Epsom and Ewell Borough Council

Climate Change Study

Stage 1 – Climate Evidence Base and Baseline

Wood Environment & Infrastructure Solutions UK Limited – January 2023

Report for

Epsom and Ewell Borough Council

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Executive summary

Climate change is regarded as one of the most significant challenges facing us today. The increasing attention is being paid to mitigation and adaption for the future. Action on climate change is being taken at all levels of the planning system, from international agreements and national targets to local planning commitments and strategies for individual developments.

The international response to the challenge of climate change has led to several commitments made by the UK Government. These in turn have resulted in legislation that sets out requirements for both public and private sector organisations in assisting the transition to a low carbon economy. This means an evolving picture for local authorities, who are obligated to maintain high levels of service across all their operations and remits, while at the same time seeking to successfully move to low carbon and resilient delivery models.

EEBC seeks to remain clear as to the general direction on climate action and ensure that measures and strategies are in place to manage this. The Council committed to tackling climate change in the borough in July 2019, and following on from this, produced a Climate Change Action Plan 2020-2024 which included commitments to:

- Develop and deliver a Local Plan and associated policies that contribute positively and demonstrate the Council's commitment to climate change.
- Bring forward a Local Plan which includes planning design policies which support the delivery of new homes that are energy efficient with minimal environmental impact.

In terms of mitigation, there are two main areas of GHG emissions which are most pressing. Reducing emissions from heating and power is a priority, as the use of gas and electricity is responsible for 61% of emissions in the borough. Emissions for transport are also a significant contributor to the total emissions in the borough. A third of borough emissions are from road transport, in particular the use of passenger and light goods vehicles.

From changes in policy, behaviour, regulation, standards and technology, there are wide implications for the Local Plan's ability to contribute to emissions and resilience objectives. Given that there is likely to be a switch away from natural gas in heating homes in the coming years, Epsom and Ewell Borough Council will need to take a policy position that positively influences homeowners to make changes. Furthermore, procurement decisions for electricity and gas, policies regarding the development of new and retrofit of non-domestic existing non-domestic buildings will be important. For transport, active travel policies which help displace car journeys in the borough will also be areas to address within the Local Plan.

Adaptation priorities are guided by a predicted increase in temperatures, a greater frequency of heatwaves, a decrease in summer rainfall and an increase in winter rainfall. An increase in temperatures raises the risk of overheating in the Borough's building stock. It is important that the planning of new homes and buildings consider this risk. Reduced summer precipitation could increase the frequency of droughts and compound water scarcity issues that exist in the borough.

There are opportunities for the Local Plan to address these issues by including adaptation measures in planning policy. It includes standards, such as the Future Buildings Standards, which requires safe levels of indoor temperatures and an increase in the efficiency of water demand and

use in the home. The integration of SuDS into new development can also promote the multi-benefits arising from the integration of flood risk management. Incorporating climate change adaptation into the planning and design of new infrastructure will avoid future retrofitting and avoid lock-ins. Nature based solutions and green infrastructure cut across impacts such as overheating and flooding.

This report highlights areas that are a priority for the Local Plan to address, for both the mitigation of climate change through the reduction of greenhouse gas emissions, and to ensure that the borough is more resilient to the effects of climate change.

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1. Introduction

At a glance

- The UK Government is signatory to international commitments that seek to minimise the impacts of climate change through action on mitigation and adaptation.
- National policy on climate change is guided by advice available from the Committee on Climate Change. Importantly, this includes establishing national carbon budgets that are set out in law and track the UK's progress towards a Net Zero future, and national risk assessments and adaptation plans that track the UK's resilience to climate change.
- Epsom & Ewell Borough Council will see the benefits of policy action at national level and needs to ensure that its own policy framework is consistent with national policy.
- Consistency with national policy does not mean that local circumstances and climate change related challenges cannot be directly addressed within the context of the emerging Local Plan.

Action on climate change

Climate change is regarded as one of the most significant threats of our times and increasing focus is being paid to mitigating and adapting for the future. Action on climate change is being taken at all levels from international agreements and national targets to local planning commitments and strategies.

The UK's Climate Change Act 2008[1], amended in 2019, provides the basis for climate action in the UK and for its Nationally Determined Contribution under the Paris Agreement. It commits the UK to a 100% reduction in greenhouse gas emissions by 2050 from 1990 levels, known as the commitment to Net Zero. As part of fulfilling this aim, a target of 78% reduction in greenhouse gas emissions by 2035 was established[2] and a Net Zero Strategy[3] setting out policies and proposals to decarbonise all sectors of the UK economy. The Climate Change Act 2008 also commits the UK to undertake a 5-year Climate Change Risk Assessment and develop a National Adaptation Programme, which detail the UK's risks and adaptation capacities to the potential impacts of climate change, such as flooding, heat stress and drought. Whilst the UK's Net Zero Strategy, Climate Change Risk Assessment and National Adaptation Programme set the national approach to climate action, local authorities play a vital role in their delivery. This is particularly relevant to the planning roles and responsibilities of local authorities.

The revised National Planning Policy Framework[4] establishes the need for the planning system to support the transition to a low carbon future, use place shaping to help radically reduce

[1] UK Government. 2008. Climate Change Act. Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents

[2] Department for Business, Energy & Industrial Strategy. 2020. The UK's Nationally Determined Contribution under the Paris Agreement [online]. Available at: https://www.gov.uk/government/publications/the-uks-nationally-determined-contribution-communication-to-the-unfccc

[3] Department for Business, Energy & Industrial Strategy. 2021. Net Zero Strategy: Build Back Greener. [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

[4] Ministry of Housing, Communities and Local Government. 2021. National Planning Policy Framework [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf.

greenhouse gas emissions and promote renewable technologies. The NPPF also requires local development plans to play a full part in contributing to community resilience in a changing climate. The planning process aims to achieve sustainable development following three overarching objectives: economic, social and environmental, including adapting to climate change. Within the framework it is recognised that plans should take a proactive approach to adapting to climate change.

Climate action can be delivered through the local planning process by setting policies that ensure development is planned and delivered in a sustainable way that minimises its contribution to further climate change and ensuring its resilience to the impacts of climate change. Specifically, climate action considers and integrates carbon neutrality (mitigation) and climate resilience (adaptation) over the lifetime (and after) of developments. To achieve best practice, climate action should be integrated into the whole life cycle of a development, from feasibility to decommissioning/end-of-life. Early integration of climate action improves option appraisal, site location, design, building material and operational decisions. By considering climate change early, developments will be delivered in a more efficient and cost-effective way.

Key considerations for climate action across planning and development include:

1. Reduction of GHG emissions and climate risk should be embedded into planning and design from the beginning of a development and throughout the project management and delivery cycle.
2. Climate mitigation and adaptation should also be addressed through the wider context of strategic policy and use (e.g., asset to be built, utilisation, social/economic/environmental landscape, new and emerging technologies, and behaviour change).
3. Emissions, energy use, embodied carbon, climate risks and adaptation measures should be considered for construction, operation and maintenance over the lifetime and final decommissioning developments.
4. Policies and assessments of climate mitigation and adaptation should be well documented and verifiable throughout the planning process.

Climate Change Mitigation

Mitigation is the act of reducing emissions to slow and prevent further climate change. Net-zero refers to the point at which the amount of greenhouse gases being released into the atmosphere by human activity, equals the amount that is being removed.[5]

To date, much of the effort to tackle the climate crisis has focused on a transition to renewable energy and the implementation of energy efficiency measures. Whilst these are both crucial to meet net-zero targets, they only address an estimated 55% of our global emissions. The remaining estimated 45% comes from the embodied carbon related to how materials are used and managed.

The need for transparent, robust assessment and reporting, which accounts for a wider set of impacts, has been recognised across the planning system. Greenhouse gas emissions are generated throughout a development's lifecycle. For example, in construction there are embodied

[5] Department for Business, Energy & Industrial Strategy. 2020. Powering our Net Zero Future. Energy White Paper. Available at:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

emissions in the raw materials and emissions generated in the manufacture, transportation and installation of these materials. During the operation phase, energy and water use, vehicle journeys and transport use, maintenance, repair and waste generation are all sources of greenhouse gas emissions. At the end-of-life (EOL), there are emissions associated with the decommissioning, deconstruction and disposal of infrastructure.

Mitigating climate change through greenhouse gas emission reduction is key to sustainable development. This does not mean that all new development must be carbon neutral from construction to operation rather, should include credible emission reduction pathways to support EEBC in reaching its net-zero ambitions.

Climate Change Adaptation

Climate adaptation refers to the ability of a system, to resist, recover from, and continue to develop despite climate-related shocks.[6] Climate change itself refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.

We are now seeing the impacts of a global temperature rise of just 1°C above pre-industrial levels. The Paris Agreement targets a global temperature rise threshold of well below 2°C, ideally 1.5°C, but current global plans give only a 50% chance of meeting 3°C.[7] In these circumstances, although the UK is committed to working for global action to parallel our own adoption of a net-zero statutory target, it is prudent to plan for a scenario of 4°C, but there is little evidence of adaptation for even 2°C. Adaptation takes time, especially for infrastructure, buildings and the natural environment, which means actions need to start now to avoid 'lock-in' to high levels of risk in 2050 and beyond.

Due to climate change, the borough is likely to experience more frequent and extreme severe weather in addition to warmer and wetter winters, as well as hotter, drier summers. Resilience to these changes can be improved by avoiding adverse events, limiting their impact, or enhancing recovery.[8] Building climate resilience into the planning system is instrumental in creating an adaptive management response to climate change. This does not mean that all new developments must be constructed to withstand all future climate variables, such as increased temperatures or decreased precipitation, but there should be credible adaptation pathways to build resilience to the impact of climate change in the design, management or operation of the development.

Scope of this Report

This report has been produced for the purpose of supporting Epsom and Ewell Borough Council (EEBC) with their strategy to tackle climate change and its impact in the area through the new Local Plan. EEBC is in the process of reviewing its Local Plan (2022-2040). This review will include strategic and detailed policies as well as site allocations and will replace the existing Local Plan. EEBC committed to tackling climate change in July 2019 and produced a Climate Change Action Plan

[6] Royal Town Planning Institute. 2020. Strategic planning for climate resilience. Available at: https://www.rtpi.org.uk/media/7030/strategic-planning-for-climate-resilience-final-003.pdf
[7] Intergovernmental Panel on Climate Change. 2021. Climate Change 2021: The Physical Science Basis. Available at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/
[8] Cambridge Institute for Sustainability Leadership. 2016. Investing for Resilience. Available at: https://www.cisl.cam.ac.uk/system/files/documents/Investing-for-resilience.pdf

2020-2024.[9] The plan commits the Council to use its mandate as a local authority to ensure sustainable development and support residents and enterprises to reduce carbon emissions. In relation to planning, the Council has identified the following objectives:

- Develop and deliver a Local Plan and associated policies that contribute positively and demonstrate the Council's commitment to climate change.
- Bring forward a Local Plan which includes planning design policies which support the delivery of new homes that are energy efficient with minimal environmental impact.
- Actively seek opportunities for the development of carbon neutral homes in the Borough.

This climate evidence base and baseline report includes:

- an overview of international, national and local legislation, policy and guidance driving climate action policies in EEBC's Local Plan.
- Evidence base and baseline for climate mitigation and adaptation policy options.
- A short-list of policy options that should be considered and tested through viability assessment for EEBC's Local Plan.

[9] Epsom and Ewell Borough Council. 2020. Climate Change Action Plan. Available at: https://www.epsom-ewell.gov.uk/residents/climate-change

2. Wider Legislative and Policy Landscape

By looking at the policy landscape across the spectrum from international through national to local level, this section identifies EEBC's position on climate change and planning policy, as well as areas where it can best influence climate action.

At a glance

- The UN Framework Convention on Climate Change (UNFCCC) provides the basis for international co-operation for action on climate change.
- The overarching aim is to stabilise greenhouse gas concentrations in the atmosphere at a level which minimises the risks and impacts of a changing climate. This amounts to minimising the rise in average global temperatures to well below 2 °C, and ideally no higher than 1.5 °C above pre-industrial levels.
- Different nations will make a range of contributions to the global net zero target depending on individual circumstances. Each nation sets out what this is within its Nationally Determined Contribution (NDC). These are collated on the UNFCCC NDC Registry.
- The UK's current NDC commits to at least a 68% reduction in GHG emissions by 2030 (against its 1990 baseline). It is accompanied by commentary on its adaptation strategy and its contribution to International Climate Finance to support developing countries.
- National Carbon Budgets for the UK are set in law restricting the cumulative GHG emissions that can be emitted within a given five-year period
- Advice from the Committee and Climate Change guides Government policy in terms of how it may achieve continued GHG emission reduction aligned with the national carbon budgets and wider net zero targets. It also supports adaption action in response to risk identified in a five-yearly national climate risk assessment.
- While the precise pathway to reach net zero and resilience is not prescriptive, it is reasonable to reflect on the nature of change in each sector of the economy and how this will impact the lives of the community in the Borough through local strategies and policies.
- A summary of alignment between local, national and international legislation and policy is summarised in **Table 2.1**.

Table 2.1 Alignment of the local, national, and international legislation, policies

Cross-cutting (mitigation and adaptation)

International	National	Local	EEBC priorities
UNFCCC convention (1992): Commits to stabilise GHG emissions and facilitate adequate adaptation to climate change **Paris Agreement (2015):** Holding the increase in the global average temperature to well below 2°C and limit the increase to 1.5 °C above pre-industrial levels; adapt to the impacts of climate change, foster climate resilience and low GHG development; Consistent climate finance flows. **Glasgow Climate Pact (2021):** strengthening efforts to build resilience to climate change, curbing greenhouse gas emissions and to provide the necessary finance for both initiatives. Commitment to halt and reverse forest and land degradation; Phase down coal power; Decarbonise shared shipping routes.	**Climate Change Act (2008, updated 2019):** Commits the UK Government to delivering an 80% reduction in carbon emissions by 2050 (against a 1990 baseline). It also requires the UK Government to ensure that there is sufficient preparation in seeking to adapt to risks posed by climate change. **National Planning Policy Framework (2012, updated in 2021):** Sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. A key aim of the NPPF is that plans should take a proactive approach to mitigating and adapting to climate change, considering the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. **25-year Environmental Plan (2018):** Set out environmental goals over a 25-year period. These include establishment of a green business council to advise government; Introducing a principle of "environmental net gain" into planning decisions; Achieving zero avoidable plastic waste by the end of 2042, among others.	**EEBC's Local Development Scheme (LDS) (2022):** The current LDS EEBC is made up of: • Epsom & Ewell Core Strategy 2007 • Plan E Epsom Town Centre Area Action Plan 2011 • Epsom & Ewell Development Management Policies Document 2015 • Surrey Waste Plan 2008 • Surrey Minerals Plan Core Strategy 2011 A new Local Plan 2040 is in the process of being developed. The Local Plan 2040 will set the vision and framework for future development of the borough to 2040. This will include addressing local housing need, the economy, environmental considerations, community infrastructure as well as strategic infrastructure needs. **EEBC's 4 Year Plan (2020):** Sets out the strategy for the provision of local services for residents, businesses, and visitors during the four-year period 2020 to 2024. Among the key areas of the plan is the "Green and Vibrant: A theme that has a focus on biodiversity, reduction in carbon dioxide emissions, waste reduction and incorporating nature-based solutions into infrastructure." **EEBC's Biodiversity Action Plan (2019):** This plan aims to conserve and enhance habitat types and species of principal importance within the borough of Epsom and Ewell as identified and listed under section 41 (England) of the NERC Act (2006) and coordinates with the Surrey Nature Partnership Biodiversity Working Group.	There is potential for EEBC to work more closely with the Surrey Development Forum to find areas of interest and initiatives that can be used to build and shape future projects in the climate change mitigation and adaptation strategy. The Biodiversity Action Plan incorporates new legislation from the 25 Year Environmental Plan, as well as the Environment Bill, and will be used to inform the 4 Year Plan for the borough.

Mitigation			
International	**National**	**Local**	**EEBC priorities**
Kyoto Protocol (2005, updated in 2020): Sets out legally binding emission reduction targets	**Carbon Budgets:** Five-yearly carbon budgets which currently run until 2032. Place a limit on the amount of GHGs the UK can legally emit during each of the five-year time periods. The UK is currently in the third carbon budget period (2018 to 2022). **UK National Determined Contribution (2020):** In its NDC, the UK is committing to reduce economy-wide greenhouse gas emissions by at least 68% by 2030, compared to 1990 levels. **Net Zero Strategy (2021):** Sets out clear policies and proposals for keeping the UK on track towards the latest carbon budget. Actions within the Net Zero Strategy support ambitions to further reduce emissions associated with extraction, processing and disposal of materials, through widescale adoption of a circular economy.	**Surrey's Greener Future Delivery Plan 2020-2050 (2019):** Sets out the joint ambition and collective commitment across Surrey to reduce GHG emissions across organisations, transport, energy generation, housing, and planning, building and infrastructure; waste, resources and circular economy, land use and food systems, industry, and green economy. **Surrey 2050 Place Ambition (2019):** Will be used to help shape projects and seek the support of wider sub-national partners and Government, particularly in relation to accessing additional funding and investment opportunities for infrastructure and to support a zero-carbon future. **Epsom and Ewell Climate Change Action Plan (2020):** The Council's Commitment is to be net carbon neutral by 2035, ahead of the Government's target of 2050 to be achieved through 6 key themes: Council leadership and influencing others; Council buildings and energy use; Council transport and switching to lower polluting vehicles; Improvements to the environment; Tackling and minimising waste; Use of technology and information systems. Each of the themes above have a list of objectives and outcomes – some support the Local Development Scheme, the 4-Year Plan or the Biodiversity Action Plan.	In order to support wider delivery of carbon budgets, EEBC will need to adopt some of the strategies in the Key Action Areas in the Net Zero Strategy This Climate Change Action Plan aligns closely with the Surrey Greener Future Plan, with all of Surrey's ambitions being captured in the EEBC plan. However, EEBC has yet to put quantitative measurements of success on these objectives, and metrics will be required to measure how well the outcomes are being met.

Adaptation			
International	**National**	**Local**	**EEBC priorities**
Cancun Adaptation Framework (2010): First formal agreement to establish principles and guidelines for decreasing the vulnerability of communities and ecosystems.	**UK Climate Change Risk Assessment (CCRA):** A five-yearly assessment of the major risks and opportunities from climate change to the UK. The most recent evidence report was published by the CCC in 2022. **UK National Adaptation Plan (NAP):** A five-year cycle of the NAP has been put by the Climate Change Act in 2013. Since then, a second National Adaptation Program has been put into place for 2018-2023, and it addresses actions required to mitigate the risks in the CCRA.	**EEBC Strategic Flood Risk Assessment (2018):** Identified that the watercourses in the borough that pose significant flood risk to buildings and infrastructure are the Hogsmill River and its tributaries, which include the Bonesgate Stream, the Horton Stream, Green Lanes Stream and Ewell Court Stream. Most of the Ewell Court Stream and lengths of Green Lanes Stream are culverted. The recommendations made by this assessment include risk reduction methods and revisions that are required to Local Planning Policy regarding flooding.	Climate risks will need to be identified for the borough, and adaptation measures, such as those as listed in the NAP that can be carried out by the council, implemented to minimise these risks. EEBC should pay particular attention to integrating adaptation and mitigation approaches and looking for 'win-win' solutions that will support sustainable development. This could be achieved in a variety of ways, for example: • by maximising summer cooling through natural ventilation in buildings and avoiding solar gain; • through district heating networks that include tri-generation (combined cooling, heat and power); or • through the provision of multi-functional green infrastructure, which can reduce urban heat islands, manage flooding and help species adapt to climate change – as well as contributing to a pleasant environment which encourages people to walk and cycle. EEBC should be aware of and avoid the risk of maladaptation. An example of this is designing buildings to maximise solar gain in winter without considering the implications for overheating in summer. The recommendations made by the Flood Risk Assessment include risk reduction methods and revisions that are required to Local Planning Policy regarding flooding. It is important for EEBC to work with Surrey County Council to produce an effective and sustainable flood risk management program.

International

United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC is an international environmental treaty that was adopted in 1992 and came into force in 1994 having been ratified by 197 nations worldwide. The nations that ratified the agreement are known as 'parties to the convention'. For this reason, when the parties to the Convention meet annually to assess progress and seek further action as is thought necessary to meet overall targets, it is known as the '***Conference of the Parties***' (COP).[10]

The ultimate objective of the Convention is to stabilize greenhouse gas concentrations in the atmosphere. It also makes a commitment to facilitate adequate adaptation to climate change. It is linked to three other UN Conventions:

- Convention on Biological Diversity
- Convention to Combat Desertification
- Ramsar Convention on Wetlands

From the outset of this agreement, it was recognised that action on climate change needs to be cost effective and that contributions from different countries will vary according to their circumstances. The UNFCCC does not set any targets for greenhouse gas (GHG) emission reduction by individual countries. It sets out how international treaties or protocols can be negotiated to support international efforts to achieve the overall objective. Leading the way in setting targets, strategies and funding for decarbonisation are the so-called industrialised countries including the United Kingdom.

Kyoto Protocol

The first meeting of the parties to the UNFCCC convention took place in Kyoto (COP-1) and the resulting Kyoto Protocol came into force in 2005. It set out legally binding emissions reduction targets. Two commitment periods were agreed, the first from 2008 – 2012, the second from 2013 – 2020.

There was an Amendment to the Protocol for the second period commitments agreed in Doha (COP-18), which came into force on 31 December 2020. This Amendment includes new commitments for countries, a revised list of GHG to be reported during the second commitment period, and changes to several articles within the Kyoto Protocol regarding the first commitment period, which required an update for the second commitment period.

The Kyoto Protocol has mechanisms to encourage GHG abatement in developing nations, as this is the most cost-effective location. This has the parallel benefits of stimulating green investment in developing countries and including the private sector in this endeavour to cut and hold GHG emissions.

[10] United Nations Framework Convention on Climate Change. 1992. Rio Declaration. Available at: https://www.un.org/en/conferences/environment/rio1992

Additionally, an Adaptation Fund was established as part of the Kyoto Protocol to finance adaptation projects in developing nations.[11]

Cancun Agreements

The agreements, reached in Cancun, Mexico, at the 2010 United Nations Climate Change Conference represent key steps forward in capturing plans to reduce greenhouse gas emissions and to help developing nations protect themselves from climate impacts and build their own sustainable futures. Among the key agreements are the establishment of the Green Climate Fund, Establishment of a new Technology Mechanism and Agreement on a Framework to Reduce Deforestation.

Paris Agreement

The Paris Agreement was adopted in December 2015. It was signed by 195 UNFCCC members and at the time of writing has been ratified by 170.

The agreement applies to the period beyond 2020 and has three key objectives:

> "(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
>
> (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;
>
> (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development."

Those countries that have ratified the agreement are legally bound to prepare, communicate, and maintain a nationally determined contribution (NDC). This sets out their targets in terms of overall reduction in nationally reported GHG emissions. A report on progress with the NDC should be produced every five years and ambitions set out at each review should be more far reaching than the previous reporting period.

Starting from 2023, governments will come together every five years in a 'global stocktake', based on the latest science and implementation progress to date. The stocktake will set the context for the raising of ambition by all Parties by looking at what has been collectively achieved and what more needs to be done to achieve the below 2°C objective.

The UK has ratified the Paris Agreement and committed to the process of progress review that it includes. The NDC for the UK was issued as part of a joint submission by the European Union. It states a commitment to achieve at least a 40% reduction in domestic GHG emissions by 2030 (against a 1990 baseline). 'Domestic' in this case refers to individual countries within the EU. It is useful to note that this 40% reduction is an aggregate figure for the EU member states, the UK's

[11] United Nations Framework Convention on Climate Change. 1997.19th Special Session of the General Assembly. Available at https://www.un.org/en/conferences/environment/newyork1997

own national commitments, as an example, are for a more significant reduction in its reported GHG emissions by 2030.[12]

Glasgow Climate Pact

At COP-26 in Glasgow, the key outcomes were the reaffirmation of the Paris Agreement by the Parties, with a package of decisions made which include strengthening efforts to build resilience to climate change, curbing greenhouse gas emissions and to provide the necessary finance for both initiatives.

Commitments in a range of other areas such as forests, methane, car emissions, and private finance were also made. This included a commitment from 137 countries, including the UK, to "halt and reverse forest loss and land degradation" by 2030.

190 countries agreed to phase down coal power, resulting in a 76% decrease in planned new coal power plants. Over 40 countries, several states and organisations declared their support for the global coal to clean power transition statement.

The Clydebank Declaration, which aims to decarbonise shared shipping routes was signed by 22 countries. Another agreement between private business, cities, as well as countries, aims to accelerate the transition to 100% zero emission cars and vans by "2040, and by no later than 2035 in leading markets".[13]

National

The Climate Change Act

The 2008 Climate Change Act commits the UK Government to delivering an 80% reduction in carbon emissions by 2050 (against a 1990 baseline) It also requires the UK Government to ensure that there is sufficient preparation in seeking to adapt to risks posed by climate change.

The UK Government is also committed within the Act to limit global temperature rise to as little as possible above 2°C. The act was updated in 2019, committing the UK to reduce economy-wide greenhouse gas emissions by at least 68% by 2030, compared to 1990 levels. The Act included a requirement to create the Committee on Climate Change (CCC), which independently assesses carbon targets and advises Government on the evidence base behind them.[14]

The Climate Change Act also sets out reporting requirements of the UK Government to produce a UK Climate Change Risk Assessment (CCRA) to be published every five years. The CCRA is the mechanism for gathering and presenting evidence to help understand climate change risks to the UK. The National Adaptation Programme (NAP) aims to set the strategy to address the risks

[12] United Nations Framework Convention on Climate Change. 2015. Paris Agreement. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[13] United Nations Framework Convention on Climate Change. 2021. Glasgow Climate Agreement. https://ukcop26.org/
[14] UK Government. 2008. Act of the Parliament of the United Kingdom. Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents

highlighted in the CCRA. [15] The CCRA addresses climate risks and opportunities across the following sectors:

- The natural environment
- Infrastructure
- People and the built environment
- Business and industry
- Local government sectors

Carbon Budgets

Since 2008, six carbon budgets have been approved by Parliament. The government has set five-yearly carbon budgets which currently run until 2032. They place a limit on the amount of GHGs the UK can legally emit during each of the five-year time periods. The UK is currently in the third carbon budget period (2018 to 2022).

Table 2.2: Carbon Budgets as set by the Climate Change Act

Budget	Time period	Carbon budget level	Reduction below 1990 levels
First Carbon Budget	2008 – 2012	3,018 MtCO2e	25%
Second Carbon Budget	2013- 2017	2,782 MtCO2e	31%
Third Carbon Budget	2018- 2022	2,544 MtCO2e	37% by 2020 (on track)
Fourth Carbon Budget	2023 – 2027	1,950 MtCO2e	51% by 2025
Fifth Carbon Budget	2028 - 2032	1,725 MtCO2e	57% by 2030
Sixth Carbon Budget	2033 - 2037	965 MtCO2e	78% by 2035

The first two carbon budgets were met and the UK is on track to outperform the third (2018 to 2022). However, it is not on track to meet the fourth (2023 to 2027) or the fifth (2028-2032).

As the UK progresses towards the higher reduction targets in carbon budgets, so the savings become harder to achieve and (potentially) more costly to implement. Any reduction in action now could result in a slowing in GHG reduction and a failure to meet later targets. This in turn results in more costly interventions to deliver the GHG emission reductions required to meet targets. To meet future carbon budgets and the Net Zero target for 2050 will require governments to introduce more challenging measures.

UK CCRA 3 and the National Adaptation Program

The UK Climate Change Risk Assessment (CCRA) is a five-yearly assessment of the major risks and opportunities from climate change to the UK. The most recent evidence report was published by the CCC in 2022.[16]

[15] Department of Environment, Food and Rural Affairs. 2013. National Adaptation Programme. Available at: https://www.gov.uk/government/publications/adapting-to-climate-change-national-adaptation-programme
[16] Committee on Climate Change. 2001. Independent Assessment of UK Climate Risk. Available at: https://www.theccc.org.uk/publication/independent-assessment-of-uk-climate-risk/

The CCRA3 report assesses 61 risks and opportunities from climate change to England, including to business, infrastructure, housing, the natural environment, our health, and risks from the impacts of climate change internationally. Of the 61, six issues are deemed to be both a risk and opportunity (Table, four of which are associated with the natural environment and each of these require more action or further investigation.[17]

A five-year cycle of the National Adaptation Programme (NAP) has been put by the Climate Change Act in 2013. Since then, a second National Adaptation Program has been put into place for 2018-2023, and it addresses actions required to mitigate the risks in the CCRA as below:

Table 2.3: Climate Risks in CCRA3 and the NAP Actions for each risk

CCRA Climate Risk	NAP Action
Flooding and coastal change risks to communities, businesses and infrastructure	• Make sure everyone is able to access the information they need to assess any risk to their lives, livelihoods, health and prosperity posed by flooding and coastal erosion; • Bring the public, private and third sectors together to work with communities and individuals to reduce the risk of harm – particularly those in vulnerable areas; • Make sure that decisions on land use, including development, reflect the level of current and future flood risk; • Boost the long-term resilience of our homes, businesses and infrastructure; • Take action to reduce the risk of harm from flooding and coastal erosion including greater use of natural flood management solutions; and • Include flood risk as a key feature of adaptation reporting from infrastructure reporting organisations.
Risks to health, well-being, and productivity from higher temperatures:	• Work with infrastructure operators included in the third cycle of adaptation reporting to outline risks posed to their productivity from climate impacts; • Deliver more, better quality and well-maintained local Green Infrastructure; and • Adapt our health systems to protect people against the impacts of climate change, such as ensuring all clinical areas in NHS Trusts have appropriate thermal monitoring in place.
Risks of water deficits in public water supply, and for agriculture, energy generation and industry, with impacts on freshwater ecology.	• Work to restore natural processes within river systems to enhance water storage capacity; and • Work towards setting challenging and ambitious goals to reduce water leakage.

[17] Betts, R.A. and Brown, K. 2021. The Third UK ClimateChange Risk Assessment Technical Report [Betts, R.A.,Haward, A.B. and Pearson, K.V.(eds.)]. Prepared for the Climate Change Committee. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/Technical-Report-The-Third-Climate-Change-Risk-Assessment.pdf

Risks to natural capital, including soils, coastal, marine and freshwater ecosystems, and biodiversity.	• Introduce a new Environmental Land Management scheme which will deliver environmental outcomes; • Develop and start to implement a Nature Recovery Network, linking habitat restoration and creation to improved access, flood protection and water quality; • Incentivise good soil management practices that enhance soil's ability to deliver environmental benefits through future environmental land management schemes; • Introduce a sustainable fisheries policy as we leave the Common Fisheries Policy and prepare marine plans that include policies for climate adaptation; • Build ecological resilience on land, in our rivers and lakes and at sea; and • Protect soils and natural carbon stores.
Risks from climate-related impacts on domestic and international food production and trade.	• Ensure a food supply chain which is resilient to the effects of a changing climate; and • Review and publish the updated UK Food Security Assessment.
New and emerging pests and diseases, and non-native species, affecting people, plants and animals.	• Manage existing plant and animal diseases and lower the risk of new ones; and • Tackle invasive non-native species.

Net Zero Strategy

In 2021, the Government released its Net Zero Strategy[18], setting out clear policies and proposals for keeping the UK on track towards the latest carbon budget. Actions within the Net Zero Strategy support ambitions to further reduce emissions associated with extraction, processing and disposal of materials, through widescale adoption of a circular economy. According to the CCC, the Government's Net Zero Strategy is a 'major step forward', that is also an 'achievable and affordable plan'[19]. **Figure 2.1** breaks down by sector the emissions reductions essential in achieving net-zero within the UK. This includes Domestic Transport, Heat and Buildings and Agriculture & LULUCF (Land Use and Land Use Change Forestry). The emission reductions are presented in their respective ranges to reflect this inherent uncertainty. Table 2.4 shows expected emissions reductions by sector.

[18] Department for Business, Energy & Industrial Strategy. 2021. Net Zero Strategy: Build Back Greener. Available at: https://www.gov.uk/government/publications/net-zero-strategy

[19] Climate Change Committee. 2021. Government's Net Zero Strategy is a major step forward. Available at: https://www.theccc.org.uk/2021/10/26/governments-net-zero-strategy-is-a-major-step-forward-ccc-says/

Figure 2.1 The UK's pathway to net-zero[11]

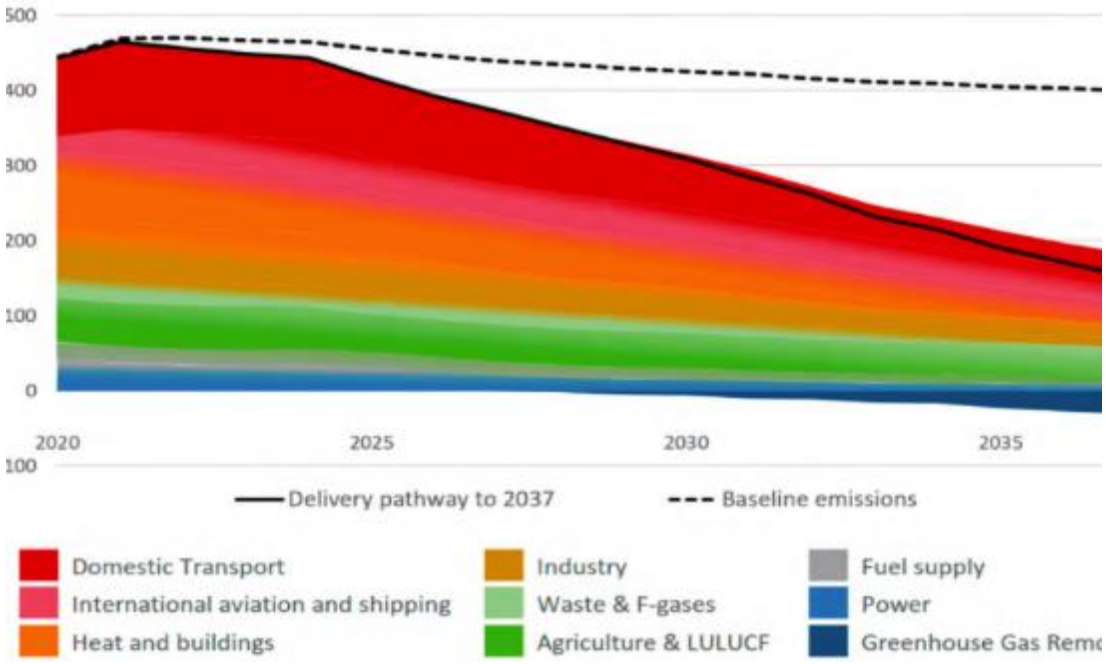


Table 2.4: Indicative UK net-zero delivery pathway to 2037 by sector[11]

Sector	UK emissions, 2019 (%)	Expected reduction by 2035 from 1990 (%)
Power	11	80-85
Fuel supply and hydrogen	5	53-60
Industry	15	63-76
Heat and buildings	17	47-62
Transport	32	47-59
Natural resources[20]	20	39-51
Greenhouse gas removals	N/A	Not defined

National Planning Policy Framework

First published in 2012, and most recently updated in 2021, the National Planning Policy Framework (NPPF)[21] sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

The 2021 revision of the NPPF, paragraph 152 states: "*The planning system should support the transition to a low carbon future in a changing climate… shape places in ways that contribute to radical reductions in greenhouse gas emissions… and support renewable and low carbon energy and associated infrastructure*".

It also requires in paragraph 154 that new development should be planned for in ways that "*can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any*

[20] Emissions savings will be achieved through municipal biodegradable waste streams diversion from landfills, agriculture and livestock management, and other sectors, such as wastewater- all areas of significant emission contributions. Increased afforestation and peat restoration will also contribute to emission savings.
[21] Ministry of Housing, Communities and Local Government. 2021. National Planning Policy Framework. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards".

Furthermore, it is stated in paragraph 155, that local planning authorities should expect new development to: "*comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable;* and take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption."

The NPPF sets out in paragraph 153 that Local Plans: "*should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply and changes to biodiversity and landscape, and the risk of overheating from rising temperatures*".

Paragraph 154 states that: "*New developments should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure*".

Paragraph 157 also states that: "*in determining planning applications, local planning authorities should expect new development to: a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable*."

The supporting Environment Agency planning practice guidance, flood risk assessments: climate change allowances, contains the percentage uplifts for climate change to be added to assessments.

25 Year Environmental Plan

The 25 Year Environmental Plan was first published in 2018, with the intention of setting out goals for the environment over a 25-year period. Some of the key areas:

- Using a "natural capital" approach to protecting and enhancing the environment, by recognising its tangible and non-tangible economic benefits.
- The establishment of a green business council to advise government on "environmental entrepreneurialism". A natural environment impact fund is being mooted to support this which would use natural capital valuations;
- Introducing a principle of "environmental net gain" into planning decisions where wider natural capital benefits will be assessed as part of the planning process;
- Achieving zero avoidable plastic waste by the end of 2042 through a number of initiatives;
- A commitment to reducing the risk of harm to people, the environment and the economy from natural hazards including flooding, drought and coastal erosion.
- The aims for a post-Brexit sustainable fisheries policy, based on a natural capital approach;

- A new commitment to publishing an overarching chemicals strategy to set out the UK's approach as it leaves the EU;
- Initial proposals for a new environmental land management system (based on paying public money for public 'goods' such as environmental enhancement)
- A target of ensuring the sustainable management of soil by 2030 and establishing sufficient data to understand the current state of soil health;
- An aim to increase woodland in England in line with the aspiration of achieving 12% cover by 2060: this would involve planting 180,000 hectares by the end of 2042; and
- A goal to mitigate and adapt to climate change by doing "what is necessary to adapt to the effects of a changing climate". The Government proposes to update the Plan at least every 5 years, and to report annually on progress to Parliament. A set of indicators will be developed to monitor progress.[22]

Local

Surrey's Greener Future

Surrey County Council Greener Futures Delivery Plan 2020-2050 sets out the joint ambition and collective commitment across Surrey to reduce carbon emissions.[23] Through this, a series of ambitions and targets for Surrey's future have been set as below:

Table 2.5: Surrey County Council's Climate Change Ambitions and Targets

No.	Ambitions	Targets
1	**Organisation Emissions:** Achieve net zero carbon local authorities that lead by example in promoting sustainable practices across their operations, estate, and vehicles.	**Net zero carbon** for Surrey's organisational emissions **by 2030 or sooner.**
2	**Transport:** Deliver and promote an integrated, accessible, affordable, and reliable public and active (walking or cycling) transport system across the County, thereby reducing journeys and improving local air quality for improved health and wellbeing of our residents.	**60% emissions reduction in the Transport sector by 2035** against business as usual as a minimum.
3	**Energy Generation:** To support the national decarbonisation ambition by leading renewable energy generation expansion and bringing low carbon heating into Surrey homes through smart, decentralised systems.	**15% of energy from solar PV by 2032.**

[22] Department of Environment, Food and Rural Affairs. 2018. 25-year Environmental Plan. Available at: https://www.gov.uk/government/publications/25-year-environment-plan

[23] Surrey County Council. 2020. Surrey County Council Greener Futures Delivery Plan 2020-2050. Available at: https://www.surreycc.gov.uk/community/climate-change/what-are-we-doing/greener-futures-climate-change-delivery-plan-2021-to-2025

4	**Housing and Planning:** To create low carbon, healthy homes for our residents that reduce emissions, have lower running costs and improve the wellbeing of our community.	**66% emissions reduction in the domestic housing sector by 2035** against business as usual as a minimum.
5	**Buildings and Infrastructure:** To drive forward the transition to a zero-carbon built environment, through the pursuit of lower operational energy use, increased supply of renewable energy to Surrey's buildings and reduced embodied carbon – the GHG emissions associated with non-operational phases e.g. construction.	**61% emissions reduction across commercial and public buildings** sector **by 2035** against business as usual as a minimum.
6	**Waste, Resources and Circular Economy**: Rethink our current approach to waste, to create a system centred on circular economy principles that seeks to prioritise the reduction of waste creation, encouraging innovative approaches to waste reutilisation and recycling - throwing away will become a last resort.	**70% of all local authority collected waste reused, composted or recycled by 2030**.
7	**Land Use and Food Systems:** Develop a land use framework for Surrey focused on increasing accessible green spaces, woodland cover in appropriate locations in line with national targets and sustainable farming practices.	**1.2 million trees planted by 2030.**
8	**Industry and Green Economy:** Pursue the transition to clean growth, through the decarbonisation of all major sectors and investment in the development of clean technologies and industries that create jobs and improve the quality of life for our residents.	**56% emissions reduction across industry by 2035** against BAU as a minimum.

Surrey 2050 Place Ambition

In July 2019, the Surrey Future Steering Board launched "Surrey's 2050 Place Ambition" to facilitate good growth which:

- Is proportionate and sustainable, focusing on places where people live and work;
- supports overall improvements to the health and well-being of our residents;
- is supported by the necessary infrastructure investment - including green infrastructure;
- delivers high quality design in our buildings and public realm;
- increases resilience and flexibility in the local economy;
- builds resilience to the impacts of climate change and flooding;
- is planned and delivered at a local level while recognising that this will inevitably extend at times across administrative boundaries.

The Place Ambition has been developed by the Surrey Future partnership and is informed by and will be implemented through various local and countywide plans and strategies including district and borough local plans, climate change strategies, economic strategies, and the local transport plan.

It does not replace any local proposals and priorities but is intended to promote a long term, co-ordinated and cross boundary approach to planning and managing the impacts of growth. The Place Ambition will be used to help shape projects we are working on together as well as seek the support of our wider sub-national partners and Government, particularly in relation to accessing additional funding and investment opportunities for infrastructure and to support a zero-carbon future. [24]

EEBC's Climate Change Action Plan

EEBC committed to tackling climate change in July 2019 and produced a Climate Change Action Plan 2020-2024. The plan commits the Council to use its mandate as a local authority to ensure sustainable development and support residents and enterprises to reduce carbon emissions. In relation to planning, the Council has identified the following objectives:

- Develop and deliver a Local Plan and associated policies that contribute positively and demonstrate the Council's commitment to climate change.
- Bring forward a Local Plan which includes planning design policies which support the delivery of new homes that are energy efficient with minimal environmental impact.
- Actively seek opportunities for the development of carbon neutral homes in the Borough.

The Council's Commitment is to be net carbon neutral by 2035, ahead of the Government's target of 2050 to be achieved through 6 key themes:

1. Council leadership and influencing others
2. Council buildings and energy use
3. Council transport and switching to lower polluting vehicles
4. Improvements to the environment
5. Tackling and minimising waste
6. Use of technology and information systems

- Each of the themes above have a list of objectives and outcomes – some support the Local Development Scheme, the 4-Year Plan or the Biodiversity Action Plan.
- This action plan aligns closely with the Surrey Greener Future Plan, with all of Surrey's ambitions being captured in the EEBC plan. However, EEBC has yet to put quantitative

[24] Surrey County Council. 2019. Surry 2050 Place Ambition. Available at: https://www.surreycc.gov.uk/land-planning-and-development/development/surrey-future/surrey-2050-place-ambition

measurements of success on these objectives, and metrics will be required to measure how well the outcomes are being met. [25]

EEBC's Local Plan

EEBC is required to review its Local Plan every five years from the date of adoption.

The current Local Plan for Epsom and Ewell Borough Council is made up of:

- Epsom & Ewell Core Strategy 2007
- Plan E Epsom Town Centre Area Action Plan 2011
- Epsom & Ewell Development Management Policies Document 2015

Although this current plan does not contain many development initiatives focused on adaptation and mitigation to withstand and offset future climate events, a new plan is in the process of being developed. This is the Local Plan 2040.

The Local Plan 2040 will set the vision and framework for future development of the borough to 2040. This will include addressing local housing need, the economy, environmental considerations, community infrastructure as well as strategic infrastructure needs. The geographical area covered by the Local Plan 2040 is the borough of Epsom and Ewell.

It is imperative that the Local Plan 2040 is developed with the guidance and reference of the national policies, in particular the National Planning Policy Framework and the 25 Year Environmental Plan, as well as local policies, such as Surrey County's Greener Future and 2050 Place Ambition.[26]

EEBC's 4 Year Plan (2020-2024)

EEBC's 4 Year Plan sets out the strategy for the provision of local services for residents, businesses, and visitors during the four-year period 2020 to 2024. The objectives fall into the 6 themes as below:

- Green and Vibrant: A theme that has a focus on biodiversity, reduction in carbon dioxide emissions, waste reduction and incorporating nature-based solutions into infrastructure.
- Safe and Well: This theme focuses on mental health, supporting vulnerable people of the community, reduction of crime and enhancing safety and wellbeing.
- Opportunity and Prosperity: This theme relies on addressing the housing needs, encouraging business creation and growth, and encouraging inward investment.
- Smart and Connected: The focus of this theme is on sustainable transport options, improving digital connections, and encouraging networking opportunities.

[25] Epsom and Ewell Borough Council. 2020. Climate change action plan. Available at: https://www.epsom-ewell.gov.uk/sites/default/files/documents//Climate%20Change%20Action%20Plan%20Final.pdf
[26] Epsom and Ewell Borough Council. 2022. New Local Plan. Available at: https://www.epsom-ewell.gov.uk/residents/planning/planning-policy/epsom-and-ewell-local-plan/emerging-new-local-plan

- Cultural and creative: This theme promotes the borough's history and culture through significant community involvement.
- Effective Council: The focus of this theme is on strengthening the financial stability of the council, improving access to technology, and encouraging people to engage with council services.[27]

To effectively achieve the outcomes for these themes, EEBC will need to consult the following national policies:

- National Planning Policy Framework for the housing needs in 'Opportunity and Prosperity', and sustainable transport options in 'Smart and Connected'.
- 25 Year Environmental Plan for biodiversity, history, and culture in 'Green and Vibrant' and 'Cultural and Creative'.
- The Climate Change Act and the Clean Growth Strategy for reduction in carbon emissions, waste and nature-based solutions in 'Green and Vibrant'.

EEBC's Strategic Flood Risk Assessment

A Strategic Flood Risk Assessment, undertaken in 2018, identified that the watercourses in the borough that pose significant flood risk to buildings and infrastructure are the Hogsmill River and its tributaries, which include the Bonesgate Stream, the Horton Stream, Green Lanes Stream and Ewell Court Stream. Most of the Ewell Court Stream and lengths of Green Lanes Stream are culverted.

The recommendations made by this assessment include risk reduction methods and revisions that are required to Local Planning Policy regarding flooding. It is important for EEBC to work with Surrey County Council to produce an effective and sustainable flood risk management program.[28]

EEBC's Biodiversity Action Plan

Epsom and Ewell Borough Council have produced a Biodiversity Action Plan in 2019 for the time period of 2020-2030. This plan aims to conserve and enhance habitat types and species of principal importance within the borough of Epsom and Ewell as identified and listed under section 41 (England) of the NERC Act (2006) and coordinates with the Surrey Nature Partnership Biodiversity Working Group.[29]

The BAP incorporates new legislation from the 25 Year Environmental Plan, as well as the Environment Bill, and will be used to inform the 4 Year Plan for the borough.

[27] Epsom and Ewell Borough Council. 2019. Four-year plan. Available at: https://epsom-ewell.gov.uk/council/four-year-plan
[28] Jacobs. Epsom and Ewell Strategic Flood Risk Assessment. 2018. Available at: https://www.epsom-ewell.gov.uk/sites/default/files/Final%20SFRA%20Update%20June%202018.pdf
[29] Epsom and Ewell. 2020. Biodiversity Action Plan. Available at: https://democracy.epsom-ewell.gov.uk/documents/s19962/Epsom%20Ewell%20Local%20Biodiversity%20Action%20Plan%202020%20Progress%20Report%20and%20Review%20of%20the%202010%20to%202020%20Act.pdf#:~:text=In%20Epsom%20%26%20Ewell%2C%20a%20Climate%20Change%20Action,years%2C%20which%20in%202020%20was%20renewed%20and%20updated

3. Greenhouse Gases

This section provides a baseline assessment of GHG emissions in the borough. The data used are government figures, from the department for Business, Energy & Industrial Strategy (BEIS).

The baseline highlights sources of GHGs within the borough and gives insight into areas of action that need to be addressed. Key challenges are summarised and opportunities in mitigating GHG emissions in these areas are explored.

Table 3.1: Summary of wider policy implications on climate mitigation by priority sector

Priority Sector	Summary of Wider Policy Implications
Power	• National grid supplied electricity will continue to be decarbonised as coal generation is phased out completely and larger amounts of renewable and clean energy comes onstream in the late 2020s onwards (including new nuclear power and offshore wind). The system will rely on use of carbon capture storage technology with gas-fired power plants to ensure a balance of supply during periods where renewable generation is lower. • Smarter management of power supply across the grid is likely to lead to more regional views of the network. This may use time of day pricing and smart meters to encourage shifts in when and how we use our power.
Heat	• A major shift away from residential use of fossil fuels for heating is anticipated. This means using electrical heating systems such as heat pumps as well as local district heating schemes where these are viable. New buildings will be designed to minimise heating needs and operate heating systems at lower temperatures than the conventional radiator systems we are familiar with at present. • Greener gas supplies via the existing national gas network may become available in the 2030s. Initially blending hydrogen with methane, this could be transformed in time to a full hydrogen network. This would offer similar performance for households and businesses as the natural gas boilers of today.
Transport	• Electric passenger vehicles will become more widespread from the mid 2025s as conventional petrol and diesel cars, light goods vehicles and taxis are phased out. Transport as a service (TAAS), where users can call up vehicles in a similar way to taxis may reduce overall vehicle ownership levels.

	• Public transport systems will rely on electricity (predominantly rail and buses) to lower GHG emissions; hydrogen or biofuels are more likely to be used by heavy goods vehicles in preference to petrol/diesel. • Fuelling networks, and potential use of vehicle batteries in grid balancing (payment for discharge of batteries at peak demand periods – so called vehicle to grid services), will be part of our future landscape.

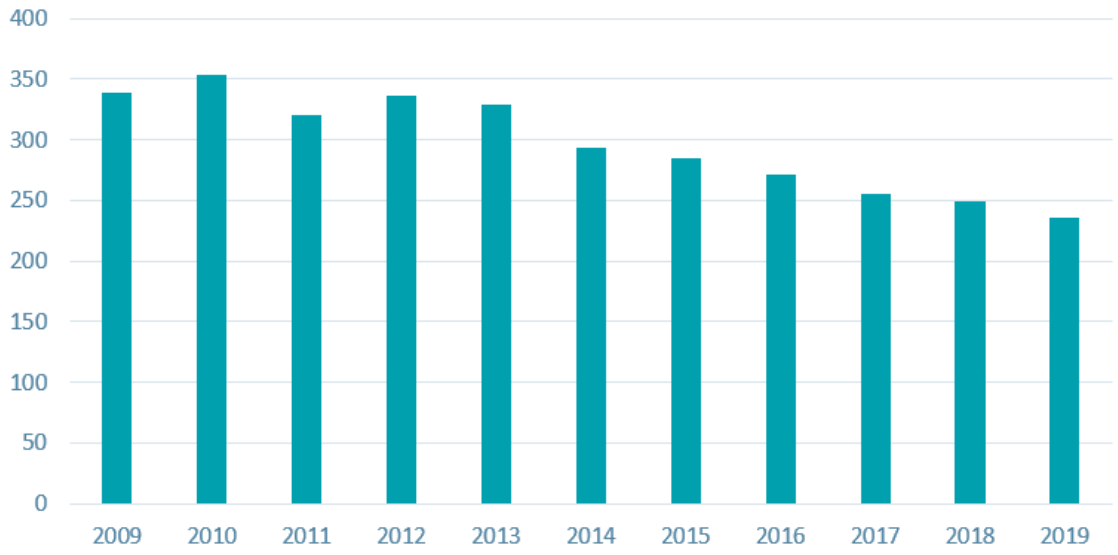
Total GHG Emissions

In establishing a baseline for GHG emissions in Epsom and Ewell, the baseline year of 2019 has been used. This is in order to avoid some of the anomalies that may arise in subsequent reporting years due to COVID-19 impacts.

In the baseline year of 2019, total borough emissions were 252,400 tCO_2e, this is equivalent to 3.1 tCO_2e per capita. A total of 236,300 tCO_2e are considered to be under the scope of Local authority. This figure excludes large industrial sites, railways, motorways and land-use.[30]

Throughout the decade preceding the baseline year, there had been a steady decrease in emissions. This is shown in **Figure 3.1**.

Figure 3.1 Emissions in Epsom and Ewell (Under LA scope, 2009-19, $ktCO_2e$)



Source: UK local authority and regional greenhouse gas emissions national statistics

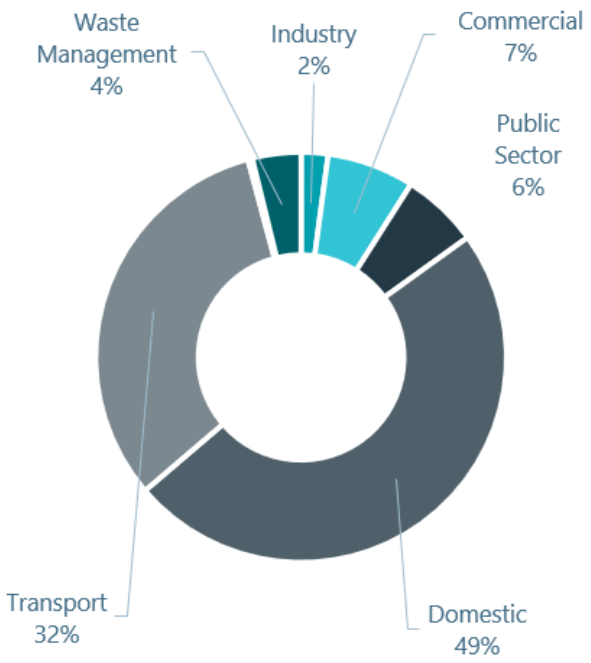
Emissions by sector

Borough emissions broken down by sector are illustrated in **Figure 3.2** .

[30] Department for Business, Energy & Industrial Strategy. 2022. UK local authority and regional greenhouse gas emissions national statistics. [online] Available at: https://www.gov.uk/government/collections/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics

Figure 3.2: Emissions by sector ($ktCO_2e$ and %)

Sector	$ktCO_2e$
Industry	5.4
Commercial	17.5
Public Sector	15.4
Domestic	123.6
Transport	81.4
Agriculture	0.9
Waste Management	9.7
LULUCF Net Emissions	-1.3
TOTAL	252.4



Source: UK local authority and regional greenhouse gas emissions national statistics

The most significant contributor to total borough emissions is the domestic sector, which contributed 49%, the equivalent of 123.6 $ktCO_2e$, in the baseline year. Emissions from transport account for 32% (81.4 $ktCO_2e$). When combined these two sectors are responsible for over 80% of total emissions in the borough.

Emissions from the commercial, public and waste management sectors make contributions of 7%, 6% and 4% respectively, while industry accounts for 2%. Cumulatively, these non-domestic sectors account for 48 $ktCO_2e$ (19%) of emissions in the borough.

Priority Areas

Heat and Power

Gas use in the domestic, industrial, commercial and public sectors, accounted for ~106 ktCO2e (42%) of borough emissions in the baseline year.

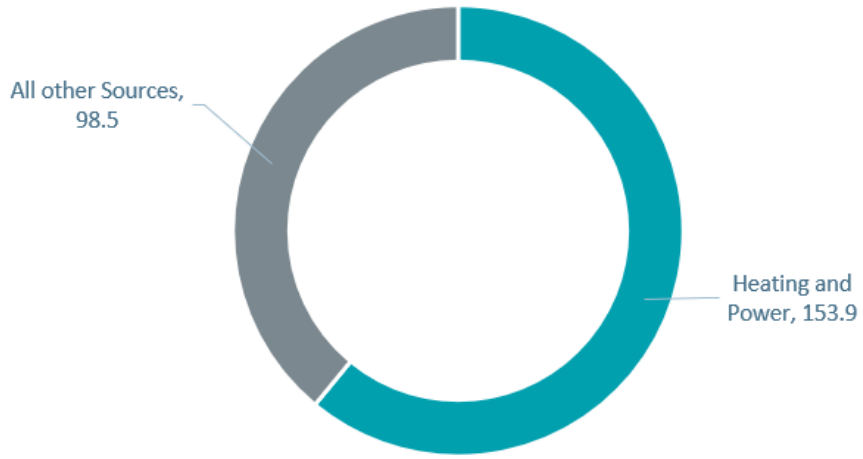
The vast majority of these emissions was from gas used in homes. The domestic use of gas accounted for ~92 $ktCO_2e$ emissions in the baseline year, which means that domestic gas use was the source of 36% of total emissions in the borough.

Electricity use in the domestic, industrial, commercial and public sectors, accounted for ~48 $ktCO_2e$ in the baseline year, c. 19% of borough emissions.

The domestic sector was again a key contributor. Emissions from electricity use in homes accounted for ~28 $ktCO_2e$ in the baseline year.

Overall, the use of gas and electricity in the borough is the source of 61% of GHG emissions (~154 $ktCO_2e$). This is illustrated in **Figure 3.3**.

Figure 3.3: Emissions from Heating and Power (related to all other sources) ($ktCO_2e$)



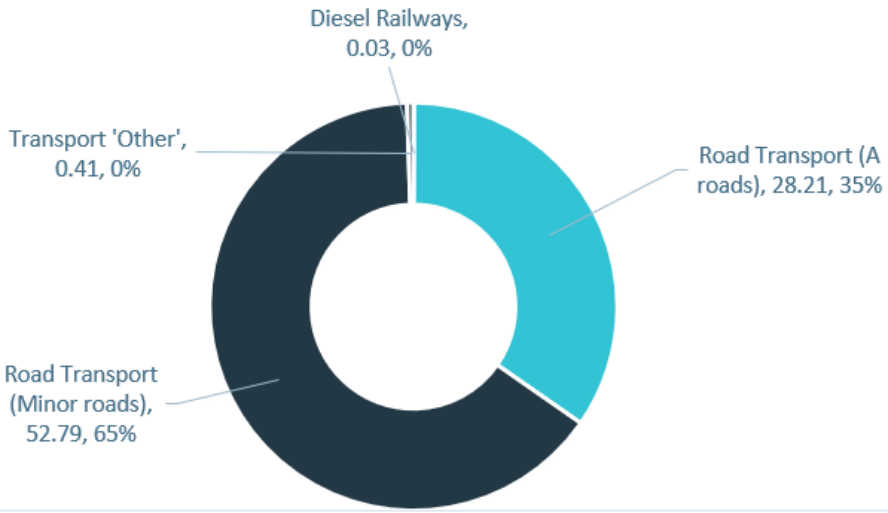
Source: UK local authority and regional greenhouse gas emissions national statistics

Lower carbon means of heating and powering the build stock (whether domestic or non-domestic) is an area of priority for EEBC.

Transport

Of the 81 $ktCO_2e$ (32%) of borough emissions from the transport sector. **Figure 3.4** illustrates the breakdown of these emissions in the baseline year and shows that borough emissions from transport are accounted for, almost entirely, by road transport.

Figure 3.4: Transport GHG Emissions ($ktCO_2e$)



Source: UK local authority and regional greenhouse gas emissions national statistics

All road transport emissions are generated through the use of A-road and minor roads (due to that fact that there are no motorways in the borough). Minor road emissions almost twice that of A-roads.

A priority in the borough is a reduction in GHG emissions from road transport.

Challenges

Heat and Power

Domestic

Given CCC advice, it is to be anticipated that a significant switch away from natural gas use in domestic heating will be required. Under the Future Homes Standard, which will come into effect from 2025, in order to ensure that new homes produce less carbon, it is likely that new build homes will no longer be connected to the gas network.

Since Epsom & Ewell is not a significant landlord within the Borough it cannot directly implement meaningful change in this space. It will therefore need to provide a policy position that positively influences private owners to make changes. This needs to align with recent Building Regulation changes encouraging lower flow temperatures and heat pump installation; heat networks will also need to be explored. A future role for hydrogen means retaining existing gas infrastructure and encouraging gas companies to modernise areas where PE pipework is not already in place.

The largest source of emissions comes from the use of gas and electricity in homes. This is illustrated in **Table 3.2**. Currently 84% of homes in Epsom and Ewell are heated by mains gas.[31]

Table 3.2: Proportion of dwellings by main fuel type/central heating

Community heating scheme	Electricity	Heat pump	Mains gas	Oil	Other
2.8%	9.85%	2.34%	84.32%	0.06%	0.11%

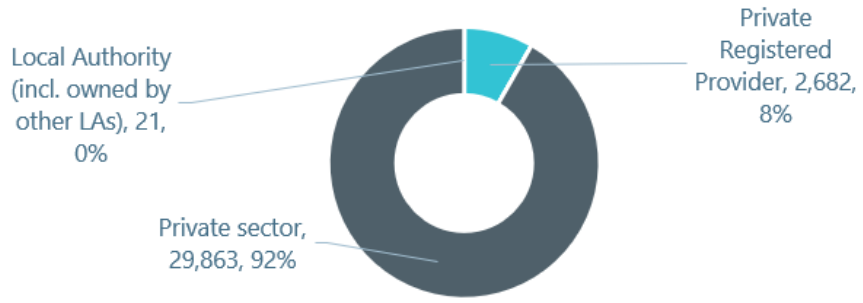
Source: ons.gov.uk

Energy efficiency in these homes is also an issue. Only 20% of detached homes and 15% of semi-detached homes have EPC rating C and above.[32]

In addition, the vast majority of houses in the borough are privately owned. **Figure 3.5** shows that the proportion of dwellings in the borough is as high as 92%.[33]

Figure 3.5: Dwellings by Tenure (2019)

[31] Office of National Statistics. 2020. Estimated proportion of dwellings with an Energy Performance Certificate by main fuel type or method of heating used in central heating. [online] Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/housing/datasets/estimatedproportionofdwellingswithanenergyperformancecertificatebymainfueltypeormethodofheatingusedincentralheating [Accessed 15 August 2022].
[32] Department for Levelling Up, Housing and Communities. 2022. Live tables on Energy Performance of Buildings Certificates. Available at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-energy-performance-of-buildings-certificates
[33] Department for Levelling Up, Housing and Communities. 2022. Live tables on dwelling stock (including vacant), Available at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants



Source: Live tables on dwelling stock

Non-domestic

Epsom & Ewell's own heat and power consumption amounts to 15.3 tCO_2e; this equates to 45% of total non-domestic heat and power.

Future procurement decisions for electricity and gas can look at renewable energy credit backed power purchase agreements. Ongoing work in both national systems will decarbonise supplies of energy further.

Retrofit of existing non-domestic buildings outside of those operated by the Council, including retail premises, will need to focus on fabric efficiency and minimising the need for heating and ventilation.

Transport

95% of GHG emissions associated with transport relate to passenger and light goods vehicles. Given national policy this means that significant reduction in GHG emissions is achievable as EV uptake increases. However, given the level of vehicle ownership in the Borough, the phase out of ICE vehicles is likely to be protracted rather than seeing a sharp overall reduction in the early 2030s.

Active travel policies are therefore important in displacing vehicle journeys overall – so as to accelerate the move away from conventional petrol and diesel vehicles.

A significant proportion of LGVs are likely to be connected with online shopping and parcel deliveries; influencing these is difficult within the remit of Borough level policies. However, wider acceleration of EV and ULEV vehicles among logistic supply chains means that these emissions contribution are likely to fall significantly over time.

For transport emissions, cars and LGVs using roads in the borough, make the greatest contribution.

As illustrated in **Table 3.3** cars make up 87.8% of all registered vehicles. Cars and LGVs combined make up 95%.[34] **Figure 3.6** shows that 91% of energy consumption from road transport is due to the use of cars and LGVs.[35]

[34] Department of Transport. 2022. Vehicle licensing statistics data tables. Available at: https://www.gov.uk/government/statistical-data-sets/vehicle-licensing-statistics-data-tables

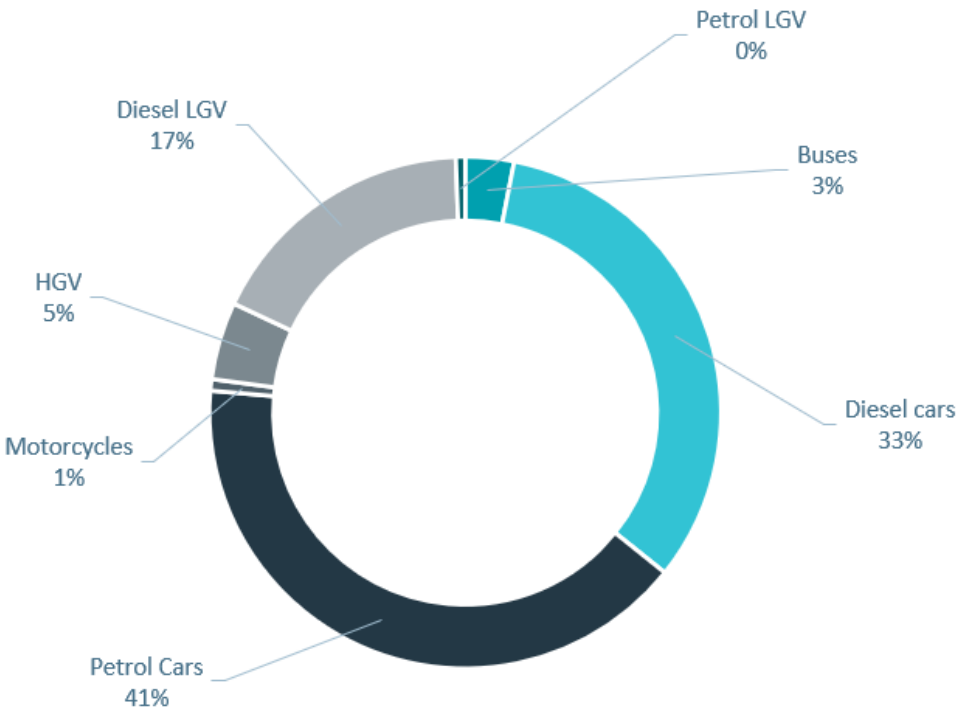
[35] Department for Business, Energy & Industrial Strategy. 2021. Road transport energy consumption at regional and local authority level, 2005-2019. Available at: https://www.gov.uk/government/statistics/road-transport-energy-consumption-at-regional-and-local-authority-level-2005-2019

Table 3.3: Vehicles Registered in Epsom and Ewell

Vehicle type	Registered number	%
Cars	39,843	87.8%
Light goods vehicles	3,256	7.2%
Motorcycles	1,666	3.7%
Other vehicles	340	0.7%
Heavy goods vehicles	159	0.4%
Buses and coaches	98	0.2%
Total	**45,362**	

Source: Vehicle licensing statistics data tables

Figure 3.6: Road Transport Energy Consumption



Source: Road transport energy consumption at regional and local authority level, 2005-2019

When compared to national levels, car ownership in the borough is high. In Epsom and Ewell 84.6% of households owned a car or van in the baseline year, compared to the UK average of 73.2%.

44.1% households own one car/van, 31.8% own two cars/vans, 6.7% three cars/vans, and 2.2% own four or more cars/vans.[36]

Residents in the borough are less likely to complete journeys on foot, when compared with national averages. In Epsom and Ewell 13.5% of adults walk for travel three times per week, in the UK this figure is 15.1%. Only 7.9% of adults walk for travel 5 times a week, the UK figure is 10.4%. This is despite the fact that key services in the borough are located within walkable distance, when compared with the national average. Journey times to these services, which include centres of employment, schools, hospitals and supermarkets are on average 18.5 minutes on foot in Epsom and Ewell. The UK average is 28 minutes.[37]

There is a low penetration of EVs and EV charging infrastructure. In total, in the baseline year, PiVs were around 2% of total registered vehicles. In addition, there were only 17 charge points in operation, 2 of which were rapid chargers. It is expected that these figures have increased in recent years, yet penetration remains a challenge.

Short list GHG mitigation policy interventions

Following the challenges and opportunities for GHG mitigation highlighted in this section, policy responses, grouped by policy themes, are contained in **Table 3.4**.

Table 3.4: Long list of potential GHG mitigation policy interventions

Sector	Suggested policy wording
Overarching	Applications for major development must include an energy hierarchy and detail how this has been applied. In addition, the incorporation of sustainable design and construction practice will need to be demonstrated.
Overarching	The layout and design of buildings should make a contribution to the reduction in energy consumption and waste and increase the recycling of materials.
Carbon reduction	Developers will be required to make developments zero carbon on-site, for both new buildings and the redevelopment and refurbishment of existing buildings. In situations where this is not feasible, it can be achieved through funding carbon reduction measures.
Decentralised energy from renewable/low carbon sources	If feasible, it is expected that new buildings will use low carbon fuels. These can include biofuel and direct electricity at scale; heat pumps, solar panels and micro-turbines at an individual dwelling scale.
Decentralised energy from renewable/low	To optimise network efficiency, the council will support major developments that connect to heat networks and where buildings achieve low flow return temperatures.

[36] Epsom and Ewell Borough Council. 2018. Epsom and Ewell Borough Profile. Available at: https://www.epsom-ewell.gov.uk/sites/default/files/documents/residents/planning/Epsom_hospital_inquiry/LPA_plg_pol_and_guid/Future40%20Annex%201.pdf

[37] Department of Transport. 2022. Walking and Cycling Statistics. Available at: https://www.gov.uk/government/collections/walking-and-cycling-statistics

carbon sources	
Energy Efficiency	Major development proposals will be supported if they include smart technologies that help residents monitor and control energy use.
Minimising Waste/Circular Economy	All development must demonstrate that the use of mains water has been minimised. This may be through a combination of measures, such as smart metering, water saving measures and/or recycling.
Minimising Waste/Circular Economy	All new build residential development mains water consumption should not exceed a daily amount of 110 litres per person.
Sustainable Design Standards	All non-residential development is to achieve BREEAM 'Excellent' UK New Construction standard or equivalent, as a minimum. This is to be achieved through a combination of onsite renewable and low-carbon technologies, and/or increased energy efficiency. Other construction standards at least as stringent as BREEAM, such as LEEDs or Passivhaus, will be recognised.
Sustainable Design Standards	All major residential development (10 or more dwellings) must achieve a Home Quality Mark 4 star. This is a minimum requirement and the attainment of higher marks will be encouraged.
Sustainable Design Standards	All major development will be required to achieve at least a XX% reduction in carbon dioxide emissions above the requirements of Part L Building Regulations.
Sustainable Design Standards	Proposals for zero carbon development are strongly supported. Applications for development should include a consideration of the following in construction: • the efficient use of mineral resources and the proportion of recycled and/or secondary aggregates • The minimisation of waste created through excavation and demolition. These materials should be reused when possible • The reduction in energy consumption. This may be through layout, building orientation, massing and/or landscaping • Water efficiency In operation development should also support sustainable lifestyles for inhabitants .
Transport	Accessibility by walking and cycling is a priority. The council will permit new development if it has a good level of within the development and between homes, jobs and services.
Transport	It is expected that new development contains an appropriate number of charging points for electric vehicles.
Transport	The council expects new development to contribute to the delivery of an integrated, accessible and safe sustainable transport network, and maximise the use of sustainable transport modes; including walking, cycling and public transport.

Transport	The location and layout of development should minimise the demand for travel and address road safety challenges. This should be demonstrable at the proposal stage.
Transport	Proposals must demonstrate compatibility with the delivery of the Surrey Transport Plan.

4. Climate Change Adaptation

This section presents the findings of the high-level climate risk assessment for the borough of Epsom and Ewell. For this assessment, data of observed climatic changes, current climatic conditions and climate projections were analysed to inform key risks for the borough, in addition to challenges and opportunities for adaptation within the local context. The baseline and future of climate risk has informed the short list of potential policy interventions suggested for consideration in the Local Plan.

Current climate

The borough of Epsom and Ewell is located in the South East England and has a temperate maritime climate, with warm summers and cold winters. The Kenley Airfield climate station is 7 miles from Epsom and Ewell and was used to obtain observed climate information.[38] The high-level comparison of observed meteorological data between 1981-2010 and 1991-2020 periods, indicate that the climate in the borough has become warmer and wetter, with the main indicators for these changes being a slight increase in the maximum average temperature, decrease in the days of frost per year, as well as increase in the annual rainfall and days of rainfall.

Precipitation

The analysis of meteorological data over the 30-year (1991-2020) period indicates that the average monthly precipitation in the borough did not exceed 71mm, with most of the precipitation falling between October and January, and least in March and July. In the assessed period, the wettest month was October, with 94.3mm of precipitation, whereas the driest month was March with 53.6mm of precipitation.

Temperature

The maximum average annual temperature for the borough is around 14°C with August and July being the hottest months. The minimum average annual temperature reaches 6°C with the coldest months being December and January. The days of frost do not exceed 35 days per year, which is about 17% less than the regional indicators.

Wind speed

The mean wind speed at 10m (knots) is about 7.6 which is slight above the average for the region.

[38] UK Met Office. 2022. UK Climate Averages. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcpgvgqmw

Figure 4.1: UK Climate Averages for Keynley Aiefield station (7 miles from Epsom and Ewell) for 1981-2010

Month	Maximum temperature (°C)	Minimum temperature (°C)	Days of air frost (days)	Sunshine (hours)	Rainfall (mm)	Days of rainfall ≥1 mm (days)	Monthly mean wind speed at 10 m (knots)
January	6.73	1.82	9.87	–	80.26	12.56	9.33
February	6.93	1.51	10.40	–	59.45	9.93	8.84
March	9.78	3.23	6.17	–	57.91	11.08	8.46
April	12.63	4.78	3.10	–	60.30	10.26	7.39
May	16.24	7.76	0.60	–	58.85	10.16	7.09
June	19.31	10.48	0.00	–	53.35	9.35	6.64
July	21.60	12.75	0.00	–	51.88	8.38	6.76
August	21.36	12.75	0.00	–	58.56	8.67	6.41
September	18.19	10.56	0.03	–	69.90	9.85	6.59
October	14.02	7.95	1.20	–	98.60	12.30	7.33
November	9.88	4.66	4.70	–	88.33	12.51	7.60
December	7.16	2.27	9.47	–	84.10	12.59	8.34
Annual	13.69	6.74	45.53	–	821.49	127.64	7.56

Source: Kenley (Surrey) UK climate averages - Met Office

Table 4.2: UK Climate Averages for Kenley Airfield station (7 miles from Epsom and Ewell) for 1991-2020

Month	Maximum temperature (°C)	Minimum temperature (°C)	Days of air frost (days)	Sunshine (hours)	Rainfall (mm)	Days of rainfall ≥1 mm (days)	Monthly mean wind speed at 10 m (knots)
January	7.03	2.09	8.59	–	86.68	13.13	9.04
February	7.46	1.98	8.31	–	65.42	11.23	8.81
March	10.10	3.39	4.49	–	53.60	9.80	8.23
April	13.29	5.12	1.99	–	57.15	9.87	7.44
May	16.58	7.95	0.17	–	59.08	9.50	7.19
June	19.57	10.74	0.00	–	59.05	9.37	6.96
July	21.77	12.88	0.00	–	56.28	8.57	6.91
August	21.43	12.95	0.00	–	66.27	9.33	6.62
September	18.37	10.67	0.00	–	66.17	9.53	6.67
October	14.24	8.14	0.60	–	94.34	12.70	7.42
November	10.18	4.88	3.06	–	92.24	13.27	7.74
December	7.54	2.52	8.09	–	90.51	13.23	8.43
Annual	14.00	6.97	35.30	–	846.79	129.53	7.62

Source: Kenley (Surrey) UK climate averages - Met Office

Table 4.1 tabulates the latest observed local climate data. The table presents a contrast of data from the last two, overlapping, climate periods 1981 – 2010 and 1991 – 2020 to demonstrate observable changes in climate parameters. This data is compared against the region (England Southeast and Central South) and England as a whole.

Table 4.1 Baseline climate data

	Nearest weather station – Kenley Airfield		Regional: England Southeast and Central South		England	
	1981 – 2010	**1991 - 2020**	**1981 – 2010**	**1991 - 2020**	**1981 – 2010**	**1991 - 2020**
Monthly average rainfall (mm)	68.46	70.57	65.41	67.17	70.82	72.47
Days of rainfall > 1mm (days per annum)	127.64	129.53	121.83	123.54	133.01	135.21
Minimum annual average temperature (°C)	6.74	6.97	6.31	6.58	5.85	6.12
Maximum annual average temperature (°C)	13.69	14	14.32	14.7	13.46	13.82
Maximum Summer average temperature (°C)	21.60	21.77	22.03	22.28	20.94	21.17
Mean wind speed at 10m (knots)	7.56	7.62	7.83	7.74	8.44	8.33
Air frost (days)	45.53	35.3	47.19	42.97	49.7	45.14

Extreme weather events - flood

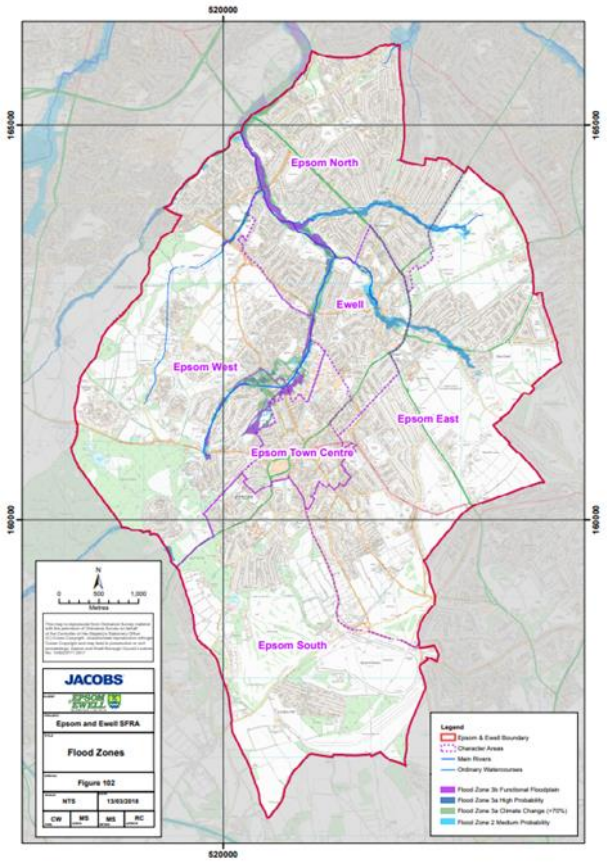
A Strategic Flood Risk Assessment (SFRA) [39] for the Borough was undertaken in 2018 to understand any changes to flood risk across the Borough and consider how the Borough should manage flood risk within local planning.

The watercourses that pose significant flood risk to buildings and infrastructure were identified as the Hogsmill River and associated tributaries which are largely urban. Fluvial flooding has occurred from the Green Lane Stream at Upper Court Road in Epsom, and the majority of the groundwater flooding incidents have been recorded within the Epsom Town Centre character areas. Numerous surface water flooding incidents have been recorded, with a higher number recorded in the central and northern areas of the Borough.

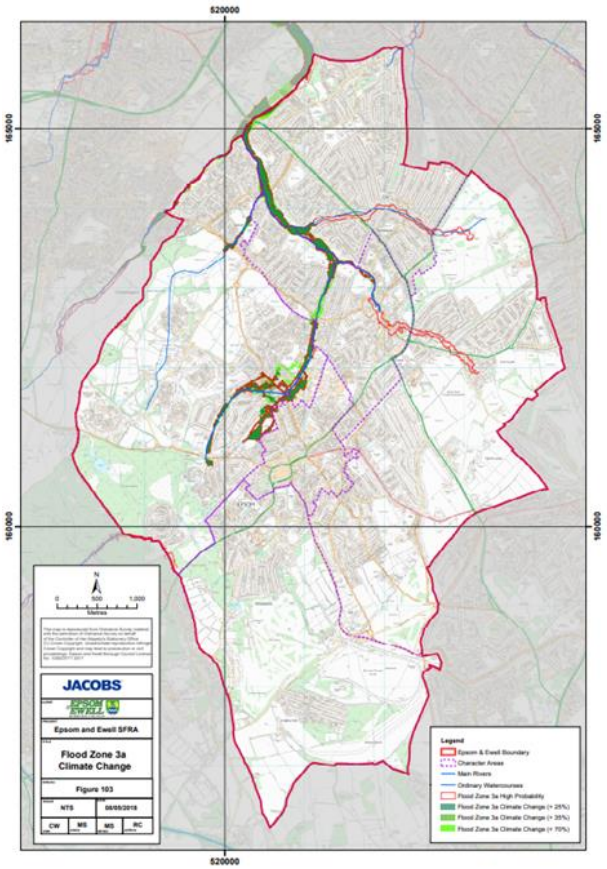
Currently, the borough is only susceptible to river flooding in a relatively small area, however there are incidents of localised flooding due to flash flooding, groundwater flooding or limited capacity of culverts. The flood risk zones associated with climate change are shown in **Figure 4.3.**

Figure 4.3 Figures extracted from the SFRA, 2018

[39] Jacobs. 2018. Epsom and Ewell Strategic Flood Risk Assessment. Available at: https://www.epsom-ewell.gov.uk/sites/default/files/Final%20SFRA%20Update%20June%202018.pdf



SFRA Flood Zones



SFRA Flood Zone 3a with climate change

The SFRA describes the benefits of the use of Sustainable Urban Drainage Systems (SuDS) to manage surface water drainage. SuDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment.

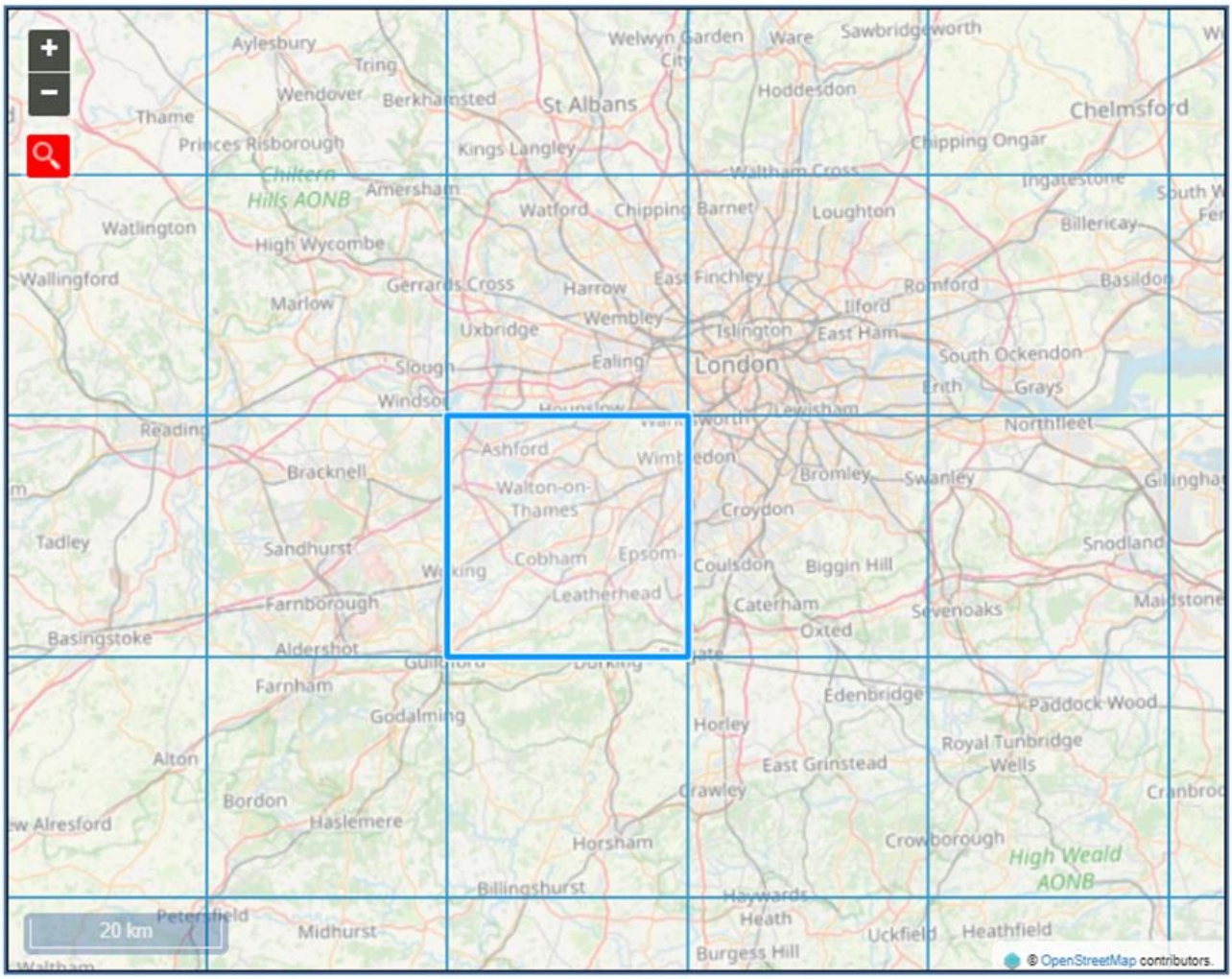
The SFRA introduces the multiple benefits that the use of SuDS can demonstrate, such as flood reduction, water quality improvement and a landscape and wildlife benefit. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings.

Future climate for the Borough

UK Climate Projections 2018 (UKCP18) provides probabilistic data on projected climate variables for the UK. UKCP18 provides the most up-to-date locally downscaled projections of how climate might change in the UK by 2100. UKCP18 provides probabilistic data on projected climate variables for the administrative regions in the UK at 25km scale. UKCP18 also provides regional (12km) climate projections and local (2.2km) scale – the latter being a level previously only used for short-term weather forecasts. The local projections support simulation of high impact events such as localised heavy rainfall in summer for critical infrastructures. The UKCP18 science reports, key messages, maps, and graphs uses a 20-year baseline period of 1981 – 2000 to present the projected change in climate variables associated with climate change. For most built infrastructure projects, the probabilistic projections are considered most suitable.

UKCP18's projections are based on emissions scenarios, known as Representative Concentration Pathways (RCP). These scenarios provide modelling of climate based on a range of possible mitigation policies. The RCPs are time- and space-dependent trajectories of concentrations of greenhouse gases and pollutants from human activities. Each pathway leads to a different range of projected global mean temperature increases over the 21st century, taking account of uncertainty in aspects such as and rate of ocean heat uptake.

Figure 4.4: UKCP18 grid square (25km^2) covering the Borough



UKCP18 data covering the Borough was obtained for two RCPs - RCP4.5 (low emissions) and RCP8.5 (high emissions). With current progress towards achieving National Determined Contributions, RCP8.5 is considered a possible, but conservative, emissions scenario. The climate time periods span the century reflecting the climatic periods 2030s (2020 – 2039), 2050s (2040 – 2059), 2070s (2060 – 2079) and 2090s (2080 – 2099). To show the probabilistic distribution of the climate projections, the data was chosen for the 10%, 50% and 90% percentile, representing the low, central and high level of projected changes, respectively. The 25km probabilistic projections were used to obtain data for rainfall and temperature anomalies from the baseline 1981 – 2000 for both summer and winter months and are shown in **Figure 4.5, Figure 4.6, Figure 4.7 and Figure 4.8.**

Figure 4.5: Rainfall anomaly - % change in precipitation for the summer months for the Borough

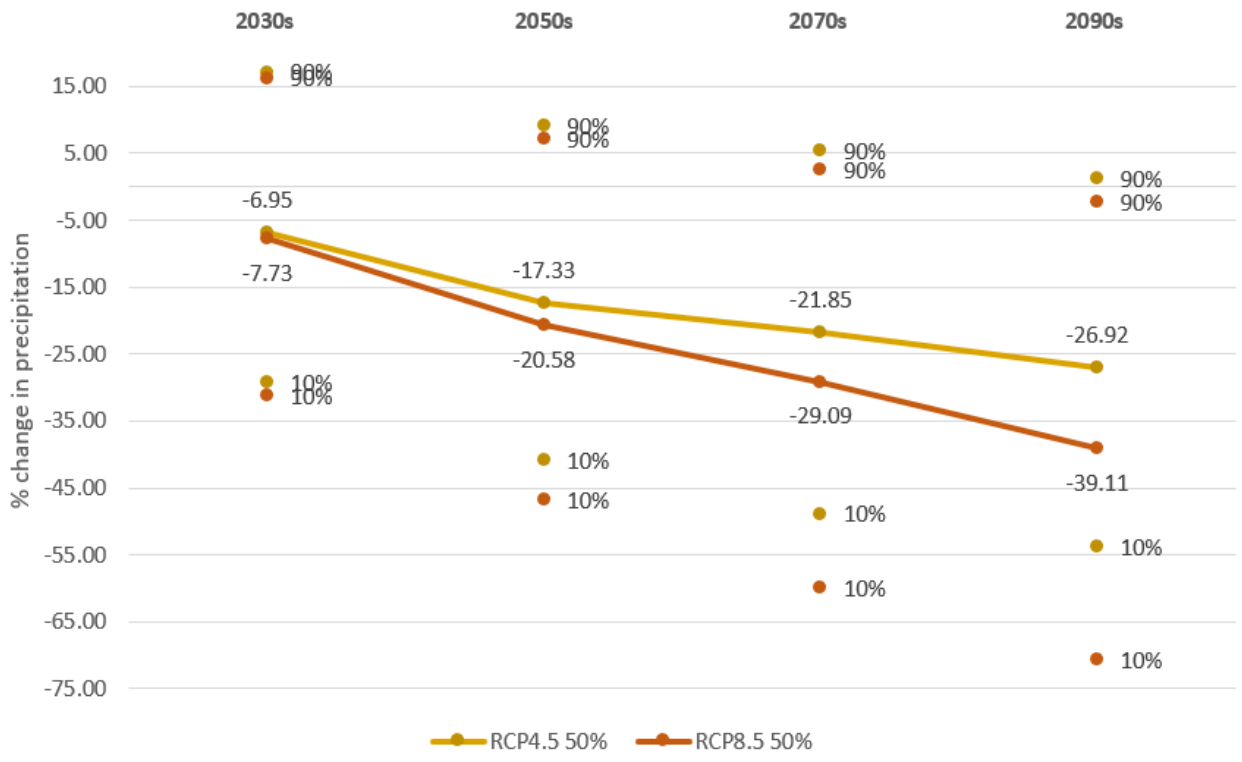


Figure 4.6: Rainfall anomaly - % change in precipitation for the winter months for the Borough

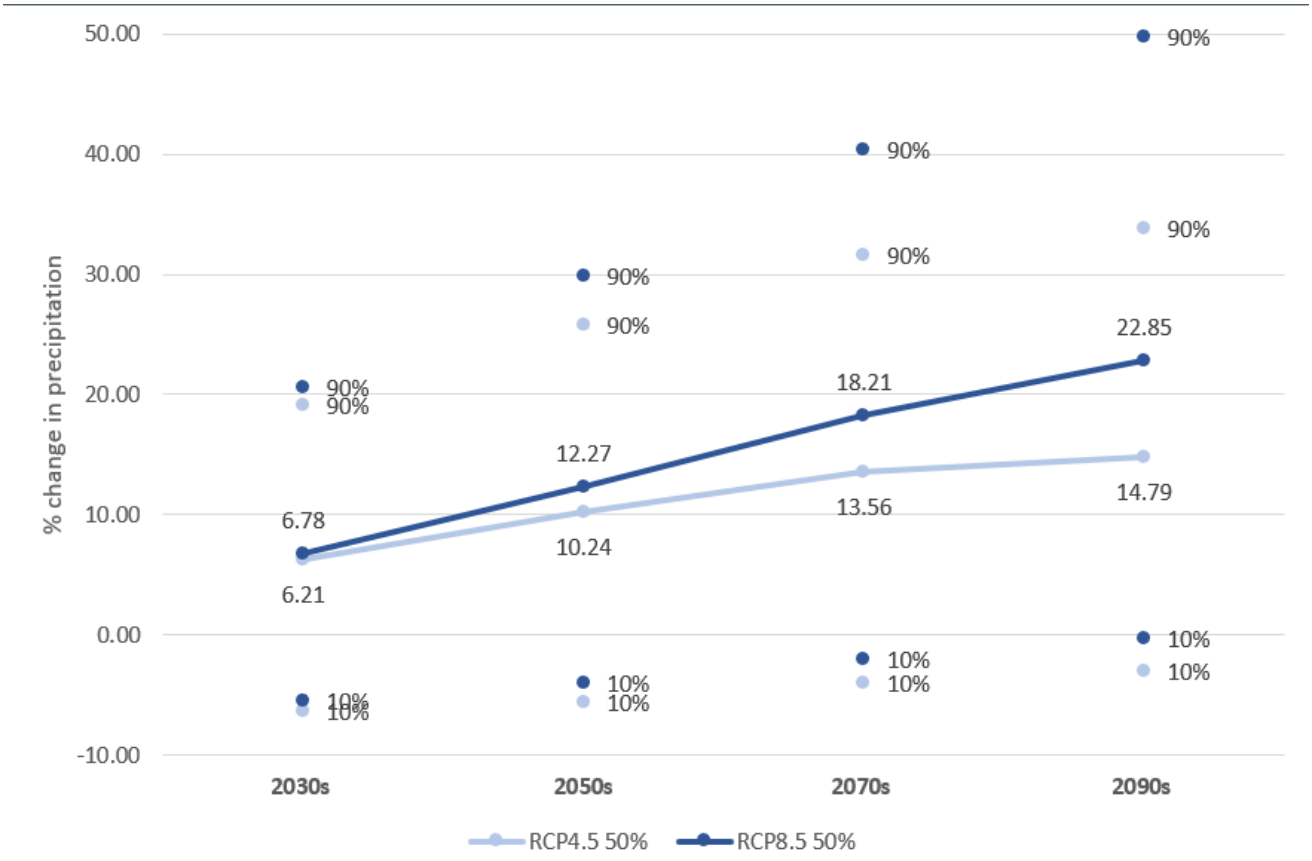


Figure 4.7: Mean change in temperature in the summer months for the Borough

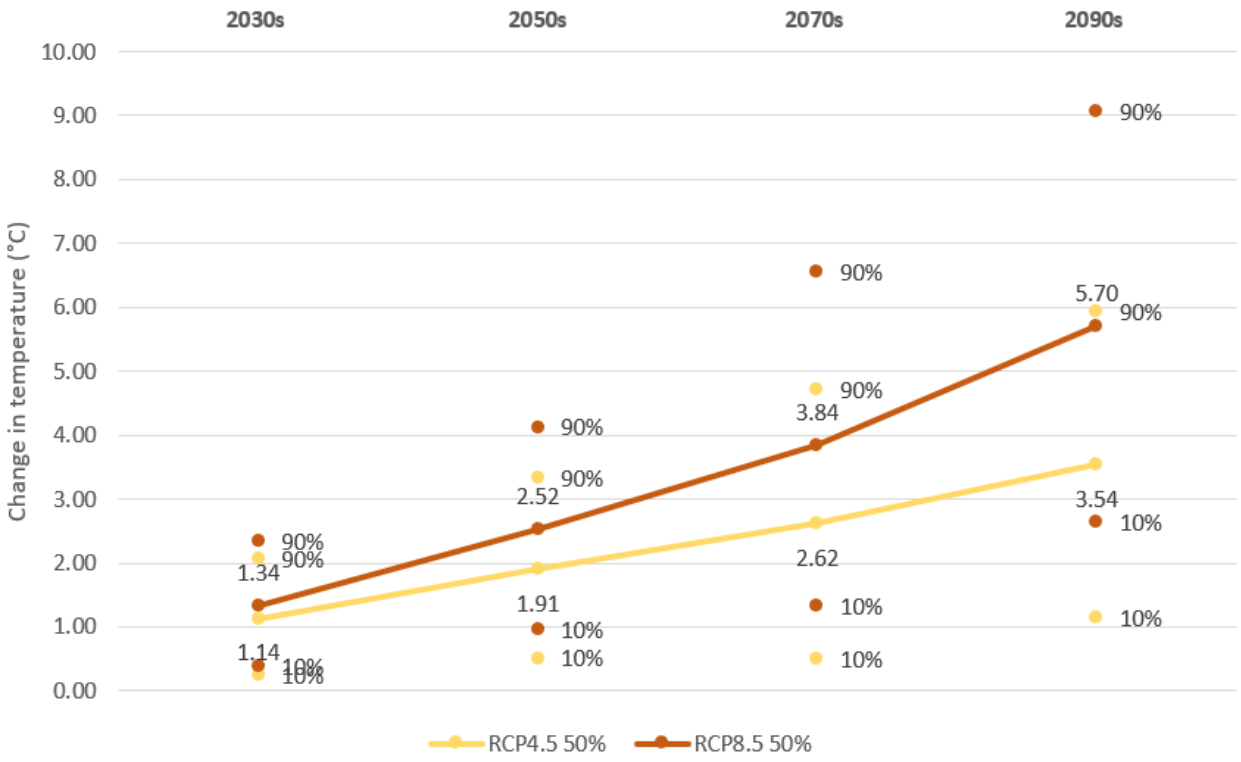
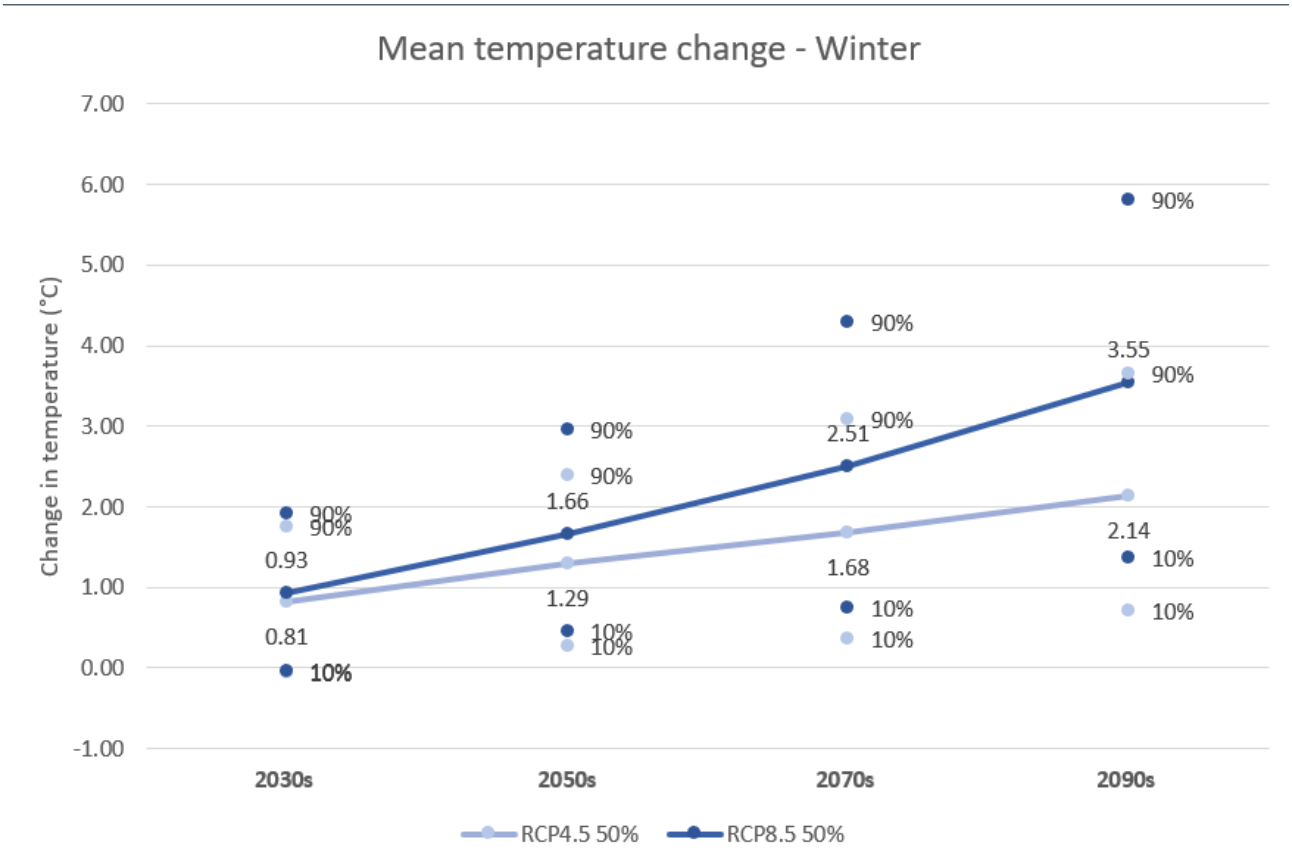


Figure 4.8: Mean change in temperature in the winter months for the Borough



High-level risk assessment for the Borough

According to the IPCC, risk is the "potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain", whereas the climate risk assessment is "a qualitative and/or quantitative scientific estimation of climate risks".[40]

In the context of climate risk assessment, the term "risk" is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure.

Risk results from the interaction of vulnerability of the project, its exposure to the climate-related hazard over time, as well as the climate-related hazard and the likelihood of its occurrence.[41] Hazards may include short-term, or acute, shocks which might result in disasters (e.g. extreme events of storm, fire or flood), and slow onset, or chronic, events that occur over a long period of time (e.g. drought, sea level rise, soil erosion).

This high-level climate risk assessment draws on:

1. Current and future climate projections for the borough from UKCP18 data;
2. Information about relevant potential hazards (e.g. heavy rainfall leading to flood, low rainfall leading to drought, temperature changes which could lead to heat waves, ice events, or changes in other extreme events such as storms); including choric and acute events.

Chronic Events:

- Increase in mean summer temperatures
- Increase in maximum summer temperatures
- Increase in mean winter temperatures
- Decrease in mean summer rainfall
- Increase in mean winter rainfall
- Increase in sea levels
- Changes (increase/decrease as applicable) in relative humidity

Acute events:

- Increased frequency and intensity of heatwaves and extreme temperatures, especially in summer
- Decreased frequency of cold weather events e.g. snow and ice
- Increased frequency of heavy rainfall events and extreme precipitation, especially in winter
- Increased frequency and intensity of storm events and high wind speeds
- Increased frequency and intensity of floods

[40] Intergovernmental Panel on Climate Change. 2018. Climate Change and Land. Available at: https://www.ipcc.ch/srccl/
[41] Intergovernmental Panel on Climate Change. 2020. Special Report on Global Warming of 1.5°C. Available at: https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/

3. Current and projected exposure, vulnerability, and adaptive capacity of key sectors such as building and infrastructure, human health and biodiversity.

Risks to health and wellbeing

The experience of the impacts of recent heatwave events and with the climate projections data, the human health impacts of increasing temperatures is considered a priority to address within policy interventions. The CCRA3 considers that the risks of the combined exposure to high temperatures, air pollution, drought and wildfires could result in excess mortality. This is a higher risk for those vulnerable peoples such as those within residential care, older persons or persons with pre-existing conditions.[6]

Specifically, there is a risk of overheating in buildings and the delivery of new homes and buildings, including health care and educational settings, to limit this risk is of particular importance to local planning.

Beyond overheating within buildings, the health and wellbeing of the population may become impacted by increasing experience of the urban heat island effect associated within urban areas. This has strong links with the integration of urban cooling measures such as green infrastructure and nature-based solutions, explored further below.

Reduced summer precipitation (e.g. by up to -39% by 2090s for the RCP8.5 50%) could increase the frequency of periods of droughts leading to water scarcity, with the south east of England most likely to be severely affected.[6] This may lead to interruptions of household water supplies and associated health impacts.

It should be noted that there are opportunities that increasing average summer temperatures could have include increasing existing tourism within the Borough and encouraging the positive physical and mental health benefits of greater uptake of recreational outdoor activities, enjoyment of improved green infrastructure and engagement with active travel.

Risks from flooding

The risk and impacts of flooding to people, communities, businesses and buildings is a closely linked impact of climate change, as described in the recently experienced flooding events summarised in **Table 4.2.** As identified within the SFRA, the catchment in the Borough is narrow and therefore the majority of the risk of fluvial flooding is confined to the river corridors, with the exception of Greens Lane Stream, therefore overall fluvial flood risk is considered low in the Borough.

Risks to infrastructure

Infrastructure within the Borough providing community services such as transport, energy and water networks, is susceptible to the impacts of future climate change. This can include flooding, high winds, high and low temperatures and lightning. The interdependency of these services also give rise to the potential for cascading failures.

Climate projections surrounding storms and windiness are more difficult to predict, however the risk to buildings from driving rain and wind is considered. The impacts to buildings can include moisture damage from water penetration, wind damage and damage from subsidence.[6]

Risks to biodiversity and green infrastructure

The impacts of climate change, such as changes in rainfall and temperatures and the rise of wildfire, can lead to changes in the distribution and composition and abundance of terrestrial and freshwater species and habitats. Land use change and human pressures through development can exacerbate these impacts.[6]

Key adaptation challenges and opportunities

The movement towards local authority action on climate change had tended to focus on Net Zero and greenhouse gas emissions, however the UK CCRA3 has highlighted that a barrier to addressing climate change risks includes the limited incorporation of adaptation issues into planning policy.[6]

Climate impacts play out very differently across the diverse physical and social geography. Urban and rural areas, upland and low-lying places all require different and fine-grained responses. In addition, each of these areas have different levels of intrinsic resilience to the impacts of climate change. As such, new built infrastructure must be considerate and climate resilient to the area in which it is located. It must also seek to increase the resilience of the area to climate change (e.g. through nature-based solutions, sustainable landscape products, green building design).

This section reviews the climate change impacts relevant to EEBC and considers the challenge and opportunities in incorporating policy intervention measures to mitigate these impacts.

Health and wellbeing

The health and wellbeing of people in homes and building as well as outdoor settings is an important aspect of adapting to projected climate change.

The update to the Future Buildings Standard is essential progress towards balancing the design of new buildings to have thermal efficiency (to achieve GHG policy) whilst ensuring safe levels of indoor temperatures and air quality. Additionally, increasing indoor temperatures contrasts with the demand for space cooling and links closely with GHG policy, to be able to provide this using low or zero carbon technologies.

Increasing the efficiency of water demand and use in the home will have adaptation benefits, and cross-cutting benefits with reducing greenhouse gases resulting from domestic water use.[6]

The benefits of outdoor activities to the health and wellbeing of residents and visitors to the Borough are well known, including the opportunity to grow access to bridleways, footprints and integrate with existing green infrastructure. The benefits of green infrastructure have secondary impacts such as natural shading and reduce the urban heat island effect, improving wellbeing of residents during higher temperature events.

Flooding

The management of flood risk within development is managed through the NPPF. Sustainable Urban Drainage Systems (SuDS) and Natural Flood Management (NFM) is becoming an increasingly important technique to bolster the traditional hard-engineered flood defence[6] carrying additional benefits such as the link to green infrastructure and biodiversity, which are promoted in the 25 Year Environment Plan. There are opportunities to integrate SuDS into new development to promote the multi-benefits arising from the integration of flood risk management, water quality improvements and biodiversity improvements, culminating in a delivery of improved ecosystem services.

Adaptation in design

The current international and national legislation, policy, design codes, standards, and guidance on incorporating climate change adaptation into development planning is a challenge to distil into appropriate policy intervention at the local level. The opportunity to integrate climate change resilience into new development arose from the update to the EIA regulations in 2017 which includes a requirement to assess the climate change resilience of major infrastructure projects. However, this is not reflected in the requirement for smaller projects. New buildings and refurbishments would need to take into consideration the impacts of extreme weather and climate change to ensure the built environment is resilient across its lifetime.

Incorporating climate change adaptation into the planning and design of new infrastructure will avoid future retrofitting and avoid lock-ins.[6]

Green infrastructure

Identifying interactions has been facilitated by the Interacting Risks supporting project, which assessed interacting and cascading risks within and between the natural environment, the built environment and infrastructure (WSP et al. 2020). They found that the natural environment was the most frequent recipient of risk flows from other impacts. However, it is important to realise that these interactions mean that the natural environment also can contribute to adaptation across risks and in other sectors, for example through the use of nature-based solutions.

Nature based solutions and green infrastructure should underpin climate change adaptation measures and cut across other impacts such as overheating and flooding. The integration of green infrastructure in new development policies improves upon existing conditions by implementing a catchment-based approach or landscape-scape initiatives to increase habitat extent, condition and connectivity, improving the resilience of the natural assets to climate change. Also, integrating long-term planning into land use policies such as woodland expansion. There is opportunity to reduce pressures from human impacts on biodiversity, and restore degraded ecosystems, improve ecological conditions.[8] This will require that GBI is more fully integrated with conventional approaches to infrastructure and plans to make it more climate resilient.

Short list of climate adaptation policy interventions

The Third UK Climate Change Risk Assessment (CCRA3) 2021 is the latest evidence report produced by the Adaptation Committee[42]. A review of the latest technical evidence of climate risk has summarised the following with relevance to EEBC and influenced by the Local Plan:

Table 4.2 Screening of UK CCRA3 risks and opportunities considered relevant to the development of the local plan

Sector	CCRA3 Risk / Opportunity considered relevant within the Local Plan
Natural Environment and Assets	N1 Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion)
	N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness.
	N11 Risks to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.
	N18 Risks and opportunities from climate change to landscape character
Infrastructure	I1 Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures
	I2 Risks to infrastructure services from river, surface water and groundwater flooding
	I8 Risks to public water supplies from reduced water availability
	I10 Risks to energy from high and low temperatures, high winds, lightning
	I12Risks to transport from high and low temperatures, high winds, lightning
	I13 Risks to digital from high and low temperatures, high winds, lightning
Health, Communities and the Built Environment	H1 Risks to health and wellbeing from high temperatures
	H2 Opportunities for health and wellbeing from higher temperatures
	H3 Risks to people, communities and buildings from flooding
	H5 Risks to building fabric
	H6 Risks and opportunities from summer and winter household energy demand (a) Opportunity - winter
	H6 Risks and opportunities from summer and winter household energy demand (b) Risk - summer
	H7 Risks to health and wellbeing from changes in air quality
	H10 Risks to health from water quality and household water supply (b) water quantity
	H12 Risks to health and social care delivery
	H13 Risks to education and prison services
Business and Industry	B1 Risks to business sites from flooding

[42] Betts, R.A. and Brown, K. 2021. Introduction. In: *The Third UK Climate Change Risk Assessment Technical Report* [Betts, R.A.,Haward, A.B. and Pearson, K.V.(eds.)]. Prepared for the Climate Change Committee, London. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/Technical-Report-The-Third-Climate-Change-Risk-Assessment.pdf

The planning system is relevant for risks that can be mediated by the built environment and infrastructure, and therefore the relevant climate change risks and opportunities have been further grouped and explored below.

Following the screening of the climate change risks and opportunities and assessing their challenges and opportunities as grouped policy themes, possible policy interventions are contained in **Table 4.3.**

Table 4.3: Short list of potential policy interventions

Policy theme	Suggested policy wording
Flood risk and drainage	The Council will expect all development (including the conversion of existing buildings) to, where practicable, incorporate sustainable drainage systems, such as green roofs, green walls, rainwater harvesting, permeable paving, rainwater gardens, swales, reed beds and treatment and balancing ponds. The SuDS design should also make allowances for climate change, in line with the latest Government's Climate Change Allowances guidance.
Green and blue infrastructure	To ensure that the Borough is future proofed for climate change, the Council will expect all development to, where practicable and with reference to local character, to promote the incorporation of green and blue infrastructure (GBI) into new developments. This could include sustainable drainage systems and the retention or provision of soft landscaping to create natural cooling measures, biodiversity habitats or promote local food growing, facilitating climate change adaptation.
	The Council will expect all development (including the conversion of existing buildings) to, where practicable, retain and/or provide soft landscaping to create natural cooling measures, biodiversity habitats or local food growing. The soft landscaping should have reference to native species and local character
	Network of green and blue infrastructure (GBI) will be protected, enhanced and managed to provide a multi-functional, high quality open space resource, capable of delivering opportunities for recreation, health and wellbeing, ecological connectivity, biodiversity net-gain as well as wider ecosystem services for climate change adaptation.
	Proposals will be required to deliver an appropriate standard of GBI to minimise the effects of the urban heat island effect including by mitigating overheating of buildings and public realm where impacts are identified by utilising appropriate mitigation measures. Planting trees and other vegetation, where appropriate as part of the landscape scheme, to provide shading of amenity areas, buildings and streets.
Health and wellbeing	New development will be permitted which helps build communities that are resilient to climate change and contribute to healthy living by delivering biodiversity net gain and avoid the loss of biodiversity and minimising the potential for heat stress, particularly areas or types of development at greater risk of heat stress, through innovative design.
	New development will be permitted which helps build communities that are resilient to climate change and contribute to healthy living by installing community composting facilities and promote local food growing, where practicable.

	The Council will expect all development (including the conversion of existing buildings) to, where practicable and with reference to local character, adopt passive design principles, including orientation, glazing and shading with regard to the winter and summer sun and natural ventilation.
Adaptation in sustainable design	Major development proposals should demonstrate how they will reduce the potential for overheating and reliance on air conditioning systems by: a. minimising internal heat generation through energy efficient design; b. reducing the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls; c. managing the heat within the building through exposed internal thermal mass and high ceilings; d. maximising passive ventilation; and e. where necessary, providing mechanical ventilation and active cooling systems.
	Proposals will be supported where they use high quality durable and adaptable materials, finishes and details that are, where appropriate - non-reflective and low heat absorbing to reduce the urban heat island impacts of development.
	Development must demonstrate that it is fully adaptable and resilient to the impacts of a changing climate, including overheating, flooding, water shortages/drought and subsidence, and must not exacerbate the impacts of climate change elsewhere.
	Development proposals will need to demonstrate how they are maximising their adaptive capacity. Planning applications relating to major development, infrastructure and potentially vulnerable developments will be required to provide severe weather management plans.
	Application of major development, including proposals involving the redevelopment of existing floor space, should be accompanied by a Sustainability Statement outlining their approach to climate change adaptation issues such as overheating, water management, wind and driving rain.
	To adapt to water stress, new development should be designed to reduce demand. Measures can include: i. reduced residential mains water consumption ii. water efficient appliances, fittings and leak detection devices for non-residential and non C3 use class residential development iii. rainwater harvesting and grey water recycling iv. drought resistant landscape design and planting.
	All developments should be fit for purpose and remain so into the future. Proposals for major development are required to set out in a sustainability statement how they have incorporated adaptations for a changing climate and changing weather patterns in order to avoid increased vulnerability and offer high levels of resilience to the full range of expected impacts.
	All non-residential development must achieve a minimum of **BREEAM 'Excellent' UK New Construction** standard or equivalent, or any equivalent new standard.