2 South East Region

2.1 Introduction

In this section we introduce the South East Region and describe the:

- Regional location in the national context;
- Projected population growth and economic development and how this is considered in our water resources planning approach;
- Natural water resources and the environmental status of our groundwater and surface water bodies; and
- Our water supply systems and the impacts of drought and climate change.

2.1.1 Regional Overview

Figure 2.1 shows the location of the South East Region for the purpose of the Regional Water Resource Plan (RWRP-SE). To deliver our RWRP-SE, we have subdivided the region into smaller management units to enable us to manage the process of identifying potential water supply solutions (Options) and the selection of our Preferred Approach to resolve our water supply and water quality deficits. These smaller units are referred to as Study Areas (SAs). Three (3) SAs have been defined in the South East Region. The Study Area boundaries are based on Water Framework Directive (WFD) catchments and Water Resource Zones (WRZs), which represent an area where supply and demand are largely self-contained. This is further explained in Section 1.4.

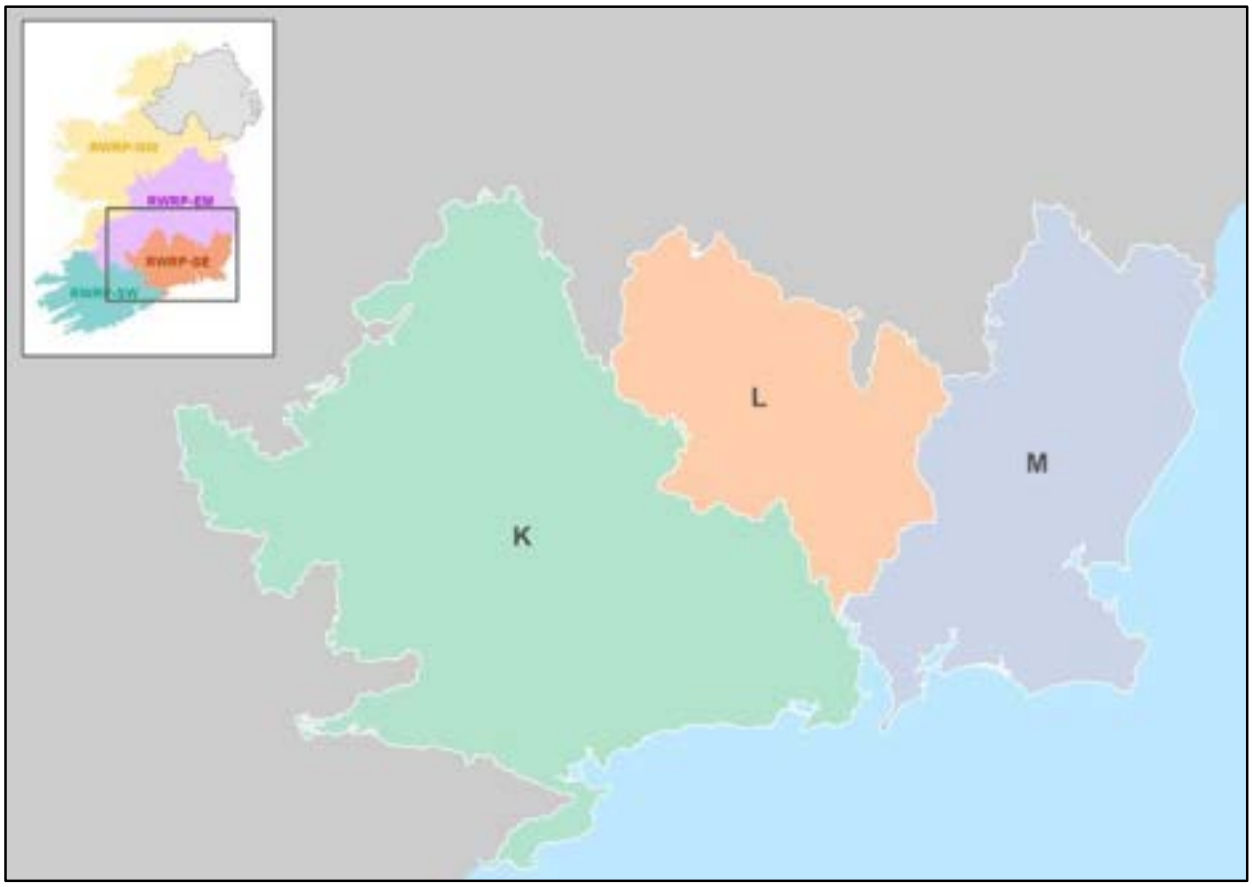


Figure 2.1 Location of the South East Region

The South East Region includes nine (9) counties: Limerick, Tipperary, Waterford, Kilkenny, Laois, Cork, Carlow, Wicklow and Wexford. It covers approximately 9,200 square kilometres (representing about 13% of the Republic of Ireland) and extends from the south-east coast, south of Arklow, towards Youghal, Mitchelstown and Limerick in the west. Waterford City is the largest settlement, comprising 14% of the regional population. It is situated on the estuary, Waterford Harbour, which receives flows from the three (3) major rivers draining the region – the Barrow, Nore and Suir.

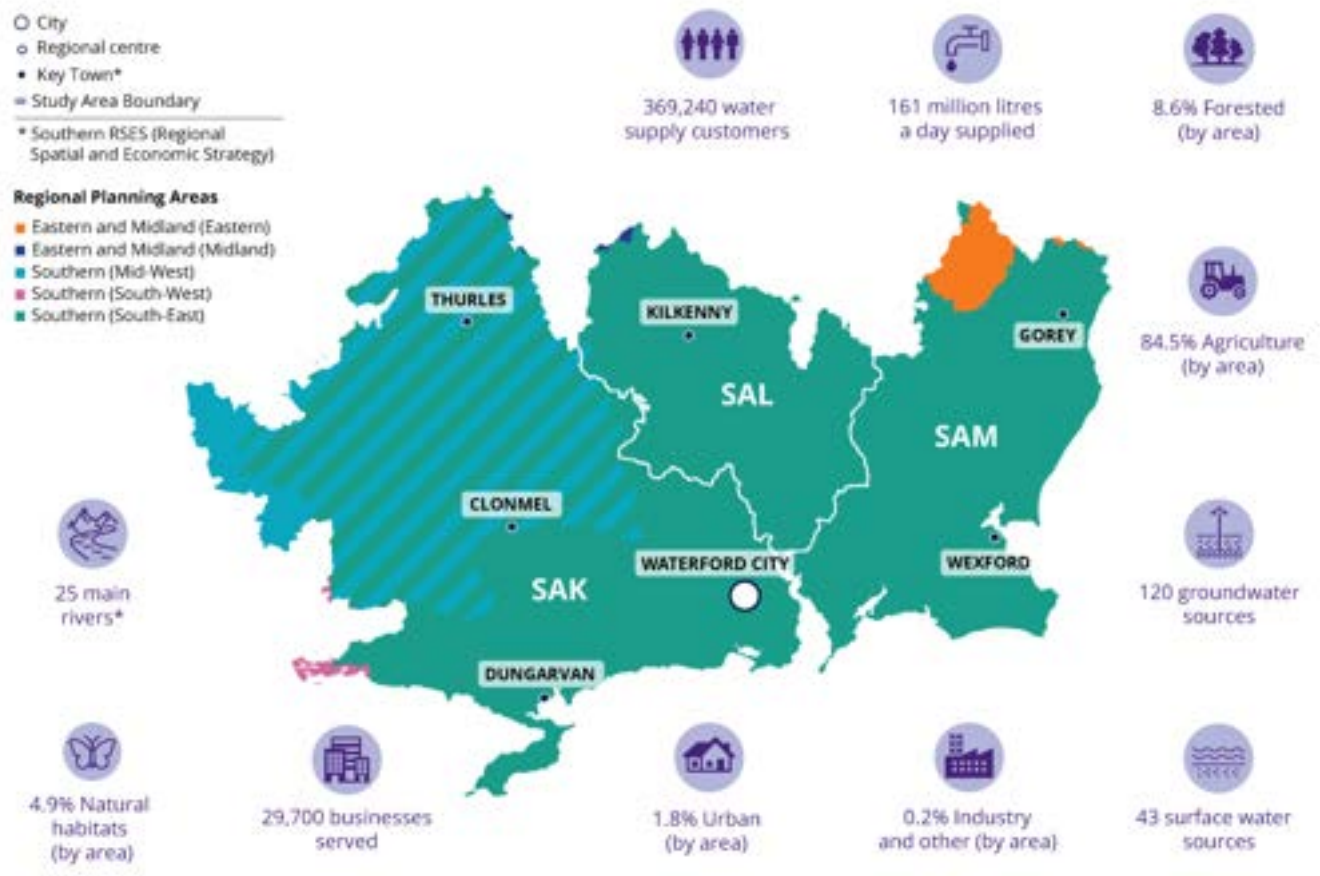
The predominant land use is agriculture, representing 84.5% of the total land area[1]. Natural habitats and forested areas comprise 4.9% and 8.6% of the land area, respectively. Urban areas cover just 1.8% of the region with industry and other minor land use categories making up the remaining 0.2%. The highest population density is in the east and includes Waterford City and the surrounding area. Uisce Éireann supplies around 161 million litres of water per day to a population of 369,240 people and 29,700 businesses in the South East Region. This represents 9% of our total supply nationally.

2.1.2 Study Areas in the RWRP-SE

The three (3) SAs making up the South East Region, and the cities, Key Towns and principal settlements (population greater than 10,000) located within them, are shown in Figure 2.2. Table 2.1 gives the area of each SA and lists the principal settlements.

There is one City, Waterford City, identified in the Southern Region Regional Spatial and Economic Strategy (RSES) and six (6) Key Towns including Kilkenny, Wexford, Thurles, Gorey, Clonmel and Dungarvan. The Key Town of Dungarven includes the satellite town of Ballinroad.

The Key Towns represent settlements that "will play a significant role in strengthening the urban structure of the Region. This is based on their strategic location and influence"[2]. It is envisaged that local authorities will plan for significant growth in these towns. Kilkenny City is the largest of the Key Towns, with a population of approximately 26,510.



*Main rivers include those classified as Stream Order 5 or higher

Figure 2.2 Study Areas of the South East Region and Key Regional Statistics

Table 2.1 Study Areas of the South East Region

Study Area	Description
SAK	SAK total area is approximately 5,060 km^2 and lies within the counties of Limerick, Tipperary, Waterford City, Waterford, Kilkenny, Laois, Cork, and Wexford*, The principal settlements (with a population of over 10,000) within SAK are Waterford City, Clonmel, Dungarvan (includes the satellite town of Ballinroad) and Tramore (CSO, 2016).
SAL	SAL total area is approximately 1,700 km^2 and lies within the counties of Tipperary, Carlow, Kilkenny, Laois, and Wexford. The principal settlement (with a population of over 10,000) within SAL is Kilkenny (CSO, 2016).
SAM	SAM total area is approximately 2,240 km^2 and lies within the counties of Carlow, Wexford, and Wicklow. The principal settlements (with a population of over 10,000) within SAM are Wexford, and Enniscorthy (CSO, 2016).

The population within the South East Region is served by 111 independent water supply systems defined by WRZs. Fifty-eight (58%) of the regional population is in SAK (Kilkenny, Limerick) which comprises Waterford City, whilst a further 27% of the region's population is located in SAM (Carlow, Wexford, Wicklow), and 14% of the region's population is located in SAL (Kilkenny, Carlow, Wexford) Table 2.2 gives the population served by Uisce Éireann and the number of WRZs in each Study Area.

Table 2.2 Study Area Population and Number of WRZs

SA No.	SA Name	Counties in SA	Total Population Served* (2019)	% of Regional Population	No. of WRZS
SAK	Waterford and South Tipperary	Limerick, Tipperary, Waterford, Kilkenny, Laois, Wexford and Cork	214,980	58	75
SAL	Kilkenny	Tipperary, Carlow, Kilkenny, Laois, Wexford	53,620	15	10
SAM	Wexford and Wicklow	Carlow, Wexford, Wicklow	100,640	27	26
RWRP-SE Area Total			369,240	100	111

* Population numbers are rounded to the nearest 10.

2.2 Growth and Development

2.2.1 Current Population

The South East Region has a population of 369,240 (9% of the national population), with 53,500 people (14% of the regional population and 1% of Ireland's population) located within Waterford City[3]. There are seven (7) settlements with a population of over 10,000 people. These are listed in Table 2.1 above. There are a further four (4) settlements with a population of over 5,000[2] including Gorey, New Ross, Thurles and Carrick-on-Suir. Eighteen percent (18%) of the region's population live in settlements of less than 5,000[2]. Figure 2.3 shows the population density across the region, highlighting smaller population centres and illustrating how much of the region is sparsely populated, resulting in the need for numerous small independent water supply systems.

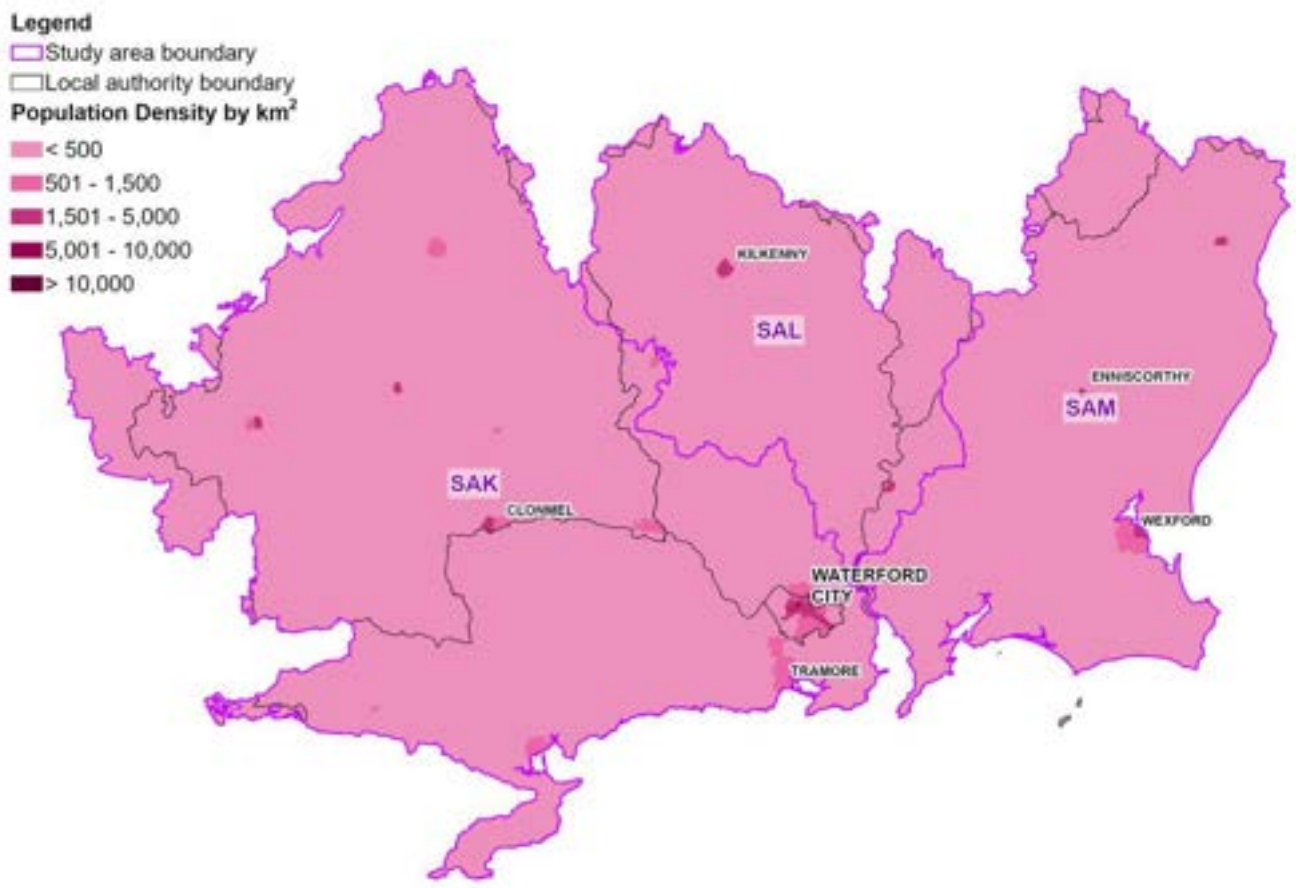


Figure 2.3 Population Density[3]

2.2.2 Growth and Economic Development Policies

Uisce Éireann's National Water Resources Plan (NWRP), which will comprise this RWRP-SE and the three (3) other regional water resource plans (Eastern and Midlands, South West and North West), is being developed to ensure water infrastructure can support the proposed growth policies at national, regional and county level. Supporting the National Policy Objectives (NPOs) and Regional Policy Objectives (RPOs) within the National Planning Framework (NPF)[4] and Regional Spatial and Economic Strategies (RSESs) is central to our NWRP.

The National Planning Framework (NPF) is the overarching policy setting out priorities for growth and development at national level over a 25-year period to 2040. A key objective is balancing development across three (3) Planning Regions, with 50% of future growth and development concentrated in the Eastern and Midland Planning Region and the other 50% directed towards the Northern and Western Region and the Southern Region.

The national objectives are then set out at regional level in the RSESs. There are three (3) regional assemblies – East/Midland Region, Southern Region, North West Region – which published RSESs for their respective regions in 2020. The RSES is a 12-year regional plan (2019-2031) which primarily aims to support the delivery of the programme for change set out in Project Ireland 2040, the National Planning Framework (NPF) and the National Development Plan 2018-27(NDP)[5].

At county level the regional policy is implemented through County/City Development Plans (CDPs), Local Area Plans (LAPs) and Metropolitan Strategic Plans (MASPs). The County Development Plan sets out the priorities within each local authority area for development over a 6-year timeframe.

The Office of the Planning Regulator (OPR) evaluates, assesses, and makes observations on the RSESs, CDPs and LAPs (including growth projections) to ensure they are in accordance with planning policy. The interaction between the planning system and Uisce Éireann's plans and programmes is summarised in Figure 2.4 below.

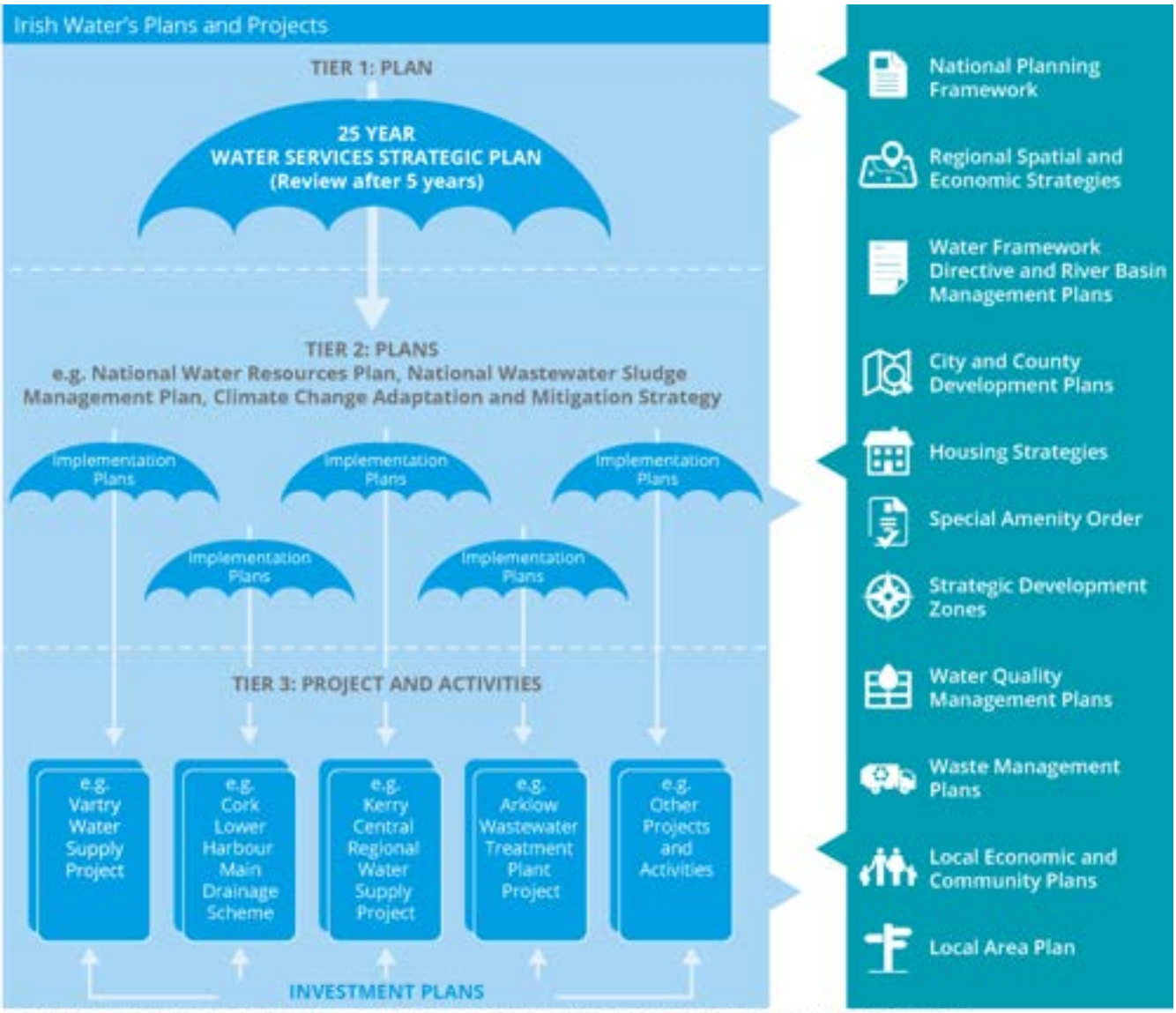


Figure 2.4 Interaction between the Planning System and Uisce Éireann's Plans and Programs

Uisce Éireann continually engages and interacts with the relevant public bodies in the planning process at all levels: national, regional and county level. Uisce Éireann is committed to taking account of national, regional and local spatial planning policy when developing investment planning (including the NWRP process) within technical, environmental, and budgetary constraints (and taking into account our sustainability policy).

The National Planning Framework recognises that "investment in water services infrastructure is critical to the implementation of the National Development Plan". Uisce Éireann's NWRP has been developed to ensure that water infrastructure can support the proposed growth policies at all three planning levels. The RWRP-SE falls within the region of the Southern Regional Assembly.

2.2.3 Population Forecasts in the RWRP-SE

Growth projections used within our RWRP-SE are based on best available data from the NPF and RSESs at the time of compiling the plan. The growth projections for the cities were taken from the NPF and RSESs, and projections for the Regional Growth Centres and Key Towns were taken from the RSESs. For all other areas, the growth projections were taken from the NPF.

In addition, we recognise the ongoing work between the Regional Assemblies and the Local Authorities over the course of the development of the Local Authority County / City Development Plans and the MASPs. As these plans are finalised, Uisce Éireann will incorporate the increasingly refined growth rates into our demand forecasts – see Section 2.2.3.1 for further details. The demand forecasts are used in our Supply Demand Balance calculations to determine future water supply deficits in the region.

The projected population used in our demand forecasts for WRZs at our regional planning Study Area level is shown in Table 2.3.

Table 2.3 Study Area Population Growth (2019 to 2044)

SA No.	SA Name	Total Population* (Source: CSO, 2016[2] and IW population projections)		Change in Population
		2019	2044	%
SAK	Waterford and South Tipperary	214,980	279,370	30
SAL	Kilkenny	53,620	66,400	24
SAM	Wexford and Wicklow	100,640	127,710	27
	TOTAL	**369,240**	**473,480**	**28**

* Population values are rounded to the nearest 10

The overall regional population growth is 28% from 2019 to 2044. All study areas in the South East Region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016.

SAK (County Kilkenny, Limerick, Tipperary and Waterford) has the highest projected growth rate at 30%, which is driven by the East Waterford Water Supply Scheme WRZ and Clonmel and Environs WRZ 2044 forecast growth of 44% and 47% respectively.

The population growth at a WRZ level is presented in Figure 2.5. The figure shows the higher growth rate projections of Waterford City and surrounds as well as Tramore and surrounding areas. It should be noted that settlements and associated growth rates are not exactly aligned with the existing water supply asset base, as our water supplies can serve large areas covering urban and rural settlements through an interconnected asset base. Where this is the case, we have attributed the differing growth rates in proportion to the supply that is in the urban and rural settlements. This ensures that the overall growth is aligned with the NPF (and LAPs, where applicable).

A summary of the population growth rates that we have assumed for the settlements in the RWRP-SE is presented in Section 3, which explains the demand forecast projections across the South East Region.

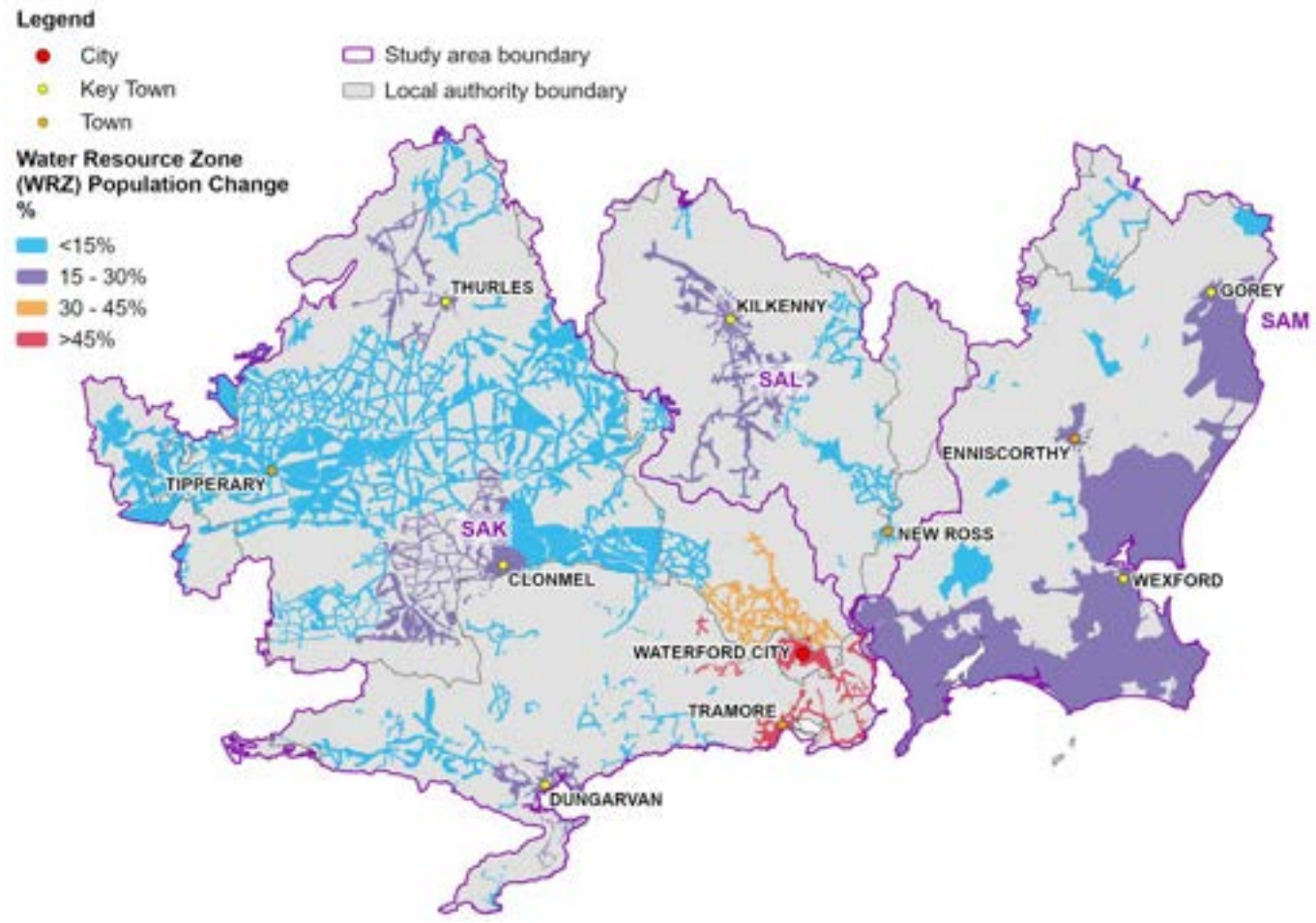


Figure 2.5 Percentage Change in Population (2019 to 2044) for WRZ's in the South East Region

2.2.3.1 Future Updates to Growth Projections

We recognise the ongoing work between the Regional Assemblies, the Office of the Planning Regulator and the local authorities over the course of the development of the Local Authority County/City Development Plans and the Waterford Metropolitan Area Strategic Plan (MASP). As these plans are finalised, Uisce Éireann will incorporate the increasingly refined growth rates into our demand forecasts. Uisce Éireann is also collaborating with Central Statistics Office (CSO) to update the 2022 Census population data for Uisce Éireann's planning boundaries. The Supply Demand Balance will be updated once the 2022 Census population update is completed. Any new census data and information will be incorporated on an iterative basis through the monitoring and feedback process set out in section 8.3.8 of the Framework Plan.

Uisce Éireann has developed a 10-year capacity register based on the Supply Demand Balance (SDB) to provide Local Authorities with an indication of settlements that have potential capacity constraints. These will be made available for use in Development Plans. This process will involve an ongoing feedback loop between the resources planning process and the forward planning processes in Uisce Éireann, the Regional Assemblies and the Local Authorities. This will allow Uisce Éireann to respond to growth and development needs and prioritise water supply investment in collaboration with Local Authorities and with reference to the County/City Development Plans, LAPS and MASPs.

The methods for forecasting water demand utilising the population projections are detailed in the NWRP Framework Plan Section 4. Projections of water demand and the resulting challenges for the South East Region are set out in Section 3 of this Plan.

2.2.3.2 Non-Domestic Growth

Within the RSES and the NPF there are also projections of non-domestic growth. The precise nature of the business activity created to drive non-domestic growth can have a significant impact on water demand as non-domestic water demand varies enormously from sector to sector and property to property. Therefore, an allowance has been made for non-domestic growth in towns and cities identified as strong growth areas in Project 2040[4]. For other areas it has been assumed that there will be no significant increase in non-domestic demand. This approach and the assumptions made are described in Section 4.3.2.3 of the Framework Plan. We will review policy and trends in relation to this over the coming years and refine our forecasts as per the monitoring and feedback process set out in Section 8.3.8 of the Framework Plan and Chapter 9 of this Plan.

2.2.4 Tourism and Recreation

Tourism has an important role in the core baseline area, particularly in rural locations, with the National Planning Framework (NPF) [4] stating that tourism is a key aspect of rural job creation now and in the future. The majority of the core baseline area encompasses Ireland's Ancient East, and slightly extends into Ireland's Hidden Heartlands on its Northern side, and the new Dublin tourism brand on its Western side, three (3) of Fáilte Ireland's tourism programmes in the country. Ireland's Ancient East is part of a tourism development strategy that covers the South, East and part of the Midlands, and places emphasis on the importance of historic sites in the area[6]. Hidden Heartlands is located in the Mid-West, focussing on rural communities[7] and the new Dublin tourism brand which is "the first Dublin-dedicated tourism campaign in many years" and seeks to change perceptions of Dublin "from a weak and one-dimensional image to that of a city pulsing with life"[8].

Key tourist attractions located within the region are described below[9]:

- The county of Carlow (SAL and M) is the second smallest and the third least populous of Ireland's 32 traditional counties. It is known for its rich store of historical and archaeological artifacts from pagan sites such as the Brownshill Dolmen and for its ecclesiastical settlements, many of which are of national significance[10];
- The county of Cork (SAK) contains internationally recognised Camden Fort Meagher, and it has been described as "Ireland's Maritime Haven", with emphasis placed on the cultural and historical attractions many of which located along the coastal environments[11];
- The county of Kilkenny (SAK and L) is known as the "Cultural County" and has rich historical roots and is famous for its medieval buildings and castles[12].
- The county of Laois (SAK and L) has been described as an "outdoor enthusiasts paradise" with emphasis also placed on the county's cultural and historical attractions[13].
- The county of Limerick (SAK) includes Limerick City, the first city of culture, and emphasises the importance of sports in its touristic appeal[14];
- The county of Tipperary (SAK and L) has been described as the "farming heartland of Ireland" with emphasis also placed on the county's cultural and historical attractions[15];
- Waterford City (SAK) is the oldest city in Ireland, and it is said to be the perfect blend of ancient and modern[16].
- The county of Waterford (SAK) is home to the stunning 25km County Waterford's Copper Coast, and an UNESCO Global Geopark which offers winding trails for walking, driving, and cycling[16];
- The county of Wexford (SAK, L and M) is known as 'The Sunny Southeast'. Alongside being a Viking town, it offers coasts and beaches, and is said to be one of the best places to see puffins in the wild[17];

- The county of Wicklow (SAM) has been described as “the garden of Ireland”, containing Ireland’s largest national park (Wicklow National Park) and emphasising outdoor recreation as a key asset for the area[18].

Ireland’s natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport. Key natural heritage and outdoor recreation attractions[19] within the core baseline area include:

- Study Area K: Comeragh Mountains, Capel Island and Knockadoon Head Nature Reserve,
- Study Area L: Ballykeeffe Wood Nature Reserve, Kyledohir Wood Nature Reserve, Garryricken Woods Nature Reserve, Kilkenny Castle
- Study Area M: Ballyteigue Burrow Nature Reserve, The Raven Nature Reserve, Wexford Wildfowl Reserve, Loftus Hall, Irish national Heritage Park

Rivers, loughs and coastal areas across the core baseline area also all make an important contribution to tourism and recreational opportunities and support important fisheries.

Rivers and coastal areas across the region make an important contribution to tourism and recreational opportunities and support important fisheries. For example, the River Barrow, which is the second longest river in Ireland (after the River Shannon) is known as an area of natural beauty and hosts many sporting activities and recreation events[20]. The River Nore, which joins the River Barrow about 20 km upstream of the Waterford Harbour estuary, is one of the best salmon rivers in Ireland[20]. The River Suir also joins the Barrow and is one of Ireland’s important brown trout fisheries[21].

In planning our water resource infrastructure, we consider the increase in water demands resulting from the influx of tourists, particularly during summer months when local demand is elevated. In cases where the holiday population is high relative to the resident population the demand peaks may be pronounced during hot, dry weather periods in the summer season. We have accounted for the impact of tourism in our water demand forecasts. This is further explained in Section 3.2.6

2.2.5 Impact of the Covid-19 Pandemic

We recognise that data relating to population forecasts, economic trends and tourism are based on information gathered before the Covid-19 pandemic. Therefore, trends and patterns may need to be revised as enough data and information is available to understand the long-term impact of the pandemic. Key considerations will include potential changes to demographics in relation to commercial and office settings, changes in hospitality and tourism impacts. Uisce Éireann will incorporate any future changes as outlined in the monitoring and feedback process summarised in Chapter 8 of the Framework Plan. One of the benefits of a more interconnected water supply network will be the flexibility to adapt to changing growth patterns.

2.3 Natural Resources

A sustainable supply of clean water to support our growing communities depends on our understanding and protection of natural resources. At a fundamental level this includes the catchment that feeds surface water and groundwater bodies and the extent of ecosystem services that these waterbodies provide. Improving sustainability is at the heart of our plans and the NWRP assessment methodology incorporates Strategic Environmental Assessment (SEA) objectives into the decision-making process. This includes taking account of cumulative impacts within catchments. As noted in Section 2.2, examples of waterbodies that provide environmental, social and cultural values for communities in the South East Region include the River Barrow, River Suir and the River Nore, collectively known as The Three Sisters. The rivers drain a large part of southern Ireland, and flow through Counties Tipperary, Carlow, Kilkenny,

Wexford and Waterford. The rivers join to form the Waterford Harbour estuary, east of the city of Waterford. The River Barrow is the longest of the three (3) rivers, and the second longest river in Ireland. It is considered one of Ireland's most scenic waterways.

Our freshwater systems support the provision of drinking water needs, livestock and firefighting as well as other uses including industry, irrigation, and recreation and amenities. In our planning, Uisce Éireann recognises that in addition to anthropogenic uses, our freshwater resources also need to sustain habitats that rely on the quality, flows and volumes within these systems. We endeavour to protect aquatic environment/habitat by maintaining water quality, physical habitats, hydrological processes, flow regimes and broader biological diversity.

In the following sections we describe the features of our natural environment that impact water quality and describe the sensitivities of the riverine ecology to changes in the flow regime. This is an important consideration for understanding the impact of abstractions and hydromorphological modifications (such as large-scale damming and channelisation). We account for these impacts by limiting new abstractions to sustainable flow thresholds. This is discussed further is Section 2.3.7. We describe the environmental status of our surface water bodies and ground water systems in Section 2.3.5 and Section 2.3.6.

2.3.1 Geology

Understanding the geology of our catchments is vital to the provision of clean, secure and sustainable water supplies. Geology is responsible for shaping mountain ranges, defining river network systems and determining their character, i.e., slope and erosivity. The geology 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. 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 resultant land use can have a detrimental impact on water quality.

The bedrock geological maps developed by the Geological Society of Ireland (GSI) are the foundation maps upon which groundwater protection and vulnerability maps have been constructed and upon which Water Framework Directive (WFD) groundwater bodies and monitoring programmes have been established by the Environment Protection Agency (EPA). In general, the topography and its associated geological deposits can be broadly split into topographic highs and lowland valleys. Considering the extent of glaciation during the last ice age the Irish landscape can be considered a glacial one. Bedrock outcrop often prevails in the mountainous areas, while the remainder of Ireland's bedrock is generally overlain by glacial material or glacially influenced materials (river alluvium, peat or coastal deposits).

The oldest geology of the South East Region, comprising greywacke sandstones, slatey mudstones, shales and quartzites, were deposited during the Cambrian Period, 541 – 485 million years ago (mya). These represent 5% of the geology of the South East Region, consisting of highly complex metamorphic rocks. There is a very minor representation of Precambrian rocks, representing just 1%. Most of them originated as sedimentary rocks such as limestones (which became marbles), sandstones (which became quartzites or psammites) and mudstones (which became schists or pelites). There are large swathes of Cambrian Metasediments stretching from Tramore in Waterford northeast to Ballygarrett at the coast in Wexford.

The Ordovician and Silurian Periods, when present day northwest and southeast Ireland, lay along the margins of separate continental masses and divided roughly along the Shannon Estuary, represents the second largest proportion (32%) of the South East Region's bedrock geology. During the closure of the Iapetus Ocean, the subduction of oceanic crust was responsible for the formation of a volcanic island arc. These volcanic rocks were erupted and intruded into the Silurian marine sedimentary sequences, which include greywackes, mudstones, lavas and tuffs. These form an extensive band which stretches from Wexford in the northeast to Stradbally on the coast of Waterford.

Broadly speaking the geology of the Munster Basin, consists of east-west trending anticlines (sandstone ridges) and synclines (limestone valleys). The Late Devonian period (c. 370 mya) was a period characterised by river deposition in a sub-equatorial arid environment. The rocks are collectively known as Old Red Sandstone (ORS) and consist mainly of coarse and fine sandstones, siltstones, shales, and conglomerates. They make up around 14% of the bedrock geology in the South East Region. These non-marine sediments can form depths of up to 6 km in places. They are resistant to erosion and often form rugged terrain of the more upland areas. Most notable are the Knockmealdown Mountains located on the borders of Tipperary and Waterford. They are predominantly overlain by quaternary sediments of Till and raised Peat in the more upland areas.

Most of the bedrock geology of the South East Region (34%) falls into the Lower Carboniferous period (350 mya), which consists of a mixture of sandstone, limestone and shale, and these represent the transition from terrestrial to marine depositional conditions. During the transgression of the warm, shallow sea limestones, sediments derived from the breakdown and disintegration of calcareous shells of invertebrate animals were deposited. They are present in the lower lying areas across large areas of Tipperary and Kilkenny and to a smaller extent southeast Wexford. The Upper Carboniferous (325 mya) is represented by 6% of the South East Region, dominated by deep water shales in the lower Namurian sequence, while the upper portions are generally sandstones and siltstones. These appear as a small occurrence in northern Tipperary and Kilkenny.

2.3.2 Groundwater Aquifers

The geology of our catchments is vital to the quantity and quality of water which we can abstract. The quantity of water which can be abstracted from a groundwater source is impacted by the depth, porosity and connectivity of the target geological formation/layer. Geological horizons such as clay and igneous rocks have limited porosity and are therefore low yielding (poor aquifers) whilst geological formations such as chalk and limestone are associated with higher porosities and can yield substantial quantities of water (good aquifers). For water to move through an aquifer the internal voids and fractures must be connected. The porosity and degree of fracturing and interconnectivity therefore impacts not just the available quantity of water but also the level of recharge of the groundwater body. This in turn impacts the potential sustainable abstraction rate.

About 34% of the water supply for the South East Region is abstracted from underground aquifers, either from boreholes, springs or infiltration galleries. Groundwater abstractions make up 120 of our 163 supply sources are groundwater sources representing an important source of supply serving independent settlements within the region. The major aquifers in the South East Region are shown in Figure 2.6.

Geological Survey Ireland has classified and mapped nine (9) aquifer categories across the country. The broad criteria used to determine aquifer categories include hydrogeological data, the presence of large springs, geology and stream density. The categories describe both resource potential/value (Regionally important, Locally important, or Poor) and groundwater flow type (through fissures, karst conduits or intergranular porosity):

- Regionally important bedrock aquifers are defined as those that can service public water supplies or that have excellent yields (>400 cubic meters per day (m^3/day)). The aquifer area is >25 km^2 and flow is predominantly though fractures, fissures and joints.
- Locally important bedrock aquifers are defined as those that can service more local public water supplies/group schemes or that have good yields (100-400 m^3/day). Flow is predominantly though fractures, fissures and joints.
- Poor bedrock aquifers are defined as those that can service small abstractions (domestic supplies/small group schemes) or that have moderate-low yields (<100 m^3/day). Flow is predominantly though a limited and poorly-connected network of fractures, fissures and joints.

Additionally, GSI usefully grouped and summarised the aquifer categories into high-level groupings that succinctly describe the broad types:

- Sand/gravel;
- Karstic;
- Productive fissured bedrock; and
- Poorly productive bedrock.

Sand and gravel aquifers are classed as an aquifer if the deposit is highly permeable, more than 10 m thick and greater than one square kilometre in areal extent. The thickness is more often used than the more relevant saturated thickness as the data for this is often not available.

These general types of aquifers can be considered as groundwater systems that have similar properties with a good indication of resource, extent and risk. Table 1.2 in Appendix C of the Framework Plan describes the nine (9) aquifer categories in detail.

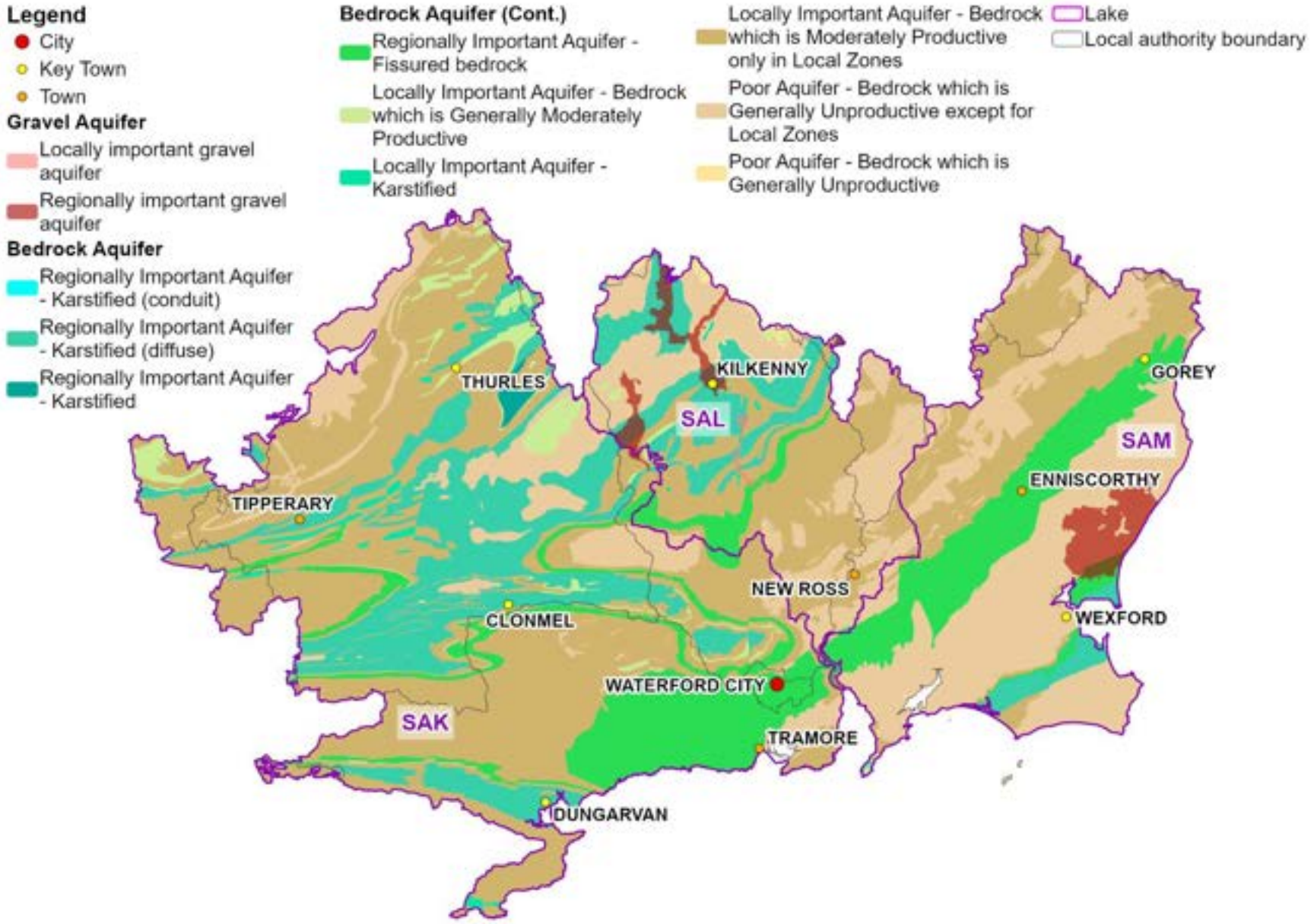


Figure 2.6 Spatial Extent of Major Aquifers in the South East Region

The predominant aquifer type of the South East Region is made up of poorly productive bedrock (70%), followed by productive fissured (22%), sand and gravel (5%) and karstic aquifers (3%).

The Old Red Sandstone (ORS) are predominantly made up of **poorly productive bedrock.** The aquifer is generally devoid of intergranular permeability, with groundwater flow occurring predominantly through fractures and faults. Most groundwater flow occurs in the top 15-20 metres of the aquifer, with levels generally mirroring topography. Deeper flows along fault zones or connected fractures are encountered however, which can provide much higher yields. Significant flows can be found at springs issuing from bedding planes marking a change in lithology. Much of western and central Waterford, as well as parts of western Tipperary, is characterised by a larger proportion of ORS bedrock resulting in lower groundwater potential in this part of the region. The Cambrian rocks, mostly seen in southeast Wexford, generally show low aquifer potential but are occasionally capable of supplying group schemes and small commercial interests.

Groundwater flow in the **productive fissured aquifers** largely takes place along fractures and faults. Where extensive faulting occurs, the aquifer permeability is likely to be increased. Additional fracturing may also be associated with the faulting. An extensive body of productive fissured bedrock, made up primarily of volcanics, stretches from Wexford in the northeast to Stradbally on the coast of Waterford. The most productive yields are sourced from the well-developed fissures in the felsic Rhyolites and Andesites. Lower permeabilities and yields do occur in these however, with intrusive rocks (dykes and sills) forming a barrier to groundwater flow. There are some productive wellfields in this formation, such as Gorey in Wexford which has in the past supplied upwards of 7,000 cubic metres per day (m^3/day). The potential for productive wells becomes less frequent in County Waterford due to the greater proportion of intrusive rocks. Although covering a less extensive area than the Ordovician Volcanics, the Devonian Kiltorcan Sandstones form a Regionally Important Fissured aquifer and can be found along the base of the Galtee Mountains, while also extends in a narrow band through Waterford, Tipperary to Kilkenny. This type of bedrock has shown to be able to provide good yields (about 700 m^3/day at Cappoquin), where permeability depends on fractures and fissures. The cleaner sandstones are likely to have a denser network of fracturing and fracture permeability in the shalier sandstones.

The differing spatial extents and permeabilities of **sand/gravel aquifers** results in a variable development potential. They act as areas for groundwater filtration owing to the intergranular flow mechanics, which offers good protection against microbial contamination. There are a number of regionally important sand and gravel aquifers (Rg) throughout the region, with the main ones occurring in Kilkenny (Nore Valley and Kilmanagh Gravels) and the Screen Hill Gravels in Wexford. Those in valley settings will likely receive significant rejected recharge from valley sides. The sand/gravel deposits, when overlying areas of bedrock aquifers, can improve the overall flow and storage to the aquifer and also protect against pollution. Conversely, groundwater from the dolomite bedrock can feed into the gravel under certain conditions.

There are extensive swathes of **regionally important karst aquifer** (diffuse Rk^d) in some areas, particularly in southern Tipperary stretching north-eastwards into Kilkenny and southeast Wexford. The distribution of permeability and yield is more homogenous where the development of karst has resulted in a more diffuse network of flow pathways. This provides a slightly more reliable flow regime than conduit (Rk^c) dominated aquifers, however these karstic environments are still prone to pollution from point sources such as septic tanks, disposal sites and land spreading. A number of large abstractions take place from these pure bedded limestones, namely Fardystown (supplies c. 9,500 m^3/day) in Wexford and Mullenbawn spring (650 – 2,200 m^3/day) in South Tipperary. Dolomitisation of the limestone results in an increase in porosity and permeability and is most notable in central Kilkenny where a band of bedrock extends to the northeast, while also being present in parts of north Tipperary. Optimum well yields from the dolomite aquifer will be obtained from boreholes drilled into one of the many fault zones and penetrate at least 50-100 metres of the aquifer. Previous groundwater exploration in the area of Bennetsbridge, Kilkenny showed the productive limestone zones to be relatively localised

and associated with areas olomitizationion. It should be noted that extensive weathering associated with olomitizationion can lead to problems when drilling.

2.3.3 Surface Water Systems

Relative to other European countries, Ireland has twice the EU average of lake coverage (12,000 lakes covering ~2% land area)[22]. In the South East Region however, there are only 11 lakes, covering 0.01% of the region's land area (less than 1 km^2). The three (3) largest lakes are Lough Knockaderry, Lough Belle and Lough Ballyshunnock.

The larger known rivers within the region include the Barrow, Suir, Nore, Slaney, Aherlow and Tar; however, they represent only a fraction of the extensive 8,830 km network currently mapped by the EPA in the South East Region. The Barrow River is the second-longest river in Ireland (after the Shannon River) and the Suir the third longest river. Along with the Nore River, the Barrow and the Suir Rivers are known as the Three Sisters. Their combined catchment areas are 9,207 km^2.

Surface water makes up 66% of the water we supply to our customers in the South East Region and comprises 43 of our 163 supply sources. The surface water river systems are shown in Figure 2.7 and described below for each Study Area.

SAL is split between the River Barrow and the River Nore catchments. The Barrow rises in the Slieve Bloom Mountains in County Laois, flowing a distance south before crossing into SAL at Muine Bheag, turning tidal at Saint Mullins, being joined by the Nore at Ringwood before flowing through New Ross into the Suir Estuary at Cheekpoint. The Nore rises at on the slopes of Borrisnoe Mountain in County Tipperary, flowing south east into SAL around Durrow, traveling through Kilkenny City, turning tidal at Inistioge, before its confluence with the Barrow. Both rivers are designated as part of the large River Barrow and River Nore Special Area of Conservation (SAC).

Most of SAK is within the large River Suir catchment, with small parts of the Study Area crossing into the coastal Colligan-Mahon catchment and the River Blackwater catchment. The River Suir is one the largest rivers in Ireland, with a total catchment area of 3,542 km^2, rising on the slopes of the Devil's Bit Mountain before draining large parts of County Tipperary as it flows south through wide karstified limestone plains. The Suir then turns sharply east to form the border with County Waterford, flowing through Clonmel before turning tidal at Carrick-on-Suir, joining the Nore and Barrow Rivers east of Waterford City, before finally entering the sea at Waterford Harbour. The River Suir is designated as the Lower River Suir Special Area of Conservation (SAC), and one of its tributaries, the Clodiagh River (Portlaw), is also designated for *Margaritifera* (Freshwater Pearl Mussel) SAC catchment.

Most of SAM is within the large River Slaney & Wexford Harbour catchment, whilst elsewhere the Study Area crosses into the small catchments of the Ballyteigue-Bannow catchment in the south, and the River Owenavorragh catchment in the north east. The River Slaney rises on Lugnaquillia Mountain, draining the western Wicklow Mountains as it flows south, crossing into SAM at Bunclody, continuing south across central County Wexford, becoming tidal at Enniscorthy before entering Wexford Harbour at Wexford Town. The Slaney has a total catchment area of 1,980 km^2 and is designated as the Slaney River Valley Special Area of Conservation (SAC). In comparison, the Ballyteigue-Bannow and Owenavorragh catchments are much smaller coastal catchments characterised by several short rivers flowing to sea.

Figure 2.7 Rivers of the South East Region

2.3.3.1 River Typologies

The riverine ecology of many of our river systems is considered highly sensitive to changes in flow and water level. The parameters identified to reflect this sensitivity include geology, gradient and altitude. There are eight (8) typologies for water resources standards for rivers that are defined based on these parameters[23]. The river water bodies in the South East Region comprise five (5) of the eight (8) typologies, as shown in Figure 2.8. The dominant river typology is represented by B1 – Hard limestone and sandstone; low-medium altitude; low-medium slope. This makes up 73% of the river systems in the region.

The most sensitive rivers are those within the C2 and D2 categories which are representative of headwaters, low nutrient, low pH and salmonid spawning and nursery areas. The salmonid spawning and nursery areas are particularly sensitive to low flows and impounding structures. These categories combined make up 26% of the river systems in the region.

The method by which waters of a similar ecological sensitivity are grouped into types for the Water Framework Directive, is referred to as a **typology**. For example, a river may be assigned to types based on altitude and alkalinity.

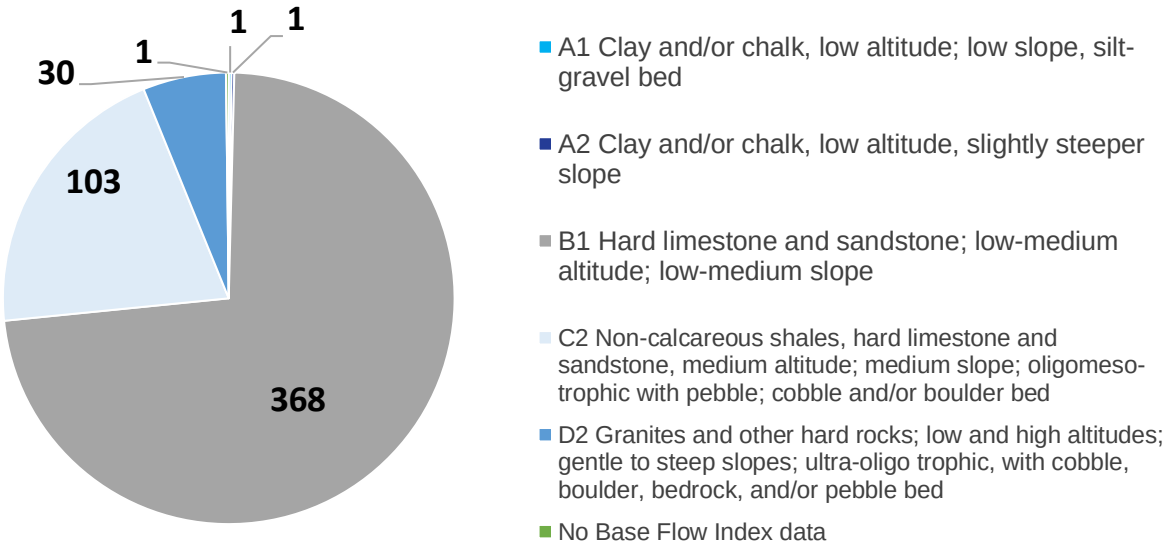


Figure 2.8 Main River Typologies in the South East Region

2.3.4 Groundwater – Surface Water Interaction

Surface water and groundwater interactions are important when considering the quantity of groundwater that can be abstracted, identifying options to support increased water demands and managing the water quality we supply. Interaction between surface water and groundwater can impact groundwater recharge rates, and therefore sustainable abstraction rates, as well as water quality through interactions with sources of pollution.

The degree of karstification is a large factor in controlling groundwater and surface water interaction. This is of importance in Groundwater Bodies (GWB) with protected ecosystems. In these karstified environments any surface water contaminants can be easily transported to groundwater and vice versa. Groundwater and surface water are more closely linked at certain karst features such as springs and swallow holes. Karst formations form regionally important aquifers in some areas of the South East Region, particularly in southern Tipperary and towards the north-east into Kilkenny and south east towards Wexford. Where the karst appears close to the surface, stream density is often low and sinking streams are activated. This can be seen where areas of thicker subsoil meet an area with karst bedrock at or close to the surface. Under certain circumstances, the River Nore, which flows south east through County Tipperary, receives relatively high baseflows from the underlying karst aquifer.

2.3.5 WFD 'Ecological Status' of Waterbodies

Our water planning approach, as set out in the Framework Plan, is developed to meet the environmental objectives of the European Union WFD (Directive 2000/60/EC) and the EPA's River Basin Management Plan (RBMP) (a requirement under the WFD). The WFD contains a standard European approach for managing waterbodies in our natural environment from abstraction to final discharge; while the RBMP outlines the WFD objectives for Ireland. It is underpinned by the following statement, "Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such"[24]. Ireland's United Nations Sustainable Development Goal 6 - Clean Water and Sanitation[25], is underpinned by the WFD. Progress in meeting the 2030 target to improve water quality is measured against the proportion of bodies of water with good ambient water quality.

The EPA coordinate WFD implementation in Ireland and carry out monitoring, assessment and setting of objectives for waterbody status nationally. Under the WFD, waterbodies are assigned an ecological status. The categories of ecological status are described in Box 2.1.

In accordance with the WFD, Uisce Éireann 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 quality elements.

Uisce Éireann considers the ecological status through the requirements for abstraction licences and discharge permits. The ecological status impacts drinking water quality and Uisce Éireann work to support the ecological status of waterbodies through our catchment-based management programmes.

Box 2.1 – Water Framework Directive (WFD) River Basin Management Plan Ecological Status Categories

Surface water bodies are classified according to their **ecological status** which is assessed by the abundance of aquatic flora and fish fauna. The biology of a waterbody is supported by the chemistry (including general physio-chemical measurements and chemical pollutants), the hydrology (flow and water levels) and the morphology (physical structure). Hydromorphological quality is only used during the assessment of high ecological status waterbodies. The ecological status shows the influence of pressures (e.g., pollution and habitat degradation) and a good ecological status is defined as 'a slight variation from undisturbed conditions.'

The classification scheme for ecological status for surface water includes five (5) categories: High, Good, Moderate, Poor and Bad. 'High status' means no or very low human pressure, 'Good status' means a 'slight' deviation from this condition, Moderate means a 'moderate' deviation whilst a Poor or Bad status recognises that the waterbody has been affected by an altered habitat and/or is polluted. The ecological status assigned for surface water bodies is determined by the status of the poorest quality element.

Overall status of groundwater bodies is assigned based on the combined chemical (the quality of groundwater) and quantitative element status. Groundwater chemical status is measured by concentrations of pollutants and changes in electrical conductivity in the groundwater body. Groundwater levels are used as one of the measures of quantitative status. Groundwater bodies are classified as either 'good' or 'poor' status.

2.3.5.1 Surface Water

The RBMP considers the actions Ireland will take to improve water quality and achieve "Good" ecological status in surface water bodies (rivers, lakes, estuaries and coastal waters) by 2027. In doing so it influences from where, in what quantities and under what conditions we can abstract water for public water supply. It also sets the legislative framework within which any new abstractions Uisce Éireann develop must conform.

The status of the South East region's surface water bodies, classified using data from 2016 - 2021, is depicted in Figure 2.9. Across Ireland there has been a decline in water quality over the last three WFD assessment cycles. The most recent water quality assessment cycle (2016 – 2021)[26] reports that the number estuaries and coastal waters in satisfactory condition has declined by almost 16% and 10% respectively. There has also been a one percent (1%) and three percent (3%) decline of monitored lakes in satisfactory condition. There are 20 WFD river water bodies that are determined to be of high ecological status. These are mostly within Study Area K (SAK), including tributaries of the Blackwater Estuary, and rivers in the Colligan-Mahon catchment and Suir catchment. Surface water bodies classified as bad status include the Kings River near Kilkenny River and the Upper Suir estuary in SAK.

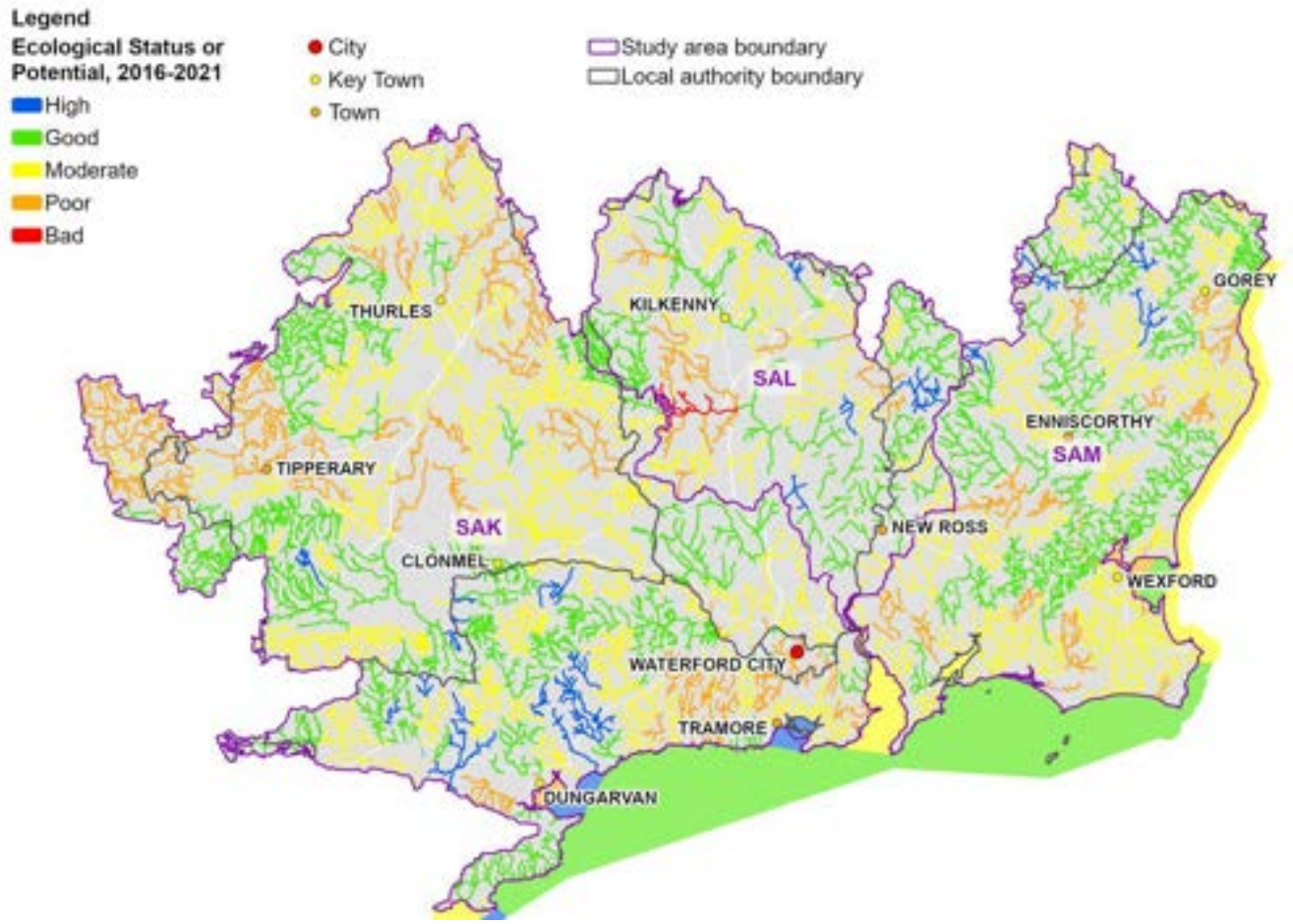


Figure 2.9 WFD 'Ecological Status' of Surface Water Bodies (2016-2021).

2.3.5.2 Groundwater

The bedrock geological maps developed by the Geological Survey Ireland (GSI) are the foundation maps upon which groundwater protection and vulnerability maps have been constructed and upon which Water Framework Directive (WFD) groundwater bodies and monitoring programmes have been established by the EPA.

The South East Region has 94 groundwater bodies (GWBs). GWBs are classified by the EPA as either 'good' or 'poor' status depending on the outcome of five (5) chemical tests and four quantitative tests. The failing of even one of these tests determines a 'poor' status for that waterbody. There are 10 GWBs in the South East Region that are currently at 'poor' Chemical Status[27]. These include Durrow, Athy-Bagnetlstown Gravels, Stoneyford Gravels, three (3) Waste Facility GWBs, and four (4) Industrial Facility GWBs. The remaining 84 GWBs in the region are currently at 'good' overall WFD status. The status of the South East region's groundwater bodies is shown in Figure 2.10.

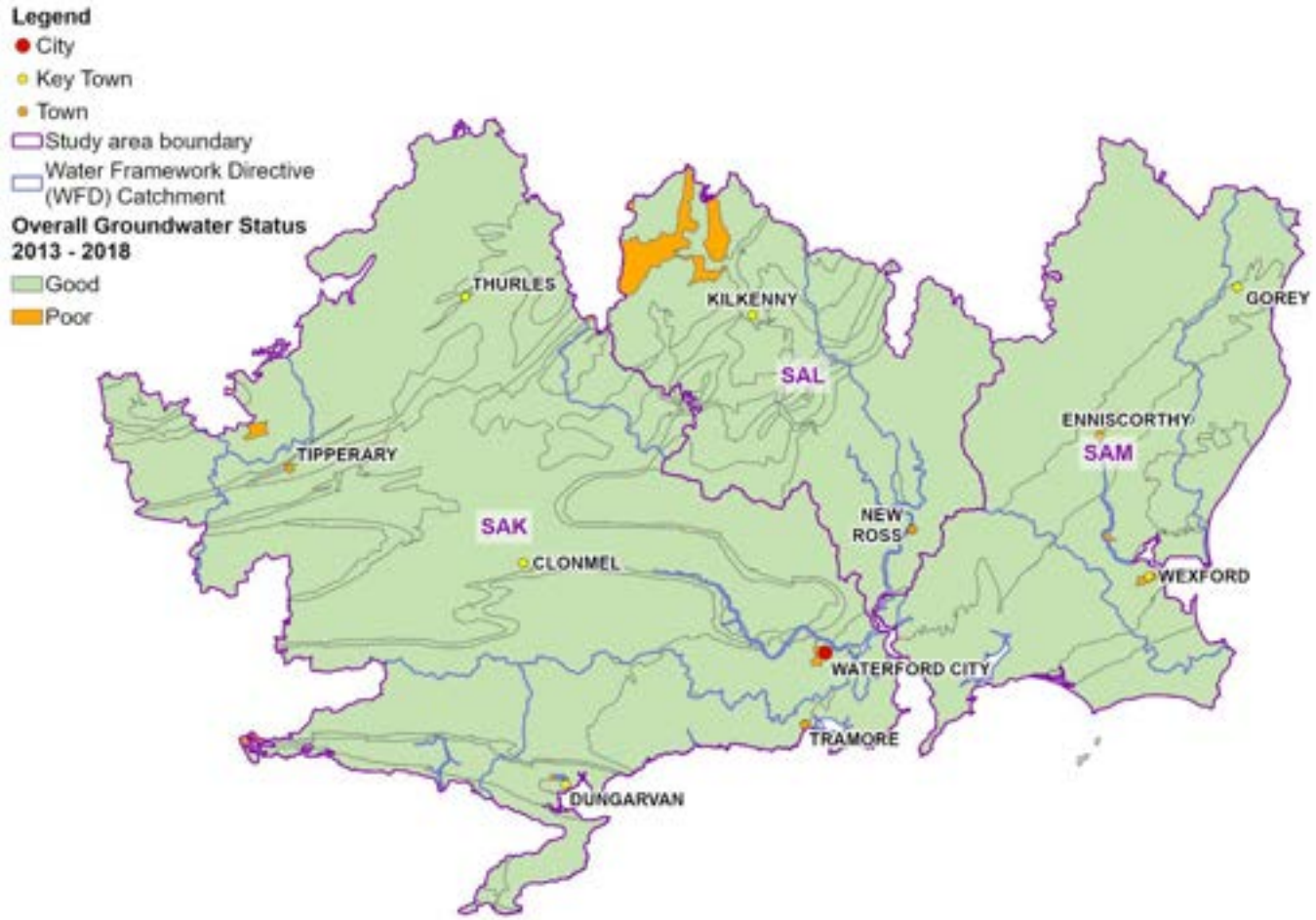


Figure 2.10 WFD Groundwater Body 'Ecological Status' (2016-2021)

Table 2.4 summarises the surface water and groundwater body classification for each Study Area. Across the region, 41% of surface water bodies (SWBs) are at 'High' or 'Good' status, while 17% SWBs are classified as below Moderate Status.

Forty-two percent (42%) of the 464 river water bodies (RWBs) in the region are classified as 'High' or 'Good' status. Forty percent (40%) of the RWBs are classified as 'Moderate condition' whilst 18% are classified as 'Poor' condition and one (the Kings River near Kilkenny) is assessed as 'Bad' Status.

Table 2.4 Water Body WFD 'Ecological Status' for each Study Area [27-31]

Study Areas	No. of WFD Catchment areas	Number of Surface Water Bodies in the region			Number of Groundwater bodies in the region	Number of Waterbodies Rated Below Moderate (SW) or poor (GW)	
		Rivers	Transitional and Coastal	Lakes		Surface Water	Groundwater
SAK	6	254	13	9	64	60	5
SAL	2	83	4	0	14	12	3
SAM	5	131	15	2	16	18	3
Regional Total	**11**	**464**	**30**	**11**	**94**	**88**	**10**

*Some water bodies fall within more than one Study Area. For this reason, the sum of the number of water bodies in each Study Area will be greater than the regional total.

2.3.6 WFD 'Risk Status' of Water Bodies and Associated Pressures

2.3.6.1 Surface Water

Risk assessment data produced to support Cycle 3 of the RBMP identifies water bodies at risk of failing WFD objectives or at risk of deteriorating from their current status due to a number of pressures.

The 2016 – 2021 WFD[31] Risk associated with river water bodies in the South East Region indicates that currently 46% (212 out of 464) of river water bodies in the region are 'At Risk', 29% (133) are 'Not at Risk', and 25% (119) are 'Under Review'. Four (4) out of 11 Lake Water Bodies (LWBs) are 'At Risk', five (5) are 'Not at Risk' and two (2) are 'Under Review'. This is represented in Figure 2.11.

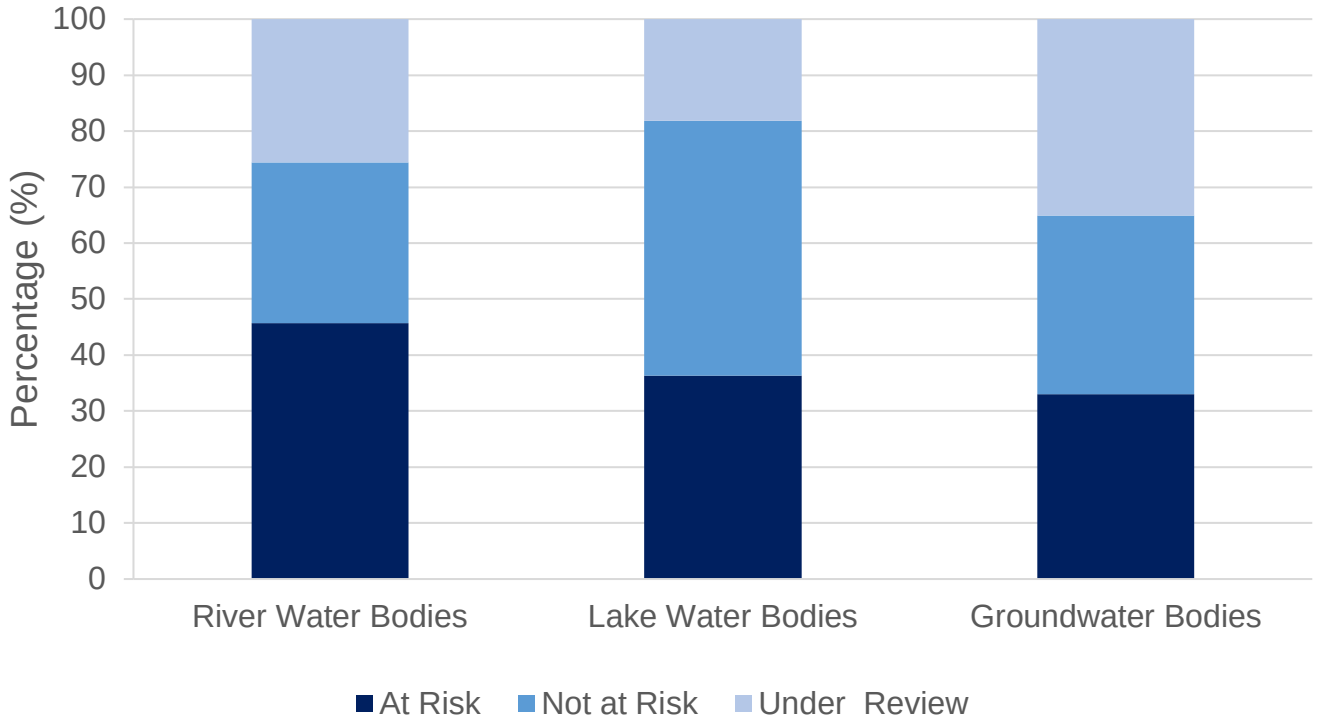


Figure 2.11 The 2016 – 2021 WFD Risk associated with River, Lake and Groundwater Bodies in the South East Region

Figure 2.12 presents the Surface Water Bodies (SWBs) 'At Risk' of not achieving the environmental objectives according to the pressures resulting from human activities. Surface Water Bodies that are 'At Risk', may be at risk due to one pressure or as a result of a combination of multiple pressures. For this reason, the sum of SWBs presented across the pressure categories exceeds the total number of SWBs reported as 'At Risk'. Of the SWBs 'At Risk' the predominant pressure associated with them is agriculture.

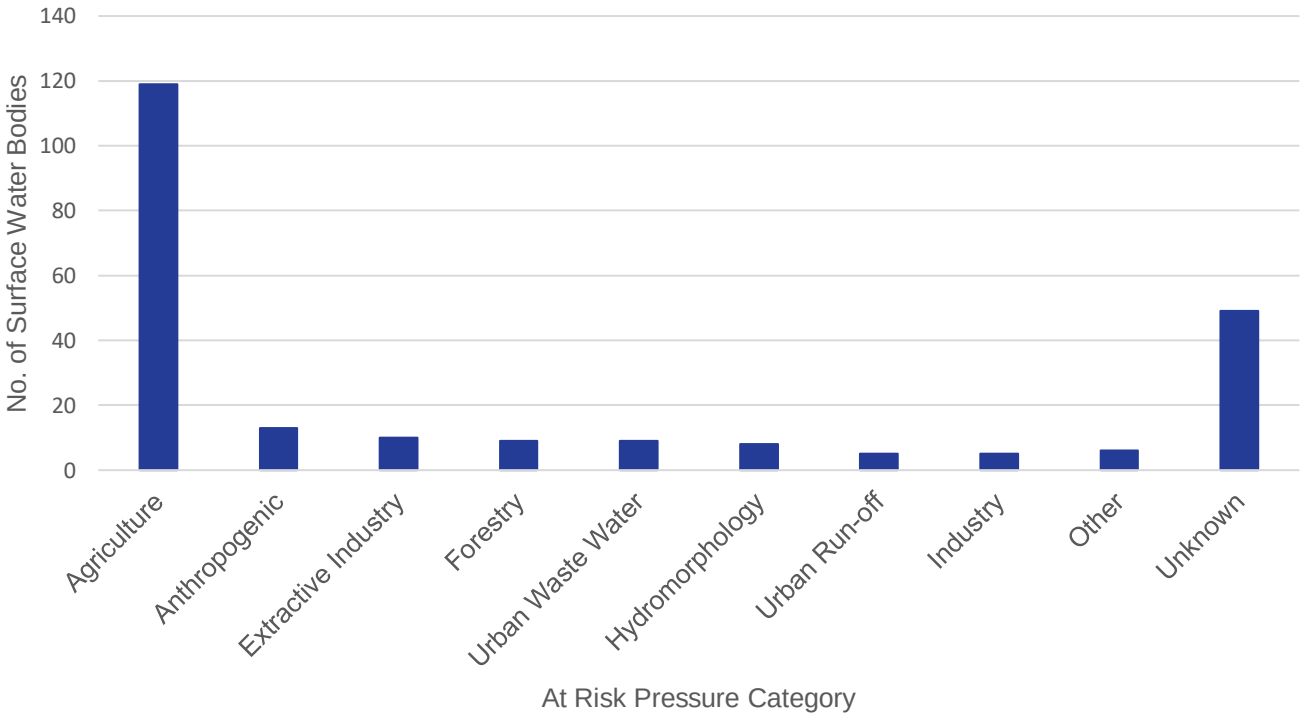


Figure 2.12 Number of Surface Water Bodies with Associated 'At Risk' Pressure Category[32]

2.3.6.2 Groundwater

The 2016– 2021 WFD Risk associated with the Ground Water Bodies (GWB) in the South West Region indicates that currently 33% (31 out of 94) GWBs are 'At Risk', 32% (30) are 'Not at Risk' and 35% (33) GWBs are 'Under Review'. (Figure 2.11).

Of the GWBs 'At Risk' the predominant pressure associated with them is agriculture, followed by industry (Figure 2.13).

The sustainable management of groundwater abstraction is challenging due to the large number of small abstractions in the region. Numerous smaller abstractions are necessary as the regions' hydrogeological conditions (as described in section 2.3.2) do not support the development of large abstractions. Uisce Éireann are committed to active participation in collaborative multiagency working forums, to draw on the expertise of stakeholder agencies with subject experts, for optimum management of Ireland's water resources.

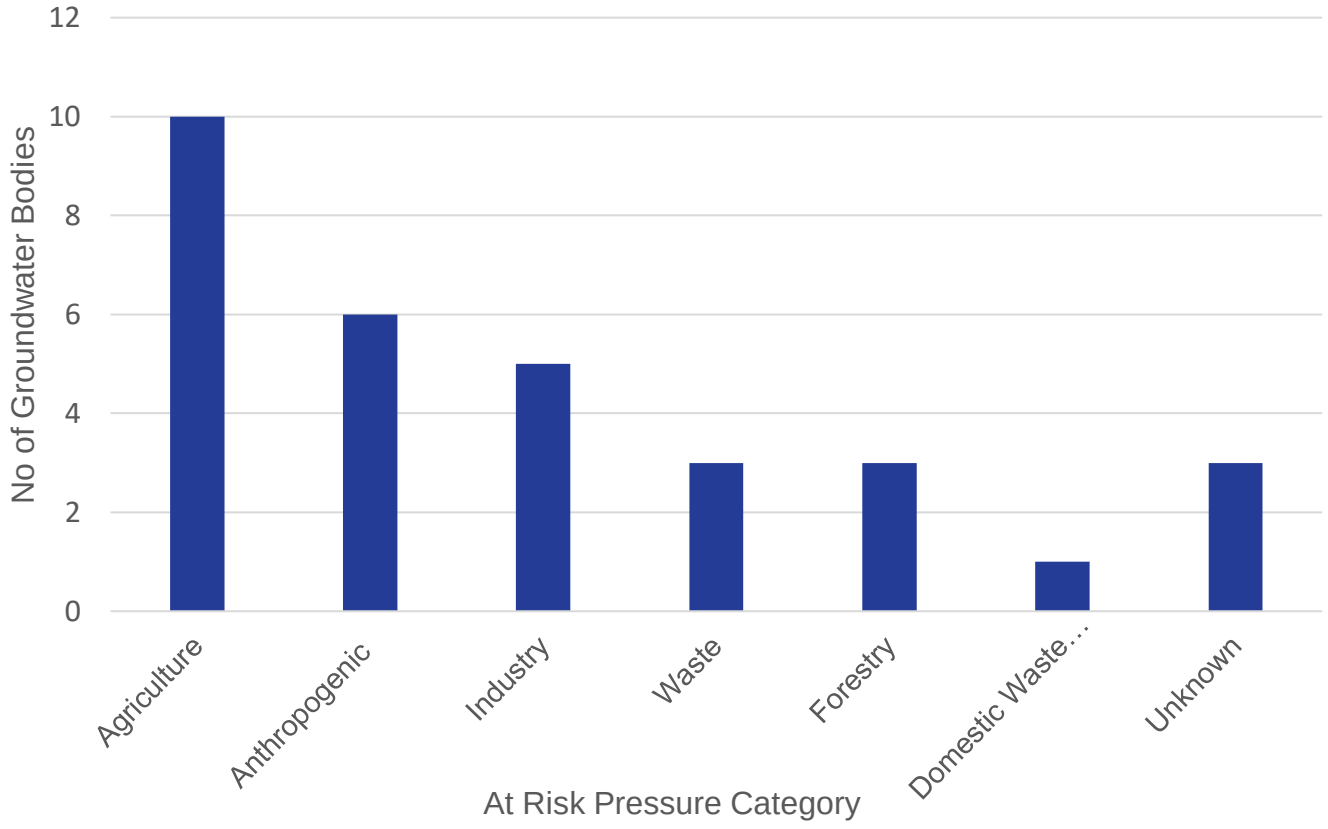


Figure 2.13 Number of Groundwater Bodies with Associated 'At Risk' Pressure Category[31]

2.3.7 Abstraction Pressures

In December 2022 the Water Environment (Abstractions and Associated Impoundments) Act (the "Abstractions Act")[33] was published, however it had not yet commenced. The Abstractions Act will align abstraction licensing with the requirements of the Water Framework Directive. The Abstractions Act has not yet commenced and the associated regulations and guidelines, which will further detail the types of assessment and national methodology to be used, are not yet in place. Whilst the regulations and guidelines for the new abstraction regime are being developed, we are assessing existing abstractions to identify surface water sites that may exceed future abstraction thresholds. We have taken a precautionary approach based on our current understanding of how new abstraction legislation might be applied. This assessment suggests that certain schemes may be subject to reductions in abstraction

under the new legislation; however, this will ultimately be determined by the EPA based on the project level information before them.

The assessment is based on the technical guidance from the United Kingdom Technical Advisory Group (UKTAG) to identify sites potentially at risk from abstraction. UKTAG comprises the Environment Agency, Natural Resources Wales, Scottish Environmental Protection Agency and Northern Ireland Environment Agency. The application of this guidance is explained in Appendix C and Appendix G of the Framework Plan.

The UKTAG standards[34] for alteration to river flows (hydrological alteration), permit a degree of modification from natural conditions. The standards are defined as an allowable percentage variation from natural flows. For “Good” ecological status watercourses, the allowable percentage variation from natural flows depends on river typology, season and flow rate. More restrictive limits apply between April and October compared to the period between November and March. The standards for “High” ecological status water bodies are defined as a lower allowable percentage variation from natural flows compared to “Good” ecological status water bodies.

The standards are only a supporting element of the overall ecological status indicator, and the EPA will utilise its own assessment methodology, which will have the benefit of containing more detailed project information and analysis. The assessment of potential future abstractions is used in this Plan as a conservative guide/indicator of abstractions that might be at risk. As further data becomes available, and more specific Irish standards are developed, Uisce Éireann will update the NWRP as appropriate using the monitoring and feedback process set out in Section 9 of this Plan.

The UKTAG method for determining the allowable abstraction for lakes requires detailed bathymetry and water level data. As this data is not widely available in Ireland, the methodology set out in a 2009 report by the Dublin City Council[35] was used to estimate the potential ecological limit of abstraction at lakes. This method sets the threshold for abstraction from lake sources at 10% of the Q50 of the rivers flowing into the lake.

A summary map showing the degree of modification of natural flows which may be permitted during periods of low flows is shown in Figure 2.14 for the South East Region.

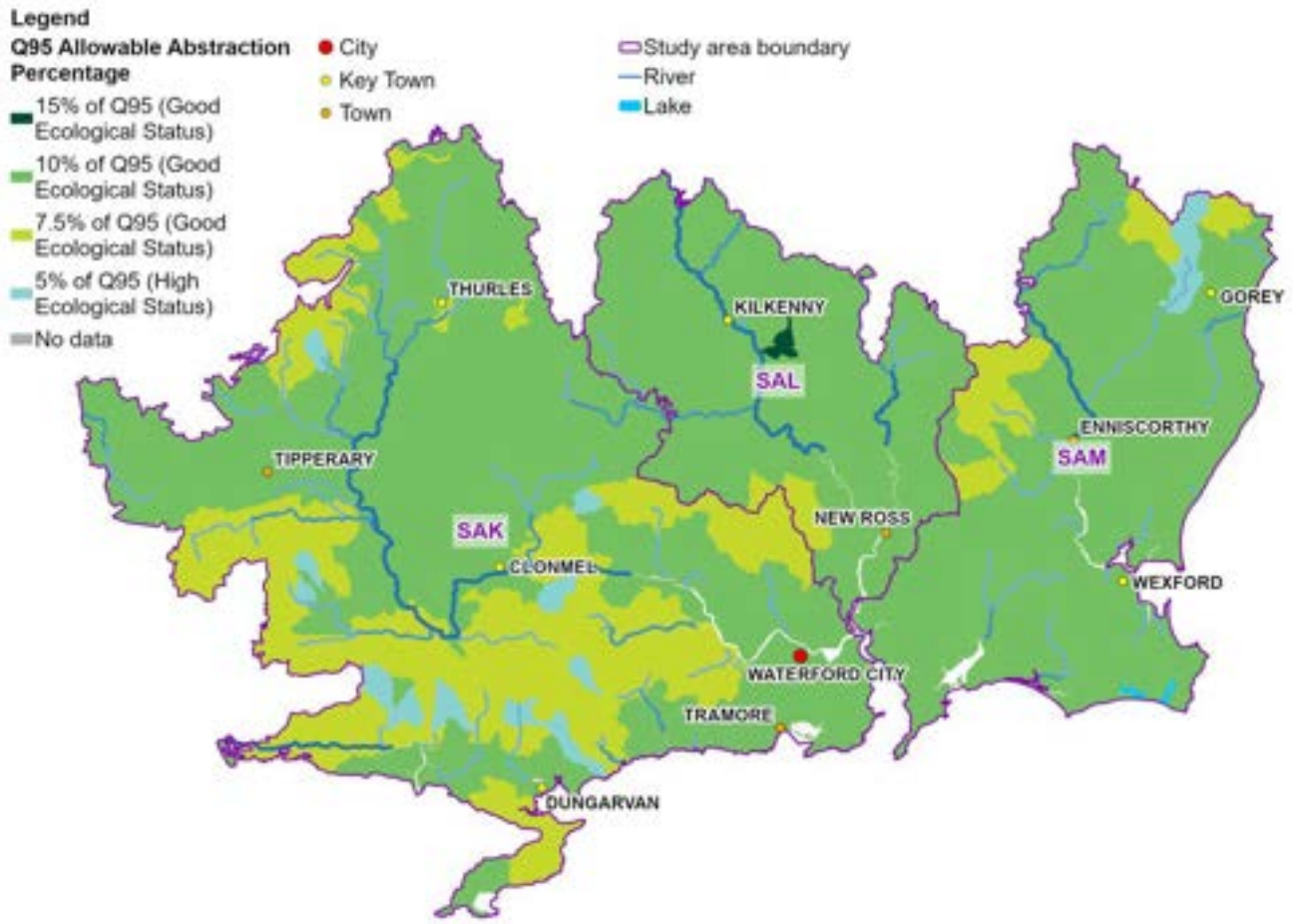


Figure 2.14 Percentage of natural flow at Q95 that can be abstracted to meet 'Good' Status

This assessment suggests that certain schemes may be subject to reductions in abstraction under the new legislation; however, this will ultimately be determined by the EPA based on the project level information before them. We have determined there are 35 out of 43 surface water abstraction sites that may not meet sustainability guidelines during dry weather flows – 22 in SAK, four (4) in SAL, and nine (9) in SAM. These sites are represented in Figure 2.15 and are listed in the respective Study Area Technical Reports (Appendix 1 - 3). A small number of the abstractions are from surface water bodies with a High WFD status, as shown in Figure 2.15. The allowable abstraction from these sites is more restrictive. Further detailed site investigations will be required to confirm the impacts of existing abstractions. Section 3.5 presents the estimated volume of abstraction reductions which may be implemented in the future to meet allowable abstraction thresholds.

As Uisce Éireann does not have full visibility of the future regulatory regime and has not progressed through the licensing process on a site-by-site basis, we have not included the estimated sustainable abstraction within the SDB calculations. Instead, we use the hydrological yield, water treatment capacity and bulk transfer limitations in our calculation of supply availability. We use the sustainable abstraction assessment to assess the sensitivity of the Preferred Approaches (solutions) that it develops as part of the NWRP.

Therefore, the RWRP-SE assumes that existing abstractions can continue on a transitional basis, subject to the regulatory requirements which will be outlined in the future regulatory regime.

For these existing abstractions, further studies will be undertaken in conjunction with the EPA and appropriate stakeholders. Following investigation, if an abstraction is confirmed to be affecting a

waterbody status the SDB will be updated, and solutions will be delivered through the future cycles of RBMPs and/or Regional Water Resources Plans.

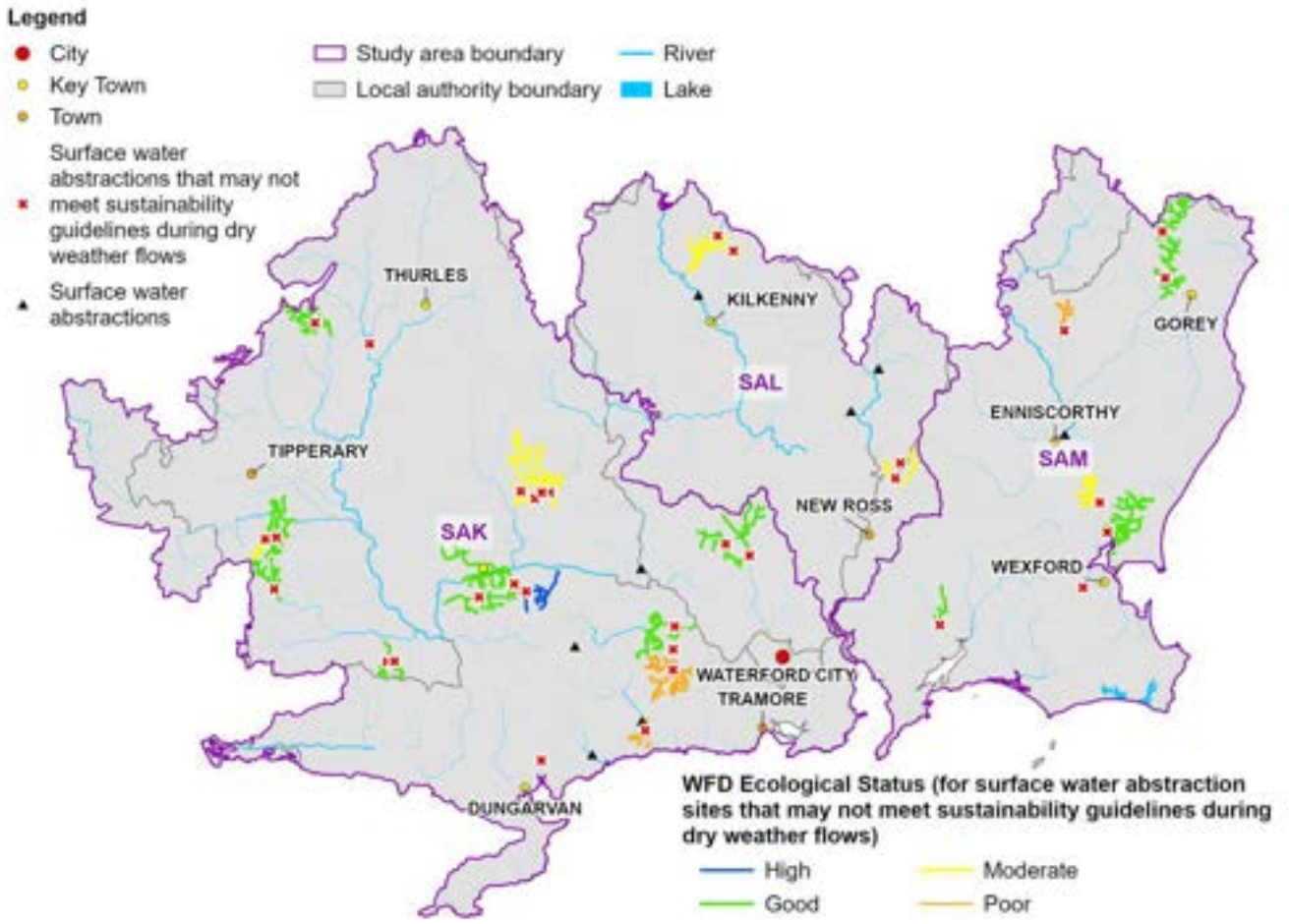


Figure 2.15 Surface Water Abstraction Sites that may not meet sustainability guidelines during dry weather flows

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

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

On an interim basis, Uisce Éireann has developed an initial assessment based on the best available information. Over the coming years, Uisce Éireann will work with the environmental regulator (the EPA) and the Geological Survey of Ireland (GSI), to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources (informed by data gathered as part of GSI's ongoing Groundwater 3D project).

2.3.8 Designated Sites in the RWRP South East Region

Our habitats and species are protected under the Habitats Directive[36]. The habitats and species that are designated to afford protection are listed in the: Habitats Directive and the Birds Directive (2009/147/EC), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

Water abstractions from both groundwater and surface water have been identified as being a potential threat to some habitats and species listed in the Annexes to the Habitats Directive. As discussed in

Section 2.3.7, sustainable abstraction limits have been assessed for new water abstractions, which will ensure the protection of these Annexed species and habitats. A full list of water dependent species and their sensitivities to sedimentation and changes to flow regime is provided in Appendix C of the Natural Impact Statement (NIS) on the Framework Plan.

European, national and local designated sites within the core baseline area (South East region) include 14 Special Protected Areas (SPAs), 33 Special Areas of Conservation (SACs), 5 sites designated as Wetlands of International Importance (Ramsar sites),1 Natural Heritage Area, 8 nature reserves and 135 proposed Natural Heritage Areas (NPWS, 2019) (Table 2.5 and Figure 2.16). There are a further 2 marine SACs and 2 marine SPAs that are not within the core baseline area but are hydrologically linked to it. These sites are Blackwater Bank SAC, Long Bank SAC, Saltee Islands SPA, and Keeragh Islands SPA. The protected sites with the greatest coverage in the South East Region and are described in Box 2.2 below.

Table 2.5 Total Number of Designated Sites in the RWRP-SE*

Designated Sites	Number of Sites
Special Protection Areas (SPAs)	14
Special Areas of Conservation (SACs)	33
National Heritage Areas (NHA)	1
Ramsar Sites	5
Nature Reserves	8
Proposed Natural Heritage Areas (pNHA)	135

* Note, some SACs or SPAs may fall within more than one Study Area.

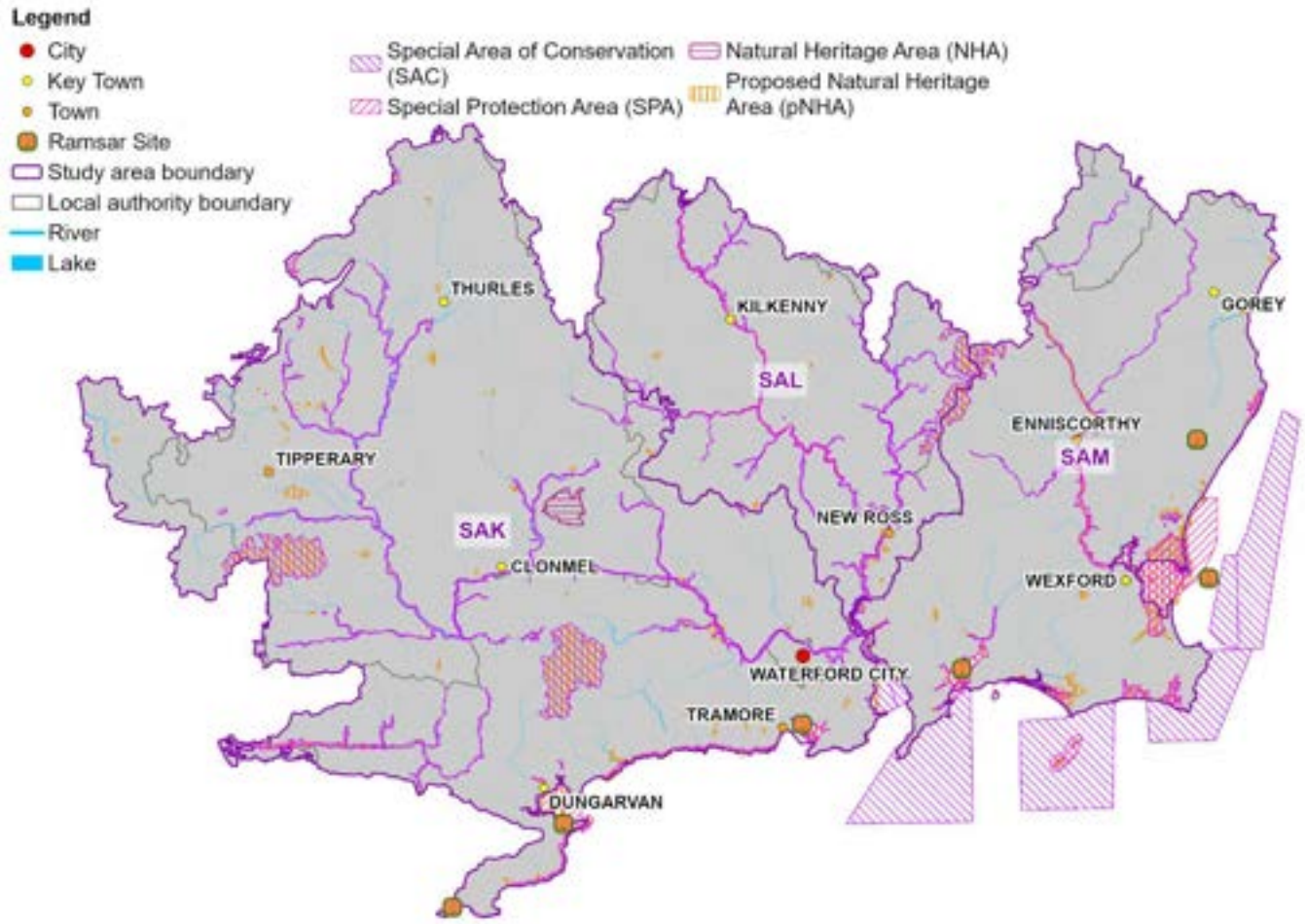


Figure 2.16 Designated Sites in the South East Region

Box 2.2 – Protected sites with the greatest coverage

Slievefelim to Silvermines Mountains SPA

A very large area covering 20,100 hectares, the site is an extensive upland site located in Counties Tipperary and Limerick. Much of the site is over 200 m in altitude and underlain mainly by sandstones of Silurian age. Several important rivers rise within the site. The site consists of a variety of upland habitats, though approximately half is afforested. Roughly one-quarter of the site is unplanted blanket bog and heath, with both wet and dry heath present. The remainder of the site is mostly rough grassland used for hill farming. This varies in composition and includes some wet areas with rushes and some areas subject to scrub encroachment. Some stands of deciduous woodland also occur, especially within the river valleys. The site is of ornithological importance because it provides excellent nesting and foraging habitat for breeding Hen Harrier and is one of the top sites in the country for the species. The presence of three (3) species, Hen Harrier, Merlin and Peregrine, which are listed on Annex I of the E.U. Birds Directive is of note.

Wexford Harbour and Slobs SPA

A large area covering 6,000 hectares focused on Wexford Harbour. Wexford Harbour is the lowermost part of the estuary of the River Slaney, which drains much of the south-east region. The site includes the natural estuarine habitats of Wexford Harbour, the reclaimed polders known as the North and South 'Slobs', and the tidal section of the River Slaney. Shallow marine water is a principal habitat, but at low tide extensive areas of intertidal flats are exposed. The flats support a rich macroinvertebrate fauna, with salt marshes fringing the intertidal flats. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands, which form part of this SPA. The site is of international importance for several species of waterbirds and is one of the top three (3) sites in the country for numbers and diversity of wintering birds. The combination of estuarine habitats, including shallow waters for grebes, diving duck and seaduck, and the farmland with freshwater drainage channels, provides optimum feeding and roost areas for a wide range of species. It is one of the two most important sites in the world for Greenland White-fronted Goose. The site is an important centre for research, education and tourism. Wexford Wildfowl Reserve is a Ramsar Convention site, a Biogenetic Reserve and a Statutory Nature Reserve. Parts of the Wexford Harbour and Slobs SPA are also designated as Wildfowl Sanctuaries.

The Raven SPA

A large coastal area of 4,200 hectares. The Raven SPA extends from north of Rosslare Point to Blackwater Harbour on the coast of Co. Wexford. The seaward boundary extends approximately 4.5 km from the shoreline to encompass areas of shallow water utilised by species of special conservation interest. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for various species. Of critical significance, is the principal night roost for the internationally important Wexford Harbour population of Greenland White-fronted Goose. Various other waterfowl species are also attracted to the site during winter for feeding and roosting. The shallow waters are particularly suitable for divers, grebes and sea duck, and nationally important populations of Red-throated Diver and Common Scoter occur, with Common Scoter population representing over 17% the total across Ireland. Nationally important populations of many birds are present here. Birds nest on the shingle and sandy beaches or on offshore sandbanks. Five (5) wintering species that regularly occur are listed on Annex I of the E.U. Birds Directive, i.e., Red-throated Diver, Great Northern Diver, Greenland White-fronted Goose, Golden Plover and Bar-tailed Godwit. Little Tern also breed within the site, area listed on Annex I of this directive. Raven Point is a statutory Nature Reserve and a Ramsar Convention.

2.3.9 Opportunities for Protection, Restoration and Enhancement

Uisce Éireann's long-term approach to protecting drinking water sources, and therefore our natural resources, will be the increasing implementation of catchment management for drinking water source protection. This will be achieved in partnership with key stakeholders. Our approach is in accordance with Article 7(3) of the Water Framework Directive and has the joint benefit of protecting our water habitats and managing the risk to our drinking water sources.

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

Biodiversity protection is a key part of Uisce Éireann's Biodiversity and Sustainability Policies. The overall aim of Uisce Éireann's Biodiversity Policy is that in association with the provision of water and wastewater services, biodiversity and the natural environment are conserved, protected and where practical enhanced through our responsible stewardship, sustainable water services and strong partnerships. Uisce Éireann launched our Biodiversity Action Plan (BAP)[37] in 2021 to deliver on this aim.

One of the key objectives of the BAP is the promotion of nature-based solutions (NBS) for water protection and wastewater treatment, which have considerable potential to deliver biodiversity. Nature-based solutions are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems, natural features and characteristics of waterbodies using natural means and processes[38]. The main functions are to improve water quality, reduce flood risk, and create habitats. Nature-based solutions have many additional benefits that include reduction in energy usage, carbon sequestration, and amenity use for local communities. They include a broad range of measures such as: wetlands, basins and ponds, reedbeds, buffer strips and hedges and forest riparian buffers. Some examples of NBS being utilised by Uisce Éireann in the South East Region include:

- The Dunhill Integrated Constructed Wetland located in County Waterford. We are working with Waterford City and County Council and the local community to progress final works. The wetland is responsible for the treatment of all the wastewater from Dunhill village.
- Working in partnership with catchment stakeholders to support initiatives such as native tree planting and bog rehabilitation, which also help to protect and restore source waters.

Examples of our catchment management activities are described in Box 2.3.

Identifying opportunities for the incorporation of NBS and catchment management activities within our abstraction catchments will continue to be encouraged and promoted through the NWRP.

Box 2.3 – Source Protection and Catchment Management Activities

Uisce Éireann is actively involved in pilot source protection projects in Ireland to trial catchment scale interventions to reduce the risk of pesticides causing exceedances in water supplies. The two key projects are described below:

A) Source to Tap Project is a cross-border partnership project that focuses on the River Erne and the River Derg catchments which cross the border between Ireland and Northern Ireland. Uisce Éireann is a project partner on this project which is funded by INTERREG (European Regional Development Fund) with match-funding having been provided by the Department of Agriculture, Environment and Rural Affairs (DAERA) in Northern Ireland and the Department of Housing, Local Government and Heritage (DHPLG) in Ireland. The project began in 2017 and will continue until 2021. It aims to develop sustainable, catchment-scale solutions for the protection of rivers and lakes, which are the main sources of our shared drinking water. Source to Tap also delivers a learning and outreach programme targeted at informing and empowering the public about their role in protecting our clean and healthy freshwater environment. An Agricultural Land Incentive Scheme is being delivered focused on changing land management practices for the protection of our water.

B) Pilot Drinking Water Source Protection Project, as committed to under the River Basin Management Plan (RBMP). Uisce Éireann is coordinating a pilot drinking water source protection project to "*trial innovative monitoring and management strategies aimed at reducing the risk of pesticide contamination of drinking waters*". Catchment management interventions to be undertaken as part of the project will involve a combination of behavioural-change initiatives and promotion of the sustainable use of pesticides. Scoping, consultation and planning of the project began in 2019 and is continuing. Our key stakeholders in catchment management include the National Pesticides and Drinking Water Action Group (NPDWAG), the National Water Forum (An Fórum Uisce), the Local Authority Water Programme (LAWPRO), Geological Survey Ireland (GSI), Department of Housing, Local Government and Heritage (DHLGH), Department of Agriculture, Food and the Marine, National Federation of Group Water Schemes, Inland Fisheries Ireland, the EPA Catchment Science Team and the National Parks and Wildlife Service (NPWS).

2.4 Water Supply

2.4.1 Rainfall

Rainfall is the key climatic variable that affects the availability of water resources. Understanding the variability across the South East Region and the impact that climate change may have on rainfall patterns is important to planning our water infrastructure.

The rainfall across Ireland is varied. Figure 2.17 shows that the South East Region includes only a few locations that are within the highest rainfall categories. The region is mostly composed of lower rainfall levels. The west of the region extending across the Counties of Tipperary and Waterford, in the Knockmealdown Mountain range, typically experiences the highest rainfall with average rainfall levels of up to 2000 mm. The far east of the region including the Wexford coast, and Waterford City experience the driest conditions across both the region and Ireland with an average annual rainfall of less than 1000 mm.

The comparison with population density (also shown in Figure 2.17) highlights that Waterford City, Tramore and Kilkenny - areas which have the greatest population density - are situated in areas of lower rainfall, meaning water resources in these areas are more likely to become stressed. Most of the region is located within moderate levels of rainfall.

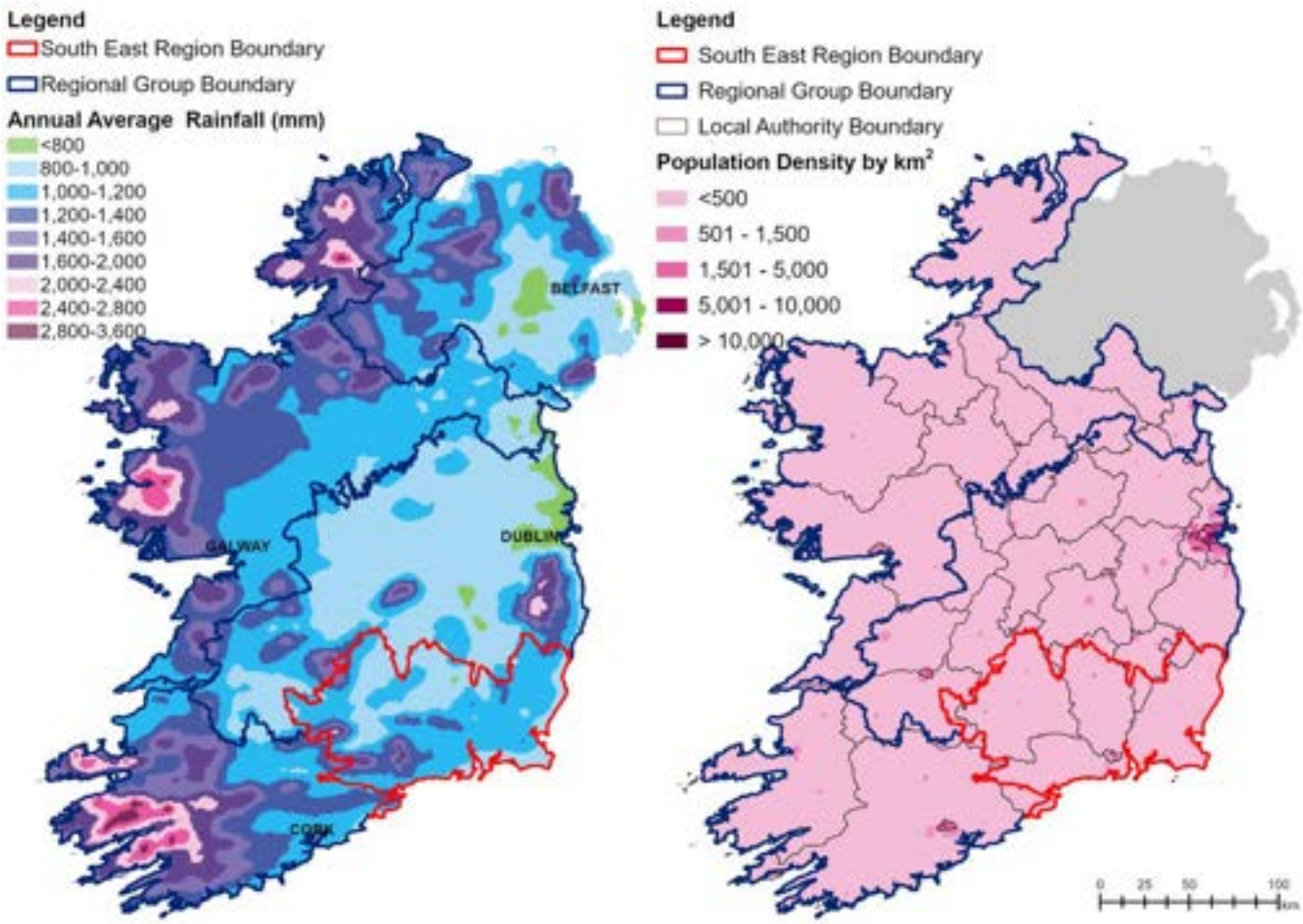


Figure 2.17 Rainfall across Ireland[39] compared with Population Density

Seasonal and annual variability of rainfall is an important consideration in water supply planning. The variability in time and magnitude will determine infrastructure requirements. For example, water reservoirs are required to store water captured during high flow periods, to supply customers during periods of low flow.

Across the South East Region, the variability in seasonal rainfall is slightly lower in the north than the east (Figure 2.18). In the eastern part of the region near Rosslare, monthly average rainfall across the year has a range of 59 mm, varying from 50 mm in May to 109 mm in October. The north of the region near Kilkenny shows reduced seasonal variability, with a range of 40 mm between the minimum average monthly rainfall in July of 55 mm and the maximum average monthly rainfall in October of 95 mm. Climate change is likely to increase the within year variability, with wetter winters and drier springs and summers[39]. This is further discussed in Section 2.4.5.

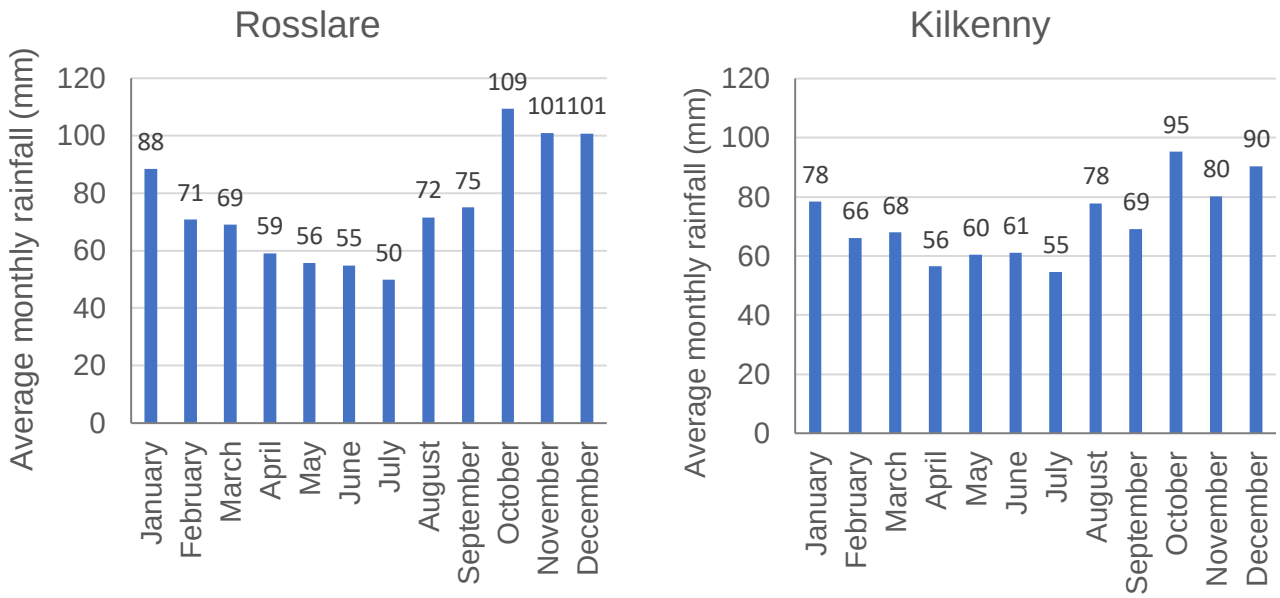


Figure 2.18 Monthly Rainfall Variability – 1981 to 2010[39]

2.4.2 Drought

Droughts occur when a period of lower-than-average rainfall causes a shortage of water. The shortage of water affects both the natural environment and sectors such as agriculture and water supply to our customers. The duration, timing and intensity of a drought can vary considerably, and these factors combine to affect different sectors in different ways. Although Ireland is considered to be a country with high rainfall, the country does experience drought events. Figure 2.19 shows there were 15 years of severe drought periods since records began in 1850 that would affect our key supplies.

The drought events experienced in 2018 and 2020, and more recently in 2022, although severe, were short in duration and are therefore not registered when compared to historical droughts. Despite this, the late spring and early summer of 2018 saw some of the lowest rainfall totals on record leading to drought conditions. In 2022, most annual rainfall totals across the country were below their 1981-2010 long-term average. Whilst these drought events were not defined as 'severe' based on historical records (due to the short duration) they were still substantial enough to impact our water supply availability. Low rainfall levels resulted in low river flows and stress to water supplies. Customers experienced reductions in water pressure and some temporary loss of supplies, principally because of a lack of capacity in our existing infrastructure. Demand for water was also higher than normal during this period, driven by high temperatures. Several supplies in the South East Region were severely impacted (Table 2.6). Sandbagging of groundwater sources and some rivers was required to maintain groundwater levels. In-stream pumping and water tankering was used to maintain supplies to customers and night-time restrictions were implemented in some areas to reduce demand.

As climate change continues droughts are expected to become more frequent[40]. Combined with the requirements of the Water Framework Directive (WFD) to reduce unsustainable abstractions (Section 2.3.5), there is a clear identified need to invest in sustainable water supply solutions to secure reliable supplies across the region.

Valuable learning on strategic and tactical drought management was gained during the 2018 drought period, which helped to improve our response during drought conditions experienced in the Spring of 2020 and the recent drought of 2022. Actions taken during the 2018 drought event and key lessons learnt are outlined in Box 2.5. Further information regarding our drought management approach is given in Appendix E of our Framework Plan.

Table 2.6 Drought impact during recent dry periods

Study Area	Drought impact
SAK	During 2018, in-stream damming was required at the surface water abstraction for Ballylaneen WTP. Unplanned outages of a few hours' duration occurred at Fews WTP as the source was unable to meet peak demand. Night-time restrictions were issued for Fews and Ballymacarbry WRZs to ensure supply to customers could be maintained. Tankering and night-t-time restrictions were also introduced in 2022 dry period to protect supplies in Kilcash and Coalbrook.
SAL	Several raw water sources experienced issues during the 2018 drought. Water levels dropped significantly at the river abstraction source to Borris WTP, as well as at Radestown WTP source, which serves Kilkenny City WRZ. During the 2020 drought, the infiltration gallery serving Bennetsbridge WTP dried up, leaving boreholes as the only source. Bennetsbridge also experienced shortages during 2022 when measures were implemented to conserve water.
SAM	In 2018, in-stream damming was required at the surface water abstraction to Wexford Town (Newtown) WTP. In-stream sand-bagging was also required at the intake of Pallis for Creagh WTP as a precautionary measure due to falling levels in Bann River. Water levels dropped at Ballykale Borehole, which is serves Gorey WRZ. Water conservations measures were introduced during the 2022 dry period in Wexford Town, Bunclody, Killmallock (Sow Regional WRZ) and Taylorstown (South Regional WRZ).

As climate change continues, droughts are expected to become more frequent[40]. Combined with the requirements of the Water Framework Directive (WFD) to reduce unsustainable abstractions (Section 2.3.5), there is a clear identified need to invest in sustainable water supply solutions to secure reliable supplies across the region.

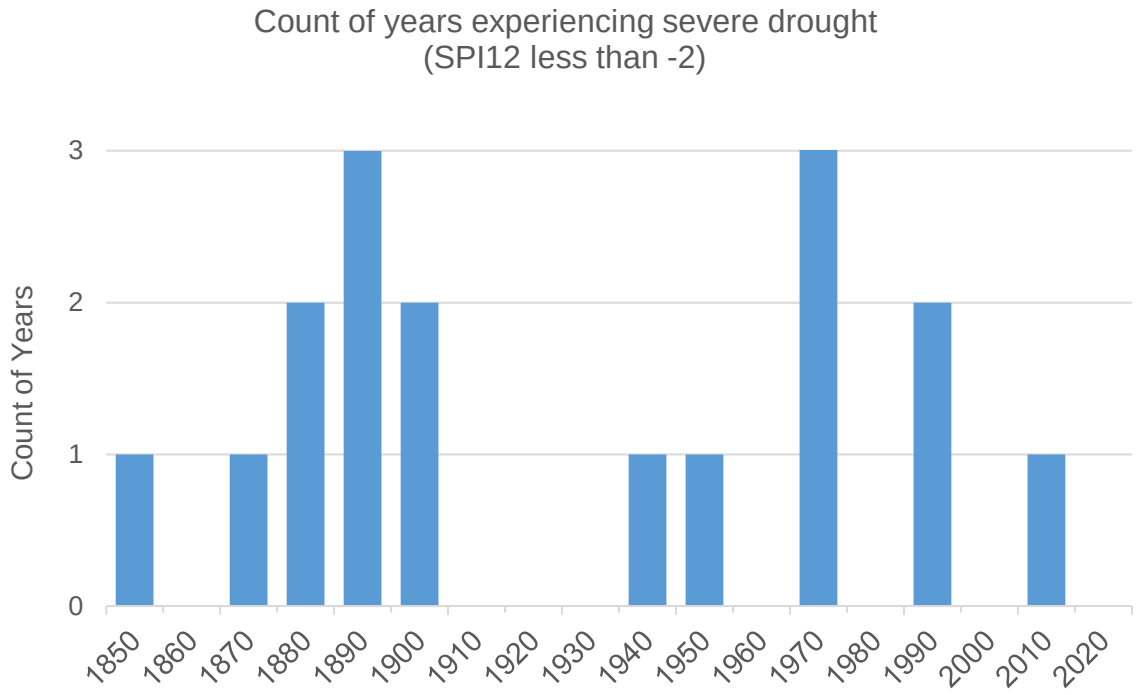


Figure 2.19 Number of Events of Severe Drought (The 12-month Standard Precipitation Index = -2)*

*The standardised Precipitation Index (SPI) is used to identify and classify meteorological drought, which is a period of abnormal rainfall deficit compared to long-term average conditions. An SPI that is less than or equal to -2.0 indicates extremely dry conditions.

Box 2.4 – 2018 Drought Experience

The late spring and early summer of 2018 saw some of the lowest rainfall totals on record, resulting in low river flows and stress to water supplies. Demand for water was also higher than normal during this period, driven by high temperatures.

In 2018, disruption to customers and environmental impacts were minimised as a result of emergency plans and activities carried out by Uisce Éireann and Local Authority operational staff, including:

- Convening a crisis management team;
- Tracking drought indicators and planning responses and activities;
- Optimising existing supplies;
- Tankering water to maintain storage levels;
- Commissioning back-up supplies;
- Controlling pressures in networks to improve water availability;
- Night-time restrictions in critical areas to conserve supplies;
- Communication campaigns to promote water conservation;
- Introduction of the first ever National Water Conservation Order;
- Working with stakeholders including the Department of Housing, Local Government and Heritage (DHPLG), National Federation of Group Water Schemes (NFGWS), EPA, Electricity Supply Board (ESB), Inland Fisheries Ireland (IFI), National Park and Wildlife Service (NPWS), Met Éireann;
- Providing alternative water supplies to customers (Bowsers, stand-pipes and bottled water), attention to critical customers, healthcare customers and vulnerable customers; and
- Engagement of our Key Account Managers with large customers.

Unfortunately, customers experienced some impacts, including reductions in water pressure and some temporary loss of supplies, principally as a result of a lack of capacity in our existing infrastructure.

A key learning from this recent drought experience was that we need to undertake further research and investigation to increase our understanding of the hydrology and hydrogeology relating to some of our water sources. We also identified the following improvements to our operational management:

- Site specific level and flow monitoring
- Live operational data
- Controls within some areas of our distribution networks to allow us to manage supplies more effectively.

2.4.3 Flood Risk

Climate projections over the next century indicate an increased likelihood of river and coastal flooding[40,41], particularly in the north and west of the country (Section 2.4.5). Increased flooding can cause pressure on drains and sewers and can affect water quality.

The Floods Directive (2007/60/EC) required member states to develop Flood Risk Management Plans for areas of existing and future potentially significant flood risk. The Floods Directive was transposed into Irish law by the EU (Assessment and Management of Flood Risks) Regulations 2010 and sets out the responsibilities of the Office of Public Works (OPW). The OPW has been implementing the Directive mainly through the Catchment Flood Risk Assessment and Management (CFRAM) Programme, through which 29 draft Flood Risk Management Plans have been developed. Approximately 300 Areas for Further Assessment have been established along with a range of measures to reduce or manage the

flood risk within each catchment. CFRAM mapping for all Areas for Further Assessment is available to view on the CFRAM website[42].

Figure 2.20 presents areas with high and medium probability of pluvial, fluvial, coastal flooding as well as historical groundwater flooding. The figure shows there is low probability of groundwater flooding within the South East Region; however, there are extensive areas of fluvial flooding in the upper reaches of the River Suir and Nore catchments as coastal flooding near Wexford, Kilmore and Waterford in SAM.

As well as considering surface water flooding, there are ongoing efforts to better understand the role of karst groundwater systems in flooding within the Flood Risk topic[43].

Guidelines for Planning Authorities on flood risk management (November 2009)[44,45] highlight that flooding of the water supply network (this includes pumping stations; electricity substations and water treatment works) can result in a loss of supply over large areas and magnify the effects of flooding beyond the immediate community directly affected. Uisce Éireann has considered the number of water treatment plants (WTPs) within areas of flood risk, where vulnerability to the effects of flooding need to be considered (Table 2.7). Nine (9) of the 143 WTPs in the region have a 10% chance of flooding in any year. These include:

- Hollyford WTP, Callan WTP, Lissava WTP, Stradbally WTP and Deelish WTP in SAK;
- Borris WTP in SAL; and
- Knockagreany WTP and Ballinellard WTP in SAM.

Callan WTP is the largest of these, serving a population of approximately 2,700.

There are no WTPs at risk of pluvial, coastal or groundwater flooding.

The WTPs that are known to be at risk of fluvial flooding are under review and where needed, protection measures will be considered for sites at risk. All new water supply options will be reviewed in terms of their risk from flooding, and this will be taken into account in the detailed siting and design to ensure improved flood risk resilience for the supply network.

Table 2.7 Total Number of WTPs at Risk of Flooding

Type of Flooding	Number of Water Treatment Plants at Risk of Flooding	
	1 in 10-year Flood Risk (10% Annual Exceedance Probability)	1 in 100-year Flood Risk (1% Annual Exceedance Probability)
Fluvial Flooding[44]	8	10
Pluvial Flooding[44]	0	0
Coastal Flooding[44]	0	0
Groundwater Flooding[44,46]	0*	0**

*Classification for Groundwater flooding recorded in database as 'High Probability'

** Classification for Groundwater flooding recorded in database as 'Medium Probability'

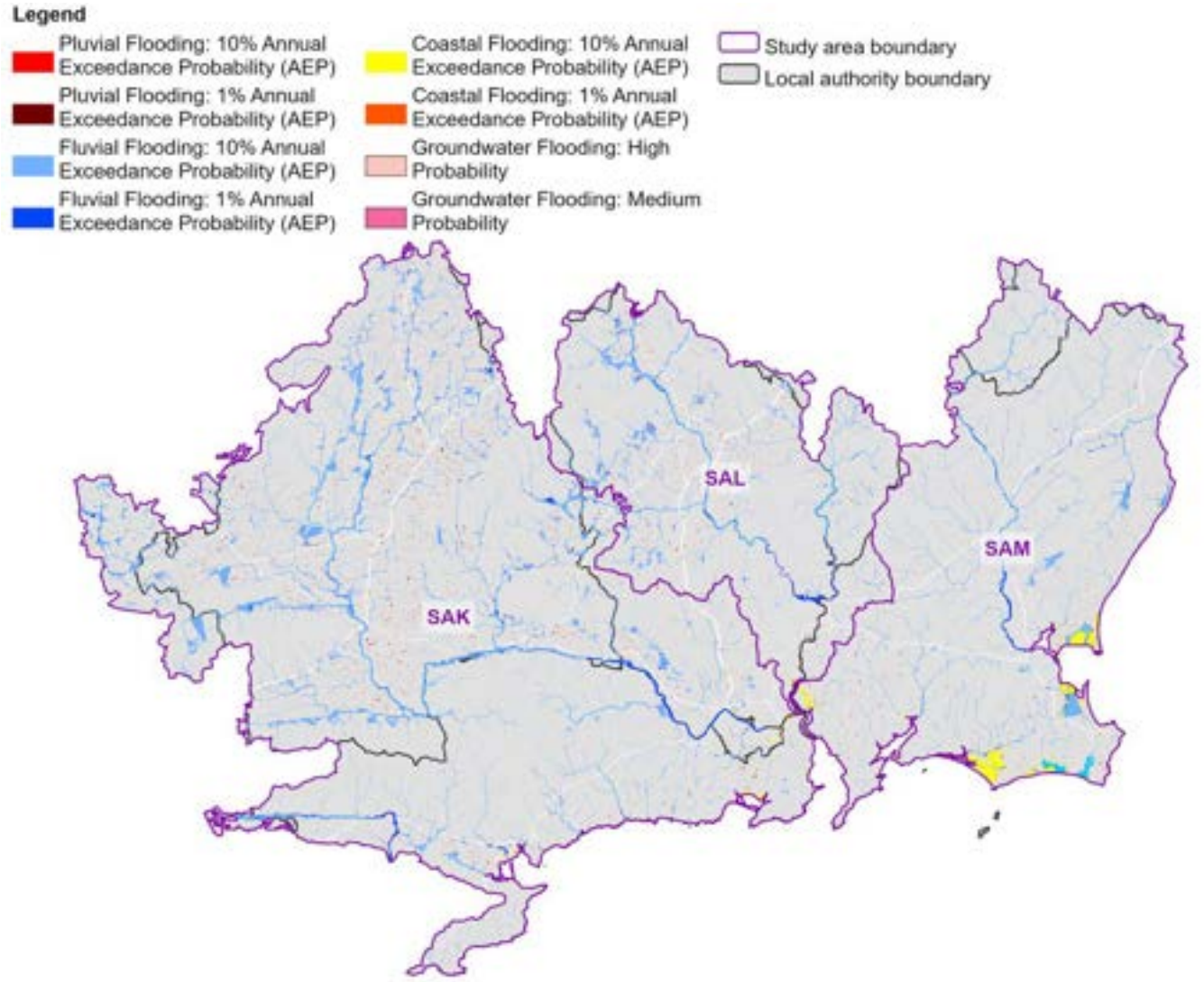


Figure 2.20 Surface Water and Groundwater Flooding

2.4.4 Water Supply Systems

The water supply systems across the South East Region draw from 163 sources (Table 2.8) and are treated in 143 Water Treatment Plants (WTPs). There are 43 surface water sources and 120 groundwater sources within the South East Region, with surface water sources supplying 66% of the total volume of water delivered to our customers either from rivers or lakes.

Around 60% of the water supplies to SAK come from surface water sources, with most of these from the River Suir system. The East Waterford WRZ in SAK is the largest WRZ in the region and has three (3) surface water abstractions feeding Adamstown WTP near Waterford City to deliver up to 58,000 m^3/day. The Water available for use (WAFU) from this system in a normal year represents approximately 23% of the regional WAFU. WAFU is further explained in Section 3.2.1 of this Plan.

The largest groundwater abstractions in the region supply Fardystown WRZ and Gorey WRZ in SAM near Wexford. These sources can deliver up to 12,000 m^3/day and 10,000 m^3/day, and approximately 10% of the regional WAFU in a normal year.

Table 2.8 Number of Water Sources in RWRP-SE

Study Area	No. of WRZS	No. of WTPS	Total Network Length* (km)	Water Sources		
				Total	Surface Water	Groundwater
SAK	75	99	4,010	110	26	84
SAL	10	13	1,205	16	7	9
SAM	26	31	3,120	37	10	27
TOTAL	**111**	**143**	**17,730**	**163**	**43**	**120**

* Network length values are rounded to the nearest 5km.

2.4.5 Climate Change

2.4.5.1 Potential Impact on Water Availability

Climate change will have significant effects on the availability of water at our sources in the future. Average annual temperatures for Ireland are expected to increase by 1.0 to 1.6 ^{o}C by the middle of this century (2041 – 2060) compared with the reference period (1981 – 2000). Warming will be enhanced at the extremes, with summer daytime and winter night-time temperatures projected to increase by 1.0 to 2.4^{o}C[47]. The projected increase in temperature will affect the amount, timing and intensity of local precipitation. In Ireland, this is expected to result in wetter winters but also drier springs and summers. Climate change simulations for Ireland show the precipitation in the autumn and winter months could increase by between 5% to 35%, while summer precipitation could decrease by a range of 0% to 30%. Under the medium to high carbon emissions scenarios dry periods are projected to increase in frequency, duration and/or magnitude from between 12% to 40% for the spring and summer months[49].

The historical analysis of average rainfall data undertaken by Murphy (2020)[49] confirms a continued trend of drier summers and wetter winters. The recent report, 'The Status of Ireland's Climate 2020'[41], published by the Environmental Protection Agency, Met Éireann and the Marine Institute, also confirms that Ireland's climate is warmer and wetter than it used to be. The study shows that there has been a 6% rise in precipitation over the past 30 years when compared to the previous three decades. While this corresponds to an observed increase in flows across most of the country, the report states there is an increase in potential drought conditions. This is the case especially in the east of the country, broadening the difference in how climate change is affecting Ireland's rivers in the east compared to the west.

The Climate Change Sectoral Adaptation Plan for Water Quality and Water Services Infrastructure[48], identifies the following key priority impacts of climate change for the water services infrastructure sector:

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

Uisce Éireann considers these impacts in our approach to supply forecasts when assessing the Supply Demand Balance across our planning period. Our assessment of the impact of climate change on the water resources of the South East Region is discussed in further detail in Section 3 of this Plan.

2.4.5.2 Further Work

Whilst there is recent work on potential climate effects on rainfall, there is less work on the projected impacts of climate change to river flow regimes across Ireland. There is also no Ireland-wide guidance available at present outlining the effects of future climate change on flows. Recognising this, we commissioned the Climate Sensitive Catchments Project to improve our understanding of how river flows may change due to climate change and how best to prepare for a hotter climate. The research characterised 206 river catchments into five (5) catchment sensitivity types as described in Box 2.5. For those located in the South East Region, most were characterised as types (a) and (d). Catchment type (a) are in the northern part of the region and are the least sensitive to changes in seasonality of wetter winters and drier summers due to high groundwater storages in these catchments. Catchment type (d) which cover areas in SAK lose more water due to evaporation and are mostly drier catchments.

Box 2.5 - Climate Sensitive Catchments Project

Project Partner: Maynooth University Irish Climate Analysis and Research Units (ICARUS)

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

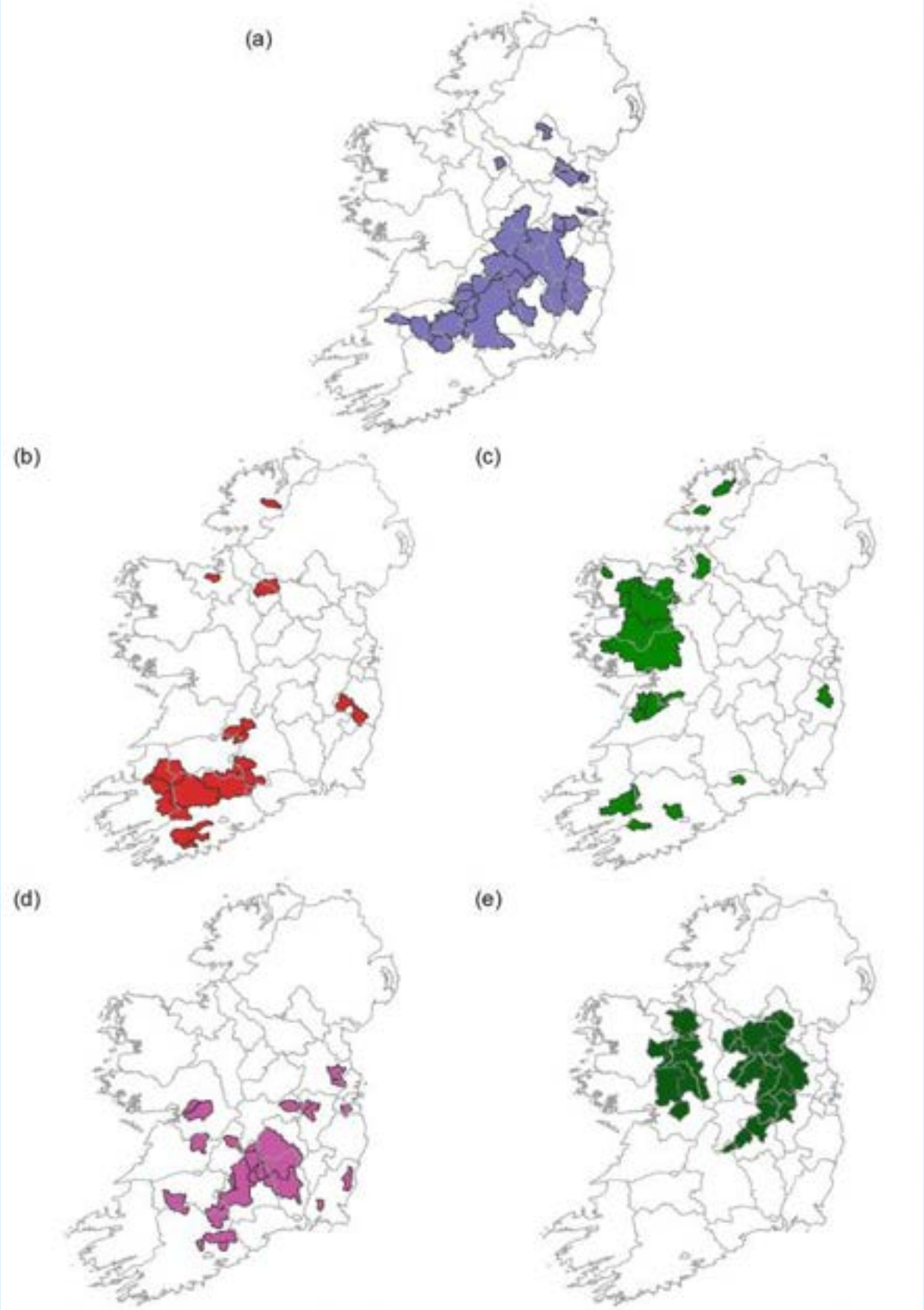
The traditional methodology to identify and assess catchments vulnerable to climate change takes a 'top down' approach, which applies information about large-scale climate change trends to small areas. This can result in inaccurate forecasting for catchments because it does not take area-specific information into consideration. This project applied a 'bottom up' methodology, which assessed how sensitive catchments are to climate change by building a catalogue of data specific to each catchment. This allowed us to identify the particular stressors and vulnerabilities in each area. By better assessing the sensitivity of catchments to climate change, we aim to increase the effectiveness of our national water management and to develop a more resilient water service.

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

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

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

Box 2.5 continued- Climate Sensitive Catchments Project



2.4.5.3 Reducing Our Carbon Footprint

The impact of climate change will be felt by every individual, household, and community in Ireland and there is now a high level of awareness and understanding of this. There is therefore, an onus on us to mitigate the magnitude of long-term climate change by taking action to reduce Greenhouse Gas Emissions (GHG) emissions, and to increase the capacity of carbon sinks such as forests and wetlands. The European Green Deal frames Europe's response to these challenges. It is the new growth strategy that will lead the transformation in Europe to a climate-neutral, fair and prosperous society, with a modern, resource-efficient and competitive economy.

In line with EU ambition, Ireland commits to achieving a 51% reduction in Ireland's overall GHG emissions from 2021 to 2030, and to achieving net-zero emissions no later than 2050.

Section 15 of the Climate Action and Low Carbon Development Act 2015 (as amended in 2021)[50] sets a new "national climate objective" for Ireland, which provides that "The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy". The amended Act requires public authorities, including Uisce Éireann, so far as practicable, to perform their functions in a manner consistent with the furtherance of the national climate objective and the relevant national and sectoral plans and strategies to mitigate greenhouse gas emissions and adapt to the effects of climate change.

The Department of the Environment, Climate and Communications' Climate Action Plan 2023 (CAP)[51] commits to achieving a 51% reduction in overall greenhouse gas emissions by 2030 and reaching net zero carbon emissions by 2050. The aim is for more sustainable growth and to create a resilient, vibrant and sustainable country. The CAP defines a roadmap to this goal and initiates a set of policy actions to achieve this. A detailed sectoral roadmap has also been set out, which is designed to deliver a cumulative reduction in emissions, over the period 2021 to 2030. It includes targets for renewable energy to provide 80% of electricity by 2030 and sets targets for agriculture and forestry and improving land management to support carbon sequestration.

Uisce Éireann is committed to improving energy efficiency and reducing carbon emissions. In 2020, we achieved a 32% improvement in our energy efficiency performance, saving an equivalent of 95,000 tonnes of carbon. We are on track to meet our target of 33% energy efficiency improvement, putting us in a strong position to meet our new target of 50% by 2030.

Uisce Éireann is committed to reducing energy consumption through a range of energy initiatives, including asset replacement and the commencement of sustainable energy pilots at two wastewater treatment plants to install solar panels to generate renewable energy. We are also reviewing the potential to produce more renewable energy from on-site wind turbines.

Uisce Éireann have made significant progress on the journey to become a low carbon, energy efficient, sustainable water utility. Our strategy and energy management programme take a business wide approach with 36 Energy Action Plans and 255 discrete energy projects, including energy efficient design, innovation, energy retrofits, renewable energy, lighting and heating, energy audits and planning, process optimisation, staff awareness and training. An example of this is the provision of 230 Solar Panels at the new WTP in Thurles, see Box 2.6.

We have also developed and published a Biodiversity Action Plan (BAP)[37] in 2020. It will help us to conserve, enhance and work with the natural environment. Our approach will protect and enhance biodiversity at our sites whilst also providing additional benefits such as carbon sequestration and drinking water source protection. We have implemented Biodiversity Management Plans and Enhancement Measures for 85 sites nationally.

Measures taken in 2020 to reduce our Carbon Footprint include;

- Decarbonising our energy consumption including installation of solar renewable energy sources.
- Implementing an energy governance model, using an asset management approach aligned with ISO 5000.
- Implementing energy efficiency projects across our operations including pumping, aeration, renewables, lighting and heating.
- Roll out the water conservation awareness campaign.
- Preparing a climate change mitigation and adaptation strategy.

The NWRP approach to assessing and selecting solutions to meet our existing and future water supply challenges, is aligned with national policy objectives. For example, Carbon Costs and Operational Costs (including energy costs) are included in the development of the overall Net Present Value (NPV) of all options. Therefore, it is a key consideration in the determination of the Preferred Approach.

Further to this, one of the six (6) Approach Categories considered in the determination of the Preferred Approach is the Lowest Carbon Approach (Table 7.1, Section 7). The Lowest Carbon Approach is the Option or combination of Options with the lowest embodied and operational carbon cost.

At project development stage further considerations will be given to energy efficient design and the potential to reduce greenhouse gas emissions and improve energy efficiency of the project by the development of clean renewable energy on-site.

Box 2.6 - Thurles Renewable Energy Project

Uisce Éireann, working in partnership with Tipperary County Council, has recently completed a solar energy project at the new water treatment plant in Thurles Co. Tipperary. This project involved the installation of 230 solar panels at the recently constructed water treatment plant, generating clean, renewable energy for the plant. This project will generate 83,264 kWh (kilowatt hours) electricity per year, improve energy efficiency at the plant and reduce carbon emissions.

This project will:

- Reduce the plant's carbon footprint, which will equate to a 40 tonnes reduction in carbon emissions.
- Generate 83,264 kWh (kilowatt hours) per year of electricity, which is equivalent to the electricity required to power 20 houses per year.
- The generation of clean renewable energy will lead to a 10% reduction in imported electricity at the site.
- Reduce greenhouse gas emissions and improve energy efficiency at the plant.

2.5 Summary

In this section we have outlined the following key characteristics of the RWRP-SE:

Population and Growth

- Uisce Éireann supplies around 161 million litres of water per day to a population of 369,240 people (18% of the national population) and 29,700 businesses in the South East Region. Approximately 14% of the regional population is located within Waterford City.
- The overall regional population growth is 28% from 2019 to 2044. All Study Areas in the South East region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016. The Waterford and South Tipperary Study Area (SAK) has the highest projected growth rate at 30%, which is driven by the East Waterford Water Supply Scheme WRZ and Clonmel and Environs forecast growth of 44% and 47% respectively by 2044.

Natural Resources and Environmental Pressures

- There are only 11 lakes in the South East Region; however, the region is drained by an extensive network of rivers, including the Barrow (the second largest river in Ireland), the Suir (the third longest river in Ireland) and the Nore Rivers. Their combined catchment areas cover approximately 9,700 km^2.
- The riverine ecology of many of our river systems is considered highly sensitive to changes in flow and water level. The most sensitive rivers are those within the river typology categories that are representative of headwaters, low nutrient, low pH and salmonid spawning and nursery areas. The salmonid spawning and nursery areas are particularly sensitive to low flows and impounding structures. These categories combined make up 26% of the main river water bodies in the region. The dominant river typology is represented by hard limestone and sandstone, located at a low to medium altitude, with a low to medium slope.
- Across the region, 41% of surface water bodies (SWBs) are at ‘High’ or ‘Good’ status, while 17% are classified as below ‘Moderate’ status.
- Ten of the 94 groundwater bodies (GWBs) are currently at ‘poor’ Chemical Status. The remaining 84 GWBs are assessed at ‘good’ overall WFD status.
- The 2016 – 2021 WFD Cycle 3 assessed both GWBs and SWBs to determine which are currently considered to be at risk of failing WFD objectives or are at risk of deteriorating from their current status. Forty-six percent (46%) of our river water bodies, four (4) of the 11 lake water bodies, and 33% of our groundwater bodies are currently ‘At Risk’, with the predominant pressure being agriculture.
- In developing our Preferred Approach to securing future water supplies we have undertaken a desktop independent assessment to identify existing surface water sites where abstractions have the potential to exceed sustainable abstraction thresholds. We have identified 35 out of 43 surface water abstractions sites that we have assessed to be below target conditions. This was a conservative assessment based on plan level information. The EPA will be the authority to adjudicate with the benefit of more detailed project level information.
- There are 61 nationally and internationally designated sites listed in the South East Region and 135 proposed Natural Heritage Areas. Protected sites with the greatest coverage in the region include the:
    - Slievefelim to Silvermines Mountain SPA, an extensive upland site located in Counties Tipperary and Limerick;
    - Wexford Harbour and Slobs SPA, covering 6,000 hectares and focused on Wexford Harbour which forms the lowest part of the estuary of the River Slaney; and

- Raven SPA, a large coastal area of 4,200 hectares extending from north of Rosslare Point to Blackwater Harbour on the coast of Co. Wexford.

Water Resources and Existing Challenges

- Surface water abstractions make up 66% of the water delivered to customers in the South East region, with the remaining 34% being supplied from groundwater sources.
- The South East region includes only a few areas where average annual rainfall exceeds 2,000 mm. Most of the highest populated areas experience annual average rainfall less than 1,000 mm.
- Several raw water sources were impacted by the recent droughts in 2018, 2021 and 2022. Water levels in rivers dropped significantly for many supplies including to Kikenny City, Borris, Fews and Wexford Town.
- The availability of water is anticipated to change over the 25-year planning period due to climate change with water availability increasing during autumn/winter and decreasing during the summer. Precipitation responsible for the recharge of our groundwater and surface water sources could increase by 5-35% during the autumn and winter months decrease by 0-30% during the summer.

Environmental and Climate Change Initiatives

- Uisce Éireann is implementing Nature Based Solutions within the South East Region. This includes final works on the Dunhill Integrated Constructed Wetland Project located in County Waterford. Identifying opportunities for the incorporation of NBS and catchment management activities within our abstraction catchments, will continue to be encouraged and promoted through the NWRP.
- Key Sustainability objectives planned for 2022 include:
    - Developing and implementing a sustainability strategy aligned with the Government Climate Action Plan and UN Sustainable Development Goals.
    - Continuing the implementation of our sustainable energy strategy.
    - Implementing and communicating our climate change strategy.
    - Developing a carbon neutrality roadmap.
    - Continuing to decarbonise our energy consumption through energy efficiency improvement and renewable energy.
    - Improving energy efficiency by upgrading and replacing inefficient plant and processes.
    - Continuing to protect and enhance biodiversity on our assets.
    - Embedding energy efficiency design into our activities in collaboration with the Sustainable Energy Authority of Ireland (SEAI).
    - Implementation of a waste management strategy, with a particular focus on the circular economy.

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