2 South West Region

2.1 Introduction

In this section we introduce the South West 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 West Region for the purpose of the Regional Water Resource Plan (RWRP-SW). To deliver our RWRP-SW, 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 West Region. The SA 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.

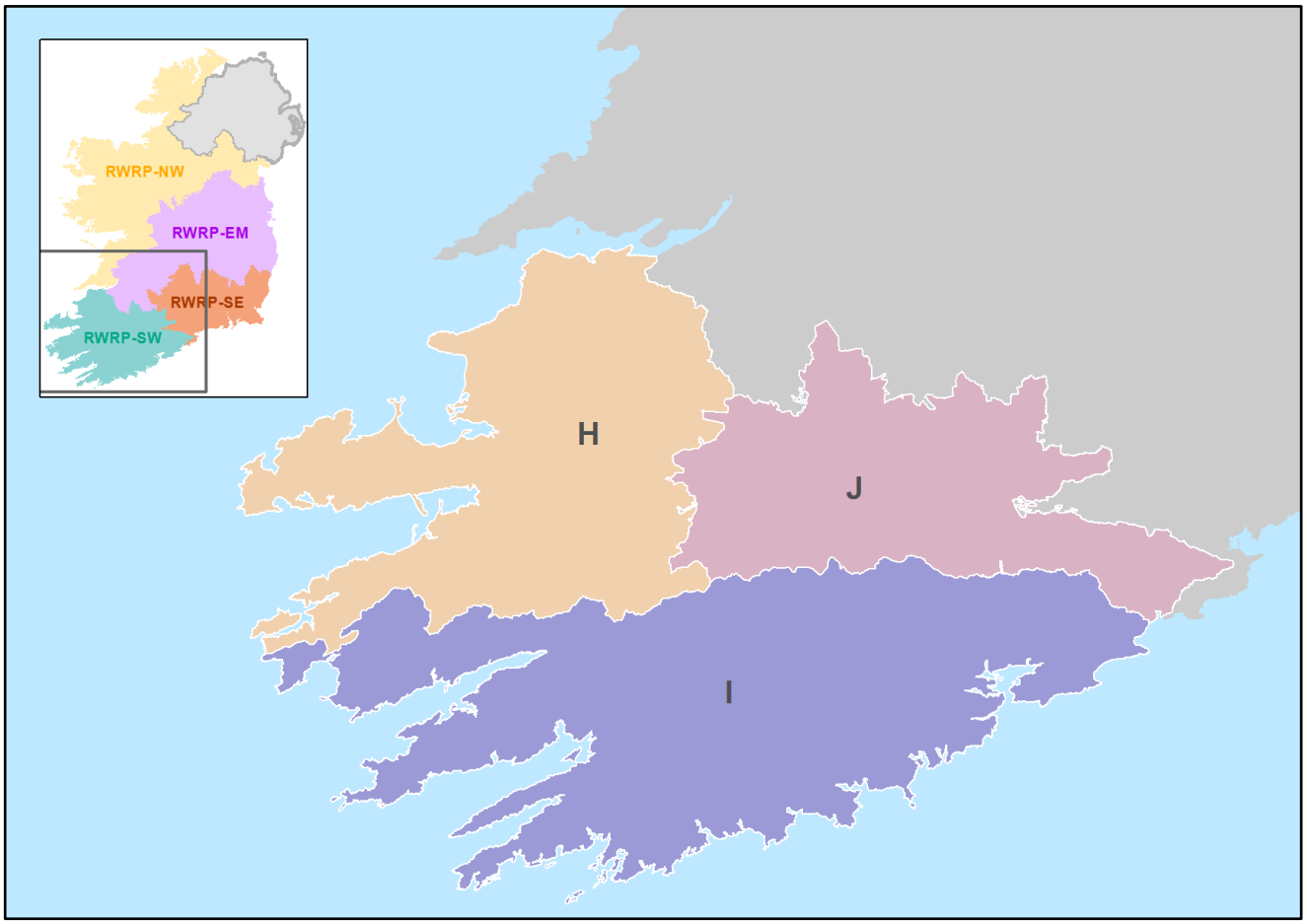


Figure 2.1 Location of the South West Region

The South West Region includes five (5) counties: Cork, Kerry, Limerick, Tipperary and Waterford. It covers approximately 13,000 square kilometres (representing about 20% of the Republic of Ireland) and extends from the southern tip of the country from the Iveragh Peninsula in the south west of County

Kerry, north to the Shannon Estuary, and south east passing through county Cork into County Waterford to the Celtic Sea at Youghal. Cork City is located in the south-east of the region and contains 42% of the regional population.

The predominant land use is agriculture, representing 66.3% of the total land area[1] Natural habitats and forested areas comprise 20.7% and 11.0% of the land area respectively. Urban areas cover just 1.6% of the region with industry making up 0.3% in area and the remaining 0.1% falling in other minor land use categories. The highest population density is in the east including Cork City and the surrounding area[2]. Irish Water supplies around 316 million litres of water per day to a population of 594,400 people and 45,000 businesses in the South West Region. This represents more than 18% of our total supply nationally. It should be noted that in some rural areas there are small communities served by group and private schemes that do not rely on Irish Water's networks.

2.1.2 Study Areas in the RWRP-SW

The three (3) SAs making up the South West 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 located within them.

There are four (4) Key Towns that are identified in the Southern Region Regional Spatial and Economic Strategy (RSES) including Tralee, Killarney, Mallow and Clonakilty. These represent settlements that "will play a significant role in strengthening the urban structure of the Region…. based on their strategic location and influence". It is envisaged that Local Authorities will plan for significant growth in these towns. Tralee is the largest of the Key Towns, with a population of almost 24,000.

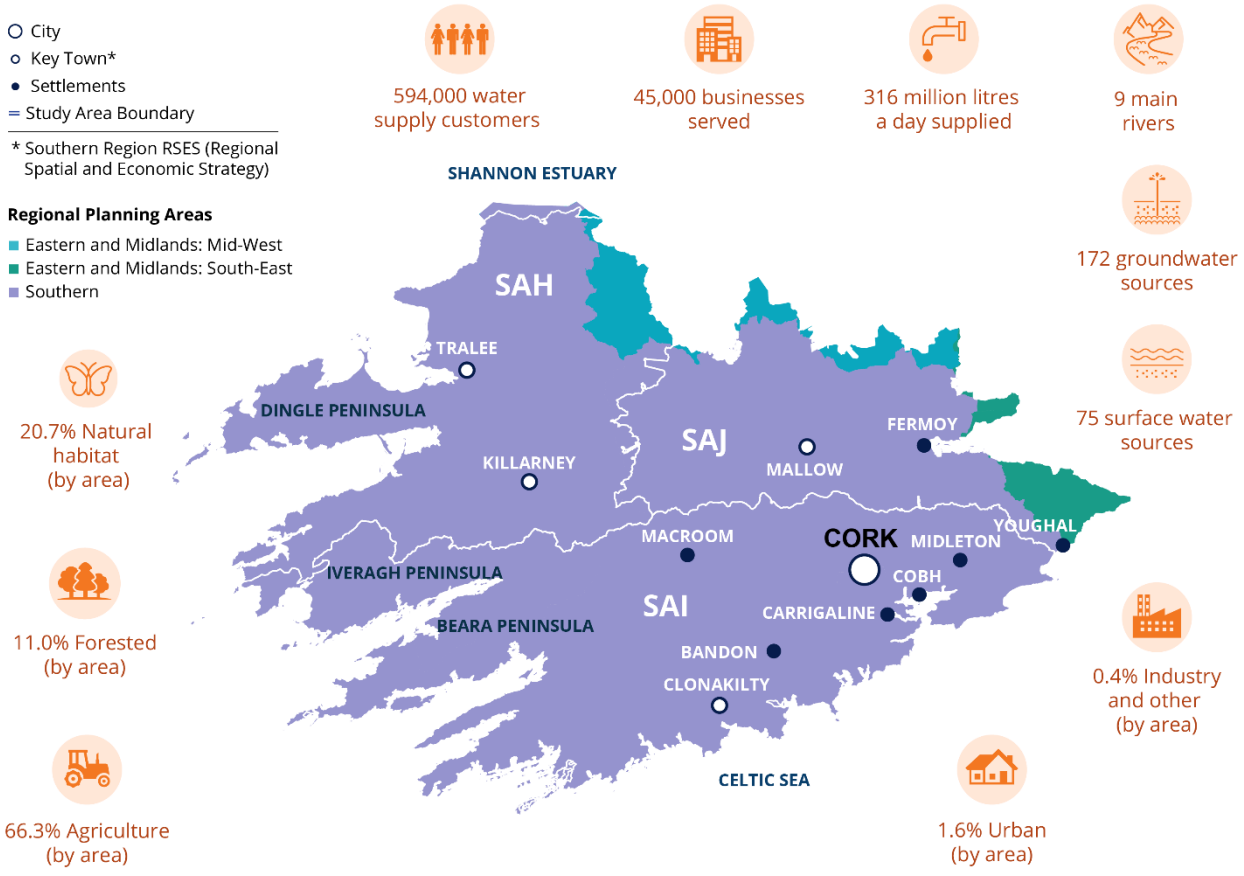


Figure 2.2 Study Areas of the South West Region and Key Regional Statistics

Table 2.1 Study Areas of the South West Region

Study Area	Description
SAH Kerry	SAH total area is approximately 4,060 km^2 and lies within the counties Kerry, Limerick and Cork. The principal settlements (with a population of over 10,000) within SAH are Tralee and Killarney (CSO, 2016)[2].
SAI Cork and Kerry	SAI total area is approximately 5,920 km^2 and lies within the counties of Cork, Kerry and Cork City. The principal settlements (with a population of over 10,000) within SAI are Cork City and suburbs, Carrigaline, Cobh and Midleton (CSO, 2016)[2].
SAJ Cork	SAJ total area is approximately 3,000 km^2 and lies within the counties of Cork, Waterford, Limerick, Tipperary and Kerry. The principal settlement (with a population of over 10,000) within SAJ is Mallow (CSO, 2016)[2].

The population within the South West Region is served by 174 independent water supply systems defined by WRZs. Sixty-six percent (66%) of the regional population is in SAI (Cork/South Kerry) which comprises Cork City, the second largest city in the Republic of Ireland. Table 2.2 gives the population served by Irish Water 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
SAH	KERRY	Kerry and Limerick	125,230	21	23
SAI	CORK/SOUTH KERRY	Cork and Kerry	389,760	66	89
SAJ	NORTH CORK AND WEST WATERFORD	Cork and Waterford	79,390	13	62
RWRP-SW Area Total			594,380	100	174

*Population numbers are rounded to the nearest 10

2.2 Growth and Development

2.2.1 Current Population

The South West Region has a population of 594,400 (14% of the national population), with 283,600 people (48% of the regional population and almost one fifth of Ireland's population) located within Cork City[2]. 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 six (6) settlements with a population of over 5,000[2] including Bandon, Fermoy, Youghal, Passage West, Kinsale and Carrigtwohill. Twenty-six percent (26%) 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.

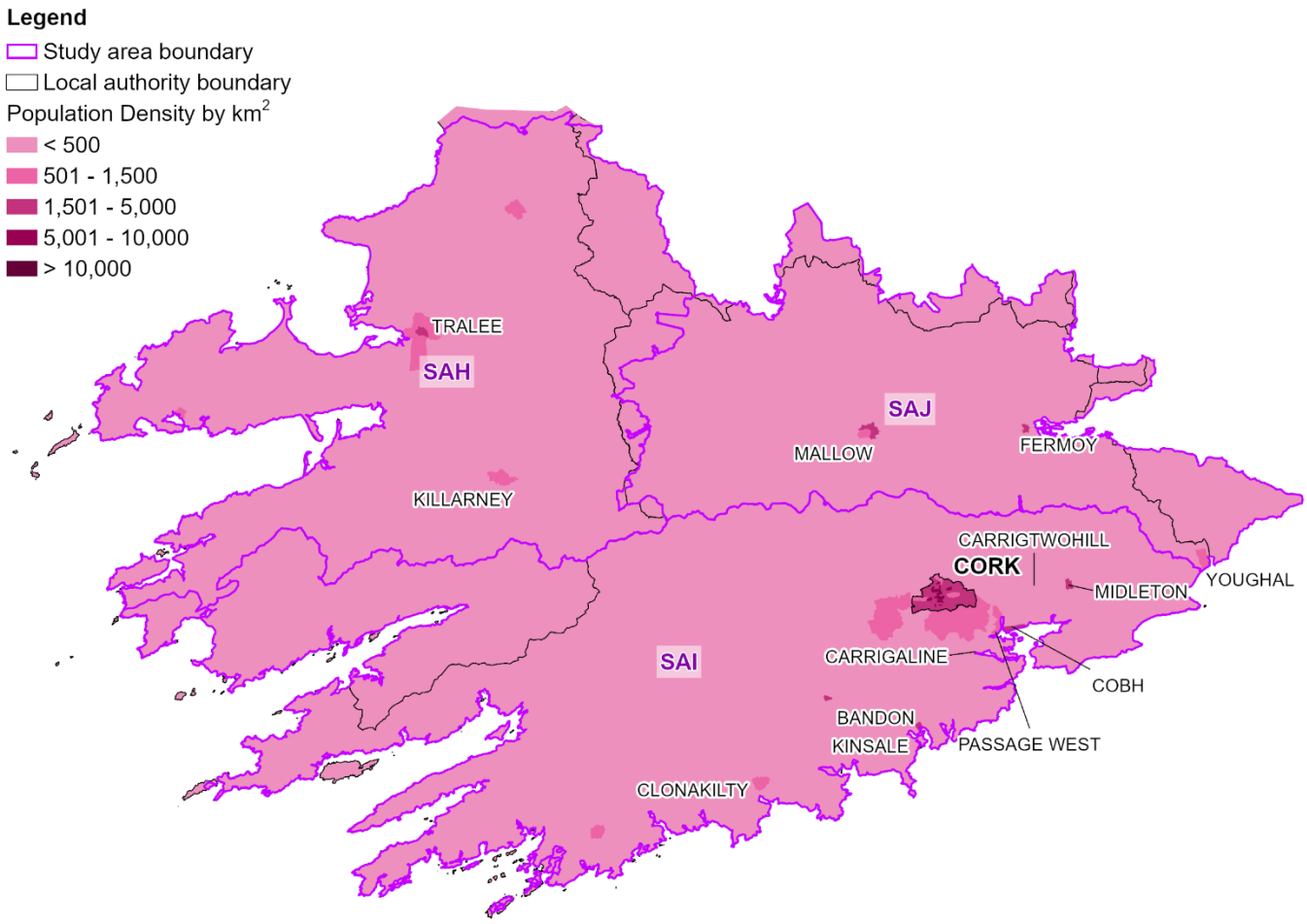


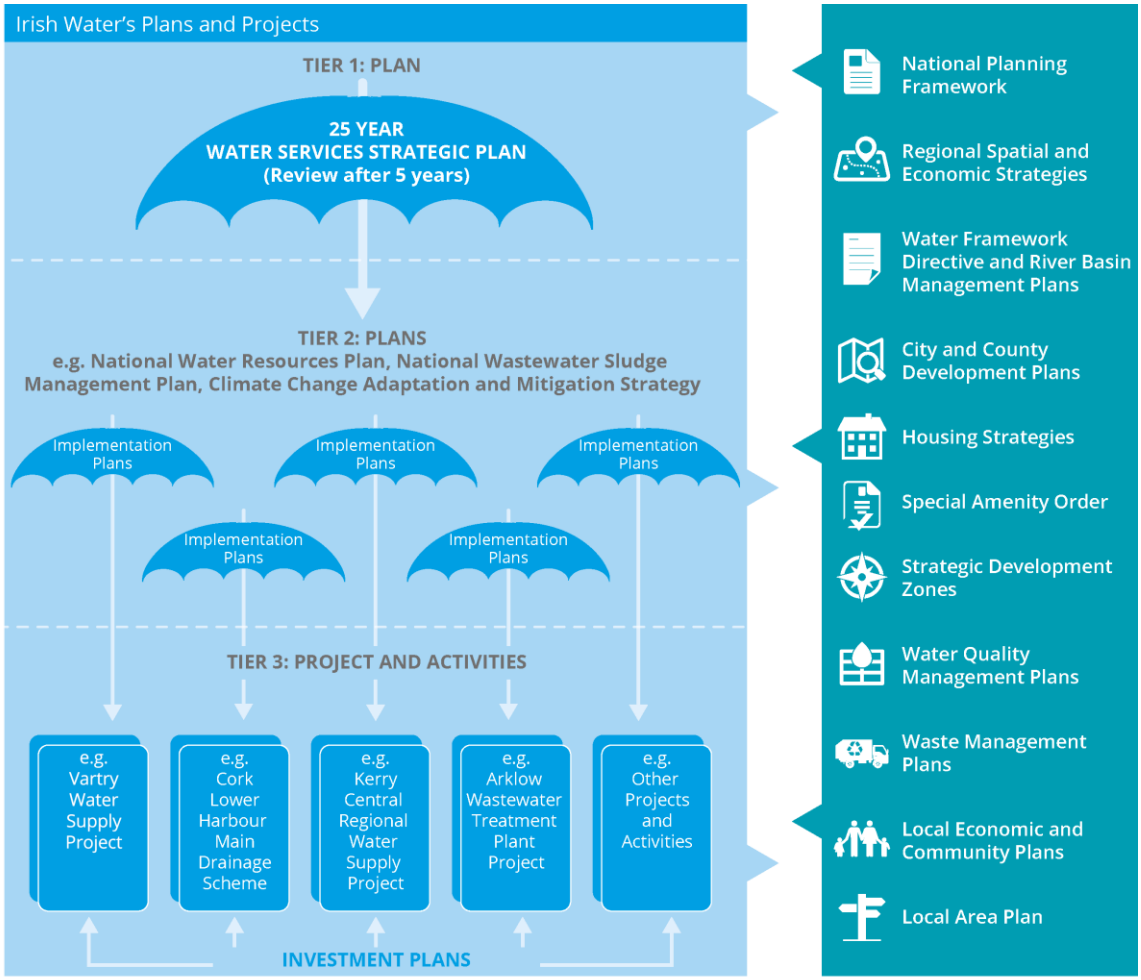
Figure 2.3 Population Density[2]

2.2.2 Growth and Economic Development Policies

Irish Water's National Water Resources Plan (NWRP), which will comprise this RWRP-SW and the three (3) other Regional Water Resource Plans (Eastern and Midlands, North West and South East), 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) 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 objectives are then set out at regional level in the RSESs. 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) then 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 Irish Water's plans and programmes is summarised in Figure 2.4 below.



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

Figure 2.4 Interaction between the Planning System and Irish Water's Plans and Programs

There are three (3) regional assemblies – East/Midland Region, Southern Region, North West Region. The regional assemblies all 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)[3] and the National Development Plan 2018-27(NDP)[4].

The RSES for each region sets out the high-level statutory framework within which each Local Authority in that region develops their City and County Development Plans, LAPs and MASPs aligning them with regional and national objectives.

Irish Water continually engages and interacts with the relevant public bodies in the planning process at all levels: national, regional and county level. Irish Water 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).

Irish Water's NWRP has therefore been developed to ensure that water infrastructure can support the proposed growth policies at a national, regional and county level. The National Planning Framework recognises that "investment in water services infrastructure is critical to the implementation of the National Development Plan".

The RWRP-SW falls within the region of the Southern Regional Assembly.

2.2.3 Population Forecasts in the RWRP-SW

Growth projections used within our RWRP-SW are based on best available data from the NPF and RSESs at the time of compiling the plan, i.e., the growth projections for the cities were taken from the NPF and RSESs, with projections for the Regional Growth Centres, Key Towns and Metropolitan Area taken from the RSESs. For all other areas, the growth projections were taken from the Draft 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, Irish Water will incorporate the increasingly refined growth rates into our demand forecasts – see Section 2.2.3.1 below for further details.

The forecast population used in our demand forecasts for WRZs at our regional planning SA level is shown in Table 2.3.

Table 2.3 Study Area Population Growth (2019 to 2044)

SA No.	SA Name	Total Population* (CSO, 2016[2] and Irish Water 2019 population projections)		Change In Population
		2019	2044	%
SAH	KERRY	125,230	150,690	20
SAI	CORK/SOUTH KERRY	389,760	544,720	40
SAJ	NORTH CORK AND WEST WATERFORD	79,390	93,760	18
	TOTAL	**594,380**	**789,170**	**33**

* Population values are rounded to the nearest 10

The overall regional population growth is 33% from 2019 to 2044. All SAs in the South West Region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016. The Cork and South Kerry SA (SAI) has the highest projected growth rate at 40%, which is driven by the Cork City forecast growth of 54%[3], by 2040. The NPF supported by the Cork Metropolitan Area Strategic Plan[5] recognises Cork "is emerging as an international centre of scale and is well placed to complement Dublin but requires significantly accelerated and urban focused growth to more fully achieve this role".

The population growth at a WRZ level is presented in Figure 2.5. The figure shows the higher growth rate projections of Cork City and surrounds and the Key Towns. 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 to the proportion of the supply that is in the urban and rural settlements, in order to ensure that the overall growth is aligned with the NPF (and Draft NPF where applicable). For example, a growth rate of 54% is applied in Cork City, whereas a growth rate of 15% is assumed for settlements with a 2016 population less than 1,500. Therefore, the overall population growth rate for SAI is 40% as shown in Table 2.2.

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

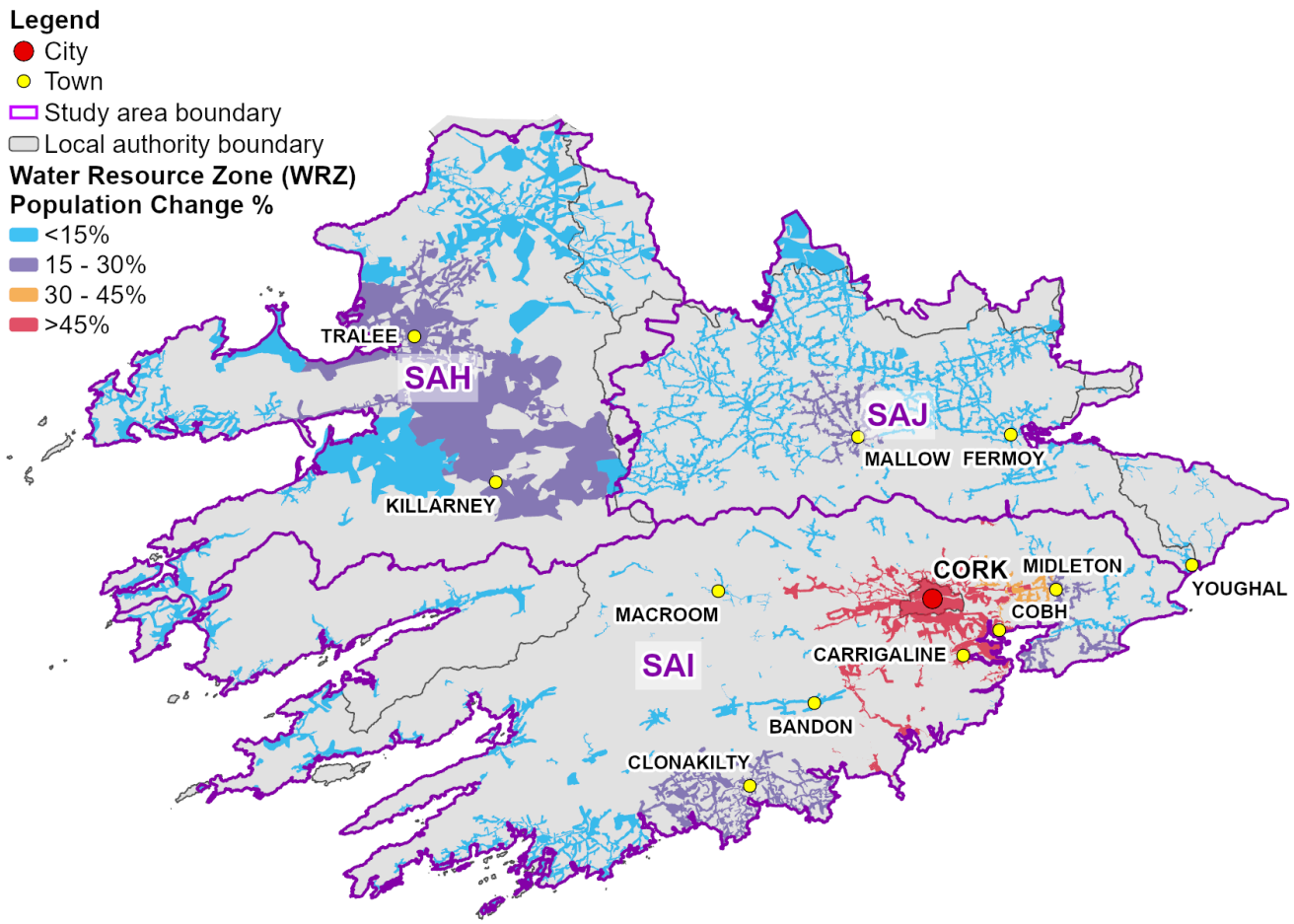


Figure 2.5 Percentage Change in Population (2019 to 2044) for WRZs in the South West Region

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 Cork Metropolitan Area Strategic Plan. As these plans are finalised, Irish Water will incorporate the increasingly refined growth rates into our demand forecasts. In addition to the Framework Plan, Irish Water has developed a 10-year capacity register based on the Supply Demand Balance (SDB) to provide Local Authorities with an indication of settlements which 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 Irish Water, the Regional Assemblies and the Local Authorities. Irish Water will update the SDB annually in line with the data received. This will allow Irish Water 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 and 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 West Region are set out in Section 3 of the 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[3]. 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 region, particularly in rural locations, with the NPF[3] stating that tourism is a key aspect of rural job creation now and in the future. In 2019 over 11.3 million tourists visited Ireland, representing an increase of more than 100,000 compared with the previous year[6].

The South West Region is located within Ireland's Ancient East and the Wild Atlantic Way, two of Fáilte Ireland's tourism programmes in the country. Ireland's Ancient East, which is part of a tourism development strategy that covers the South, East and part of the Midlands, places emphasis on the importance of historic sites in the area; and Ireland's Wild Atlantic Way is Ireland's first long-distance touring route, which aims to achieve greater visibility for the west coast of Ireland[7].

Key tourist attractions located within the region are described below:

- The county of Cork (SAs H, I and J) 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 are located along the coastal environments;
- The county of Kerry (SAs H and I) has been described as having 'rich history, delicious food, and unique wildlife' also placing emphasis on the county's natural assets including mountains, rivers and lakes. The county contains Ireland's UNESCO World Heritage Site at Sceilg Mhichíl and Killarney National Park, the first national park in Ireland and only one in the South West Region;
- The county of Waterford (SAJ) has been referred to as a place 'where Ireland begins', emphasising the importance of the county's natural assets, such as beaches and mountains, as well as its heritage and history; and
- The county of Tipperary (SAJ) has been described as the "farming heartland of Ireland" with emphasis also placed on the county's cultural and historical attractions[8].

Ireland's natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport[9]. Key natural heritage and outdoor recreation attractions within the region include:

- Study Area H: Killarney National Park, Mount Brandon and Tralee Bay Nature Reserves;
- Study Area I: Glengarriff Woods and The Gearagh Nature Reserves; and
- Study Area J: Kilcolman Bog Nature Reserve, River Blackwater and Slí Iarthuaisceart Chorcaí North West Cork Walking Trails[10].

Rivers, loughs and coastal areas across the region also make an important contribution to tourism and recreational opportunities and support important fisheries. For example, the River Blackwater, which is the second longest river in Ireland (after the Shannon River) at 169 km in length, is noted for its trout and

salmon fishing[11]. It flows from the Mullaghareirk Mountains in County Kerry in an easterly direction through County Cork, and eventually turns south to drain into the Celtic Sea at Youghal.

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 these 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. The demand forecasts are used in our Supply Demand Balance calculations to determine future water supply deficits within the region. 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 be potential changes to demographics in relation to commercial and office settings, changes in hospitality and tourism impacts. Irish Water 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, and this includes taking account of cumulative impacts within catchments. Examples of waterbodies that provide substantial environmental, social and cultural values for communities in the South West Region include the Lough Caragh located within Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Special Area of Conservation (SAC) in County Kerry; and the River Blackwater which drains an expansive area of County Cork and is a Salmonid area.

Our freshwater systems support the provision of drinking water needs, livestock and firefighting as well as other uses including industry, irrigation, electricity generation, and recreation and amenities. In a water scarce climate, some of these uses are competing. The River Lee hydro-electric power scheme which also supplies water to a sizeable area of County Cork - including Cork City and surrounds - is an example of competing use (see Box 2.1).

Irish Water understands 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 recognise that the protection of the aquatic environment/habitat requires the maintenance of water quality, physical habitat, 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) which we consider through our assessment of sustainable flow thresholds. This is discussed further is Section 2.3.7. We also describe the environmental status of our surface water bodies and ground water systems in Section 2.3.5 and Section 2.3.6.

Box 2.1 – Competing Demands for Water Supply and Hydro Electric Power Generation

The River Lee hydro-electric power scheme is one of the largest schemes in the country and includes dams and generating stations at Carrigadrohid and Inniscarra in County Cork. The scheme was constructed in the 1950s, more than two decades before the Cork Harbour and City water supply scheme was introduced.

The ESB Group (the Electricity Supply Board) own and operate the hydroelectric scheme, including the reservoirs created behind the two dams. Water impounded by Inniscarra dam provides the largest source of drinking water in County Cork. The River Lee is also the source of drinking water for Cork City and surrounds. Irish Water has an agreement with ESB to facilitate the abstractions for water supply from the River Lee. Irish Water works with ESB to ensure the volume of water required for supply is available while facilitating the required compensation flows downstream of the Inniscarra dam.

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 WFD groundwater bodies and monitoring programmes have been established by the Environment Protection Authority (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 South West Region encompasses the Munster Basin, a large basin primarily composed of Devonian and Carboniferous sedimentary rocks. Broadly speaking the geology of the Munster Basin, consists of east-west trending anticlines (sandstone ridges) and synclines (limestone valleys). The Cork-Kenmare Fault Zone had a large influence on sedimentation during the Late Devonian period (c. 370 million years ago (mya)), 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 the majority (56%) of the bedrock geology in the South West Region. These non-marine sediments can form depths of up to 6km in places. They are resistant to erosion and often form rugged terrain of the more upland areas. Most notable are the Slieve Mish Mountains north of Dingle Bay and along a major east-west anticline covering the Macgillycuddy's Reeks just west of the Killarney National Park eastwards to Mallow. They are predominantly overlain by quaternary sediments of Till and raised Peat in the more upland areas.

The southern region of the basin consists of a mixture of sandstone, limestone and shale. These represent the transition from terrestrial to marine depositional conditions during the Lower Carboniferous period (350 mya). Limestone makes up 24% of the region's bedrock geology and are present in the lower lying areas, notably along the S-shaped "green belt" stretching from Ardfert to Killarney, and along

the southern coast of Cork, stretching from Skibbereen to Cork city. The Upper Carboniferous (325 mya) is represented by 19% of the South West Region, dominated by deep water shales, as seen in North Kerry/West Limerick.

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, only represents a minor proportion (1%) of the South West 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.

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, which in turn impacts the potential sustainable abstraction rate. The majority of Ireland is occupied by poorly and moderately productive aquifers, meaning large rates of abstraction at a single point are often impossible and most of the bedrock is relatively poor at storing and transmitting groundwater.

About 19% of the water supply for South West Region is abstracted from underground aquifers, either from boreholes, springs or infiltration galleries. 172 of our 247 supply sources are groundwater. The major aquifers in the South West 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):

- Regionally important bedrock aquifers are defined as those that can service public water supplies or that have excellent yields (>400 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 m3/day). Flow is predominantly though fractures, fissures and joints.
- Poor bedrock aquifers are defined as those that can service more 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.

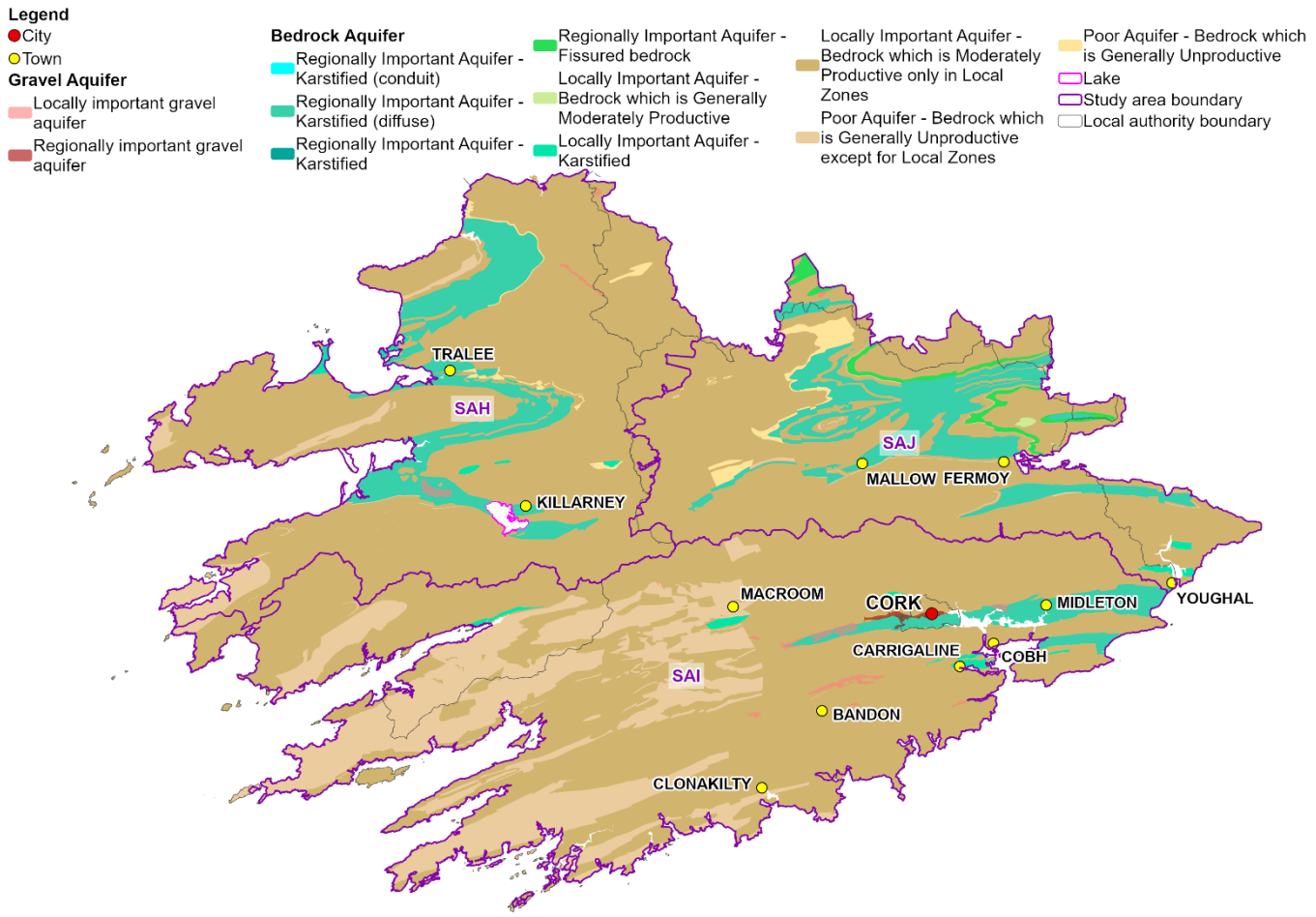


Figure 2.6 Spatial Extent of Major Aquifers in the South West Region

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
- 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.

The predominant aquifer type of the South West Region (51%) is made up of poorly productive bedrock, followed by karstic (34%), productive fissured (9%) and sand and gravel (6%) aquifers.

The Old Red Sandstone (ORS) are predominantly of a poorly productive bedrock flow regime and assumed to be generally devoid of intergranular permeability, with groundwater flow occurring mostly through fractures and faults. Most groundwater flow occurs in the top 15-20 metres of the aquifer, with levels generally mirroring topography, although deeper flows along fault zones or connected fractures are encountered which can provide much higher yields. Significant flows can be found at springs issuing from bedding planes marking a change in lithology. There are also large swathes of Dinantian (Lower

Carboniferous) Impure Limestones which are interleaved with the Pure Bedded Limestones. The limestones are often characterised by the occurrence of chert and shale bands and are generally less productive than the Pure Bedded Limestones.

The karst forms a key regionally important aquifer in some areas, namely around Ardfert and Castlemaine in Kerry and the low-lying valleys between Mallow and Charleville in Cork. The southern region is predominantly characterised by a more diffuse network of flow pathways, where the distribution of permeability, and hence yield, is more homogenous. The karst system of North Cork appears more complex and is likely comprised of solutionally enlarged channels (conduit flow) and other karst features at the surface (represented by springs), and a deeper diffuse type groundwater flowing south.

The Kiltorcan Sandstones make up the productive fissured aquifers in this region and can be found in a narrow band through north east Cork and into Waterford. In general, optimum well yields will be from wells that penetrate to a depth at least 50-100m and near a significant structural feature such as an anticline or fault. It is likely the abstraction at Charleville receives much of the groundwater inflow from this rock unit.

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 sand and gravel aquifers throughout the region, many of which are undeveloped e.g., Lee Valley Gravels in Cork and the Killorglin gravels in Kerry. The Brinny Gravels, north of Bandon, house a number of industrial abstractions, while the Ardfert South scheme currently abstracts from the Ardfert gravels. 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.

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)[11]. In the South West Region there are 104 lakes covering 0.5% of the region's land area (740 km^2). The five (5) largest lakes make up ~60% of the lake coverage in area - Lough Leane, Lough Currane, Lough Carrigdrohid, Lough Carragh and Lough Inniscarra. The larger known rivers within this region include the Lee, the Laune, the Feale, the Bandon, the Blackwater, the Maine, the Roughty and the Funshion; however, they represent only a fraction of the extensive 14,770 km network currently mapped by the EPA in the South West Region. Our surface water river systems are shown in Figure 2.7.

SAH is split between the Laune-Maine-Dingle Bay catchment in the south, and the Tralee Bay-Feale catchment in the north. The Laune River catchment drains the southeast of the Study Area, flowing through the large Lough Leane waterbody at Killarney, before entering the sea at Dingle Bay. The River Feale catchment drains the northern part of the Study Area, as it flows through Abbeyfeale in County Limerick, before Listowel in County Kerry, and emptying into the Shannon Estuary at Cashen Bay. The Study Area includes the Dingle Peninsula and the northern side of the Iveragh Peninsula, which are drained by a series of small rivers.

The north east area of SAI comprises the Lee, Cork Harbour and Youghal Bay WFD catchment, which includes the area drained by the River Lee. The River Lee rises in the Shehy Mountains in west County Cork on the border of County Kerry and flows east through Cork City entering the Celtic Sea at Cork Harbour. Lough Carrigadrohid and Inniscarra are two impounding reservoirs on the River Lee that form part of the Electricity Supply Board (ESB) hydroelectric scheme. The southern part of SAI is drained by the Bandon and llen Rivers, while the west of the Study Area is drained by Dunmanus-Bantry-Kenmare catchment.

SAJ is almost entirely within the Blackwater (Munster) catchment except for a small part in the far north of the Study Area crossing into the Shannon Estuary South catchment. The River Blackwater is one of the largest rivers in Ireland, with a total catchment area of 3,310 km^2, draining a major part of County Cork. It rises in the Mullaghareik Mountains in County Kerry and flows east through County Cork passing through the towns of Mallow and Fermoy, then into County Waterford before entering the Celtic Sea at Youghal.

Figure 2.7 Rivers and Lakes of the South West Region

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[12]. The river water bodies in the South West Region comprise three (3) of the eight (8) typologies, as shown in Figure 2.8. The dominant river typology is represented by D2 – Granites and other hard rocks; low-high altitude; and low-medium slope, ultra-oligo trophic with cobble boulder bedrock and/or pebble bed. This makes up 52% (321) of the main river water bodies 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 48% of the main river water bodies 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.

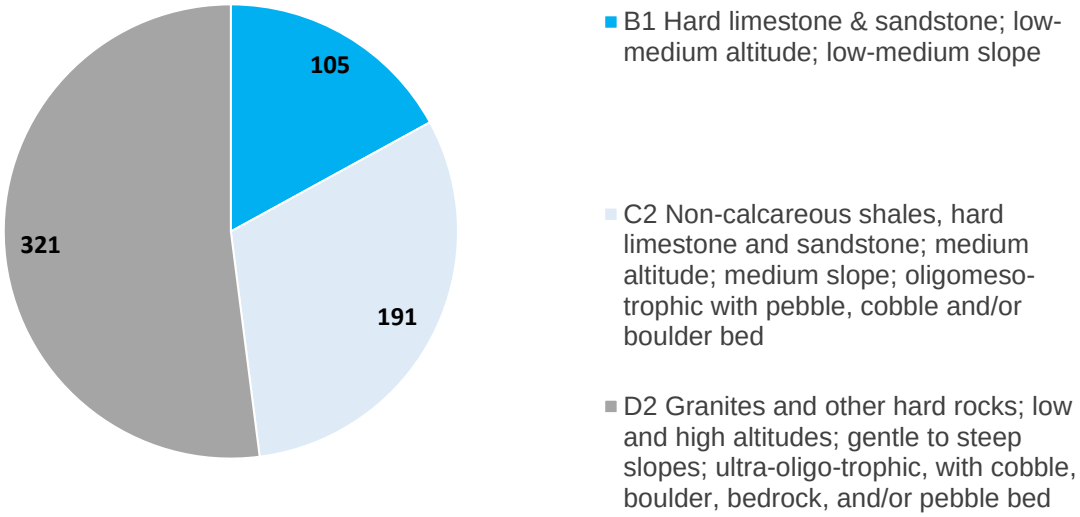


Figure 2.8 Main River Typologies in the South West Region

2.3.4 Groundwater – Surface Water Interaction

Surface water and groundwater interactions are important when considering both the quality and quantity of groundwater which may 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. In the case of the North Cork karst, groundwater flow patterns comprise diffuse and conduit flow. The springs generally occur as single outflows along the banks of rivers at the base of the karst plateaus, thus representing overflows for groundwater heading to the rivers. Secondly there is a significant component of deeper groundwater flowing south. It is possible that this component of groundwater ultimately discharges to the River Blackwater. Groundwater level data suggests a gradient along the Blackwater that would allow for this to occur although further investigation, including water level mapping, is recommended to better understand the karstic regime and any surface water gains/losses[13].

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 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"[14]. 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 2.2.

In accordance with the WFD, Irish Water 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

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

Box 2.2 – 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 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 Irish Water develop must conform.

Across Ireland there has been a decline in water quality since the last WFD assessment (2013-2018). The most recent water quality assessment cycle (2016 – 2021)[15] reports that the number of estuaries and coastal waters in satisfactory condition has declined by almost 16 percent and 10 percent respectively. There has also been a 1% decline of monitored rivers and a 3% decline of monitored lakes in satisfactory condition.

The South West Region, however, does have some of the best river water quality in the country and the majority of high and good ecological status lakes are also found in the south west. The status of the South West Region's surface water bodies classified using data from 2016 -2021, is depicted in Figure 2.9. Rivers of Poor status include reaches of the Feale in SAH, the Blackwater in SAJ and the Lower Lee in SAI.

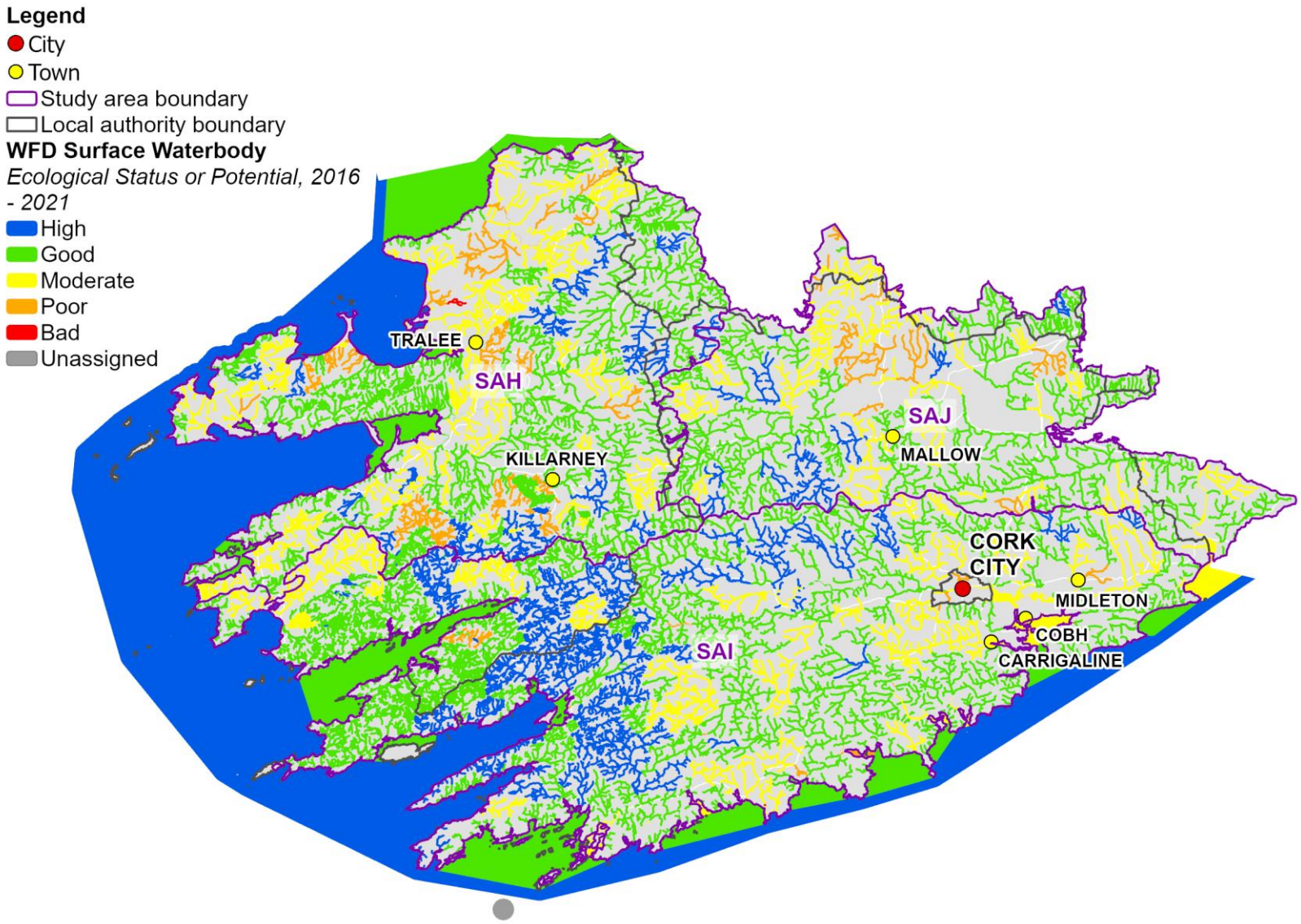


Figure 2.9 WFD 'Ecological Status' of Surface Water Bodies.

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 West Region has a total of 74 groundwater bodies (GWBs). GWBs are classified by the EPA as either 'good' or 'poor' status depending on the outcome of five chemical tests and four quantitative tests. The failing of one of these tests determines a 'poor' status for that waterbody. The quality of groundwater in Ireland is generally good; however, the most recent assessment cycle (2016-2021) reports a small decline of about 1% since the last assessment cycle (2013-2018).

There are no GWBs in the South West Region that are currently at 'poor' Quantitative Status. Three GWBs are at 'poor' Chemical Status[16]: two industrial facilities in SAH and SAJ and one Waste Facility in SAI.

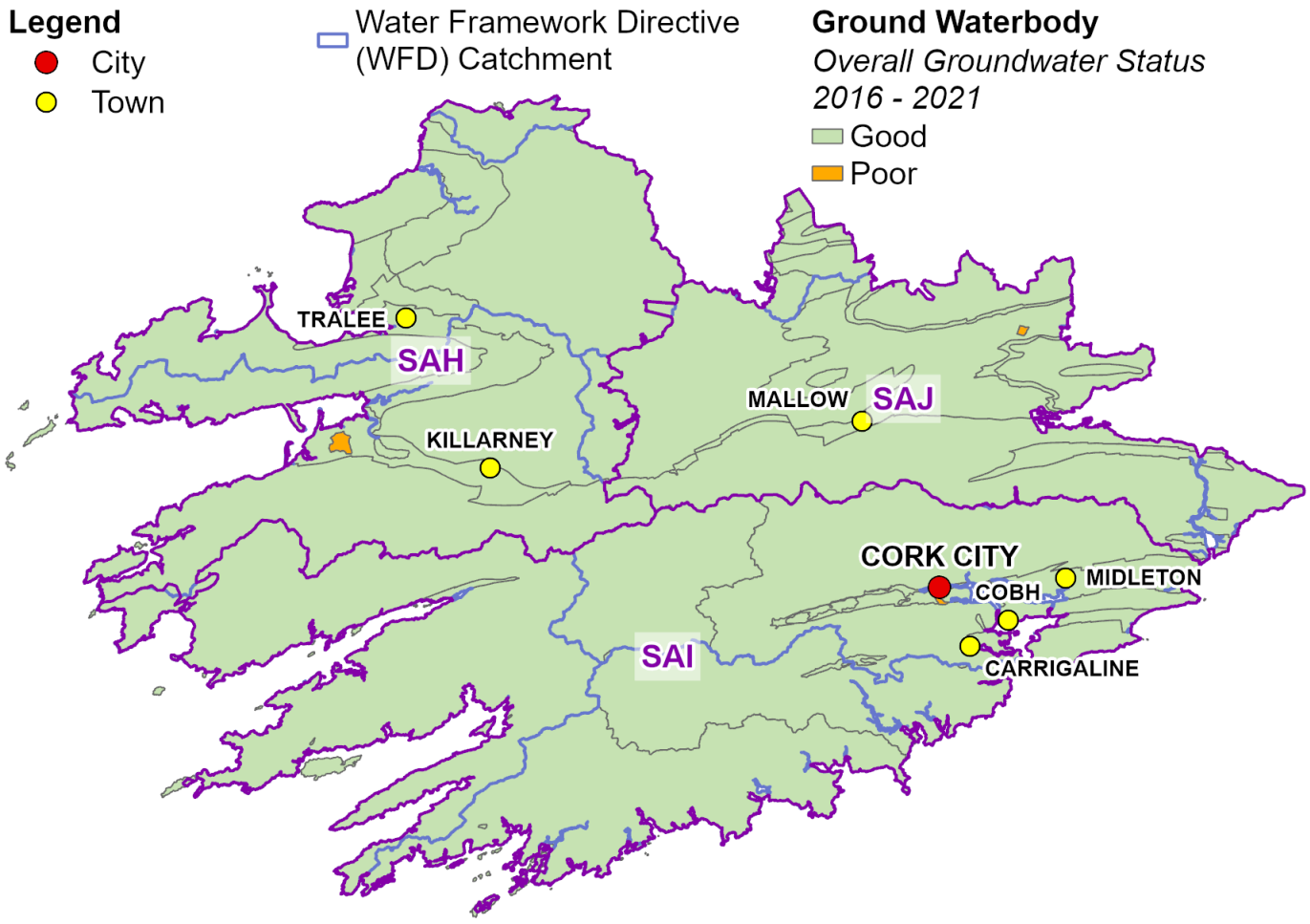


Figure 2.10 WFD Groundwater Body 'Ecological Status' (2016-2021)

Table 2.4 summarises the surface water and groundwater body classification for each Study Area.

Across the region, 72% (of surface water bodies (SWBs) are at 'High' or 'Good' status, 22% are classified as 'Moderate'. Five percent 5% are at a 'Poor' or 'Bad' Status (below 'Moderate') consisting of 31 RWBs, two (2) lakes and nine (9) transitional waterbodies. One percent of SWBs remain 'Unassigned'.

Table 2.4 Water Body WFD 'Ecological Status' for each Study Area [16-20]

Study Areas	No. of WFD Catchment areas	Number of Surface Water Bodies (SWBs) in the region			Number of Groundwater bodies in the region	Number of Waterbodies Rated Below Moderate (SW) or poor (GW)[16]	
		Rivers (RWBs)	Transitional and Coastal	Lakes		Surface Water	Groundwater
SAH	5	187	20	56	19	19	1
SAI	3	271	61	48	28	13	1
SAJ	5	156	4	0	38	10	1
Total*	13	604	85	104	74	42	3

*Some river waterbodies and groundwater bodies fall within more than one Study Area. For this reason, the total river waterbodies and groundwater bodies in each Study Area will be greater than the total number in the region.

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 Risk associated with river water bodies in the South West Region indicates that currently 27% of river water bodies in the region are 'At Risk', 55% are 'Not at Risk' and the remaining 18% are 'Under Review'[21]. Just over 11% of Lake Water Bodies (LWBs) are 'At Risk', 78% are 'Not at Risk' and 11% are 'Under Review'. This is represented in Figure 2.11.

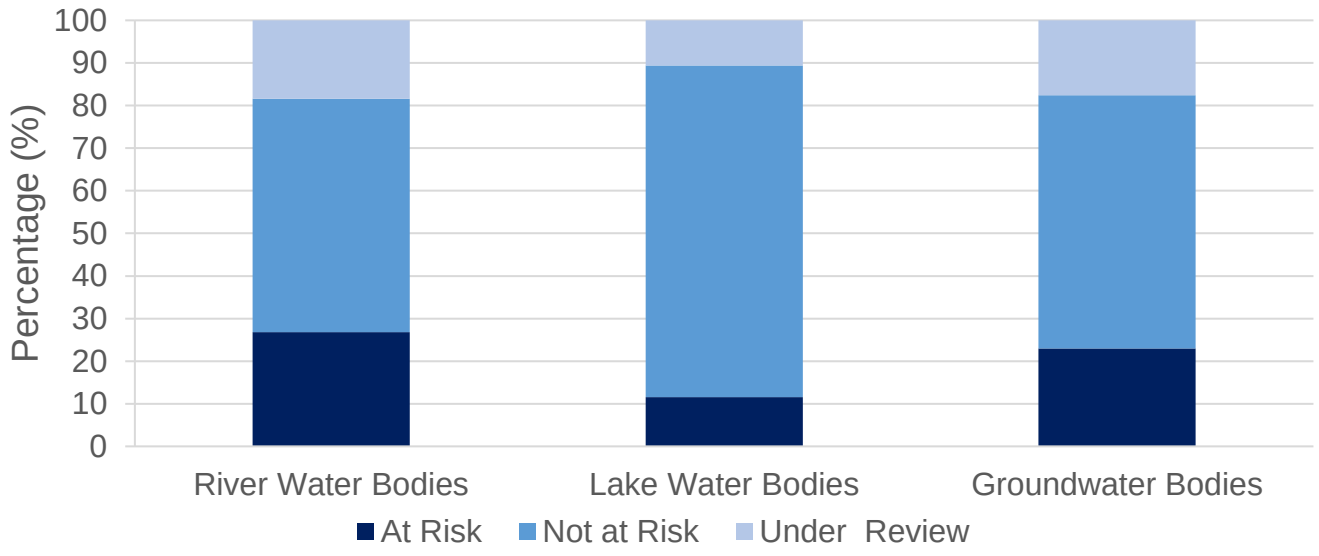


Figure 2.11 The 2013 – 2018 WFD Risk associated with River, Lake and Groundwater Bodies in the South West Region

Figure 2.12 presents the Surface Water Bodies (SWB) 'At Risk' of not achieving the environmental objectives according to the pressures resulting from human activities. Those SWB 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 SWB presented across the pressure categories exceeds the total number of SWB reported as 'At Risk'. Of the surface water bodies 'At Risk' the predominant pressure associated with them is agriculture, followed by anthropogenic, forestry, hydromorphology, urban run-off, and extractions. The Other category includes urban and domestic wastewater, industry, and historically polluted sites.

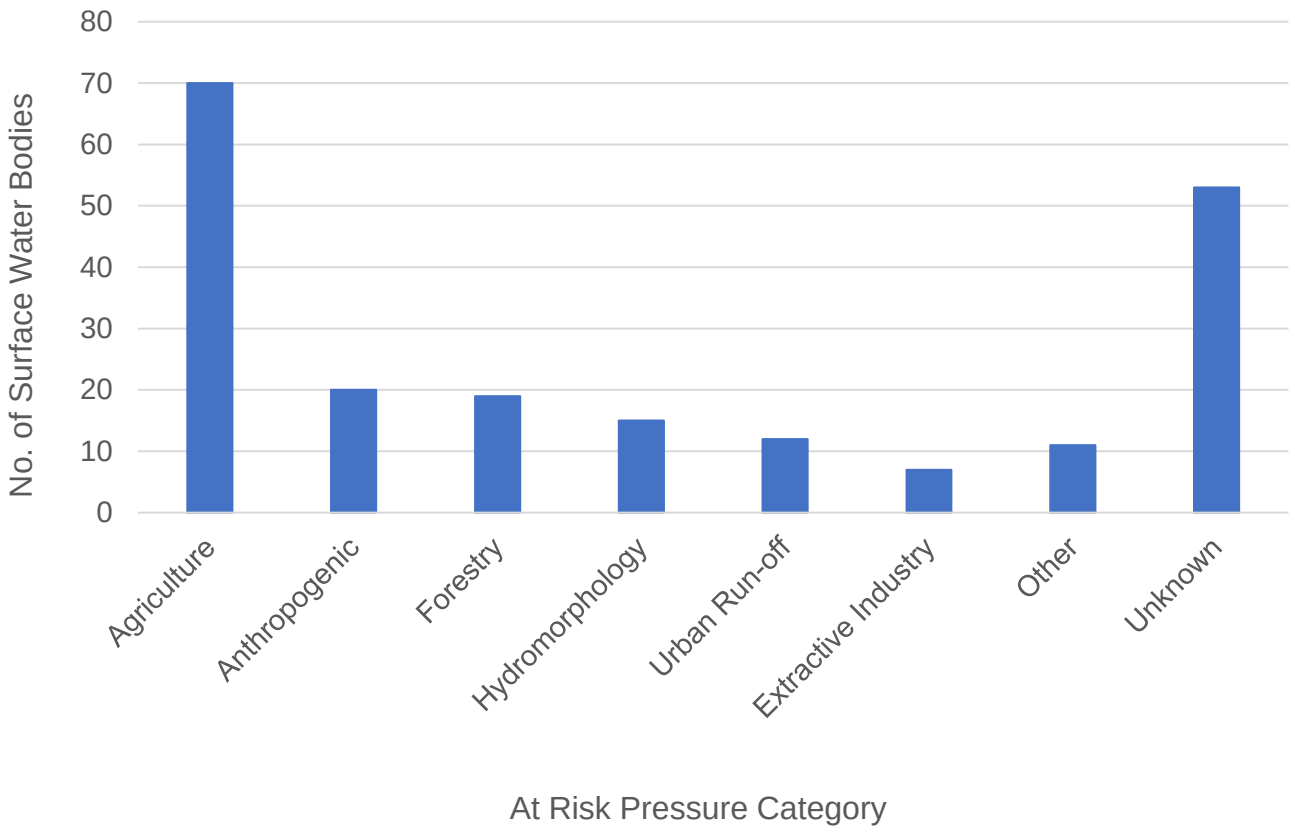


Figure 2.12 Number of Surface Water Bodies with Associated 'At Risk' Pressure Category[21]

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 23% (17 out of 74) GWBs are 'At Risk', 59% (44) are 'Not at Risk' and 18% (13) GWBs are 'Under Review' (Figure 2.11).

Of the GWB 'At Risk' the predominant pressure associated with them is agriculture, followed by industry, waste facilities and forestry, and one urban wastewater impact (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. Irish Water 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.

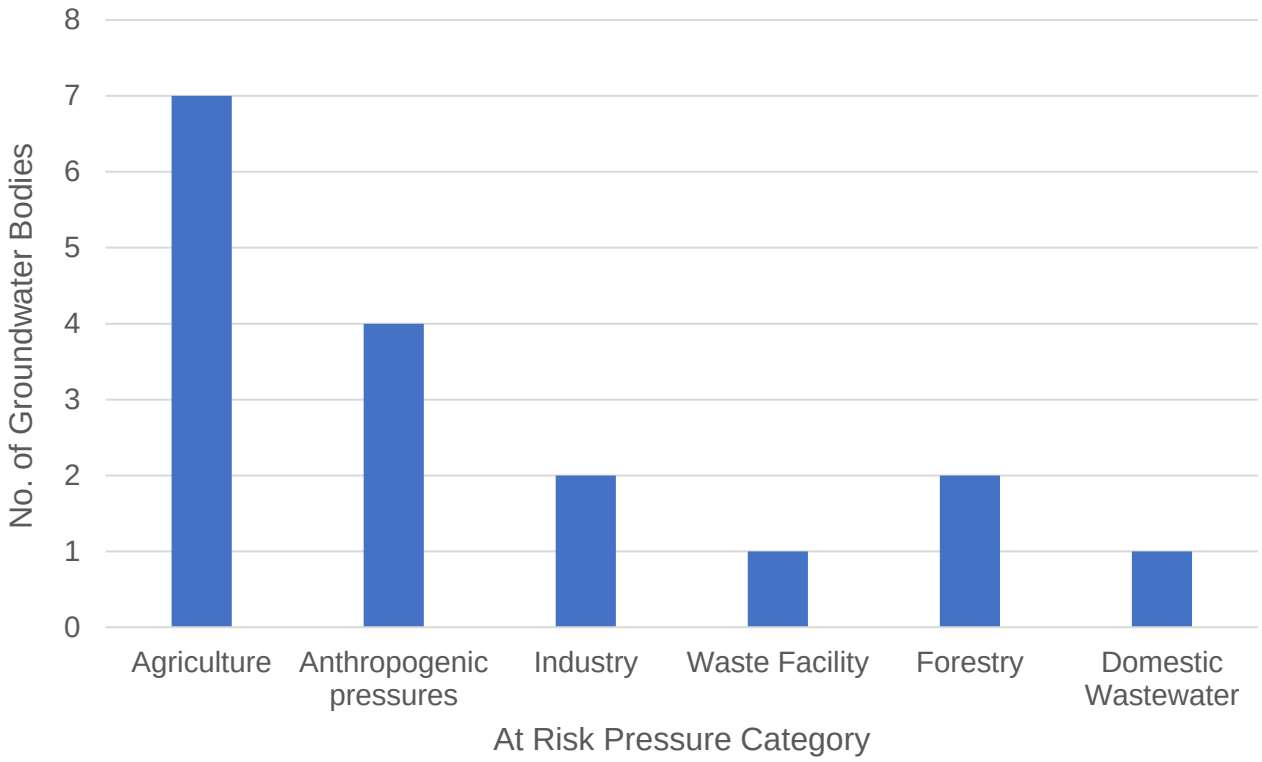


Figure 2.13 Number of Groundwater Bodies with Associated 'At Risk' Pressure Category[21]

2.3.7 Abstraction Pressures

At the end of 2022, the Government passed the Water Environment (Abstractions and Associated Impoundments) Act, 2022 (the Abstractions Act)[22], which will ensure our national abstractions align 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, Irish Water 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 proposed 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. In developing our Preferred Approach (solutions to address the current and future supply deficit), we have considered the potential impact of the pending Abstraction Legislation on our Supply Demand Balance and used this information to consider opportunities to improve environmental outcomes through our Plan solutions.

Irish Water has been an active participant in the characterisation process for the 3rd cycle River Basin Management Plan 2022-2027 and liaised closely with the EPA during the development of the Framework Plan. Therefore, although the pending Abstraction legislation is still under development and there may be some uncertainty in our calculations of sustainable abstraction, the assessments used as part of the development of the Regional Plan have followed the same principles as those that will likely be used by the regulatory authorities (based on the legislation as currently envisaged) as outlined in Appendix G of the Framework Plan. 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[23] 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 UKTAG allowable abstraction standards are detailed in Appendix C of the Framework Plan.

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 which might be at risk. As further data becomes available, and more specific Irish standards are developed, Irish Water 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 bathometry and water level data, which are not widely available in Ireland. Instead, the methodology set out in a 2009 report by the Dublin City Council[24] 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 surface water bodies in the South West Region. The upper reaches of the Laune and Lee Rivers have a high ecological status and hence the allowable abstraction is likely to be more restrictive. These river systems provide a supply to Killarney and Cork City and surrounding area, respectively.

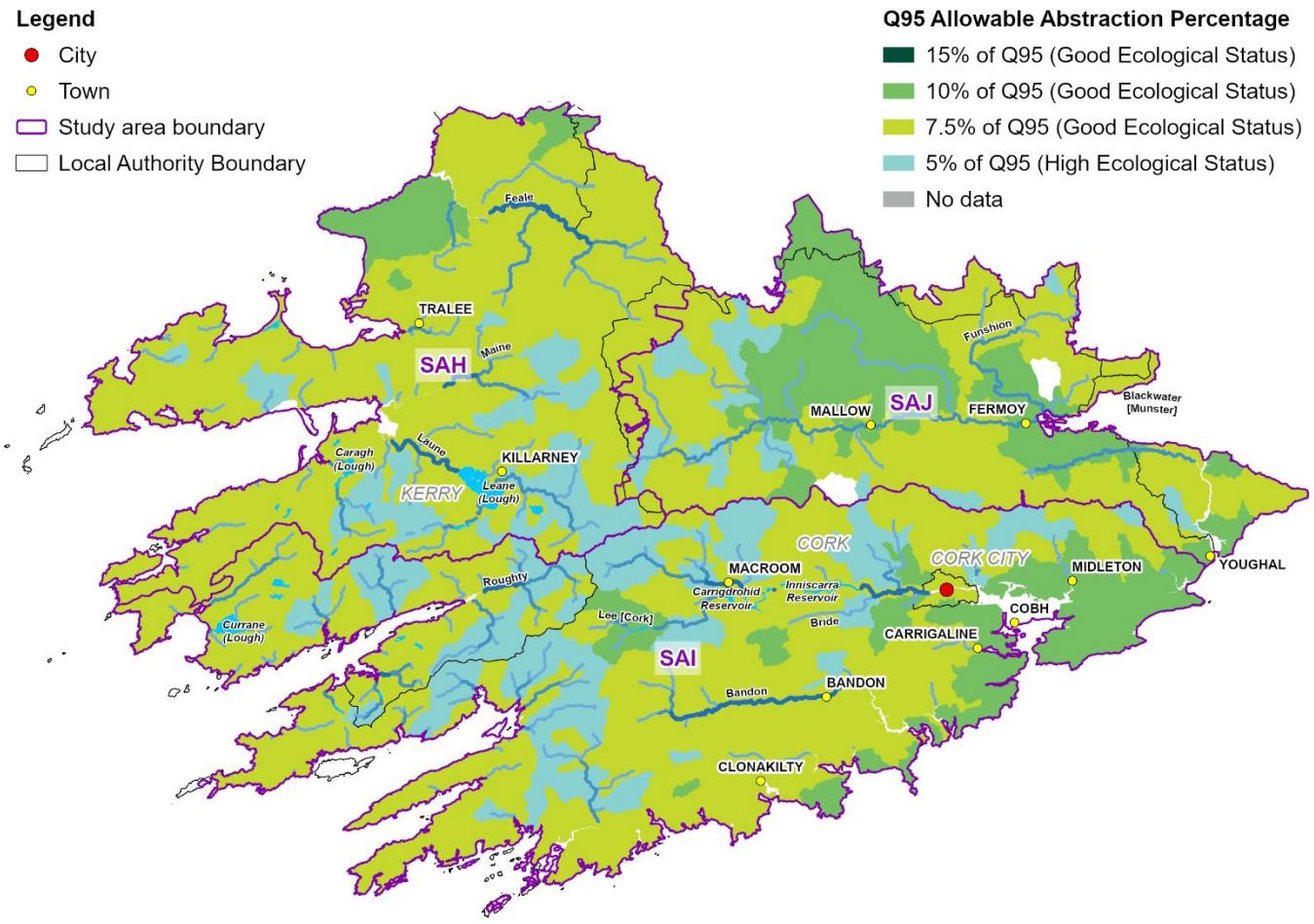


Figure 2.14 Percentage of natural flow at Q95 that can be abstracted to meet 'Good' Status

By applying the UKTAG allowable abstraction thresholds, Irish Water has determined there are 54 out of 75 surface water abstraction sites that may not meet sustainability guidelines during dry weather flows – 19 in SAH, 32 in SAI and four (4) in SAJ. 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 Moderate WFD status, as shown in Figure 2.15. Further detailed site investigations will be required to confirm the impacts of existing abstractions.

The estimated volume of abstraction reductions which may be implemented in the future to meet allowable abstraction thresholds is presented in Section 3.5 of this Plan.

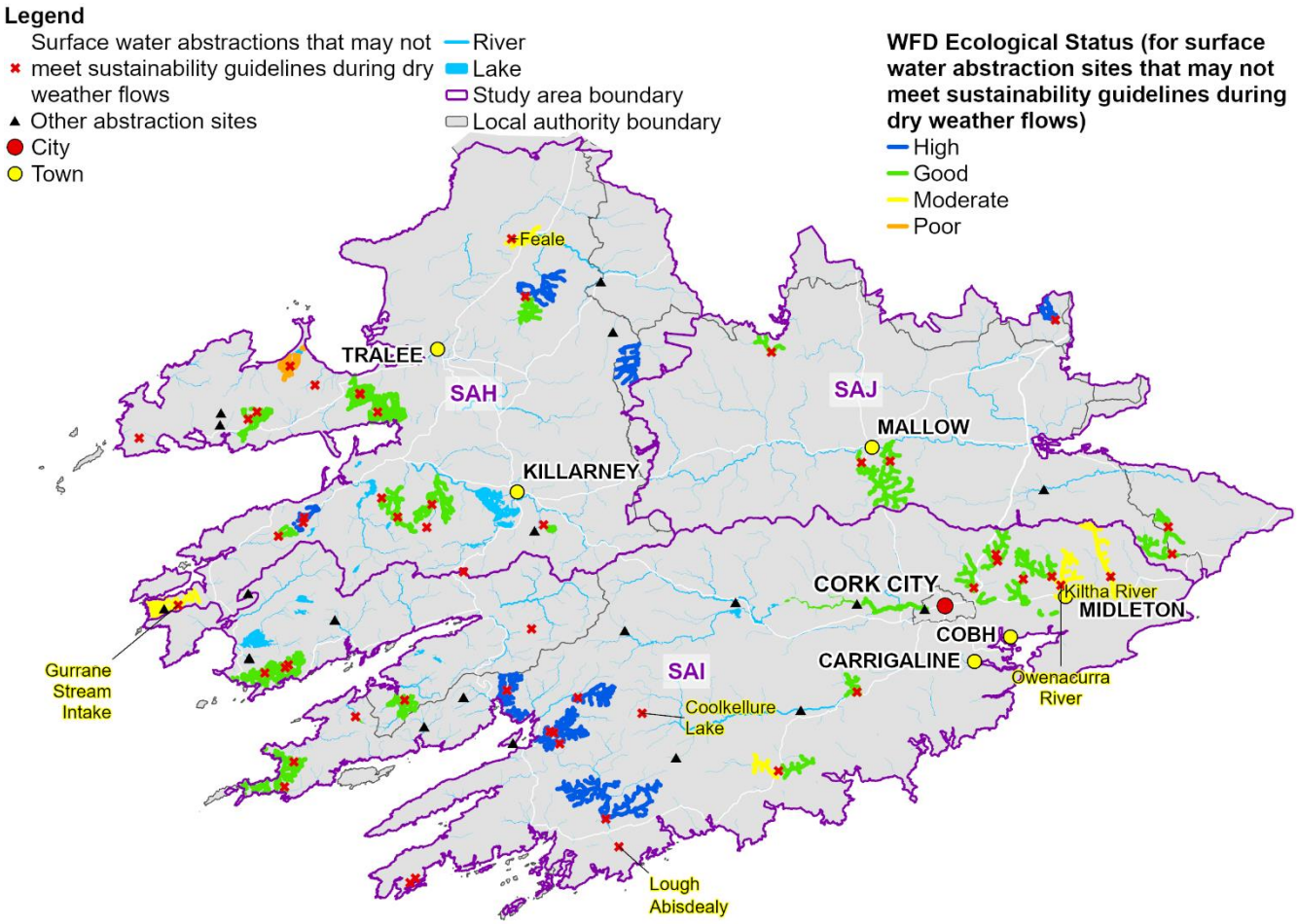


Figure 2.15 Surface Water Abstraction Sites that may not meet sustainability guidelines during dry weather flows

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

2.3.8 Designated Sites in the RWRP South West Region

Our habitats and species are protected under the Habitats Directive[25]. 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). There are 288 designated sites associated with the South West Region (Table 2.5 and Figure 2.16).

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 above, 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 NIS on the Framework Plan.

Many of the surface waters within the South West Region are within designated areas, including the large Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC, which is a protected site with the greatest coverage in the region. The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle is the largest SPA in the region. These are both described in Box 2.3 below.

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

Designated Sites	Number of Sites
Special Protection Areas (SPAs)	29
Special Areas of Conservation (SACs)	53
Natural Heritage Areas (NHA)	17
Proposed Natural Heritage Areas (pNHA)	168
Ramsar Sites	7
Nature Reserves	13
National Parks	1

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

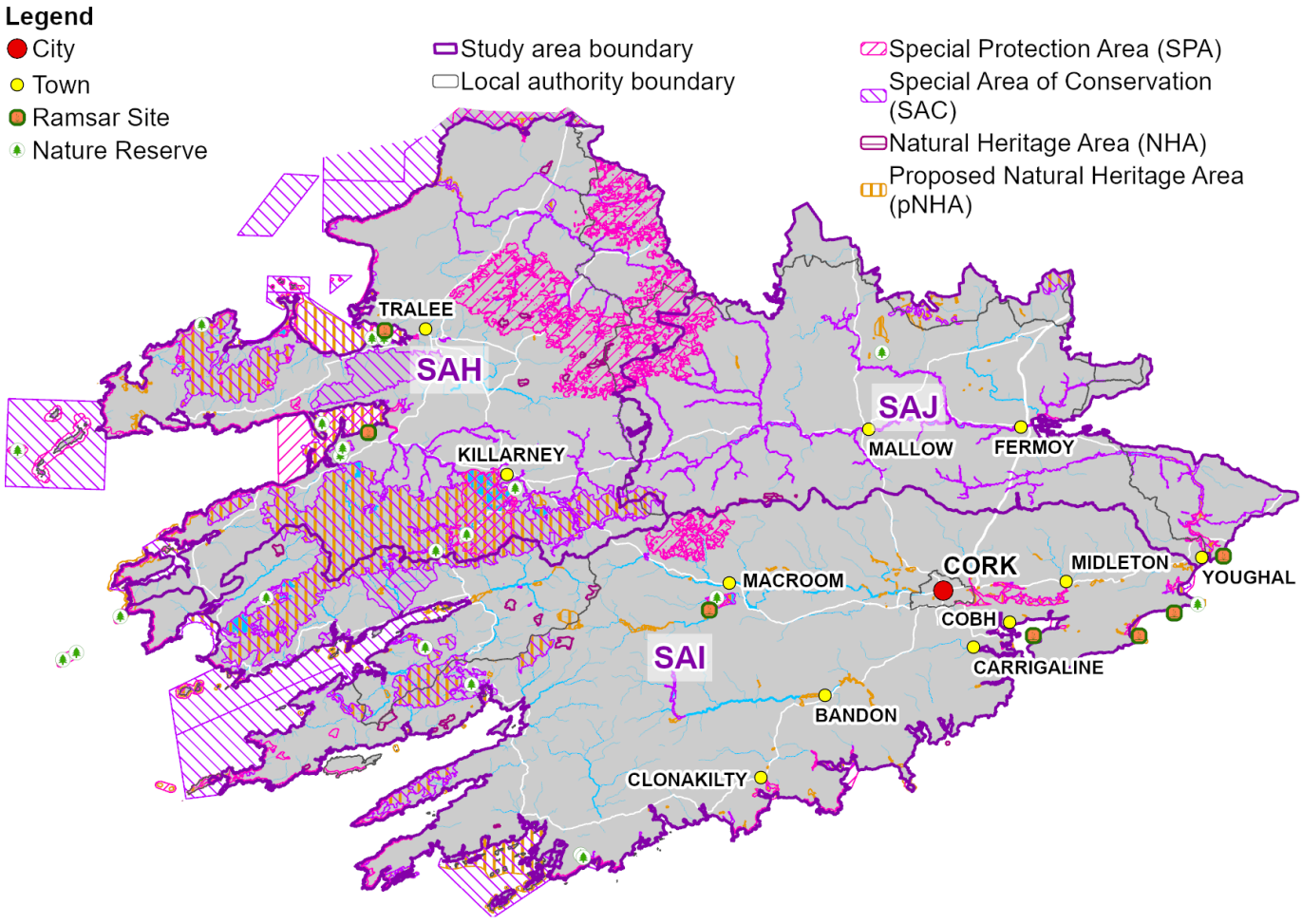


Figure 2.16 Designated Sites in the South West Region

Box 2.3 – Protected sites with the greatest coverage

A) Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC & pNHA: A very large area (74,980 hectares) comprising mountains, rivers and lakes of the Iveragh Peninsula, and the Paps Mountains, stretching eastward from Killarney towards Millstreet. Generally, Lusitanian flora and fauna is well-represented, while the high peaks and cliffs support rare glacial relicts. A wide range of natural features contribute to its important ecological status and these include blanket bog, alluvial woodland, good quality oligotrophic lakes, rare invertebrates and fish and several other annexed species. The site is also home to the most extensive oakwoods in the country, with some of the best bryophyte communities in Europe. The area is designated as a National Park and supports 12 Annex II species of flora and fauna, six (6) Annex I bird species and at least 33 Irish Red Data Book species.

A) Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA:

A very large upland site covering 56,648 hectares, centred on the borders between the counties of Cork, Kerry and Limerick. It is the source of many rivers, namely the Blackwater, Feale, Clydagh, Oolagh, and Smerlagh. A substantial part (28%) of the site is unplanted blanket bog and heath, with both wet and dry heath present. The remainder of the site is largely rough grassland that is used for hill farming. Some areas of scrub and deciduous woodland occur, especially within the river valleys. The site supports approximately 21% of the all-Ireland population of Circus Cyaneus, the largest in the country. It serves as an excellent habitat for both nesting and foraging purposes. Asio Flammeus, a rare breeding bird in Ireland, has nested in the past and has been recorded intermittently in recent years. Lagopus Lagopus, a Red Data Book species, also occurs.

2.3.9 Opportunities for Protection, Restoration and Enhancement

Irish Water'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 in partnership with key stakeholders. This approach is in accordance with Article 7(3) of the Water Framework Directive and has the joint benefit of protecting our water habitats and managing the risk to our drinking water sources.

In 2019, the Irish Government declared a National Climate Change and Biodiversity Emergency to highlight the significant concerns around Ireland's biodiversity and recognizing the urgency to act on these interconnected global crises. Irish Water 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 Irish Water's Biodiversity and Sustainability Policies. The overall aim of Irish Water's Biodiversity Policy is that in association with the provision of water and wastewater services, biodiversity and the natural environment are conserved, protected and where practical enhanced through our responsible stewardship, sustainable water services and strong partnerships. Irish Water launched its Biodiversity Action Plan (BAP)[26] 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. NBS are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems, as well as natural features and characteristics of waterbodies using natural means and processes[27]. The main functions are to improve water quality, reduce flood risk, and create habitats. NBS have many additional benefits that include reduction in energy usage, carbon sequestration, and amenity use for local communities. NBS include a broad range of measures such as: wetlands, basins and ponds, reedbeds, buffer strips and hedges and forest riparian buffers.

Some examples of NBS being utilised by Irish Water in the South West Region include:

- Working in partnership with Local Authorities to support biodiversity across many of their sites including Integrated Constructed Wetlands in Lixnaw, County Kerry.
- 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.
- Biodiversity enhancement measures such as near Lough Guitane, where we are working with the Forest Service and planning for the establishment of 5.27 hectares of riparian woodland at our Water Treatment Plant site. Irish Water will use native tree species to re-create a habitat that would have existed along the watercourses before these habitats were cleared for other land uses. Riparian woodlands prevent contaminants from entering the watercourse, for example, soil, fertilisers and other pollutants. This will provide source protection, a carbon sink and biodiversity enhancement.

Examples of our catchment management activities are described in Box 2.4.

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 2.4 – Source Protection and Catchment Management Activities

Irish Water 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. Irish Water is a project partner on this project which is funded by INTERREG 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). Irish Water 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), the Agriculture and Food Development Authority (Teagasc), Geological Survey Ireland, 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 West 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 some of the highest areas of rainfall across Ireland occur in the South West Region. Most of the region experiences average annual rainfall between 1,400 and 1,600 mm per year. In comparison, Counties Dublin and Kildare (located in the Eastern and Midlands Region of the NWRP) experience the driest weather across the country with average annual rainfall of less than 800 mm.

The high elevation areas on the Invaragh and Dingle Peninsulas, where the Carrantuohill and Brandon Mountains are located respectively, experience an average annual rainfall of up to 3,600 mm. (With an elevation of 1,041 m, the Carrantuohill Mountain is the highest point of Ireland). The lower rainfall areas in the region, averaging between 1,000 mm and 1,200 mm, occur in the south east (including Cork city and surrounding suburbs) and north east of the Study Area.

The comparison with population density also shown in Figure 2.17 highlights that the areas of lowest rainfall across Ireland also have the greatest population density, meaning resources in our most populated areas (such as Cork City and surrounds) can become stressed.

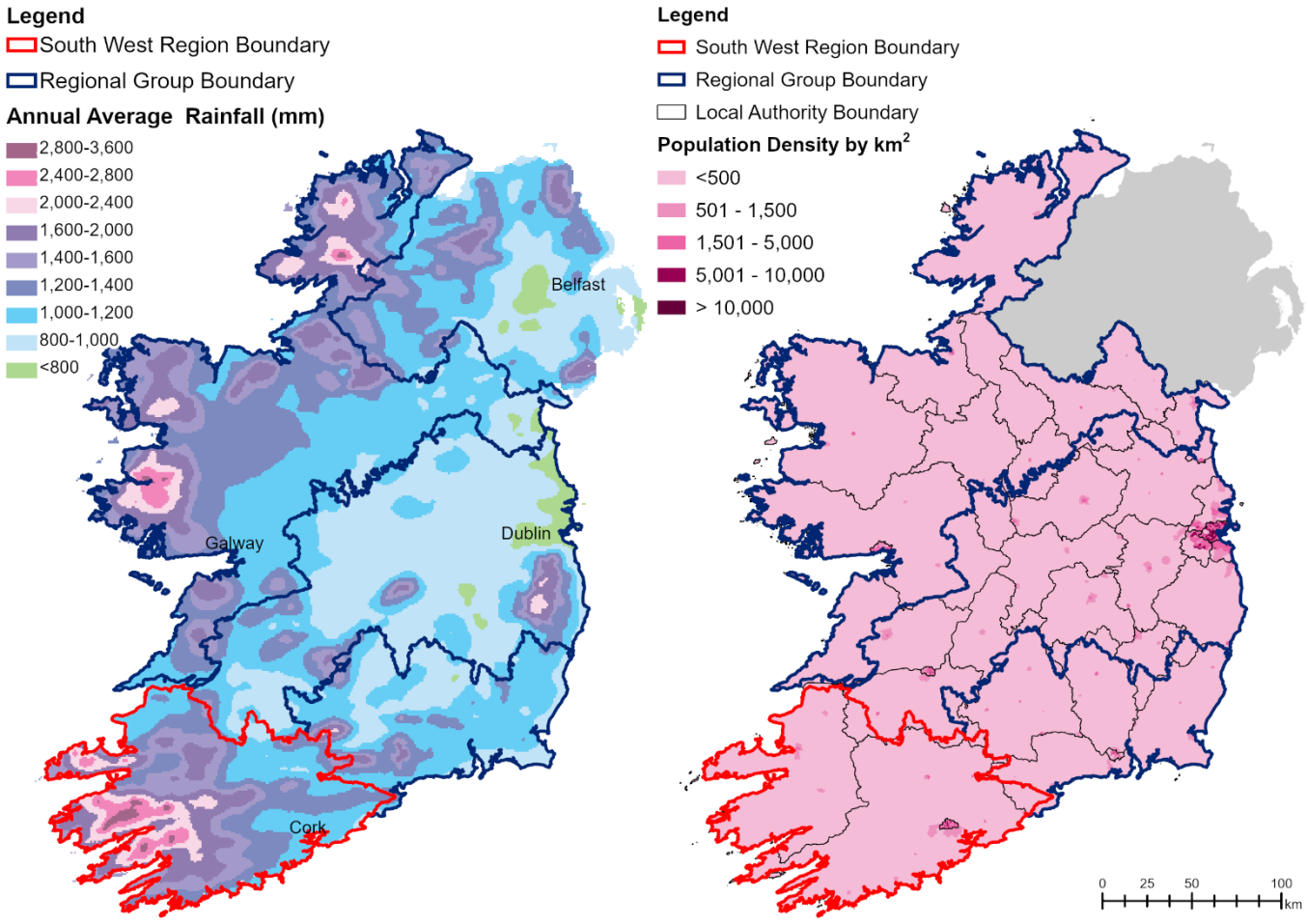


Figure 2.17 Rainfall across Ireland compared with Population Density[28]

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 West Region, the variability in seasonal rainfall is higher in the west than the east (Figure 2.18). In the western part of the region, monthly average rainfall across the year has a range of 83 mm, varying from 94 mm in May to 177 mm in October. The eastern area near Cork shows reduced seasonal variability, with a range of 61 mm between the minimum average monthly rainfall in April (77 mm) and the maximum average monthly rainfall in October (138 mm). Climate change is likely to increase the within year variability, with wetter winters and drier springs and summers[28]. This is further discussed in Section 2.4.5.

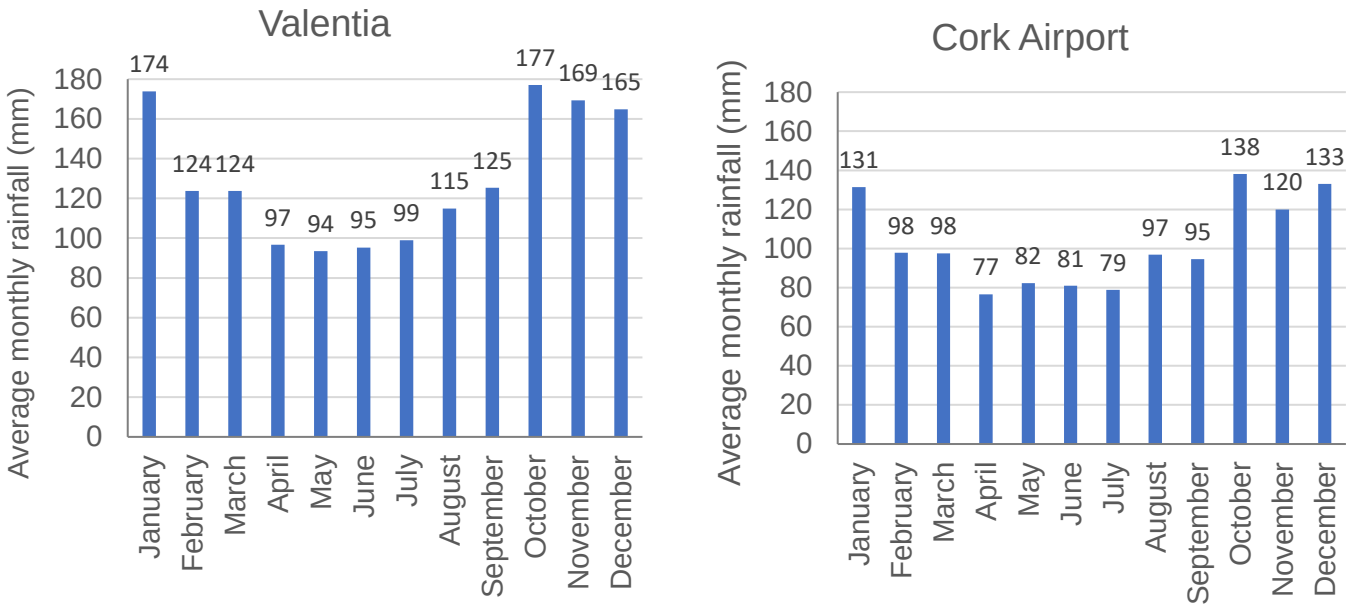


Figure 2.18 Monthly Rainfall Variability – 1981 to 2010[28]

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 large amounts of rainfall, the country does experience drought events. Figure 2.19 shows there were seven (7) events of severe drought periods since records began in 1850..

The drought events experienced in 2018, 2020 and more recently in 2022, although severe, were short in duration and are therefore not represented in Figure 2.19 when compared to historical droughts. The late spring and early summer of 2018 saw some of the lowest rainfall totals on record leading to drought conditions. Whilst the drought event was not defined as ‘severe’ based on historical records (due to its short duration) it was 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 as a result 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 West Region were severely impacted including Abbeyfeale and the Central Regional supply (where pumping was required due to the low levels of the Lough

Guitane source) in SAH, Clonakilty in SAI and Charleville in SAJ. Night time restrictions have also been implemented in recent years for the Mid-Kerry supply.

In August 2022, after a prolonged period of low rainfall, raw water sources across 30 supplies in the West Cork Area (WCA) were significantly depleted and we were tankering water to several areas to maintain water supply to our customers. We ran a significant water conservation communications campaign (including stakeholder and media engagement, social media, media and press advertising); however, this did not result in a significant reduction in demand and the supplies were still stretched. Due to the prolonged dry period, it was envisaged that it would take significant levels of rainfall to recharge the water sources in these areas, therefore a Water Conservation order was imposed on 30 supplies in the WCA to allow our supplies to replenish.

As climate change continues droughts are expected to become more frequent[29]. 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.

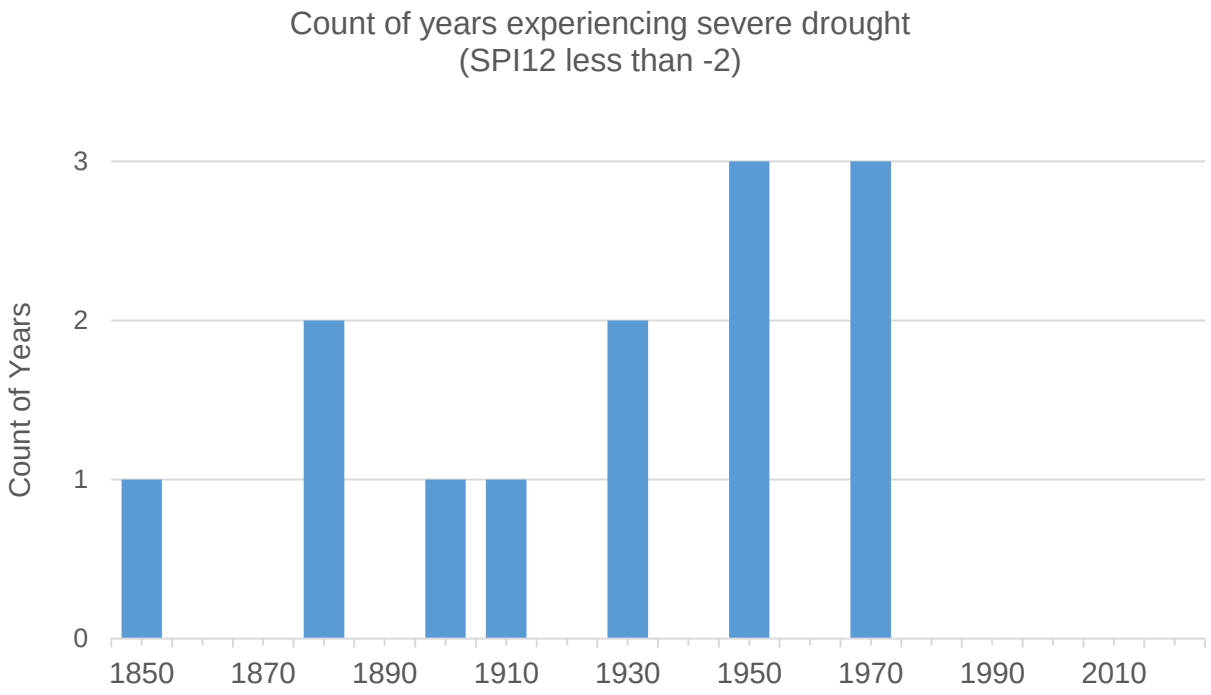


Figure 2.19 Number of Events of Severe Drought (The 12-month Standard Precipitation Index = -2)*

*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 2.5 – 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 Irish Water 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 (DHLGH), 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 and support our operational management with:

- 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[29,30], 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[31].

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 West Region. Areas adjacent to River Lee in Tralee, adjacent to River Feale near Listowel and River Blackwater from Fermoy, through Mallow as far as Rathmore are considered to have high probability (10% Annual Exceedance Probability (AEP)) of fluvial flooding. River Feale near Listowel as well as areas adjacent to River Laurne and Caragh Lough are considered to have high probability of both coastal and fluvial flooding, as are some of the smaller estuaries.

As well as considering surface water flooding, there are ongoing efforts to better understand the role of karst groundwater systems in flooding within the Flood Risk topic[32].

Guidelines for Planning Authorities on flood risk management (November 2009)[33] highlight that flooding of the water supply network (this includes pumping stations; electricity substations and water treatment works) can result in a loss of supply over large areas and magnify the effects of flooding beyond the immediate community directly affected. Irish Water has considered the number of water treatment plants (WTPs) within areas of flood risk, where vulnerability to the effects of flooding need to be considered (Table 2.6). Twenty-six (26) of the 227 WTPs in the region have a 10% chance of flooding in any year. The WTPs that are known to be at risk, are under review and where needed, protection measures will be considered for sites at risk. All new 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 2.6 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[34]	1	2
Pluvial Flooding[34]	24	25
Coastal Flooding[34]	1	1
Groundwater Flooding[34,35]	0	0

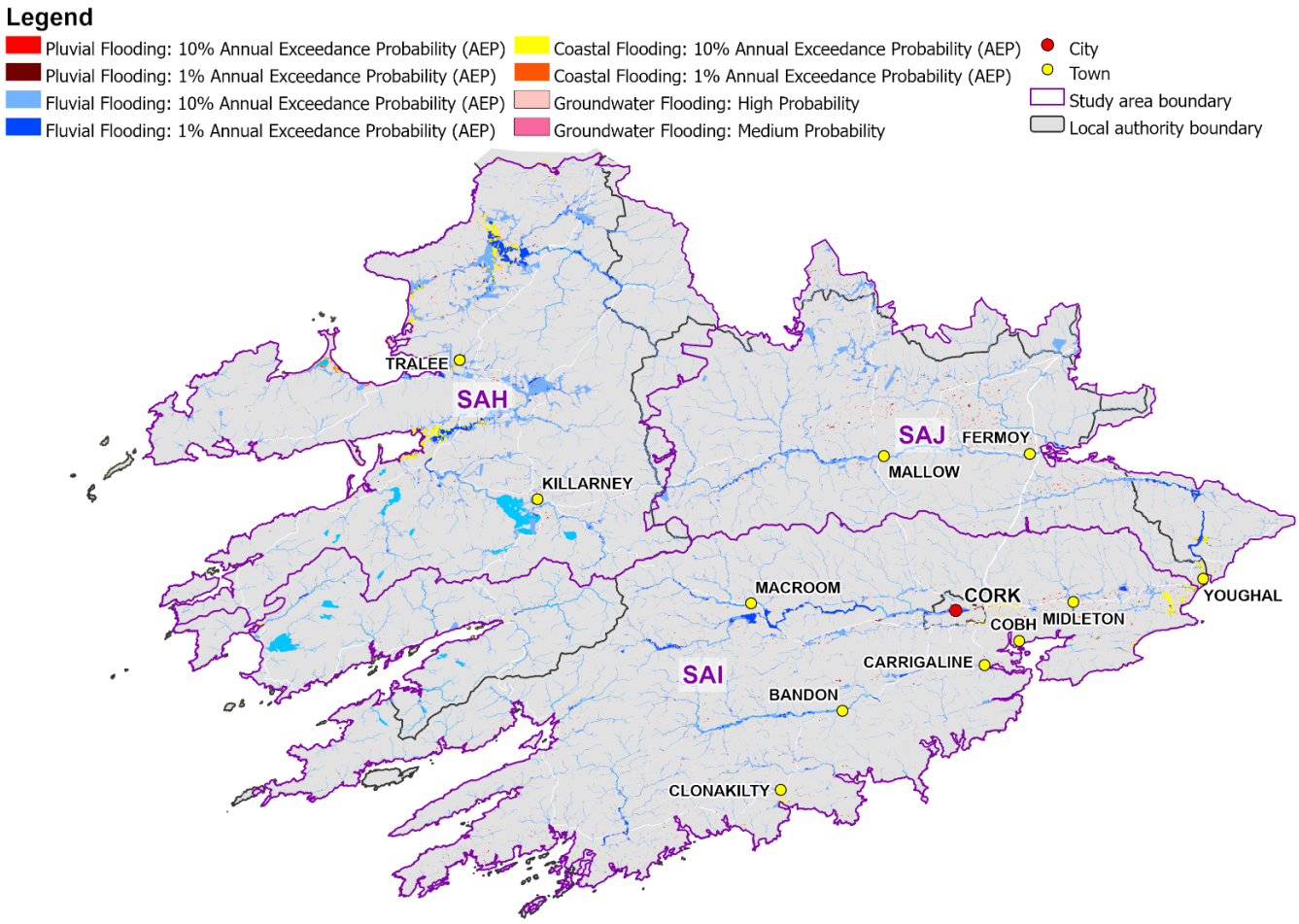


Figure 2.20 Surface Water and Groundwater Flooding

2.4.4 Water Supply Systems

The water supply systems across the South West Region draw from 247 sources (Table 2.7) and are treated in 227 Water Treatment Plants (WTPs). Although the majority of our water supply sources are groundwater (172), surface water sources (75) supply 81% of the total volume of water delivered to our customers, either from rivers or lakes.

Most of the water supplies for SAH (Kerry) and SAI (Cork/South Kerry) are abstracted from a few large surface water sources. The highest volume abstraction in SAH is from the Lough Guitane source within the upper Laune catchment, which represents 50% of the Water Available for Use (WAFU) for the Study Area in a normal year (WAFU is further explained in Section 3.2.1 of this Plan). This abstraction supplies the Kerry Central Regional Water Supply Scheme which serves the communities of Tralee, Killarney, Castleisland and Castlemaine. Fifty-five percent (55%) of the total WAFU in SAI comes from two (2) large abstractions from the River Lee source in SAI: an intake from the Inniscarra Reservoir supplying Inniscarra WTP (the third largest plant in the country with a capacity of 90,000 Ml/d feeding Cork City and surrounding suburbs); and a direct river abstraction further downstream from the River Lee, feeding Lee Road WTP at Cork City. Approximately a quarter of the water supplies for SAJ come from six (6) surface water sources within the Blackwater catchment. The largest is on the main River Blackwater channel to supply the Fermoy WRZ.

Groundwater supplies make up the dominant abstraction in SAJ, where groundwater in North Cork provides over 30,000 m^3/day via public water supplies (not counting private wells and group water schemes)[36]. Overall, 172 groundwater sources are managed by Irish Water across the South West Region, with the majority of the smaller abstractions taking place from the sandstones, producing yields

averaging 120 – 350 m^3/day. The higher abstraction volumes generally take place in the karst, with a number of large springs issuing from bedding planes marking a change in lithology. These springs can at times provide very large overflows, and under the Geological Survey Ireland (GSI) classification scheme, would be regarded as large springs (>2160 m^3/day).

Table 2.7 Number of Water Sources in RWRP-SW

Study Area	No. Of WRZs	No. Of WTPs	Total Network Length* (km)	Water Sources		
				Total	Surface Water	Groundwater
SAH	23	46	2,480	57	26	31
SAI	89	102	3,775	110	44	66
SAJ	62	79	1,670	80	5	75
TOTAL	**174**	**227**	**7,925**	**247**	**75**	**172**

* 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 to 1.6 ^oC 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 to 2.4^oC[37]. The projected increase in temperature will affect the amount, timing and intensity of local precipitation. In Ireland, this is expected to mean wetter winters but also drier springs and summers. Climate change simulations for Ireland show the precipitation in the autumn and winter months could increase by between 5% to 35%, while summer precipitation could decrease by a range of 0% to 30%. Under the medium to high carbon emissions scenarios dry periods are projected to increase in frequency, duration and/or magnitude from between 12% to 40% for the spring and summer months[38].

The historical analysis of average rainfall data undertaken by Murphy (2020)[39] confirms a continued trend of drier summers and wetter winters. The recent report, 'The Status of Ireland's Climate 2020[30], published by the Environmental Protection Agency, Met Éirean 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 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. For the South West region, Cork City and surrounds, which is located in the south east of the region, is likely to experience an increase in drought conditions that will impact water availability. The increased threat of flooding across the region can also impact water availability if the drawdown of catchment reservoirs is required to increase flood capacity as this can lead to a reduction in available supplies for the following spring/summer.

The Climate Change Sectoral Adaptation Plan for Water Quality and Water Services Infrastructure[38], 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)

Irish Water 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 West 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 five (5) catchment sensitivity types as described in Box 2.6. In the South West Region, many of the catchments are characterised as types (b) and (c) which have lower natural water storage and see the greatest decrease in flow due to wetter winters and drier summers. These include the Blackwater catchment in SAJ, the eastern catchments of SAH (including the Laune River catchment) and the Bandon and Lee catchments within SAI. There are small areas in the northern part of SAI that are characterised as type (d) which is most sensitive to changes in the annual mean precipitation.

Box 2.6 - 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.

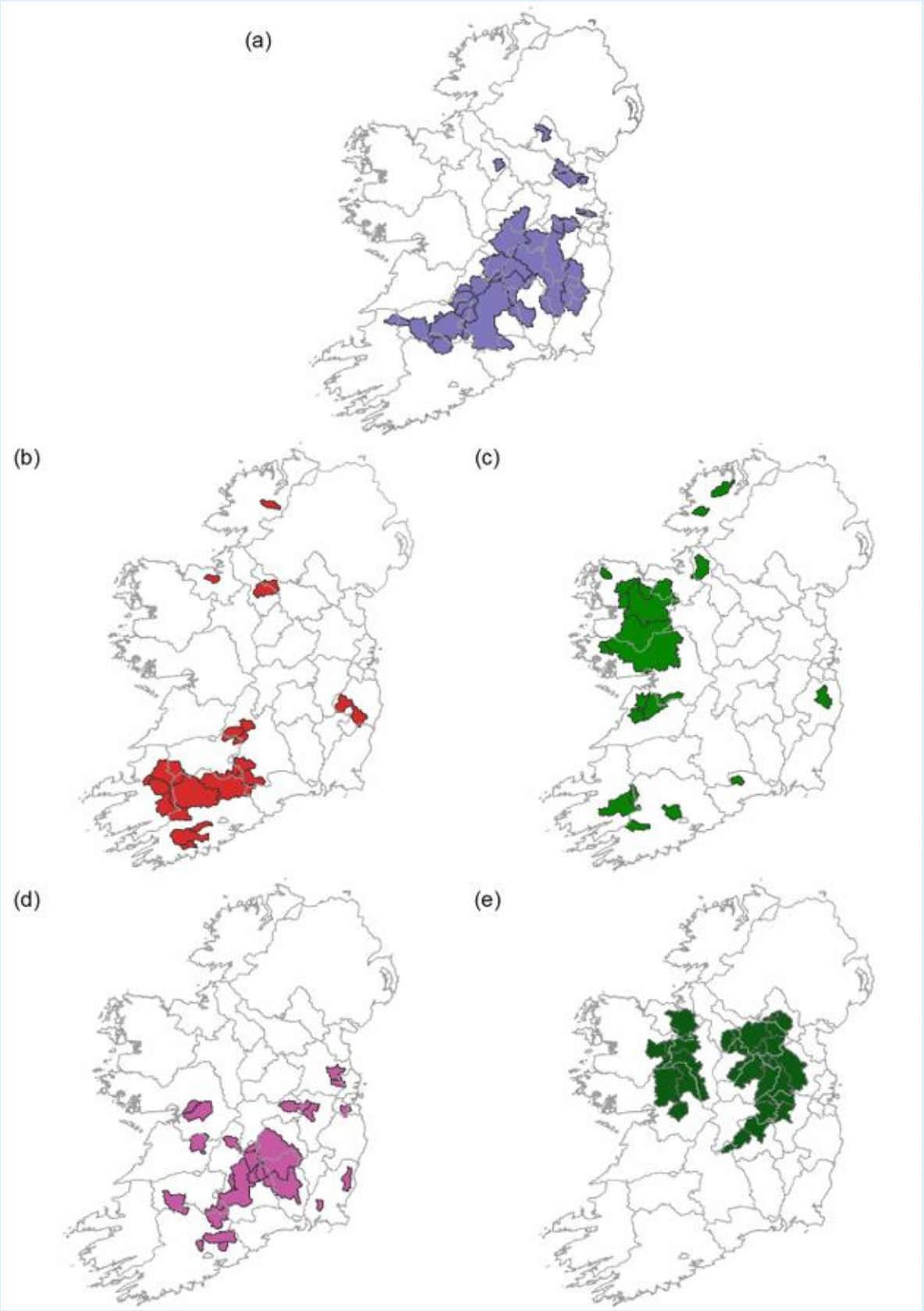
The traditional methodology to identify and assess catchments vulnerable to climate change takes a 'top down' approach, which applies information about large-scale climate change trends to small areas. This can result in inaccurate forecasting for catchments because it does not take area-specific information 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 2.6 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 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.

Section 15 of the Climate Action and Low Carbon Development Act 2015 (as amended in 2021)[40] sets a new "national climate objective" for Ireland, which provides that "The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy". The amended Act requires public authorities, including Irish Water, 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)[41] 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. The CAP 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.

Irish Water 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.

Irish Water is committed to reducing energy consumption through a range of energy initiatives, including asset replacement and the commencement of sustainable energy pilots at two (2) 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.

Irish Water 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 replacement of inefficient pumps across our water supply infrastructure, see Box 2.7.

We have also developed and published a Biodiversity Action Plan (BAP)[26] 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 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, see Section 6, 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 and the use of innovative technology to reduce energy demand.

Box 2.7 - Pump Replacement

Irish Water has completed a national review of pumps across our infrastructure to identify energy inefficient assets and created a programme of works to replace these pumps. This has led to a reduction in operating costs and carbon emissions. The table below provides an overview of sites in the South West Region where pumps have been replaced recently and provides details of the annual kilowatt-hour (kWh) reduction achieved.

Site	Annual Energy Reduction
Carrs Hill Pump Station (PS)	352,718 kWh
Dromore PS, Mallow	232,892 kWh
Doneraile/Shanballymore PS	264,433 kWh
Freemount WTP	185,757 kWh
Baxters Br. PS, Bandon	150,985 kWh

2.5 Summary

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

Population and Growth

- Irish Water supplies around 887 million litres of water per day to a population of 594,400 people (14% of the national population) and 45,000 businesses in the South West Region. Almost 48% of the regional population is located within Cork City.
- The overall regional population growth is 33% from 2019 to 2044. All Study Areas in the South West region have a projected growth rate that exceeds the 12% national rate observed in the 10-year period from 2006 to 2016. The Cork and South Kerry SA (SAI) has the highest projected growth rate at 40%, which is driven by the Cork City forecast growth of 54%, by 2040.

Natural Resources and Environmental Pressures

- In the South West Region there are 104 lakes covering approximately 0.5 % of the region's land area (740 square kilometres) with five (5) lakes making up ~60% of the area - Lough Leane, Lough Currane, Lough Carrigdrohid, Lough Carragh and Lough Inniscarra. The larger known rivers within this region include the Lee, the Laune, the Feale, the Bandon, the Blackwater, the Maine, the Roughty and the Funshion; however, they represent only a fraction of the extensive 14,770 km network currently mapped by the EPA in the region.
- 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 84% of the main river water bodies in the region.
- Across the region, just under 50% of surface water bodies (SWBs) are at 'High' or 'Good' status, while 36 SWBs are classified as Moderate or below Status, representing about 5% of the total SWBs in the region.
- Four (4) of the 70 groundwater bodies (GWBs) are currently at 'poor' Chemical Status. The remaining 66 GWBs are currently assessed at 'good' overall WFD status.
- The 2013 – 2018 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. Twenty-four percent (24%) of our river water bodies, 11% of our lake water bodies and 20% of our groundwater bodies are currently 'At Risk' with the predominant pressure being agriculture.
- In developing our Planned 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 54 sites which we consider 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 288 nationally and internationally designated sites listed in the South West Region. Protected sites with the greatest coverage in the region include the Killarney National Park, Macgillycuddy's Reeks and Caragh River catchment SAC and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

Water Resources and Existing Challenges

- Surface water abstractions make up 81% of the water delivered to customers in the South West region, with the remaining 19% being supplied from groundwater sources.
- Most of the region experiences average annual rainfall between 1,400 and 1,600 mm per year. In comparison, Counties Dublin and Kildare (located in the Eastern and Midlands Region of the NWRP) experience the driest weather across the country with average annual rainfall of less than 800 mm. The high elevation areas on the Invaragh and Dingle Peninsulas, where the Carrantuohill and Brandon Mountains are located respectively, experience an average annual rainfall of up to 3,600 mm. The lower rainfall areas, averaging between 1,000 mm and 1,200 mm, occur in the south east (including Cork city and surrounding suburbs) and north east of the Study Area.
- 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

- Irish Water is implementing Nature Based Solutions within the South West Region. Some of these include; integrated constructed wetlands in Lixnaw, County Kerry; and the establishment of 5.27 hectares of riparian woodland at our water treatment plant site at Lough Guitane providing source protection, a carbon sink and biodiversity enhancement. 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 2021 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 circular economy.

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