery Score			Best	Worst
Best AA Score	Two -3 Biodiversity Scores	No -3 Biodiversity Scores	Two -3 Biodiversity Scores	Two -3 Biodiversity Scores
Lowest Carbon Score			Worst	Best
Most Resilient Score			Best	Worst
Best Environmental Score		Best	Worst	

*Note these scores are subject to review and revision as part of developing the Regional plan and are presented here for illustration

4.4 Comparison of SA5 Approaches

An overall summary of the SA approaches identified for SA5 is provided below in Table 4-5, covering the main components of each SA approach. Table 5-6 provides an overview of the environmental scores and comparison of approaches based on the MCA.

Table 4-5: SA approach components summary

Infrastructure summary	Do Minimum	SA Approach 1 (LCo)	SA Approach 2 (BE, BA)	SA Approach 3 (QD, MR)	SA Approach 4 (LC)
New pipeline network (km)	0	22	45	153	22
New WTPs	0	1	1	0	1
Upgrade WTPs	0	13	11	5	11
New/upgraded abstractions	0	6	5	2	6
WTPs decommissioned	0	0	0	11	0
Abstractions abandoned	0	0	0	14	0
Service reservoirs	0	4	4	6	4
Storage reservoirs	0	0	0	0	0

A relative assessment of the four SA approaches based on the environmental option scores is summarised in Table 5-6 below. This covers:

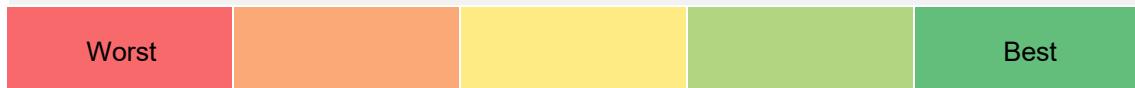
- Scores across the options summed for all the sub-criteria against each SEA objective topic heading;
- Total numbers of -3 scores representing higher risk of effect, or likely greater requirement for mitigation, against each SEA objective topic heading; and
- Indication of the extent of difference in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

Table 4-6: SA approach comparison summary*

Topic	Total no. of	SA Approach 1 (LCo)	SA Approach 2 (BE, BA)	SA Approach 3 (QD, MR)	SA Approach 4 (LC)	Range (difference between lowest and highest score)
Population, health, economy and recreation	-3 scores	No difference				0
	MCA score	Yellow	Green	Red	Yellow	-10
Water Environment: quality and resources	-3 scores	Red	Red	Green	Red	1
	MCA score	Red	Yellow	Green	Red	-6
Biodiversity, Flora and Fauna	-3 scores	Red	Green	Red	Red	3
	MCA score	Yellow	Yellow	Red	Green	-25
Material Assets	-3 scores	Green	Green	Red	Green	6
	MCA score	Yellow	Green	Red	Yellow	-14
Landscape and Visual	-3 scores	No difference				0
	MCA score	Orange	Green	Red	Green	-6
Climate Change	-3 scores	No difference				0
	MCA score	No difference				0
Culture, Heritage and Archaeology	-3 scores	No difference				0
	MCA score	No difference				0
Geology and Soils	-3 scores	No difference				0
	MCA score	Green	Green	Red	Green	-4

Key

MCA/No. of -3 scores against each criterion



* Note these scores are subject to review and revision as part of developing the Regional plan and are presented here for illustration

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

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

4.4.1 SA Approach 1 (LCo)

SA approach 1, key comparison points:

- Scored the best in the Least Cost category;
- Two -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 1 and SA approach 4 are very similar in terms of infrastructure development, the difference being the SA grouped options within them. For SA approach 1, SA grouped option 9 involves an increased abstraction from an existing surface water source, whereas for SA approach 4, SA grouped option 10 involves a new groundwater abstraction.

4.4.2 SA Approach 2 (BE, BA)

SA approach 2, key comparison points:

- Scored the best for the following categories: Best Environmental and Best AA categories;
- No -3 biodiversity scores (higher risk options that could impact on European sites); and
- Similar in terms of infrastructure development to SA approach 1 and SA approach 4. The main difference being that SA grouped option 2 (from SA approach 2) results in approximately double the pipeline length of the SA grouped options within SA approach 1 and SA approach 4. In addition, SA approach 2 has one less abstraction.

4.4.3 SA Approach 3 (QD, MR)

SA approach 3, key comparison points:

- Scored the best in the Quickest Delivery and Most Resilient categories;

- Two -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 3 is very different in terms of infrastructure development from any of the other SA approaches. The main differences are due to the SA grouped options within them. SA approach 3 contains SA grouped option 15 &16, which includes:
 - i. Over four times the length of pipeline required compared with any other SA approach;
 - ii. Extensive rationalisation leading to the decommissioning of 11 WTPs and 14 abstractions;
 - iii. Fewer upgrades to WTPs and no new WTP; and
 - iv. Fewer new/upgraded abstractions.

4.4.4 SA Approach 4 (LC)

SA approach 4, key comparison points:

- Scored the best in the Lowest Carbon category;
- Two -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 4 and SA approach 1 are very similar in terms of infrastructure development, the difference being the SA grouped options within them as explained above.

4.5 SA5 Approach Assessment Comparison

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

The SDB shows a current deficit, applying the level of service in the area with the corresponding requirements for reserves, indicating operation of supplies with an SDB ranging from -6,155 m³/d in 2019, to a projected maximum of -9,114 m³/d in 2044 during dry conditions under a ‘Do Minimum’ scenario. As a result, public water supplies in this area are vulnerable, particularly under drought conditions. In addition, there may be ongoing reliability issues with the supplies and the situation is expected to further deteriorate due to climate change driven reductions in water resources and increased demand growth within the area.

Table 4-7: Supply Demand Balance for SA5

WRZ Name	WRZ code	Population	Maximum Deficit m ³ /day	
			2019	2044
Athlone	3200SC0002	22,477	-3,068	-4,605

WRZ Name	WRZ code	Population	Maximum Deficit m ³ /day	
			2019	2044
South Roscommon (Lisbrock & Killelgan)	2600SC0006	13,920	-884	-1,594
Clara/Ferbane / Moyclare	2500SC0016	8,665	No Deficit	No Deficit
Ballinasloe Public Supply	1200SC0006	8,291	-1,080	-1,583
Birr / Kinnitty	2500SC0015	5,742	-220	-252
Mount Talbot/Four Roads	2600SC0001	3,711	No Deficit	-73
Rahan	2500SC0017	3,684	No Deficit	No Deficit
Banagher PWS	2500SC0001	3,492	No Deficit	No Deficit
Kilcormac PWS	2500SC0003	1,186	-175	-226
Ahascragh P.S.	1200SC0005	770	-728	-781

An overall assessment of the SA approaches considered and the 'Do Minimum' approach as a continuation of the current situation is provided in Table 4-8 below.

Table 4-8: Assessment of the SA approaches and the 'Do Minimum' approach*

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

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

The overall assessment of the approaches against the SEA objectives indicates that SA approach 2 is likely to have lower biodiversity impacts and climate change resilience effects compared with SA approach 1; identified as the Preferred Approach. Mitigation for the Preferred Approach is identified in Section 5 through the individual options assessment and the Section 6 cumulative assessment. General AA and SEA mitigation is also included in Appendix H and Appendix I respectively. All the approaches address the identified water supply quantity and quality requirements to secure a level of service important for public health and wellbeing compared with the 'Do Minimum'.

4.6 Selection of the SA Preferred Approach

SA approach 1 has been selected as the best performing approach overall across the different categories.

The SA Preferred Approach includes two -3 Biodiversity score options. For such options, mitigation in the form of avoidance is provided for within the Plan, for example, should potential adverse effects on European sites be identified at the project level from such an option, the Plan will have identified other options that could be progressed at the project level if required. Summarised in Table 4-9 below, are all of the Preferred Approach options where a -3 Biodiversity score was identified with other options that could be progressed at project level should the current -3 Biodiversity score Preferred Approach option have potential for AESI (identified at the project level). SA grouped option 2 (from SA approach 2) has been identified as a potential alternative, where no -3 Biodiversity scores have been identified.

The approach for mitigation in the form of avoidance is provided in Appendix H, for example, should potential adverse effects on European sites be identified at the project level from a given option/SA Preferred Approach, other options¹ are identified that could be progressed at the project level if required. Therefore, no project arising from the Framework Plan with AESI identified at the project stage, would be progressed. This process is covered in detail in the NIS of the Framework Plan.

Table 4-9: Summary of SA5 Preferred Approach Options with -3 Biodiversity Scores

Preferred Approach taken forward with '-3 biodiversity scores'	Other options/combinations that could be progressed at project level if potential for AESI identified from Preferred Approach
Athlone/South Roscommon (SA grouped option 9)	SA Approach 2 (SA grouped option 2)
Mount Talbot/Four Roads (TG4-SA5-37b)	SA Approach 2 (SA grouped option 2)

¹ These options may not have progressed as the Preferred Approach initially as they may have scored significantly worse against other environmental, resilience or feasibility criteria (e.g. the best AA approach may identify an option that results in four times more carbon being produced or is twice as expensive).

5

SA5 Preferred Approach: SEA Assessment

5 SA5 Preferred Approach SEA Assessment

5.1 SA5 Preferred Approach Options

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

The SA Preferred Approach consists of WRZ options for all of the WRZs in the Study Area, primarily driven by the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For two of the larger demand areas, Athlone and South Roscommon RWSS, the SA Preferred Approach involves increasing the existing abstraction on the River Shannon at Lough Ree and improving the interconnection between these two neighbouring WRZs. The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, along with increased surface water abstractions.

Table 5-1 gives a breakdown of the options in SA5 and the abstractions associated.

Table 5-1: Preferred Approach breakdown

WRZ Name and Option Reference	Option Description	Abstraction / Demand
TG4-SA5-01 1200SC0005 Ahascragh	<p>Increase GW abstraction for Ahascragh WRZ to supply deficit</p> <ul style="list-style-type: none">• Increase GW abstraction to meet WRZ future deficit (DYCP 2044)• Suck South GWB WFD status 2013-2018 – Good	1,687 m ³ /d (+1,149 m ³ /d)
TG4-SA5-09b (SA grouped option 9) 3200SC0002 Athlone	<p>Upgrade Athlone WTP to 18M/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm</p> <ul style="list-style-type: none">• SA grouped option (9) involving increased SW abstraction from River Shannon and upgrade of Athlone WTP to meet Athlone WRZ deficit, and interconnection to South Roscommon (Lisbrick & Killelgan) WRZ to meet deficit	16,734 m ³ /d (+4,978 m ³ /d)
TG4-SA5-20 1200SC0006 Ballinasloe	<p>New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)</p> <ul style="list-style-type: none">• New GW abstraction to meet WRZ deficit (DYCP 2044)• WRZ current supply sources to be maintained - 2no. SW abstractions (River Suck and Bunowen River)• Current SW sources: River Suck WB (SUCK_140) WFD status 2013-2018 – Moderate; Bunowen River WB(AHASCRAHG_040) – Good	6,831 m ³ /d (+2,477 m ³ /d)

WRZ Name and Option Reference	Option Description	Abstraction / Demand
	<ul style="list-style-type: none"> • New GW (Suck South GWB) WFD status 2013-2018 - Good 	
TG4-SA5-25 2500SC0015 Birr/Kinnitty	<p>Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity</p> <ul style="list-style-type: none"> • Increase SW abstraction to meet WRZ deficit (DYCP 2044) • Camcor River WB (CAMCOR_050) WFD status 2013-2018 – Good 	3,243 m ³ /d (+676 m ³ /d)
TG4-SA5-33 2500SC0003 Kilcormac	<p>Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP</p> <ul style="list-style-type: none"> • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Tullamore GWB WFD status 2013-2018 – Good 	713 m ³ /d (+381 m ³ /d)
TG4-SA5-37b 2600SC0001 Mount Talbot/ Four Roads	<p>Increase GW abstraction at Mount Talbot Spring to supply deficit</p> <ul style="list-style-type: none"> • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Suck South GWB WFD status 2013-2018 – Good 	3,460 m ³ /d (+526 m ³ /d)
TG4-SA5-51 (SA grouped option 9) 2600SC0006 South Roscommon (Lisbrock & Killeglan)	<p>Upgrade Athlone WTP to 18MI/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm</p> <ul style="list-style-type: none"> • SA grouped option (9) involving increased SW abstraction from River Shannon and upgrade of Athlone WTP to meet Athlone WRZ deficit, and interconnection to South Roscommon (Lisbrock & Killeglan) WRZ to meet deficit • Current GW (Suck South GWB and Funshinagh GWB) WFD status 2013-2018 - Good • Athlone source River Shannon WB (SHANNON (Upper) _120) WFD status 2013-2018 – Poor 	8,942 m ³ /d (+2,764 m ³ /d)
TG4-SA5-67 2500SC0016 Clara/Ferbane	<p>No deficit. Upgrade WTP to address WQ issues.</p> <ul style="list-style-type: none"> • Gageborough River WB (BROSNA_080) WFD status 2013-2018 – Good • WRZ not in deficit, option to upgrade WTP for WQ issues 	N/A
TG4-SA5-75 2500SC0017 Rahan	<p>No deficit. Upgrade WTP to address WQ issues.</p> <ul style="list-style-type: none"> • Tullamore GWB WFD status 2013-2018 – Good • WRZ not in deficit, option to upgrade WTP for WQ issues 	N/A
TG4-SA5-80 2500SC0001 Banagher	<p>No deficit. Upgrade Banagher WTP to address WQ issue</p> <ul style="list-style-type: none"> • WRZ not in deficit, option to upgrade Banagher WTP for WQ issues • WTP supplied by SW abstraction from River Shannon • River Shannon abstraction WB (SHANNON (LOWER)_010) WFD status – Unassigned but Poor immediately downstream 	N/A

WRZ Name and Option Reference	Option Description	Abstraction / Demand
TG4-SA5-81 2500SC0001 Banagher	<p>No deficit. No deficit. Upgrade Clontotin WTP to address WQ issue</p> <ul style="list-style-type: none"> WRZ not in deficit, option to upgrade Clontotin WTP for WQ issues WTP supplied by GW abstraction (2no. BHs) GW abstraction (Banagher GWB) WFD status – Good 	N/A

The SA Preferred Approach options are shown in Figure 5-1, in relation to key environmental designations.

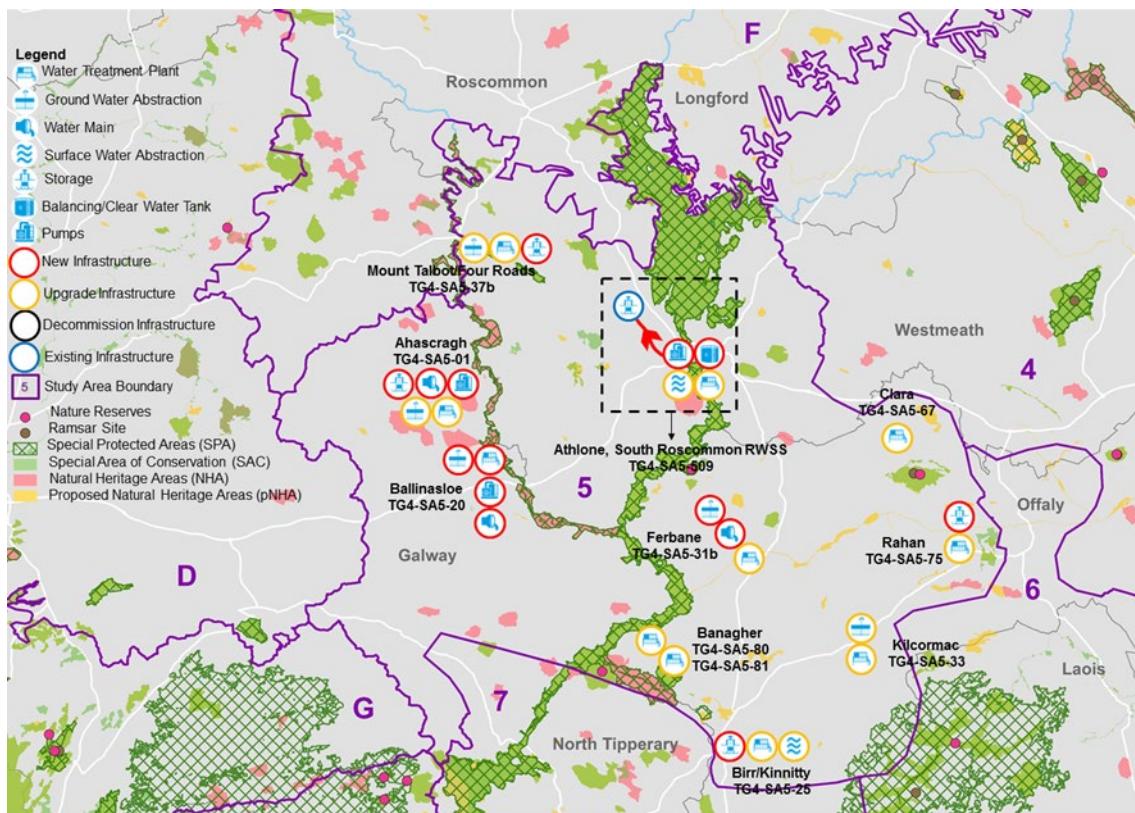


Figure 5-1: SA Preferred Approach and key environmental designations

The SA Preferred Approach options have each been assessed against the SEA objectives, taking account of construction and operational phases, long term and short term, permanent and temporary, and indirect and direct impacts. Mitigation requirements to avoid or reduce effects have also been taken into consideration. Table 5-2 provides a breakdown of the infrastructural components and Table 5-3 provides an assessment summary of the options included in the SA Preferred Approach.

Table 5-2: Component table

Options	New / refurbished pipeline	New WTP	Upgrade WTPs	New / upgraded abstractions	WTPs decommissioned	Abstractions abandoned	Service reservoirs	Storage reservoirs
TG4-SA5-01	✓	-	✓	✓	-	-	✓	-
TG4-SA5-09b								
TG4-SA5-51 (SA grouped option 9)	✓	-	✓	✓	-	-	✓	-
TG4-SA5-20	✓	✓	-	✓	-	-	-	-
TG4-SA5-80	-	-	✓	-	-	-	-	-
TG4-SA5-81	-	-	✓	-	-	-	-	-
TG4-SA5-25	-	-	✓	✓	-	-	✓	-
TG4-SA5-67	-	-	✓	-	-	-	-	-
TG4-SA5-33	-	-	✓	✓	-	-	-	-
TG4-SA5-37b	-	-	✓	✓	-	-	✓	-
TG4-SA5-75	-	-	✓	-	-	-	✓	-

Table 5-3: Options assessment summary*

Option ID	Option Description	Phase	Protect public health and promote wellbeing (P1, P2, P3)	Protect and enhance biodiversity and contribute to resilient ecosystems (B1, B2, B3, B4 and B5)	To protect landscapes, townscapes and visual amenity (L1)	Protect and where appropriate enhance, built and natural assets and reduce waste (M1 and M2)	Reduce greenhouse gas emissions (C1)	Contribute to environmental climate change resilience (R1, R2 and R5)	Protect and improve surface water and groundwater status (W1, W2 and W3)	Avoid flood risk (W5)	Protect and where appropriate, enhance cultural heritage assets (CH1)	Protect quality and function of soils (G1)
TG4-SA5-01	Increase GW abstraction for Ahascragh WRZ to supply deficit	Construction	-	-	-	-	-	0	0	0	-	-
		Operation	+	-	0	-	-	-	-	0	0	0
TG4-SA5-20	New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)	Construction	-	-	-	-	0	-	-	-	-	-
		Operation	+	0	-	0	0	-	-	-	0	0
TG4-SA5-80	No deficit. Upgrade Banagher WTP to address WQ issue	Construction	-	-	-	0	0	+	0	0	0	0

Option ID	Option Description	Phase		Protect public health and promote wellbeing (P1, P2, P3)	Protect and enhance biodiversity and contribute to resilient ecosystems (B1, B2, B3, B4 and B5)	To protect landscapes, townscapes and visual amenity (L1)	Protect and where appropriate enhance, built and natural assets and reduce waste (M1 and M2)	Reduce greenhouse gas emissions (C1)	Contribute to environmental climate change resilience (R1, R2 and R5)	Protect and improve surface water and groundwater status (W1, W2 and W3)	Avoid flood risk (W5)	Protect and where appropriate, enhance cultural heritage assets (CH1)	Protect quality and function of soils (G1)	
		Operation	+	0	0	0	0	0	0	0	0	0	0	0
TG4-SA5-81	No deficit. Upgrade Clontotin BH to address WQ issue	Construction	-	-	-	0	0	0	0	0	0	0	0	0
		Operation	+	0	0	0	0	0	0	0	0	0	0	0
TG4-SA5-25	Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity	Construction	-	-	0	-	-	0	0	0	0	-	-	-
		Operation	0	-	0	-	-	-	-	-	0	0	0	0
TG4-SA5-67	No deficit. Upgrade WTP to address WQ issues.	Construction	-	-	0	0	0	+	0	0	0	0	0	0

Option ID	Option Description	Phase	Protect public health and promote wellbeing (P1, P2, P3)	Protect and enhance biodiversity and contribute to resilient ecosystems (B1, B2, B3, B4 and B5)	To protect landscapes, townscapes and visual amenity (L1)	Protect and where appropriate enhance, built and natural assets and reduce waste (M1 and M2)	Reduce greenhouse gas emissions (C1)	Contribute to environmental climate change resilience (R1, R2 and R5)	Protect and improve surface water and groundwater status (W1, W2 and W3)	Avoid flood risk (W5)	Protect and where appropriate, enhance cultural heritage assets (CH1)	Protect quality and function of soils (G1)
		Operation	+	0	0	0	0	0	0	0	0	0
TG4-SA5-33	Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP	Construction	-	-	-	-	0	0	0	0	0	0
		Operation	++	-	0	0	0	--	-	0	0	0
TG4-SA5-37b	Increase GW abstraction at Mount Talbot Spring to supply deficit	Construction	-	-	-	-	-	-	0	0	-	-
		Operation	+	-	0	-	-	-	-	0	0	0
TG4-SA5-75	No deficit. Upgrade WTP to address WQ issues.	Construction	-	-	-	0	0	0	0	0	0	0

Option ID	Option Description	Phase		Protect public health and promote wellbeing (P1, P2, P3)	Protect and enhance biodiversity and contribute to resilient ecosystems (B1, B2, B3, B4 and B5)	To protect landscapes, townscapes and visual amenity (L1)	Protect and where appropriate enhance, built and natural assets and reduce waste (M1 and M2)	Reduce greenhouse gas emissions (C1)	Contribute to environmental climate change resilience (R1, R2 and R5)	Protect and improve surface water and groundwater status (W1, W2 and W3)	Avoid flood risk (W5)	Protect and where appropriate, enhance cultural heritage assets (CH1)	Protect quality and function of soils (G1)
		Operation	+	0	0	0	0	0	0	0	0	0	0
SA grouped option 9 (TG4-SA5-09b and TG4-SA5-51)	Upgrade Athlone WTP to 18M/l/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm	Construction	-	-	-	-	-	-	0	0	0	0	-
		Operation	++	-	0	-	-	-	-	-	-	0	0

*Note these scores are subject to review and revision as part of developing the Regional plan and are presented here for illustration

5.2 Additional Measures

In addition to the SA Preferred Approach supply options, Irish Water is already implementing measures across the three pillars of Lose Less, Use Less and Supply Smarter to improve the level of service to their customers in this Study Area. These are described in the Case Study SA5 Technical Report and include leakage reduction and water conservation.

5.2.1 Leakage Reduction



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

- Ongoing leakage management including active leakage control, pressure management, and find and fix activities to offset Natural Rate of Leakage Rise; and
- Further net leakage reductions, to move towards achieving the national SELL target by 2034, in the WRZs: Ahascragh P.S., Ballinasloe Public Supply, Rahán and Athlone.

5.2.2 Water Conservation



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

5.3 Interim Measures

The Case Study SA5 Technical Report identifies potential interim measures that may be required to address water treatment issues at existing water treatment plants. These are expected to be small scale, within site works and are not likely to give rise to significant environmental effects. However, they would need to be subject to relevant assessments, including AA screening as and when they are required.

5.4 Approach Uncertainty and Adaptability

A summary of the adaptability criteria and sensitivity analysis Irish Water have undertaken for the SA5 Preferred Approach is provided in the Case Study SA5

Technical report. A high-level assessment of what this could mean for the SEA is shown in Table 5-4.

Table 5-4: SA5 sensitivity analysis and environmental impacts

Uncertainty	Likelihood	Increase / Decrease in Deficit	Environmental Impacts relative to assessment of Preferred Approach Key: Green - positive Amber - negative
Sustainability	Moderate	+197 m ³ /d	<p>The impact of sustainability reductions would reduce the volumes that can be abstracted from Irish Water's existing sources; therefore, increasing the SDB deficit.</p> <p>Irish Water's outline sustainability assessments would mean a potential increase in deficit for SA5 based on reductions in the sustainable abstraction amounts from the Gageborough River (197 m³/day), affecting the Clara Ferbane WRZ.</p> <p>As this WRZ currently shows no deficit, feasible options would have to be considered if a sustainability issue is confirmed for the Gageborough River.</p>
			<p>The SA Preferred Approach addresses reduction, although additional sustainability reductions could add pressure for additional supply from outside the Study Area.</p>
Climate Change	High (international climate change targets have not been met)	+1 MI/d	<p>Higher climate change scenarios would impact Irish Water's existing supplies and result in decreased water availability at certain times of year.</p> <p>Although the likelihood of this scenario is high based on climate change adaptation to date, potential impacts may be mitigated by optimising Irish Water's operations on a more environmentally sustainable basis across the range of supplies.</p>
			<p>Potential for additional abstraction pressure unless optimisation can address.</p>
Demand Growth	Low/Moderate (growth has been based on policy)	-200 m ³ /d	<p>The impact of lower than expected growth would reduce the SDB deficit and the overall need requirement.</p> <p>The SDB deficit is spread across 10 individual WRZs and is driven by quality and quantity issues. In this rural area, growth is relatively low. However, there</p>

Uncertainty	Likelihood	Increase / Decrease in Deficit	Environmental Impacts relative to assessment of Preferred Approach Key: Green - positive Amber - negative
			are large growth centres such as Carlow Town and Portlaoise.
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements
Leakage Targets	Moderate (the distribution network in the region is extensive at approx. 1,100 kilometres)	+3,790 m ³ /d	<p>The impact of lower than expected leakage savings would increase the SDB deficit and the overall need requirement.</p> <p>Due to the length and condition of Irish Water's networks, Irish Water could potentially fail to achieve target leakage reductions within the timeframes set out. However, as Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets of approximately 3.8Ml/d across SA5's WRZs, as opposed to accepting lower targets.</p>
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements
	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	-200 m ³ /d	<p>Increased leakage savings beyond SELL would reduce the SDB deficit and the overall need requirement.</p> <p>This could increase carbon and the effects of abstraction pressure on the environment</p>

6

SEA Cumulative Effects for SA5 Preferred Approach

6 SA5 SEA Cumulative Effects

Secondary, cumulative and the synergistic nature of the effects of the SA5 Preferred Approach proposals are required to be considered as part of SEA. These include:

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

Cumulative effects are also considered for the proposals across the nine Study Areas within Region/Group 4 and reported in the SEA Environmental Report of the Framework Plan.

6.1 Cumulative Effects ‘Within Plan’ for SA5

The potential ‘within plan’ cumulative effects for SA5 are considered at the following different levels:

- Option level: Identification of mutually exclusive or dependent options – this was considered through the options screening and approach development process;
- SA approaches: Cumulative effects are taken into account in the selection of approaches for key aspects such as abstraction from the same waterbody through the sustainability rules applied for abstractions (see Section 3.2);
- SA Preferred Approach: The combined effect of options within the SA Preferred Approach – these are addressed in this Section; and
- Group/Region 4 level: Considering combined effects from proposals in the nine Study Areas (see the SEA Environmental Report of the Framework Plan).

For cumulative effects to occur, there needs to be an overlap of temporal periods. For example, two schemes being constructed at the same time could result in cumulative traffic movements, while two schemes being operated together could result in additional drawdown of groundwater levels. A precautionary approach has been taken for the cumulative effects assessment, which assumes that all options could be constructed at the same time and then all options would be operated at the same time (Table 6-1).

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

- Biodiversity – for example, a cumulative loss of habitats or changes to a habitat’s quality through changes in water quality or groundwater levels;
- Water environment (surface water and groundwater WFD status) – for example, changes to water flow due to combined abstraction pressure;
- People and health – for example, disruption due to multiple construction works taking place at the same time;

- Landscape and visual – for example, if there are a number of options located close together that could alter the landscape character or views; and
- Climate change – combined carbon emissions for the approach as a whole have been considered through the approach selection process and are also reported here to identify potential requirements for mitigation. Combined effects on climate change adaptation are also considered.

6.1.1 Cumulative Effects during Construction

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

Table 6-1: Potential in-combination effects between preferred options in SA5

Keys													
		Construction Phase	Operation Phase	Construction and Operation	Suck	Shan	N52	TG4-SA5-20	TG4-SA5-25	TG4-SA5-33	TG4-SA5-37b	TG4-SA5-75	
Preferred Approach	TG4-SA5-01	TG4-SA5-20	TG4-SA5-80	TG4-SA5-81	TG4-SA5-81	TG4-SA5-67	TG4-SA5-33	TG4-SA5-37b	TG4-SA5-75	TG4-SA5-33	TG4-SA5-37b	TG4-SA5-75	
SA grouped option 9 (TG4-SA5-51 and TG4-SA5-09b)													
TG4-SA5-75						N52	N52						
TG4-SA5-37b													
TG4-SA5-33													
TG4-SA5-67													
TG4-SA5-25													
TG4-SA5-81				Shan									
TG4-SA5-80													
TG4-SA5-20	Suck												

There could be cumulative effects associated with construction, in terms of traffic, noise and dust, for the options located around the N52 near Rahan (indicated by N52 in Table 6-1) and also for the options located around Athlone and Ballinasloe. These could be mitigated by standard mitigation measures such as planning of construction traffic

routes and movements and engaging with local residents about the disruption. With these standard good practice measures in place, there are unlikely to be significant cumulative effects.

There could be cumulative effects during construction associated with options located around the River Suck Callows SPA and the River Shannon Callows SAC. These are both designated for their wetland habitats and bird species. Cumulative construction works within the river valley could affect water quality through increasing surface water run off or increasing the risk of pollution during works. However, these can be managed by standard good practice mitigation, such as having buffers along the edge of the river and having an emergency plan in place during construction. With these standard good practice measures in place, there are unlikely to be significant cumulative effects. The impacts on the European designations has been assessed as part of the AA and the results are summarised in Section 10 of this report.

6.1.2 Cumulative Effects during Operation

There could be cumulative effects during operation for the options located around the River Suck Callows SPA and the group of options around the N52 at Rahan due to the additional groundwater abstraction, see Figure 6-1 for the Preferred Approach abstractions in SA5.

The potential for cumulative effects on groundwater bodies have been considered in hydrogeological assessment of the groundwater abstractions (AWN, 2020). This study concludes that all four of the WFD groundwater bodies affected by abstractions have a good quantitative status, therefore, the likelihood of affecting their WFD objectives is low and no interaction was identified with existing Irish Water abstractions.

There could also be cumulative effects in terms of carbon across the SA Preferred Approach. The whole life carbon estimate (including construction and operation) for the SA Preferred Approach is to be determined. 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. Mitigation for carbon emissions could include sourcing energy from renewable sources and improving energy efficiency. This could be undertaken alongside leakage reduction and campaigns to raise awareness of measures to reduce water consumption (which in turn would reduce energy consumption). This could include the promotion of water efficient devices and working with planning authorities and developers to encourage new development to be water efficient.

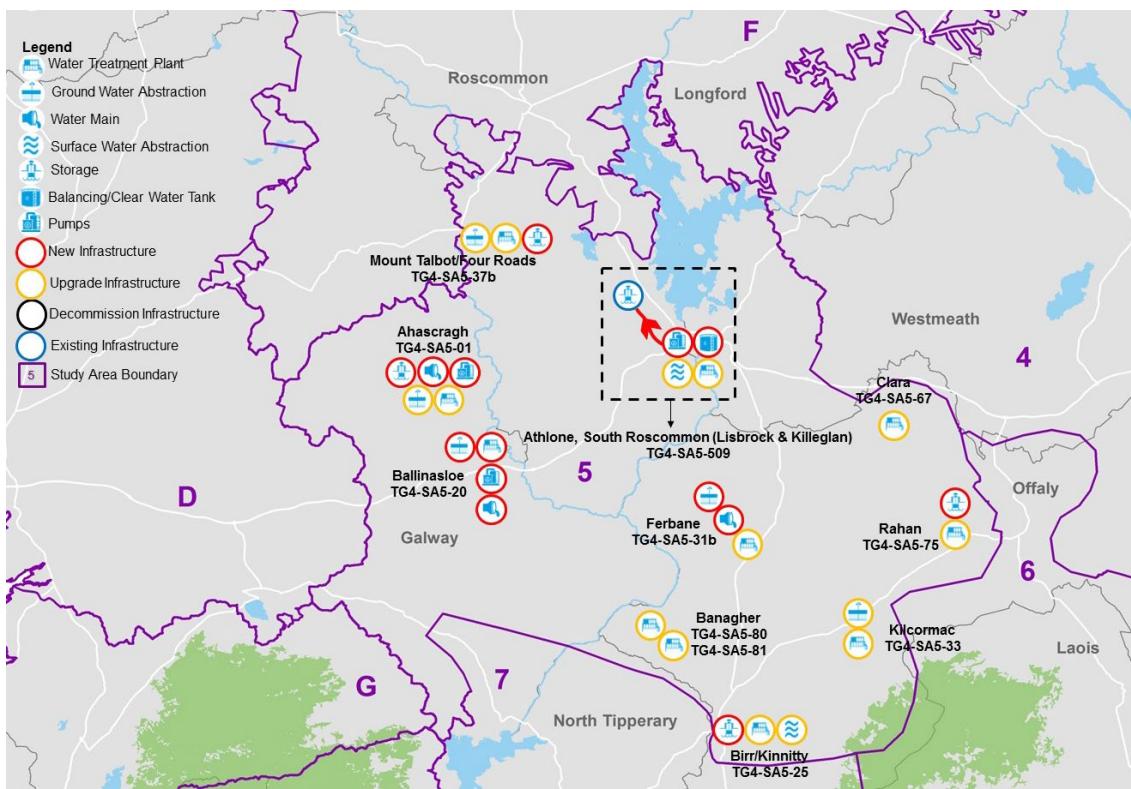


Figure 6-1: SA Preferred Approach abstractions in SA5

6.2 Cumulative Effects with Other Developments

The SA5 Preferred Approach has been assessed alongside other developments that could occur within the plan area. Potential effects could include increased traffic and noise. These could be mitigated by standard mitigation measures, such as planning of construction traffic routes and informing local residents about the works. With these standard good practice measures in place, there are unlikely to be significant cumulative effects.

Table 6-2 shows that within SA5 there are a number of regeneration and construction projects clustered around Athlone. There is also a project located at Clara and at Ballinasloe.

6.2.1 Cumulative Effects during Construction

The regeneration projects in Athlone, and to a lesser degree in Clara and Ballinasloe, could result in cumulative effects with the SA Preferred Approach if they were to be constructed at the same time (Table 6-2). Potential effects could include increased traffic and noise. These could be mitigated by standard mitigation measures, such as planning of construction traffic routes and informing local residents about the works. With these standard good practice measures in place, there are unlikely to be significant cumulative effects.

Table 6-2: Potential cumulative effects between preferred options and other developments in SA5

Preferred Approach	TG4-SA5-01	TG4-SA5-20	TG4-SA5-80	TG4-SA5-81	TG4-SA5-25	TG4-SA5-67	TG4-SA5-33	TG4-SA5-37b	TG4-SA5-75	SA grouped option 9 (TG4-SA5-51 and TG4-SA5-09b)
Lissywollen, Athlone										Yellow
Athlone Town Centre Regeneration and Enhancement										Yellow
Athlone Sewerage Scheme										Purple
South Westmeath Regional Water Supply Scheme										Purple
Athlone Tourism Cultural Quarter										Yellow
Athlone Institute of Technology STEM building										Yellow
Athlone, Life Sciences Innovation Hub and Soft Landing Space										Yellow
Athlone, Loughanaskin										
Raheen, Clara						Yellow				

Preferred Approach	TG4-SA5-01	TG4-SA5-20	TG4-SA5-80	TG4-SA5-81	TG4-SA5-25	TG4-SA5-67	TG4-SA5-33	TG4-SA5-37b	TG4-SA5-75	SA grouped option 9 (TG4-SA5-51 and TG4-SA5-09b)
Ballinasloe, Portiuncula ward block										

6.2.2 Cumulative Effects during Operation

There could be cumulative effects during construction between the SA Preferred Approach, the Athlone Sewerage Scheme and the South Westmeath Regional Water Supply Scheme. These projects could have potential benefits for water quality and quantity to the Shannon River, which could combine with the SA Preferred Approach to bring cumulative benefits to water quality and quantity.

There could be cumulative effects in terms of carbon, as all developments will result in producing carbon, both during construction and operation. As outlined in Section 6.1.2, any increase in carbon can be considered a significant effect, as these add cumulatively across all developments and contribute to the national target for carbon. The same mitigation options could be used, including sourcing energy from renewable sources and raising awareness of measures to reduce water consumption (which in turn would reduce energy consumption). Working with third parties, including planning authorities and other developers, to identify water efficient measures and joint promotion of water issues would also further mitigate this effect.

7

Appropriate Assessment of SA5 Preferred Approach

7 Appropriate Assessment of SA5 Preferred Approach

7.1 AA: Appraisal of LSE leading to potential AESI

European sites identified as at risk of LSEs as a result of progressing the Preferred Approach for SA5 are shown in Appendix E while potential AESI and impact types identified for SA5 are discussed below and outlined in Appendix F.

Table 7-1: European sites within the Zone of Influence (ZoI) of Study Area 5 (Offaly-Roscommon South Roscommon (Lisbrick & Killeglan) Sub-Area) with LSE identified and the potential for AESI (in the absence of more detail/mitigation)

SACs	SPAs
River Shannon Callows SAC (000216)	River Suck Callows SPA (004097)
Lough Ree SAC (000440)	Lough Ree SPA (004064)
Four Roads Turlough SAC (001637)	Four Roads Turlough SPA (004140)
Lisduff Turlough SAC (000609)	Middle Shannon Callows SPA (004096)
Lough Croan Turlough SAC (000610)	All Saints Bog SPA (004103)
	River Little Brosna Callows SPA (004086)
	Dovegrove Callows SPA (004137)

The Preferred Approach for SA5 includes a number of new or increased surface and groundwater abstractions; many of which are within karstic aquifers with a potential link to surrounding European designated sites. Potential operational impacts were identified as a result of progressing four options associated with the Preferred Approach for SA5. These include three groundwater and one surface water abstraction (TG4-SA5-01, TG4-SA5-20, SA grouped option 9 and TG4-SA5-37b), which could potentially impact on wetland bird species utilising wetland habitats within the River Suck Callows SPA, aquatic QI species (otter - *Lutra lutra*) associated with The River Shannon Callows SAC and Lough Ree SAC, and a number of SACs designated for turloughs (Four Roads Turlough SAC, Lisduff Turlough SAC and Lough Croan Turlough SAC) through a reduction or change in water levels/flows (water table/availability) and or changes in water quality (habitat degradation/hydrological changes).

The main construction related impacts related to the spread of invasive species, disturbance to QI species (otter), and pollution impacts (resulting in changes to water quality) where European sites are hydrologically linked to potential works area (e.g. works associated with SA grouped option 9 potentially impacting on the River Shannon Callows SAC and Lough Ree SAC).

In addition, works adjacent to or in close proximity to Four Roads Turlough SPA, River Suck Callows SPA, Dovegrove Callows SPA, Middle Shannon Callows SPA, All Saints Bog SPA and River Little Brosna Callows SPA and Lough Ree SPA (associated with options: TG4-SA5-01, SA grouped option 9, TG4-SA5-25, TG4-SA5-37b and TG4-SA5-81), could result in disturbance related impacts to QI bird species; particularly, whooper swan (*Cygnus cygnus*) and Greenland white-fronted goose (*Anser albifrons flavirostris*)

that may be utilising habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).

Table 7-2: Summary of potential impact pathways from option TG4-SA5-509 (09b & 51) on SACs with the potential to give rise to AESI

SAC	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Shannon Callows SAC (000216)	✓	✓	✓		✓
Lough Ree SAC (000440)		✓	✓		✓

Table 7-3: Summary of potential impact pathways from option TG4-SA5-80 on SACs with the potential to give rise to AESI

SAC	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Shannon Callows SAC (000216)	✓	✓			✓

Table 7-4: Summary of potential impact pathways from option TG4-SA5-81 on SACs with the potential to give rise to AESI

SAC	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Shannon Callows SAC (000216)		✓			✓

Table 7-5: Summary of potential impact pathways from option TG4-SA5-67 on SACs with the potential to give rise to AESI

SAC	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Shannon Callows SAC (000216)		✓			

Table 7-6: Summary of potential impact pathways from option TG4-SA5-37b on SACs with the potential to give rise to AESI

SAC	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
Four Roads Turlough SAC (001637)		✓	✓		
Lisduff Turlough SAC (000609)		✓	✓		
Lough Croan Turlough SAC (000610)		✓	✓		

Table 7-7: Summary of potential impact pathways from option TG4-SA5-01 on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Suck Callows SPA (004097)		✓	✓		✓

Table 7-8: Summary of potential impact pathways from option TG4-SA5-509 (09b & 51) on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
Lough Ree SPA (004064)					✓
Middle Shannon Callows SPA (004096)					✓
River Suck Callows SPA (004097)					✓

Table 7-9: Summary of potential impact pathways from option TG4-SA5-20 on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Suck Callows SPA (004097)		✓	✓		✓

Table 7-10: Summary of potential impact pathways from option TG4-SA5-80 on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
Middle Shannon Callows SPA (004096)					✓

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
All Saints Bog SPA (004103)					✓

Table 7-11: Summary of potential impact pathways from option TG4-SA5-81 on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
Middle Shannon Callows SPA (004096)					✓
All Saints Bog SPA (004103)					✓
River Little Brosna Callows SPA (004086)					✓

Table 7-12: Summary of potential impact pathways from option TG4-SA5-25 on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
Dovegrove Callows SPA (004137)		✓	✓		✓

Table 7-13: Summary of potential impact pathways from option TG4-SA5-37b on SPAs with the potential to give rise to AESI

SPA	Habitat Loss (incl. supporting habitat outside designated sites)	Habitat degradation (impacts to water quality and hydrological/hydrogeological changes etc.)	Water table/ availability	Mortality	Disturbance (incl. spread of non-native invasive species)
River Suck Callows SPA (004097)		✓	✓		✓
Four Roads Turlough SPA (004140)		✓	✓		✓

7.2 Protection of European Sites in Plan Development

There are a number of measures employed to ensure the protection of European sites in the plan development process such as mitigation measures for the Preferred Approach options.

7.2.1 Avoidance

The setting of sustainable abstraction limits for any new or increased abstractions arising as a result of the Framework Plan have been established to ensure impacts on aquatic QI species and habitats requiring high status water quality are avoided.

The Option Assessment Methodology has aimed to identify options that avoid or minimise impacts on European sites. The best AA approach gives maximum consideration to those options with no potential for impacts on European Sites or options with LSEs that can be addressed with general/standard mitigation measures at the project level (based on desktop study). It puts avoidance of impacts on European sites at the forefront taking account for the fact that options with a high likelihood of having adverse effects on a European site have already been removed at coarse screening stage. Taking this approach, if an option meets the “Objectives of the Plan” and is assessed as having no potential impact on a European Site (zero or neutral score based on desktop assessment), it is automatically adopted as the Preferred Approach at WRZ level (this is in line with the provisions of Article 6(3) of the Habitats Directive to ensure the protection of European Sites).

As discussed previously, no option arising from the Plan with the potential for AESI identified at project level will be progressed, as the Plan will have identified other options that could be progressed at the project level if required. Such protective measures have been built into the plan to ensure AESI are avoided as a result of adopting the Framework Plan.

7.3 AA: Conclusion to AESI

Appendix F summarises the potential impacts to European sites and the corresponding mitigation measures to ensure any potential adverse effects on site integrity are avoided as a result of progressing the Preferred Approach for SA5.

7.4 AA: Assessment of In-combination Effects

Under Article 6(3) of the Habitats Directive, an assessment of 'in-combination' effects with other plans and projects is required. The assessment used the best available information at the time of writing.

The assessment of 'in-combination' effects focuses on potential effects between other major projects or plans. In-combination effects between the options from the other Study Areas will be assessed in the Regional Plans. The in-combination assessment is detailed in Appendix G and is summarised in Table 7-14 below.

In summary, potential in-combination effects with other projects and plans were identified. However, with the implementation of mitigation there will be no adverse effects on the integrity of any European site, either alone or in-combination with other plans or projects as a result of implementing the SA5 Preferred Approach.

There are some limitations at the plan level as information on other non-Irish Water abstractions may not be available, therefore, yield assessments undertaken as part of the Framework Plan are based on the best information available to Irish Water at the time of writing. At the project level further detailed assessment of potential in-combination effects in relation to surface or ground water abstractions will be required and appropriate measures to avoid in-combination effects be identified at that stage.

Table 7-14: Summary of in-combination assessment for SA5

Potential for in-combination effect	Conclusion
<p><u>In-combination with other plans and projects</u></p> <p>There are potential in-combination effects with other projects and plans were identified for <u>River Suck Callows SPA and Lough Ree SPA</u> from disturbance to QI bird species and/or habitat degradation during construction if option <u>TG4-SA5-01, SA grouped option 9, TG4-SA5-20 and TG4-SA5-37b</u> if these projects progressed at the same time as the Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block works project. There is also potential for in-combination construction related impacts in relation to disturbance to otter and pollution on <u>Lough Ree SAC</u> in relation to the same project if progressed at the same time as <u>SA grouped option 9</u>.</p>	With the implementation of mitigation as detailed in Appendix G. There will be no adverse effects on the integrity of this European site, either alone or in-combination with other plans or projects.

Potential for in-combination effect	Conclusion
<p>Potential in-combination impacts from disturbance, spread of invasive species and/or habitat degradation on River Shannon Callows SAC, River Suck Callows SAC and Lough Ree SAC/SPA (disturbance only) if construction phase for SA grouped option 9, TG4-SA5-37b, TG4-SA5-80, TG4-SA5-67 and TG4-SA5-81 progressed concurrent with Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar) works.</p>	

8

SEA Summary

8 SEA Summary

SEA objectives have been taken into account at each stage of the approach development process for SA5 and a range of options and SA Approaches have been considered and assessed, including a 'Do Minimum' approach.

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

Key potential adverse impacts identified, following implementation of standard and SEA mitigation, include:

- Moderate adverse impacts on River Suck Callows SPA and NHA associated with temporary loss of habitats during construction of pipeline crossings under TG4-SA5-20 and impacts on wetland habitats of the SPA/NHA resulting from increased abstraction from Mount Talbot Spring under TG4-SA5-33 (moderate adverse). The proposed abstraction increases from Mount Talbot Spring under TG4-SA5-33 may also affect downstream groundwater dependent terrestrial ecosystems (GWTEs), including Lough Croan Turlough SAC and SPA, Lisduff Turlough SAC and Four Roads Turlough SAC and SPA;
- Moderate adverse impacts on the River Shannon Callows SAC and SPA, Middle Shannon Callows SPA and downstream wetland habitats, including Lough Ree SAC, SPA and Pnha, resulting from increased abstraction from the River Shannon at Athlone under SA grouped option 9;
- Moderate adverse effects on habitats within the River Brosna and Dovegrov Callows SPA and pNHA associated with the proposed abstraction increase from the River Camcor, and on habitats important for salmonids and crayfish within the River Silver as a result of increased groundwater abstraction at Kilcormac; and
- Moderate adverse effect on the WFD status of Gageborough River, as the proposed abstraction volumes represent a relatively high proportion (>95%) of Q95 flows. Several other WRZ options are also flagged as requiring further consideration in terms of their longer term sustainability and resilience to future climate change (TG4-SA5-20 and TG4-SA5-33).

Cumulative effects assessment has identified potential significant effects in relation to carbon, 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 combined NPV carbon cost from the individual options provides an indicator for total lifetime carbon (to 2050) but does not take account of efficiencies from replacement of failing infrastructure or treatment technology or potential for mitigation such as use of renewable energy sources. Insufficient

information is available for the cumulative effects assessment to consider how total Study Area carbon will change overall and per ML of water.

SEA mitigation identified to address the key adverse impacts identified above include further hydrological or hydrogeological modelling (as appropriate) to further inform understanding of potential impacts on the River Suck Callow SPA and NHA, River Shannon Callows SAC and other European and national designated sites identified as potentially affected by increased abstractions from existing surface and groundwater sources (see the NIS of the Framework Plan for further information). Measures to address the cumulative impact on carbon include sourcing the energy supply from sustainable sources. In addition, there are opportunities to reduce water demand (which in turn would reduce energy and carbon) by raising awareness of water issues, promoting water efficient devices and through leakage reduction.

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

An overall summary assessment, including potential for cumulative and in-combination effects and other measures, identified to be progressed alongside the supply side options is provided in Table 8-1. Key mitigation and proposed monitoring measures are also shown.

Table 8-1: SEA summary

SEA objectives	SA Preferred Approach (PA) (SA approach 1) Residual effects including mitigation C – construction (short term) O – operational (long term)	Mitigation	Monitoring	
			Study Area level	Scheme level

SA Preferred Approach with interim measures as required and a programme of leakage reduction and water conservation measures, taking an adaptive approach to address uncertainty

1. Protect public health and promote wellbeing	<p>C Minor Adverse O Minor Beneficial to Moderate Beneficial</p> <p>The PA is expected to improve overall drinking water quality reliability and sustainability through the decommissioning of failing WTPs and the replacement of abstractions vulnerable to drought conditions. The PA is expected to reduce risks to access of good quality water supply across different conditions and over the plan period.</p>	<p>Standard good construction practice and consultation</p> <p>Further assessment of risks to water quality and consideration of catchment management initiatives to improve water quality and reduce treatment cost. For example, working with landowners and managers on practices to reduce levels of sediment and pollution from entering water courses through run off.</p>	<ul style="list-style-type: none"> Level of service, and the frequency and duration of drought orders Number of days/hours when water supply to people is disrupted due to drought, freeze-thaw or other service/infrastructure issues Number of public rights of way closures/diversions and length of paths created compared to loss 	<ul style="list-style-type: none"> Duration of construction works, and number of complaints received regarding construction works Duration of temporary closures of footpaths and other recreational assets Number of days where recreational uses of the River Camcor, Silver or Shannon are impeded
2. Protect and where appropriate enhance, built and natural assets and reduce waste	<p>C Neutral to Minor Adverse O Neutral to Minor Adverse</p> <p>New resources required for construction works, including extensive lengths of pipeline, service reservoirs and new/upgraded WTPs. Ongoing maintenance requirements.</p>	<p>Materials management to be integrated into design to optimise use of existing resources and minimise waste from construction and operation.</p>	<ul style="list-style-type: none"> Loss of greenfield land, including agricultural, forestry or other land uses Disruptions to strategic infrastructure/services 	<ul style="list-style-type: none"> Construction wastes sent to landfill

SEA objectives	SA Preferred Approach (PA) (SA approach 1) Residual effects including mitigation C – construction (short term) O – operational (long term)	Mitigation	Monitoring	
			Study Area level	Scheme level
			<ul style="list-style-type: none"> Use of waste management plans Volume of drinking water treatment residuals sent to landfill 	
3. Protect and enhance biodiversity and contribute to resilient ecosystems	<p>C Neutral to Moderate Adverse O Neutral to Moderate Adverse</p> <p>Impacts from construction works for pipelines and service reservoirs on biodiversity. These can be minimised through careful routing and siting.</p> <p>Operational impacts on habitats of the River Brosna and Silver River.</p> <p>Potential for construction and operational impacts on European and National designated sites, most notably the River Suck Callows SAC and SPA, and the River Shannon Callows SAC and SPA.</p>	<p>Routing/siting to avoid impacts. Standard good construction practice and specific measures as identified in the NIS of the Framework Plan.</p> <p>Further hydrological/hydrogeological assessments to determine impacts on designated sites.</p> <p>Operating rules to limit impacts on European and National sites.</p>	<ul style="list-style-type: none"> Temporary and permanent habitats lost vs habitats created/enhanced Site condition and population data for QI of European and National designated sites, including River Shannon Callows SAC and SPA and River Suck Callows SAC and SPA 	<ul style="list-style-type: none"> Monitor construction activities to ensure compliance
4. To protect landscapes, townscapes and visual amenity	<p>C Neutral to Minor Adverse O Neutral to Minor Adverse</p> <p>Construction landscape impacts and long term impacts from above ground structures, such as new WTPs.</p>	<p>Routing and siting to reduce tree loss and appropriate location and design of above ground structures with landscape planting.</p> <p>Reinstatement of land use and vegetation.</p>	<ul style="list-style-type: none"> Total working area of pipelines non-designated landscapes Land use/landscape features re-established for schemes over appropriate period – areas/km successfully 	<ul style="list-style-type: none"> Duration of construction works Number of complaints received regarding visual impact of construction works

SEA objectives	SA Preferred Approach (PA) (SA approach 1) Residual effects including mitigation C – construction (short term) O – operational (long term)	Mitigation	Monitoring	
			Study Area level	Scheme level
			restored to meet requirements	
5. Reduce greenhouse gas emissions	C Neutral to Minor Adverse O Neutral to Minor Adverse Embodied and operational carbon contribute to national level carbon emission targets. Leakage and water efficiency can contribute to reducing carbon.	Design to minimise embodied carbon emissions and optimise operational efficiency. Seek renewable energy supply sources and optimise use of leakage and water efficiency measures to reduce carbon. Consider offsetting approaches with multiple benefits for water quality, carbon sequestration and linking with other objectives.	<ul style="list-style-type: none"> Percentage of energy supply from renewable sources or reduced energy use Carbon footprint (total tonnes) per year, predicted over plan period, lifetime of schemes and carbon intensity of water resource options (tonnes/ML/d) 	<ul style="list-style-type: none"> Carbon footprint (total tonnes) during construction Operational Carbon Intensity kgsCO₂equic/ML
6. Contribute to environmental climate change resilience	C Moderate Adverse to Neutral O Moderate Adverse to Minor Beneficial Abstractions generally reduce environmental resilience but overall improved flexibility for operation using regional schemes has the potential to reduce pressure on at risk local resources. WRZ options TG4-SA5-20, and TG4-SA5-33 require further assessment to understand their sustainability in the longer term.	Consider how operation can further reduce climate change pressure on at risk sources and associated designations, particularly for TG4-SA5-20 and TG4-SA5-33. Sustainability review of sources taking account of groundwater and surface water interconnections for WRZ options TG4-SA5-20 and TG4-SA5-33.	<ul style="list-style-type: none"> WFD waterbody status objectives at risk and designated site condition status Frequency of drought orders requiring change to normal abstractions/ compensation releases 	<ul style="list-style-type: none"> None identified

SEA objectives	SA Preferred Approach (PA) (SA approach 1) Residual effects including mitigation C – construction (short term) O – operational (long term)	Mitigation	Monitoring	
			Study Area level	Scheme level
7. Protect and improve surface water and groundwater status	C Neutral to Minor Adverse O Neutral to Moderate Adverse Generally, new/increased abstractions are limited to allowable limits and have a low risk of adverse effect on WFD waterbody status objectives, with the potential exception of the River Gageborough.	Further investigation to consider effects on groundwater abstraction on the surface water environment.	<ul style="list-style-type: none"> WFD waterbody status objectives at risk 	<ul style="list-style-type: none"> Pollution incidents during construction Additional monitoring of River Gageborough if needed
8. Avoid flood risk	C Neutral to Minor Adverse O Neutral to Minor Adverse Potential loss of flood plain increasing flood risk from construction and location of above ground structures for TG4-SA5-20. Also, flood risk impacts on operations with effect on meeting supply.	Siting and design of schemes to take account of flood risk and design for flood risk resilience.	<ul style="list-style-type: none"> Number of options at risk of flooding at each AEP level 	<ul style="list-style-type: none"> Lost time to flooding Lost time to power supply interruptions
9. Protect and where appropriate, enhance cultural heritage assets	C Neutral to Minor Adverse O Neutral Potential construction impacts on unknown archaeological interest. Impacts on known interests are expected to be avoided.	Standard good practice approaches to minimise potential impacts.	<ul style="list-style-type: none"> Number of archaeological assets adversely affected by water resource options Number of options that are rerouted to avoid cultural heritage impacts Number of schemes including improvements to access recording of archaeological assets 	<ul style="list-style-type: none"> Number of archaeological finds recorded during construction

SEA objectives	SA Preferred Approach (PA) (SA approach 1) Residual effects including mitigation C – construction (short term) O – operational (long term)	Mitigation	Monitoring	
			Study Area level	Scheme level
			or communication/ interpretation of interest features	
10. Protect quality and function of soils	C Neutral to Minor Adverse O Neutral Potential for loss and damage to valuable soils during construction but impacts to geological assets are expected to be avoided.	Standard good practice to conserve and reinstate soils.	<ul style="list-style-type: none"> • Soil Management Plans implemented • Volume of contaminated land restored, or soils removed 	<ul style="list-style-type: none"> • Total volume of soil removed or reused on site

9

WFD Summary

9 WFD Summary

The application of allowable abstraction constraints on new options limited the options considered to those abstractions that are expected to meet sustainability requirements. Options identified for SA5 are also 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 groundwater bodies used for the SA5 abstractions have good quantitative status (AWN, 2020). The abstractions are not located in close proximity and the risk of combined effects on groundwater body WFD objectives, or on existing abstractions, are considered low. However, cumulative effects need to be considered further in terms of both sustainability for connected surface waterbodies and groundwater dependent habitats and protected areas.

Options reliant on GDA sources will be considered in SA9 and at the Region/Group 4 level.

10

Appropriate Assessment Summary

10 Appropriate Assessment Summary

The NIS of the Framework Plan's conclusions for SA5, regarding 'In-combination effects with other plans and projects' and 'In-combination effects between Preferred Options', are shown below and are included in more detail in Appendix G.

Potential in-combination effects with other projects and plans were identified for River Suck Callows SPA and Lough Ree SPA. These effects relate to disturbance to Qualifying Interest bird species during construction if options TG4-SA5-01, SA grouped option 9, TG4-SA5-20 and TG4-SA5-37b are progressed at the same time as the Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block works project. There is also potential for in-combination construction related impacts regarding disturbance to otter and pollution on Lough Ree SAC regarding the same project if progressed at the same time as SA grouped option 9.

Potential in-combination impacts from disturbance, spread of invasive species and habitat degradation of River Shannon Callows SAC, River Suck Callows SAC and Lough Ree SAC/SPA (disturbance only) if the construction phase for SA grouped option 9, TG4-SA5-37b and TG4-SA5-81 is progressed concurrently with Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar) works.

There is potential for construction and operational related in-combination effects from the preferred options within SA5 on the River Suck Callows SPA from habitat degradation, water table/availability and disturbance impacts if construction of options is concurrent and/or during operation.

If the construction of preferred options occurs concurrently, the following impacts could occur:

- Habitat loss, disturbance, spread of invasive species and habitat degradation impacts for River Shannon Callow SAC; and
- Disturbance impacts on Middle Shannon Callows SPA and All Saints Bog SPA.

With the implementation of mitigation as detailed in Appendix F, there will be no adverse effects on the integrity of this European site, either alone or in-combination with other plans or projects.

11

Recommendations for Implementation

11 Recommendations for Implementation

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

- SEA Environmental Report of the Draft Framework Plan – this includes general proposals and standard mitigation requirements (also see Appendix I); and
- SEA Environmental Report of the Regional Plan - this will include specific mitigation and monitoring requirements for Region/Group 4 options and cumulative effects.

This case study is an example of an environmental review that forms part of the Regional Plan. The Regional Plan will include nine individual Study Area reports (SA1-9) as Appendices to the Regional Plan. The SEA Environmental Report for the Regional Plan will also be supported by nine Study Area Environmental Reviews (SA1-9) as Appendices.

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Appendix A MCA Environment Criteria Scoring Rules: as applied for SA5

A.1 Fine Screening MCA: Environmental Scoring Rules Applied

In the Draft Framework Plan, Irish Water describe the Option Assessment Methodology that will be used to develop a national programme of proposed solutions for all of their water supplies. The solutions will be used to reduce or eliminate the Supply Demand Balance (SDB), Water Quality, Reliability and Sustainability risks.

The purpose of Irish Water's options assessment process is to consider the widest practicable range of solutions to resolve identified need within a given area.

Environmental and social assessment criteria were included from the earliest stages of the screening process, with screening criteria being applied to filter out any options that are not feasible, or viable on environmental sustainability, resilience or deliverability grounds.

In the first stage of the options screening process the unconstrained options were identified to address need. These options were then subject to coarse screening against the criteria of resilience, deliverability and environment. Any unconstrained options were rejected at this stage if they were unviable in relation to one or more assessment criteria. The remaining options were progressed to further assessment through the fine screening process.

A.2 Fine Screening

The remaining options were subject to a more detailed Multi Criteria Assessment (MCA) at the Fine Screening Stage using desktop assessments of best available environmental data. The objective of the fine screening process is to ensure that all options which will progress to the feasible options list meet the following overarching criteria:

- Resilient;
- Feasible and Flexible;
- Progressible;
- Environmentally and socially viable; and
- Cost Effective.

These criteria were broken down into sub-criteria (see Table A-1 - Table A-9) which were then rated between 3 and -3 depending on the option's impact (see Figure A-1).

For the environmental and social criteria, each topic was rated using specific rules covered in this Appendix to provide a basis for consistency and comparability. The fine screening process, assessment criteria and general scoring guide are provided in the Draft Framework Plan.

Major Positive / Beneficial	Moderate Positive / Beneficial	Minor Positive / Beneficial	Neutral / Negligible Risk	Minor Risk	Moderate Adverse Risk	Major Adverse Risk
3	2	1	0	-1	-2	-3

Figure A-1: Fine screening rating

A.2.1 Limitations

This is a high-level desk based assessment using option descriptions and indicative locations and routings. The scoring guidance and rules are intended to help provide a consistent approach across a large number of options of different types and levels of information. The MCA is a comparative assessment and does not replace requirements for more detailed or project level assessment.

A.3 MCA Scoring Criteria

These scoring rules focus on the environmental and social criteria and are based on the SEA objectives.

A.3.1 Sustainability (Environmental and Social Impacts)

The criteria for Sustainability (Environmental and Social impacts) and the questions used to rate options within the criteria for the fine screening are shown in Table A-1.

Table A-1: Fine screening sustainability (environmental and social impacts) criteria

SEA Objective /Topic headings	Scoring questions
Sustainability (Environmental and Social impacts)	
Population, health, economy and recreation	P1: Will the option impact public health and quality of life, during construction?
	P2: Will the option impact public health and quality of life, during operation?
	P3: What is the impact on recreational amenities?
Water Environment: Quality and Resources	W1: Would the option or associated construction activities affect WFD Status of water body status, in terms of quantity and quality for surface water?
	W2: Would the option or associated construction activities affect WFD Status of water body status, in terms of quantity and quality for groundwater?
	W3: Would the option or associated construction activities affect WFD Status of water body status, in terms of hydro morphology?
	W4: Would this option reduce pressure on water environment through water savings?
	W5: Is there a potential for this option to increase flood risk – e.g. increase base flow or result in loss of flood plain?
	W6: Will Navigation be affected?

SEA Objective /Topic headings	Scoring questions
Biodiversity, Flora and Fauna	B1: Potential to result in adverse effects on the integrity of a European site?
	B2: Potential to impact on Annex species outside designated areas?
	B3: Potential to impact on National designated sites?
	B4: Potential to impact Biodiversity in all other areas?
	B5: Risk of INNS?
Material Assets	M1: Will the option make effective use of existing assets?
	M2: 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	L1: Could this option impact the landscape character areas, townscape character areas or important views – detract or improve?
Climate Change	CC1: What is the level of construction and operational carbon emissions associated with the option – tonnes?
Culture, Heritage and Archaeology	CH1: 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	G1: Would any designated or non-designated geological features, valuable soils, or contaminated land sites be affected?

So that the criteria could be rated comparatively across the Study Areas and options, it was important that a set of rules were followed in the rating process. The rules for the Sustainability (Environmental and Social impacts) criteria are shown in Table A-2 - Table A-9.

A.3.2 Population, Economy, Tourism and Recreation, and Human Health

Table A-2: Fine screening questions for P1, P2 and P3

Fine Screening Question P1	Criteria	Data Source	Score	
Population, Economy, Tourism and Recreation, and Human Health: Will the option impact public health and quality of life, during construction?	<ul style="list-style-type: none"> • Level of concern about temporary risks to health, for example in relation to disturbance or loss of access due to construction or increased risk from poor water quality and risks of flooding during construction. 	<ul style="list-style-type: none"> • IW GIS layer on settlements and amenities • Consideration to scale of the option and sensitivity of the area • Are options located in close proximity to settlements (distance <2km)? • Are options routed through settlements? 	3	N/A
	<ul style="list-style-type: none"> • Ratings should be assigned relative to schemes/options under consideration rather than to absolute values. 		2	N/A
	<ul style="list-style-type: none"> • Check GIS for impacts on roads/towns and whether they are urban/rural. 		1	N/A (no positive impact from construction works)
	<ul style="list-style-type: none"> • No construction would be for example an abstraction increase with no associated works. 		0	No or minimal construction
			-1	Rural – small scale construction/upgrade and/or remote from sensitive receptors
			-2	Urban – large scale construction/upgrade and near sensitive receptors
			-3	No foreseeable -3 impact for this criterion. Construction impact expected to be temporary and subject to standard mitigation

Fine Screening Question P2	Criteria	Data Source	Score	
Population, Economy, Tourism and Recreation, and Human Health: Will the option impact public health and quality of life, during operation?	<ul style="list-style-type: none"> • Level of concern about risks to health, for example in relation to water quality, water borne disease transmission, insect borne disease transmission, recreational and agricultural land take, and risks of flooding. 	<ul style="list-style-type: none"> • IW GIS layers on settlements and amenities • Are options located in close proximity to settlements (distance <2km)? • Are options routed through settlements? 	3	N/A
	<ul style="list-style-type: none"> • Ratings should be assigned relative to schemes/options under consideration rather than to absolute values. 		2	N/A
	<ul style="list-style-type: none"> • Benefits: improved Level of service or water quality /access is an overall objective through options in combination. 		1	Upgrades to WTP/new WTP likely to result in improved water quality/reliability
	<ul style="list-style-type: none"> • Unlikely to be sufficient information for individual options on for allocation of +2/+3 scoring. Positive scores where WTPs on RAL are upgraded. 		0	Below ground assets in rural/urban area, upgrades to existing sites or new sites within industrial areas
			-1	New above ground assets in rural areas near sensitive receptors
			-2	New above ground assets in urban areas near sensitive receptors
			-3	Unlikely for individual options to score -3 as standard mitigation expected to be applied.

Fine Screening Question P3	Criteria	Data Source	Score	
Population, Economy, Tourism and Recreation, and Human Health: What is the impact on recreational amenities?	<ul style="list-style-type: none"> • Type of land take • Duration of land take • Level of impact on recreational amenity • Improvement or creation of new recreation amenity (however this potential for should be improvement would need to be indicated in the option design. IW reservoirs for water supply normally have restrictions for recreational use this so cannot be assumed as a benefit for impoundments or bunded reservoirs for example) 	<ul style="list-style-type: none"> • IW GIS layer for amenities (based on Failte Ireland information) and GIS layer for walking trails. • Is the option located within close distance of an amenity marked on the layer? • Layers may not accurately reflect all amenities in an area. 	3	N/A
	2	N/A		
	1	Potential for a net improvement to amenity provision (informal or formal recreation)		
	0	No change		
	-1	Temporary amenity area loss/loss of access to amenity area during construction		
	-2	Reduction/restriction of amenity		
	-3	Permanent amenity area loss		

* Extra costs associated

A.3.3 Water environment: Quality and Resources

Table A-3: Fine screening question W1, W2, W3, W4 and W5

Fine Screening Question W1	Criteria	Data Sources	Score	
Water environment: Quality and Resources: Would the option or associated construction activities affect WFD Status of water body status, in terms of quantity and quality for surface water?	<ul style="list-style-type: none"> Based on standards outlined in WFD: % of Q95 – detailed scoring guide takes account of WFD water body status and whether a river or lake waterbody. Potential to contribute to meeting WFD objectives considered based on review of potential over abstraction risk from existing abstractions. Unlikely to be sufficient information for allocation of +2/+3 scoring for individual options 	<ul style="list-style-type: none"> Catchments.ie for additional information on catchments IW GIS layer for surface water WFD status. Check Hydrotool/Hydronet to ensure that proposed abstraction is within 10% of Q95. 	3	N/A
			2	N/A
			1	Option involves removing existing surface water abstraction identified as at risk of over abstraction
			0	=<5% Q95 OR No abstraction from surface water
			-1	5-7.5% Q95
			-2	7.5-10% Q95
			-3	>10% of Q95 also preventing a return to good status*

Fine Screening Question W2	Criteria	Data Sources	Score	Bedrock	Gravels
Water environment: Quality and Resources: Would the option or associated construction activities affect WFD Status of water body status, in terms of quantity and quality for groundwater?	<ul style="list-style-type: none"> • % of average recharge. • WFD Assessment of Impact & Assignment of Risk Categories Table 4 • Option = Proposed Q [MI/d] • Review of sustainability of groundwater abstractions • Unlikely to be sufficient information for allocation of +2/ +3 scoring for individual options 	<ul style="list-style-type: none"> • Check underlying aquifer and 'Average Recharge' (GSI) • Groundwater Working Group Document No. 5, 2005) 	3	N/A	N/A
			2	N/A	N/A
			1	Option involves removing existing groundwater abstraction identified as at risk of over abstraction	
			0	<2% OR No abstraction from groundwater	<2% OR No abstraction from groundwater
			-1	<10%	<20%
			-2	<30%	<30%
			-3	>30%	>30%

Fine Screening Question W3	Criteria	Data Sources	Score	
Water environment: Quality and Resources: Would the option or associated construction activities affect WFD Status of water body status, in terms of hydromorphology?	<ul style="list-style-type: none"> • Option type and its perceived effect on hydromorphology • Potential benefits from river restoration/ removal of barriers such as weirs where this is feasible and there is agreement with parties responsible for the structures. • Unlikely to be sufficient information for allocation of +2/+3 scoring for individual options 	<ul style="list-style-type: none"> • Catchments.ie for additional information on catchments • IW GIS layer for groundwater WFD status, groundwater risk status, and surface water WFD status. 	3	N/A
	2	N/A		
	1	Option likely to contribute to WFD objectives by removing barriers or structures such as weirs or by including river restoration		
	0	No change to hydromorphology		
	-1	Lower intake on lake abstraction – new infrastructure		
	-2	New river abstraction and intake structure		
	-3	Impoundment option – online with loss of river channel		

Fine Screening Question W4	Criteria	Data Source	Score	
Water environment: Quality and Resources: Would this option reduce pressure on water environment through water savings?	<ul style="list-style-type: none"> • Does the option include leakage reduction or a reduction in abstraction? 	<ul style="list-style-type: none"> • EPA Hydrometric data (initially) • Qube Model 	3*	N/A
	<ul style="list-style-type: none"> • Positive score if option includes mains replacement reducing leakage or a reduction in abstraction – supporting objectives of use less and lose less.* 		2*	N/A
	<ul style="list-style-type: none"> • *Water savings options are not currently considered as Irish Waters leakage reduction targets were included in their supply demand balance calculations for this iteration of the Framework Plan. 		1	Unlikely to be sufficient information to score positive benefits for water savings from individual options
	<ul style="list-style-type: none"> • (note negative effects on environment addressed through criteria W1,2 3 and 4) 		0	No water savings associated with this option
			-1	N/A
			-2	N/A
			-3	N/A

Fine Screening Question W5	Criteria	Data Source	Score	
Water environment: Quality and Resources: Is there a potential for this option to increase flood risk – e.g. increase base flow or result in loss of flood plain?	<ul style="list-style-type: none"> OPW Rules Floodinfo.ie to determine whether option would result in loss of flood plain Option supporting retention of water in upper catchment Option providing storage capacity for flood water 	<ul style="list-style-type: none"> OPW online resource for flood mapping and previous flood events (not used at this stage) Floodinfo.ie for flood mapping and previous flood events 	3	Unlikely to be sufficient information for allocation of +3 scoring
				2
				1
				0
				-1
				-2
				-3

Fine Screening Question W5	Criteria	Data Source	Score	
Water environment: Quality and Resources: Will Navigation be affected?	<ul style="list-style-type: none"> Potential for impacts on navigable waterways – based on proximity of works to navigable waterways and type of works. 	<ul style="list-style-type: none"> Navigable Waterways GIS information 	3	N/A
			2	N/A
			1	N/A
			0	No impact on navigable waterways expected
			-1	Navigation could potentially be affected by option such as a new abstraction on a navigable waterway but impacts likely to be avoidable through siting and design
			-2	Navigation could potentially be affected by option due to reduced water levels in navigable waterway
			-3	Navigation would potentially be affected by option due to proposed structures or reduced water levels in navigable waterways

A.3.4 Biodiversity, Flora and Fauna

Table A-4: Fine screening question B1, B2, B3, B4 and B5

Fine Screening Question B1	Criteria	Data Source	Score *	
Biodiversity, Flora and Fauna: Is there potential for the option to result in adverse effects on the integrity of a European site?	<ul style="list-style-type: none"> Undermining the sites conservation objectives through direct or indirect effect pathways. Direct loss of habitat or supporting habitat. Mortality of Qualifying Interest species (QIs). Changes to water quality, both qualitatively and quantitatively. Changes in hydrology impacting on water dependant species and habitats (ground water dependant terrestrial ecosystems -GWDTE). Unlikely to be sufficient information for allocation of +2 or +3 positive scoring for level of benefit 	<ul style="list-style-type: none"> NPWS GIS Database for European Designated sites including SACs and SPAs SAC/SPA Conservation Objectives 	3	N/A
	2	N/A		
	1	Potential for benefits to designated site from removal or reduction of an impact - thereby improving the conservation status or condition of a European site.		
	0	No potential for option to impact on European site		
	-1	Hydrological link to European site (SAC/SPA). No direct habitat loss within European site. No works within a European site. Potential for disturbance to QI species outside European site (e.g. mobile QI species otter, birds etc.). Impacts can be mitigated		
	-2	No direct habitat loss within European site. Temporary works within or adjacent to European site or direct crossing of river European site. Potential for temporary disturbance to QI species within European site. Impacts can be mitigated		

			-3	In some instances, impacts may not be fully known or understood without further detailed site assessment. Site assessment could identify potential adverse effects on site integrity (AESI) for which mitigation or alternative option may be required
Fine Screening Question B2	Criteria	Data Source	Score	
Biodiversity, Flora and Fauna: Is there potential for the option to impact Annex I habitats or Annex II/ IV species outside European sites?	<ul style="list-style-type: none"> Undermining the favourable conservation status of species and habitats listed on the annexes of the Habitats Directive (e.g. species and habitats listed in Article 17 reports). Direct habitat loss Disturbance to species Disturbance to or loss of commuting or foraging habitat Direct mortality of species Unlikely to be sufficient information for allocation of +2 or +3 scoring of level of benefit 	<ul style="list-style-type: none"> NPWS GIS Layer - Ecosystem Provision National Biodiversity Data Centre (NBDC) NPWS Article 17 GIS Layer 	3	N/A
			2	N/A
			1	Potential benefits to Annexed species through for example removal of obstructive weir or addition of fish pass
			0	No potential for option to impact on Annex I habitats or Annex II/ IV species
			-1	Disturbance to Annex I habitats or Annex II/ IV species Disturbance to or loss of commuting or foraging habitat used by Annexed species

			-2	Direct mortality of Annexed species outside of European sites		
			-3	Unlikely to be sufficient information for allocation of -3 scoring therefore level of negative impact currently not measurable		
Fine Screening Question B3	Criteria	Data Source	Score			
Biodiversity, Flora and Fauna: Is there potential for the option to impact on a Nationally Designated site (e.g. NHAs, pNHAs).		<ul style="list-style-type: none"> Undermining the conservation of national designated sites. Direct impact on designated site (e.g. direct loss of habitat) Disturbance (e.g. spread of invasive species from adjacent sites). Unlikely to be sufficient information for allocation of +2 or +3 scoring of level of benefit 	<ul style="list-style-type: none"> NPWS GIS layer -NHAs, pNHAs. GIS layer – foss wetland. 	3	N/A	
			2	N/A		
			1	Potential for benefits to designated site from enhancement or removal of an effect such as from an existing abstraction		
			0	No impact on national designated sites expected		
			-1	No direct loss of habitat within designated area. Indirect (temporary) impact.		
			-2	Direct loss of habitat within designated area. Direct (permanent) impact.		

			-3	No -3 scoring as there will be avoidance and/or mitigation to prevent significant impact on National Designated sites.
Fine Screening Question B4	Criteria	Data Source	Score	
Biodiversity, Flora and Fauna: Is there potential for the option to impact on Biodiversity in all other areas	<ul style="list-style-type: none"> Outside of European and Nationally designated sites Loss of significant areas of ecologically valuable habitat and/or by undermining biodiversity objectives outlined in local or national plans (e.g. county development plans) Direct habitat loss (e.g. hedgerows/woodlands other semi-natural habitats) Disturbance to species protected under the wildlife act (e.g. badger, common frog, newts, nesting birds etc.) Direct mortality of species protected under the wildlife act (e.g. badger, common frog, newts, nesting birds etc.) Positive scoring for overall biodiversity enhancements where sufficient information is available for the options. 	<ul style="list-style-type: none"> GIS layer – foss wetland/aerial photography National Biodiversity Data Centre (NBDC) 	3 2 1 0 -1 -2 -3	<p>Potential to create new high value habitat on a large scale</p> <p>Potential to create new high value habitat on a small scale</p> <p>Potential to improve biodiversity through enhancement of existing habitat or improving connectivity</p> <p>No impact on biodiversity expected</p> <p>Temporary loss of habitat or temporary disturbance to species.</p> <p>Permanent loss of habitat and or direct mortality of species protected under the wildlife act.</p> <p>No -3 scoring as there will be avoidance and/or mitigation to prevent biodiversity loss as included in the option design.</p>

Fine Screening Question B5	Criteria	Data Source	Score	
Biodiversity, Flora and Fauna: Is there potential for the option to spread invasive non-native species?	<ul style="list-style-type: none"> Species listed on the third schedule of the Hab+A94:C102itats Regulations 2011, (S.I. 477) Regs 49 & 50 Prohibition on dispersal of certain species. Presence of highly invasive species e.g. Japanese knotweed (JK), Himalayan balsam (HB), zebra mussel (ZM) etc. Unlikely to be sufficient information for scoring positive benefits from removal of invasive species 	<ul style="list-style-type: none"> National Biodiversity Data Centre 	3	N/A
			2	N/A
			1	N/A
			0	No risk of spreading invasive species (e.g. tankering of water) OR no high risk options. Irish Water do not allow transfer of raw water between catchments
			-1	No major risk identified e.g. no records of key invasive (JK, HB, ZM etc.) identified on NBDC. However, site assessment would still be required to rule out presence of invasive at project level.
			-2	Risk identified e.g. records of key invasive species (JK, HB, ZM etc.) identified on NBDC.
				Significant cost to eradicate
				H.B. J.K. and aquatic species. Can mitigate for this however, associated time constraint and cost.

			-3	No high-risk options such as raw-water transfer are removed through Coarse Screening
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* Score of -1, -2 or -3 = potential likely significant effects (LSEs) have been identified at fine screening stage in the absence of mitigation (stage 1 of the AA process cannot take mitigation into account).

0 score: those options scoring 0 are those unlikely to result in likely significant effects (LSEs) on a European site (based on desktop review). During the optioneering process Irish Water identify if these 0 scoring options meet the "Objectives of the Plan" and are assessed as having no potential impact on a European Site, it is automatically adopted as the Preferred Approach at WRZ level.

-1 score: potential for LSE (generally construction related impacts) identified. However, it is considered that these LSEs will not result in adverse effects on site integrity (AESI) with standard best practice project specific mitigation (for example pollution control compliant with legislation to protect the general environment and not always specifically for European sites or their qualifying interest features). These options are not considered to lead AESI based on the plan level rules/protective measures applied and desktop information available at the time of assessment.

-2 score: potential for LSE (generally construction related impact) identified. However, it is considered that these LSEs will not result in AESI with standard best practice project specific mitigation. These options are not considered to lead AESI based on the plan level rules/protective measures applied and desktop information available at the time of assessment.

-3 score: potential for LSEs that may be harder to mitigate or where uncertainty around potential impacts remains (uncertainty may remain until site level assessments are carried out) and although deemed feasible through Stage 2, may require a higher burden of site based proof to succeed if it ever progresses to project level. As part of the feedback loop from the Natura Impact Statement for the Plan, any sites with a -3 score are noted and a better approach to these options identified where possible (e.g. an option that meets the Plan objectives and doesn't score -3). Where there are no options that meet this criterion the -3 options are progressed as the Preferred Approach. For such options mitigation in the form of avoidance is provided within the Plan, for example should potential adverse effects on European sites be identified at the project level from such an option the Plan will have identified other options that could be progressed at the project level if required.

A.3.5 Material Assets

Table A-5: Fine screening questions M1 and M2

Fine Screening Question M1	Criteria	Data Source	Score	
Material Assets: Will the option make effective use of existing assets?	<ul style="list-style-type: none"> Negatively scored if additional infrastructure required e.g. new WTP, pipeline, boreholes. Neutral score if existing assets utilised Positive score for improved efficiency and allowing decommissioning of old/failing assets Unlikely to be sufficient information for allocation of +2 or +3 scoring of level of benefit 	<ul style="list-style-type: none"> IW GIS layers 	3	N/A
			2	N/A
			1	Rationalisation of existing assets
			0	Component upgrade within existing site
			-1	Brownfield Site, WTP upgrade, new/replaced network <20km
			-2	Greenfield Site new WTP, new/replaced network 20-50km
			-3	New WTP with limited life span (e.g. Lough Talt). Significant above ground assets (desal), new/replaced network >50km

Fine Screening Question M2	Criteria	Data Source	Score	
Material Assets: Will this option conflict with critical infrastructure, or does the option conflict with existing business, planned land use or valuable agricultural land. (see W6 for Navigation impact)	<ul style="list-style-type: none"> IW GIS layer on land use can highlight areas where agricultural land may be disrupted. IW GIS layer for existing water infrastructure Cannot assess planned land use on IW GIS but can use Myplan.ie to check how land is zoned in a number of different areas Cumulative impacts on other plans and projects will be assessed separately. 	<ul style="list-style-type: none"> IW GIS layers Myplan.ie 	3	N/A
	2	N/A		
	1	Unlikely to have positive impact		
	0	No long term impact on critical infrastructure or operations – such as below ground assets where land can be reinstated		
	-1	Loss of agricultural land. New above ground assets that will change land use		
	-2	Loss to amenities, parks and designated sites or below ground works on land with strategic use.		
	-3	Land with strategic use potential and above ground infrastructure		

A.3.6 Landscape and Visual

Table A-6: Fine screening questions L1

Fine Screening Question L1	Criteria	Data Source	Score	
Landscape and Visual: Could this option impact the landscape character areas, townscape character areas or important views – detract or improve?	<ul style="list-style-type: none"> • Does the option entail new assets e.g. WTP, pipeline and boreholes? • Proximity to settlements • Are there any landscape considerations in this area? • Score more negatively if located in a sensitive landscape. 	<ul style="list-style-type: none"> • Datasets/Documents exist for some counties (e.g. Wicklow) but no central map with all counties • IW GIS layers 	3	Unlikely to be sufficient information for allocation of +3 scoring
			2	Unlikely to be sufficient information for allocation of +2 scoring
			1	Rationalisation involving removal of above ground structures
			0	No additional visual impact – such as upgrade within an existing site
			-1	Temporary View Impact i.e. construction of below ground assets
			-2	New above ground assets
			-3	New significant above ground assets in landscape amenity areas

A.3.7 Climate Change

Table A-7: Fine screening questions CC1

Fine Screening Question CC1	Criteria	Data Source	Score	
Climate Change: What is the level of construction and operational carbon emissions associated with the option – tonnes?	<ul style="list-style-type: none"> Carbon cost information to be used if available for fine screening otherwise scoring based on indicators of construction and operational scale from initial option descriptions 	<ul style="list-style-type: none"> Option desc riptions 	3	N/A
	<ul style="list-style-type: none"> New large WTPs scored negatively based on energy requirements. 		2	N/A
	<ul style="list-style-type: none"> Energy intensive processes such as desalination and effluent reuse to be reflected in scoring 		1	N/A
	<ul style="list-style-type: none"> Note: Carbon calculations for embodied and operational carbon and NPV costings undertaken after fine screening and used as an input for the approach development rather than the MCA carbon scoring. 		0	Small increases in abstraction at existing sites <10m ³ /d or small scale upgrades.
	<ul style="list-style-type: none"> There might be opportunity for reducing carbon through the use of renewable energy sources. If this information is not available for scoring it will be highlighted in the assessment for consideration either for a specific scheme or in relation to opportunities across a WRZ/study area/region. 		-1	Increases in abstraction, pumping water through <20km of network, increase in abstraction to from 0.1 to 10Ml/d
			-2	Significant new/increases in abstraction (>10 to 50Ml/d), pumping water through >20-50km of network
			-3	Significant new/increases in abstraction (>50Ml/d), pumping water through >50km of network or energy intensive treatment such as desalination

A.3.8 Cultural Heritage

Table A-8: Fine screening questions CH1

Fine Screening Question CH1	Criteria	Data Source	Score	
<p>Cultural Heritage:</p> <p>Does this option avoid direct damage to, or detract from the setting of, designated cultural heritage assets, or does this contribute to protecting them?</p>	<ul style="list-style-type: none"> • Is the option located in proximity distance of these sites? • Unknown archaeological risk is not scored at this stage but to be considered at later assessment stages. • Unlikely to be sufficient information to score any benefits such as improvements to access to sites. 	<ul style="list-style-type: none"> • IW GIS layers for National Monuments in State Care and NIAHs • Online historic environment viewer 	3	N/A
	2	N/A		
	1	N/A		
	0	No or low risk to cultural heritage sites		
	-1	New above ground assets close to heritage site (NIAH/SMR) – potential to detract from setting		
	-2	New above ground/below ground asset close to heritage site (NIAH/SMR) that would not result in a loss of site but would involve a large amount of archaeological input		
	-3	New above ground/below ground asset resulting in loss of NIAH/SMR site (e.g. a pipeline through an earthworks site)		

A.3.9 Geology and Soils

Table A-9: Fine screening questions G1

Fine Screening Question G1	Criteria	Data Source	Score	
Geology and Soils: Would any designated or non-designated geological features, valuable soils, or contaminated land sites be affected?	<ul style="list-style-type: none"> Loss of valuable geological sites or risks from contaminated sites and loss of soils resources. Lack of detail on design and routing at this stage so not possible to assess to sufficiently to compare options other than to check geological features are avoided. Further assessment of impact on soils or risks from contaminated land would be required at a more detailed assessment stage. 	<ul style="list-style-type: none"> Online GSI database IW GIS layers for soils, geological features 	3	N/A
	2	N/A		
	1	N/A		
	0	No or low risk to geological heritage sites		
	-1	New above ground assets close to geological heritage site – potential to detract from setting. Some risk to archaeological interest from below ground construction		
	-2	New above ground/below ground asset within geological heritage site that would not result in a loss of site but would involve a large amount of input		
	-3	New above ground/below ground asset resulting in loss of geological heritage site		

Appendix B SA5 Example for a Preferred Approach Options Assessment

Keys	
Nature of effect:	
L	= long term (>15 years)
S	= short term (<5 years)
P	= permanent
T	= temporary
Significance of effect:	
+++	Major beneficial
++	Moderate beneficial
+	Minor beneficial
0	Neutral
-	Minor adverse
--	Moderate adverse
---	Major adverse
Carbon NPV Cost/Tonnes (scaled):	
0	Neutral
-	Minor
--	Moderate
---	Major

Option ref: TG4-SA5-XX	
Option description: Increase GW abstraction for the WRZ to supply deficit <p>This option proposes to increase supply to the WRZ by an increase to the existing groundwater abstraction. The option also includes an upgrade to the WTP, a new reservoir, new/upgrade pumps and new/upgraded network to allow for the additional supply. No WTP or abstraction will be decommissioned as part of this option.</p> <p>The locations and details of any required mains, networks upgrades and service reservoirs will be determined at project level.</p>	
Interdependencies/ Assumptions/Risks <ul style="list-style-type: none"> Planning permissions and licencing required to deliver this option Pump and pipe sizing based on 24 hour Deficit Pipes are laid in road 	<p>Standard mitigation implemented: It is assumed that all construction activities would be undertaken in line with standard good practice measures as outlined in a CEMP. The appropriate pre-construction ecological surveys would be undertaken to inform an assessment of risks to habitats and protected species and requirements for invasive species management measures, and measures such as directional drilling would be used to minimise impacts on the regional and national road network. All habitats and land uses would be reinstated following construction except where specifically identified within the assessment.</p>

Assessment limitations: At this stage of plan development limited information is available regarding the exact location and spatial extents of new infrastructure proposals and the potential impacts of new or increased abstractions on water quality and quantity. The assessment has been undertaken using professional judgement and based on high level quantitative information where available.

Assessment certainty: **Medium**

Nature of effect:

L = long term (>15 years)

S = short term (<5 years)

P = permanent

T = temporary

Significance of effect:

+++ Major beneficial

++ Moderate beneficial

+ Minor beneficial

0 Neutral

- Minor adverse

-- Moderate adverse

--- Major adverse

SEO	Potential effects (after standard mitigation)	SEA mitigation	Residual effects	
			Construction	Operation
Protect public health and promote wellbeing (P1, P2, P3)	Potential short term minor adverse impacts to public health and/or quality of life from dust, noise and additional traffic movements within a rural area during the construction phase. Minor beneficial impacts assessed during operation as the new storage reservoir and supply network will be below ground, and other new infrastructure would be small scale and/or within the curtilage of the existing WTW. Option will increase the resilience of water supply for local communities, with attendant beneficial impacts for public health.	Public consultation to minimise short term disruption and impact. WTP upgrade to meet standards as required in Drinking Water Regulations (S.I. No. 122 of 2014) (as amended).	- (S, T)	+ (P)
Protect and enhance biodiversity and contribute to resilient ecosystems (B1, B2, B3, B4 and B5)	Potential short term minor adverse effects during construction associated with very localised removal of potential habitats including trees, hedges and grassland during construction of the new surface reservoir and the new borehole. Potential permanent minor adverse effect on the SPA and NHA (designated for wetland habitat and wintering waterfowl) during operation associated with increase in abstraction volumes from existing groundwater source which is indirectly linked to the SPA/NHA, and through direct impacts on Atlantic salmon populations within the River as a result of reduced flow volumes.	Further assessment of potential impacts on European and National designated sites (SPA and NHA) and development of mitigation (for example, seasonal limits on abstraction volumes as informed through further study including hydrogeological modelling). NIS required. Small scale refinements to pipeline alignment to avoid or minimise impacts on non-designated habitats where practicable. Reinstatement to include biodiversity enhancement including improvements to habitat connectivity and link to landscape sensitivity.	- (P)	- (P)

To protect landscapes, townscapes and visual amenity (L1)	Potential for short term minor adverse impacts to the local landscape and visual amenity of the area during construction of the new borehole, surface reservoir and supply network. Neutral impacts anticipated during operation as the new surface reservoir and supply network would be underground, and other new infrastructure would be small scale and/or within the curtilage of the existing WTW.	Utilisation of landscape screening if appropriate to reduce visual impacts during construction.	- (S, T)	0 (P)
Protect and where appropriate enhance, built and natural assets and reduce waste (M1 and M2)	<p>Option would require construction of approximately XXkm of new network to transfer water between the WTW and the new storage reservoir, and then on to distribution.</p> <p>Potential for small temporary loss of agricultural land during construction of the new supply network, and small scale permanent loss of agricultural land within the footprint of the new surface reservoir.</p>	Refine pipeline alignment and siting of storage reservoir to avoid built and natural assets where practicable. Consideration of waste hierarchy in design.	- (S, T)	- (L)
Reduce greenhouse gas emissions (C1)	<p>Relative to deployable output created, carbon emissions associated with the construction and operation of this option are assessed as minor adverse.</p> <p>Carbon NPV Cost = €XXX</p> <p>Embodied Carbon (tonnes) = XXX</p>	Consider potential for use of renewable energy sources to reduce carbon footprint during construction and operation.	- (S, T)	- (P)
Contribute to environmental climate change resilience (R1, R2 and R5)	The increased abstraction volume and storage reservoir would help ensure future resilience of supply for local communities. The increased groundwater abstraction has potential adverse effects for environmental resilience; however, initial high level assessments indicate that this aquifer is relatively resilient to future climate change.	Further hydrological modelling and assessment to determine potential impacts on waterbodies and terrestrial ecosystems that are reliant on source inputs from this groundwater body under future climate scenarios.	0 (S, T)	- (L)

Protect and improve surface water and groundwater status (W1, W2 and W3)	Any potential construction impacts on surface water quality can be mitigated through implementation of standard good practice measures. Permanent minor adverse effect identified during operation associated with risk to groundwater status as a result of increased abstraction.	Further investigation into the hydrological impacts of increasing the groundwater abstraction volumes at this location, and then if deemed necessary, development of operating procedures for the new increased abstraction at this location which aim to safeguard groundwater flows and quality.	0 (S, T)	- (L)
Avoid flood risk (W5)	No impediment to surface water flow paths or increase to flood risk anticipated.	None identified	0 (S, T)	0 (P)
Protect and where appropriate, enhance cultural heritage assets (CH1)	The option is located where there are a number of cultural heritage assets and known archaeology listed under the Record of Monuments/Record of Protected Structures and/or National Inventory of Architectural Heritage records. Potential minor adverse short term impacts on the setting of heritage assets during construction of the new surface water reservoir and supply network, and also risks of disturbance to unknown archaeology where new infrastructure is located outside the road network or footprint of the existing WTW. During operation, the supply network and storage reservoir would be below ground, there would be no long term impacts on cultural heritage assets.	Maintenance of access to cultural heritage assets during construction. Further desk based archaeological assessment work to help inform siting of storage reservoir and pipeline alignment and identify appropriate mitigation for risks to unknown archaeology during construction.	- (S, T)	0 (P)
Protect quality and function of soils (G1)	No geological features or valuable soil resources at risk as a result of the option. However, there is potential risk of minor damage to valuable soils during construction of the new surface water reservoir and also the new borehole, pumping station and supply network.	Development of Soil Management Plan	- (S, T)	0 (P)

Appendix C Fine Screening Summaries

Note these scores are subject to review and revision as part of developing the Regional plan and are presented here for illustration

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

Table C-1: Fine screening summary of groundwater options in SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-01	Increase GW abstraction for Ahascragh WRZ to supply deficit								0	0	-10
TG4-SA5-02	New GW abstraction for Ahascragh WRZ to supply deficit								0	0	-10
TG4-SA5-04	Rationalise Ahascragh WRZ to South								1	0	-16

Ref.	Name	Environmental							Total 3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
	Roscommon (Lisbrock & Killeglan)										
TG4-SA5-07a	Develop Moate groundwater (3 No. borehole) and transfer water from new WTP at Moate through new pumped watermain (17.5km) to SR in Athlone.								0	0	-17
TG4-SA5-07b	Develop Moate groundwater (3 No. borehole) and transfer water from new WTP at Moate through new pumped watermain (17.5km) to SR in Athlone. This will allow 1 Ml/d to be offset from Athlone WTP and supply South Roscommon deficit with new supply watermain (1								0	0	-17

Ref.	Name	Environmental							Total 3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-08	New GW at Athlone WRZ - Athlone Gravels to supply the deficit								1	0	-15
TG4-SA5-11	New riverbank filtration adjacent to River Shannon at Athlone to supply deficit in Athlone WRZ								1	0	-18
TG4-SA5-14	Gravels at Ballycumber to supply deficit								0	0	-16
TG4-SA5-16	New GW at South Roscommon (Lisbrick & Killeglan) WRZ to supply deficit in Athlone & South Roscommon (Lisbrick & Killeglan)								1	0	-13
TG4-SA5-20	New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)								0	0	-16

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-26	New GW abstraction to supply Birr and Kinnity								0	0	-17
TG4-SA5-29	Supply deficit from Tullamore (SA6) (develop Tullamore wellfield and upgrade existing WTP)								0	0	-14
TG4-SA5-31a	Increase GW abstraction at Rahan to supply deficit and transfer spare capacity to Clara/Ferbane into SR via new pumped watermain (12.9km)								2	0	-20
TG4-SA5-31b	GW in Ferbane Gravels								0	0	-10
TG4-SA5-33	Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP								0	0	-8
TG4-SA5-34	New GW abstraction to supply deficit in Kilcormac								0	0	-11

Ref.	Name	Environmental							Total 3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-37a	Increase GW abstraction at Mount Talbot Spring to supply deficit								1	0	-12
TG4-SA5-37b	Increase GW abstraction at Mount Talbot Spring to supply deficit								1	0	-12
TG4-SA5-38b	Interconnect Mount Talbot/Four Roads with South Roscommon (Lisbrick & Killeglan) and supply deficit from new GW at South Roscommon (Lisbrick & Killeglan)								1	0	-11
TG4-SA5-42a	New GW at Killeglan and upgrade of WTP								1	0	-11
TG4-SA5-42c	New GW at Killeglan and upgrade of WTP								1	0	-12
TG4-SA5-42d	New GW at Killeglan and upgrade of WTP								1	0	-16

Ref.	Name	Environmental							Total 3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-43	New GW at Lisbrock and upgrade of WTP								1	0	-11
TG4-SA5-47	Supply deficit from Mount talbot spring (Mount Talbot/Four Roads WRZ)								1	0	-12
TG4-SA5-49	Develop Moate groundwater (3 No. borehole) and transfer water from new WTP at Moate through new pumped watermain (17.5km) to SR in Athlone. This will allow 1 MI/d to be offset from Athlone WTP and supply South Roscommon deficit with new supply watermain (1								0	0	-16
TG4-SA5-50a	New GW at South Roscommon (Lisbrock & Killeglan) WRZ to supply deficit in Athlone & South								1	0	-13

Ref.	Name	Environmental							Total scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
	Roscommon (Lisbrock & Killeglan)										
TG4-SA5-59	Increase GW abstraction at Ballyshane Bridge Borehole, Kinnity (Bredagh groundwater body - productive fissured bedrock) to partly supply deficit								0	0	-10
TG4-SA5-64	Increase GW abstraction at Clara Plant BH and upgrade Clara WTP to supply deficit								0	0	-9
TG4-SA5-65	Increase GW abstraction at Moyclare Wells and Moyclare WTP to supply deficit (Gageborogh-Brosna Gavels groundwater body)								1	0	-13
TG4-SA5-73	Increase abstraction at Hollimshill BHs and upgrade Rahan -								0	0	-9

Ref.	Name	Environmental							Total 3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
	Holmshill WTP (Tullamore groundwater body - karstic bedrock)										
TG4-SA5-74	Increase abstraction at Agall Spring and upgrade Agall WTP (Tullamore groundwater body - karstic bedrock)								1	0	-11
TG4-SA5-75	No deficit. Upgrade WTP to address WQ issues.								0	0	-8
TG4-SA5-76	New GW abstraction/wellfield at Holimshill-Killeigh Gavels groundwater body - location TBC								1	0	-14

Table C-2: Fine screening summary of surface water options in SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-03	Increase SW abstraction on River Suck for Ahascragh WRZ to supply deficit								0	0	-12
TG4-SA5-05a	Interconnect South Roscommon (Lisbrock & Killeglan), Athlone and Ballinasloe to supply deficits and increase resilience of WRZs								1	0	-15
TG4-SA5-09a	Upgrade Athlone WTP to 18Ml/d								1	0	-14
TG4-SA5-09b	Upgrade Athlone WTP to 18M/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm								1	0	-15

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-15	Upgrade Ballymahon (Abbeyshrule WTP) and interconnect	Orange	Light Orange	Orange	Orange	Light Orange	Orange		0	0	-15
TG4-SA5-17a	Increase abstraction from River Suck	Light Orange	Light Grey	Orange	Light Orange	Light Grey	Light Grey		0	0	-11
TG4-SA5-17b	Supply deficit from Ballinasloe (River Suck) and interconnect South Roscommon (Lisbrock & Killeglan) (existing links)	Light Orange	Light Grey	Orange	Light Orange	Light Grey	Light Grey		0	0	-11
TG4-SA5-17c	Supply deficit from Ballinasloe (River Suck) and interconnect South Roscommon (Lisbrock & Killeglan) (existing links)	Light Orange	Light Grey	Orange	Light Orange	Light Grey	Light Grey		0	0	-12
TG4-SA5-17d	Supply deficit from Ballinasloe (River Suck) and interconnect South Roscommon (Lisbrock & Killeglan) (existing links)	Light Orange	Light Grey	Orange	Light Orange	Light Grey	Light Grey		0	0	-12

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-18	Interconnect South Roscommon (Lisbrick & Killeglan), Athlone and Ballinasloe to supply deficits and increase resilience of WRZs (offset from South Roscommon (Lisbrick & Killeglan)	Orange	Grey	Red	Orange	Orange	Orange	Grey	1	0	-15
TG4-SA5-25	Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity	Orange	Grey	Orange	Orange	Orange	Orange	Grey	0	0	-11
TG4-SA5-28	Supply deficit from Banagher WRZ to Clara Ferbrane Moyclare via new watermain (6.4km) - in surplus	Orange	Grey	Orange	Orange	Orange	Orange	Grey	0	0	-11
TG4-SA5-35	New SW abstraction from River Silver to supply deficit in Kilcormac (River Silver 10% 95 = 1.6Ml/d)	Orange	Orange	Orange	Orange	Orange	Orange	Grey	0	0	-14

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-39	Increase SW abstraction from River Suck at Ballinasloe and supply deficit at Mount Talbot								0	0	-12
TG4-SA5-45a	Increased SW abstraction from River Suck and WTP Upgrade at Ballinasloe								0	0	-12
TG4-SA5-45b	New SW abstraction from River Suck								0	0	-16
TG4-SA5-45c	Supply deficit from Ballinasloe and interconnect WRZs (existing links)								0	0	-11
TG4-SA5-46b	Interconnect South Roscommon (Lisbrick & Killeglan), Athlone and Ballinasloe to supply deficits and increase resilience of WRZs								1	0	-15

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-51	Upgrade Athlone WTP to 18M/l/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm	Orange	Grey	Red	Orange	Orange	Orange	Grey	1	0	-15
TG4-SA5-57	New SW abstraction from River Little Brosna to supply deficit	Grey	Orange	Orange	Orange	Orange	Orange	Grey	0	0	-18
TG4-SA5-67	No deficit. Upgrade WTP to address WQ issues.	Grey	Red	Orange	Orange	Grey	Orange	Grey	1	0	-12
TG4-SA5-69	New SW abstraction from River Brosna to supply deficit	Grey	Orange	Orange	Orange	Orange	Orange	Grey	0	0	-19

Table C-3: Fine screening summary of surface water/groundwater filtration options in SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-55	New riverbank filtration from River Camcor to supply deficit								0	0	-14

Table C-4: Fine screening summary of Group Water Scheme options in SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-13	Large reserve at Mount Temple GWS - supply/part supply deficit								0	0	-14

Table C-5: Fine screening summary of rationalisation option in SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-78	Rationalise Rahan WRZ to Tullamore (neighbouring scheme) and supply deficit from Tullamore WRZ (network upgrades required)								0	0	-12

Table C-6: Fine screening summary of cross study area supply options for SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-12b	Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	Orange	Grey	Orange	Red	Grey	Grey	Grey	1	0	-18
TG4-SA5-19	Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	Orange	Grey	Orange	Red	Grey	Grey	Grey	1	0	-18
TG4-SA5-27	Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	Orange	Grey	Orange	Red	Grey	Grey	Grey	1	0	-18
TG4-SA5-30	Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	Orange	Grey	Orange	Red	Grey	Grey	Grey	1	0	-18
TG4-SA5-36	Interconnection of Athlone, Ballinasloe,	Orange	Grey	Orange	Red	Grey	Grey	Grey	1	0	-18

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
	Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan										
TG4- SA5- 41	Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan								1	0	-18

Table C-7: Fine screening summary of water quality options in SA5

Ref.	Name	Environmental							Total -3 scores	Environmental scoring	
		Population, health, economy and recreation	Water Environment: quality and resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology		Positive score - potential beneficial effects	Negative scores - potential adverse effects
TG4-SA5-80	No deficit. Upgrade Banagher WTP to address WQ issue								0	0	-7
TG4-SA5-81	No deficit. Upgrade Clontotin BH to address WQ issue								0	0	-7

Appendix D SA Approaches for SA5

WRZ	Preferred Approach - SA Approach 1			Least Cost - SA Approach 1			Best Environmental - SA Approach 2			Quickest Delivery - SA Approach 3		
	Option Description	Group	Comment	Option Description	Group	Comment	Option Description	Group	Comment	Option Description	Group	Comment
1200SC0005: Ahascragh	TG4-SA5-01: Increase GW abstraction for Ahascragh WRZ to supply deficit			TG4-SA5-01: Increase GW abstraction for Ahascragh WRZ to supply deficit			TG4-SA5-01: Increase GW abstraction for Ahascragh WRZ to supply deficit			TG4-SA5-04: Rationalise Ahascragh WRZ to SRRWSS		
3200SC0002: Athlone	TG4-SA5-09b: Upgrade Athlone WTP to 18M/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm	509		TG4-SA5-09b: Upgrade Athlone WTP to 18M/d and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm	509		TG4-SA5-13: Large reserve at Mount Temple GWS- supply/part supply deficit			TG4-SA5-12b: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnity, Clara/Ferbane and Rahan		
1200SC0006: Ballinasloe	TG4-SA5-20: New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)			TG4-SA5-20: New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)			TG4-SA5-17c: Supply deficit from Ballinasloe (River Suck) and interconnect SRRWSS (existing links)	502		TG4-SA5-19: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnity, Clara/Ferbane and Rahan		
2500SC0001: Banagher	TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue			TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue			TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue			TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue		
2500SC0001: Banagher	TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue			TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue			TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue			TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue		
2500SC0015: Birr/Kinnity	TG4-SA5-25: Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity			TG4-SA5-25: Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity			TG4-SA5-25: Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity			TG4-SA5-27: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnity, Clara/Ferbane and Rahan		
2500SC0016: Clara/Ferbane	TG4-SA5-67: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-67: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-67: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-30: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnity, Clara/Ferbane and Rahan		
2500SC0003: Kilcormac	TG4-SA5-33: Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP.			TG4-SA5-33: Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP.			TG4-SA5-33: Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP.			TG4-SA5-36: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnity, Clara/Ferbane and Rahan		
2600SC0001: Mount Talbot/Four Roads	TG4-SA5-37b: Increase GW abstraction at Mount Talbot Spring to supply deficit			TG4-SA5-37b: Increase GW abstraction at Mount Talbot Spring to supply deficit			TG4-SA5-39: Increase SW abstraction from River Suck at Ballinasloe and supply deficit at Mount Talbot	502		TG4-SA5-37b: Increase GW abstraction at Mount Talbot Spring to supply deficit		
2500SC0017: Rahan	TG4-SA5-75: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-75: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-75: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-41: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnity, Clara/Ferbane and Rahan		
2600SC0006: SRRWSS	TG4-SA5-51: Upgrade Athlone WTP to 18MLD and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm	509		TG4-SA5-51: Upgrade Athlone WTP to 18MLD and supply deficit to the east of South Roscommon via new watermain, connecting into existing 400mm	509		TG4-SA5-45a: Increased SW abstraction from River Suck and WTP Upgrade at Ballinasloe	502		TG4-SA5-42d: New GW at Killeglan and upgrade of WTP		

	Most Resilient - SA Approach 3			Lowest Carbon - SA Approach 4			Best Appropriate Assessment - SA Approach 2		
WRZ	Option Description	Group	Comment	Option Description	Group	Comment	Option Description	Group	Comment
1200SC0005: Ahascragh	TG4-SA5-04: Rationalise Ahascragh WRZ to SRRWSS	515		TG4-SA5-01: Increase GW abstraction for Ahascragh WRZ to supply deficit			TG4-SA5-01: Increase GW abstraction for Ahascragh WRZ to supply deficit		
3200SC0002: Athlone	TG4-SA5-12b: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	516	Transfer	TG4-SA5-16: New GW at SRRWSS WRZ to supply deficit in Athlone & SRRWSS	510		TG4-SA5-13: Large reserve at Mount Temple GWS- supply/part supply deficit		
1200SC0006: Ballinasloe	TG4-SA5-19: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	516	Transfer	TG4-SA5-20: New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)			TG4-SA5-17c: Supply deficit from Ballinasloe (River Suck) and interconnect SRRWSS (existing links)	502	
2500SC0001: Banagher	TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue			TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue			TG4-SA5-80: No deficit. Upgrade Banagher WTP to address WQ issue		
2500SC0001: Banagher	TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue			TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue			TG4-SA5-81: No deficit. Upgrade Clontotin BH to address WQ issue		
2500SC0015: Birr/Kinnitty	TG4-SA5-27: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	516	Transfer	TG4-SA5-25: Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnitty			TG4-SA5-25: Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnitty		
2500SC0016: Clara/Ferbane	TG4-SA5-30: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	516	Transfer	TG4-SA5-67: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-67: No deficit. Upgrade WTP to address WQ issues.		
2500SC0003: Kilcormac	TG4-SA5-36: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	516	Transfer	TG4-SA5-33: Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP.			TG4-SA5-33: Increase GW abstraction to supply deficit in Kilcormac and upgrade WTP.		
2600SC0001: Mount Talbot/Four Roads	TG4-SA5-37b: Increase GW abstraction at Mount Talbot Spring to supply deficit			TG4-SA5-37b: Increase GW abstraction at Mount Talbot Spring to supply deficit			TG4-SA5-39: Increase SW abstraction from River Suck at Ballinasloe and supply deficit at Mount Talbot	502	
2500SC0017: Rahan	TG4-SA5-41: Interconnection of Athlone, Ballinasloe, Kilcormac, Birr/Kinnitty, Clara/Ferbane and Rahan	516	Transfer	TG4-SA5-75: No deficit. Upgrade WTP to address WQ issues.			TG4-SA5-75: No deficit. Upgrade WTP to address WQ issues.		
2600SC0006: SRRWSS	TG4-SA5-42d: New GW at Killeghan and upgrade of WTP	515		TG4-SA5-50a: New GW at SRRWSS WRZ to supply deficit in Athlone & SRRWSS	510		TG4-SA5-45a: Increased SW abstraction from River Suck and WTP Upgrade at Ballinasloe	502	

Appendix E Likely Significant Effect (LSE) Tables

Note if the option from the Preferred Approach is not listed below, there were no European sites identified within the Zol of that option (e.g. Preferred Approach option TG4-SA5-33)

Table E-1: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-01 leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
River Suck Callows SPA (004097)	ca. 4.6km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b non-b	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	<p>Option includes an increase in groundwater abstraction. Option Study Area overlies a karst aquifer.</p> <ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) <p>There is a risk to the wetland used by migratory waterbirds due to the underlying karst/gravel aquifer at the abstraction point.</p>	Y

Table E-2: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-509 (09b & 51) leading to potential LSEs

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
River Shannon Callows SAC (000216)	1.1km	<p>Annex I Habitats</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p> <p>Lowland hay meadows (<i>Alopecurus pratensis, Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion, Alnion incanae, Salicion albae</i>) [91E0]</p> <p>Annex II species</p> <p><i>Lutra lutra</i> (Otter) [1355]</p>	<p>This option includes an increase in abstraction from the River Shannon. Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Physical loss of habitats/supporting habitat Habitat degradation – changes in water quality (pollution) Disturbance (including biological disturbance) 	<p>This option includes an increase in surface water abstraction from the River Shannon.</p> <ul style="list-style-type: none"> Habitat degradation – changes in water quality (hydrological changes) Changes in water table/ availability from abstraction 	Y
Lough Ree SAC (000440)	<600m	<p>Annex I Habitats</p> <p>Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> - type vegetation [3150]</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) [6210]</p> <p>Active raised bogs [7110]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Disturbance to otter 	<p>This option includes an increase in abstraction downstream of this SAC. Option study area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Habitat degradation – changes in water quality (hydrological changes) 	Y

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		<p>Degraded raised bogs still capable of natural regeneration [7120]</p> <p>Alkaline fens [7230]</p> <p>Limestone pavements [8240]</p> <p>Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0]</p> <p>Bog woodland [91D0]</p> <p><u>Annex II species</u></p> <p><i>Lutra lutra</i> (Otter) [1355]</p>		<ul style="list-style-type: none"> Changes in water table/ availability from abstraction 	
Crossword Bog SAC (002337)	4.2km	<p><u>Annex I Habitats</u></p> <p>Active raised bogs [7110]</p> <p>Degraded raised bogs still capable of natural regeneration [7120]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <p>However, impacts are unlikely given distance from site and the QI features it supports.</p>	<p>No operational impacts are predicted</p>	N
Pilgrim's Road Esker SAC (001776)	ca. 10km	<p><u>Annex I Habitats</u></p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*) important orchid sites) [6210]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <p>However, impacts are unlikely given distance from site and the QI features it supports.</p>	<p>No operational impacts are predicted</p>	N
Mongan Bog SAC (000580)	ca. 10km	<p><u>Annex I Habitats</u></p> <p>Active raised bogs [7110]</p>	<p>Option Study Area is hydrologically linked to this European site.</p>	<p>No operational impacts are predicted</p>	N

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the Rhynchosporion [7150]	However, impacts are unlikely given distance from site and the QI features it supports.		
Ballynamona Bog and Corkip Lough SAC (002339)	ca. 1.6km	Annex I Habitats Turloughs [3180] Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the Rhynchosporion [7150] Bog woodland [91D0]	Study Area is located downstream of this site. Therefore, impacts are unlikely given distance from site and the QI features it supports.	No operational impacts are predicted	N

Table E-3: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-509 (09b & 51) leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
Lough Ree SPA (004064)	<600m	Little Grebe (<i>Tachybaptus ruficollis</i>) [A004] Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Mallard (<i>Anas platyrhynchos</i>) [A053] Shoveler (<i>Anas clypeata</i>) [A056] Tufted Duck (<i>Aythya fuligula</i>) [A061] Common Scoter (<i>Melanitta nigra</i>) [A065] Goldeneye (<i>Bucephala clangula</i>) [A067] Coot (<i>Fulica atra</i>) [A125] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142]	non-b non-b non-b non-b non-b non-b breed non-b non-b non-b non-b breed	<ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds within the SPA, using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	No operational impacts are predicted	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Common Tern (<i>Sterna hirundo</i>) [A193] Wetland and Waterbirds [A999]				
Middle Shannon Callows SPA (004096)	1.1km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Corncrake (<i>Crex crex</i>) [A122] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]	non-b non-b breed non-b non-b non-b non-b	<ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds within the SPA, using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland) 	No operational impacts are predicted	Y
River Suck Callows SPA (004097)	4.4km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140]	non-b non-b non-b non-b non-b	<p style="color: red;">Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA 	No operational impacts are predicted	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]		or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).		

Table E-4: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-20 leading to potential LSEs

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
River Shannon Callows SAC (000216)	ca. 15km	Annex I Habitats Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410] Lowland hay meadows (<i>Alopecurus pratensis, Sanguisorba officinalis</i>) [6510] Limestone pavements [8240]	Option Study Area is hydrologically linked to this European site. However, given the distance from site, and the QI features it supports there is no potential for LSE.	No potential impact pathway. Although there is a groundwater abstraction, this is over 5km from this site. Therefore, given the distance from the site and the QI features it supports there is no potential for LSE.	N

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0]			
		<u>Annex II species</u> <i>Lutra lutra</i> (Otter) [1355]			

Table E-5: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-20 leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
River Suck Callows SPA (004097)	ca. 100m	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142]	non-b non-b non-b non-b non-b	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> • Habitat degradation – changes in water quality (pollution) • Disturbance: there is potential for disturbance to QI birds given the proximity to the SPA. 	<p>Option includes a groundwater abstraction. Option Study Area overlies a karst aquifer.</p> <ul style="list-style-type: none"> • Changes in water table/ availability from abstraction • Habitat degradation – changes in water quality (hydrological changes) 	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]			There is a risk to the wetland used by migratory waterbirds due to the underlying karst/gravel aquifer at the abstraction point.	

Table E-6: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-80 leading to potential LSEs

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
River Shannon Callows SAC (000216)	< 550m	<u>Annex I Habitats</u> Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410] Lowland hay meadows (<i>Alopecurus pratensis, Sanguisorba officinalis</i>) [6510] Limestone pavements [8240] Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion, Alnion incanae, Salicion albae</i>) [91E0]	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Physical loss of habitats/supporting habitat Habitat degradation – changes in water quality (pollution) Disturbance (including biological disturbance) 	No operational impacts are predicted	Y

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		<u>Annex II species</u> <i>Lutra lutra</i> (Otter) [1355]			
Redwood Bog SAC (002353)	ca. 6km	<u>Annex I Habitats</u> Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the <i>Rhynchosporion</i> [7150]	Option Study Area is hydrologically linked to this European site. However, given the distance from site, and the QI features it supports there is no potential for LSE.	No operational impacts are predicted	N

Table E-7: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-80 leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
Middle Shannon Callows SPA (004096)	ca. 550m	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Corncrake (<i>Crex crex</i>) [A122]	non-b non-b breed non-b	• Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA	No operational impacts are predicted	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]	non-b non-b non-b	but ecologically connected to it (e.g. grassland, arable farmland).		
All Saints Bog SPA (004103)	3.7km	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	non-b	<ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	No operational impacts are predicted	Y
River Little Brosna Callows SPA (004086)	5km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Pintail (<i>Anas acuta</i>) [A054] Shoveler (<i>Anas clypeata</i>) [A056]	non-b non-b non-b non-b non-b	Given the distance from site, and the QI features it supports there is no potential for LSE.	No operational impacts are predicted	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b			

Table E-8: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-81 leading to potential LSEs

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
River Shannon Callows SAC (000216)	2.5km	<p>Annex I Habitats</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p> <p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p>Annex II species</p> <p><i>Lutra lutra</i> (Otter) [1355]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> • Habitat degradation – changes in water quality (pollution) • Disturbance (including biological disturbance) 	No operational impacts are predicted	Y
All Saints Bog and Esker SAC (000566)	ca. 2.5km	<p>Annex I Habitats</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) [6210]</p> <p>Active raised bogs [7110]</p> <p>Degraded raised bogs still capable of natural regeneration [7120]</p>	Given the distance from site, and the QI features it supports there is no potential for LSE.	No operational impacts are predicted	N

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		Depressions on peat substrates of the Rhynchosporion [7150] Bog woodland [91D0]			

Table E-9: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-81 leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
Middle Shannon Callows SPA (004096)	2.5km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Corncrake (<i>Crex crex</i>) [A122] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156]	non-b non-b breed non-b non-b non-b non-b	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	No operational impacts are predicted	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]				
All Saints Bog SPA (004103)	2.5km	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	non-b	<ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	No operational impacts are predicted	Y
River Little Brosna Callows SPA (004086)	4.5km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Pintail (<i>Anas acuta</i>) [A054] Shoveler (<i>Anas clypeata</i>) [A056] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156]	non-b non-b non-b non-b non-b non-b non-b non-b non-b	<ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	No operational impacts are predicted	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]				

Table E-10: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-25 leading to potential LSEs

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
River Shannon Callows SAC (000216)	ca. 15km	Annex I Habitats Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410] Lowland hay meadows (<i>Alopecurus pratensis, Sanguisorba officinalis</i>) [6510] Limestone pavements [8240]	Option Study Area is hydrologically linked to this European site. However, given the distance from site, and the QI features it supports there is no potential for LSE.	No operational impacts are predicted	N

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0] Annex II species <i>Lutra lutra</i> (Otter) [1355]			

Table E-11: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-25 leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
Dovegrove Callows SPA (004137)	3.7km	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	non-b	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it 	<p>Option includes a surface water abstraction.</p> <ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) <p>There is a risk to the wetland used by migratory waterbirds</p>	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
				(e.g. grassland, arable farmland).	due to the underlying karst/gravel aquifer at the abstraction point.	
River Little Brosna Callows SPA (004086)	6.4km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Pintail (<i>Anas acuta</i>) [A054] Shoveler (<i>Anas clypeata</i>) [A056] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b non-b non-b non-b non-b non-b non-b	Option Study Area is hydrologically linked to this European site. However, given the distance from site, and the QI features it supports there is no potential for LSE.	No potential impact pathway. Although there is a groundwater abstraction, this is over 5km from this site. Therefore, given the distance from the site and the QI features it supports there is no potential for LSE.	N

Table E-12: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-67 leading to potential LSEs. **Note: No SPAs within Zol for TG4-SA5-67**

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
Clara Bog SAC (000572)	ca. 2km	<p>Annex I Habitats</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210]</p> <p>Active raised bogs [7110]</p> <p>Degraded raised bogs still capable of natural regeneration [7120]</p> <p>Depressions on peat substrates of the Rhynchosporion [7150]</p> <p>Bog woodland [91D0]</p>	Given the distance from site, lack of hydrological link and the QI features it supports there is no potential for LSE.	No operational impacts are predicted	N
River Shannon Callows SAC (000216)	ca. 25km	<p>Annex I Habitats</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p> <p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <ul style="list-style-type: none"> • Habitat degradation – changes in water quality (pollution) 	No operational impacts are predicted	Y

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
		<u>Annex II species</u> <i>Lutra lutra</i> (Otter) [1355]			

Table E-13: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-37b leading to potential LSEs

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
Four Roads Turlough SAC (001637)	1.2km	<u>Annex I Habitats</u> Turloughs [3180]	No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports.	<p>Option includes an increase in groundwater abstraction. Option Study Area overlies a karst aquifer.</p> <ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) <p>Abstraction point is within a karstic aquifer which connects the site to the SAC within 5km.</p>	Y

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
Lisduff Turlough SAC (000609)	3.4km	Annex I Habitats Turloughs [3180]	No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports.	<p>Option includes an increase in groundwater abstraction. Option Study Area overlies a karst aquifer.</p> <ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) <p>Abstraction point is within a karstic aquifer which connects the site to the SAC within 5km.</p>	Y
Aughrim (Aghrane) Bog SAC (002200)	4.4km	Annex I Habitats Degraded raised bogs still capable of natural regeneration [7120]	No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports.	No operational impacts are predicted	N
Ballygar (Aghrane) Bog SAC (002199)	4.9km	Annex I Habitats Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120]	No potential impact pathway given distance from site, lack of hydrological connection and the QI features it supports.	No operational impacts are predicted	N
Lough Croan Turlough	5.0km	Annex I Habitats Turloughs [3180]	No potential impact pathway given distance from site, lack of hydrological connection	<p>Option includes an increase in groundwater abstraction. Option Study Area overlies a karst aquifer.</p>	Y

European Sites	Distance from Option Study Area (km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
SAC (000610)			and the QI feature it supports.	<ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) <p>Abstraction point is within a karstic aquifer which connects the site to the SAC within 5km.</p>	

Table E-14: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-37b leading to potential LSEs. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
River Suck Callows SPA (004097)	0km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142]	non-b non-b non-b non-b non-b	<p>Option Study Area is directly adjacent to this European site.</p> <ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds, within the SPA, using supporting habitats in areas outside of the SPA but 	<p>Option Study Area overlies a karst aquifer.</p> <ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) 	Y

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Potential for LSEs
				Construction	Operation	
		Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]		ecologically connected to it (e.g. grassland, arable farmland).		
Four Roads Turlough SPA (004140)	1.2km	Golden Plover (<i>Pluvialis apricaria</i>) [A140] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b	<ul style="list-style-type: none"> Disturbance: there is potential for disturbance to QI birds using supporting habitats in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). 	<p>Option Study Area overlies a karst aquifer.</p> <ul style="list-style-type: none"> Changes in water table/ availability from abstraction Habitat degradation – changes in water quality (hydrological changes) 	Y
Lough Croan Turlough SPA (004139)	5.0km	Shoveler (<i>Anas clypeata</i>) [A056] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b	No potential impact pathway given distance from site, lack of hydrological connection and the QI features it supports.	No operational impacts are predicted	N

Table E-15: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-75 leading to potential LSEs. **Note: No SPAs within Zol for TG4-SA5-75**

European Sites	Distance from Option Study Area (Km)	Qualifying Interests	Potential Impact Pathway		Potential for LSEs
			Construction	Operation	
Clara Bog SAC (000572)	2.3km	<p>Annex I Habitats</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) [6210]</p> <p>Active raised bogs [7110]</p> <p>Degraded raised bogs still capable of natural regeneration [7120]</p> <p>Depressions on peat substrates of the <i>Rhynchosporion</i> [7150]</p> <p>Bog woodland [91D0]</p>	<p>No potential impact pathway given distance from site, lack of hydrological connection and the QI features it supports.</p>	<p>No operational impacts are predicted.</p>	N
Charleville Wood SAC (000571)	3.5km	<p>Annex I Habitats</p> <p>Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0]</p> <p>Annex II Species</p> <p><i>Vertigo moulensisiana</i> (Desmoulin's Whorl Snail) [1016]</p>	<p>No potential impact pathway given distance from site, lack of hydrological connection given that the study area is downstream of this European site, and the QI features it supports.</p> <p>At fine screening potential LSE were identified but on review the potential for LSE have been ruled out because of a lack of hydrological link.</p>	<p>No operational impacts are predicted.</p>	N

Appendix F Adverse Effects on Site Integrity (AESI) Tables

Preferred Approach option TG4-SA5-33 not listed below as no LSEs identified for this option.

Table F-1: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-01 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
River Suck Callows SPA (004097)	ca. 4.6km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b non-b	Option Study Area is hydrologically linked to this European site. Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	Option includes an increase in GW abstraction. Option Study Area overlies a karst aquifer. Water table/ availability There is a risk to the wetland used by migratory waterbirds due to the underlying Karst/gravel aquifer at the abstraction point. Habitat degradation – changes in water quality	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) With the implementation of mitigation as noted above there is no potential for AESI	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
					(hydrological changes). Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.		

Table F-2: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-509 (09b & 51) and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
River Shannon Callows SAC (000216)	1.1km	Annex I Habitats Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]	This option includes an increase in abstraction from the River	This option includes an increase in SW abstraction from the River Shannon.	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. 	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
		<p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p>Annex II species</p> <p><i>Lutra lutra</i> (Otter) [1355]</p>	<p>Shannon. Option Study Area is hydrologically linked to this European site.</p> <p>Habitat loss – there is potential for some loss of/damage to supporting habitat during construction works given that the works are within River Shannon, upstream of the SAC.</p> <p>Habitat degradation – water quality potential pollution of watercourses during construction could affect hydrologically</p>	<p>Habitat degradation – changes in water quality (hydrological changes)</p> <p>Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species or habitats.</p> <p>Water table/ Availability</p> <p>There is potential for impacts on otter utilising watercourse hydrologically linked to this European site through a reduction in flows/water levels.</p>	<ul style="list-style-type: none"> Measure 6.3.5a: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
			connected habitats. Disturbance (including biological disturbance) – there is potential for disturbance to otter from construction works. There is also potential for the spread of invasive species given that the works are within the River Shannon.			
Lough Ree SAC (000440)	<600m	<p>Annex I Habitats</p> <p>Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> - type vegetation [3150]</p> <p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*) important orchid sites) [6210]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <p>Disturbance – there is potential for disturbance to</p>	<p>This option includes an increase in abstraction downstream of this European site. Option Study Area is hydrologically</p>	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5a: Hydrogeological modelling (Appendix H, Section H.2.5) 	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
		<p>Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Alkaline fens [7230] Limestone pavements [8240] Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0] Bog woodland [91D0]</p> <p><u>Annex II species</u> <i>Lutra lutra</i> (Otter) [1355]</p>	otter from construction works due to their proximity to the SAC.	<p>linked to this European site. Habitat degradation – changes in water quality (hydrological changes) Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species or habitats.</p> <p>Water table/ availability There is likely a high association between surface water and groundwater flows at the abstraction point; a high Baseflow Index (BFI). Therefore, there is potential impacts to</p>	With the implementation of mitigation as noted above there is no potential for AESI	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
				groundwater dependent habitats.		

Table F-3: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-509 (09b & 51) and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (Non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
Lough Ree SPA (004064)	<600m	Little Grebe (<i>Tachybaptus ruficollis</i>) [A004] Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Mallard (<i>Anas platyrhynchos</i>) [A053] Shoveler (<i>Anas clypeata</i>) [A056]	non-b non-b non-b non-b non-b non-b non-b breed non-b non-b non-b	Disturbance - there is potential for disturbance to QI birds within the SPA, using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (Non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
		Tufted Duck (<i>Aythya fuligula</i>) [A061] Common Scoter (<i>Melanitta nigra</i>) [A065] Goldeneye (<i>Bucephala clangula</i>) [A067] Coot (<i>Fulica atra</i>) [A125] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Common Tern (<i>Sterna hirundo</i>) [A193] Wetland and Waterbirds [A999]	non-b breed				
Middle Shannon Callows SPA (004096)	1.1km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Corncrake (<i>Crex crex</i>) [A122] Golden Plover (<i>Pluvialis apricaria</i>) [A140]	non-b non-b breed non-b non-b non-b non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (Non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
		Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]		connected to it (e.g. grassland, arable farmland).			
River Suck Callows SPA (004097)	4.4km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	

Table F-4: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-20 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
River Suck Callows SPA (004097)	ca. 100m	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b non-b	Option Study Area is hydrologically linked to this European site. Habitat degradation – water quality there is potential for pollution of wetland habitat that could pose a risk to migratory waterbirds. Disturbance - there is potential for disturbance to QI birds within the SPA, using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g.	Option includes a GW abstraction. Option Study Area overlies a karst aquifer. Water table/ availability There is a risk to the wetland used by migratory waterbirds due to the underlying Karst/gravel aquifer at the abstraction point. Habitat degradation – changes in water quality (hydrological changes).	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
				grassland, arable farmland).	Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.		

Table F-5: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-80 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (Km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
River Shannon Callows SAC (000216)	< 550m	<p>Annex I Habitats</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <p>Habitat degradation – water quality potential pollution of</p>	<p>No operational impacts are predicted</p>	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. 	N

European Sites	Distance from Proposed Study Area (Km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
		<p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p>Annex II species</p> <p><i>Lutra lutra</i> (Otter) [1355]</p>	<p>watercourses during construction could affect hydrologically connected habitats.</p> <p>Disturbance (including biological disturbance) – there is potential for disturbance to otter from construction works. There is also potential for the spread of invasive species given that the works are hydrologically linked to the SAC.</p>		<p>With the implementation of mitigation as noted above there is no potential for AESI</p>	

Table F-6: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-80 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)	
				Construction	Operation			
Middle Shannon Callows SPA (004096)	ca. 550m	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Corncrake (<i>Crex crex</i>) [A122] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]	non-b non-b breed non-b non-b non-b non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>		N
All Saints Bog SPA (004103)	3.7km	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix A, Section H.2. 	N	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
				hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).		With the implementation of mitigation as noted above there is no potential for AESI	

Table F-7: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-81 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (Km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
River Shannon Callows SAC (000216)	2.5km	<p>Annex I Habitats</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p> <p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <p>Habitat degradation – water quality potential pollution of watercourses during construction could</p>	<p>No operational impacts are predicted</p>	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (Km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
		<p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p><u>Annex II species</u> <i>Lutra lutra</i> (Otter) [1355]</p>	<p>affect hydrologically connected habitats.</p> <p>Disturbance (including biological disturbance) – there is potential for disturbance to otter from construction works. There is also potential for the spread of invasive species given that the works are hydrologically linked to the SAC.</p>			

Table F-8: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-81 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)	
				Construction	Operation			
Middle Shannon Callows SPA (004096)	2.5km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Corncrake (<i>Crex crex</i>) [A122] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]	non-b non-b breed non-b non-b non-b non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>		N
All Saints Bog SPA (004103)	2.5km	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate	No operational impacts are predicted	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. 	N	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
				hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).		With the implementation of mitigation as noted above there is no potential for AESI	
River Little Brosna Callows SPA (004086)	4.5km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Pintail (<i>Anas acuta</i>) [A054] Shoveler (<i>Anas clypeata</i>) [A056] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179]	non-b non-b non-b non-b non-b non-b non-b non-b non-b non-b	Disturbance - there is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	No operational impacts are predicted.	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. With the implementation of mitigation as noted above there is no potential for AESI	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
		Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]					

Table F-9: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-25 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
Dovegrove Callows SPA (004137)	3.7km	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395]	non-b	Option Study Area is hydrologically linked to this European site. Disturbance - there is potential for disturbance to QI birds using habitats situated	Option includes a SW abstraction. Habitat degradation – changes in water quality (hydrological changes). Abstraction could lead to	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
				within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	hydrological changes (reduced flows – impacting on water quality) that could impact QI species. Water table/ availability There is potential for impacts on aquatic QI species utilising watercourse hydrologically linked to this European site through a reduction in flows/water levels.		

Table F-10: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SACs) with option TG4-SA5-67 and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
River Shannon Callows SAC (000216)	ca. 25km	<p><u>Annex I Habitats</u></p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p> <p>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</p> <p>Limestone pavements [8240]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p><u>Annex II species</u></p> <p><i>Lutra lutra</i> (Otter) [1355]</p>	<p>Option Study Area is hydrologically linked to this European site.</p> <p>Habitat degradation – water quality potential pollution of watercourses during construction could affect hydrologically connected habitats.</p>	<p>No operational impacts are predicted.</p> <ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
Four Roads Turlough SAC (001637)	1.2km	<p>Annex I Habitats</p> <p>Turloughs [3180]</p>	No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports.	<p>Option includes an increase in GW abstraction. Option Study Area overlies a karst aquifer.</p> <p>Water table/ availability abstraction point is within a karstic aquifer which connects the site to the SAC within 5km. This SAC contains a groundwater dependent QI habitat that could be impacted by abstraction.</p> <p>Habitat degradation – changes in water quality (hydrological changes). Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI habitat.</p>	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
Lisduff Turlough SAC (000609)	3.4km	Annex I Habitats Turloughs [3180]	No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports.	<p>Option includes an increase in GW abstraction. Option Study Area overlies a karst aquifer.</p> <p>Water table/ availability abstraction point is within a karstic aquifer which connects the site to the SAC within 5km. This SAC contains a groundwater dependent QI habitat that could be impacted by abstraction.</p> <p>Habitat degradation – changes in water quality (hydrological changes). Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI habitat.</p>	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	
Lough Croan Turlough	5.0km	Annex I Habitats Turloughs [3180]	No potential impact pathway	Option includes an increase in GW abstraction. Option Study	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. 	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
			Construction	Operation		
SAC (000610)			given distance from site, lack of hydrological connection and the QI feature it supports.	<p>Area overlies a karst aquifer.</p> <p>Water table/ availability abstraction point is within a karstic aquifer which connects the site to the SAC within 5km. This SAC contains a groundwater dependent QI habitat that could be impacted by abstraction.</p> <p>Habitat degradation – changes in water quality (hydrological changes). Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI habitat.</p>	<ul style="list-style-type: none"> Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	

Table F-11: Source-Pathway- Receptor Analysis – potential impact pathways connecting European Sites (SPAs) with option TG4-SA5-37b and Mitigation Measures. Unless otherwise stated impacts are considered direct impacts

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
River Suck Callows SPA (004097)	0km	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas penelope</i>) [A050] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Lapwing (<i>Vanellus vanellus</i>) [A142] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b non-b non-b non-b	Option Study Area is directly adjacent to this European site. Disturbance - there is potential for disturbance to QI birds using supporting habitats in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	Option includes an increase in ground water abstraction. Option Study Area overlies a karst aquifer. Water table/ availability a potential lowering in groundwater level could impact QI birds indirectly through degradation of supporting groundwater dependent habitat within the SPA. Habitat degradation – changes in water quality (hydrological	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	N

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
					changes). Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.		
Four Roads Turlough SPA (004140)	1.2km	Golden Plover (<i>Pluvialis apricaria</i>) [A140] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] Wetland and Waterbirds [A999]	non-b non-b	Disturbance - there is potential for disturbance to QI birds using supporting habitats in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland).	Option includes an increase in ground water abstraction. Option Study Area overlies a karst aquifer. Water table/ availability a potential lowering in groundwater level could impact QI birds indirectly through degradation of supporting groundwater dependent habitat within the SPA.	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. Measure 6.3.5b: Hydrogeological modelling (Appendix H, Section H.2.5) <p>With the implementation of mitigation as noted above there is no potential for AESI</p>	

European Sites	Distance from Proposed Study Area (km)	Qualifying Interests	Breeding (breed)/ Non-breeding (non-b)	Potential Impact Pathway		Mitigation Measure Conclusion	Adverse Effects on Site Integrity (Y/N)
				Construction	Operation		
					<p>Habitat degradation – changes in water quality (hydrological changes).</p> <p>Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.</p>		

Appendix G In-combination Assessment Tables

Table G-1: In-combination assessment of preferred approach with other relevant plans and projects within SA5

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
STUDY AREA 5					
<p>TG4-SA5-01 Increase GW abstraction for Ahascragh WRZ to supply deficit Option Study Area is 4.6km and hydrologically linked to River Suck Callows SPA. There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). There is a risk during operation to the wetland used by migratory waterbirds due to the underlying karst/gravel aquifer at the abstraction point. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.</p>	<ul style="list-style-type: none"> • Habitat degradation • Disturbance • Water table / availability 	<p><u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u> This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022. River Suck Callows SPA is less than 1km from the scheme and therefore there may be in-combination effects from disturbance.</p> <p><u>Raheen, Clara social housing scheme for 38 units.</u> River Suck Callows SPA is approximately 30km south-west of the scheme and therefore no in-combination effects are predicted</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre</u></p>	<p>Yes – from disturbance impacts on River Suck Callows SPA if construction phase concurrent with Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block works</p>	<ul style="list-style-type: none"> • General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there will be no adverse effects on the integrity of this European site, either alone or in combination with other plans</p>	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		<u>Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u> River Suck Callows SPA is approximately 19km west of these schemes so no in-combination effects are predicted.		or projects.	
TG4-SA5-509 (09b & 51) Upgrade Athlone WTP to 18MI/d Upgrade Athlone WTP to 18MI/d and supply deficit to the east of South Roscommon via new watermain (1.6km), connecting into existing 400mm Option Study Area includes an increase in abstraction from the River Shannon. It is 1.1km and hydrologically linked to River Shannon Callow SAC . There is potential for some loss of/damage to supporting habitat during construction works given that the works are within River Shannon. Potential pollution of watercourses during construction could affect hydrologically connected habitats. Potential for disturbance to otter from	<ul style="list-style-type: none"> Habitat loss Disturbance Spread of invasive non-native species Habitat degradation Water table / availability 	<u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u> This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022. River Shannon Callows SAC is approximately 14km east of these localized works so no in-combination effects are predicted. Lough Ree SAC is less than 1km from the scheme. Therefore, there may be in-combination effects from disturbance and pollution. Lough Ree SPA is less than 1km from the scheme and therefore the may be in-combination effects from disturbance. River Suck Callows	Yes - from disturbance and habitat degradation impacts on Lough Ree SAC and SPA (disturbance only) and River Suck Callows SPA if construction phase concurrent Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block works	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. With the implementation of mitigation as noted above there will be no adverse effects on the integrity of this European site,	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>construction works. There is also potential for the spread of invasive species given that this Option includes an increase in abstraction from the River Shannon. During operation there is a risk this abstraction will reduce water flow in the River Shannon, which could impact otter. There is also potential for impacts on otter utilising watercourse hydrologically linked to this European site through a reduction in flows/water levels.</p> <p>Option Study Area is less than 600m and hydrologically linked to Lough Ree SAC. Potential for disturbance to otter from construction works due to their proximity to the SAC. There is likely a high association between surface water and groundwater flows at the abstraction point; a high Baseflow Index (BFI). Therefore, there is potential during operation for effects to the hydrologically linked groundwater dependent habitats of this European site and further detailed study required. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species or habitats.</p>		<p>SPA is less than 1km from the scheme and therefore, there may be in-combination effects from disturbance and pollution.</p> <p><u>Raheen, Clara social housing scheme for 38 units.</u></p> <p>River Shannon Callows SAC is approximately 19km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>Lough Ree SAC is approximately 24km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>River Suck Callows SPA is approximately 30km south-west of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u></p> <p>River Shannon Callows SAC is</p>	<p>Yes - from disturbance, spread of invasive species and habitat degradation impacts on River Shannon Callows SAC and Lough Ree SAC and SPA (disturbance only) if construction phase concurrent with Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme (Athlone and Mullingar)</p>	<p>either alone or in combination with other plans or projects.</p>	

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>Option study area is less than 600m and hydrologically linked to Lough Ree SPA. There is potential for disturbance to QI birds within the SPA during construction, using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts predicted.</p> <p>Option Study Area is 1.1km from Middle Shannon Callows SPA. There is potential for disturbance during construction to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p> <p>Option Study Area is 4.4km from River Suck Callows SPA. There is potential for disturbance during construction to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p>		<p>less than 1km from these schemes therefore there may be in-combination effects from disturbance, spread of invasive species and pollution. Lough Ree SAC is less than 1km from the scheme therefore there may be in-combination effects from disturbance and pollution. Lough Ree SPA is less than 1km from the scheme and therefore there may be in-combination effects from disturbance. River Suck Callows SPA is approximately 19km west of the scheme and therefore no in-combination effects are predicted.</p>	<p>Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar) works</p>		

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>TG4-SA5-20</p> <p>New wellfield in Ballinasloe to supply the scheme (better quality water anticipated - lower OPEX costs)</p> <p>Option Study Area is 100m and hydrologically linked to River Suck Callows SPA. There is potential for pollution of wetland habitat that could pose a risk to migratory waterbirds. There is potential for disturbance to QI birds within the SPA, using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). During operation there is a risk to the wetland used by migratory waterbirds due to the underlying Karst/gravel aquifer at the abstraction point. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.</p>	<ul style="list-style-type: none"> • Habitat degradation • Disturbance • Water table/ availability 	<p><u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u></p> <p>This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022. River Suck Callows SPA is less than 1km from the scheme and therefore, there may be in-combination effects from disturbance and pollution.</p> <p><u>Raheen, Clara social housing scheme for 38 units</u></p> <p>River Suck Callows SPA is approximately 30km south-west of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u></p>	<p>Yes – from disturbance and habitat degradation impacts on River Suck Callows SPA if construction phase concurrent with Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block works</p>	<ul style="list-style-type: none"> • General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there will be no adverse effects on the integrity of this European site, either alone or in combination with other plans or projects.</p>	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		River Suck Callows SPA is approximately 19km west of the scheme and therefore no in-combination effects are predicted.			
TG4-SA5-80 No deficit. Upgrade Banagher WTP to address WQ issue Option Study Area is less than 550m and hydrologically linked to River Shannon Callows SAC . There is potential for some loss of/damage to supporting habitat during construction works given the proximity of the works to the SAC. Potential pollution of watercourses during construction could affect hydrologically connected habitats. There is potential for disturbance to otter from construction works. There is also potential for the spread of invasive species given that the works are hydrologically linked to the SAC. No operational impacts are predicted. Option Study Area is about 550m from Middle Shannon Callows SPA . There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in	<ul style="list-style-type: none"> • Habitat loss • Habitat degradation • Disturbance • Spread of invasive non-native species 	<u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u> This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022. River Shannon Callows SAC is approximately 14km east of these localized works so no in-combination effects are predicted. Middle Shannon Callows SAC is approximately 14km east of this localised scheme so no in-combination effects are predicted. All Saints Bogs SPA is approximately 24km south-east of the scheme and therefore no in-	Yes - from disturbance, spread of invasive species and habitat degradation impacts on River Shannon Callows SAC if construction phase concurrent with Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone	<ul style="list-style-type: none"> • General Mitigation Measures are outlined in Appendix H, Section H.2. With the implementation of mitigation as noted above there will be no adverse effects on the integrity of this European site, either alone or in combination with other plans or projects.	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p> <p>Option Study Area is 3.7km from All Saints Bog SPA. There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p>		<p>combination effects are predicted.</p> <p><u>Raheen, Clara social housing scheme for 38 units</u></p> <p>River Shannon Callows SAC is approximately 19km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>Middle Shannon Callows SAC is approximately 19km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>All Saints Bogs SPA is approximately 32km south-west of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter,</u></p>	<p>Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar) works</p>		

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		<p><u>Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u></p> <p>River Shannon Callows SAC is less than 1km from these schemes therefore there may be in-combination effects from disturbance and pollution. Middle Shannon Callows SAC is less than 1km from the scheme therefore there may be in-combination effects from disturbance, spread of invasive species and pollution. All Saints Bogs SPA is approximately 30km south of the scheme and therefore no in-combination effects are predicted.</p>			
TG4-SA5-81 No deficit. Upgrade Clontotin BH to address WQ issue	<ul style="list-style-type: none"> Habitat degradation Disturbance 	<p><u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u></p> <p>This project is due to start in 2020</p>	Yes - from disturbance, spread of invasive species	<ul style="list-style-type: none"> General Mitigation Measures are outlined in 	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>Option Study Area is 2.5km and hydrologically linked to River Shannon Callows SAC. Potential pollution of watercourses during construction could affect hydrologically connected habitats. There is potential for disturbance to otter from construction works. There is also potential for the spread of invasive species given that the works are hydrologically linked to the SAC. No operational impacts are predicted.</p> <p>Option Study Area is 2.5km from Middle Shannon Callows SPA. There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p> <p>Option Study Area is 2.5km from All Saints Bog SPA. There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p>	<ul style="list-style-type: none"> Spread of invasive non-native species 	<p>with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022.</p> <p>River Shannon Callows SAC is approximately 14km east of these localized works so no in-combination effects are predicted.</p> <p>Middle Shannon Callows SPA is approximately 14km east of this localised scheme so no in-combination effects are predicted.</p> <p>All Saints Bogs SPA is approximately 24km south-east of the scheme and therefore no in-combination effects are predicted.</p> <p>River Little Brosna Callows SPA is approximately 20km south-east of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Raheen, Clara social housing scheme for 38 units</u></p> <p>River Shannon Callows SAC is approximately 19km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>Middle Shannon Callows SPA is approximately 19km north-west of the scheme and therefore no in-</p>	<p>and habitat degradation impacts on River Shannon Callows SAC and from disturbance on Middle Shannon Callows SPA if construction phase concurrent with Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement,</p>	<p>Appendix H, Section H.2</p> <p>With the implementation of mitigation as noted above there will be no adverse effects on the integrity of this European site, either alone or in combination with other plans or projects.</p>	

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>Option Study Area is 4.5km from River Little Brosna Callows SPA. There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). No operational impacts are predicted.</p>		<p>combination effects are predicted. All Saints Bogs SPA is approximately 32km south-west of the scheme and therefore no in-combination effects are predicted. River Little Brosna Callows SPA is approximately 34km south-west of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u></p> <p>River Shannon Callows SAC is less than 1km from these schemes therefore there may be in-combination effects from disturbance, spread of invasive species and pollution. Middle Shannon Callows SPA is less than 1km from the scheme therefore there may be in-combination effects from disturbance. All Saints Bogs SPA</p>	<p>Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar) works</p>		

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		<p>is approximately 30km south of the scheme and therefore no in-combination effects are predicted.</p> <p>River Little Brosna Callows SPA is approximately 30km south of the scheme and therefore no in-combination effects are predicted.</p>			
<p>TG4-SA5-25</p> <p>Increase abstraction from the River Camcor and upgrade WTP to supply Birr and Kinnity</p> <p>Option Study Area is 3.7km and hydrologically linked to Dovegrove Callows SPA. There is potential for disturbance to QI birds using habitats situated within the immediate hinterland of the SPA or in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). During operation there is a risk to the wetland used by migratory waterbirds due to the underlying Karst/gravel aquifer at the abstraction point. There is potential for impacts on aquatic QI species utilising watercourse hydrologically linked to this European site through a reduction in flows/water</p>	<ul style="list-style-type: none"> • Habitat degradation • Disturbance • Water table / availability 	<p><u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u></p> <p>This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022.</p> <p>Dovegrove Callows SPA is approximately 30km south-east of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Raheen, Clara social housing scheme for 38 units</u></p> <p>Dovegrove Callows SPA is approximately 33km south-west of the scheme and therefore no in-combination effects are predicted</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen,</u></p>	No	N/A	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
levels.		<u>Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u> Dovegrove Callows SPA is approximately 33km south of the scheme and therefore no in-combination effects are predicted.			
TG4-SA5-37b Increase GW abstraction at Mount Talbot Spring to supply deficit Option Study Area is 1.2km from Four Roads Turlough SAC & SPA . Abstraction point is within a karstic aquifer which connects the site to the SAC within 5km. This SAC contains a groundwater dependent QI habitat that could be affected by abstraction potentially resulting in LSE. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI habitat. There is potential for disturbance during construction to QI birds using	<ul style="list-style-type: none"> Water table / availability Disturbance Habitat degradation 	<u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u> This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022. Four Roads Turlough SAC & SPA is approximately 20km north of the scheme. No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports. Therefore, no in-combination effects are predicted. Lisduff Turlough SAC is approximately 25km north of the scheme. No	Yes - from disturbance and habitat degradation impacts on River Suck Callows SAC and disturbance on the River Suck Callows SPA if construction phase concurrent with Life	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. 	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>supporting habitats in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). During operation a potential lowering in groundwater level could impact QI birds indirectly through degradation of supporting groundwater dependent habitat within the SPA. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.</p>		<p>potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports. Therefore, no in-combination effects are predicted. Lough Croan Turlough SAC is approximately 19km north-east of the scheme. No potential impact pathway given distance from site, lack of hydrological connection and the QI feature it supports. Therefore, no in-combination effects are predicted. River Suck Callows SPA is less than 1km from the scheme. Therefore, there may be in-combination effects from disturbance and habitat degradation.</p>	<p>Sciences Innovation Hub and Soft Landing Space Portiuncula ward block works</p>	<p>of this European site, either alone or in combination with other plans or projects.</p>	
<p>Option Study Area is 3.4km from Lisduff Turlough SAC. No construction impacts predicted. Abstraction point is within a karstic aquifer which connects the site to the SAC within 5km. This SAC contains a groundwater dependent QI habitat that could be affected by operational abstraction potentially resulting in LSE. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI habitat.</p>		<p><u>Raheen, Clara social housing scheme for 38 units</u></p>			
<p>Option Study Area is 5km from Lough Croan Turlough SAC. No construction impacts predicted. Abstraction point is within a karstic aquifer which connects the site to the SAC within 5km. This SAC contains a groundwater dependent</p>		<p>Four Roads Turlough SAC & SPA is approximately 43km north-west of the scheme and therefore no in-combination effects are predicted. Lisduff Turlough SAC is approximately 47km north-west of the scheme and therefore no in-combination effects are predicted.</p>			

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
<p>QI habitat that could be affected by operational abstraction potentially resulting in LSE. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI habitat.</p> <p>Option Study Area is directly adjacent to River Suck Callows SPA. There is potential for disturbance during construction to QI birds using supporting habitats in areas outside of the SPA but ecologically connected to it (e.g. grassland, arable farmland). During operation a potential lowering in groundwater level could impact QI birds indirectly through degradation of supporting groundwater dependent habitat within the SPA. Abstraction could lead to hydrological changes (reduced flows – impacting on water quality) that could impact QI species.</p>		<p>Lough Croan Turlough SAC is approximately 39km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>River Suck Callows SPA is approximately 30km south-west of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u></p> <p>Four Roads Turlough SAC & SPA is approximately 20km north-west of the scheme and therefore no in-combination effects are predicted. Lisduff Turlough SAC is approximately 23km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p>Lough Croan Turlough SAC is approximately 15km north-west of the scheme so no in-combination effects are predicted. River Suck</p>			

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		Callows SPA is approximately 19km west of the scheme and therefore no in-combination effects are predicted.			
<p>TG4-SA5-67</p> <p>No deficit. Upgrade WTP to address WQ issues.</p> <p>Option Study Area is 25km from and hydrologically linked to River Shannon Callows SAC. Potential pollution of watercourses during construction could affect hydrologically connected habitats. No operational impacts are predicted.</p>	<ul style="list-style-type: none"> Habitat degradation 	<p><u>Life Sciences Innovation Hub and Soft Landing Space Portiuncula ward block</u> This project is due to start in 2020 with a duration of 6 to 9 months. The target date for completion of the 50-bed ward block is 2022.</p> <p>River Shannon Callows SAC is approximately 14km east of these localized works so no in-combination effects are predicted.</p> <p><u>Raheen, Clara social housing scheme for 38 units</u> River Shannon Callows SAC is approximately 19km north-west of the scheme and therefore no in-combination effects are predicted.</p> <p><u>Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre</u></p>	<p>Yes - from habitat degradation impacts on River Shannon Callows SAC if construction phase concurrent with Athlone Institute of Technology STEM building, Lissywollen, Athlone, Athlone Sewerage Scheme, Athlone Town Centre Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme</p>	<ul style="list-style-type: none"> General Mitigation Measures are outlined in Appendix H, Section H.2. <p>With the implementation of mitigation as noted above there will be no adverse effects on the integrity of this European site, either alone or in combination with other plans or projects.</p>	N

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		<u>Regeneration and Enhancement, Athlone Tourism Cultural Quarter, Loughanaskin, and South Westmeath Regional Water Supply Scheme (Athlone and Mullingar)</u> River Shannon Callows SAC is less than 1km from these schemes therefore there may be in-combination effects from pollution.	(Athlone and Mullingar) works		
All Preferred Options The European sites that may be impacted by options within Study Area 5 are River Suck Callows SPA , River Shannon Callow SAC , Lough Ree SAC and SPA , Middle Shannon Callows SPA , All Saints Bog SPA , River Little Brosna Callows SPA , Dovegrove Callows SPA , Four Roads Turlough SAC and SPA , Lisduff Turlough SAC and Lough Croan Turlough SAC .	<ul style="list-style-type: none"> • Habitat loss • Disturbance • Spread of invasive non-native species • Habitat degradation • Water table / availability 	<u>All Preferred Options</u> There is potential for in combination effects from the preferred options within SA5 to River Suck Callows SPA given that options TG4-SA5-01, TG4-SA5-509, TG4-SA5-20 and TG4-SA5-37b have potential for impacts. Potential for in combination from disturbance (options 01, 509, 20 and 37b) during construction and hydrological changes (options 01, 20 and 37b) and water table/availability impacts (options 01, 20 and 37b) during operation. There is potential for in combination effects from the	Yes – from habitat degradation, water table/availability and disturbance impacts on River Suck Callows SPA if construction of options is concurrent and/or during operation. Yes – from habitat loss, disturbance, spread of invasive species and habitat	<ul style="list-style-type: none"> • General Mitigation Measures are outlined in Appendix H, Section H.2. • Measure 6.4.4a and 6.4.4b: Hydrogeological modelling (Appendix H, Section H.2.5) 	N With the implementation of mitigation as noted above

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		<p>projects within SA5 to River Shannon Callows SAC given that options TG4-SA5-509, TG4-SA5-80, TG4-SA5-81 and TG4-SA5-67 have potential for impacts.</p> <p>Potential for in-combination effects from habitat loss (options 509 and 80 only), disturbance (options 509, 80 and 81 only), spread of invasive species (options 509, 80 and 81 only) and pollution (all options listed above) during construction.</p> <p>There is potential for in combination effects from the projects within SA5 to Middle Shannon Callows SPA given that options TG4-SA5-509, TG4-SA5-80 and TG4-SA5-81 have the potential for impacts. Potential for in-combination effects from disturbance during construction.</p> <p>There is potential for in combination effects from the projects within SA5 to All Saints Bog SPA given that options TG4-SA5-80 and TG4-SA5-81 have the potential for impacts. Potential for in-combination effects from</p>	<p>degradation impacts on River Shannon Callow SAC if construction of options is concurrent.</p> <p>Yes – from disturbance, impacts on Middle Shannon Callows SPA if construction of options is concurrent.</p> <p>Yes – from disturbance, impacts on All Saints Bog SPA if construction of options is concurrent.</p>	<p>there will be no adverse effects on the integrity of this European site, either alone or in combination with other plans or projects.</p>	

Preferred Option	Potential Impacts – Key Types	Potential for In-combination Implications on European Sites Project(s) being assessed against identified in bold and underlined	Potential for Likely Significant Effects in-combination (Yes/No)	Mitigation and Conclusion	In-combination Adverse Effects on Site Integrity (Y/N)
		<p>disturbance during construction.</p> <p>Option TG4-SA5-509 is the only option within SA5 with potential for impacts on Lough Ree SAC and SPA. Therefore, there is no potential for in combination effects to these European sites.</p> <p>Option TG4-SA5-81 is the only option within SA5 with potential for impacts on River Little Brosna Callows SPA. Therefore, there is no potential for in combination effects to these European sites.</p> <p>Option TG4-SA5-25 is the only option within SA5 with potential for impacts on Dovegrove Callows SPA. Therefore, there is no potential for in combination effects to these European sites.</p> <p>Option TG4-SA5-37b is the only option within SA5 with potential for impacts on Four Roads Turlough SAC & SPA, Lisduff Turlough SAC and Lough Croan Turlough SAC. Therefore, there is no potential for in combination effects to these European sites.</p>			

Appendix H Appropriate Assessment General Mitigation Measures and Principles

H.1 Overview

The various measures that may be applied to options include:

- General Measures (established construction best-practice, etc.) which will be applied to all options;
- Option-specific Measures (established and reliable measures identified to avoid specific potential effects on European sites, in particular for highly sensitive species incl. freshwater pearl mussel);
- Further assessments and data; and
- These measures will be applied unless project-level AAs or project-specific environmental assessments demonstrate that they are not required (i.e. the predicted effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate and provide protection for the European site(s).

Note that these measures are not exhaustive or exclusive and must be reviewed at the project stage, taking into consideration any changes in best-practice as well as project-specific survey information or studies.

H.2 General Mitigation Measures

H.2.1 Scheme Design and Planning

All options will be subject to project-level environmental assessment as and when they are brought forward, which will include assessments of their potential to affect European sites during their construction or operation. These assessments will consider or identify (inter alia):

- Potential for avoiding effects on European sites through design (e.g. alternative pipeline routes; micro siting; etc);
- Best practice construction measures that need to be incorporated into scheme design and/or planning to avoid or mitigate potential effects, for example, ensuring that sufficient working area is available for pollution prevention measures to be installed, such as sediment traps; and
- Operational regimes required to ensure no adverse effects occur (e.g. compensation flow releases or reduced abstraction rates (seasonal restrictions)).

Note that these measures could only be identified through detailed site assessments and agreed through the abstraction licensing process when in place).

H.2.2 Pollution Prevention

Best practice construction methods will be applicable to all of the proposed options and can be relied on (at this level) to prevent significant or adverse effects on a European site occurring as a result of construction related impacts (e.g. pollutants). Pollution control measures will be detailed in project specific construction and environmental management plans. The following guidance documents detail the current industry best-practices in construction that are likely to be relevant to all options:

- Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters; and
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes¹

Construction Industry Research and Information Association (CIRIA) guidance:

- CIRIA C532: Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors;
- CIRIA C692: Environmental Good Practice on Site;
- CIRIA C648: Control of Water Pollution from Linear Construction Projects: Technical Guidance; and
- CIRIA C648: Control of water pollution from linear construction projects: Site guide.

The best-practice procedures and measures detailed in these documents will be followed for all construction works arising from the Framework Plan as a minimum standard, unless project-specific investigations identify additional measures and/or more appropriate non-standard approaches for dealing with potential site-derived pollutants.

H.2.3 General measures for species and habitats

Most species-specific avoidance or mitigation measures can only be determined at the project level, following detailed project-specific surveys. Detailed species-specific mitigation measures will vary according to a range of factors that cannot be determined at the strategic (Framework Plan) level. In addition, some general ‘best-practice’ measures may not be appropriate to the QI of the European sites concerned (for example, clearing vegetation in winter is usually proposed to avoid impacts on nesting birds; however, this is unlikely to be necessary to avoid effects on some SPA species (such as overwintering estuarine birds) and the removal of vegetation in winter might actually have a negative effect on these species through disturbance). However, the following general measures will be followed to minimise the potential for impacts on QI species unless project level environmental assessments or project level AA indicate

¹<https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Crossing-of-Watercourses-during-the-Construction-of-National-Road-Schemes.pdf>

that they are not required or not appropriate, or that alternative or additional measures are more appropriate/necessary.

Works programme: The works programme and requirements for each option will be determined at the earliest opportunity to allow surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with bodies such as the National Parks and Wildlife Service (NPWS), Environment Protection Agency (EPA) and Inland Fisheries Ireland (IFI).

Scheme design: Will aim to minimise the environmental effects by 'designing to avoid' potential impacts.

Habitat Loss and Supporting Habitats Loss: Pipelines are usually (where practical) constructed within existing public roads, therefore limiting or avoiding the potential for habitat loss within European sites. Where possible all new infrastructure such as WTPs will be cited outside of European sites. Where European sites cannot be avoided altogether, detailed surveys of habitats within the affected area will be undertaken to locate and avoid sensitive habitats to ensure there is no loss of QI Annex I habitats or Annex II species. Similarly, any upgrade of existing infrastructure within or adjacent to European sites will aim to avoid impacts on these species or habitats through appropriate scheme design.

Habitat features that may be used by QI species (supporting habitat) when outside the European site boundary will be avoided through project specific studies and appropriate scheme design. Surveys focusing on mobile QI species will ensure any significant areas of supporting habitat (for example, foraging areas for QI birds very near but outside of an SPA, otter holts outside an SAC boundary) will be identified and avoided or appropriate mitigation measures put in place to protect them.

Invasive Species: There is the potential for both terrestrial and aquatic non-native invasive species to be present across the country. If present, these could potentially be spread to habitats within SACs/SPAs during construction works/operation (for example, maintenance works to WTPs and pipelines). The introduction of invasive species into a European site can affect the conservation objectives for QI habitats or species, potentially adversely affecting the integrity of the European site (for example, affecting vegetation composition of an Annex I QI habitat, affecting species distribution and abundance and/or out-competing native species). Invasive species surveys (for species listed on Schedule 3 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011)) will be undertaken for any future projects that may arise from the Framework Plan. If invasive species are found to be present, an Invasive Species Management Plan will be prepared to outline the control and/or removal measures. These measures will ensure such species are not spread during construction or operation of any future projects that may arise from option types outlined within the Framework Plan. All works relating to invasive species will be implemented in line with relevant national guidelines as well as those relevant guidelines produced by Irish Water including:

- Biosecurity protocols in relation to water quality and biological sampling; and
- Invasive Species Management Guidelines for Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*).

Pre-construction Surveys/Seasonal Restrictions/Ecological Clerk of Works: To ensure appropriate protection of QI habitats and species, pre-construction surveys will be undertaken for all future projects (where required). Additionally, the implementation of seasonal working restrictions may be required. Furthermore, works in sensitive areas will be supervised by an experienced ecologist/Ecological Clerk of Works with appropriate qualifications to manage the risks associated with the specific conservation interests of the affected European Site.

H.2.4 Option Specific Measures

SA5 has no option specific measures as outlined in Table H-1 below.

Table H-1: Option specific mitigation measures

Study Area/Option	European Site	QI Features	Mitigation Measure (in addition to General Mitigation Measures)
SA5	N/A	N/A	N/A

H.2.5 Further assessments and data to inform potential impacts

Applying the sustainable abstraction limits of 10% and 5% of Q95 will provide protection for European sites. However, as with all projects, further assessments will be required at the project level to ensure the most robust data is used to inform any environmental assessment in support of planning applications/abstraction licences etc.

Further detailed site-specific hydrological assessments will be required for a number of the options relating to new or increased ground or surface water abstractions. These will be required to fully understand the potential impacts (if any) on European sites, this is particularly important for new ground water abstractions where there is very limited information or knowledge on allowable abstraction limits or potential zones of contribution (the area over which effects may occur). Outlined below are some of the assessments that may be required at the project level:

- Measure 6.3.5a: Hydrological modelling: This will indicate what change in water levels would result from a given abstraction. This data would need to be interpreted alongside field data on the QI(s) in question (for example fish habitat assessment undertaken at low flows). Modelling may also include potential changes in salinity associated with desalination plants;
- Measure 6.3.5b: Hydrogeological modelling: This will indicate the distribution and movement of groundwater sources. This data will need to be interpreted alongside field data on the QI(s) in question (for example. how the

- groundwater abstraction may interact with groundwater dependent QI habitats or species); and
- Measure 6.3.5c: Examining lake/groundwater catchment (for abstractions): To determine if the lake is a hydraulic sink or part of groundwater flow-through systems or linked to surrounding GWDTHs.

Note that this list of assessment is non-exhaustive and must be reviewed at the project stage, taking into account project-specific survey information or studies.

Appendix I SEA 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 Table I-1.

Table I-1: Embedded standard mitigation

Mitigation assumptions
Studies and surveys
Feasibility and scheme option studies, including detailed pipeline routing, siting and technology options to avoid effects on designated sites and species.
Studies, surveys and consultation on environmental effects of proposed development following relevant good practice guidance to inform design, identify relevant mitigation and to support appropriate planning permission, EIA and licencing processes.
Investigation, monitoring and modelling studies for groundwater and surface water abstractions to be agreed where relevant in context of schemes meeting WFD no deterioration requirements and RBMP objectives and to support AA requirements.
Short term/construction impacts
Local residents provided with due notice of construction works.
Ensure safe access for pedestrians, cyclists and equestrians, providing diversions where necessary.
Implementation of traffic management measures to minimise disruption to minor roads, including, where possible, limitation of works within peak periods or times.
Use of construction techniques that avoid or minimise disruption to major infrastructure and river crossings, such as directional drilling (where appropriate).
Any disruption to the road to be agreed in advance with transport authorities and traffic management plans to be used where needed.
No works to take place within curtilage of designated cultural heritage sites without necessary consents in place. Directional drilling where needed. Archaeological watching briefs during ground works where agreed as needed to address risk with planning authorities.
No works to take place within or in close proximity to designated sites without necessary consents in place and impacts to be avoided through detailed routing and trenchless construction approaches or timing to avoid disturbance where appropriate.
Appropriate permissions and consents to be obtained for all works which may affect a European protected species or nationally protected species.
A suitably qualified and experienced ecological clerk of works (ECoW) to carry out site supervision works during activities that affect sensitive habitats and species, ensure that site specific mitigation identified following surveys is undertaken.
Appropriate watercourse consents and environmental permits to be obtained for construction activities in or near water.
Consent for noisy works to be obtained and noise barriers used where required.

Mitigation assumptions
Best practice measures to control noise, air and water pollution in accordance with guidance.
Long-term mitigation (outside permanent footprints)
Full reinstatement of all footpaths and recreational areas.
Full reinstatement of all habitat types, including hedgerows, and provision of compensation habitat where appropriate.
All river abstraction points to be fitted with fish screens.
Full reinstatement of landscape features, and good management practice for the long-term restoration of landscape features.
Full restoration of agricultural land and previously undeveloped land.
Appropriate abstraction licence to be obtained for new, increased or traded licences.
New built infrastructure to incorporate the appropriate flood defence measures.

Table I-2 illustrates the mitigation measures that specifically respond to the significant environmental effects identified for each SEA topic within the nine SAs of Region/Group 4.

Table I-2: Group/Region 4 significant impacts and corresponding mitigation measures

SEA Topic (abridged)	Significant Impact Identified in SEA	Mitigation Measures
Population & Health	Construction-stage disruption to access routes and recreational areas Construction-stage noise disturbance, dust and extra traffic Changes to drinking water quality caused by WTPs at risk of failure	<ul style="list-style-type: none"> Regular community liaison Construction Environmental Management Plan, Traffic Management Plan Drinking water safety plans, catchment management, leakage reduction programmes, drought management actions – see EAP Design of upgraded plant to meet drinking water standards
Water	Draw-down of groundwater levels caused by abstraction Draw-down of surface water levels caused by abstraction Impacts on water quality from surface water runoff or	<ul style="list-style-type: none"> Detailed studies required to determine abstraction regime that will not result in significant negative impacts on groundwater waterbody WFD status – see climate resilience measure below Use of treatment and dispersal technologies appropriate to the source effluent and receiving waters Improvements to residuals management Implementation of best practice pollution prevention guidance, e.g. IFI 2016, CIRIA C532 Emergency Pollution Response Plan Catchment management to improve water quality

SEA Topic (abridged)	Significant Impact Identified in SEA	Mitigation Measures
	drawdown of water levels Increase in flood risk due to construction of new infrastructure	<ul style="list-style-type: none"> Locate new infrastructure away from areas of high flood risk. Where this is unavoidable, implement appropriate flood protection measures
Biodiversity	Loss or fragmentation of habitats within construction footprint Discharges of pollutants into water bodies and subsequent impacts on aquatic biodiversity Spread of invasive species during construction works	<ul style="list-style-type: none"> Location of construction works to consider designated sites or important habitats AA screening required Pre-construction Surveys/Seasonal Restrictions/ECoW Ecology surveys, CEMPs and consultation to inform site-specific location, design and mitigation Construction site reinstatement to include biodiversity enhancement and habitat connectivity measures INNS Management Plan and biosecurity protocols in relation to water quality and biological sampling Environmental flow linked abstraction limits to minimise impact on summer low flows or fish migration periods
Landscape	Impacts on local landscapes and visual amenity during construction	<ul style="list-style-type: none"> Design of new plant to minimise visual effects and agree design with local authorities Use landscape screening if appropriate, to reduce visual impacts during construction Tree protection fencing Lighting management
Material assets	Disruption to infrastructure or access to infrastructure, access routes, public spaces and agricultural land	<ul style="list-style-type: none"> Refine site locations and pipeline alignments to avoid built and natural assets WRZ configuration – rationalisation opportunities for assets, waste and energy use, sustainable source use – see EAP
Climate change	Reduced resilience to climate change impacts	<ul style="list-style-type: none"> Design criteria to emphasise climate change resilience Prepare and implement a Climate Change Adaptation and Mitigation Strategy – see WSSP Climate Sensitive Catchments Project, leakage reduction programmes, drought management actions – see EAP Development of operational procedures for new groundwater abstraction which seek to limit abstraction volumes under conditions of environmental stress. Further research and assessment work required to inform development of operational procedures

SEA Topic (abridged)	Significant Impact Identified in SEA	Mitigation Measures
	Increase in greenhouse gas emissions	<ul style="list-style-type: none"> Consider potential for use of renewable energy sources and energy efficiency measures to reduce carbon footprint during construction and operation
Cultural heritage	Loss or damage to cultural heritage assets within construction footprint	<ul style="list-style-type: none"> Maintenance of access to cultural heritage assets during construction Locations of known archaeological interest/value, or areas where archaeological work is planned, will be signposted/fenced off to avoid unintentional damage Where a previously unknown heritage asset is discovered, or a known heritage asset proves to be more significant than foreseen at the time of application, the developer will inform the local planning authority and inform the project team of a solution that protects the significance of the new discovery, as far as practicably possible Further cultural heritage and archaeological assessment and consultation to influence site location, design, pipeline alignment etc

Appendix J Environmental and Social Costs

J.1 Introduction

This methodology sets out the approach to estimating the environmental and social (E&S) costs for individual options for Irish Water. It uses an ecosystem services approach, and uses both data relating to UK-based studies and Irish-based studies.

The aim of the calculations was to capture and value significant residual impacts in relation to ecosystem services. The availability of options data and robust ecosystem services values mean that potential impacts on three ecosystem services are valued:

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

(Note: Carbon emissions are addressed separately and are calculated alongside the construction and operational costs for the options).

Valuation of potential impacts on recreation and biodiversity were excluded from the E&S costs to avoid double counting, as potential effects on recreational amenities are captured within the Multi-Criteria Analysis (Environmental/Population, health, economy and recreation category).

There is the potential for additional ecosystem services categories to be captured within the E&S costs if additional time was available to undertake research into the availability of additional relevant studies.

As the actual route selection and site selection for the options has not yet been carried out, the E&S costs are based on the best available geographic information. A number of assumptions have been made in terms of land type and the size of the land take. Once route and site selection have taken place, the E&S costs can be refined to reflect this updated information.

The E&S costs were provided as a snapshot for one year – they are included in the EBSD model where they are discounted to produce the costs over the required time period.

The E&S costs are presented in 2018 prices, as 2018 is the most recent available data for the GDP deflator. If the E&S costs are required in a different base year to facilitate comparison of costs, assumptions could be made to convert them to the required base year.

The following section looks at individual impact categories in more detail.

J.2 Methodology

J.2.1 Climate regulation – woodland

The climate regulation/woodland impacts are calculated as an annual value – the impact of any woodland lost will continue to be felt in terms of loss of carbon sequestration.

The carbon sequestration rate per hectare of woodland is used to calculate the value of climate regulation for three categories of woodland – broadleaved, coniferous and mixed forest.

For coniferous and broadleaved, the values are calculated as weighted averages of the carbon sequestration rate for young and adult trees. The carbon sequestration rate is taken from the UK Forestry Commission's Woodland Carbon Code Carbon Look-Up Tables (2013) and is weighted by the proportion of young and adult trees (UK Forestry Commission's National Inventory of Woodland and Trees, 2003).

The mixed forest carbon sequestration rate is the weighted average of the coniferous and broadleaved sequestration rates, based on the biomass stocks of living coniferous and broadleaved trees.

Table J-1: Carbon sequestration assumptions

Assumption	Value	Unit	Study year
Total area of young coniferous trees	84,221	Hectares	2003
Total area of adult coniferous trees	1,228,121	Hectares	2003
Total area of young broadleaved trees	26,879	Hectares	2003
Total area of adult broadleaved trees	510,299	Hectares	2003
Carbon sequestration rate for young coniferous trees	2.64	tCO ₂ e/ha	2013
Carbon sequestration rate for adult coniferous trees	4.47	tCO ₂ e/ha	2013
Carbon sequestration rate for young broadleaved trees	2.20	tCO ₂ e/ha	2013
Carbon sequestration rate for adult broadleaved trees	4.71	tCO ₂ e/ha	2013
Biomass stocks in living coniferous trees in GB	218	Million tonnes oven dry	2013
Biomass stocks in living broadleaved trees in GB	208	Million tonnes oven dry	2013

The non-traded value of carbon is used as there is no market for carbon sequestration – it is the social cost.

The carbon cost is taken from the PSC Central Technical References and Economic Appraisal Parameters document¹, published by the Department of Public Expenditure and Reform.

The non-trade price of carbon is uplifted to 2018 prices using the GDP deflator for Ireland published by the World Bank²; 2018 prices were selected, as this was the most recent year for the GDP deflator.

J.2.2 Traffic impacts – opportunity cost of time due to road congestion from roadworks

The traffic impacts are calculated as a one-off value – this is because these impacts will only be realised during construction.

The number of vehicles per day, speed of pipe laying and time of delay at roadworks for different road types are used with the average value of time per hour to calculate the cost of congestion.

The number of vehicles per day are taken from the UK Department for Transport's 'Road Traffic Estimates: Great Britain 2017'. The speed of pipe laying has been informed by professional judgement and is assumed to be 30m/day. The time of delay at roadworks is presented by type of road – motorway, A road, B road, minor road – averaging the values for urban and rural roads³.

Table J-2: Traffic assumptions

Assumption	Value	Unit	Study year
Number of vehicles per day on a motorway (passing a reference point)	88,000	Vehicles	2017
Number of vehicles per day on an A road (passing a reference point)	35,500	Vehicles	2017
Number of vehicles per day on a B road (passing a reference point)	14,000	Vehicles	2017
Number of vehicles per day on a minor road (passing a reference point)	1,600	Vehicles	2017
Average time delay at road works for motorway	0.06	Hours/vehicle	2005
Average time delay at road works for A road	0.06	Hours/vehicle	2005
Average time delay at road works for B road	0.03	Hours/vehicle	2005
Average time delay at road works for minor road	0.004	Hours/vehicle	2005

1 <https://www.gov.ie/en/publication/public-spending-code/>

2 <https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS?locations=IE>

3 Goodwin, P. (2005) Utilities' street works and the cost of traffic congestion, London, National Joint Utilities Group. Available at: <http://www.njug.org.uk/wp-content/uploads/93.pdf>

The average value of time per hour is calculated using the value of time from Transport Infrastructure Ireland's 'Project Appraisal Guidelines for National Roads Unit 6.11'⁴, and apportioning it by the vehicle miles by type of vehicle for Great Britain⁵. Data for Ireland for vehicle miles was not readily available. This produced an estimate for the value of time per hour for an average vehicle.

The length of pipe laid which intersects different types of road was provided through GIS data.

J.2.3 Food – crops and livestock

The food/crops and livestock impacts are calculated as an annual value – the impact of any agricultural land lost will continue to be felt in terms of loss of productive agricultural land.

The area of land take for each option was calculated using information on the proposed new infrastructure – water treatment plants, desalination plants, pumping stations, groundwater treatment plants, boreholes and reservoirs. As the geographic information for each option is only indicative at this stage, it was assumed that all of the proposed land take was agricultural land.

The value of the agricultural land was calculated using information on the indicative monetary estimates of the gross margins (£/hectare) for selected crops from the Multi-Coloured Manual⁶. An average of the gross margin for different arable land types was used.

Table J-3: Agricultural land MCM assumptions

MCM group	Gross margin (£/ha) 2017 prices	MCM group assumption
Winter wheat	758	Assumes 9t/ha
Extensive arable	741	Assumes wheat 70%, oil seed rape 20%, beans 10% by area
Intensive arable	1370	Assumes wheat 66%, sugar beet 17%, potatoes and vegetables 17% by area

This was uplifted to 2018 prices using the GDP deflator for Ireland published by the World Bank⁷. 2018 prices were selected, as this was the most recent year for the GDP deflator. It was converted to euros using the Bank of England's euro/sterling spot exchange rate⁸.

⁴<https://www.tiipublications.ie/library/PE-PAG-02030-01.pdf>

⁵ Data table TRA4213 in Department for Transport (2017) 'Road Traffic Estimates: Great Britain 2017' available from <https://www.gov.uk/government/statistics/road-traffic-estimates-in-great-britain-2017>

⁶ <https://www.mcm-online.co.uk/handbook/>

⁷ <https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS?locations=IE>

⁸<https://www.bankofengland.co.uk/boeapps/database/fromshowcolumns.asp?Travel=NlxSUX&FromSeries=1&ToSeries=50&DAT=RNG&FD=1&FM=Jan&FY=2010&TD=28&TM=Jul&TY=2020&FNY=&CSVF=TT&html.x=167&html.y=37&C=DMD&Filter=N>