Southend-on-Sea City Council

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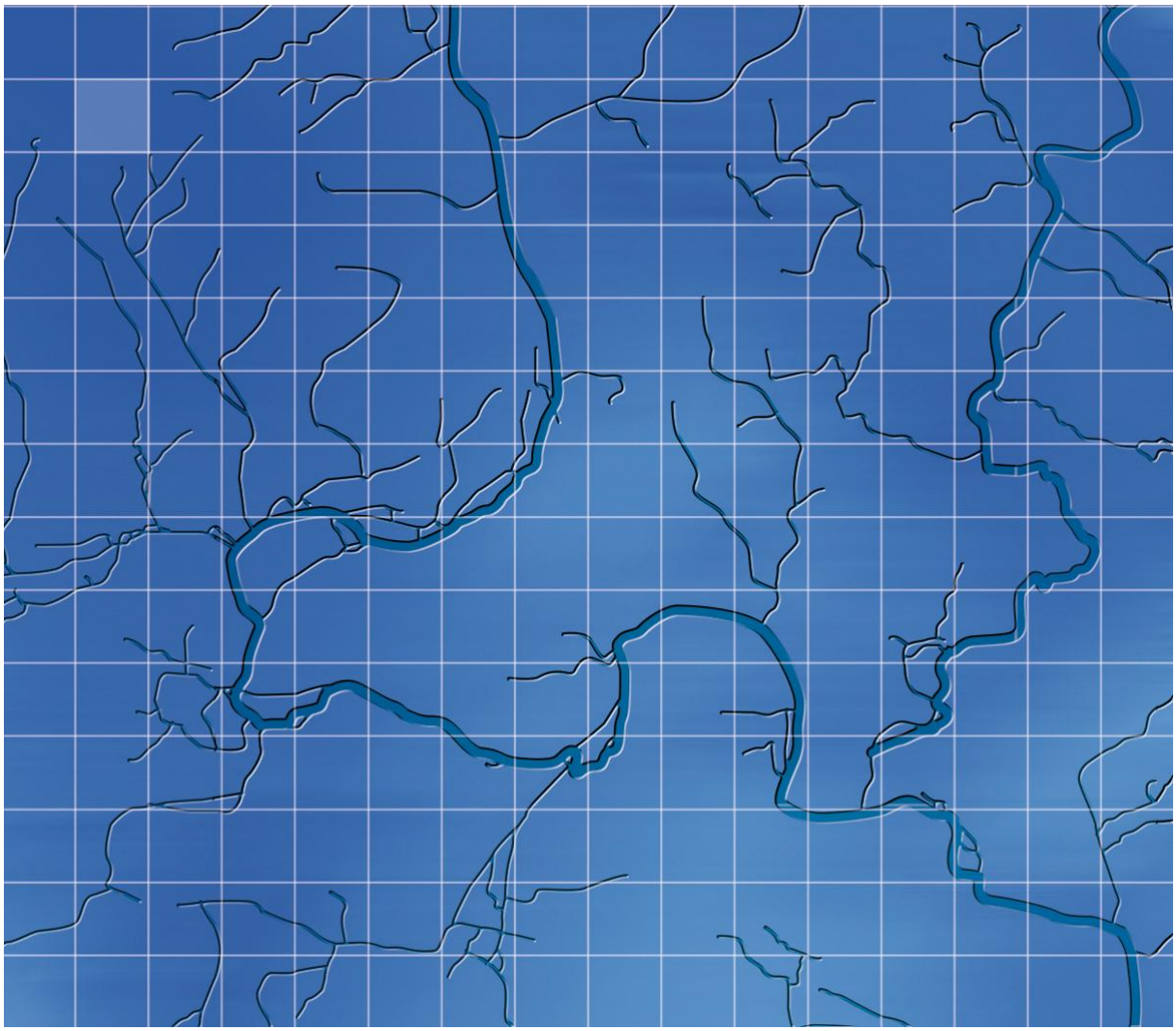
Southend-on-Sea
Water Cycle Study Report



Southend-on-Sea City Council

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Water Cycle Study Report

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WHS10277

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For and on behalf of Wallingford HydroSolutions Ltd.

The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

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Non-Technical Summary

Introduction

Wallingford HydroSolutions (WHS) has been commissioned by Southend-on-Sea City Council to undertake a Water Cycle Study to support the Council's emerging Local Plan 2025–2045.

The study reviews the capacity of water resources and wastewater infrastructure within the city, alongside the environmental capacity of the receiving water environment. It draws on information and data provided by stakeholders, supplemented by technical analysis, including headroom assessments and load standstill calculations for Water Recycling Centres (WRCs) that may be affected by development proposed through the Local Plan.

The study will form part of the evidence base for the Local Plan and will inform policies and infrastructure requirements needed to support the delivery of sustainable future development.

Development and the Water Cycle

New development requires a reliable clean water supply, the safe collection and treatment of wastewater, and appropriate measures to manage flood risk.

Development increases demand for clean water and has the potential to increase flows entering the sewer network and downstream WRCs. The allocation of development in certain locations may result in existing infrastructure capacity being exceeded, potentially leading to service failures, adverse impacts on the water environment and significant infrastructure upgrade costs. Strategic planning for water supply and wastewater infrastructure is therefore essential.

Effective engagement between the local authorities, developers, Anglian Water as the sewerage undertaker, and Essex and Suffolk Water as the water supplier is important to ensure that infrastructure requirements are identified and addressed at an early stage.

Once development is brought forward, Anglian Water and Essex and Suffolk Water are responsible for ensuring that their respective infrastructure is upgraded where necessary so that development can proceed without presenting an unacceptable risk to the environment.

The Environment Agency (EA) regulates sewage discharges through Environmental Permits, which establish permitted effluent quality standards for a range of parameters to protect the receiving environment. In relation to water supply, the EA regulates abstraction from rivers, lakes, groundwater and other sources through abstraction licences. Anglian Water and Essex and Suffolk Water are responsible for ensuring compliance with these permits and licenses.

Where insufficient treatment headroom exists at WRCs, increased flows can place pressure on treatment processes and may require investment to ensure compliance with permitted discharge conditions. A lack of headroom at a WRC can also place additional pressure on the upstream sewer network, potentially increasing the frequency of untreated discharges through Combined Sewer Overflows (CSOs).

Discharges from WRCs and CSOs can present risks to water quality, including through increased concentrations or loads of ammonia, biochemical oxygen demand (BOD) and phosphorus, potentially affecting the health of receiving waterbodies.

Development can also increase water demand and associated abstraction from rivers and groundwater sources. Increased abstraction can affect local water environments. Where abstraction exceeds sustainable levels, reduced river flows, increased water temperatures and higher concentrations of pollutants can occur, potentially affecting fish, plants and other aquatic wildlife.

The Water Framework Directive (WFD)[1] seeks to protect and enhance surface waters, including rivers and other watercourses. It assigns waterbodies an overall ecological and chemical status based on a range of indicators. Development and other activities should not result in deterioration of the existing status of a waterbody, either overall or for individual quality elements.

The National Planning Policy Framework (NPPF)[2] requires planning policies and decisions to contribute to and enhance the natural and local environment. This includes preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of water pollution. Where possible, development should also contribute to improvements in local environmental conditions, including water quality, taking account of relevant information such as river basin management plans implementing the WFD.

The NPPF also requires strategic policies to make adequate provision for water supply and wastewater infrastructure to support planned development.

Water Resources and Supply

The study assesses future water demand arising from development in Southend against Essex and Suffolk Water's latest 2024 Water Resources Management Plan (WRMP), considering three population and development growth scenarios:

- **Lower growth:** 9,800 dwellings, comprising Local Plan development within Southend's existing urban area.
- **Medium growth:** 14,700 dwellings, including an additional urban extension to the north of the city.
- **Upper growth:** 28,100 dwellings, reflecting the Government's housing target based on the standard methodology. This scenario is not considered achievable, as the Local Plan evidence indicates that Southend does not have sufficient land to accommodate this level of housing need.

The WRMP considers water supply and demand over 2025–2075, including climate change, future development and potential water resource options. Southend is wholly located within the Essex Water Resource Zone (WRZ), wider network pressures and cumulative development have also been considered.

The study also reviews higher water-efficiency standards for residential and non-residential development and the current and likely future abstraction strategy for the area.

Findings

- Essex and Suffolk Water's latest WRMP indicates that, without intervention, water supply deficits could arise within the Essex WRZ up to 2045 and beyond.
- Short- to medium-term deficits are expected to be managed through demand-reduction measures, including leakage reduction, smart metering and improved water efficiency.
- While these measures should reduce forecast deficits, additional supply-side schemes are likely to be required over the longer term.

[1] European Commission, *Water Framework Directive (2000)*, http://ec.europa.eu/environment/water/water-framework/index_en.html

[2] Ministry of Housing, Communities and Local Government (2026) *National Planning Policy Framework* https://www.gov.uk/government/publications/national-planning-policy-framework--2

- Essex and Suffolk Water is planning to invest £1 billion over five years (2025–2030) to upgrade water networks and treatment facilities and improve supply resilience across Essex and Suffolk. Major projects within Essex include investment in water treatment, storage and long-term resource management.
- Future supply schemes beyond 2030 are proposed at a strategic scale and will require significant lead-in times.
- Essex and Suffolk Water's forecasts are generally above the lower and medium growth scenarios proposed by Southend-on-Sea City Council, although the District Metering Area forecast is slightly below the medium scenario.
- Overall, the forecasts appear capable of accommodating Southend's anticipated growth. Under the medium scenario, however, development phasing may need to be considered to ensure that any required infrastructure can be delivered in time. Mitigations such as water re-use, rainfall harvesting and grey water schemes should also be prioritised.
- Under the upper growth scenario, which reflects the Government's housing target but is not being proposed by the Council, growth would be substantially higher than Essex and Suffolk Water's current forecasts and could create additional unforeseen demands on water supply infrastructure.
- Existing abstractions within the city are mainly associated with agricultural and amenity uses and are considered to have a limited impact on water resources relative to public water supply abstractions.
- Additional abstraction for public water supply may be required in future, depending on growth, climate change and the effectiveness of WRMP measures.
- The assessment is subject to uncertainty, particularly regarding: (i) the extent to which WRZ-level forecasts reflect conditions within Southend; and (ii) the effects of development on the local water supply network.
- Further technical work will be required to refine Southend-specific forecasts and quantify future supply-demand deficits. Future WRMP updates scheduled for 2029 should help address this by incorporating more recent Local Plan evidence.
- Essex and Suffolk Water is best placed to assess future supply and demand impacts and infrastructure requirements, with network upgrades requiring further assessment as individual development sites progress through the planning process.

Recommendations

- Essex and Suffolk Water should continue to provide and upgrade water supply infrastructure to support new development without presenting an unacceptable environmental risk.
- Essex and Suffolk Water should take account of development identified through the Local Plan when preparing its forthcoming WRMP2029.
- The EA should review and provide feedback on WRMP2029, ensuring that future water needs are appropriately addressed and that Southend has access to a secure and sustainable water supply.
- The EA should continue to regulate abstraction from rivers, groundwater and other sources, ensuring that abstraction remains sustainable and within permitted limits.

- Southend-on-Sea City Council should work collaboratively with Essex and Suffolk Water to discuss sites being brought forward, including development profiles and anticipated delivery timescales.
- Developers should engage with Essex and Suffolk Water as early as possible to enable modelled impact assessments and identify any required water supply upgrades and delivery timescales. Pre-planning enquiries are encouraged.
- Where strategic infrastructure upgrades are required, consideration should be given to phasing some dwellings towards the later part of the plan period, particularly for larger developments exceeding 500 dwellings.
- The Council should consider a policy on water-efficient design, recommending a consumption target of 100 litres per person per day (l/p/d) by 2030, reducing to 80 l/p/d by 2035. For non-household development, a minimum of three credits under the BREEAM New Construction Standard measure "Wat01" is recommended.
- The Council should provide Essex and Suffolk Water with its Annual Monitoring Reports and Housing Land Supply Statements, setting out projected housing development within the administrative area.

Wastewater Infrastructure, Water Quality and Environmental Capacity

The Water Cycle Study assesses wastewater infrastructure and the environmental capacity of receiving watercourses in the context of proposed development and climate change. It reviews information provided by Anglian Water and the EA to identify infrastructure constraints, alongside catchment data to assess water quality and ecological trends. Key areas of risk and high-level measures to protect and enhance water quality have been identified.

A headroom assessment has been undertaken for all WRCs that may be affected by development proposed through the Local Plan, including Southend WRC and Rochford WRC. The assessment considers the lower, medium and upper growth scenarios and determines whether the WRCs are expected to have sufficient headroom, under their current permits, to accommodate predicted additional wastewater flows through to 2045.

Load standstill calculations have also been undertaken for Southend WRC and Rochford WRC. These consider forecast changes in flow identified through the headroom assessments and the resulting implications for pollutant loads and discharge permits.

Findings

- The sewer network and Southend WRC currently serve more than 201,653 people, with demand expected to increase as the population grows.
- The headroom assessment for Southend WRC indicates that it is forecast to have sufficient treatment capacity throughout the plan period under all growth scenarios assessed.
- The headroom assessment for Rochford WRC indicates that its permitted Dry Weather Flow (DWF) is forecast to be exceeded by the end of the plan period, although this is largely driven by growth within Rochford District.
- The only Local Plan site expected to drain to Rochford WRC is Airport Business Park (EA051), which is anticipated to be substantially completed before capacity constraints arise, and is situated outside the administrative boundary of Southend.

- Watercourses across the study area currently have Moderate ecological status and Fail chemical status, indicating limited environmental capacity to accommodate additional pressures from development.
- Load standstill calculations indicate that future growth could increase pollutant loads at both Southend and Rochford WRCs beyond current permitted levels, potentially affecting WFD objectives if not appropriately managed.
- The wastewater treatment improvements required to accommodate future growth are considered technically achievable but will require advance planning, investment and permitting.
- CSOs are an existing issue within the city. Many discharge to the Thames Estuary, which includes protected bathing waters at this location, and some CSOs are reported to spill frequently.
- Anglian Water is working with Southend-on-Sea City Council and has invested £90 million in a sustainable drainage (SuDS) scheme to reduce CSO spills and sewer flooding.
- The EA is also supporting schemes at Marine Parade and Silverdale Road to retrofit drainage measures and smart rainwater-harvesting assets, respectively.
- It should be recognised that infrastructure upgrades can take several years to plan, consent and deliver, making early planning and stakeholder engagement essential.
- Existing Council policies already support the protection and enhancement of water quality and the alignment of development with wastewater infrastructure provision.

Actions and Recommendations

- Development should be phased in consultation with Anglian Water and Rochford District Council where wastewater capacity constraints may arise.
- WRC capacity and discharge permit limits should be considered when planning larger developments, particularly those exceeding 500 dwellings.
- The Council should provide Anglian Water with Annual Monitoring Reports and information on major development proposals.
- The Water Cycle Study should be shared with neighbouring authorities, Anglian Water and the EA.
- SuDS and sewer separation should be promoted where appropriate.
- Opportunities to retrofit SuDS within existing developed areas should be explored to reduce current pressures on sewerage infrastructure.
- The Council should prioritise greening the city through landscaping and tree planting to create a connected network of green spaces and corridors that provide nature-based solutions to urban drainage.
- Early engagement between developers and Anglian Water should be encouraged to identify infrastructure requirements and delivery timescales.
- Anglian Water should incorporate projected growth into its wastewater planning and progress any required permits and infrastructure upgrades in advance of development.

- The EA should continue to ensure that environmental permits support sustainable growth while protecting water quality.

Flood Risk

A high-level review of flood risk in Southend has been undertaken, focusing on the potential impacts of future development.

- Development has the potential to affect a range of flood mechanisms, including fluvial, surface water and sewer flooding.
- The impact of development on flood risk, and the impact of flood risk on development, can be reduced by applying the Sequential and Exception Tests set out in the NPPF and ensuring that development follows relevant SuDS guidance.
- At the site-specific level, SuDS should be incorporated at all development sites. Ground raising and compensatory storage may also be required where sites are at risk of flooding.
- Necessary local sewer upgrades should be delivered prior to occupation where required, helping to reduce the risk of increased surface water and sewer flooding.
- The flood risk assessment undertaken as part of this study is high level. Specific sewer network upgrades required to accommodate development are likely to require further technical assessment by Anglian Water in collaboration with developers as sites progress through the planning process.
- Developers should follow national and local standards and guidance relating to flood risk, including the NPPF, EA guidance, Lead Local Flood Authority (LLFA) guidance and relevant environmental guidance within Essex.
- The Strategic Flood Risk Assessment (SFRA) supporting the Local Plan will provide a more detailed assessment of fluvial and surface water flood risk constraints at each development site where there is a medium or high risk of flooding.

Other Environmental Constraints

Other relevant environmental constraints have been identified through consultation with the Council and EA during the early stages of the project. These principally relate to protected sites, designated habitats and odour.

- The city includes a number of protected sites and designated habitats which present constraints to development in certain areas. This includes SACs, SPAs, SSSIs, Shellfish Waters, Bathing Waters and Seagrass Meadows.
- At this stage, this study has identified the main environmental constraints with respect to protected sites. Further work at the planning application stage including Environmental Impact Assessments (EIAs) and Habitat Regulations Assessments (HRAs) may be required to determine impacts on specific designated sites and any required mitigation.
- In terms of odour risk, some of the sites proposed in the local plan encroach on land close to the Southend WRC. For the sites identified where odour risk could be a concern, developers should contact Anglian Water prior to submitting a planning application.
- Developers should follow national and local environmental standards and guidance. This includes the NPPF, EA guidance, LLFA guidance and wider environmental guidance from other stakeholders in the Essex area.

Contents

Glossary

90th Percentile (90thO%ile)	The 90th percentile is a value that's greater than 90% of the numbers in a set. It is a useful statistic for measuring performance data and identifying anomalies.
95th Percentile (95thO%ile)	The 95th percentile is a value that's greater than 95% of the numbers in a set. It is a useful statistic for measuring performance data and identifying anomalies.
Abstraction licence	Authorisation granted by the Environment Agency to allow the removal of water from a source.
Ammonia	Ammonia is an inorganic chemical compound of nitrogen and hydrogen with the formula NH_3. It is used as a fertilizer, cleaning product and in the production of plastics. Sewage is also a source of ammonia.
Assessment Point (AP)	A significant point on a river, often where two major rivers join or at a gauging station.
Asset Management Period (AMP)	The AMP sets the framework for how water companies manage their assets, deliver services to customers, and invest in infrastructure over a five-year period. The AMP is regulated by Ofwat, the Water Services Regulation Authority in England and Wales. AMP 7 ran from 2020-2025, AMP8 runs from 2025-2030.
Biochemical Oxygen Demand (BOD)	BOD is a measure of how much oxygen is used to break down organic matter in water. It is an important indicator of water quality and organic pollution. A high BOD indicates that there is more organic pollution in the water. BOD is used to measure the level of organic pollution in wastewater before it's released to a watercourse.
Combined Sewer Overflows (CSOs)	Many parts of England have a combined sewage system with clean rainwater and wastewater conveyed in the same pipe. During heavy rainfall the capacity of these pipes can be exceeded, which means possible backing up of the system and inundation of Water Recycling Centres (WRCs) downstream. CSOs were developed as overflow valves to reduce the risk of sewage backing up during heavy rainfall. They are a necessary part of the sewer system but where they regularly spill it can indicate underlying issues with the sewer system's condition and capacity.
Compliance Assessment Report (CAR)	A written report compiled by Environment Agency officers when assessing compliance with an environmental permit. The CAR is used to record the findings of the EA's site inspections, audits and monitoring activities. It also includes reviews of monitoring and other data/reports.
Deployable Output (DO)	The reliable output of an active source, or group of sources, or of a bulk supply of water, which is constrained by: environment; licence, if applicable; pumping plant and/or well/aquifer properties; raw water mains and/or aquifers; transfer and/or output main; treatment; water quality.
DG5 Sewer Flooding	Director General 5 (DG5) is a measure established by Ofwat to monitor the number of properties at risk of flooding from sewers. The DG5 register, produced by water companies, contains information of properties that have been flooded internally and externally by sewage or are considered to be at risk from flooding in the future.
Discharge Permit	An environmental permit granted by the Environment Agency to discharge liquid effluent or waste water to a surface water or the groundwater body.

District Metering Area (DMA)	A DMA is a discrete area of the water distribution network that can be isolated by closing valves so that the quantities of water entering and leaving the area can be metered. The volume of water into and out of the DMA is measured by a district meter. The purpose of a DMA is to divide each WRZ into manageable sections to detect and determine the location of burst mains, calculate the level of leakage in each DMA and compare DMAs so that activities can be targeted to where they will have the greatest impact in reducing leakage.
Drainage and Wastewater Plan (DWMP)	Strategic plans where wastewater companies take a company-wide approach to managing their wastewater and drainage assets. DWMPs look at current and future capacity, pressures, and risks to their networks such as climate change and population growth over a 25-year period.
Drought Order	A drought order is a legal instrument in the UK used during exceptional water shortages to manage resources, allowing water companies to take more water from the environment or restrict non-essential water usage. They are granted by DEFRA. Relative to a drought permit, orders are broader, enabling stricter demand restrictions and covering more complex environmental or third-party impacts.
Drought Permit	An authorisation granted by the Environment Agency under drought conditions, which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis. Permits allow quicker, simpler changes to abstraction licences relative to wider reaching drought orders.
Dry Weather Flow (DWF)	DWF is the average daily flow to a WRC during a period without rain. The EA sets limits on the quality and quantity of treated effluent from a WRC so that the WRC do not cause an unacceptable impact on the environment. The flow that may be discharged in dry weather is one of these limits.
Dry Year Annual Average (DYAA)	The annual average value of water demand, deployable output or some other quantity over the course of a dry year.
Dry Year Critical Period (DYCP)	The water demand, deployable output or some other quantity during the time in a dry year when demand is greatest, often termed the peak week. Also commonly known as the summer peak period.
Environment Agency (EA)	The Environment Agency (EA) is a non-departmental public body, established in 1996 and sponsored by the UK government's Department for Environment, Food and Rural Affairs (DEFRA). Their responsibilities include water quality and resources, fisheries, inland river, estuary and harbour navigations, conservation and ecology, regulating major industry and waste, treatment of contaminated land and managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.
Environmental Destination	The EA's "Environmental Destination" for water resources is a long-term (2050) strategy in England designed to restore and protect the water environment by quantifying necessary changes to water abstraction. It calculates how much water usage must be reduced to ensure a sustainable, healthy environment for ecosystems, factoring in climate change and future population growth.
Environmental Impact Assessment (EIA)	EIA is a tool used to assess the significant effects of a project or development proposal on the environment.
Flood Zone 1	Areas situated in Flood Zone 1 have a low probability of flooding, with less than a 0.1% probability of river or sea flooding.

Flood Zone 2	Areas situated in Flood Zone 2 have a medium probability of flooding and have an annual probability of river flooding between 1.0% and 0.1% or an annual probability of sea flooding between 0.5% and 0.1%.
Flood Zone 3a	Areas situated in Flood zone 3a have a high probability of flooding, with a 1% or greater annual probability of river flooding or a 0.5% or greater annual probability of sea flooding.
Flood Zone 3b	The functional floodplain. This is where water from rivers or the sea has to flow or be stored in times of flood. Local authorities should identify areas of functional floodplain in their Strategic Flood Risk Assessment.
Flow to Full Treatment (FFT)	A measure of how much wastewater a treatment works must be able to treat at any time. All WRCs are built to be able to deal with a certain amount of wastewater, calculated depending on the area they serve, and many have a requirement in their environmental permit about the FFT level they must work to.
Good Ecological Potential (GEP)	GEP is the ecological quality that can be achieved in the affected water bodies without a significant adverse impact on the benefits provided by the uses or a significant adverse impact on the wider environment.
Groundwater Infiltration	Groundwater infiltration occurs when groundwater finds its way into the underground water and sewerage system. Small leaks, openings, defective joints and cracks are the main causes for infiltration.
Habitat Regulations Assessment (HRA)	A HRA is a process that determines whether development plans could negatively impact local plans on a recognised protected European site.
Hands off flow (HoF)	A condition attached to an abstraction license which states that if flow (in the river) falls below the level specified on the license, the abstractor will be required to reduce or stop the abstraction.
Headroom (Sewage Treatment)	Headroom refers to the remaining capacity a treatment facility has to process additional wastewater flow. It is measured as the difference between the measured DWF and the consented DWF.
Headroom (Water Resources)	A planning buffer between water supply (Water Available for Use - WAFU) and demand, designed to manage uncertainties like climate change, population growth, and infrastructure outages. Target Headroom is the minimum, risk-based margin water companies plan to maintain to guarantee service levels.
Household (HH) Consumption	Water consumed by household customers.
Leakage	Water that leaks from sewers, water mains and customer supplies pipes.
Load Standstill	An improvement in the quality of effluent, so that extra pollution load will not result in a deterioration in the water quality of the watercourse.
Monte Carlo Simulation	A Monte Carlo simulation is a way to model the probability of different outcomes in a process that cannot easily be predicted due to the intervention of random variables. It involves repeatedly generating random input values within a defined probability distribution to model a complex system and analysing the range of possible outcomes.
Natural Flood Management (NFM)	NFM involves working with nature to reduce the risk of flooding for communities. It uses various techniques to restore or mimic the natural functions of rivers, floodplains and the wider catchment.

Non-Household (NHH) Consumption	Water consumed by businesses.
Olfactometry	Olfactometry is the process of measuring the concentration and intensity of odour. Olfactometry is often used for monitoring wastewater infrastructure, where controlling odorous emissions is important for environmental and health reasons.
Orthophosphate	Orthophosphate is a phosphorus compound. It is commonly used for water treatment.
Price Review (PR)	The price determination process undertaken by Ofwat every five years. Each water and sewerage undertaker submits a business plan covering the five-year period for which Ofwat will determine cost and revenue allowances.
Sewage	Sewage is a subset of wastewater (see definition below), generally referring to the liquid waste from domestic uses including toilets and kitchens.
Sewage Pumping Stations (SPS)	SPS typically move sewage from lower to higher elevations. The stations pump raw sewage and wastewater into pipes transporting the waste to a WRC or other disposal site.
Sewage Treatment Works (STW)-	Sewage treatment works are plants designed to treat and clean sewage and wastewater before it is released into the environment. Treatment typically consists of three phases termed primary, secondary and tertiary water treatment.
Sewerage	The physical infrastructure including the underground network of pipes, pumping stations, manholes, and treatment facilities, used to collect, transport, and process wastewater and surface runoff
Simulation of Catchments (SIMCAT)	SIMCAT is the EA's randomised water quality river model. It is a crucial tool for setting and reviewing discharge permits at a catchment scale and to quantify the source apportionment of both point and diffuse pollutant load within the receiving watercourse. Driven by summary statistics of flow and quality, SIMCAT uses Monte Carlo simulation to predict in-river summary statistics for direct comparison with environmental quality standards.
Site of Specific Scientific Interest (SSSI)	A SSSI is a formal conservation designation. Usually, it describes an area that's of particular interest to science due to the rare species of fauna or flora it contains (Biological SSSI) - or important geological or physiological features that may lie in its boundaries (Geological SSSI).
Smarter Business Visit (SBV)	A location-based business programme that helps customers to fit water-saving devices, identify and potentially fix leaking toilets and fit free urinal controls if practical.
Source Protection Zones (SPZs)	SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.
Special Area of Conservation (SAC)	A site designated as being of special conservation value under the Conservation of Habitats and Species Regulations 2017. It protects one or more special habitats and/or species – terrestrial or marine.
Storm Overflow Assessment Framework (SOAF)	The SOAF written by the Environment Agency sets out how sewer systems comply with current statutory requirements. The framework shows that any overflow reported to exceed the spill frequency thresholds set out in this document should be investigated.
Sustainable Drainage	SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to transport (convey) surface water and slow runoff down (attenuate) before it enters watercourses. They provide areas to store

Systems (SuDS)	water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration).
Sustainability Reductions	Sustainability Reductions are mandatory reductions to a water company's licensed abstraction volumes, set by the EA. These reductions ensure that abstraction levels do not lead to environmental deterioration.
Technically Achievable Limits (TALs)	Technically Achievable Limits (TALs) define the lowest numeric concentration of a given pollutant that conventional wastewater treatment technologies can reliably achieve. In the UK, TALs are central to environmental permits and nutrient neutrality regulations.
Total Phosphorous	Total phosphorus (TP) is the sum of all phosphorus in a sample, including dissolved and particulate forms. I' is a key measurement used to assess water quality and wastewater treatment. Sewage, fertilizer and urban runoff are key sources.
Urban Creep	Urban creep is the increasing density of development, due to extension, paving over of gardens and other permeable areas, which increases the impermeability of developed areas and causes rates and volumes of runoff to rise.
Wastewater	Wastewater is the broad term for water that has been used and requires treatment before returning to the environment. Wastewater includes water discharged from domestic, industrial, commercial, and agricultural activities.
Water Available for Use (WAFU)	The overall amount of water that is available to use. This takes account of the total deployable output minus water lost through planned and unplanned events, sustainability reductions, climate change, water transferred out of a supply area to other companies (exports) and water received from other companies (imports).
Water Framework Directive (WFD)	The Water Framework Directive (WFD) 2000/60/EC is an EU directive to establish a framework for the protection of all water bodies, this was transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The WFD set a programme and timetable for Member States to set up River Basin Management Plans by 2009, which are then periodically updated every 5-years.
Water Recycling Centre (WRC)	This is the term Anglian Water use to refer to Sewage treatment works. They are plants designed to treat and clean sewage and waste water before they are released into the environment. Treatment typically consists of three phases termed primary, secondary and tertiary water treatment.
Water Resource Management Plan (WRMP)	WRMPs set out how water companies intend to achieve a secure supply of water for their customers and a protected and enhanced environment. Water companies in England or Wales, must prepare and maintain a WRMP every 5-years to align with the AMP.
Water Resource Zone (WRZ)	The largest possible zone in which all resources, including external transfers, can be shared and hence, the zone in which all customers will experience the same risk of supply failure from a resource shortfall.
Water Services Regulation Authority (Ofwat)	The Water Services Regulation Authority, or Ofwat, is the body responsible for economic regulation of the privatised water and sewerage industry in England.
Water Trading	An agreement with an existing licence holder to give part or all of their water abstraction right permanently or temporarily.

Water Treatment Works (WTW)	A plant that treats water to a specific standard, often to produce potable water.
Windfall Development	Development not specifically allocated in a development plan but unexpectedly becomes available during the lifetime of a plan.

1 Introduction

1.1 Scope of Assessment

Wallingford HydroSolutions (WHS) has been commissioned by Southend-on-Sea City Council to undertake a water cycle study to support the council's emerging Local Plan 2025-2045.

It reviews the infrastructural capacity of water resources and wastewater infrastructure within the city, alongside the environmental capacity of the receiving water environment. This review draws on available information and data provided by stakeholders, alongside further detailed analyses, including headroom assessments and load standstill calculations for Water Recycling Centres (WRCs) affected by development proposed in the local plan.

The study will form part of the evidence base for the local plan and will inform polices and the infrastructure needed to support the delivery of sustainable future development.

1.2 Water Cycle Study Objectives

Water cycle studies are voluntary studies that consider how strategic plans and development proposals will affect the water environment. The study's objectives include the following:

- Review the Southend-on-Sea City Council extent and amount of proposed development.
- Communicate with key stakeholders including Southend-on-Sea Council, the Environment Agency (EA), Essex County Council, Anglian Water, Essex and Suffolk Water and Natural England.
- Review existing literature and evidence on water resources, water quality, flood risk and other environmental constraints.
- Identify environmental issues, constraints on development and potential solutions based upon this review.
- Determine the quantum of development expected within the Southend and Rochford WRC catchments to 2045.
- Undertake a headroom assessment for each of the WRCs to determine projected changes in flows against permitted levels, identifying where there may be capacity concerns.
- Outline recommendations for future development and actions for regulators to manage projected changes in headroom.
- Undertake load standstill calculations at the Rochford WRC and Southend WRC to assess the potential impact of development on key water quality parameters. These will consider current effluent quality the Technically Achievable Limits (TAL) agreed with the EA
- Outline recommendations for future development and actions for regulators to manage projected changes in water quality.
- Inform wider policy planning requirements based on study's findings.

2 Method Statement

The water cycle study has been completed using national EA guidance on water cycle studies[3]. It has also been guided by the specification provided by and further consultation with the councils.

2.1 Initial Liaison and Data Collation

Development of the water cycle study report has been underpinned by early stakeholder liaison and collaboration. The primary stakeholders identified to inform the study include the EA, Essex County Council, Essex and Suffolk Water who supply water to the city and Anglian Water who manage wastewater in the city. They have been engaged with in order to obtain the datasets required to progress the study and to gain a clear understanding of the water environment and water infrastructure for the city, in addition to the development pressures in neighbouring authorities.

2.2 Data Sources

Following the initial liaison stage the following data sources were used to inform the water cycle study report.

- Essex & Suffolk Water Resources Management Plan 2024[4] and supporting technical reports - To determine future water demand and water resource options across the city.
- Anglian Water (DWMP)[5] 2023 - To determine Anglian Water's future goals with regard to drainage and wastewater infrastructure in the study area.
- Essex Rivers Hub Catchment Plan[6] - To help understand current and future pressures on the water environment and mitigation measures.
- Essex County Council's Water Strategy for Essex 2024[7] - To help understand current and existing pressures on the water environment and mitigation measures.
- Anglian Water WRC Catchments - To identify scale of development in Southend-on-Sea and neighbouring authorities draining to the WRC in the future.
- Southend-on-Sea Infrastructure Delivery Plan[8] – Assessment of water infrastructure in the city.
- Event Duration Monitoring (EDM) Storm Overflows[9] - To assess performance of storm overflows in the city, including information on spill count and spill duration.
- EA Catchment Data Explorer[10] - To review Water Framework Directive (WFD) classifications and objectives for waterbodies falling within Southend.
- EA Abstraction Licenses[11] and Discharge Permits[12] - To gain spatial understanding of current discharges and abstractions to determine future management.

[3] Environment Agency (2021) *Guidance- Water Cycle Studies* https://www.gov.uk/guidance/water-cycle-studies
[4] Essex and Suffolk Water (2024) *Draft Final Water Resources Management Plan 2024* https://www.nwg.co.uk/globalassets/wrmp/nwg/october-24/esw/esw-wrmp24-main-report_final-oct-24.pdf
[5] Anglian Water (2023) *Drainage and Wastewater Management Plan (DWMP)* https://www.anglianwater.co.uk/SysSiteAssets/household/about-us/dwmp/dwmp-1.pdf
[6] Essex Rivers Hub (2025). Catchment Plan. https://www.essexrivershub.org.uk/wp-content/uploads/2025/01/2025_Essex_Rivers_Hub_Catchment_Plan.pdf.
[7] Essex County Council (2024). Water Strategy for Essex. https://www.essex.gov.uk/sites/default/files/2024-03/Water%20Strategy%20for%20Essex%202024.pdf
[8] Arup & DAC Planning (2025). Southend-on-Sea Infrastructure Delivery Plan.
[9] Environment Agency (2026) *Event Duration Monitoring - Storm Overflows – Annual* https://environment.data.gov.uk/dataset/21e15f12-0df8-4bfc-b763-45226c16a8ac
[10] EA. Catchment Data Explorer. https://environment.data.gov.uk/catchment-planning/
[11] EA (2026) Abstractions licences *Abstraction Licences – Abstraction_ Licence_Points.xlsx*
[12] EA (2026) Discharge Permits *Discharge Permits – Discharge_Consents.xlsx*

- EA Fluvial Flood Maps[13]– to quantify fluvial flood risk across the study area.
- EA Surface Water Flood Maps[14] – to quantify the pluvial flood risk across the study area.
- Anglian Water sewer flooding data– to determine risk of sewer flooding based on incidences of sewer flooding.
- Proposed Local Plan Site Allocations[15]- To determine future development and localised demand for water supply and wastewater management in Southend.
- Rochford Call for Sites[16]- To determine additional demand on wastewater assets serving Southend from the neighbouring Rochford district.
- Castle Point Site Allocations[17]- To determine additional demand on wastewater assets serving Southend from the neighbouring Castle Point Borough.
- Anglian Water measured daily flow data for the years 2020-2025[18]- used to estimate Q80 and Q90 flows.
- Anglian Water WRC catchment extent data[19]- to identify development draining to specific WRCs.
- EA discharge permits at each WRC[20]- Used to extract the permitted DWF. These were cross checked with the EA and Anglian Water before undertaking the assessments
- EA Water Quality Explorer[21]- To obtain effluent data for the years 2020-2025 informing load standstill calculations at Southend WRC and Rochford WRC respectively.

2.3 Structure of the Water Cycle Study

The first stage of the study has sought to identify the baseline conditions of the current water environment. Information has been gathered on precipitation, surface water, groundwater, water quality, land use and other relevant factors across the study area.

The development planned and proposed within the city, along with that identified in neighbouring authorities, has subsequently been reviewed. The scale and spatial distribution of committed development in Southend has been established in consultation with Southend-on-Sea City Council. As a result of this consultation three growth scenarios have been considered for the purposes of this study. This includes a lower growth scenario of 9,800 dwellings which includes all local plan development in the existing urban area of Southend and a medium growth scenario of 14,700 dwellings which includes the addition of an urban extension to the north of the city. A third upper growth scenario of 28,100 dwellings is tested, this scenario is not considered achievable but aligns with the government's housing target for the city when estimated using the standard methodology[22]. Further detail on each scenario is provided in section 4.2 of this report.

After establishing the baseline conditions and the quantum of future development, the following four elements have been assessed, forming the basis of the study.

[13] EA (2025) *Flood Map for Planning – Flood Zones* https://environment.data.gov.uk/dataset/04532375-a198-476e-985e-0579a0a11b47
[14] EA (2025) *Risk of Flooding from Surface Water https://environment.data.gov.uk/dataset/b5aaa28d-6eb9-460e-8d6f-43caa71fbe0e*
[15] Southend-on-Sea City Council (2026) *Master Sites Spreadsheet 13-04-2026.xlsx*
[16] Rochford District Council (2026) Call for Sites – Merged_Features.shp
[17] Castle Point Borough Council (2026) CPBC Housing Allo & Broad Locations.xlsx
[18] Anglian Water (2026) *ESAM Q80 Q90 240226.xlxs*
[19] Anglian Water (2026) *STW Catchment Boundaries* - STW Catchment Boundaries
[20] EA (2026) *DWF Permits* - DWF Permits
[21] EA (2026) *Water Quality Explorer* https://environment.data.gov.uk/water-quality
[22] Ministry of Housing, Communities and Local Government, Department for Levelling Up, Housing and Communities (2025) *New Standard Method* lhn-outcome-of-the-new-method.ods

- Water resources and supply
- Wastewater infrastructure, water quality and environmental capacity
- Flood risk
- Other environmental issues

The study has reviewed these four elements in the context of planned and proposed development and climate change. Opportunities to manage future development in the city and protect and enhance the water environment have been identified, alongside any evidence gaps and constraints on development.

In order to gain a deeper understanding of these four elements, as part of liaison with stakeholders key documents have been identified to supplement this water cycle study. These include water company resource management plans, drainage and wastewater management plans, river basin management plans and abstraction licensing strategies.

2.4 Water Resources and Supply

Future water demand has been assessed against Essex and Suffolk Water's latest revised Water Resource Plan (WRMP) published in 2024. In estimating future demand the three growth scenarios for Southend have been considered (see section 4.2 for more detail). The WRMP sets out how Essex and Suffolk Water plan to provide a secure and sustainable supply of water for customers over the next 50 years (2025-2075), thereby incorporating the period being assessed in this study. Southend is entirely located within the Essex Water Resource Zone (WRZ). The plan also considers the whole Essex and Suffolk Water network, which is vital for putting development in the city in the context of cumulative development across other functional catchment areas. Also assessed are the impacts of climate change, the current and future supply and demand position, and potential resource options moving forward.

Essex and Suffolk Water has been consulted throughout the development of this part of the study to confirm their understanding of the resource plan and identify any specific pressures in the study area.

In the context of the assessment, the potential for higher water efficiency standards have been considered for the city. The study seeks to provide comment on the tighter standards being put forward in the government's latest review of water efficiency standards, identify exemplar standards that developers could aim for and considers standards for non-residential development.

Abstraction licences from the EA have been obtained and analysed for the city. Subsequently, a high-level review has been undertaken, looking at the current abstraction strategy in the city and likely changes going forward.

Based on the findings of the above, the water cycle study report advises on future demand and resource management in the study area.

2.5 Wastewater Infrastructure, Water Quality and Environmental Capacity

2.5.1 Data Review

The water cycle study reviews the infrastructural capacity of the wastewater system and environmental capacity of the receiving water environment. This assessment has been undertaken in the context of the level of development identified and climate change.

In terms of infrastructural capacity relevant information from Anglian Water and the EA has first been obtained, including information on the major WRCs, DG5 sewer flooding records and combined

sewer overflows (CSOs). This has enabled a high-level assessment of locations which are close to or at capacity and where upgrades to manage future development may be necessary.

An initial review of environmental capacity has been undertaken using the EA's catchment data explorer. This has been used to find the current trends in ecological and chemical status for a number of watercourses in the study area, with a particular focus on those earmarked for future development and containing WRCs. The Anglian Rivers Basin Management Plan has been reviewed to identify the current measures in place to maintain water quality across the city.

In the context of these findings and the future development proposals put forward, risk areas have been identified and high-level recommendations on potential measures to protect and where possible enhance water quality identified.

2.5.2 Headroom Assessments

To further assess infrastructural capacity as a result of development, a headroom capacity assessment has been undertaken at all WRCs that may be impacted by development proposed in the local plan, this includes the Southend WRC and Rochford WRC. The assessment will determine whether the WRCs have sufficient headroom under current permits and capacity to process the predicted additional wastewater flows to 2045.

An assessment of whether the WRCs have sufficient headroom to manage the future development proposed over the lifespan of the local plan (2025-2045) was carried out using the following data sources:

- Measured annual average Q80 and Q90 flow data supplied by Anglian Water for the years 2017-2025.
- WRC catchment extent data provided by Anglian Water.
- Development allocations in the emerging local plan, adopted local plans and undeveloped sites with planning permission provided by Southend-on-Sea City Council. This included information on the number of residential dwellings and area of employment land expected across the plan period. In total, three growth scenarios have been assessed (see section 4.2 for more detail).
- Estimates of windfall development over the plan period provided by Southend-on-Sea City Council. A total dwelling number for windfall development was provided, as Southend WRC catchment covers the majority of the city all windfall development was assumed to drain there.
- Development figures for relevant neighbouring authorities. This includes the following:

  i) Rochford District Council – A significant proportion of this district drains to the Rochford WRC. Rochford district council have provided broad allocations following a call for sites and an associated subsequent site assessment. The broad allocations currently make provision for 35,529 dwellings, of which approximately 75% are located in the Rochford WRC catchment. However, many of these sites will not come forward, given that the housing requirement for the district is 14,469 dwellings up to 2043. The housing requirement value was adopted with 75% of this draining to Rochford WRC assuming the distribution of sites remain broadly the same. This translates to 10,852 additional dwellings. Southend WRC also serves a small area in the east of Rayleigh, located in the district. Approximately 4% of the broad allocations fell in this area, this translates to 579 dwellings when considering the housing requirement.

  ii) Castle Point Borough Council – Southend WRC serves the town of Hadleigh, located in Castle Point borough to the west of Leigh-on-Sea. Castle Point Borough Council have provided site allocations and dwellings numbers to be delivered in the borough up to 2043. Of these allocations, 9 residential sites are located within the Southend WRC catchment, totalling 1,097 dwellings.

The current discharge permits in place at each WRC, to extract the permitted DWF. These were cross checked with the EA and Anglian Water before undertaking the assessments.

Using the data sources above, the first step was to set a baseline DWF using the measured flow data provided by Anglian Water. When setting a permitted DWF the EA typically use the Q80 flow (the flow exceeded for 80% of the time) provided they are confident that it will not lead to a significant water quality deterioration. However, the Q90 flow (the flow exceeded for 90% of the time) is monitored by the sewerage undertaker and the EA for compliance purposes. This is because, being a lower flow, it gives greater certainty of an exceedance of the permitted DWF. As it is important to understand how growth with affect both measurements of DWF, the Q80 and Q90 are both used with two scenarios tested in the headroom assessments. Scenario one uses the 80th percentile annual exceedance flow values for the last five years (2021-2025) as the baseline DWF. Whereas scenario 2 uses the 90th percentile annual exceedance flow values for the last five years (2021-2025) as the baseline DWF.

The next step was to determine which development allocations would drain to each WRC using the WRC catchments also provided by Anglian Water. Anglian Water were contacted at this stage to confirm which WRC greenfield development would connect to. For each WRC, the future DWF was calculated by estimating the expected increase in flows from future development across the plan period. This considered household consumption and consumption from employment land. Household consumption was calculated using the equation below:

$$Household\ Consumption = Dwellings \times Occupancy\ Rate \times Per\ Capita\ Consumption$$

In terms of occupancy rate per dwelling (p/dw), projections of household occupancy rates have been provided by Southend-on-Sea City Council for the lower and medium growth scenarios. The baseline (2025) occupancy rate for both scenarios is 2.28 p/dw, which is projected to fall across the plan period to 2.09 p/dw for the lower growth scenario and to 2.11 p/dw for the medium growth scenario. The average occupancy rates over the plan period of 2.19 p/dw and 2.20 p/dw have been applied respectively. Note, for the upper growth scenario no projections have been produced, therefore the average occupancy rate for the medium growth scenario (2.20 p/dw) was adopted.

Essex and Suffolk Water have provided per capita consumption figures for each WRZ in their WRMP. The per-capita consumption figures applied for the Essex WRZ have been used. At the start of the plan period this is 146.69 l/p/d which falls to 117.02 l/p/d by the end of the plan period. As for the occupancy rates, the average across the plan period of 131.86 l/p/d has been adopted. It should be noted that this per capita rate is the WRMP Preferred Final Plan normal year consumption, for more details on the assumptions for this scenario, see section 5.5.

Table 1 lists the occupancy rates and per capita consumption figures applied across all of the growth scenarios.

Table 1 - Occupancy Rates and Per Capita Consumption figures applied

Growth Scenario	Occupancy Rate (p/h)	Per Capita Consumption (l/p/d)
Lower	2.19	131.86
Medium & Upper	2.20	

It is more difficult to estimate water use associated with employment site allocations because there are a range of employment uses that could come forward on the earmarked sites, each of which may result in different wastewater flows. Nonetheless a reasonable estimate may be obtained using the formula below:

$$Employment\ Consumption = Employees \times Per\ Capita\ Consumption$$

The components of the formula above and associated assumptions are as follows:

- Employees– Southend-on-Sea City Council have provided the potential number of jobs to be created and lost at each employment and residential allocation in the emerging local plan and for sites with existing planning permission.
- Per capita consumption - A per-capita consumption rate of 50 l/p/d was used for employment land based on estimates made by South Staffs Water for office buildings which is expected to make up the majority of the employment land in the local plan. No equivalent rate is provided in Essex & Suffolk Water's WRMP. This consumption rate is higher than benchmark figures stated by Waterwise of 15 l/p/d and is considered precautionary.

It was assumed that 100% of water used is returned to sewer. In reality this is unlikely to be the case but again guarantees that a precautionary approach is taken when assessing the capacity of the WRCs. When assessing capacity, the permitted DWF at the WRCs were used as a substitute for actual designed hydraulic capacity for each WRC being assessed. It should be noted that whilst the permitted flows will relate well to the actual designed hydraulic capacity of a WRC in some cases, in other cases they may not.

2.5.3 Load Standstill Calculations

To assess environmental capacity in more detail and determine potential permit changes arising from future development in the city, in combination with the impacts arising from development in neighbouring authorities load standstill calculations have been undertaken at the Southend WRC and Rochford WRC. Both sewage treatment works discharge to tidal waters and are therefore not represented in the EA's SIMCAT model, meaning that water quality modelling cannot be undertaken.

The load standstill calculations took the averaged 2021-2025 Q80 flow and the averaged 2021-2025 effluent quality results obtained from the EA's Water Quality Explorer[23] at each WRC to determine baseline load amounts for monitored water quality parameters. Only the Q80 flow was considered as this ensures that a worst-case approach is taken when assessing against permit limits and the environment. The water quality parameters assessed are listed below, these are the same parameters set out in the discharge permit for each WRC.

- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Suspended Solids

The monitored baseline load amounts were then compared to the load amounts that would occur with the same quality conditions applied but for the calculated Q80 flows once growth has been accounted for. For the Southend WRC this considered the lower, medium and upper growth scenarios (for more detail see section 4.2). Where the estimated future loads exceeded current permit limits, the improvement in water quality needed to achieve compliance was estimated. A second calculation was also undertaken to estimate the water quality improvement needed to reduce load amounts to baseline levels.

The levels of improvement required was subsequently compared to the EA's technically achievable limits (TALs) for each parameter, which are listed below.

- BOD: 5 mg/l
- COD: No TAL for discharges from WRCs
- Suspended Solids: 15 mg/L

[23] EA (2026) *Water Quality Explorer* https://environment.data.gov.uk/water-quality

Each water quality parameter was then assigned a score based on the degree of improvement required relative to the applicable TAL. The scoring methodology is presented in Table 2.

Table 2- Load Standstill scoring methodology

Score	Description
	No water quality improvement required
	Improvement required, but within TALs
	Improvement required, not achievable within TALs

If the required quality conditions fall below the TALs, environmental capacity could be a constraint on growth in the short term. Upgrades to wastewater infrastructure such as increased capacity to support a reduction in Q80 (DWF) may be required with development phasing needed to allow upgrades to take place.

It is recognised that COD does not have a TAL value, however it includes BOD, therefore the ratios between the two parameters at each WRC have been compared to assess whether the improvement required is achievable.

2.6 Flood Risk

A high-level review of flood risk in Southend has been carried out. The review of flood risk has focused on the potential impacts of future development.

An evaluation of the areas most sensitive to flood risk has been extrapolated to 2045 to consider the overall impact of the development proposed. This has used the EA national flood maps and DG5 records of sewer flooding. As well as accounting for the scale of development, climate change and local SuDS policy have also been considered.

2.7 Other Environmental Constraints

Any other relevant environmental constraints have been identified through consultation with the councils and the EA in the early stages of the project. This section principally covers protected sites and odour.

There are a number of designated sites and areas within and around Southend, including Bathing Waters, Special Areas of Conservation (SACs), Shellfish Protected Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Seagrass Meadows. The potential impact of future development on these sites and areas is considered.

The location of WRCs in relation to developments is also discussed in the context of odour risk. If it is deemed certain developments are at reasonable risk of odour from treatment works, presently or in the future, WHS will comment on future steps and any need for further assessment.

The findings of this chapter are likely to inform nature recovery and potential environmental improvements within the city.

3 Baseline Assessment

The study area and main watercourses across it are shown in Figure 1. The study area comprises the administrative area of Southend-on-Sea City Council which lies within the county of Essex.

The EA has classified the area served by Essex and Suffolk Water (which includes Southend) as being in "serious water stress" [24]. Serious water stress is defined in the Water Industry (Prescribed Conditions) Regulations 1999[25] as where *'the current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand'.*

In terms of watercourses, Prittle Brook is the main watercourse in the city, flowing eastwards from Leigh-on-Sea towards Prittlewell. Eastwood Brook follows a similar course further to the north, with both brooks heading north out of the city adjacent to London Southend Airport before flowing into the River Roach estuary. Willingale Brook is a small urban watercourse which generally flows south through Southchurch, before discharging to the sea near Southchurch Park. The catchment is bordered to the north by the Mucking Hall Brook catchment, a small brook draining a golf course and agricultural land towards the north of the city boundary. The southern part of the administrative area covers the Leigh Creek and wider Lower Thames estuary area.

In terms of the water quality and the condition of watercourses, the EA catchment data explorer shows that the 3 surface water catchments and 1 Transitional and Coastal (TRaC) catchment that fall within the city boundary each have an ecological status of *Moderate*. All catchments were measured to have a Fail chemical status in 2019. The condition of the water environment is assessed in more detail in section 6.3.

According to the Met Office[26] average annual rainfall in the region is 527 mm (1991-2020), which is significantly drier in comparison to other areas in the UK. Rainfall is delivered relatively uniformly across the year with moderate increases between October and November. This figure has been derived from a weather station in Shoeburyness.

In terms of groundwater, British Geological Society (BGS) mapping shows that the majority of Southend is underlain by the London Clay Formation consisting predominantly of clay, with silt and sand. The permeability is considered to be low and is classified as unproductive strata. This is defined as 'rocks with essentially no groundwater'.

In terms of superficial deposits, terrace deposits of sand and gravel are the most prominent across the city, associated with historical tidal and fluvial activity. Clay and Silt head are present closer to watercourses, with blown sand deposits also present in areas adjacent to the seafront. These deposits generally have an aquifer designation (superficial deposits) of Secondary A or B close to the watercourses and Secondary (undifferentiated) in the wider floodplains. Secondary A aquifers comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers. Secondary B aquifers are mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks and openings or eroded

[24] Environment Agency (July 2021) Water Stressed Areas - Final Classification 2021. Version 1.0: www.gov.uk/government/publications/water-stressed-areas-2021-classification

[25] UK Statutory Instruments (1999) *The Water Industry (Prescribed Conditions) Regulations 1999* https://www.legislation.gov.uk/uksi/1999/3442/contents/made

[26] Met Office (2025) UK Climate Averages. Shoeburyness. [Accessed January 2026]. https://www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/u10t6c5ev

layers. Secondary undifferentiated aquifers are those where it is not possible to apply either a Secondary A or B designation because of the variable characteristics of the rock type.

Based on Soilscapes mapping, the majority of the city is sited on freely draining slightly acid loamy soils, with more slowly permeable soils present in the west of the city. Areas located within the tidal extents of the Thames estuary are underlain by loamy and clayey coastal flat soils with naturally high groundwater.

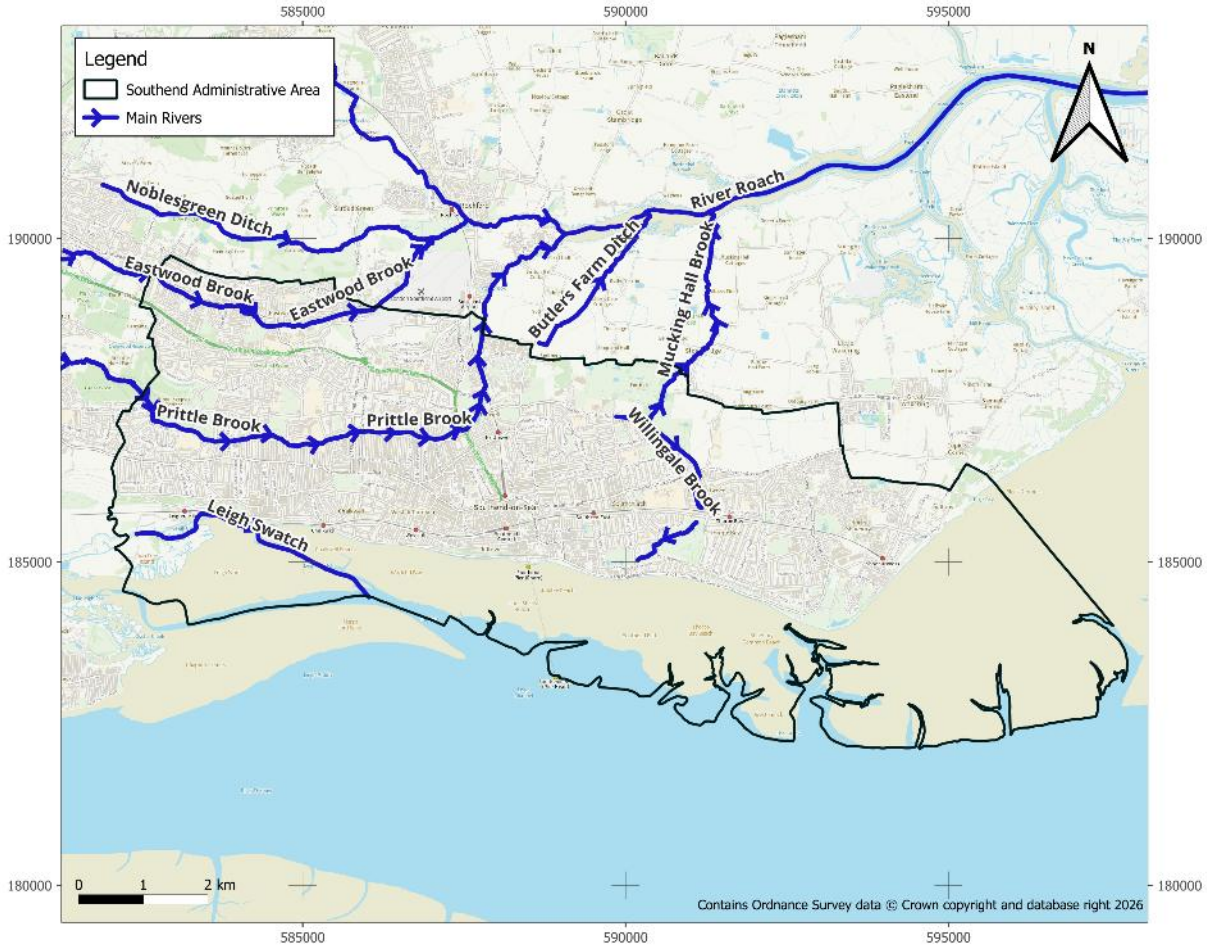

Figure 1 - Southend-on-Sea City Council Boundary and Watercourses

4 Future Development

4.1 Introduction

This section presents the future development allocations and proposals identified in Southend-on-Sea City Council's emerging Local Plan 2025–2045. It also outlines anticipated development within neighbouring authorities and describes the assumptions relating to future growth that have informed this study.

4.2 Development in Southend-on-Sea

Southend-on-Sea City Council has provided details on the development expected within the city across the local plan period (2025-2045).

This includes development and employment allocations in the local plan, sites with planning permission within the next 5 years and an allowance for windfall development. For each residential site, the number of dwellings expected during the plan period was provided. For employment or mixed-use sites, the amount of employment floorspace and expected gross job numbers was provided. The phasing of each development site is also provided.

The Local Plan provides for at least 9,500 dwellings. An urban extension to the north of the city which will comprise development on several large green belt sites could potentially deliver a further 4000-5000 homes. For the purposes of this study a lower growth scenario of 9,700 dwellings and a medium growth scenario of 14,700 dwellings are considered. Note, both scenarios include 3000 dwellings from windfall developments.

The lower and medium scenarios are the primary scenarios assessed against in this study, however an upper growth scenario of 28,100 dwellings over the plan period is also tested. This figure aligns with the housing need in the city estimated using the Government's Standard Housing Method. It is not considered achievable, given that the Local Plan process has confirmed that Southend does not have sufficient land to meet the housing need estimated by the standard housing method. As a densely developed urban area, opportunities for both brownfield and greenfield development are highly limited.

The plan also recognises that future growth must be sustainable and infrastructure-led, supported by investment in utilities, transport, employment, education, healthcare, green spaces and community facilities. To support this development earmarked will be phased, with a greater proportion of housing delivered later in the plan period to help ensure supporting infrastructure is in place. The Council is set to continue working with neighbouring authorities to explore whether unmet housing need can be accommodated elsewhere.

In terms of employment, the number of jobs to be delivered over the plan period totals 3,081, of these, 2,571 jobs are expected to be created at site allocations over the plan period, and 510 over the next 5 years from planning permissions. The same expected number of jobs is applied across the three growth scenarios assessed.

For the headroom assessments and load standstill calculations, the WRC catchment areas provided by Anglian Water were subsequently used to identify which sites drain to the Southend and Rochford WRCs which both serve parts of the city. Where development sites were situated between two catchments, Anglian Water were contacted to confirm which WRC they would likely connect to, subject to a sustainable point of connection.

4.3 Neighbouring Authorities

Future development in neighbouring authorities also needs to be considered where relevant. Figure 2 shows the extent of the WRC catchments against the relevant local authority boundaries. Based on their catchment's areas, the two WRCs assessed in the study have the potential to be impacted by development in Rochford district and Castle Point Borough.

1. **Southend WRC** - Whilst the catchment largely serves Southend, it also drains parts of the Rochford district including the town of Rayleigh and a number of development areas along the district's border with Southend. The catchment also covers the settlement of Hadleigh which is located to the east of Southend in Castle Point Borough.
2. **Rochford WRC** – The catchment largely serves Rochford, however several areas along Southend's northern border drain to Southend, this includes London Southend Airport.

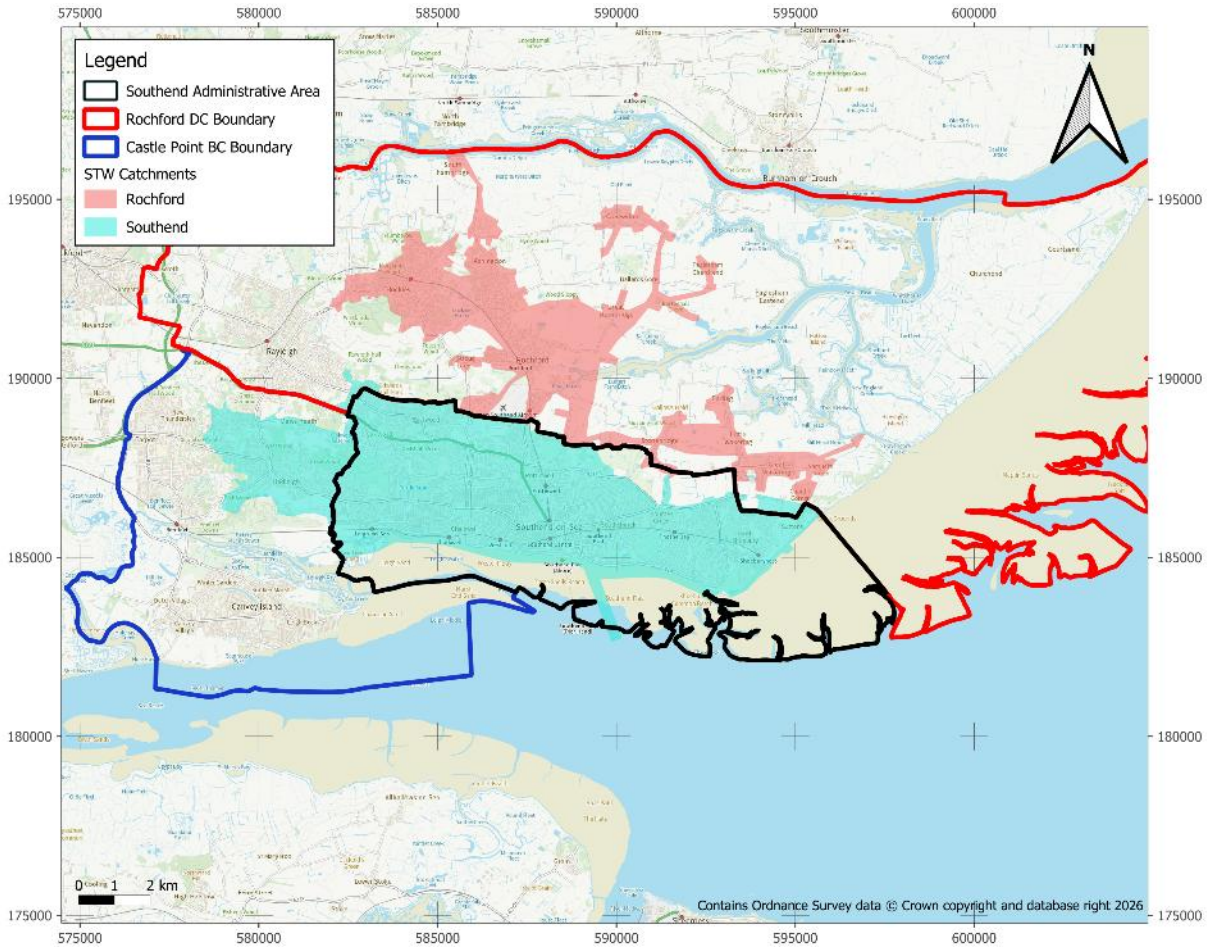

Figure 2 - Southend WRC and Rochford WRC catchments relative to Local Authority Boundaries

In terms of Castle Point Borough Council, they have provided the development allocations earmarked in their 2026-2043 local plan which would drain to Southend WRC. This totals nine allocations which are set to deliver 1,097 dwellings across their plan period, no employment use was listed for any of these sites within the area. Note, the dwelling numbers are between 2026-2043 and some of the sites may be expanded further beyond this date. To account for the two additional years at the end of Southend's local plan, the figures per annum between 2026-2043 were estimated and multiplied

by two. Table 5 shows the sites being considered including the allowance for development between 2043-2045.

Table 3- Castle Point Borough Council Site Allocations draining to Southend WRC

Site	No of Dwellings	Employment Area (Ha)
Thundersley Clinic	24	N/A
Kiln Road Campus	730	N/A
Thames Loose Leaf	27	N/A
Hadleigh Clinic	14	N/A
The Island Site	94	N/A
Osborne Motor Co	9	N/A
Castle Lane Car Park	39	N/A
Johnsons Factory	46	N/A
Land South of Scrubs Lane	114	N/A
2-year allowance (2043-2045)	129	N/A
Total	**1226**	**N/A**

Rochford district council have provided broad allocations following a call for sites and an associated subsequent site assessment. The broad allocations currently make provision for 35,529 dwellings, of which approximately 75% are in the Rochford WRC catchment. However, many of these sites will not come forward as the housing requirement in the district is lower. The council's emerging evidence[27] estimates a requirement for 14,469 dwellings over 20-years. This is based on the government's standard methodology, which sets a requirement to deliver 689 dwellings per annum. Applying this over 20-years which matches the length of Southend's plan period leads to 13,780 dwellings. However, Rochford has applied an additional 5% 'buffer' to account for problems with some sites coming forward. To ensure a precautionary approach, the 14,469 dwelling number is adopted herein.

As stated above, in total 75% of these dwellings would be expected to drain to Rochford WRC assuming the distribution of sites (based on the call for sites) remains broadly the same. This translates to 10,852 additional dwellings. Southend WRC also serves a small area in the east of Rayleigh, located in the district. Approximately 4% of the broad allocations fell in this area, this translates to 579 dwellings when considering the precautionary housing requirement.

[27] Rochford District Council (2025) *Rochford Local Plan Update* https://rochford.moderngov.co.uk/documents/s1540/Rochford%20Local%20Plan%20Update%20July%202025.pdf

5 Water Resources and Supply

5.1 Introduction

This section first assesses the current water resources supplying the Southend-on-Sea administrative area. Subsequently, the supply-demand position moving forward is reviewed against future development at the strategic and site level. This includes all development earmarked up to 2045. The assessment seeks to determine whether there will be enough water resources available to sustainably manage the projected development levels in the study area.

The existing abstraction licenses and license strategies across the study area are also reviewed. Recommendations are then made on future demand and resource management in the study area. Mitigation measures and key actions for stakeholders are also provided.

5.2 Water Company Planning

Essex and Suffolk Water is responsible for water supply across Southend, whilst Anglian Water is responsible for drainage and wastewater collection and treatment. The water companies within England responsible for providing water supply and wastewater collection and treatment are funded in 5-year planning periods. The budget they have available to spend is determined by the Water Services Regulation Authority (OFWAT) in consultation with government, the EA and consumer organisations amongst others. The consultation process is known as the Price Review (PR). The latest Price Review was in 2024 (PR24) and determined how much money water companies have available to spend between 2025 and 2030 during Asset Management Plan 8 (AMP8). Once funding has been obtained for upgrading and/or building new infrastructure, there remain significant lead times for planning and construction before infrastructure can be considered functional. In this respect the water companies require detailed information on likely housing development well in advance.

5.3 Water Resource Zone

Figure 3 shows the Essex WRZ relative to Southend-on-Sea City Council's administrative boundary. The boundary falls entirely within the Essex Water Resource Zone (WRZ). The WRZ is bounded by the Thames Estuary to the south, and the Essex coastline in the East. It should be noted that the southern extent of the administrative boundary encompasses several beaches, these are not served by water supply infrastructure and fall outside of the Essex WRZ.

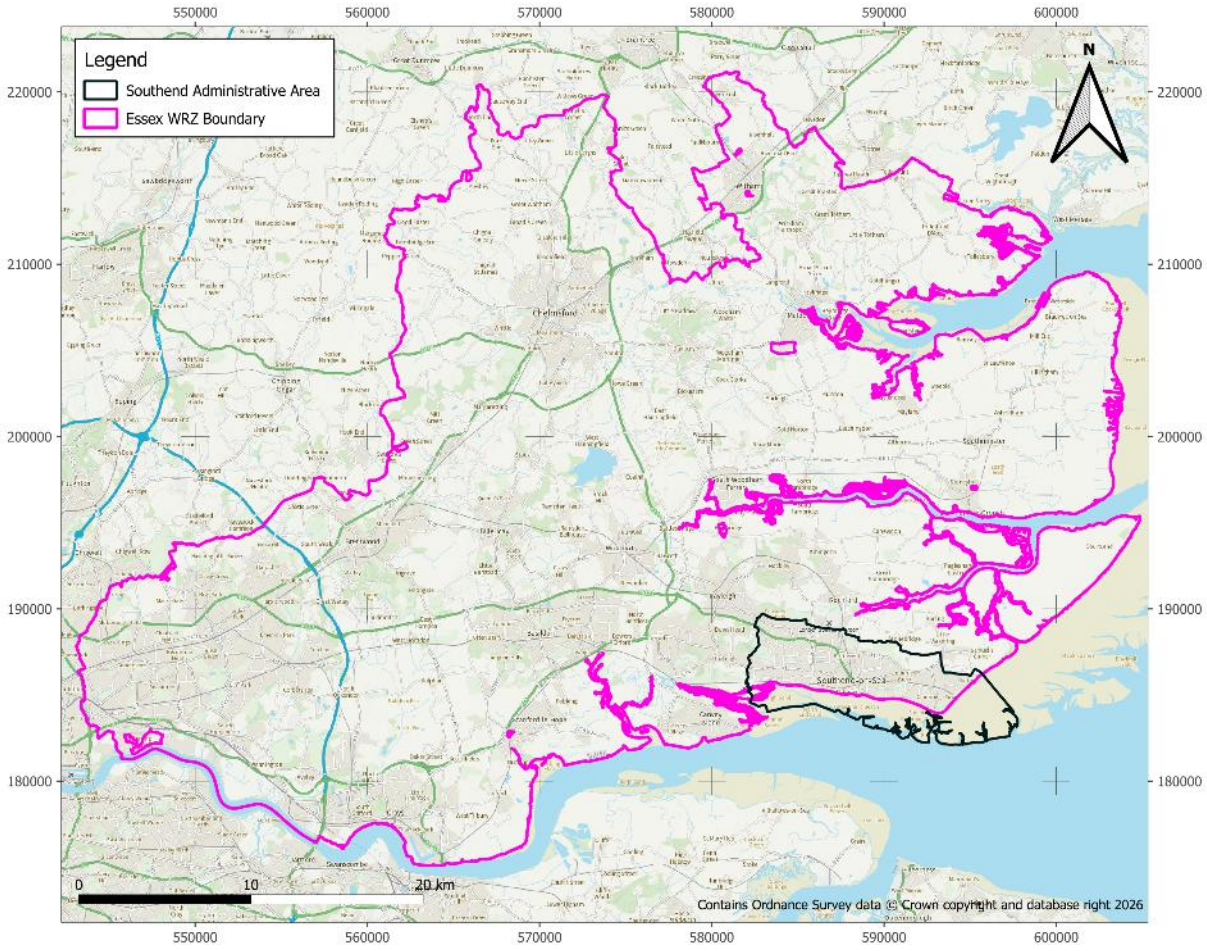

Figure 3- Southend-on-Sea Boundary relative to Essex Water Resource Zones

The Essex WRZ is regarded as highly integrated, with a network known as the 'Essex System', which has a large degree of flexibility for moving raw and potable water into and around the zone, to where it is required[4]. The zone has a baseline deficit due to increased demand driven by population increases and non-household usage, alongside pressures to supply from climate change and drought mitigation measures.

The intrinsic water resources which supply the zone are summarised in Table 4. The major transfers within and from outside of the WRZ are shown in Figure 4. As can be seen, the WRZ relies on both local and external transfers. In dry years more than 50% of water comes from outside of the WRZ, making it highly reliant on inter-basin transfers for drought resilience and demand reliability. Southend specifically is largely supplied by Hanningfield Reservoir and the North Essex Transfer (water originating from the Ely-Ouse River in Norfolk), alternating depending on demand.

In terms of the Essex WRZ as a whole, there is a water sharing agreement between Essex & Suffolk Water and Thames Water. Under the agreement, Thames Water exports a significant volume of raw water from its Lee Valley reservoirs to Essex and Suffolk Water's supply area.

Table 4 - Water sources and transfers within and outside the Essex WRZ

Category	Source / Scheme	Description	Typical Contribution / Notes
Internal (within Essex WRZ)	Local rivers – Chelmer, Blackwater, Stour, Roman	Abstracted for supply to Hanningfield and Abberton reservoirs and treatment works	Major internal source of water for the WRZ (98%); supplemented in dry years
	Reservoirs – Hanningfield, Abberton	Pumped-storage reservoirs supplied by local rivers	Key regulation and storage points
	Groundwater (Chalk aquifer)	Small-scale borehole abstraction	~2% of internal supply
Transfers into Essex WRZ (external)	Ely-Ouse to Essex Transfer Scheme (EOETS)	Transfers water from the Great Ouse system (Norfolk) via pipelines, pumping and river networks	Primary external supply; crucial in dry years
	Bulk transfer from Thames Water (Lea Valley)	Imported raw water into Chigwell treatment works	Major support source, particularly under drought conditions
	EA augmentation schemes (GOGS, SAGS)	Groundwater pumping schemes to maintain river flows	Used as backup or to enhance supply reliability

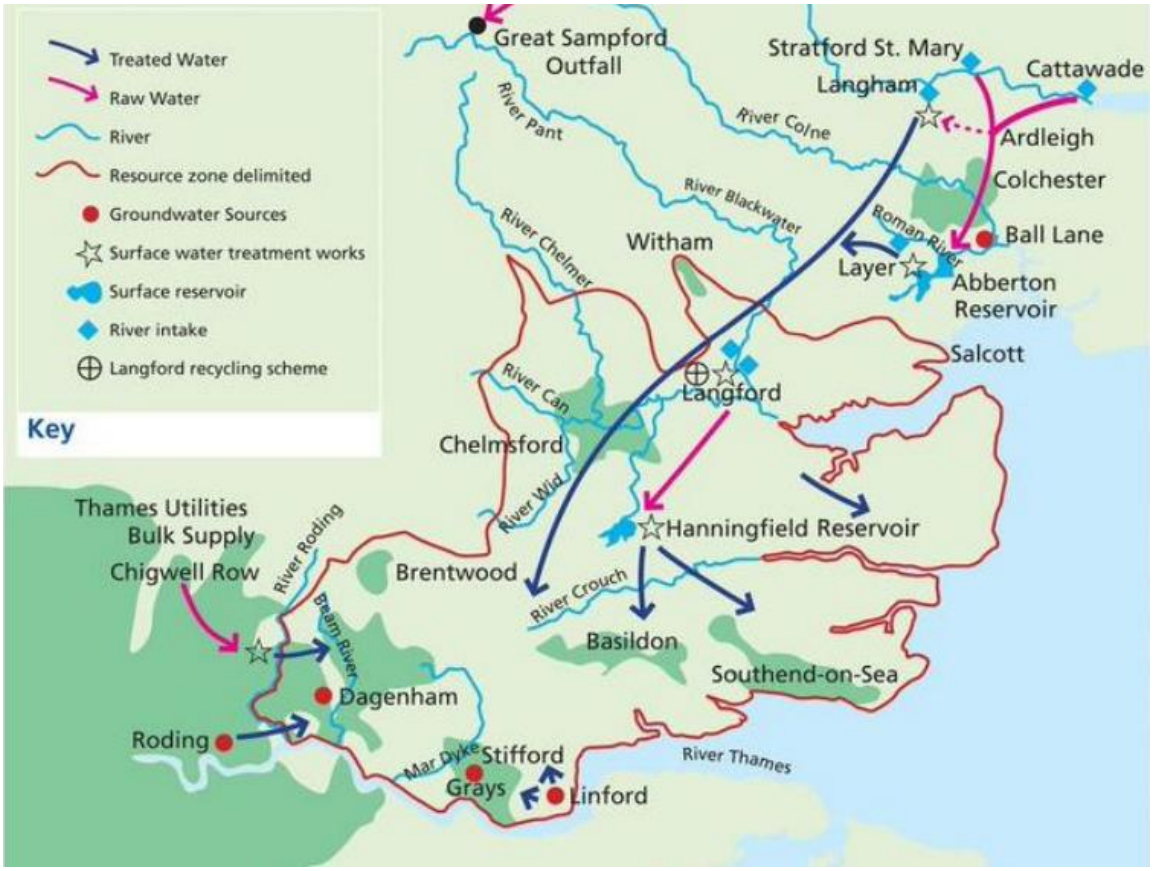

Figure 4 - Principal Features of the Essex WRZ (Source: Essex and Suffolk Water[4])

5.4 Population and Dwelling Forecast

Essex and Suffolk Water has assessed the impact of forecast population, household growth and non-household growth on water resources as part of its draft Water Resources Management Plan (WRM2024. It sets out how they plan to provide a secure and sustainable supply of water for customers over the next 50 years (2025-2075). This study has used the information from this latest WRMP to determine demand and delineate the potential impact of future development in the city.

Population and dwelling forecasts are paramount in estimating future demand. Essex and Suffolk Water's forecasts, created with Edge Analytics, consider housing development, ageing population profiles and migration. The population forecasts and dwelling figures used to inform water resources are heavily based on local plans and also consider Office of National Statistics (ONS) trend-based projections. In addition to the central forecasts, Essex and Suffolk Water has also produced low and high scenarios in the production of demand forecasts for use in adaptive planning scenarios. Only the central forecasts (based on local plans) are considered for this study.

Population and dwelling forecasts are generated for each WRZ based on an aggregate of the findings for each district metering area (DMA). The values derived by Essex and Suffolk Water are used to inform future demand, which is subsequently used in the determination of suitable resource options. The figures derived have been compared against the development proposed in the local plan to determine if the levels of growth are potentially in excess of or below Essex and Suffolk Water's anticipated values.

According to the Essex and Suffolk Water, the base population (2021/22) in the Essex WRZ is 1,777,943, residing in 656,001 dwellings. Based on the census data, the Southend population in 2021 was 180,700[28], equating to 10.16% of the total Essex WRZ population. The number of households in the city was 78,341 in 2021[29], translating to a dwelling proportion of 11.94%.

The central housing plan population forecasts for the Essex WRZ area in the WRMP show an average population growth of 21.99%, equating to an increase in population of 390,906 from the base year to 2049/50. In the absence of a breakdown for each local authority area, population growth is assumed to be uniform across the Essex WRZ area. The population growth in Southend is therefore also assumed to be 21.99% translating to an increase in population of 39,736 by 2049/50.

Essex and Suffolk Water has also estimated dwelling numbers and provided these are the WRZ and DMA level. In terms of the WRZ, as already mentioned, the base year shows 656,001 dwellings in the Essex WRZ. The projected increase in dwelling numbers across the WRZ by 2049/50 is 191,168 (29.14%). Using the census data above, 78,341 dwellings have been applied for Southend in the base year. A corresponding 29.14% increase in dwellings within the city translates to a total of 22,829 new dwellings (29.14%) by 2049/50. This assumes uniform growth across the WRZ and that the occupancy rate remains relatively stationary with respect to population change.

In terms of the DMA projections, the DMA areas used by Essex & Suffolk water do not strictly align with the Southend City boundary, as there are slight overlaps with neighbouring districts. It was therefore not possible to do a direct comparison of the dwellings earmarked in the local plan. However based on the dwelling number provided, there are a total of 94,154 dwellings in 2021/22, increasing to 110,398 dwellings by 2049/50. An increase of 17.25% which suggests that the growth forecast

[28] ONS (2022) *How the population changed in Southend-on-Sea: Census 2021 https://www.ons.gov.uk/visualisations/censuspopulationchange/E06000033/*

[29] ONS (2026). Census 2021. Table TS017 – Households, Southend-on-Sea. Extracted from Nomis [Accessed 21st of April 2026]. Contains Crown Copyright Data.

by Essex and Suffolk Water in Southend is lower than the wider Essex WRZ. Table 5 summarises the values estimated in terms of population and dwelling growth.

Table 5 - Base and Projected (2049/50) Population & Dwelling Estimates based on ESW's WRMP

	Essex WRZ	Southend
Base Population (2021/2022)	1,777,943	180,700
Projected Population (2049/50)	2,168,849	220,436
Base Dwelling (2021/2022)	656,001	78,341
Projected Dwellings (2049/50)	847,169	101,170
DMA Base Dwelling (2021/2022)	-	94,154
DMA Projected Dwellings (2049/50)	-	110,398

To allow a comparison with the development proposed in the local plan, it is necessary to consider the total number of dwellings forecast by Essex and Suffolk water across the plan period (2025-2045). The WRMP does not provide a breakdown for each year, therefore, to estimate this number, the dwelling per annum between the base year (2021/2022) and 2049/2050 has been estimated. This number has subsequently been multiplied by the number of years in the plan period (20-years). Table 6 shows the results of this analysis and compares these with the number of dwellings expected in the emerging local plan. At the time of writing, Southend-on-Sea City Council has provided two scenarios (lower, medium) for the number of dwellings expected to be delivered in the city between 2025-2045. These scenarios include the local plan allocations, adopted local plan allocations, existing planning permissions and an allowance for windfall development, the medium growth scenario includes the Land North of Southend (LNOS) green belt allocations. A third upper scenario aligning with the government's housing requirement for the city is also tested, however it is not considered achievable for the reasons outlined in section 4.2)

Table 6 - Comparison in estimated Dwelling Per Annum and across the plan period

	E&S Water WRZ	E&S Water DMA	Lower	Medium	Upper
Dwellings Per Annum	815	535	490	735	1,405
Dwellings Across Plan Period	16,300	10,691	9,800	14,700	28,100

Comparing the scaled-down Essex and Suffolk Water forecasts with the development proposed by Southend-on-Sea City Council indicates that they sit significantly above the lower growth scenario (39.88%) earmarked by the council and marginally above the medium growth scenario (9.82%). The DMA forecast is above the lower growth scenario (9.09%) but sits below the medium growth scenario (-27.27%).

Overall, this suggests that Essex and Suffolk Water's current forecasts are broadly aligned with, and capable of accommodating, the level of growth likely to come forward in Southend. However, for the medium growth scenario, Essex and Suffolk Water will likely need to assess the proposed phasing of development to accommodate any necessary new or improved infrastructure. Mitigations such as water re-use, rainfall harvesting and grey water schemes should also be prioritised.

Further to this, Essex and Suffolk Water have identified that infrastructure improvements will be needed to accommodate the proposed levels of growth across their operating area as a whole. These improvements include mains rehabilitation works, water main reinforcements and duplications to ensure supply is maintained. Pre-planning enquiries to Essex and Suffolk Water are also encouraged as these will support efficient and effective planning.

In terms of the upper growth scenario, if the Government's housing target was pursued, additional pressure on water resources could arise. This scenario is projected to be substantially higher (72.39%) than the level of growth currently forecast by Essex and Suffolk Water, potentially creating unforeseen demands on water supply infrastructure. It should be noted that WRMP was prepared before the Government increased local authority housing targets.

In summary, the proposed development in Southend is not expected to create unforeseen pressure on water resources. However, it is important to note that the scaled-down figures provided by Essex and Suffolk Water rely on assumptions of uniform population growth and stable occupancy rates across the WRZ. Furthermore, assessing Southend in isolation does not accurately reflect future water availability; local supply will inevitably be shaped by broader pressures within the Essex WRZ and the wider Essex and Suffolk Water network due to water transfers. Finally, while Southend cannot meet the government's housing targets, any resulting shortfalls may need to be absorbed by neighbouring authorities. This redistribution will impact water availability across the entire Essex WRZ as local surpluses could potentially be leveraged to address shortages elsewhere.

5.5 Demand

5.5.1 Demand Forecasts

Background

Demand includes household use, non-household use, operational use (water used maintaining the network), water taken unbilled and leakage. The main driver on demand is population; however several other factors also play a role, including the effects of climate change, improvements in efficiency, and changes in household/non-household consumption. Essex & Suffolk Water's (ESW) Water Resources Management Plan 2024 (WRMP24) prioritises demand management as the first line of action to ensure long-term water resilience across the Essex WRZ. This strategy follows the national twin-track approach, emphasising demand reduction before new supply development.

Baseline Forecast

Essex and Suffolk water have estimated a baseline and final plan demand forecast. The baseline plan assumes new demand management activity ceases at the end of AMP7 (2025) as per EA guidelines. The measures introduced under AMP7 include the installation of meters, leakage reductions and household use reductions (due to public awareness and water efficiency savings). The Ml/d savings earmarked for these measures introduced under AMP7 will still have a continued effect, however additional measures introduced as part of AMP8 and beyond are not accounted for.

The WRMP has assessed demand using the Normal Year Annual Average (NYAA), Dry Year Annual Average (DYAA) and Dry Year Critical Period (DYCP) forecasts. The NYAA is the annual average value of water demand over the course of an average year. The DYAA is the annual average value of water demand over the course of a dry year. The DYCP forecast describes the average daily demand during the peak week for water demand, rather than an annual average across the year. A shortfall in DYAA would suggest a longer-term water shortage across the year, whereas a shortfall in DYCP would suggest a water shortage when demand is high.

For the NYAA baseline plan forecast, despite a per capita reduction in consumption (due to AMP7 measures), total demand in the Essex WRZ is expected to increase from approximately 389 Ml/d in 2025/26 to 410 Ml/d by 2045/46. For the DYAA forecast, demand increases from 399 Ml/d in 2025/26 to 418 Ml/d by 2045/46. For the DYCP forecast, demand increases from 483 Ml/d to 504 Ml/d by 2045. The increases in demand are largely driven by population growth increasing household demand, non-household consumption is forecast to fall with a small decrease in leakage too. Figure

5 is extracted from the WRMP, it provides a summary of the changes to NYAA, DYAA and DYCP values from the base year (2021/22) to 2097/2098, the end of the plan period (2045/46) is marked.

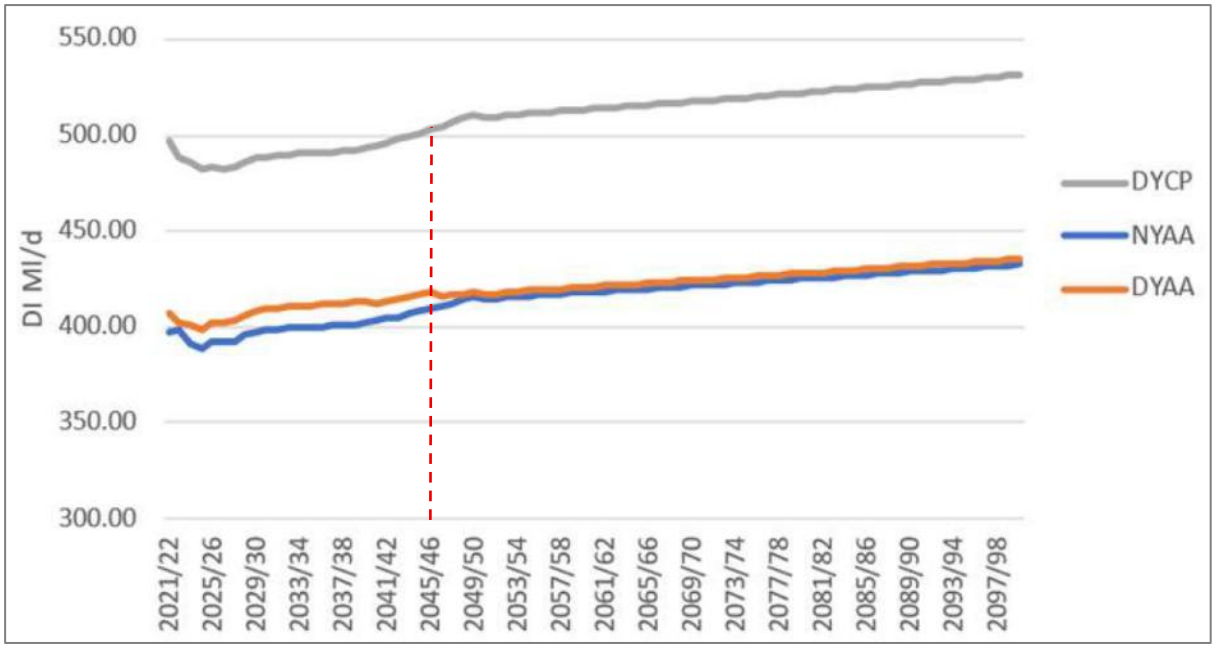

Figure 5- Plot showing NYAA, DYAA and DYCP forecasts for Essex WRZ (*Source: Essex & Suffolk Water*[30])

Final Forecast

The final demand forecast incorporates AMP8 measures and includes the following conditions:

- Customer demand with medium water efficiency options from 2025/26 onwards, includes:
  - Universal Metering and Smart Meter Rollout aiming for full coverage by the mid-2030s. These provide accurate usage data, enabling better monitoring and leak detection.
  - Behavioural Change Programmes: Aim to reduce per capita consumption (PCC) to 122 l/p/d by 2038 (152 l/p/d currently) through promotion of water-saving devices, education campaigns, and audits for businesses.
- Leakage medium option, reduction of 40% leakage by 2050 supported by smart data analytics and proactive maintenance.
- Government led interventions applied to household consumption, such as water efficiency labelling on white goods.

Figure 6 is extracted from the WRMP. The WRMP only provides a graph of the final demand forecast for DYAA and the baseline scenario, if the above measures were not implemented. Once again, this runs from the base year (2021/2022) to 2097/2098, the end of the plan period (2045/2046) has been marked. In the baseline scenario, demand rises gently from 400 Ml/d in 2025/26 to 418 Ml/d by 2045/46. In the WRMP final plan DYAA forecast, demand decreases from 400 Ml/d in 2025/26 to 345 Ml/d by 2045/46.

[30] Essex & Suffolk Water (2024) *Demand Forecast WRMP24 Technical Report Figure 117*

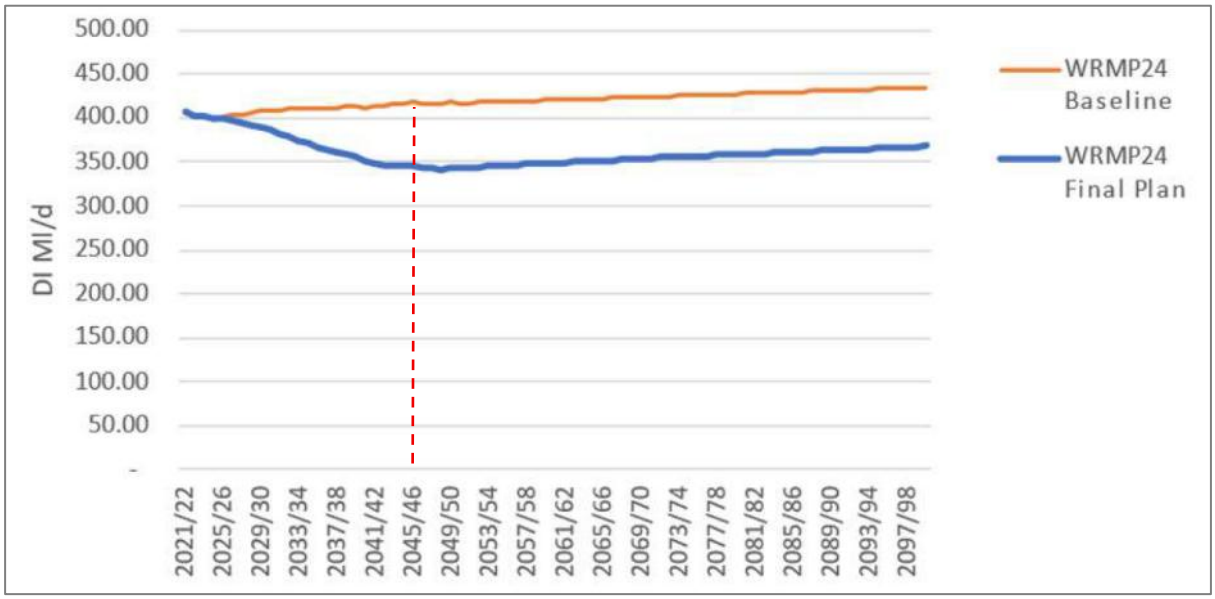

Figure 6- Plot showing Final Plan DYAA forecast for Essex WRZ (*Source: Essex & Suffolk Water*[31])

The final plan indicates a substantial reduction in demand; however, it relies on several assumptions related to behavioural change, leakage, and government-led interventions. It should also be noted that the level of development proposed in the local plan Scenario 2 appears to exceed the growth anticipated by Essex and Suffolk Water, so in Southend specifically the fall in demand may be reduced.

Non-Household Consumption

A further consideration is uncertainties over non-household consumption. To understand future non-household demand Essex and Suffolk Water began by analysing their current non-household demand at an industry sector level. Local Authorities located within their operating area were then contacted to request information they hold on new non-household developments. In addition, all large users (premise using greater than 20,000 m^3 of water per year) were contacted in relation to their expected changes to demand in the short and medium term. This information was incorporated into the demand scenarios along with employment and Gross Value Added (GVA) data supplied by ONS. Where relevant, large known new demands likely to start in the next few years, such as the construction and operation of power generation plants were also applied on top of the base forecast.

As shown in Figure 7, in the Essex WRZ the changes in the overall forecasts in the next decade are dominated by the impacts of several large projects in the energy and construction sectors. This includes a nuclear power station thought to be the Bradwell B proposal located at Bradwell-on-sea, and the construction of the lower Thames crossing, a new road that will connect Essex and Kent. Significantly the Thames Freeport initiative in South Essex is not included in the demand figures due to uncertainties around its delivery. If it does go ahead, it could supply an additional 21,000 jobs and lead to a further increase in non-household consumption.

New large user demand in Essex is forecast to peak in 2033/34, followed by declining consumption as some users require lower volumes. Under the medium forecast, demand then gradually decreases to 2100. While population-related sectors such as health and education are expected to grow, this is

[31] Essex & Suffolk Water (2024) *Demand Forecast WRMP24 Technical Report Figure 124*

offset by reduced demand from office-based industries and hospitality, which are less population-dependent. Smaller declines are also expected in non-service sectors including agriculture, food processing, and manufacturing.

Between 2025 and the end of the plan period (2045), the early rise in large user demand is not fully offset by these broader trends, leaving overall non-household consumption in Essex in 2045 at a similar level to 2025 (57 Ml/d under the central forecast).

It should be noted that the high scenario forecast shows an increasing trend from 2037/38, it assumes more pronounced increases in both population and employment, along with additional large user requests being met in full. Signficantly none of the employment sites being brought forward in the local plan are for data centres or energy infrastructure which tend to be particularly water intensive.

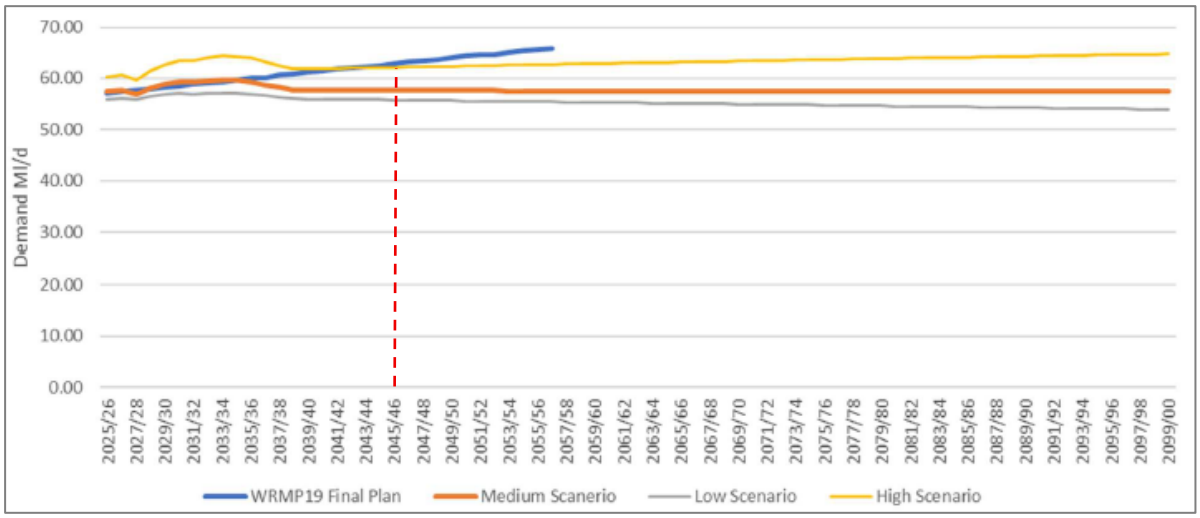

Figure 7 - Low, Medium and High consumption scenarios for Essex WRZ (*Source: Essex & Suffolk Water*[32])

It should be noted that Essex and Suffolk Water has implemented a non-domestic moratorium within its Hartsmere WRZ. This is a temporary prohibition of new non-household supplies currently in place until 2033. It serves to protect all existing and new household water demand until new water supplies have been developed. No such moratorium is in place in the Essex WRZ, however there may be a potential need for one should future demand outpace the supply options coming forward.

As noted, there are uncertainties in growth and consumption trends for both household and non-household customers, Essex and Suffolk Water review its forecasts annually through the annual water balance. Forecasts are compared with observed data, and any significant differences are investigated to understand their causes and implications for future projections. Any resulting changes are documented in the annual review reports in line with regulatory reporting requirements.

5.5.2 Water Efficiency

Water efficiency is a key measure to reduce water demand going forward and is heavily tied to local plan policy. Water efficiency measures can also reduce strain on wastewater networks and WRC's by

[32] Essex & Suffolk Water (2024) *Demand Forecast WRMP24 Technical Report Figure 124*

decreasing the volume of wastewater requiring treatment. The findings of the WRMP and future water efficiency standards are explored in more detail in this section.

Essex and Suffolk Water's WRMP has projected future changes to household water efficiency based on three different scenarios (Low, Medium, High) for household consumption, and one scenario for non-household consumption. Medium enhanced was selected as the preferred option, which includes a focus on the highest water users (top 5%), alongside offering support to customers though flow controllers, and leaking toilet identification and repair. Table 5 summarises the projected impact on PCC for each scenario during the four AMP phases corresponding with the local plan period. It is noted that the current PCC is 152 l/p/d.

Table 7 - PCC Impact (l/head/d) options scenario projections from E&S WRMP

Scenario	AMP8 (25-30)	AMP9 (30-35)	AMP10 (35-40)	AMP11 (40-45)
Low	2.39	2.22	2.07	1.88
Medium	4.49	4.17	3.88	3.69
High	5.00	4.65	4.11	3.94

Table 8 shows the projected changes in household PCC through the plan period based on water efficiency measures alone. They offer a significant demand reduction however are dependent on the actions of a number of stakeholders, including national government, Essex and Suffolk water and Southend-on-Sea City Council. A summary of the measures included in each scenario is included below in Table 9.

Table 8 - PCC (l/p/d) projections under each scenario

Household Efficiency Scenario	2025/26	2045/46
Baseline	153*	143*
Low	153*	136*
Medium	153*	128*
Medium Plus (Enhanced smart metering)**	153*	125*
High	153*	127*

*Approximate values extracted from figures.

** WRMP Preferred Option

Table 9 - Summary of measures in household efficiency scenarios

Household Efficiency Scenario	Mitigations Measures in Scenario
Baseline	Assumes only AM7 efficiency and metering measures, no government interventions with PCC driven by natural consumer behaviour.
Low	Focused on limited high-impact, low-cost measures such as visits to top 5% highest users. Includes lower end of government intervention.
Medium	Includes wider range of interventions such as awareness campaigns, engagement platforms, efficient toilet rebates and flow restrictors.
Medium Plus (Enhanced smart metering)**	Greater breadth of internal leakage support, with multiple efficiency measures completed at the point of smart meter installations.
High	Increased scale of implementation, find and fix teams and engagement with unmeasured properties. Greater deliverability risks and costs.

** WRMP Preferred Option

In terms of future standards, currently for new build dwellings, a water efficiency calculation is a legal requirement set out in Part G of the Building Regulations. These calculations are required for all new build dwellings, as well as conversions. Part G requires that a dwelling must not use more

than 125 l/p/d. However, the Planning Practice Guidance (PPG)[33] states that where there is a clear local need, local planning authorities can set out local plan policies requiring new dwellings to meet the tighter Building Regulations optional requirement of 110 l/p/d.

Presently, as mentioned the national government's PCC target is 110 l/p/d, however tighter standards may be sought going forward. In September 2025, the UK government consulted[34] on lowering the baseline mandatory efficiency standard to all new homes from 125 l/p/d to 105 l/p/d and lowering the optional standard from 110 l/p/d to 100 l/p/d. While not yet implemented, these changes could take effect in 2026.

In addition to the currently proposed reform package the Government is considering further phases of amendments to the Building Regulations Part G. The consultation included a call for evidence, whereby the government is seeking information and evidence on whether the government should pursue tightening mandatory standards to 95 or 100 l/p/d and optional standards to 80-90 l/p/d. A significant portion of the evidence gathering focuses on the feasibility of mandating reuse systems through the Building Regulations, including rainwater harvesting, greywater harvesting, and black water harvesting systems.

Aligning with this, the Environmental Improvement Plan 2025 states that water efficiency, water recycling, and drainage standards should be reviewed regularly to determine whether they need strengthening, including exploring opportunities to meet the standard such as technological innovation to increase water-efficient housing.

Given the issues of water stress a number of public and private bodies have further investigated the potential for tighter standards. In response to the EA's publication, *Meeting our Future Water Needs: a National Framework for Water Resources*[35] a roadmap is being developed by national government towards greater water efficiency in new developments and retrofits. The Future Homes Hub is providing input to the roadmap by bringing together industry stakeholders. It has published a report[36] which highlights the need for changes in future PCC standards, fittings, labelling, water reuse and water positivity to enable sustainable growth. In terms of PCC specifically, it has reviewed foreseeable changes in fittings and technology to set out a roadmap for future standards between 2025-2035. These are shown in Table 10, with different standards set depending on levels of water stress.

Table 10 - Future Homes Hub Litres per person per day framework

Demand Programme	2025	2030	2035
Achieved through fittings approach	105 l/p/d	100 l/p/d	90 l/p/d
In water stressed areas	100 l/p/d	90 l/p/d	80 l/p/d
In seriously water stressed areas	90 l/p/d	To be determined	To be determined

[33] Department for Levelling Up, Housing and Communities (2015) *Housing: optional technical standards* https://www.gov.uk/guidance/housing-optional-technical-standards

[34] DEFRA (2025) *Review of Water Efficiency Standards in the Building Regulations 2010* https://consult.defra.gov.uk/water-efficiency-demand/review-of-water-efficiency-standards/

[35] EA (2020) *Meeting our future water needs: a national framework for water resources* https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

[36] Future Homes Hub (2024) *Water Ready- A report to inform HM Government's roadmap for water efficient new homes* https://irp.cdnwebsite.com/bdbb2d99/files/uploaded/Water%20Ready_A%20report%20to%20inform%20HM%20Government-s%20roadmap%20for%20water%20efficient%20new%20homes.pdf

Royal Institute of British Architects (RIBA) has also developed in consultation with other professional UK construction bodies voluntary performance targets for water use[37] with regard to construction. With regards to their Climate Challenge, they have set a target for residential property consumption of <75 l/p/d. The performance targets align with the future legislative horizon and set out challenging but achievable targets in order to have a realistic prospect of achieving net zero carbon for the whole UK building stock by 2050. In terms of water use it sets a standard of 95 l/p/d by 2025 and 75 l/p/d by 2030. BREEAM[38] does not set specific standards for PCC, however does set graded standards for individual water fittings which developers can use to reduce water consumption. The Future Homes Hub, RIBA and BREEAM standards are all voluntary standards at this stage that developers could choose to align with.

In terms of Southend specifically, the Shared Standards in Water Efficiency for Local Plans[39] was published in 2025 as a collaborative initiative between a number of stakeholders and regulatory agencies, including the Environment Agency, Natural England, Essex & Suffolk Water and Anglian Water, to address serious water scarcity in Eastern England. It provides a strategic framework for LPAs to implement more rigorous water efficiency requirements for both residential and commercial developments. Specifically, the report advocates for reducing household consumption to as low as 85 l/p/d, which is significantly stricter than current national building regulations. A further recommendation relates to BREEAM's graded standards. New, extended or redeveloped non-household buildings can achieve the credits under the 4 water categories WAT01 – Water Consumption (highest weighting, with a maximum of 5 available credits), WAT02 – Water Monitoring, WAT03 – Water Leak Detection, and WAT04 – Water Efficient Equipment. The Shared Standards recommends that the tightest standards of water efficiency are sought and that new or extended residential development, alongside redeveloped non-household development, aim to achieve full credits in the BREEAM water calculator, with a minimum of 3 credits in the WAT01 category.

Essex County Council also has local guidance relevant to Southend. The Water Strategy for Essex makes recommendations which promote consideration of on-site water reuse and recycling as part of all new development. These measures support the Government's Environment Improvement Plan for clean and plentiful water and also support the county council's commitment to Levelling Up the Environment in Essex.

The Essex Local Flood Risk Management Strategy (LFRMS) aims to set out the county-wide approach to the management of local flood risk. A review of the strategy is in progress and will ensure the inclusion of integrated water management approaches and highlight water efficiency measures for sustainable water use and flood reduction. As further information is available this will be shared with local planning authorities to support the production of Local Plans and the supporting documents associated with them.

In view of the water efficiency recommendations in the shared standards along with other relevant documents alongside Southend being in an area of serious water stress, it is recommended that the city council consider a policy on water efficient design, which recommends 100l/p/d by 2030 down

[37] RIBA (2021) *RIBA 2030 Climate Challenge* https://www.architecture.com/-/media/files/Climate-action/RIBA-2030-Climate-Challenge.pdf?srsltid=AfmBOopW1CKKCWUCJ76wMu2194M2EVKmfsT9sCZT-NoSvN8rClGvzGv1
[38] BREEAM (2024) *BREEAM Standards* https://breeam.com/standards
[39] Shared Standards in Water Efficiency for Local Plans (2025) https://www.anglianwater.co.uk/siteassets/developers/new-content/p--c/shared-standards-in-water-efficiency-for-local-plans.pdf

to 80l/p/d by 2035. This is considered achievable, as the proposed standards do not go further than the Future Homes Standards, it would not be a policy cost requiring viability testing.

For non-household development, it is recommended that the policy requires a minimum of 3 credits under the BREEAM New Construction Standard measure "Wat01".

Planning applications will need to include sufficient detail as to the intended Water Efficiency standard and set out the measures to be incorporated to enable compliance.

It should be noted that reducing PCC to tighter standards across the city will also likely require demand reduction actions from Essex and Suffolk Water in combination with government led policy changes.

5.6 Supply

While demand reduction is the priority, Essex & Suffolk Water recognises that population growth, climate change, and environmental constraints will require additional water sources to maintain long-term supply resilience. Without any upgrades to existing infrastructure and new transfers, it is expected that Essex and Suffolk water will have insufficient water resources over the next 25 years and will rely heavily on water transfers from elsewhere.

As part of the WRMP, Essex and Suffolk Water has determined the amount of water that is available for water supply, termed the Deployable Output (DO). It has also estimated and forecast the Water Available for Use (WAFU). The WAFU is the amount of water that water companies expect to be able to supply under the demand conditions set out in the levels of service. The key components of WAFU are the DO and water from neighbouring water companies' resources zones. It also takes into account climate change, the water lost through process, planned and unplanned events (outages) sustainability reductions and water transfers to other companies. Note, in their WRMP, when estimating WAFU, the DO values are estimated for a dry year.

In 2025/2026 the WAFU in the Essex WRZ is estimated to be 384 Ml/d under DYAA conditions. Based on the baseline demand figures shown in section 5.5, there is a shortfall relative to demand of 16 Ml/d in dry years.

Looking to the future, water supplies are initially forecast to fall, the main cause being climate change. However, in 2035 there is a 20 Ml/d step up as a result of the current water sharing agreement with Thames Water expiring. The current water trading agreement results in an average net transfer of 71 Ml/d from Thames Water's supply area to Essex and Suffolk Water. The current agreement extends to 31st March 2035, after this point the transfer shall revert to the original 1963 agreement which required an average net transfer of 91 Ml/d.

Without this step up, the WAFU would continue to fall, however instead it means that by the end of the plan period the WAFU is slightly higher at 385 Ml/d under DYAA conditions. Despite this given the projected baseline demand forecast presented in section 5.5 there is an increase in the overall shortfall to 30 Ml/d. Importantly when considering the final plan demand figures there would be a 40 Ml/d surplus.

Figure 8 is extracted from the WRMP shows the Essex WRZ DYAA supply and demand balance from the 2025/2026 to 2049/2050, the end of the plan period (2045/2046) is marked.

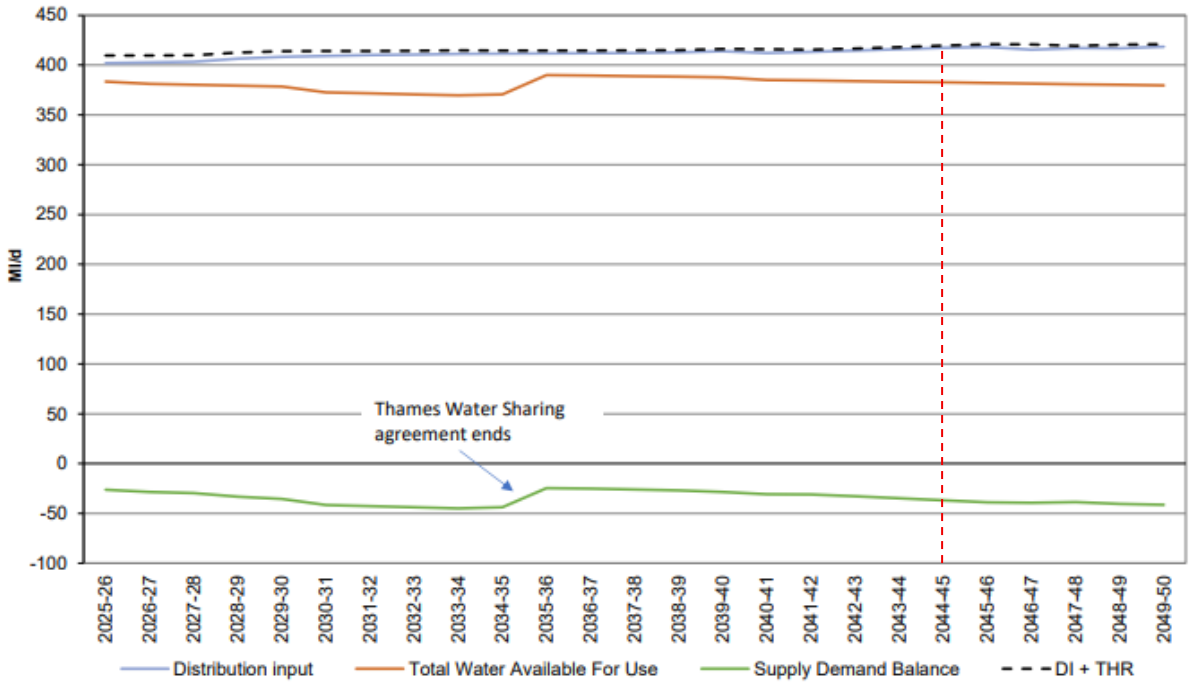

Figure 8- Plot showing supply and demand balance for Essex WRZ (*Source: Essex & Suffolk Water*[40])

Overall, the results suggest that the current deficit will fall if the demand reductions outlined in the final plan are achieved. However, the growth earmarked in the local plan's higher growth scenario (scenario 2) appears to be slightly higher than the growth projected in the WRMP so may bring additional pressures.

Furthermore, both the projected demand reductions and future supply are subject to uncertainty. Future supply will also be influenced by the impacts of climate change. Figure 9 extracted from the WRMP, presents the findings of Essex & Suffolk Water's climate change vulnerability assessment, conducted as part of the WRMP. It identifies the Essex WRZ as being of medium vulnerability. Medium vulnerability is defined as a situation in which climate change introduces moderate uncertainty to household demand, potentially influencing investment planning.

Adding to this, as outlined already the Essex WRZ is heavily reliant on water-sharing agreements, meaning that the supply-demand balance in external areas could significantly affect the water available locally. It is not clear whether the increased water transfer from Thames Water is guaranteed at this stage. Taken together, these factors create an uncertain future for water security and in general it can be concluded that without corrective action, the supply for the Essex WRZ and for Southend may become less secure over time. This implies a need for resource options to increase water security going forward.

[40] Essex & Suffolk Water (2024) *WRMP24 Figure 21*

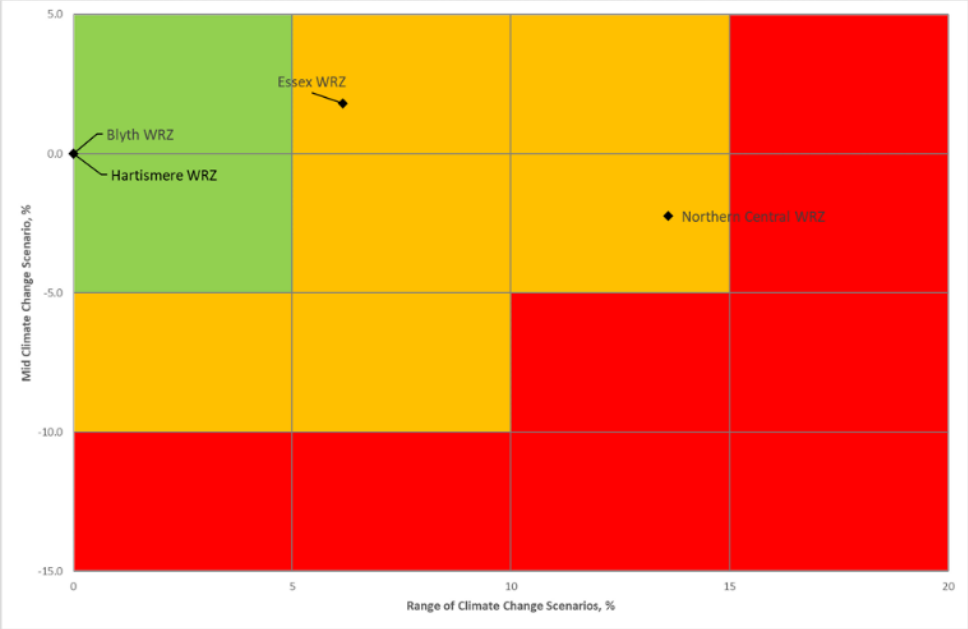

Figure 9 - E&S Water Vulnerability Assessment- Climate Change (Source: Essex & Suffolk Water[41])

5.6.1 Resource Options

In terms of resource options, The Essex & Suffolk Water WRMP24 identifies several potential resource options following a multi-stage screening process based on environmental constraints, alongside economic and technical feasibility.

A number of options for desalination plants were initially explored, including terrestrial and barge options at both Tilbury and Canvey Island. Whilst these supply options offer large increases in yield (e.g. up to 190Ml/d for a desalination plant), they are subject to significant lead times, with the majority forming part of ESW's long-term planning horizons beyond 2050. These options are energy intensive and would therefore be vulnerable to changes in energy prices in the long term alongside having high carbon footprints.

In terms of other potential resource options, reinstatement of a well site and construction of another well at Linford, near Tilbury, could provide up to 10Ml/d, within 10 years of the scheme's implementation, this would utilise the full abstraction licence available[42]. Following pending completion of a transfer to Abberton Reservoir near Colchester, up to 8 Ml/d could be pumped into the Essex WRZ following pump and clarifier upgrades. A further yield of 3.9 Ml/d could be found from new water treatment processes at the Langham and Langford Water Treatment Works (WTWs). These works treat wastewater for drinking, and new processes offering the removal of nitrates and cryptosporidium could yield additional yields. Table 11 details the supply options taken forward in the final preferred plan in ESW's WRMP24.

[41]Essex and Suffolk Water (2024). Supply forecasting. ESW_Supply Forecasting Final WRMP24 Technical Report.pdf.
[42]Essex and Suffolk Water (2024). Least Cost Planning. ESW_Least Cost Planning Final WRMP24 Technical Report.pdf.

Table 11 - Feasible Resource Options for Essex WRZ

Option Type	Name	Output (Ml/d)	Commentary	Within Plan Period
Desalination	Canvey Island Terrestrial Desalination Plant	190	The maximum predicted deficit in the Canvey Island Area is 65 Ml/d. Based on the land available it is estimated that the largest output flowrate is 107 Ml/d. Several smaller sizes were also considered. A lower range and upper range option of 80 Ml/d and 134 Ml/d are also being explored. Transfer to Hanningfield WTW.	Likely to be beyond 2045
Water Reuse	Southend-on-Sea water reuse plant	40.5	Water Reuse plant being fed from WRC, with transfer to Hanningfield Reservoir. Output dependant on WRC capacity.	Likely to be beyond 2045
Groundwater	Linford GW + WTW	10.0	Reinstate abandoned artesian well (3.5Ml/d), alongside new borehole well (3.5Ml/d) to make use of full abstraction licence. Upgrade to WTW to 10Ml/d capacity. No network upgrade required.	2027/28
Raw Water Pumping Station (RWPS)	Abberton RWPS	8.0	Additional pumping capacity at Abberton RWPS.	2030/31
Water Treatment	Langham WTW Nitrate Scheme	0.9	Electrodialysis Reversal nitrate removal plant at Langham WTW.	2029/30
	Langford WTW Nitrate Scheme	2.8	Electrodialysis Reversal nitrate removal plant at Langford WTW.	2029/30
	Langford WTW UV	0.2	Ultraviolet contractors to treat for cryptosporidium.	2029/30

In addition to the measures outlined in the table above, Essex and Suffolk water identifies continued operation of the Abberton and Hanningfield reservoirs as being central to Essex's future supply. River

abstractions from the Chelmer, Blackwater, Stour, and Roman rivers will continue but face potential sustainability reductions. Optimised storage and winter abstraction strategies are proposed to help increase deployable output.

Inter-Regional Transfers in the form of strategic pipelines connecting Essex to neighbouring WRZs could also deliver additional capacity via shared infrastructure. It should also be noted that large regional reservoirs such as the Fens and South Lincolnshire Reservoirs are under development and could store and transfer water to Essex by the late 2030s–2040s.

All of the identified supply options are expected to benefit Southend. The resource options will strengthen water supplies within the Essex WRZ. As the water supply network across the WRZ is interconnected, any additional water resources developed in the zone can be transferred to the city if needed. However, it should be noted that the degree to which Southend benefits from the supply increases at a specific time will be influenced by supply pressures elsewhere including in the Essex WRZ and the wider Essex and Suffolk Water supply area. Surplus water in one location may be used to address supply deficits in another.

5.6.2 Drought Permits

In addition to the supply options outlined above, the WRMP states that a number of drought permit options are available to Essex & Suffolk Water, but it has never been required to use these permits. Drought permits are options that enable water companies to abstract more water than permitted by their abstraction licenses. These options are only available in drought situations and require the water company to demonstrate that there has been an exceptional shortage of rainfall. For the Essex WRZ, during the 2022 drought, the EA stated that they would consider a temporary licence variation to the Ely Ouse River at Denver Abstraction licence to allow refilling of Essex & Suffolk Water Reservoirs[43]. Essex & Suffolk water have not included supply gains from Drought Permits in their final supply demand balance forecasts, and plan to increase the return period of needing drought actions once current WRMP supply schemes are in supply from 2032.

5.6.3 Summary of Demand and Supply Options

Unlike the supply options, the demand options are able to deliver from the first year of implementation due to shorter lead times. Whilst the yield from such measures is typically less than those found for the supply options, they still offer significant savings. Based on a review of the figures estimated in the WRMP, reductions in leakage could yield 10.91 Ml/d by 2044/45, and a reduction of 28 Ml/d by 2045/46 from efficiency measures.

This should be sufficient to significantly offset some of the deficits measured in the development scenarios tested by Essex and Suffolk Water. However, it should be noted that there remains an element of risk and uncertainty around the expectation on the public and on the government to assist in the demand reductions. It is also noted that the current dwellings expected in the local plan may exceed those forecast in Essex and Suffolk Water's WRMP, when considering the higher growth scenario.

In the short to medium term, supply options brought forward in the WRMP24 could yield up to 21.9 Ml/d, but uncertainty persists regarding the exact timings these supplies would be available and at full capacity. These options include new water transfers, WTW's and boreholes, alongside improved water treatment processes. Furthermore, in the longer-term supply options are likely to be

[43] Essex 7 Suffolk Water. Lessons Learnt from 2022 Drought. – "ESW_Lessons Learnt from 2022 Drought Final WRMP Technical Report.pdf"

necessary. In this regard, Essex and Suffolk Water is exploring several options for its supply area including water transfer schemes, desalination plants and new water recycling centres. These have the potential to offset the deficits estimated, however will require significant lead in times and are proposed to serve the Essex and Suffolk Water supply area rather than Southend in isolation.

5.7 Abstraction Licenses

A data request was sent to the EA to establish the existing water abstraction licenses currently in use in the city and in surrounding areas. All relevant abstraction licenses are point abstractions.

In total eight point abstractions were identified by the EA, four of which are within the administrative boundary of Southend-on-Sea. Two of these are groundwater abstraction licenses, both of which are located in the northeast of Southend and are related to a well at Sutton Hall Farm near Great Wakering. Year-round abstraction is permitted for agricultural use, with one license for direct irrigation and one for storage for irrigation. The groundwater source is noted as the Eastern Area of the Essex Gravels groundwater body. The other two licenses within the administrative boundary are surface water abstractions that fall in the Mucking Hall Brook catchment. They both relate to commercial use at the Garon Park Golf Complex.

In terms of the four licenses outside of the boundary, these include an amenity license on the Prittle Brook just upstream of Southend, two agricultural use licenses located in the downstream reaches of the Mucking Hall Brook, and a further agricultural use license to the north of London Southend Airport.

Generally, surface water abstraction is permitted on these licenses between the 1st of November and the 31st of March, this is the period of when river flows are expected to be higher, and reflects the strategy outlined in the Essex Abstraction License Strategy[44], discussed in greater detail below.

Table 12 provides more information about the abstractions including the license holder and their uses. Figure 10 maps the location of the abstractions. Appendix 1 provides the full abstraction records provided by the EA.

Table 12 - Abstraction License Details

Licence Holder	Category	Easting	Northing	Source of Supply	Use	Period
Tabor Farms Ltd	Agriculture	593079	187220	Groundwater – Essex Chalks Eastern Area	Direct Spray Irrigation	Year Round
Tabor Farms Ltd	Agriculture	593079	187220	Groundwater - Essex Chalks Eastern Area	Storage for Spray Irrigation	Year Round
John Armitage	Amenity	581431	188080	Surface Water – Prittle Brook	Make-up or Top Up Water	01/11 – 31/03
Tabor Farms Ltd	Agriculture	591300	189700	Surface Water – Mucking Hall Brook	Storage for Spray Irrigation	01/11 – 31/03
Tabor Farms Ltd	Agriculture	591300	189700	Surface Water – Mucking Hall Brook	Make-up or Top Up Water	01/11 – 31/03
Tabor Farms Ltd	Agriculture	586700	189700	Surface Water – River Roach Tributary	Direct Spray Irrigation	01/06 – 31/08
Garon Park Golf Complex	Commercial	590550	187400	Surface Water – Mucking Hall Brook	Storage for Spray Irrigation	01/11 – 31/03
Garon Park Golf Complex	Commercial	589550	188050	Surface Water – Mucking Hall Brook Tributary	Storage for Spray Irrigation	01/11 – 31/03

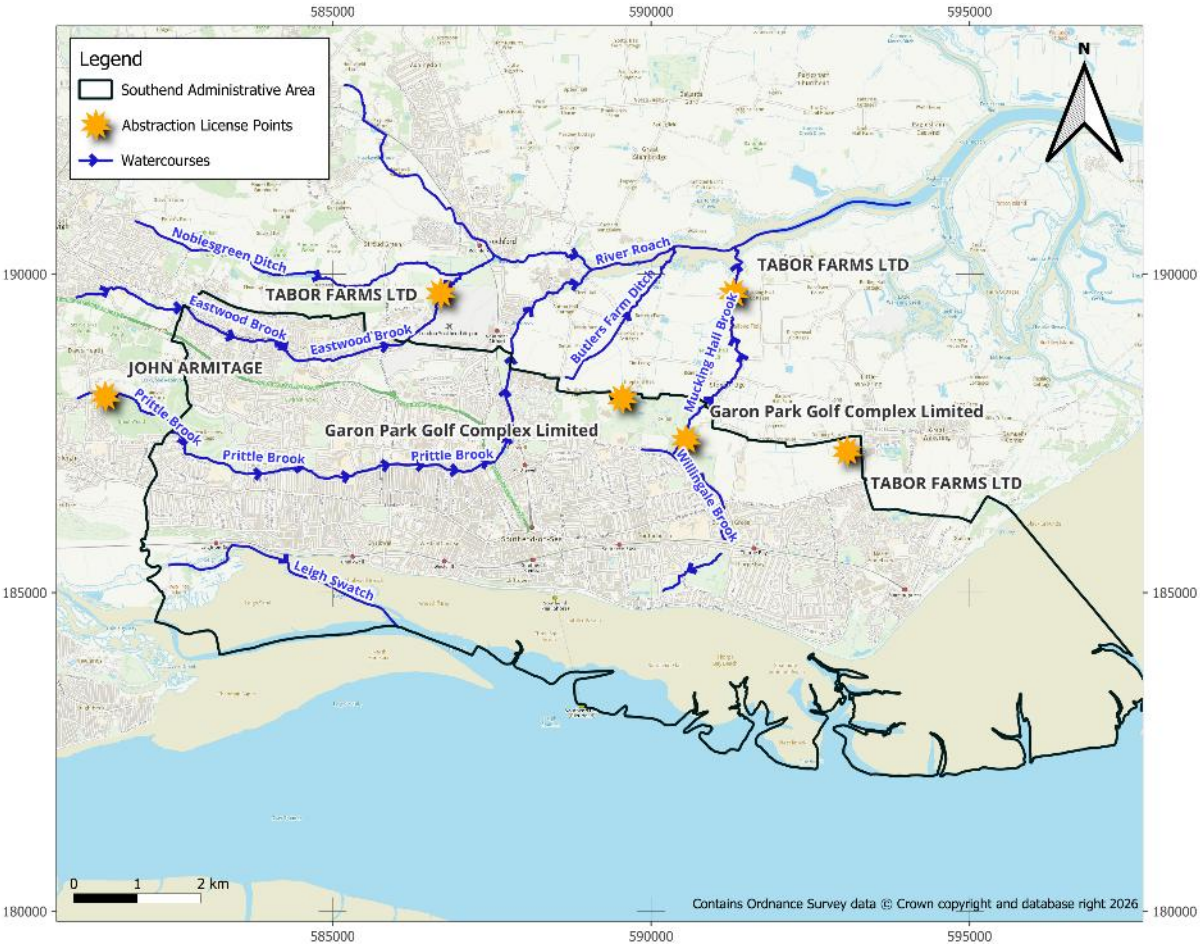

Figure 10 - Location of abstraction licenses in Southend-on-Sea and surrounding area

Based on the Essex Abstraction License Strategy[44], the catchments of Prittle Brook, Eastwood Brook and Mucking Hall Brook, covering the north and west of the city, are classed as 'restricted water available for licensing' at the Q95 (very low flows). The Q95 or 'very low flow' is the flow that will be equalled or exceeded for at least 95% of the time. Under this condition if all licensed water is abstracted there will not be enough water left for the needs of the environment, which means that no new consumptive licences are granted. However, the catchments are classed as 'water available licensing' for Q30 (high), Q50 (median) and Q70 (low) flow conditions. These catchments are tributaries of the River Roach, with the strategy estimating that for 347-days of the year abstraction may be available in the catchment, which is relatively high compared to other catchments in Essex. The abstraction strategy does highlight that more stringent requirements may also be required in protected areas for example Special Areas of Conservation (SAC) and Special Protection Area (SPA).

The catchments in the south and east of the city which do not drain to the River Roach, including Willingale Brook, are classed as 'water not available for licensing' at the Q95 flows. They are subsequently classed as 'restricted water available for licensing' at the Q30, Q50 and Q70 flows.

In terms of groundwater, the confined groundwater aquifer across the majority of Essex is deemed by the EA to be fully committed and no abstraction can take place. However, in the Southend area, areas of unconfined shallow gravel aquifers are present (see section 6.3.3 for more detail). Groundwater licences that do not have a direct impact upon the Q95 river flow may be permitted in the catchments of tributaries of the River Roach. In these cases, restrictions will be determined on a case-by-case basis, and applications will be subject to the normal licence determination process.

The majority of abstraction licenses across the city are for agricultural and amenity purposes. However, further abstraction for water supply may be required going forward. This will depend on the availability of water sources, development and climate pressures not only in the city but across the wider Essex WRZ. It will also be influenced by the implementation of Essex and Suffolk Water's WRMP. In this regard, existing and future abstractions may need to be managed and reduced where possible through better management practices. DEFRA's water abstraction plan[45] lists the following measures to reduce abstraction:

- Introducing controls on more licences to better protect the environment, particularly at low flows.
- Capping licences to prevent increased abstraction damaging the environment.
- Fine tuning the use of surface water and groundwater sources to make the best use of water when it is available while protecting the environment.
- Supporting rapid water trading where it is needed most to allow abstractors to share access to water quickly.
- Allowing some winter abstractors to take water at the highest flows in the summer to boost the use of stored water.
- Sharing real-time information on river flows and forecast changes to help abstractors plan their water use.
- Managing water discharges to benefit abstractors downstream who depend on them.

[44] EA (2019) *Essex Abstraction License Strategy*. https://assets.publishing.service.gov.uk/media/5a7507d4ed915d3c7d529d6d/ALS_2017_Essex.pdf
[45] DEFRA (2021) *Water abstraction plan* https://www.gov.uk/government/publications/water-abstraction-plan-2017/

5.8 Summary

Based on the demand and supply forecasts in Essex and Suffolk Water's latest WRMP without corrective action there could be shortfalls in water in the Essex WRZ up to 2045 and beyond. This suggests that water shortage for the city is a concern moving forward.

The WRMP has identified demand management through a combination of leakage reduction, smart metering and the promotion of water efficiency as the best means to negate a water deficit in the short to medium term. This should be sufficient to offset some of the deficits estimated, however supply options are likely to be necessary, especially in the longer term. These have the potential to offset the deficits estimated, however will require significant lead in times and are proposed to serve the Essex and Suffolk supply area rather than Southend in isolation.

Essex and Suffolk Water's forecasts are generally above the lower and medium growth scenarios proposed by Southend-on-Sea City Council, although the DMA forecast is slightly below the medium scenario. Overall, the forecasts appear broadly aligned with and capable of accommodating Southend's anticipated growth. Under the medium scenario, however, the phasing of development may need to be assessed to ensure that any required new or upgraded infrastructure can be delivered.

The upper growth scenario, based on the Government's housing target but importantly not proposed by the Council, would substantially exceed Essex and Suffolk Water's forecasts, potentially creating additional unforeseen demands on water supply infrastructure.

Abstractions across the city is predominantly for agricultural and amenity purposes, overall, their impact on water resources is thought to be small. However, further abstraction for water supply may be required going forward. This will depend on development and climate pressures not only in the city but across the wider Essex and Suffolk water supply area. It will also be influenced by the implementation of the WRMP.

The assessment undertaken provides an understanding of water resource pressures in the city in the context of future development and climate change. However, it is important to note that the findings are caveated on the basis of several assumptions. The main evidence gaps are identified as:

- Whether the demand and supply changes forecasted for the WRZ and DMAs based on population and dwellings fully translate to the Southend.
- The effects of development on the local water supply network.

To provide more confidence in the assessment and fill the evidence gaps identified, further technical work would be required in order to refine population estimates and derive specific deficits for Southend, considering the quantum of development proposed in the upcoming local plan. However, this should be captured in future updates to Essex and Suffolk Water's WRMP which will make use of more recent local plan data including the emerging local plan. In supplying water to Southend, Essex and Suffolk Water are best placed to assess the impact of future development on supply and demand, which will require an in-depth understanding of how its WRZs and DMAs operate and access to the models used in development of the WRMP. The deliverability of upgrades to the water network would also require further technical input from Essex & Suffolk as sites are brought forward through the planning process.

To further strengthen the long-term management of water resources throughout the plan period, the following stakeholder actions and recommendations have been identified:

- Essex and Suffolk water will continue its responsibilities in upgrading and providing water supply for new developments without presenting a risk to the environment.

- Essex and Suffolk water will need to assess future development earmarked in the local plan when developing their upcoming WRMP2029.
- The EA will need to review and provides feedback on Essex and Suffolk water's WRMP2029, ensuring that Essex and Suffolk water address future water needs and provide a secure and sustainable water supply to the city.
- The EA will continue to regulate the abstraction of water from rivers and other sources in the city, ensuring it is sustainable and within legal limits.
- Southend City Council will work collaboratively with Essex and Suffolk Water to discuss sites being brought forward, their associated build profiles and timings.
- It is recommended that developers engage with Essex and Suffolk water as early as possible so they can undertake modelled impact assessments to confirm if specific water supply upgrades are required and when. Pre-planning enquires are encouraged.
- Should strategic infrastructure upgrades be required to supply new development, the option to phase some of the dwellings to later in the plan period should be considered, especially for larger scale residential developments (>500 dwellings).
- The council should consider a policy on water efficient design, which recommends 100l/p/d by 2030 down to 80l/p/d by 2035. For non-household development, it is recommended that the policy requires a minimum of 3 credits under the BREEAM New Construction Standard measure "Wat01".
- The council will provide Essex and Suffolk water with their Annual Monitoring Reports and Housing Land Supply Statements, which outline projected housing development within their administrative areas.

6 Wastewater, Water Quality and Environmental Capacity

6.1 Introduction

This section assesses the infrastructural capacity of the wastewater system and environmental capacity of the receiving water environment. The infrastructural capacity is defined as the ability of the wastewater system to collect, transfer and treat wastewater from homes and businesses. The environmental capacity is defined as the water quality needed to protect aquatic wildlife and the environment. The latter is associated with the water quality targets required to protect waterbodies and the associated WRC and storm discharge environmental permits in place to achieve this.

The study begins with a review of existing literature and available data for both aspects, followed by detailed quantitative assessments. These include a headroom assessment to evaluate infrastructural capacity and load standstill calculations to assess potential permit changes and environmental capacity. Both consider the proposed development within Southend over the plan period (2025–2045), with the aim of determining whether there will be any detrimental impact on water quality and the need for additional wastewater infrastructure.

6.2 Infrastructural Capacity

6.2.1 Drainage and Wastewater Management Plan & Catchment Strategic Plan

Water and sewerage companies must produce Drainage and Wastewater Management Plans (DWMPs) looking at current and future capacity covering a minimum of 25 years, pressures, and risks to their networks such as climate change and population growth. DWMPs must detail how companies will manage these pressures and risks through their business plans and how they will work with other risk management authorities and/or drainage asset owners.

Anglian Water published their latest DWMP in 2023[46].The DWMP process is iterative and will be repeated every 5 years, with Anglian Water currently preparing the next DWMP due in 2028. Some of the goals in the current DWMP are:

- Network resilience– Reduce risk of sewer flooding up to a 1 in 50-year storm event. Reduce number of sewer collapse.
- Storm Overflow Performance – Reduce the number of spills.
- Pollution Risks – Reduce number of pollution incidents classed as category 1-3 by the EA. Ensure compliance of WRC discharge permits.
- Enable sustainable economic and housing growth.

The area covered by the DWMP includes a large area across the east of England, from the Humber estuary in the north to the Thames Estuary. The drainage network in Southend comprises a combination of both combined and separate systems for wastewater and surface water. Separate systems are more prevalent in newer developments, reflecting policies that require the segregation of wastewater and surface water flows. However, combined sewers still make up a significant proportion of the sewer network and many of the separate systems ultimately drain into combined sewers, evidenced by the presence of Combined Sewer Overflows (CSOs) across the city. Surface water sewers and highway drainage discharge directly into nearby watercourses. The river water quality status in this region and within the city specifically is moderate (see section 6.3.2 for more

[46] Anglian Water (2023) *Drainage and Wastewater Management Plan (DWMP)* https://www.anglianwater.co.uk/siteassets/household/new-report/dwmp-1.pdf

detail on watercourse classifications), influenced by urbanisation and transport runoff, and point sewage discharge and diffuse agricultural pollution.

The DWMP's initial risk-based screening found that 600 of the 1,100 catchments in their area were vulnerable to the risks associated with development and climate change and warranted long-term planning. To prevent these outcomes, Anglian Water have identified the following options as part of their long-term strategy[47]. A summary of key measures is provided below in Table 13.

Table 13 - Summary of relevant mitigation options from Anglian Waters DWMP Technical Report.

Group	Option	Details
Customer side management	Water Efficiency	Reduce water consumptions though efficiency savings to reduce Dry Weather Flows (DWFs).
	Rainwater Harvesting	Measures such as water butts to reduce water entering the system during rainfall events.
CSO's	Resilience to Flooding	Provide physical barriers or non-return devices to reduce sewer flooding incidents.
	Increase Capacity	Increase pump capacity, build storage tanks.
	Reduce Infiltration into sewage network	Reline sewers and manhole covers to reduce infiltration.
Surface Water Management	New surface water sewerage	Direct surface water away from CSOs and WRCs.
	SuDS	Public SuDS such as rain gardens, attenuation ponds and green roofs.
Wastewater Treatment	Process Optimisation	Adjusting processes and adopting new technologies to get the most out of existing assets.
	Relocate Outfalls	Move discharge points to another watercourse.
	Water Reuse	Direct the WRC discharge for a non-potable use rather than discharging.
	Improved Maintenance	Fixing assets when needs arise and proactively identify hotspots.

The widespread implementation of these measures and others detailed in the long-term strategy could be vital in ensuring sufficient infrastructural and environmental capacity going forward. In terms of Southend specifically, the DWMP identified Southend and Great Yarmouth as two catchments where surface water management could be explored.

Since the DWMP, they have committed to invest £90 million into surface water management in Southend specifically with the cited aim of delivering CSO spill and sewer flood reduction through nature-based urban regeneration[48]. This is being funded via an Advanced Water Industry National Environment Programme (A-WINEP) with a 5-to-10-year delivery schedule running through the AMP8 investment cycle (2025–2030) and beyond. It includes the installation of green infrastructure including rain gardens, wet swales, wetlands and bioretention across Southend to remove surface water from the combined system. It also seeks to maximise opportunities for urban regeneration, education and social prosperity.

[47] Anglian Water (2023) *DWMP Technical Report.* https://www.anglianwater.co.uk/siteassets/household/about-us/dwmp/dwmp---technical-report-1.pdf.
[48] Anglian Water (2026) *Urban Regeneration Programme* https://www.anglianwater.co.uk/environment/enhancing-the-environment/advanced-winep-a-winep/urban-regeneration-programme

Partly linked to this there are ongoing programmes of work for schemes in Marine Parade, Thorpe Hall Avenue, and Silverdale Road. These are also being funded by the EA and Southend City Council. More detail is provided on each of these schemes in Table 14.

Table 14- Summary of Surface Water Management Schemes

Location	Summary of Work	Overall Aim	Funding Sources
Marine Parade	Retrofitting dry rain gardens, green corridors, and sustainable drainage hubs along the City Beach promenade.	To relieve pressure on the coastal sewer network, improve bathing water quality, and upgrade the public seafront.	£2 Million Total: Southend Council (Levelling Up funds), Environment Agency (£800k), and Anglian Water (£500k).
Thorpe Hall Avenue	Installing localised street-level SuDS and green infrastructure under the railway bridge and near highway bottlenecks.	To divert flash surface flooding away from a critical 6-foot-wide combined sewer overflow (CSO) pipe.	£350,000: Funded through Anglian Water's Advanced WINEP (A-WINEP) framework.
Silverdale Road	Providing residential properties with smart rainwater-harvesting assets alongside targeted council gully clearing.	To manage middle-catchment rainwater at source, reducing the volume of clean runoff entering urban sewers.	Defra FCRIP Fund: Financed via the regional £6.325 million Catchment to Coast (C2C) program.

Anglian Water are proactively working with the City Council to help shape a partnership delivery model. They have stated that the intensification of growth in the city may require both on-site and off-site infrastructure to address the cumulative impacts of surface water run-off. The use of planning obligations and/or Southend's Community Infrastructure Levy (CIL) could be utilised with Anglians Water's investment to maximise the use of SuDS in the city.

Further to this, Anglian Water requires a SuDS-first approach for new development, with foul and surface water managed through separate systems. Developers must demonstrate that the surface water drainage hierarchy has been followed and that higher-order alternatives to sewer discharge have been fully explored and are not feasible.

Where connection to an existing public surface water sewer is proposed, developers should provide supporting evidence and, where appropriate, engage with the LLFA.

Even where the drainage hierarchy has been followed, developers must consult Anglian Water to confirm whether adequate capacity is available in the receiving network.

It should be noted that the impacts of future growth will be considered through the next DWMP for 2030-2055. Anglian Water will conduct a risk assessment for three different timescales: the short- (5yr), medium- (15yr) and long- (25yr +) term. The outputs from these will be used to develop 'best value' investment solutions to meet their obligations.

6.2.2 Water Recycling Centres

Discharges from WRCs are controlled by discharge consents set by the EA, which detail the flow rate and effluent quality that the WRC must meet to achieve water quality targets. The Dry Weather Flow (DWF) is a key parameter in this regard, it is the flow that may be discharged in dry weather (i.e. flow which occurs in the absence of any runoff from rainfall, snow melt or other sources). The DWF permit specifies the allowable discharge flow rate and required effluent quality of the flow. Anglian Water uses DWF as a key metric to assess available headroom and capacity when reviewing growth plans.

The flow to full treatment (FFT) is also important it measures how much wastewater a treatment works is able to treat at any time. Where the FFT level is exceeded, water may need to be diverted

to storm tanks (if available). Water will typically be held in these tanks until the storm passes. The contents of these storm tanks can then be returned to be treated by the works. Where a storm is prolonged or sustained, then often the environmental permit will allow the water company to release the extra incoming rainwater and diluted wastewater into the environment, normally after partial treatment. If a water company is diverting this rain and wastewater to storm tanks or the environment before reaching the works' FFT level, they could be breaking the conditions of their environmental permit.

Population growth could increase the amount of treated sewage being discharged to the receiving water environment. If population increase causes effluent flows to increase above the consented flow, then there will be a risk of failing to meet water quality objectives. To mitigate against this, the treatment capacity at WRCs may need to be increased and/or the treatment technologies improved. Current discharge permits may also need to be renegotiated, as an increase in DWF Permit limits can also results in changes to other permit parameters.

Southend is primarily served by the Southend WRC, with small areas along the city's northern boundary draining to the Rochford WRC. Areas outside of the city boundary also drain to Southend WRC, including areas of the Castle Point Borough to the west and Rochford District to the northwest. The location and catchments associated with the WRCs are shown in Figure 11.

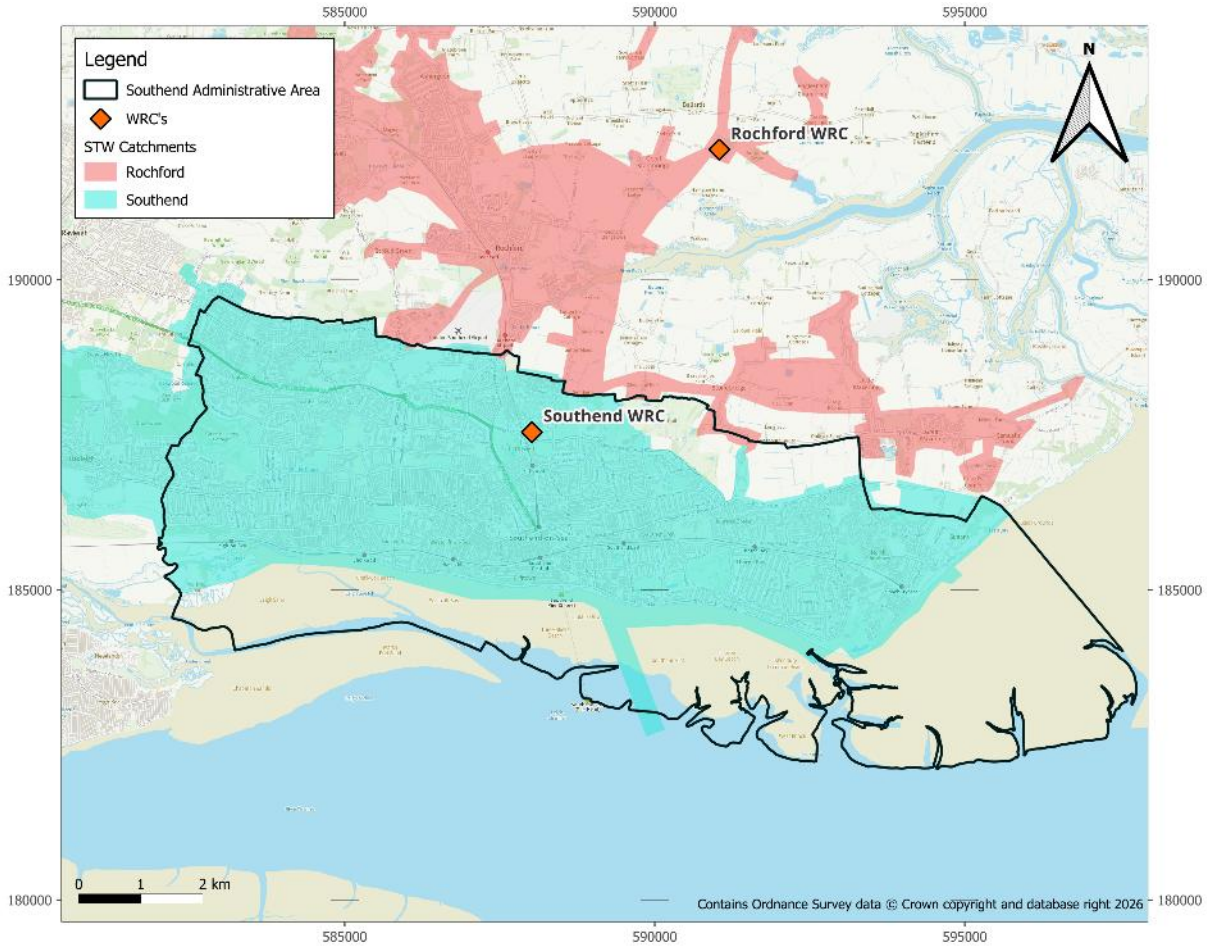

Figure 11 - WRC Catchments in Southend-on-Sea

Anglian Water provide medium- and long-term strategic goals for the sewage catchments in Southend. These have been assessed by Anglian Water in their DWMP Technical Report[47], a summary

of these for the WRCs serving Southend is provided in Table 15. They largely relate to upstream measures rather than upgrades to the WRCs.

Table 15 - Summary of Anglian Water's Visions for WRCs serving Southend

WRC Catchment	Medium Term Strategy	2050 Strategy
Southend WRC	Network Attenuation	25% Surface water removal
Rochford WRC	Increase Network Capacity	10% Surface Water Removal

In terms of how they will deliver network attenuation, increased network capacity and the removal of surface water, as part of the WINEP, Anglian Water must set out how they intend to contribute to delivering wider national environmental objectives. This includes investment amounts and programmes relating to asset improvements, investigations, monitoring and catchment interventions. A number of the measures for Southend have been described in section 6.2.1.

6.2.3 Combined Sewer Overflows (CSOs)

Many parts of England have a combined sewerage system which transports both clean rainwater and wastewater. During heavy rainfall the capacity of these pipes can be exceeded, which means possible inundation of WRCs and backing up of network infrastructure. CSOs were developed as overflow valves to reduce the risk of sewage backing up during heavy rainfall. These overflows discharge diluted untreated sewage during heavy rainfall. CSOs discharge to watercourses in the city and to the Lower Thames Estuary. The EA works closely with water companies to ensure CSOs are closely monitored to identify where the system is not operating as it should. The Environment Act 2021[49] introduced new requirements, stipulating that storm overflow discharges in England must be reported, including their location and the duration of any spill.

The national government's Storm Overflows Discharge Reduction Plan[50] sets targets for regulators and water companies to prioritise improving the water environment. This ties into some of the aims set out in Anglian Water's DWMP (see section 6.2.1). The reduction plan states that by 2040, water companies should have improved 87% of overflows discharging into high-priority sites and 60% of all overflows. By 2050 all overflows should be improved. Note, for a CSO (including both CSOs at WRCs and network CSOs) to be considered as improved, it must meet the following criteria.

- It must be demonstrated that discharges from the CSOs have no local adverse ecological impact.
- The CSO will not be permitted to discharge above an average of 10 rainfall events per year.
- The CSO has screening controls that avoid pollution by limiting discharge of persistent inorganic material. Disinfection may be required in some cases to reduce harmful pathogens.
- The CSO spills no more than 2 times per season when upstream of a designated bathing water.

Supporting the reduction plan is the Storm Overflow Assessment Framework (SOAF). The EA published an updated Storm Overflow Assessment Framework[51] in 2025, which was updated to reflect policy developments, greater data availability and the learnings from the original 2018 framework, implemented during the PR19 period (2020-2025). The latest framework defined the

[49] Parliament of the United Kingdom (2021) *The Environment Act 2021* https://www.legislation.gov.uk/ukpga/2021/30/contents
[50] UK Government (2023) *Storm overflows discharge reduction plan* https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan
[51] Environment Agency (2025). Storm Overflow Action Plan. https://www.gov.uk/government/publications/storm-overflow-assessment-framework-2025/storm-overflow-assessment-framework-2025

spill frequencies which triggers an investigation into a storm overflow. It should be noted that this methodology is focused on inland overflows to freshwater, the methodology for overflows to transitional and coastal water (TRaC) waters will follow once ecological harm standards are agreed.

Table 16 – EA Surface Waterbodies Spill Frequency Investigation Triggers

Time period of available data (years)	Investigation trigger (average number of spills per year)
1	Greater than 30
2	Greater than 20
3 (or more)	Greater than 10

The framework applies the 12:24 method. This is a regulatory method used to aggregate Event Duration Monitoring (EDM) data into discrete spill events. Under this measure, any discharge occurring within an initial 12-hour window from the start of the overflow is recorded as a single event. To trigger a second recorded event, a 24-hour dry period must pass following the end of the previous 12-hour block, any intermittent discharges occurring before this 24-hour gap are considered to be part of the initial spill event.

Anglian Water have also published a Storm Overflow Action Plan[52], outlining what improvements they will make to 2050 to reduce the impacts of storm overflows. One criterion for being a target CSO is being located near bathing waters which applies to many of the CSOs in Southend. As outlined in section 6.2.1, Anglian Water is already working alongside Southend-on-Sea City Council on a SuDS Scheme to reduce spills and sewer flooding. The scheme will aim to reduce the amount of surface water entering the foul water system during heavy rainfall, in turn reducing the likelihood of storm overflows, alongside reducing flood risk. Other Anglian Water initiatives in coastal areas include working alongside food serving establishments to reduce blockages in the network caused by fat, oils and greases, which can cause spills during dry weather periods. Anglian Water state they aim to go beyond their regulatory commitments, these include achieving a 17% reduction in discharges from storm overflows by 2030.

Related to this, Anglian Water's Sewerage Environmental Incentive Scheme encourages brownfield redevelopment that reduces or eliminates surface water discharge into combined or foul sewers. By diverting rainwater away from the sewer network, the scheme reduces stormwater inflows and lowers treatment volumes at WRC's.Further development has the potential to increase risks unless infrastructural capacity is in place. It is Anglian Water's responsibility to continue to monitor CSOs and take appropriate action. Anglian Water publish monthly CSO overspill data, as well as key metrics annually[53].

The location of CSOs outfall monitored across the city are mapped in Figure 12 with their performance summarised in Table 17. Appendix 2 provides the full dataset, which includes further information on each CSO. In total 41 CSO's have been identified, with two of these located outside of the city, in Rayleigh. These lie upstream of the city but have been selected given that they discharge into Eastwood Brook and may have implications on water quality in the city.

[52] Anglian Water (2025). Action on Storm Overflows. Our plan to 2050. https://www.anglianwater.co.uk/siteassets/household/services/aw0784-storm-overflow-action-plan.pdf
[53] Anglian Water (2025). Annual EDM Return for 2024. event-duration-monitor-edm-return-for-anglian-water-annual-2024.xlsx.fwin

The period of record is relatively short in some instances; however, by 2023 Anglian Water had placed monitors on each CSO in the city, in line with the national target that all CSO's were monitored by the end of 2023. We have therefore assessed the most recent 3 years of data.

Of the 41 CSO's, seven are located at sewage pumping stations. Due to the topography of the city, sewage from many areas, such as Shoeburyness, is required to be pumped to Southend WRC, which is located on higher topography than many parts of the city. These CSOs should operate when the pumping capacity of the station is exceeded due to heavy rainfall, however blockage or pump failure could also lead to operation. One CSO is located at the inlet of Southend WRC, this discharges into the Thames Estuary via the long sea outfall connected to the works. It should operate during periods of heavy rainfall when more stormwater and effluent is reaching the WRC than can be treated safely or stored temporarily. Infrastructural failure or inadequate treatment capacity for the population served could also lead to CSOs at WRC spilling outside of periods of heavy rainfall. The remaining CSOs are located along strategic points on the network, again these should operate when network capacity is exceeded due to heavy rainfall. However, blockages, infiltration and infrastructure failures downstream could also lead to these spills becoming operational.

Nine of the CSOs discharge to surface waterbodies, and as such are subject to the investigation triggers detailed in Table 16, of these CSOs, one has exceeded the level at which an investigation is required based on the three previous years of data. This is the Bell Public House/Prince Avenue CSO, which has discharged to a tributary of Prittle Brook an average of 12.33 times annually between 2023-2025. The remaining CSOs discharge to TRaC waters. As mentioned previously, at the time of writing, the EA have stated that a methodology for discharges to TRaC waters will follow once ecological harm standards are agreed. Of the CSOs discharging to TRaC water, three have exceeded the spill count which would trigger an investigation under the discharge to freshwater standards. Under the WINEP framework for AMP8, Anglian Water are currently conducting investigations to reduce storm overflows at several of the CSO's in Southend. They are set to deliver traditional storm tanks at Western Valley and Hartington Road Overflows in order to meet the WINEP driver for 2 spills or less per bathing water season. Furthermore within AMP8, Anglian Water will also install 6mm screening on the majority of CSO's in Southend, which will prevent large debris from spilling to watercourses, in line with government policy

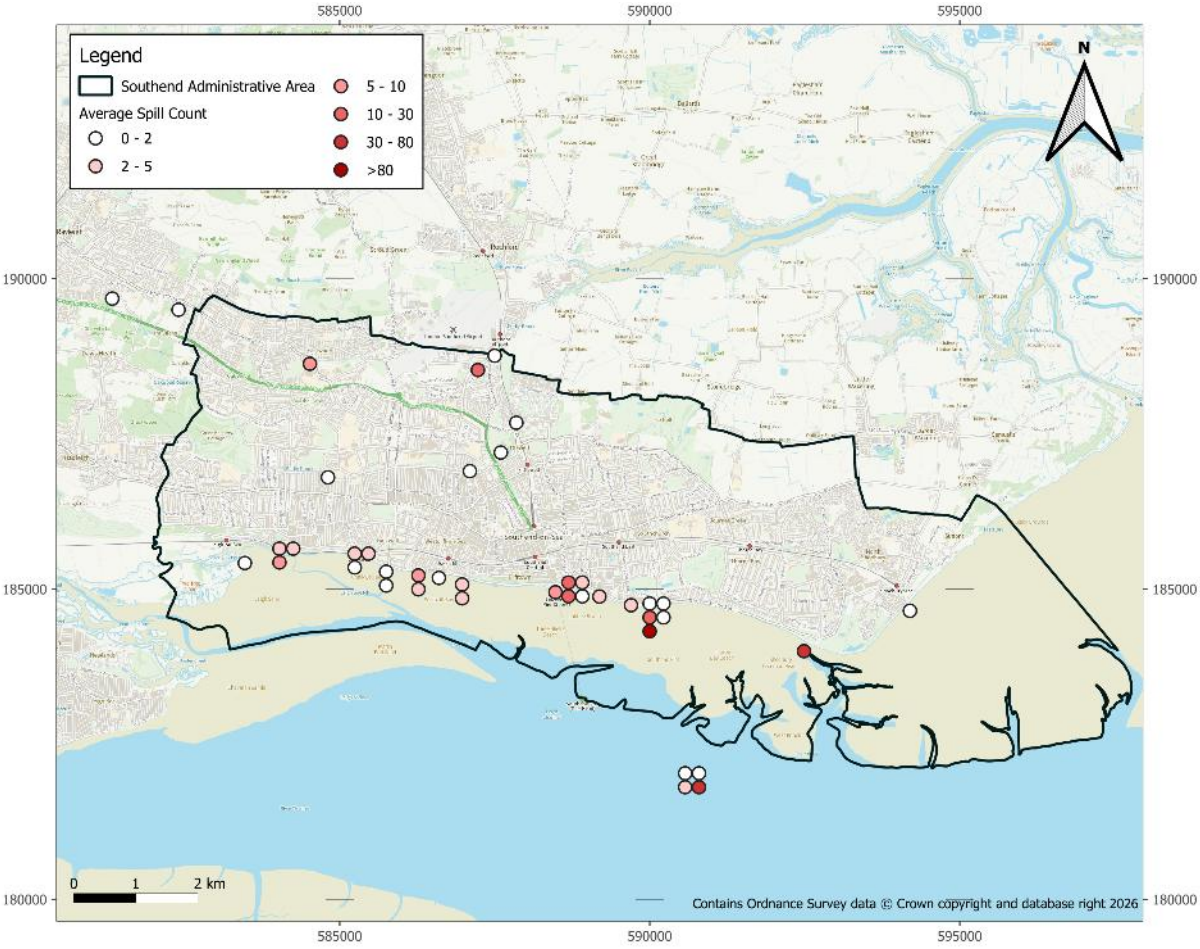

Figure 12 - Location and average spill count of CSO's under study

Table 17 - CSO Spill frequency and duration data 2023 – 2025

WHS CSO ID	CCSO Name	EA Permit Reference	Asset Type	Receiving Waterbody	NGR	Spill Count 2023	Duration 2023 (hh:mm)	Spill Count 2024	Duration 2024 (hh:mm)	Spill Count 2025	Duration 2025 (hh:mm)	Average Spill Count	Average Duration (hh:mm)
1	Chalkwell/Ridgeway OV	**S/WR73**	Network CSO	Thames Lower	TQ8575085280	2*	03:00*	2	03:00	0	0	1	01:30
2	Chalkwell/Ridgeway OV	**S/WR480**	Network CSO	Thames Lower	TQ8575085280	0*	00:00*	0	00:00	N/A	N/A	0	00:00
3	Eastwood Pk South SSO	**AW2NFE03958**	Network CSO	Eastwood Brook	TQ8452088630	13**	08:30**	14	09:15	6	03:15	10	06:15
4	Victoria Road CSO OV	**S/WR479**	Network CSO	Thames Lower	TQ9001084720	2*	04:00*	0	00:00	3	02:30	1.5	01:15
5	Woodgrange Drive CSO 1	**S/WR479**	Network CSO	Thames Lower	TQ9001084720	2*	00:45*	0	00:00	1	00:30	0.5	00:15
6	Victoria Avenue	**AW2NFE01558**	Network CSO	Prittle Brook	TQ8760087200	0	00:00	1	00:30	2	00:30	1	00:20
7	Southend-Pavillion CSO	**AW2NFE02253**	Network CSO	Prittle Brook	TQ8481086800	0	00:00	1	00:15	0	00:00	0.33	00:05
8	Wyburns Avenue PS	**AW2NFE10060**	Pumping Station CSO	Eastwood Brook	TQ8133089680	4	10:00	1	01:45	0	00:00	1.66	03:55
9	Bartlettes Road PS	**ASENF2130**	Pumping Station CSO	Eastwood Brook	TQ8240089500	2	02:00	0	00:00	0	00:00	0.33	00:40
10	Belton Gardens PS	**S/WR73**	Pumping Station CSO	Thames Lower	TQ8347085420	1**	8:45**	2	07:00	1	01:15	1.5	04:08
11	Victoria W'f Tank CSO	**S/WR74**	Network CSO	Thames Lower	TQ8414085540	1	01:00	4	01:30	4	02:15	3	01:35
12	Leigh Hill CSO	**EPR/AB3756TL**	Network CSO	Thames Lower	TQ8414085540	7*	01:45*	7	02:30	1	00:15	4	01:23
13	Leigh Hl/Cliff Pd CSO	**S/WR75**	Network CSO	Thames Lower	TQ8414085540	7	02:45	7	02:45	5	02:30	6.33	02:40
14	Brittania Rd Tank Ov	**S/WR78**	Network CSO	Thames Lower	TQ8627085220	20*	19:25*	14	06:30	6	02:45	10	04:18
15	Western Valley SP	**S/WR78**	Pumping Station CSO	Thames Lower	TQ8627085220	7*	5:45*	5	07:00	4	02:45	4.5	04:38
16	Hamlet Ct Rd CSO	**S/WR79**	Network CSO	Thames Lower	TQ8660085180	0	00:00	2	00:30	2	00:30	1.33	00:20
17	Canewdon Road SP	**S/WR81**	Network CSO	Thames Lower	TQ8694085160	1*	00:45*	0	00:00	4	01:45	2.5	00:53
18	Retreat Road CSO	**S/WR80**	Network CSO	Thames Lower	TQ8701084990	0*	00:00*	1	00:30	4	01:30	2.5	01:00
19	Pier Hl/High St CSO	**S/WR83**	Network CSO	Thames Lower	TQ8848084950	23*	10:00*	6	02:15	9	04:15	7.5	03:15
20	Church Road CSO	**EPR/AB3352TF**	Network CSO	Thames Lower	TQ8880084990	10*	03:30*	17	08:45	18	09:30	17.5	09:08
21	Queensway CSO	**S/WR84**	Network CSO	Thames Lower	TQ8880084990	22**	14:45**	4	01:30	0**	00:00**	4	01:30
22	Southchurch Road CSO	**EPR/AB3254TZ**	Network CSO	Thames Lower	TQ8880084990	4*	01:15*	18	13:00	9	04:15	13.5	08:38
23	Hartington Rd BF	**S/WR85**	Network CSO	Thames Lower	TQ8881085010	0*	00:00*	1	00:15	1	00:15	1	01:15
24	Southend Burdett Road CSO	**S/WR86**	Network CSO	Thames Lower	TQ8919084880	2	00:20	4	00:42	7	01:04	4.33	00:42
25	Manilla Road	**S/WR87**	Network CSO	Thames Lower	TQ8970084740	4	06:00	5	16:26	5**	30:22**	4.5	11:13
26	Riv Dr/Chinch'la CSO	**EPR/AB3752TR**	Network CSO	Thames Lower	TQ9018084610	9*	03:45*	43	52:15	17	16:45	**30**	34:30

WHS CSO ID	CCSO Name	EA Permit Reference	Asset Type	Receiving Waterbody	NGR	Spill Count 2023	Duration 2023 (hh:mm)	Spill Count 2024	Duration 2024 (hh:mm)	Spill Count 2025	Duration 2025 (hh:mm)	Average Spill Count	Average Duration (hh:mm)
27	Riviera Drive BF	**EPR/AB3754TQ**	Network CSO	Thames Lower	TQ9018084610	0*	00:00*	0	00:00	0	00:00	0	00:00
28	Woodgrange Drive CSO 1	**S/WR88**	Pumping Station CSO	Thames Lower	TQ9018084610	91*	463:15*	165	1633:15	13	14:15	**178**	823:45
29	Archer Cl CSO	**CASM.0089**	Network CSO	Thames Lower	TQ9068081920	0*	00:00*	0	00:00	1	00:15	0.5	00:08
30	Hams/Roy Art W CSO	**CASM.0089**	Network CSO	Thames Lower	TQ9068081920	0*	00:00*	0	00:00	2	00:30	1	00:15
31	Roy Art/Ash Av CSO	**CASM.0089**	Network CSO	Thames Lower	TQ9068081920	5*	04:00*	5	06:45	4	04:15	4.5	04:30
32	Shoebury Ness Rd Sp	**S/WR90**	Pumping Station CSO	Thames Lower	TQ9249084000	63*	33:50*	84	65:00	69	31:15	**76.5**	48:08
33	Shoebury Rampart St Sp	**S/WR91**	Pumping Station CSO	Thames Lower	TQ9420084650	0**	00:00**	0	00:00	0	00:00	0	00:00
34	Rochford Road CSO	**AW2NFE05483**	Network CSO	Prittle Brook	TQ8750088760	1	01:30	2	1:45	1	00:15	1.33	01:10
35	Shakespeare Avenue CSO	**AW2NFE18768**	Network CSO	Prittle Brook	TQ8710086900	0**	00:00**	0	00:00	1	00:15	0.5	00:08
36	Prittle Brook Storage Tank	**S/WR76**	Network CSO	Thames Lower	TQ8536085460	3	00:30	2	08:00	5	00:32	3.33	3:01
37	Chalkwell/Ridgeway Ov	**S/WR480**	Network CSO	Thames Lower	TQ8535085460	0*	00:00*	7	16:00	0	00:00	3.5	08:00
38	Chalkwell/Ridgeway Ov	**S/WR480**	Network CSO	Thames Lower	TQ8535085460	2*	00:30*	1	00:30	0	00:00	0.5	00:08
39	Priory Crescent SSO	**AW2NFE05183**	Network CSO	Prittle Brook	TQ8785087680	0	00:00	0	00:00	2	01:00	0.33	00:20
40	Southend WRC	**CASM.0072**	Inlet SO at WwTW	Thames Lower	TQ9070081920	112	481:00	43	196:26	94**	236:42**	**77.5**	676:13
41	Bell Public House/Prince Ave CSO	**AW2NFE17964**	Network CSO	Prittle Brook	TQ8723088530	17	25:30	13	15:45	7	06:30	**12.33**	15:55

*Denotes that the EDM was installed during that year.

**Denotes that the EDM data is available for <90% of the year and should be excluded from average due to potential impacts of seasonal variation

6.3 Environmental Capacity

6.3.1 Water Framework Directive and River Basin Management Plans

The Anglian Rivers Basin Management Plan[54] (RBMP) was initially published by DEFRA and the EA in 2015 and updated in 2022. The purpose of the RBMP is to provide a framework for protecting and enhancing the water environment. To achieve this, and because water and land resources are closely linked, it also informs decisions on land use planning.

The RBMP covers the following areas which relate to management of land and water:

- Baseline classification of water bodies
- Statutory objectives for protected areas
- Statutory objectives for water bodies
- Challenges for the water environment
- Summary programme of measures to achieve statutory objectives

The Water Framework Directive (WFD)[55] transposed into law by the Water Environment Regulations 2017 in England and Wales[56] provides most of the legislative basis for the RBMP. Water bodies are assessed based on the WFD indicator, which measures the health of the water environment and assigns them a status. The assessment is based on a range of quality elements relating to the biology and chemical quality of surface waters. Table 18 gives a description of each of the status classes.

Table 18- Definition of ecological status in Water Framework Directive

Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife, or fisheries.
Good	Slight change from natural conditions because of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife
Moderate	Moderate change from natural conditions because of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions because of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions because of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

These status classes feed into the overall environmental objectives of the WFD and the associated RBMP. The environmental objectives are listed below. It is essential that the Local Plan have regard for the RBMP and be delivered with no adverse impact to WFD waterbodies.

- To prevent deterioration of the status of surface waters and groundwater
- To achieve objectives and standards for protected areas

[54] EA (2022). River basin management plan for the Anglian River Basin District. https://assets.publishing.service.gov.uk/media/635242f8e90e07768c1a73a0/Anglian_river_basin_management_plan_2022_HRA.pdf

[55] European Commission, *Water Framework Directive (2000)*, http://ec.europa.eu/environment/water/water-framework/index_en.html

[56] Parliament of the United Kingdom (2017) *The Water Environment (Water Framework Directive) (England & Wales) Regulations (2017)* https://www.legislation.gov.uk/uksi/2017/407/contents

- To aim to achieve good status for all water bodies
- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- The cessation of discharges, emissions and priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

The RBMP outlines the measures potentially needed to achieve these statutory objectives and the regulators/operators responsible. These measures are/will be essential in maintaining environmental capacity in response to increased housing and population growth. Table 19 summarises some of the key measures relevant to the study area[57].

Table 19- Key measures summarised from Anglian Rivers RBMP

Category	Description	Key Stakeholders
Advice Schemes	Advice to farmers on environmental improvements and nutrient management	NFU
Education, targeted information	Aquatic Biosecurity Campaigns- Slowing spread of invasive species via public awareness	GB Non-Native Species Secretariat
	Behaviour campaigns on water use	EA, E&SW, Anglian Water (AW)
Financial incentives	Environment Management capital programme including diffuse pollution control initiatives	EA
	EA Flood and Coastal Risk Management capital programme- includes river restoration	EA
	England Woodland Creation Offer- Tree planting to improve water quality	Forestry Commission
	Green recovery challenge fund- various environmental improvement projects	Defra
	Environment Land Management Schemes- Various environmental improvements by land managers	Defra
	Water Environment Improvement Fund- Local habitat improvement schemes and pollution control initiatives	EA
Guidance/Process	Water Leaders Group to act as advocates for restoration of natural processes within freshwater catchments	EA
	Water Environment Transformation (WET) Programme - to support wider implementation of nature-based solutions through PR24 process and the agriculture sector	EA
	Drainage Wastewater Management Plans to inform measures identified by Water Industry in Price Review24	EA and AW
Non-regulatory	Nature Recovery Network- Various actions to protect, improve, expand, and connect habitats including water and water-dependent environments	Natural England
Partnerships	Catchment partnership led projects and measures related to multiple funding streams and outcomes for water quality, quantity, habitat and flood risk reduction	EA, E&SW, AW
Regulatory	Water Industry National Environment Programme schemes - Habitat improvements and farm nutrient management plans	EA, E&SW, AW, NFU
	Sustainable abstraction improvements through changes to abstraction licences, licence conditions and non-licence changes at specific sites	EA, E&SW
	Sewage treatment improvements by changes to licence conditions at specific sites	EA and AW
Research	Water Leaders Group developing shared guidance and case studies for integrating investment in and across catchments	EA

[57] Environment Agency (2022). Summary of RBMP Measures. Summary of the measures planned for each river basin district.xlsx.

6.3.2 Surface Water and TRaC Waterbodies

The EA's catchment data explorer was used to extract information about the water environment for the WFD catchments falling within the Southend area. The catchment data explorer provides information on the ecological and chemical status of WFD catchments throughout the UK.

The ecological status of WFD catchments can be classified as *Bad, Poor, Moderate, Good* and *High*. For the chemical status, WFD catchments are classed as either as a *Fail* or *Good*. For this study the classifications are used to assess the existing pressures on specific catchments in the study area and understand their environmental capacity. Figure 13 shows the WFD within the city. It should be noted that the parts of the city not located in WFD surface water catchments, either drain to the Tidal Crouch TRaC or Thames Lower TRaC waterbodies which lie to the north and south of the city respectively. Slightly different metrics are used to assess WFD classifications for these water bodies.

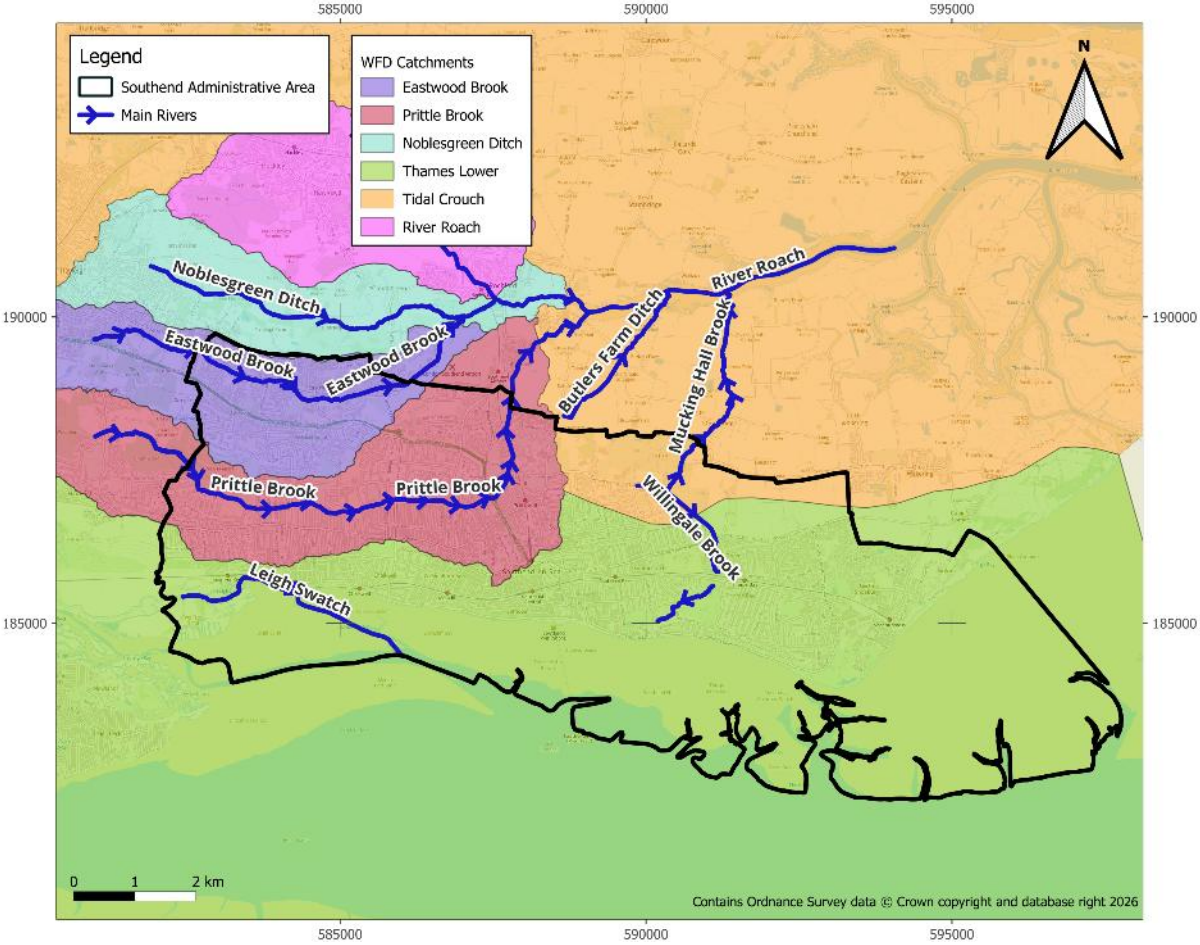

Figure 13 - WFD Cycle 3 River and Coastal Waterbody Catchments

Table 20 shows the ecological and chemical status of the three River WFD catchments which fall within the city. Table 21 shows the same for the two transitional WFD catchments. For ecological status, all five are classed as *Moderate*. All catchments were measured to have a *Fail* chemical status in 2019. For the 2019 assessment of chemical status, the EA changed some methods and increased their evidence base. Due to these changes, all water bodies now fail chemical status. This is largely due to the introduction of thresholds for newly introduced substances. The assessment is not comparable to the assessments undertaken for previous WFD cycles. The table also lists the reasons for not achieving good status, based on a specific source's effect on a metric used to determine

ecological and chemical classifications. Where the water industry has been identified as a reason it is highlighted in bold text. In many of these cases the water industry is not the only reason listed with agriculture, transport and land management practices often also being cited as reasons for not achieving good status. Those being impacted by the water industry could be more sensitive to future development given its potential impact on increasing pollutant loads.

Table 20- Ecological and Chemical Status of River Waterbodies in the study area

Waterbody Name - WBID	Ecological	Chemical	Classification Item and reasons for not achieving good status (RNAG)
Prittle Brook - GB105037028730	Moderate	Fail*	Phosphate levels (diffuse runoff from urbanisation and transport), invertebrates (physical modification and diffuse urbanisation and rural land management pollution) and supporting elements (physical modification).
Eastwood Brook - GB105037028741	Moderate	Fail*	Supporting elements (physical modification)
Noblesgreen Ditch - GB105037028743	Moderate	Fail*	Phosphate (**point sewage discharge** and diffuse transport runoff), supporting elements (physical modification) and Invertebrates (saline intrusion and diffuse urbanisation runoff).

*Classification from 2019, no classification available for 2022

Table 21 - Ecological and Chemical Status of Transitional Waterbodies in the study area

Waterbody Name	Ecological	Chemical	Classification Item and reasons for not achieving good status (RNAG)
Thames Lower - GB530603911401	Moderate	Fail*	Angiosperms (physical modification), Dissolved Organic Nitrogen (**point sewage discharge**, diffuse agricultural pollution) and supporting elements (physical modification).
Crouch - GB520503704100	Moderate	Fail*	Dissolved Organic Nitrogen (**point sewage discharge** and diffuse agricultural pollution)

The current status of watercourses within the city shows them to be potentially vulnerable, with limited environmental capacity especially likely in catchments with failures in nutrient status. It should be noted that not all the failures or deterioration necessarily impose a significant limit to growth, especially where other reasons (i.e. agricultural impacts) are playing a large role in the watercourse not achieving good status.

The findings potentially highlight the need for CSO and WRC upgrades to be implemented in a timely manner. When implemented, these should reduce spills, improve effluent quality or increase the headroom available to allow development to take place without compromising water quality.

As well as the additional wastewater draining to WRCs, development can also affect surface water flow routes and water quality through direct runoff to waterbodies. This has the potential to impact upon the ecology of the watercourses running through the city. In this regard, the use of SuDS and associated flow control should be encouraged to ensure development does not affect or has minimal impact on water quality or flow regimes (more detail on SuDS is provided in section 7.4).

6.3.3 Groundwater

The EA catchment data explorer was also used to assess the status of groundwater bodies. One WFD groundwater body intersects Southend, this is the Essex Gravels Groundwater body, shown in Figure 14. Groundwater bodies are measured against a quantitative status and a chemical status. Good quantitative status can be achieved by ensuring that the available groundwater resource is not reduced by the long-term annual average rate of abstraction. In addition, impacts on surface water linked with groundwater or groundwater-dependent terrestrial ecosystems should be avoided, as should saline intrusions.

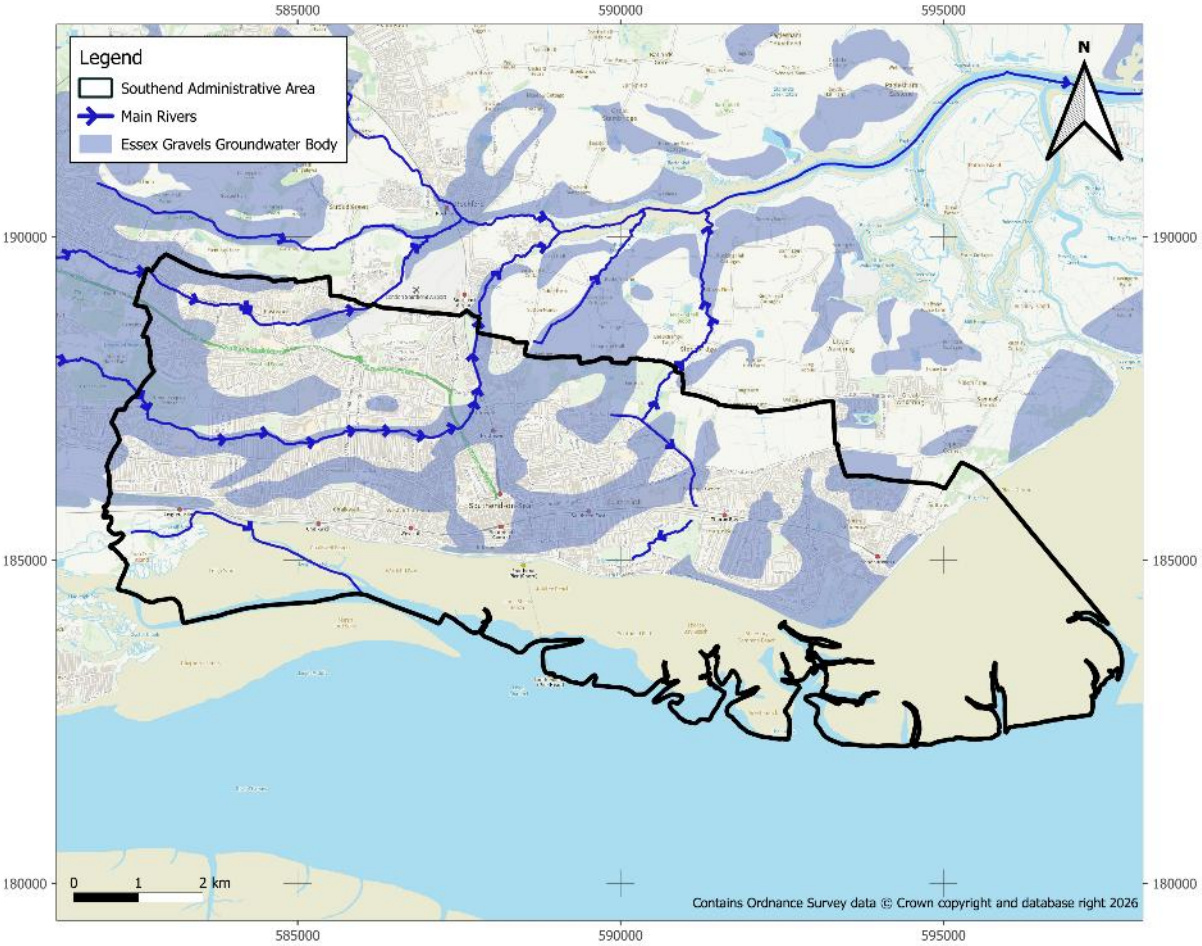

Figure 14- WFD Groundwater Catchments intersecting the city

The WFD groundwater classification for the Essex groundwater catchment is *Poor.* This is due to its chemical status, as its quantitative status is *Good.* The reasons for not achieving good status are diffuse pollution from poor nutrient/livestock management practices associated with agriculture and land management, so are not currently directly tied to future growth. Whilst the quantitative classification is *Good,* abstractions could potentially increase to meet future demand and offset shortages in surface water supplies as a result of climate change. This in turn could have a detrimental impact on quantitative status if not properly managed.

6.4 Headroom Assessments

6.4.1 Background

Increased domestic population and/or employment activity can lead to increased wastewater flows arriving at a WRC. Where there is insufficient headroom at the works to treat these flows, this could lead to breaches in flows permitted leading to a greater volume of treated sewage being discharged into receiving watercourses presenting a water quality risk. A lack of headroom at a WRC can also lead to the capacity of the sewer network upstream being exceeded more regularly, in turn contributing to a greater number of untreated sewer discharges via CSOs.

To assess the headroom available at the two WRCs in this study, the methodology in section 2.5.2 has been applied considering the quantum of development outlined in section 4.

6.4.2 Review of Dry Weather Flow (DWF) Data

An initial assessment of headroom capacity at WRCs was undertaken using DWF data supplied by Anglian Water for 2017 – 2025. In line with EA recommendations the previous 5-years of data (2021-2025) have been used. Using 5 years of data provides an overview of trends and dampens the impact of unusually wet or dry years.

Table 22 shows the Q80 and Q90 flow values recorded at each WRC between 2021-2025. The baseline DWF used for the headroom assessments and load standstill calculations is an average of the flow values across 2021-2025.

Table 22- 80th and 90th percentile annual exceedance flow values (2021-2025)

WRC Name	Q80					
	2021	2022	2023	2024	2025	Avg
Southend	51360	43583	48270	48960	48879	48210
Rochford	7667	6669	7234	7135	7179	7177
WRC Name	**Q90**					
	2021	2022	2023	2024	2025	Avg
Southend	49558	41075	46447	47137	47056	46255
Rochford	7290	6415	6937	6838	6882	6872

Figure 15 and Figure 16 shows the variation in the Q80 flow values between 2021-2025 with the average across all years marked in red. Q80 flow trends are similar across both WRCs. The highest recorded flows occurred in 2021, potentially driven by the COVID-19 pandemic as commuting to metropolitan centres like London declined. Conversely, the lowest flows were recorded in 2022, likely due to that year's low rainfall and high temperatures. While 2023 and 2024 were wet and exceptionally wet respectively, 2025 marked a return to drier conditions. However, the year-on-year flow variations between these later years is less pronounced, potentially due to confounding factors such as population growth and groundwater infiltration.

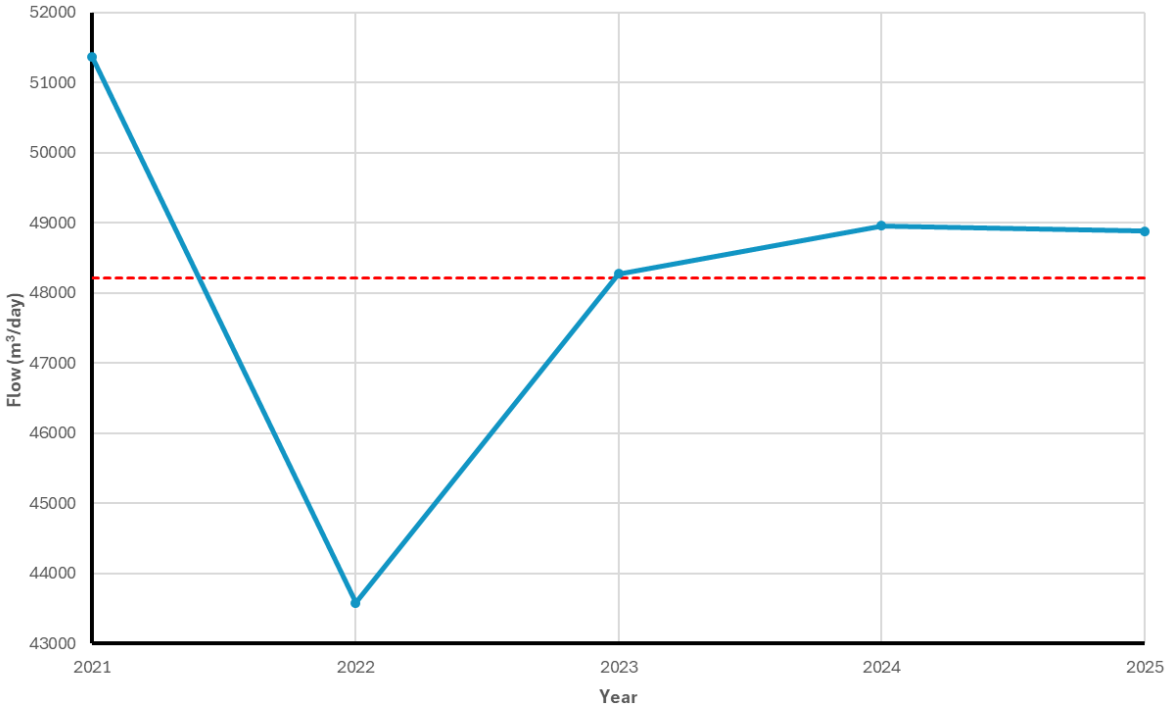

Figure 15- Trends in Q80 flow values (2021-2025) at Southend WRC

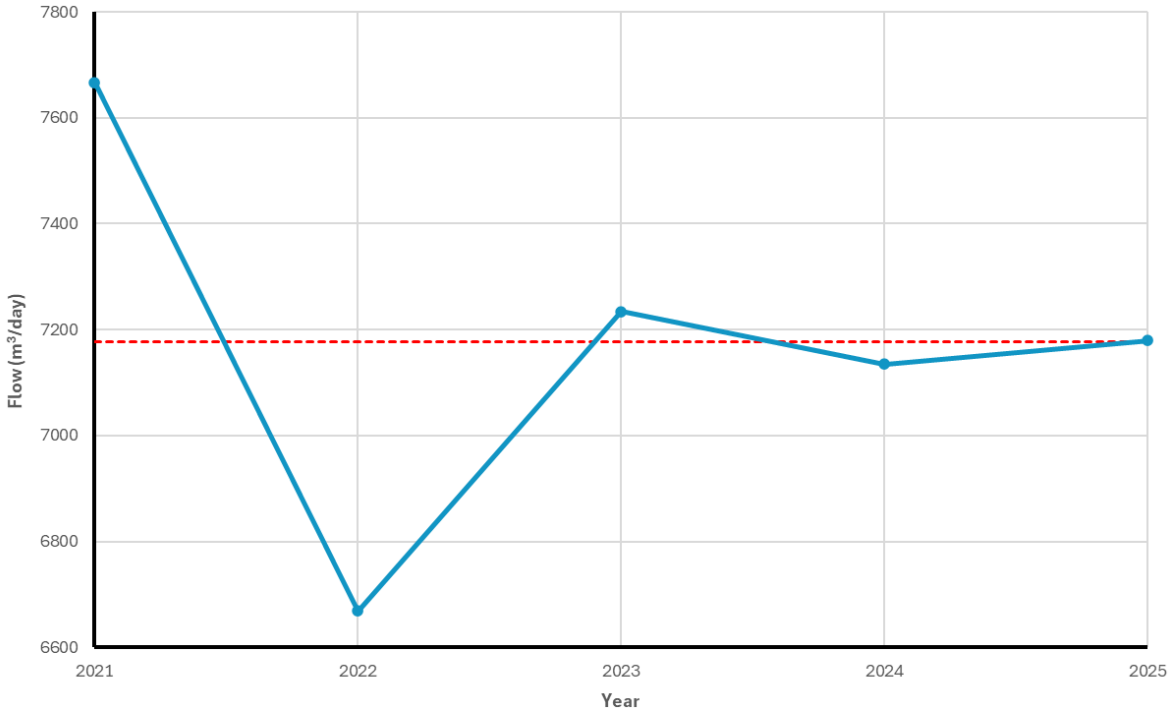

Figure 16 - Trends in Q80 flow values (2021-2025) at Rochford WRC

6.4.3 Results at Southend WRC

The Southend WRC outfalls via a long sea outfall to the Lower Thames Estuary (at E:590700, N: 181920). This extended outfall is used to protect coastal bathing water status. It has a permitted DWF of 60,000 m^3/day. In the period between 2021-2025, the average Q80 and Q90 flows have been under the permitted amount, with an average over this period of 48,210 m^3/day and 46,255 m^3/day respectively.

The low, medium and high growth scenarios detailed in section 4 have been tested as part of the headroom assessment at the Southend WRC.

In the lower growth scenario, the additional housing is projected to contribute an additional 3,493 m^3/day by the end of the plan period. The addition of this flow would increase the Q80 and Q90 flows to 51,703 m^3/day (up 7.25%) and 49,747 m^3/day (up 7.56%) respectively, see Figure 17.

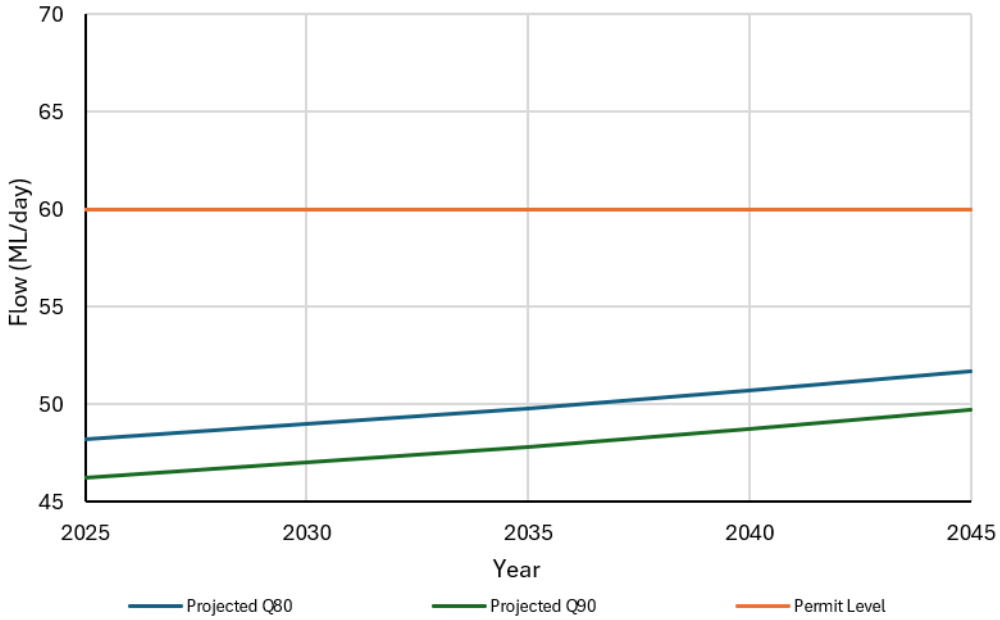

Figure 17 – Southend WRC Low Growth Scenario DWF Headroom Forecast

In the medium growth scenario, the additional housing is projected to contribute an additional 4,919 m^3/day by the end of the plan period. This added flow would increase Q80 and Q90 to 53,129 (up 10.20%) m^3/day and 51,173 m^3/day (up 10.63%) respectively, see Figure 18.

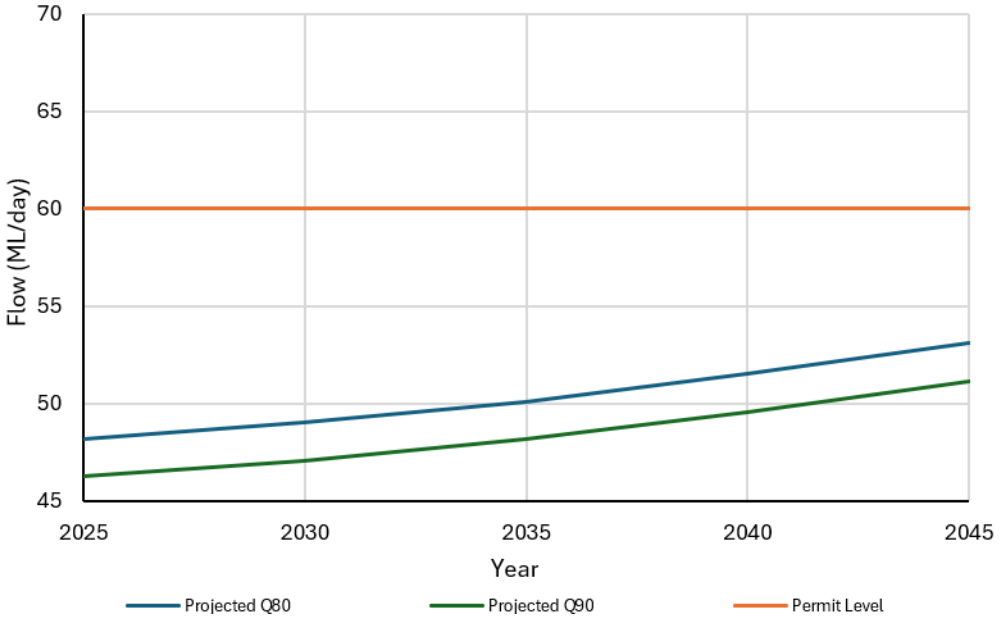

Figure 18 - Southend WRC Medium Growth Scenario DWF Headroom Forecast

If the governments housing needs target were to be met, the additional housing is projected to contribute an additional 8,790 m^3/day by the end of the plan period. This added flow would subsequently increase Q80 and Q90 to 57,000 (up 18.23%) m^3/day and 55,044 m^3/day (up 19.00%) respectively, see Figure 19.

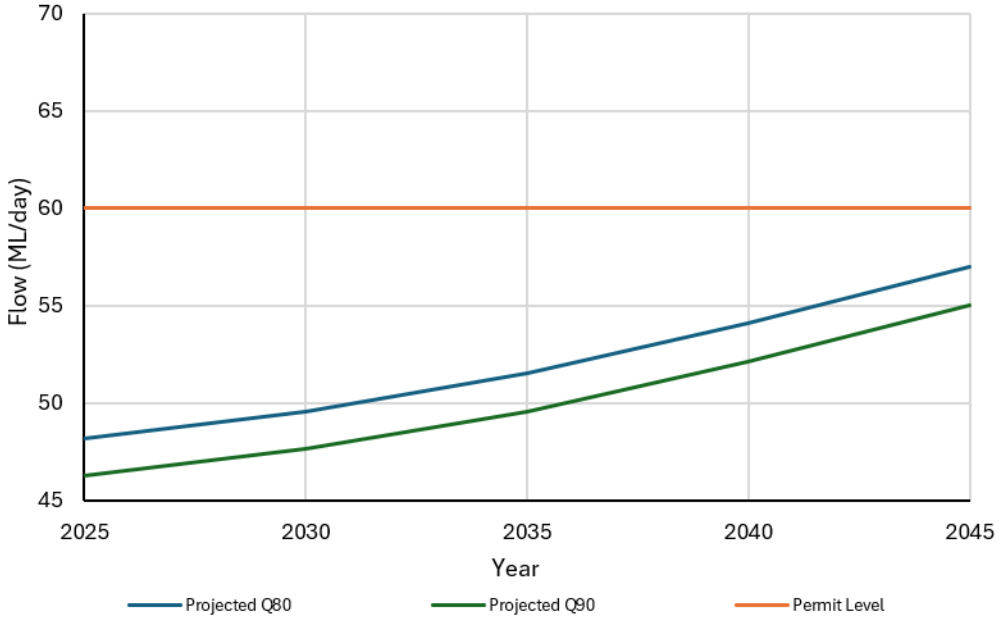

Figure 19 - Southend WRC Upper Growth Scenario DWF Headroom Forecast

Despite the additional development draining to the WRC, in all three scenarios the Q80 and Q90 remains below the current permitted DWF. Further to this, Anglian Water have confirmed that there are no planned AMP8 growth schemes at the WRC. Based on these findings, the WRC itself has the DWF headroom to support future growth over the plan period. However, whilst the treatment works has capacity in dry conditions, frequent overflows and backups occur during periods of heavy rainfall.

Between 2023 and 2024, the inlet to the WRC spilled for an annual average of over 338 hours. Furthermore, several other combined sewer overflows (CSOs) upstream on the network also discharge.

While CSOs remain a concern, future wet-weather events are likely to be a greater driver of impacts than future development in most cases, because the additional stormwater volumes are typically much larger. Mitigation may not necessarily require increasing WRC capacity; targeted network improvements such as pumping upgrades, storage tanks, and smart monitoring/controls could provide greater benefit. As outlined in section 6.2.1 there is also a wider WINEP scheme to implement SuDS and reduce spills in Southend, this has the potential to attenuate future surface water flows draining to Southend WRC.

6.4.4 Results at Rochford WRC

The Rochford WRC outfalls to the tidal River Roach at E: 592894, N:191257 via a treatment lagoon called Stannets Creek Reservoir. It has a permitted DWF of 8,630 m^3/day. In the 5-year period between 2021-2025, the Q80 and Q90 flows have been under the permitted amount, with an average over this period of 7,177 m^3/day and 6,872 m^3/day respectively.

Additional development draining to the WRC would cause both the Q80 and Q90 flow to exceed the permitted DWF during the plan period (see Figure 20). Using the development trajectory provided by the council this occurs around 2034 for the Q80 flow and around 2036 for the Q90 flow. By the end of the plan period (2045) the projected Q80 and Q90 are 10,337 m^3/day (up 20.05%) and 10,033 m^3/day (up 16.57%) respectively.

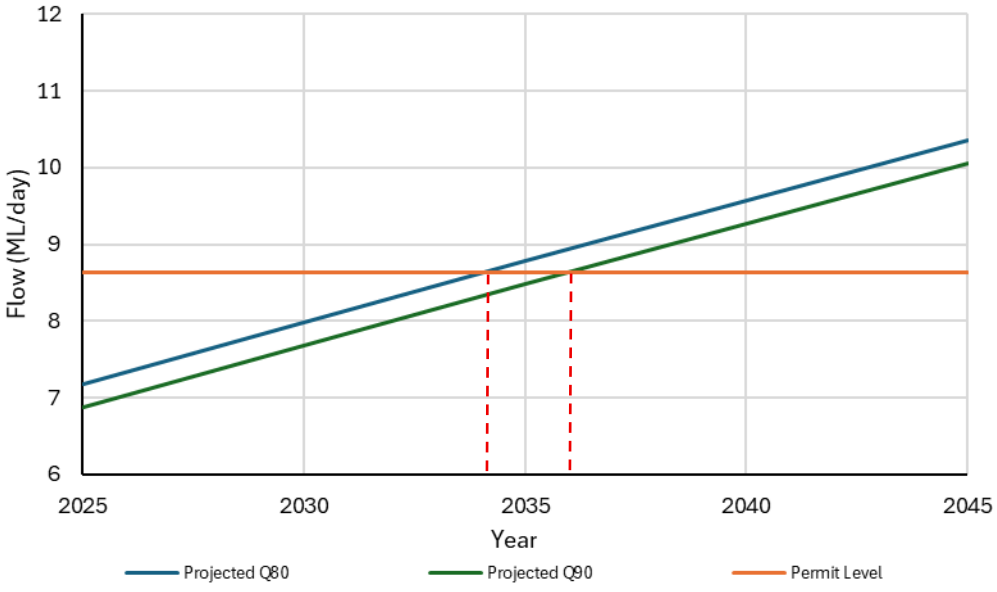

Figure 20- Rochford WRC DWF Headroom Forecast

The headroom assessment suggests that whilst Rochford WRC currently has sufficient headroom, it is projected to exceed this within the plan period. It should be noted that this is mainly due to future development estimated in the Rochford district, with less than 1% of the projected increase in flows coming from development in Southend.

Despite this Southend-on-Sea City Council should still work with Anglian Water and Rochford District council to ensure that development is phased appropriately. Currently the Airport Business Park (EA051) is the only site in the local plan which is expected to drain to Rochford WRC. It is an

employment site with the majority of it being built out before 2030 when the WRC should have capacity.

Accommodating development beyond 2030 may necessitate treatment upgrades to maintain water quality; however, if the WRC is already operating near technically achievable limits, this may not be feasible; section 6.5.2 assesses this in more detail. In such cases, significant upgrades to the capacity of the works and upstream drainage network may be required. Anglian Water should apply for the necessary permits well in advance of development build-out.

6.5 Load Standstill Calculations

6.5.1 Load Projections

To assess environmental capacity and potential permit changes arising from future development load standstill calculations have been undertaken at the Southend WRC and Rochford WRC. These follow the methods detailed in section 2.5.3 considering the quantum of development in section 4.

Southend WRC currently has the following permit levels for the determinants assessed:

- BOD- 25 mg/l (95th Percentile)
- COD- 125 mg/l (95th Percentile)
- Suspended Solids- 150 mg/l (95th Percentile)

Table 23 presents the projected increase in effluent load from Southend WRC resulting from the three future development scenarios. Based on the 95th percentile value for monitored flows between 2021-2025 the baseline value for BOD already exceeds the permit limit of 25 mg/L. For COD the baseline value is slightly below its permit limit of 125 mg/L and for suspended solids the baseline value is significantly below its permit limit of 150 mg/L. When considering the three growth scenarios, BOD and COD are projected to exceed their current permit limits in all the scenarios. This is despite Q80 flows remaining well within the current permit limit of 60,000 m^3/day. Suspended solids remain below the permit limits across all the scenarios.

Table 23- Southend WRC Load Projections

Parameter	Baseline (2021-25)	Permit Limits	Lower Growth Scenario	Medium Growth Scenario	Upper Growth Scenario
Q80 (Litres)	48210.4	**60000**	51702.9	53128.8	57000.1
BOD – 95th Percentile (mg/L)	26.10	**25**	27.99	28.76	30.86
COD – 95th Percentile (mg/L)	121.60	**125**	130.41	134.01	143.77
Suspended Solids – 95th Percentile (mg/L)	29.40	**150**	31.53	32.40	34.76

Rochford WRC currently has the following permit levels for the determinants assessed:

- BOD- 25 mg/l (95th Percentile)
- COD- 125 mg/l (95th Percentile)
- Suspended Solids- 60 mg/l (95th Percentile)

Table 24 presents the projected increase in effluent load from Rochford WRC resulting from future growth. The Airport Business Park (EA051) is the only development allocation in the Southend emerging plan that drains to Rochford WRC so as for the headroom assessment only one growth scenario is assessed. Based on the 95th percentile values for monitored flows between 2021-2025 the baseline values for BOD and COD are below their permit limits of 25 mg/L and 125 mg/L respectively. For suspended solids the baseline value already slightly exceeds the permit level of 60

mg/L. When considering future growth, BOD, COD and suspended solids are all projected to exceed their current permit limits.

Table 24- Rochford WRC Load Projections

Parameter	Baseline (2021-25)	Permit Limits	Future Scenario
Q80 (Litres)	7176.80	**8630**	10337.10
BOD – 95th Percentile (mg/L)	20.00	**25**	28.86
COD – 95th Percentile (mg/L)	122.20	**125**	176.01
Suspended Solids – 95th Percentile (mg/L)	60.60	**60**	87.29

6.5.2 Water Quality Treatment

The results presented in Section 6.5.1 indicate that, if current levels of wastewater treatment are maintained, there is an increased risk of permit limits being exceeded, potentially resulting in a deterioration of the WFD status of the receiving water bodies.

To mitigate this risk, a higher standard of effluent treatment is likely to be required. To assess the level of treatment needed, two analyses have been undertaken. The first estimates the reduction in effluent concentrations required to accommodate future growth while remaining within existing permit limits. The second determines the reductions necessary to prevent deterioration from baseline water quality conditions.

The feasibility of achieving these improvements has been assessed by comparing the required concentration reductions against the TALs for each parameter (see Section 2.5.3). A traffic-light scoring system has then been applied based on the extent of improvement required relative to the relevant TAL. A green score indicates that no water quality improvement is required; an amber score indicates that AN improvement is required but that it remains within the applicable TAL; and a red score indicates that improvements beyond the applicable TAL would be necessary (see Table 2 for more detail).

The level of water quality improvements required to remain within current permit limits for the Southend WRC are detailed in Table 25. As shown in section 6.5.1 the concentration of suspended solids remains within the permit limit of 150 mg/L for all of the growth scenarios assessed, therefore no water quality improvement is required to stay within the permit limit.

BOD already exceeds its permit limit of 25 mg/L in the baseline with a 9.6% reduction in BOD required to bring it back below this level. When growth is accounted, this increases to between 10.6% and 19.0% across the three growth scenarios assessed. Significantly the level of improvement required is comfortably above the TAL for BOD of 5 mg/L.

COD concentrations are below the permit limit of 125 mg/L in the baseline; however, they are projected to exceed this limit under all growth scenarios. The reduction required to maintain compliance with the permit varies from 4.1% to 13.1% across the assessed growth scenarios.

While no TAL has been defined for COD, only relatively modest reductions in baseline COD concentrations are required to accommodate growth. In addition, the improvements required for BOD, which is a component of COD, are substantially greater than its TAL. Therefore, the reductions required for COD are considered technically achievable.

Table 25- Summary of water quality improvements required to meet current permit limits (Southend WRC)

Improvement in baseline quality required			
Parameter	**Lower**	**Medium**	**Upper**
BOD (mg/L)	23.3	22.7	21.1
COD (mg/L)	116.6	113.4	105.7
Suspended Solids (mg/L)	N/A	N/A	N/A
mg/L reduction			
Parameter	**Lower**	**Medium**	**Upper**
BOD (mg/L)	2.8	3.4	5.0
COD (mg/L)	5.0	8.2	15.9
Suspended Solids (mg/L)	N/A	N/A	N/A
Percentage improvement reduction			
Parameter	**Lower**	**Medium**	**Upper**
BOD (%)	10.6	13.0	19.0
COD (%)	4.1	6.7	13.1
Suspended Solids (%)	N/A	N/A	N/A

The level of water quality improvements required at Southend WRC to prevent any deterioration from baseline water quality are detailed in Table 26.

The improvements required in BOD are less than those required to meet the current permit limit given that BOD already exceeds its permit limit in the baseline. In this regard they should not be sought.

For COD and suspended solids, however, the required improvements exceed those necessary to meet the current permit limits. The percentage reductions required are proportional to the projected flow increases associated with future development and are therefore consistent across all parameters. For the lower, medium and upper growth scenarios they are 6.7%, 9.3% and 15.4% respectively. Importantly the level of improvements required remains comfortably above the TALs for BOD and suspended solids and are also considered technically achievable for COD.

Table 26- Summary of water quality improvements required to prevent deterioration (Southend WRC)

Improvement in baseline quality required			
Parameter	**Lower**	**Medium**	**Upper**
BOD (mg/L)*	24.3	23.7	22.1
COD (mg/L)	113.4	110.3	102.8
Suspended Solids (mg/L)	27.4	26.7	24.9
mg/L reduction			
Parameter	**Lower**	**Medium**	**Upper**
BOD (mg/L)	1.8	2.4	4.0
COD (mg/L)	8.2	11.3	18.8
Suspended Solids (mg/L)	2.0	2.7	4.5
Percentage improvement reduction			
Parameter	**Lower**	**Medium**	**Upper**
BOD (%)	6.7	9.3	15.4
COD (%)	6.7	9.3	15.4
Suspended Solids (%)	6.7	9.3	15.4

The level of water quality improvements required to remain within current permit limits for the Rochford WRC are detailed in Table 27.

BOD and COD concentrations are below their respective permit limits of 25 mg/L and 125 mg/L in the baseline; however, they are projected to exceed these limits under all growth scenarios. For BOD, the reduction required to maintain compliance with the permit is 13.4%, and for COD it is 29.0%. Importantly the level of improvement required for BOD remains comfortably above the TAL

for BOD of 5 mg/L. The corresponding reductions in COD are significant however they are considered technically achievable remaining above 80 mg/L.

In terms of suspended solids, it slightly exceeds its permit limit of 60 mg/L in the baseline with a 1.0% reduction in suspended solid required to bring it back below this level. When growth is accounted, this increases substantially to 31.3%. Significantly the level of improvement required is comfortably above the TAL for suspended solids of 15 mg/L.

Table 27- Summary of water quality improvements required to meet current permit limits (Rochford WRC)

Improvement in baseline quality required	
Parameter	**Future Growth**
BOD (mg/L)	17.4
COD (mg/L)	86.8
Suspended Solids (mg/L)	41.7
mg/L reduction	
Parameter	**Future Growth**
BOD (mg/L)	2.7
COD (mg/L)	35.4
Suspended Solids (mg/L)	18.9
Percentage improvement reduction	
Parameter	**Future Growth**
BOD (%)	13.4
COD (%)	29.0
Suspended Solids (%)	31.3

The level of water quality improvements required at Rochford WRC to prevent any deterioration from baseline water quality are detailed in Table 28.

The improvements required in suspended solids are less than those required to meet the current permit limit given that suspended solids already exceeds its permit limit in the baseline. In this regard they should not be sought.

For BOD and COD, however, the required improvements exceed those necessary to meet the current permit limits. As mentioned for Southend WRC, the percentage reductions required are proportional to the projected flow increase. Therefore, across are parameters the improvement is 30.6%. Importantly the level of improvement required remains comfortably above the TALs for BOD and suspended solids and are also considered technically achievable for COD.

Table 28- Summary of water quality improvements required to prevent deterioration (Rochford WRC)

Improvement in baseline quality required	
Parameter	**Future Growth**
BOD (mg/L)	13.9
COD (mg/L)	84.4
Suspended Solids (mg/L)*	42.1
mg/L reduction	
Parameter	**Future Growth**
BOD (mg/L)	6.1
COD (mg/L)	37.4
Suspended Solids (mg/L)	18.5
Percentage improvement reduction	
Parameter	**Future Growth**
BOD (%)	30.6
COD (%)	30.6
Suspended Solids (%)	30.6

The load standstill calculations for Southend WRC and Rochford WRC indicate that future growth will cause an increase in pollutant loads that will likely exceed the current permit limits for all parameters

with the exception of suspended solids at Southend WRC. As noted for the headroom assessments the changes at Rochford WRC mainly come as a result of development in Rochford District rather than from Southend.

To accommodate future growth mitigative action will be required to improve effluent quality. This is assuming there are no planned or longer-term increases in treatment capacity at the WRC sites, which could allow WRCs to store effluent for longer and reduce existing discharge volumes. The water quality improvements are all considered feasible and technically achievable. The calculated compliance targets remain well above the TALs for BOD and suspended solids, while the COD reductions necessary to achieve compliance are not considered onerous.

Note, the assessments undertaken to date assume that all local plan, previously adopted local plans, undeveloped sites with planning permission and windfall sites will be built out. The TALs applied are also based on present day technology and technology may improve over the plan period.

6.6 Summary

The main sewer network and the Southend WRC in the city currently manages the demand of over 201,653 people. This is set to increase as a result of population growth, and it is essential that there is sufficient infrastructural and environmental capacity to safeguard against issues such as ecological damage and sewer flooding.

The WRCs serving the city are the most important infrastructural asset with respect to future development. The headroom assessment confirmed that there is expected to be sufficient headroom at Southend WRC by the end of the plan period, under each of the growth scenarios assessed. At Rochford, the Q80 flow is projected to exceed the current permitted DWF by more than 20% by the end of the plan period. However, only one employment allocation in the local plan is proposed to drain to Rochford WRC and the projected changes in flow are largely as a result of estimated development in Rochford.

Despite this Southend-on-Sea City Council should still work with Anglian Water and Rochford District council to ensure that development is phased appropriately. Currently the Airport Business Park (EA051) is the only site in the local plan which is expected to drain to Rochford WRC. It is an employment site with the majority of it being built out before 2030 when the WRC should have capacity.

In terms of environmental capacity, the EA's catchment data explorer suggests that all of the watercourses in the study area have *Moderate* ecological status and *Fail* with regard to chemical status. This suggests that overall, they are potentially vulnerable to future development, with limited environmental capacity likely in catchments with failures in nutrient status associated with sewage discharge (e.g. Phosphates, pH).

Future upgrades to the sewer network alongside measures identified in the Anglian River Basin Management Plan and Anglian Water's DWMP could help in reducing impacts however it will take time for these measures to take effect. It is vital that the correct measures are followed by several stakeholders, including developers, the EA, local authorities and Anglian Water, to ensure that the current statuses of the watercourses improve.

In terms of future changes to permits at the two WRCs serving the city, load standstill calculations for Southend WRC and Rochford WRC have been undertaken and indicate that future growth will cause an increase in pollutant loads that will likely exceed the current permit limits for the majority of parameters assessed. This could potentially lead to a deterioration in WFD status for the receiving waterbodies if not properly managed.

To accommodate future growth mitigative action will be required to improve effluent quality at the WRCs. Based on the load standstill calculations, the water quality improvements required are all considered feasible and technically achievable. The calculated compliance targets remain well above the TALs for BOD and suspended solids, while the COD reductions necessary to achieve compliance are not considered onerous. However, Anglian Water need to be aware of development coming forward so it can apply for the necessary permits well in advance of development build-out.

It should be noted that in all cases the assessments assume that all local plan allocations and existing planning applications will be built and does not consider planned or longer-term changes to DWF, treatment systems and storage capacity. If funding is obtained for upgrading and/or building new infrastructure, there remain significant lead times for planning and construction before infrastructure can be considered functional. In this respect, Anglian Water will require detailed information on likely housing development well in advance. Local network upgrades can take between 18 months and 3 years to implement, while larger strategic upgrades, such as those at WRCs, can take between 3-5 years. As such, developers should be encouraged to liaise with Anglian Water at an early stage in the planning process to ensure sufficient capacity is in place both at the WRC, and the wider connecting network.

The EA will also need to consider development against infrastructural and environmental capacity in setting future environmental permits which allow development to progress sustainably without presenting a risk to the water environment.

To support the EA and Anglian Water in maintaining compliance and safeguarding environmental capacity, Southend-on-Sea City Council have already set out several policies which seeks to protect and enhance water quality, both surface water and ground water, in line with The Water Framework Directive 2017 and to align the delivery of development with wastewater infrastructure being in place through liaison with Anglian Water. This includes Policy DM9.3, which relates to Environmental Protection. The policy outlines that development which adversely affects water quality will be resisted, and that proposals should not only include measures to reduce risk to the water environment but aim to improve water quality.

It is also recommended that Southend-on-Sea City Council takes the following actions:

- Explicitly consider the available WRC capacity and permit limits when phasing development in liaison with Anglian Water. This is particularly important for larger scale developments (>500 dwellings) in the WRC catchments where capacity and/or water quality is a concern.
- Provide Annual Monitoring Reports to Anglian Water detailing projected housing growth in their administrative areas and larger scale developments coming forward.
- Provide a copy of the WCS to planning colleagues at neighbouring authorities, with specific attention brought to the assessment at Rochford WRC as their catchments extends across local authority boundaries.
- Provide a copy of the WCS to Anglian Water and the EA.
- Promote the use of SuDS at development sites and where appropriate, sewer separation of surface water and foul water.
- Explore options to retrofit SuDS in existing development areas to reduce current pressures on sewerage infrastructure.
- Prioritise greening the city through landscaping and tree planting to create a network of green spaces and corridors.

In response to these actions, Anglian Water will need to assess growth demands as part of their wastewater asset planning activities and feedback to Southend-on-Sea City Council if concerns arise. In relation to this they have stated that: *"Future investments (from 2030) for maintenance and any*

process upgrades would be identified through the next Drainage and Water Recycling Management Plan (DWMP28) which will be published in 2028. This will address the 25-year period 2030–2055 and will inform Anglian Water's investments in the next Business Plan (Price Review 2029 – PR29) for the Asset Management Period 2030-2035 (AMP9). DWMP28 must set out how Anglian Water will manage and develop their drainage and sewerage systems to meet their obligations under Water Industry Act 1991. This includes understanding how to deal with challenges such as asset health, climate change and population growth."

7 Flood Risk

7.1 Introduction

This section includes a high-level review of the flood risk relevant to this study across Southend and its relationship with the development proposed. How flood risk might be managed moving forward is also addressed.

7.2 Overview of Flood Risk relevant to WCS

Fluvial flood risk is present along main rivers (which are the responsibility of the EA) and ordinary watercourses (which are the responsibility of the Southend City Council acting as the Lead Local Flood Authority (LLFA) and riparian owners). The main watercourses affecting fluvial flood risk in the city are Prittle Brook, Eastwood Brook, Mucking Hall Brook and Willingale Brook.

Surface water flood risk also effects many locations across the City. This includes Leigh-on-Sea Ghyllgrove, Kingswood, Lee Chapel North and Lee Chapel South. Lower lying areas often where the drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage and sewer flooding.

Tidal flooding primarily affects areas in the south of the city, including the length of the seafront. Several streets around the Eastern Esplanade and Southchurch Park are in inundated during the 3.3% AEP scenario, with more widespread flooding in the Southchurch and Thorpe Bay areas during the 0.5% and 0.1% AEP defended events. In the east of the city, areas of tidal flood risk are present across Shoeburyness and Suttons.

Sewer flooding often occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Groundwater flooding, which is more common in the hard rock aquifers in the east of the city, can also contribute to sewer flooding through groundwater infiltration, where groundwater finds its way into the sewer system. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

The Anglian Water DG5 sewer flooding register is available at the property level and has been obtained to further assess the spatial distribution of sewer flooding. The flood risk register provided, is a record of properties that are deemed to be at risk of flooding due to hydraulic incapacity (i.e. not due to blockages, collapses or pump failure) during a storm event with a return period of 20 years or lower. In total there are 25 properties on the register within Southend. Of these properties, 22 have recorded events since 2012. The remaining 3 properties, located in Bournes Green, have been assessed to be at risk, however no events have been recorded. The register further indicates that 14 properties are at risk of external sewer flooding in a 1-in-20-year event, 5 during a 1-in-10 event and 5 are at risk in a 1-in-5-year event. The one remaining property is currently under investigation to confirm the risk level.

The location of the properties within the register are shown in Figure 21 with properties at risk across several areas in the City. Generally, the area with the densest area of properties at risk is around Leigh-on-Sea and Eastwood, with 5 properties at risk around Thorndon Park Drive. In the south of the city, individual properties are at risk in Chalkwell, Westcliff and Southchurch. Further to this, 4 commercial premises are also at risk on Temple Farm Industrial Estate, with 4 events here since 2019. The full sewer flooding records provided by Anglian Water for this study are provided in Appendix 3.

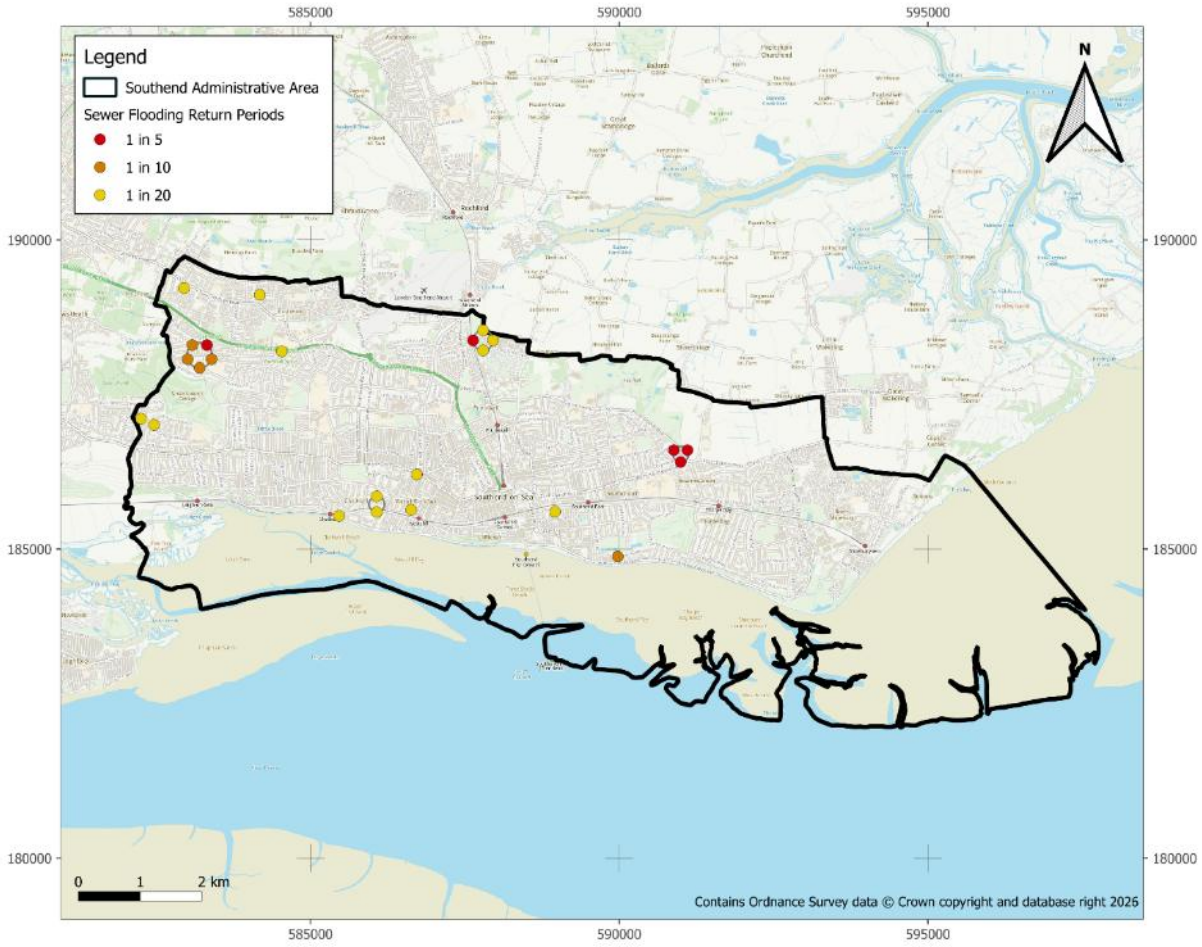

Figure 21 - DG5 Sewer Flood Risk Register Records

7.3 Impacts of Development on Flood Risk

Development, if not properly managed, has the potential to impact a wide range of flood mechanisms, including those identified in section 7.2. Land use change influences the characteristics of how rainwater runs off land into local water networks such as drains, streams and rivers. Localised changes in land use can alter the pre-existing baseline behaviour of an individual area, and when this occurs collectively over multiple areas within a catchment, it can cause a change in flooding characteristics for the area. As such, this may incur detrimental impacts downstream on a catchment-wide scale.

Specifically, the replacement of rural land use with impermeable surfaces will increase the volume and rates of surface water runoff following rainfall. When instances of this happen repeatedly across a catchment, this can result in a catchment experiencing shorter amounts of time between rainfall events and peak flood levels, resulting in greater magnitude floods and making effective flood response more difficult. This can impact both fluvial flood risk and surface water flood risk. Windfall sites and urban creep could also contribute to these forms of flood risk by the same mechanism.

In addition, development may result in the loss of floodplain area causing reduced floodplain storage capacity which could have a detrimental impact on fluvial flood risk on immediately neighbouring land, as well as downstream. Instances of practices that may cause this, include changes in a

buildings footprint which could reduce flood storage area, whilst the raising of land levels above the existing floodplain may interfere with storage and floodwater conveyance.

Development across the city could also contribute to sewer flooding. As more land drains to the sewer network, its capacity will need to increase to ensure that it is not overloaded and surcharges. Several areas within the city have been identified as being at high risk of flooding due to limited sewer capacity. During periods of heavy rainfall, the sewer network has been known to become surcharged, leading to localised flooding.

7.4 Mitigation Options

Flood risk is a key factor in spatial planning. Government policy seeks to ensure that all developments are safe with respect to flooding, and that floodplains are used for their natural purposes. As mentioned, development on a floodplain is both at risk from flooding and also has the potential to reduce the ability of the river corridor to convey and store flood waters without suitable mitigation measures. This means that if development is not adequately controlled, there will be a detrimental effect on third party flood risk, with the floodplain's capacity reduced and water displaced elsewhere.

Through application of the National Planning Policy Framework (NPPF)[58] a sequential approach will be taken in the Local Plan to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites in areas with a lower probability of flooding. If following this exercise, sites still need to be allocated in at risk areas, an Exception Test is typically required, which requires that the development is safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

In terms of the Local Plan, whilst development will be sited outside of floodplain areas where possible and often upon previously developed land, it still has the potential to exacerbate flood risk due to increased runoff from hard impermeable surfaces. There will be a change in land use in some areas as a result of the Local Plan. To accommodate such a change, it is likely that mitigation options will need to be implemented at a number of sites in order to facilitate development, ensuring development is both safe and does not increase third party flood risk elsewhere. Options to be considered include:

- Increase floodplain storage/provide compensatory storage should the development require any ground raising above measured/modelled flood levels.
- Sustainable Drainage Systems (SuDS) guidelines to achieve no net increase in runoff as a result of the development proposals (obligatory for most development sites).
- Possibility of developer contributions to fund local improvement schemes elsewhere.
- Flood resilient and resistant building design.
- Flood incident management (flood warning) and emergency planning.
- Opportunities for SuDS at locations where there is mutual benefit in relation to reducing overall flood risk to new and existing developments.

SuDS in particular are seen as key in ensuring development does not lead to increased runoff rates and volumes. SuDS are designed to manage stormwater locally (as close to its source as possible), to mimic natural drainage and encourage its infiltration, attenuation and passive treatment. They

[58] Ministry of Housing, Communities and Local Government (2026) *National Planning Policy Framework* https://www.gov.uk/government/publications/national-planning-policy-framework--2

also help maintain and improve water quality. The national standards for SuDS[59] published by DEFRA (2025), sets out the standards for SuDS systems in England and provide key information for designers, property developers, local authorities and other interested parties, such as sewerage undertakers and the EA. Southend City Council acting as a LLFA are legally responsible for managing local flood risks arising from surface water, groundwater, and ordinary watercourses. Their primary duties include developing flood strategies, investigating flood incidents, regulating watercourses, and managing new development drainage.

Essex County Council act as the LLFA for the two tier areas of Essex. Southend City Council use much of their guidance, including the SuDS Design Guide for Essex[60], which sets the local standards for development to meet and adhere to. This applies to major planning applications of typically 10 dwellings or more. The Essex LLFA also provides a pre-paid SuDS planning advice service[61] which enables planners to be informed of SuDS and drainage requirements for their proposed development.

Note, some of sites being brought forward in the local plan are located on previously developed land (brownfield sites), the local standards stipulate that for brownfield sites a betterment on existing runoff rates and volumes should be sought to meet the equivalent greenfield runoff rate (rural land use). If this is not possible, brownfield rates should as a minimum ensure that a 50% betterment is possible. A 10% allowance for urban creep in new development sites is also stipulated to safeguard against drainage schemes becoming non-compliant.

There are also a number of critical drainage areas within Southend which have been identified by the Essex LLFA. These include NRoch_001 – Eastwood, NRoch_002 - Southend-on-Sea, NRoch_010 – Garon Park and NRoch_009 – Little Wakering. These areas are defined hydrologically and represent areas where multiple or interlinked sources cause flooding during an extreme rainfall event. Within these areas these the LLFA stipulate that any hardstanding surface should be permeable where practicable and that the development should limit discharge to the 1-in-1-year greenfield rate, incorporating rainwater harvesting where possible, and ensuring all residential properties are equipped with a water butt as a minimum.

In managing stormwater locally through infiltration and attenuation, SuDS also has the potential to reduce the amount of surface water runoff entering sewer systems and thereby sewer flood risk overall. SuDS also has the potential to treat and enhance water quality. Both of these facets will be key in managing the infrastructural and environmental capacity available in the city, in addition to limiting significant increases in discharges from the WRCs serving the city. In terms of the latter, upgrades to WRCs including the provision of new storm tanks could allow for more water to be stored at WRCs for subsequent treatment and discharge when water levels are within normal range.

Southend-on-Sea City Council and Essex County Council acting as LLFAs encourage developers to use nature-based solutions as much as possible to create multifunctional spaces that address a wide range of outcomes, including amenity and biodiversity. Integrated water management approaches should be prioritised to address key environment challenges including drought resilience, flood risk reduction and water quality improvements. As part of this the LLFA recommend that priority be given to managing water on site and where possible recovering water for non-potable use, such as toilet

[59] DEFRA (2025) *National standards for sustainable drainage systems (SuDS)* https://www.gov.uk/government/publications/national-standards-for-sustainable-drainage-systems/national-standards-for-sustainable-drainage-systems-suds
[60] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide For Essex* https://www.essexdesignguide.co.uk/suds
[61] Essex County Council (2020) *Apply for SuDS planning advice* https://flood.essex.gov.uk/new-development-advice/apply-for-suds-advice/

flushing, washing machines and to water the garden. These measures improve water efficiency and can reduce flood risk.

In areas of the city potentially affected by sewer flooding, developers are encouraged to explore future opportunities for funding and collaborative working with the local authority, government bodies, and private partners. This will help support the delivery of a flood-resilient drainage network and promote sustainable development across the city.

To ensure that existing conditions are not exacerbated, it is recommended that no discharge from new developments is permitted into the foul or combined sewer network, in accordance with the SuDS Design Guide (2020)[62].

Both Essex and Suffolk Water and Anglian Water promote SuDS as an alternative to conventional pipped drainage for managing surface water. Both will work in collaboration with developers to advise and potentially adopt SuDS features. When considering sites in the Local Plan and windfall sites, any developer is encouraged to work with the relevant water company early in the planning process to understand what infrastructure is required, in addition to where, when and how it will be delivered. Urban creep and climate change will also need to be considered in any liaison to ensure the infrastructure upgrades implemented are resilient going forward. During the plan period, mitigation may also be implemented at the catchment wide scale (typically by the EA, LLFAs or local authorities), encompassing natural flood risk management (NFM), river engineering, wide scale sewer network upgrades, rural land management, urban design and defence infrastructure. These measures have the potential to reduce flood risk for new and existing development.

7.4.1 Working With Natural Processes

To identify suitable locations for Natural Flood Management (NFM) across Southend, a review of the Working with Natural Processes datasets was conducted. Developed by the EA, Defra and research partners, the datasets highlight where nature based solutions, such as tree planting and floodplain restoration, can be strategically placed to naturally slow down, store, and reduce flood risk. Due to the city's extensive urban footprint, viable areas are highly limited. However, potential for riparian woodland exists primarily along the Prittle Brook catchment, most notably within the southern section of the Manchester Drive allotments in Leigh-on-Sea. Additional opportunities to extend riparian floodplain woodland exist at Priory Park, Warners Bridge Park and the Land North of Southend (LNOS) local plan allocation sites. Furthermore, Prittle Brook could be reconnected to its floodplain along its stretch through Belfairs Park in the west, as well as across most of Priory Park. Willingale Brook could be reconnected to its floodplain at several locations in and around Whitchurch, particularly through Thorpe Hall Golf Club and Southchurch Park. The potential for natural runoff attenuation features in Southend is highly limited, though it should be noted the datasets are constrained so that they do not cover urban areas or roads. Potential urban areas where these measures can be implemented should be explored by the council, in liaison with stakeholders and residents.

7.5 Summary

Both the impact of development on flood risk, and the impact of flood risk on development can be reduced by following the Sequential and Exception Tests outlined in the NPPF and ensuring that development in the study area follows SuDS guidelines. This includes LLFA guidance and wider

[62] Essex County Council (2020) *The Sustainable Drainage Systems Design Guide for Essex* www.essexdesignguide.co.uk/suds

environmental guidance from other stakeholders summarised herein and detailed in the following documents:

- Essex Design Guide[59]
- Essex Green Infrastructure Strategy[63]
- Essex Green Infrastructure Standards[64]
- Essex Local Nature Recovery Strategy[65]
- Essex Strategy and SPD[66]
- Essex integrated water management strategy (in review due early 26/27)
- Water Strategy for Essex[67]

At the site-specific level, SuDS should be implemented at all sites. Ground raising and compensatory storage may also be required where sites are at flood risk. Furthermore, ensuring local sewer upgrades are in place prior to development will safeguard against increased surface water and sewer flood risk. In line with NPPF, it is also recommended that where possible development should seek to reduce flood risk overall. Methods to reduce flood risk at sites and downstream may include creating flood storage areas, establishing wetland features, promoting vegetation growth and the use of NFM practices. Alongside these site scale measures; catchment scale measures may help reduce flood risk in the city. Whilst the specific locations with potential for implementation of NFM practices are limited, several specific sites have been identified. A reduction in flood risk could also be supported by a direct financial contribution from developers to wider flood risk management infrastructure through section 106 agreements or a community infrastructure levy.

The assessment of flood risk undertaken to date is high level. The specific upgrades required to the sewer network in response to development are likely to require further technical work by Essex and Suffolk Water and Anglian Water in collaboration with developers. The SFRA supporting the Local Plan will include a more detailed assessment of the fluvial, tidal and surface water flood risk constraints at each of the development sites.

[63] Essex Green Infrastructure Partnership (2020) *Essex Green Infrastructure Strategy* www.essex.gov.uk/sites/default/files/migration_data/files/downloads.ctfassets.net/knkzaf64jx5x/35jhjEoQZAc4f7bwGyLa38/fc90fbc5519874490047930aae371036/Essex_Green_Infrastructure_strategy.pdf
[64] Essex Planning Officers Association (2020) *Essex Green Infrastructure Standards* www.essexdesignguide.co.uk/supplementary-guidance/essex-green-infrastructure-standards/
[65] Essex Local Nature Partnership (2025) Essex Local Nature Recovery Strategy www.essex.gov.uk/sites/default/files/2025-07/Essex%20Local%20Nature%20Recovery%20Strategy.pdf
[66] Bird Aware Essex Coast (2026) *Essex Strategy and SPD* https://birdaware.org/essex/bird-aware-essex-about-us/our-strategy/
[67] Essex County Council (2024) *Water Strategy for Essex* https://www.essex.gov.uk/sites/default/files/2024-03/Water%20Strategy%20for%20Essex%202024.pdf

8 Other Environmental Constraints

8.1 Protected Sites

Further environmental constraints arise mainly from the protected status of sites across the city. Any developments that are close to or within the boundary of a designated site such as a Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI) or RAMSAR sites, may require a Habitat Regulations Assessment (HRA) if they could significantly harm the designated features of the site[68]. This includes watercourses located within the city, which may be hydrologically connected to protected sites. An initial screening stage would be required, followed by an appropriate assessment if needed. The HRA process is focused on protecting the qualifying features of designated sites.

Where it is considered that an adverse effect on the integrity of the protected site is likely, and no alternatives are available, the project can only go ahead if there are imperative reasons of over-riding public interest and if the appropriate compensatory measures can be secured. Planning authorities can also insist that developments carried out without necessary planning permission are removed.

Often protected sites play a key function in terms of water quality which is vital for maintaining the environmental capacity across the city. If development is not properly managed, it could lead to a deterioration in water quality or changes in the flow regime at protected sites. Care needs to be taken both during and after construction to ensure that runoff from development sites is adequately treated before entering the local drainage network. This will in turn safeguard environmental capacity and allow for further development to be delivered sustainably. Many protected sites carry multiple overlapping designations, particularly around Southend and the lower Thames Estuary, to reflect various interests which operate at different legislative scales.

8.1.1 Special Areas of Conservation

SACs are strictly protected sites designated under the European Union's Habitats Directive. The Essex estuaries SAC covers an area of 472km^2 from the Thames Estuary in the south to Brightlingsea in the north. Figure 22 shows the location of the Essex Estuaries SAC in relation to Southend-On-Sea Administrative area and the current site allocations for the local plan.

[68] UK Government (2023). Habitats regulations assessments: protecting a European site.

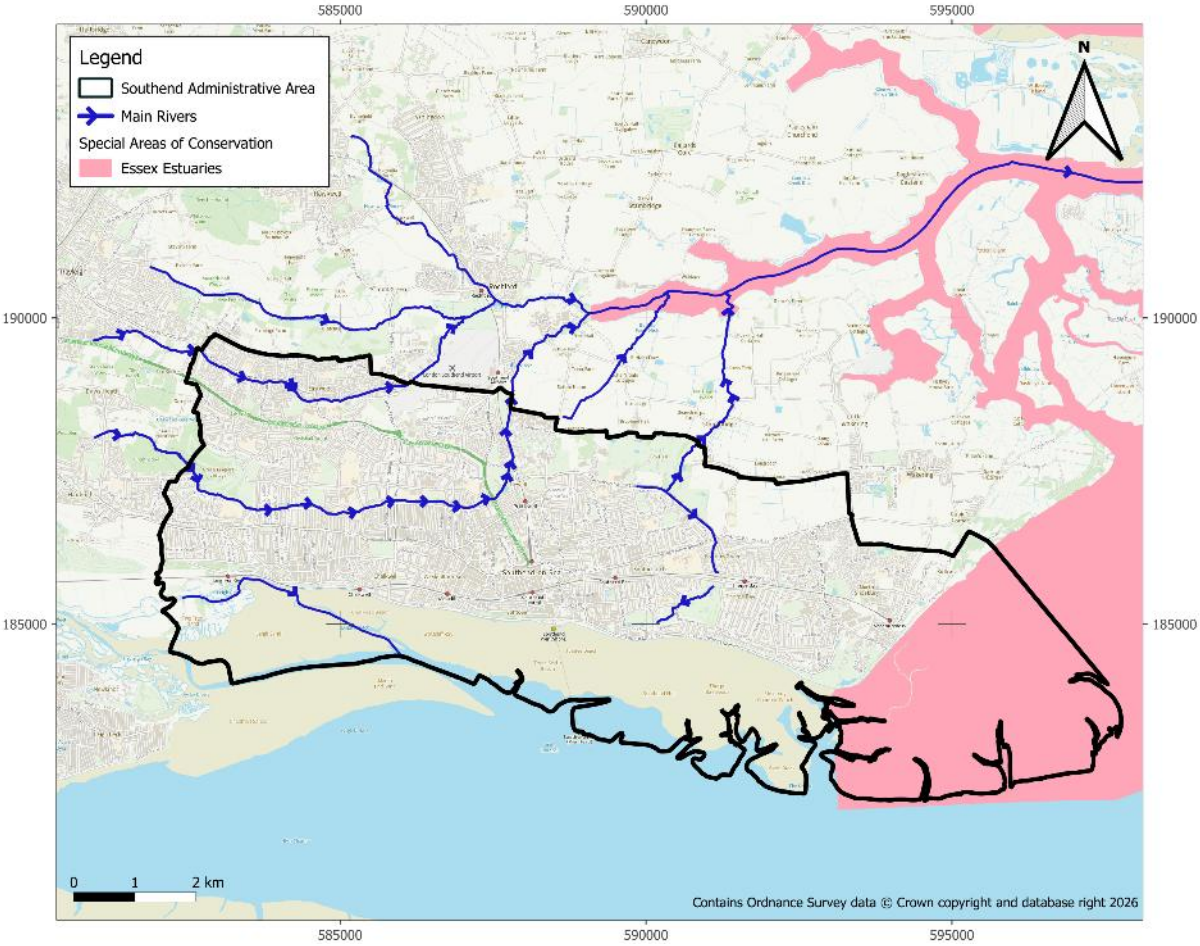

Figure 22 - SACs across the city and in the surrounding area

8.1.2 Special Protection Areas

SPAs are closely linked to the designated of SAC's but are designated on the basis of rare and vulnerable bird species. The Outer Thames Estuary SPA covers the tidal reach of Prittle Brook and the wider River Roach estuary, with the designated area beginning approximately 0.7km north of the city to the east of London Southend Airport. The area to the south and east of the city's foreshore is covered by two SPAs, these are the Benfleet and Southend Marshes SPA and the Outer Thames Estuary SPA. The extents of SPAs in an around the city are shown in Figure 23.

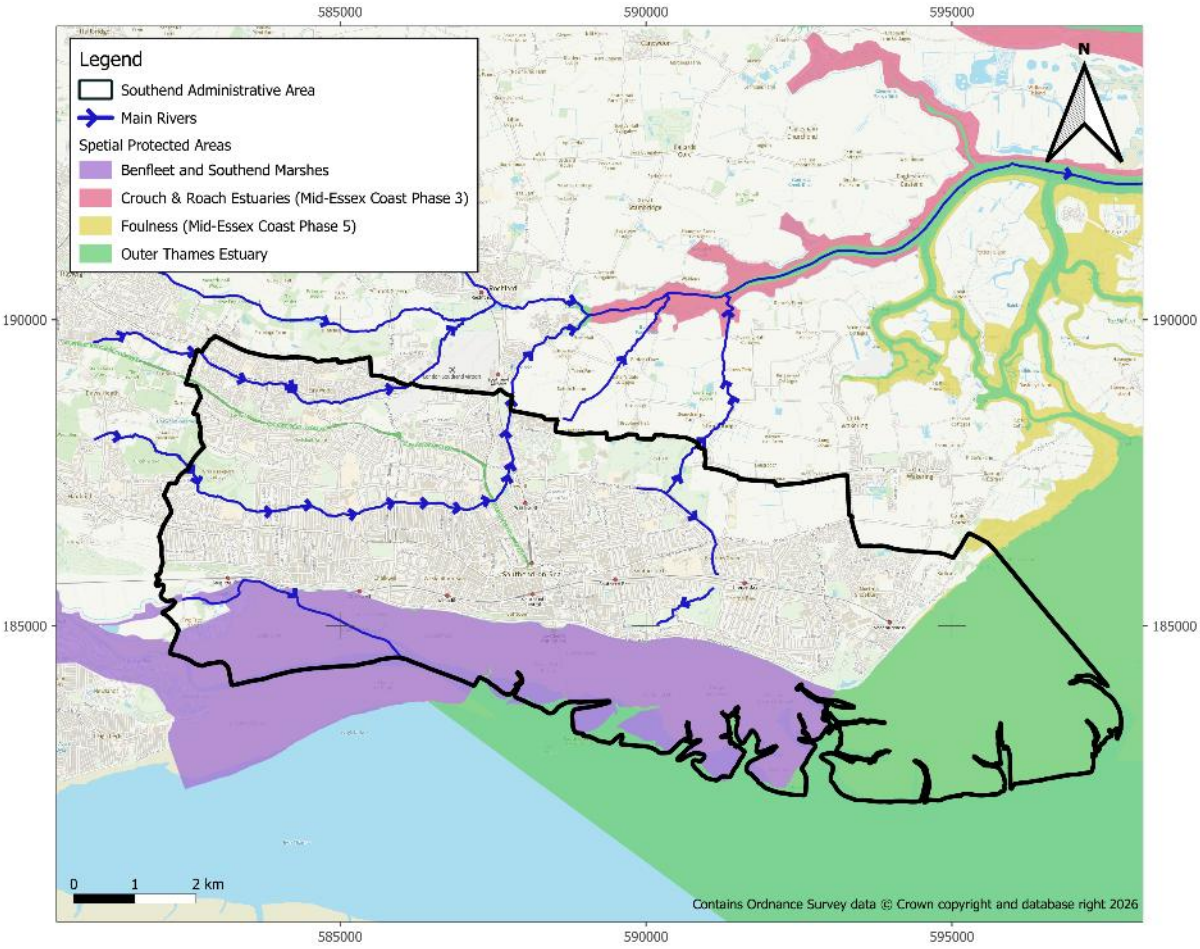

Figure 23 - SPAs across the city and in the surrounding area

8.1.3 Site of Special Scientific Interest

An SSSI is a formal conservation designation, in this case recognised for is biological and ecological importance. Usually, it describes an area that is of particular interest to science due to the rare species of fauna or flora it contains (Biological SSSI) or important geological or physiological features that may lie in its boundaries (Geological SSSI).

There is one SSSI within the city's administrative area, this is the Benfleet and Southend Marshes SSSI, which includes the city's foreshore area. The Crouch and Roach Estuaries SSSI is located north of the city and is drained to by the Prittle Brook, Eastwood Brook and Mucking Hall Brook catchments. Three further terrestrial SSSIs also located to the west and northwest of Southend, however these are not considered hydrologically connected to development within Southend.

Local planning authorities are required to have policies in their development plans that protect SSSIs. They are also required to consult the appropriate conservation body over planning applications which might affect the special interest of a SSSI. The landowners of SSSIs are also required to obtain consent from the relevant nature conservation body if they want to permit potentially damaging activities. Figure 24 shows the location of SSSIs in relation to Southend-on-Sea city council's administrative area and the current site allocations in the local plan.

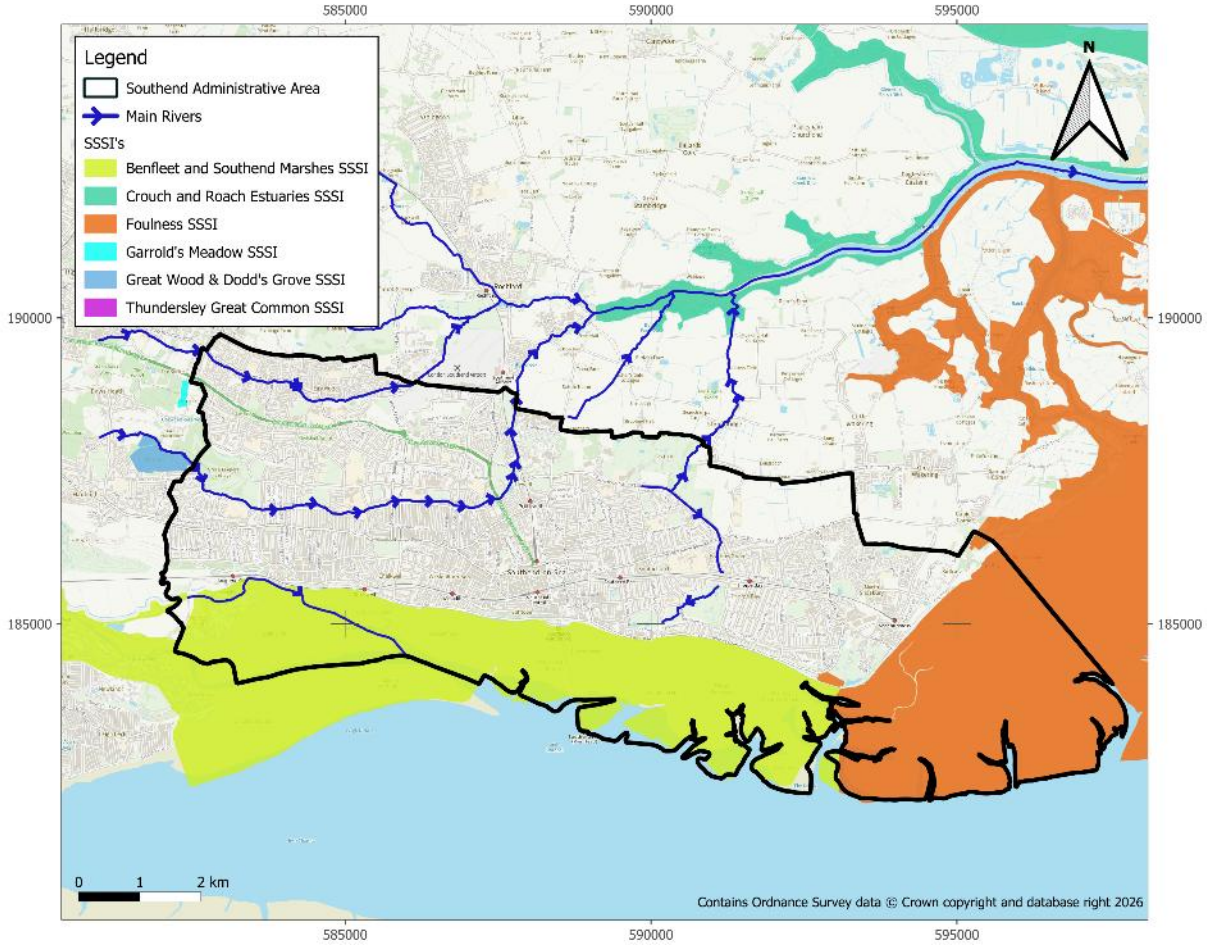

Figure 24- SSSIs across the city and surrounding area

8.2 Other Designations and Protections

8.2.1 Shellfish Waters

Shellfish Water Protected Areas are coastal and tidal environments designated to protect economically significant shellfish populations. They are primarily governed under the WFD, with the primary objective being to maintain or improve water quality to a standard that prevents contamination of shellfish intended for human consumption, as well as to protect stock levels. The standards set out in the current WFD are generally equivalent or more stringent than the superseded Shellfish Water Directive[69]. Surface water within Southend flows into two Shellfish Water Protected Areas, the Upper Roach Shellfish Water to the north, and the Southend Shellfish Water to the south.

8.2.2 Bathing Waters

There are eight designated bathing waters in Southend, which are protected under the Bathing Water Regulations 2013 to protect water quality in areas where large numbers are expected to swim. These areas are monitored to ensure human health and are giving a rating of either 'poor', 'sufficient', 'good' or 'excellent based on sampling for Intestinal Enterococci (IE), 'Escherichia coli (EC)' and other parameters. In the most recent classification, five of the bathing waters in Southend were given a

[69] DEFRA (2016). Water Framework Directive: shellfish protected areas.

rating of 'good', and 3 were rated 'excellent', see Table 29. To be classified as 'Excellent', bathing waters must have EC levels of ≤500 Colony Forming Units(cfu)/100ml and IE levels of ≤200 cfu/100ml based on the 95th percentile of samples. A 'Good' status is achieved when EC levels are ≤1000 cfu/100ml and IE levels are ≤400 cfu/100ml, also calculated at the 95th percentile. These percentile rankings ensure that the water meets these strict safety standards at least 95% of the time.

Table 29 - Bathing Waters in Southend and classifications

Bathing Water Name	Classification 2022	Classification 2023	Classification 2024	Classification 2025
Leigh Bell Wharf	Good	Good	Good	Good
Southend Chalkwell	Good	Good	Good	Good
Southend Westcliff Bay	Excellent	Excellent	Good	Good
Southend Three Shells	Excellent	Excellent	Excellent	Excellent
Southend Jubilee	Good	Good	Good	Good
Southend Thorpe Bay	Excellent	Good	Excellent	Excellent
Shoeburyness	Excellent	Excellent	Excellent	Good
Shoebury East	Excellent	Excellent	Excellent	Excellent

Anglian Water have stated as part of their Storm Overflows Action Plan[52] that they want to ensure that 100% of coastal bathing water are classified as Good or Excellent by 2030. Specific investment has been allocated in AMP8, which includes working with Southend-on-Sea city council to reduce the amount of surface water entering the sewerage system, which will in turn reduce spills into the bathing waters.

8.2.3 Seagrass Meadows

Intertidal seagrass meadows play a crucial ecosystem function by providing habitat for many juvenile fish species, sequestering carbon and controlling erosion. Seagrass meadows are highly vulnerable to development due to eutrophication from pollution, driven by increased nutrient loading from WRC outflows and CSO spills. There are several intertidal seagrass meadows located in Southend, with the largest and most significant of these located to the south of Leigh-on-Sea, see Figure 25.

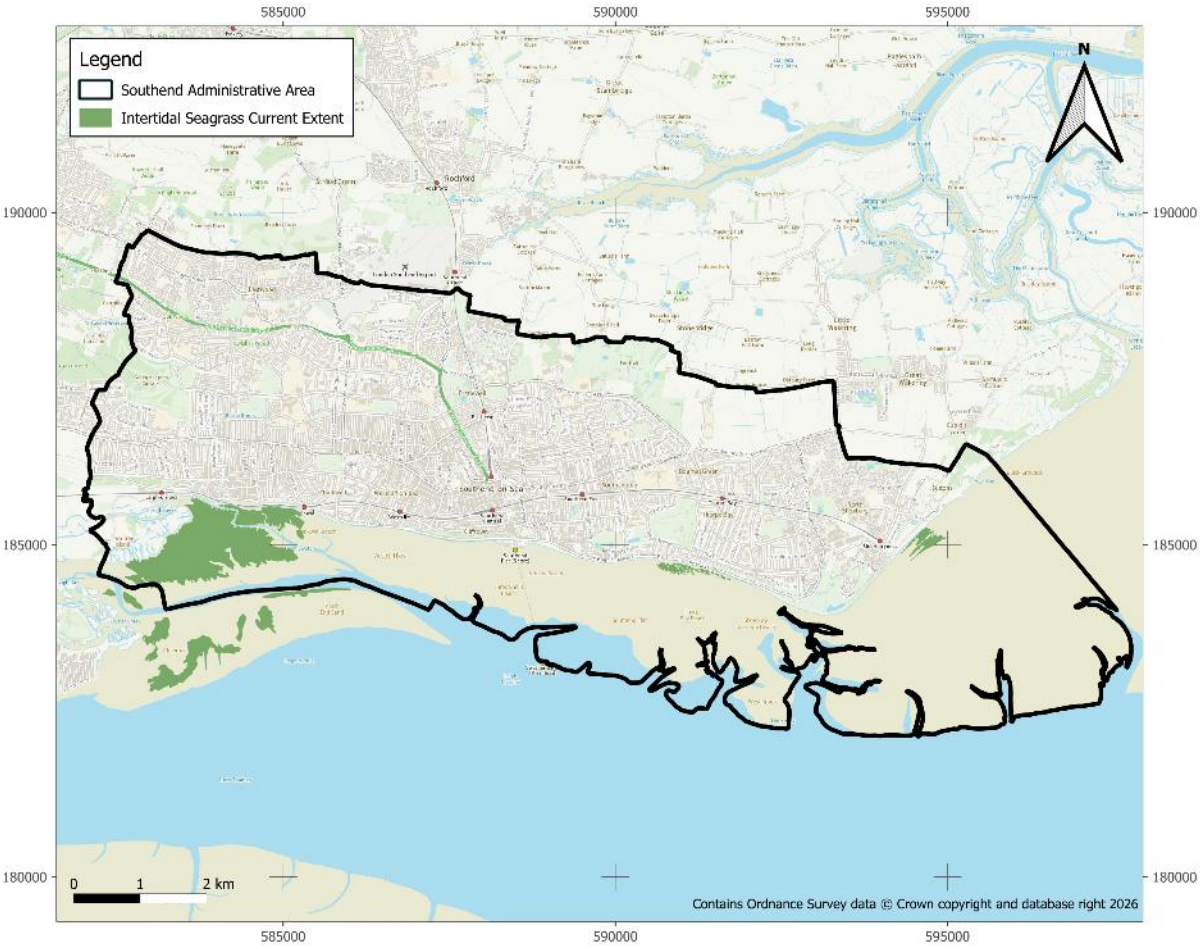

Figure 25 - Extent of Seagrass Meadows in Southend

8.3 Odour Risk

WRCs and other wastewater sites, like pumping stations and storm tanks, can sometimes be odour sources. They were originally built a significant distance away from urbanised areas; however, population growth means these once remote sites are now potential locations for development. Anglian Water has published guidance[70] for new and 'change of use' developments proposed near WRCs and large pumping stations. Anglian Water aims to ensure all proposed developments near its wastewater sites are risk assessed and, where necessary, that developers fund any mitigation needed to enable them to build there.

In general, Anglian Water employ a risk-based methodology to assess odour risk from WRCs, based on the population served and the development's proximity to the site, see Table 30. Any development falling within the 'amber' or 'red' categories requires further investigation due to potential odour risk or impacts on WRC operations

[70] Anglian Water. *Asset Encroachment.* https://www.anglianwater.co.uk/siteassets/developers/new-content/p--c/aws-assest-encroachment-sm.pdf [Accessed August 2025]

Table 30 - Anglian Water WRC Odour Encroachment Risk Assessment Methodology (Source: Anglian Water)

Population Served by STW	Distance from Proposed Development from STW (m)						
	50	100	150	200	250	300	400
0 - 1,000							
1,001 - 2,500							
2,501 - 5,000							
5,001 - 10,000							
10,001 - 50,000							
50,001 - 100,000							
>100,001							

Figure 26 shows the proposed site locations relative to Southend and Rochford WRCs with a nominal 800m buffer shown around both WRCs. The WRCs serve more than 50,000 people and where this is the case, the buffer zone may be set based on Anglian Water's discretion.

Figure 26 - WRCs with 800m buffer relative to site allocations

It has been estimated that four sites identified in the Local Plan fall will partially fall within 400m of Southend WRC, these are sites EA009, HEA264; EA047 and EA007. As stated, Southend WRC serves a population greater than 50,000, so the 400m buffer zone may be increased and affect the other development sites.

At these sites odour risk is likely to be a concern and should be assessed before the planning application stage. This will enable issues to be identified and resolved where possible, meaning fewer delays at the planning and construction stages. Where odour risk is a concern, developers may be required to submit an odour modelling assessment, in consultation with Anglian Water. Where mitigation is required, the developer must fund this. It can be costly to reduce and treat odour. Measures include increased maintenance of plant and equipment, covers for tanks, the use of enclosure and venting and end of pipe treatments (i.e. dilute, disperse or abatement).

8.4 Summary

The city includes a number of protected sites and designated habitats which may present constraints to development in certain areas. Ensuring these areas continue to serve their function will help maintain environmental capacity which is vital for allowing development to continue sustainably into the future.

At this stage, this study has identified the main environmental constraints with respect to protected sites. Further work at the planning application stage including Environmental Impact Assessments (EIAs) and Habitats Regulation Assessments (HRAs) may be required to determine impacts on specific Bathing Waters, Shellfish protected areas, SACs, SPA's and SSSIs; along with any required mitigation.

In terms of odour risk, a number of the sites proposed in the Local Plan could encroach on land close to WRCs. For these sites, developers should contact Anglian Water prior to submitting a planning application. This will enable issues to be identified and resolved at an early stage where possible, meaning fewer delays at the planning and construction stages.

The assessments outlined above should be sufficient to address the evidence gaps identified in this study without the need for further assessment.

To help protect the environment development must follow national policy outlined in the NPPF in addition to relevant local policies and guidance. This includes LLFA guidance and wider environmental guidance from other stakeholders in the Essex area (referenced in section 7.5).

9 Conclusions & Recommendations

The conclusions and recommendations from this study are as follows:

Water Resources and Supply

Conclusions

- Essex and Suffolk Water's latest WRMP indicates that, without intervention, water supply deficits could arise within the Essex WRZ up to 2045 and beyond.
- Short- to medium-term deficits are expected to be managed through demand reduction measures, including leakage reduction, smart metering and improved water efficiency.
- While these measures should reduce forecast deficits, additional supply-side schemes are likely to be required in the longer term.
- Essex & Suffolk Water are set to invest £1 billion over five years (2025-2030) to upgrade water networks, treatment facilities, and supply resilience across Essex and Suffolk. Within Essex, major projects target water treatment, storage, and long-term resource management.
- Future supply schemes beyond 2030 are proposed at a strategic scale and will require significant lead-in times.
- Essex and Suffolk Water's forecasts are generally above the lower and medium growth scenarios proposed by Southend-on-Sea City Council, although the DMA forecast is slightly below the medium scenario.
- Overall, the forecasts appear capable of accommodating Southend's anticipated growth. Under the medium scenario, however, the phasing of development may need to be assessed to ensure that any required new or upgraded infrastructure can be delivered. Mitigations such as water re-use, rainfall harvesting and grey water schemes should also be prioritised.
- Under the upper growth scenario, which reflects the Government's housing target but importantly is not being proposed by the Council, growth would be substantially higher than Essex and Suffolk Water's current forecasts. This could create additional, unforeseen demands on water supply infrastructure.
- Existing abstractions within the city are mainly for agricultural and amenity uses and are considered to have a limited impact on water resources relative to water supply uses.
- Additional abstraction for public water supply may be required in future, depending on growth, climate change and the effectiveness of WRMP measures.
- The assessment is subject to uncertainty, particularly regarding, i). the extent to which WRZ-level forecasts reflect conditions in Southend; and ii). the effects of development on the local water supply network.
- Further technical work would be required to refine Southend-specific forecasts and quantify any future deficits. This should be partly addressed with future WRMP updates which are expected to incorporate more recent Local Plan evidence and provide a more robust assessment of future water resource pressures.
- Essex and Suffolk Water are best placed to assess future supply-demand impacts and infrastructure requirements, with network upgrades requiring further assessment as development sites come forward through the planning process.

Recommendations

- Essex and Suffolk water will continue its responsibilities in upgrading and providing water supply for new developments without presenting a risk to the environment.

- Essex and Suffolk water will need to assess future development earmarked in the local plan when developing their upcoming WRMP2029.
- The EA will need to review and provides feedback on Essex and Suffolk water's WRMP2029, ensuring that Essex and Suffolk water address future water needs and provide a secure and sustainable water supply to the city.
- The EA will continue to regulate the abstraction of water from rivers and other sources in the city, ensuring it is sustainable and within legal limits.
- Southend City Council will work collaboratively with Essex and Suffolk Water to discuss sites being brought forward, their associated build profiles and timings.
- It is recommended that developers engage with Essex and Suffolk water as early as possible so they can undertake modelled impact assessments to confirm if specific water supply upgrades are required and when. Pre-planning enquires are encouraged.
- Should strategic infrastructure upgrades be required to supply new development, the option to phase some of the dwellings to later in the plan period should be considered, especially for larger scale residential developments (>500 dwellings).
- The council should consider a policy on water efficient design, which recommends 100l/p/d by 2030 down to 80l/p/d by 2035. For non-household development, it is recommended that the policy requires a minimum of 3 credits under the BREEAM New Construction Standard measure "Wat01".
- The council will provide Essex and Suffolk water with their Annual Monitoring Reports and Housing Land Supply Statements, which outline projected housing development within their administrative areas.

Wastewater Infrastructure, Water Quality and Environmental Capacity

Conclusions

- The sewer network and Southend WRC currently serve over 201,653 people, with demand expected to increase as the population grows.
- Southend WRC is forecast to have sufficient treatment capacity throughout the plan period under all growth scenarios assessed.
- Rochford WRC is forecast to exceed its permitted DWF by the end of the plan period, although this is largely driven by growth within Rochford District.
- The only Local Plan site expected to drain to Rochford WRC is Airport Business Park (EA051), which is anticipated to be largely completed before capacity constraints arise.
- Watercourses across the study area have Moderate ecological status and Fail chemical status, indicating limited environmental capacity for additional development.
- Future growth is expected to increase pollutant loads at both Southend and Rochford WRCs beyond current permit limits, potentially affecting WFD objectives if unmanaged.
- The required wastewater treatment improvements are considered technically achievable, but will require advance planning and permitting.
- Combined sewer overflows are an issue in the city, many drain to the Thames Estuary which is a protected bathing water in this location and some are spilling frequently.
- Anglian Water is working alongside Southend-on-Sea City Council and have invested £90 million on a SuDS Scheme to reduce spills and sewer flooding.
- The EA are also supporting on schemes in Marine Parade and Silverdale Road to retrofit drainage measures and smart rainwater harvesting assets respectively.

- Infrastructure upgrades can take several years to deliver, making early planning and stakeholder engagement essential.
- Existing Council policies already support the protection and enhancement of water quality and alignment of development with wastewater infrastructure provision.

Recommendations

- Phase development in consultation with Anglian Water and Rochford District Council where wastewater capacity constraints may arise.
- Consider WRC capacity and permit limits when planning larger developments, particularly those exceeding 500 dwellings.
- Provide Anglian Water with Annual Monitoring Reports and information on major development proposals.
- Share the Water Cycle Study with neighbouring authorities, Anglian Water and the Environment Agency.
- Promote SuDS and sewer separation where appropriate.
- Explore options to retrofit SuDS in existing development areas to reduce current pressures on sewerage infrastructure.
- Prioritise greening the city through landscaping and tree planting to create a network of green spaces and corridors.
- Encourage early engagement between developers and Anglian Water to identify infrastructure requirements and delivery timescales.
- Anglian Water should incorporate projected growth into wastewater planning and progress any required permits and upgrades in advance of development.
- The EA should continue to ensure environmental permits support sustainable growth while protecting water quality.

Flood Risk

- Development has the potential to impact on a wide range of flood mechanisms including fluvial, surface water and sewer flooding.
- Both the impact of development on flood risk and the impact of flood risk on development can be reduced by following the Sequential and Exception Tests outlined in the NPPF and ensuring that development in the study area follows SuDS guidelines.
- At the site-specific level, SuDS should be implemented at all of the sites. Ground raising, and compensatory storage may also be required where sites are at flood risk.
- Ensuring local sewer upgrades are in place prior to the occupation of development will safeguard against pronounced surface water and sewer flood risk.
- The assessment of flood risk undertaken to date is high level. The specific upgrades required to the sewer network in response to development are likely to require further technical work by Anglian Water in collaboration with developers at the planning stage.
- Developers should follow national and local standard and guidance on flood risk. This includes the NPPF, EA guidance, LLFA guidance and wider environmental guidance from other stakeholders in the Essex area.
- The SFRA supporting the local plan will include a more detailed assessment of the fluvial and surface water flood risk constraints at each of the development sites.

Other Environmental Constraints

- The city includes a number of protected sites and designated habitats which present constraints to development in certain areas. This includes SACs, SPAs, SSSIs, Shellfish Waters, Bathing Waters and Seagrass Meadows.
- At this stage, this study has identified the main environmental constraints with respect to protected sites. Further work at the planning application stage including Environmental Impact Assessments (EIAs) and HRAs may be required to determine impacts on specific designated sites and any required mitigation.
- In terms of odour risk, some of the sites proposed in the local plan encroach on land close to the Southend WRC. For the sites identified where odour risk could be a concern, developers should contact Anglian Water prior to submitting a planning application.
- Developers should follow national and local environmental standard and guidance. This includes the NPPF, EA guidance, LLFA guidance and wider environmental guidance from other stakeholders in the Essex area.

Appendix 1 – EA Abstraction Licenses

Appendix 2 – Anglian Water CSO Monitoring Data

Appendix 3 – Anglian Water DG5 Flood Risk Register

Appendix 4 – Correspondence Log