East London Joint Waste Plan

Climate Change Topic Paper

Report: Consultation Draft

Version: 2.0

Date: July 2024

Barking & Dagenham

Havering LONDON BOROUGH

Newham London

London Borough of Redbridge

BPP Consulting Document Control

Project: East London Joint Waste Plan
Report: Climate Change Topic Paper
Version Description: Consultation Draft
Version No: 2.0
Date: 25.07.24

Version No.	Version Description	Author	Date	Reviewed	Date
1.0	Draft for client review	David Payne	26.06.24	Ian Blake	08.07.24
2.0	Consultation Draft	Ian Blake	25.07.24	Ian Blake	25.07.24

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Abbreviations and Glossary

Abbreviations

CfD	Contracts for Difference
CBDP	Carbon Budget Delivery Plan
CCC	Climate Change Committee
NAP	National Adaptation Programme
NPPF	National Planning Policy Framework
NPPW	National Planning Policy for Waste
NPS	National Policy Statement
SFRA	Strategic Flood Risk Assessment
SA	Sustainability Appraisal
SuDS	Sustainable Urban Drainage Systems
UKCP	United Kingdom Climate Projections

Glossary

Biogenic	Material within the waste stream that has been generated by the bio-cycle and was growing in the last hundred or so years. Examples include food, paper, garden waste, wood.
Carbon Offsetting	Carbon offsetting is a method of funding equivalent carbon dioxide saving elsewhere to compensate for emissions.
Carbon Sequestration	Carbon sequestration is the long-term storage of carbon dioxide. Sometimes called carbon dioxide removal (CDR), the practice involves capturing carbon dioxide from the atmosphere.
Circular Economy	The circular economy means decoupling economic activity from the consumption of resources. It is based on three principles: Design out waste and pollution; keep products and materials in use; regenerate natural systems.
Climate change adaptation	Adjustments made to natural or human systems in response to the actual or anticipated impacts of climate change, to mitigate harm or exploit beneficial opportunities.

Climate change mitigation	Action to reduce the impact of human activity on the climate system, primarily through reducing greenhouse gas emissions.
Combined Heat and Power (CHP)	The harnessing of both electricity and heat from power generating plants.
Greenhouse Gases	A greenhouse gas is a gas which absorbs reflected solar energy. This has the effect of making the Earth's atmosphere warmer. Solar energy enters the Earth's atmosphere and reaches its surface. Some of that energy is reflected back into space, however greenhouse gases absorb this reflected energy back to the Earth. Carbon dioxide, methane and nitrous oxide are all greenhouse gases.
Life Cycle Assessment (LCA)	Life Cycle Assessment involves an analysis of the impact a product or service may have on the world around it. It provides a framework for measuring the relative impact of different options and facilitating decision making.
Local Plans	Prepared by local planning authorities, Local Plans guide decisions on future development proposals for an area. They set out policies to be used in decision making which are supported by a vision for how the local planning authority would like the area to develop.
Marine Plans	Marine plans mange the seas around England by setting out the priorities and direction for future development within the plan area.
Municipal Solid Waste (MSW)	Commonly known as refuse or rubbish and is a waste type consisting of everyday items that are discarded by the public. It covers household waste and household-like commercial and industrial waste (e.g. from offices or hotels).
'R1' Recovery status	The definition in the revised Waste Framework Directive for a 'recovery' operation. For municipal waste incinerators this is based on a calculation of a plant's efficiency in converting tonnages of municipal waste to energy. Plants operating at or above the stipulated thresholds can be classified as 'recovery operations' for the purposes of the waste hierarchy. Incinerators operating below the threshold are classed as 'disposal'.
Strategic Flood Risk Assessment (SFRA)	Strategic Flood Risk Assessments help inform development decisions by considering the flood risk in a particular location. They identify opportunities to reduce the cause and impact of flooding and areas where development may be restricted, or additional management may be required to reduce the risk of flooding.
Sustainability Appraisal (SA)	Sustainability Appraisals assess whether planning policy documents promote sustainable development. SAs consider the social, environmental and economic aspects of sustainability.

1. Executive Summary

1.1 This topic paper sets out background information, legislation, policy and guidance on climate change to ensure that this is properly considered in preparation of the proposed policies in the Regulation 18 East London Joint Waste Plan.

1.2 Legislation and planning policy provides a framework within which local authorities are expected to respond to the challenges of climate change. Local planning authorities have a statutory duty to take climate change into account through the formulation and implementation of planning policy in Local Plans. The National Planning Policy Framework (NPPF) also requires that land use planning contributes to mitigating and adapting to climate change and the move to a low carbon economy. Plans are to take a proactive approach to mitigating and adapting to climate change taking account of the long-term implications for flood risk, coastal change, water supply, biodiversity & landscapes, and the risk of overheating from rising temperatures. Policies should ensure resilience of infrastructure.

1.3 Like the rest of the country, East London is expected to be affected by increases in the incidence and severity of drought, heatwaves, flood risk, water stress and pressures on existing infrastructure caused by climate change.

1.4 The management of waste results in emissions of greenhouse gases, which vary depending on the type of waste, how it is managed and transported. Changing approaches to waste management by a shift towards resource management and the circular economy is expected to result in reductions in greenhouse gas emissions.

1.5 The management of waste also needs to adapt to the impacts of climate change. Climate resilience can be built into waste infrastructure, for example by considering flood risk and water management, when identifying suitable sites. By reviewing the evidence of predicted climate change effects, it has been possible to identify the most likely impacts on waste management in East London.

1.6 The principal aim of this topic paper is to provide information that ensures that climate change is fully taken into account when planning for waste in East London, satisfying the requirements of national planning policy and taking account of the ‘Climate Emergency’ declared by all councils in East London.

2. Introduction

2.1 Climate change refers to a large-scale, long-term shift in the planet's weather patterns and average temperatures.[1] There is scientific consensus that the release of carbon dioxide and other greenhouse gases into the atmosphere contributes towards rising global temperatures which results in long term changes to the climate. These rising temperatures impact on seasonal variations in weather patterns and broadly in the UK this is resulting in warmer, wetter winters and dryer, hotter summers along with more extreme events[2].

2.2 This topic paper is, in part, a response to the 'Climate Emergency' recognised by all four councils in East London. Consensus on the urgency of climate change and the need to act promptly and collaboratively led to London Councils adopting the Joint Statement on Climate Change in December 2019. They agreed to: "act ambitiously to meet the climate challenge that the science sets out, and find political and practical solutions to delivering carbon reductions that also secure the wellbeing of Londoners."

2.3 This topic paper provides an overview of likely climate change impacts in East London and how the management of waste can, and should, mitigate and adapt to these. It is intended to underpin the development of updated planning policy on the management of waste in East London so that climate change is taken into account in future planning policy and decision making on planning applications.

[1] Met Office. 2020. *What is climate change?* https://www.metoffice.gov.uk/weather/climate-change/what-is-climate-change

[2] Met Office Hadley Centre, Environment Agency, Department for Environment, Food & Rural Affairs and Department for Business, Energy and Industrial Strategy. 2019. *UK Climate Projections: Headline Findings*. Crown copyright, Met Office. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf.

3. Context

How the climate is changing and expected to change in the future and the resulting impacts

3.1 Since the industrial revolution the average temperature of our planet has risen by around 1°C. This is considered to represent a rapid change. The effects of this change are already being felt. 2022 was the warmest year in the UK since 1884, 0.9°C above the 1991–2020 average. 2022 was the first year to record a UK annual mean temperature above 10°C. The decade 2013–2022 was on average 0.3°C warmer than the 1991–2020 average and 1.1°C warmer than 1961–1990; every one of the UK's ten warmest years has occurred since 2002. The decade 2013–2022 was on average as wet as 1991–2020 and 8% wetter than 1961–1990 for the UK overall. Over the 30 year period 1993–2022 sea level has risen by 11.4 cm and the rate of sea-level rise is increasing[3].

3.2 General climate change trends projected over the UK for the 21st century show an increasing pace of change to warmer, wetter winters and hotter, drier summers with an increase in the frequency and intensity of extreme events. The infographic below shows probable future climate outcomes for the UK.

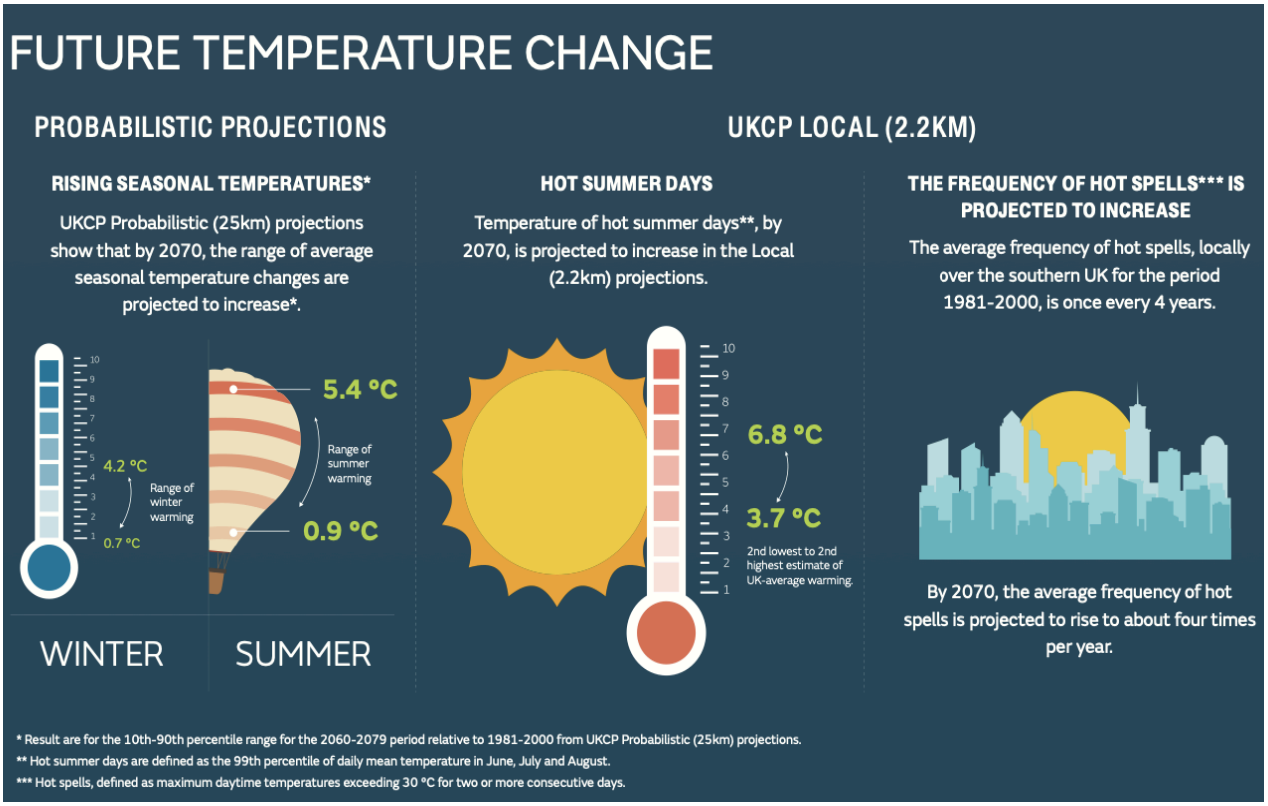

Figure 1[4]: Future Temperature Change

[3] State of the UK Climate 2022, https://www.metoffice.gov.uk/research/climate/maps-and-data/about/state-of-climate

[4] Met Office. 2019.

3.3 Table 1 sets out anticipated climate outcomes under a low and high emissions scenario.

Table 1: Summer and Winter Changes by the 2070's in central England

	Summer Rainfall Change	**Winter Precipitation Change**	**Summer Temperature Change**	**Winter Temperature Change**
Low Emission Scenario	41% drier to 9% wetter	3% drier to 22% wetter	No change to 3.3°C warmer	-0.1°C cooler to 2.4°C warmer
High Emission Scenario	57% drier to 3% wetter	2% drier to 33% wetter	1.1°C warmer to 5.8°C warmer	0.7°C warmer to 34.2°C warmer

Source: Met Office[5]

3.4 Figure 2 shows the correlation between atmospheric carbon dioxide and global average surface temperatures. This graph is based on data collected from Met Office, NASA and the US National Centres for the Environmental Information.

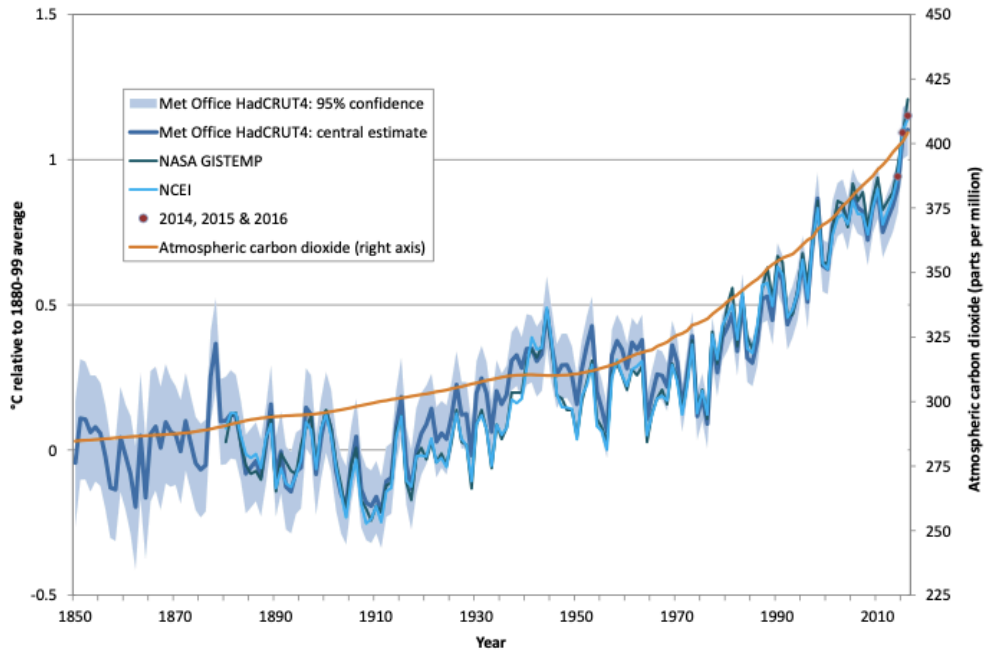

Figure 2[6]: Atmospheric carbon dioxide and global average surface temperatures 1850-2016

[5] Met Office. 2022. *UKCP18 Climate change over land.* Available from: chrome- April 2024 www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-infographic-headline-findings-land.pdf April 2024

East London

3.5 East London can be expected to be affected by increases in drought, heatwaves, water stress, flooding and flood risk, and pressures on existing infrastructure caused by rising temperatures.

3.6 A large area of East London is covered by Environment Agency Flood Zone 2 and 3 designations (medium and high probability of fluvial flooding) due to its low lying nature, particularly proximate to the Thames and tributaries. The Thames is a tidal river that is sensitive to future sea level rises and requires a complex system of barriers, defences and other measures to manage and prevent flooding. The UKCP18 projections show London is facing a probable sea level rise of 0.29m – 1.15m by 2100[7]. In addition, reduced summer rainfall is leading to more regular drought warnings and heatwaves are becoming more frequent[8] while increased incidence of extreme events, including intense rainfall, will increase surface water flooding.

Flooding along Green Street, Newham, 19th September 2014

Legislative and policy context regarding climate change that is relevant to the management of waste

3.7 International commitments on climate change have been transposed into national legislation and implementation of this has been enshrined into national, and, in turn, local policy. This section therefore reviews the current policy position in relation to climate change, and waste management in particular.

[7] Met Office. UK Climate Projections (UKCP). [online]. Available at: chrome-www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-infographic-headline-findings-marine.pdf website accessed April 2024

[8] www.london.gov.uk/sites/default/files/london_city_resilience_strategy_2020_digital_0.pdf

International

UNFCCC Paris Agreement – December 2015

3.8 The UK played a central role in securing the 2015 Paris Agreement. in which, for the first time, countries representing over 90% of global economic activity agreed stretching national emission reduction targets in a global effort to tackle climate change. The central aim of the Paris Agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Article 2(b) states that the Agreement aims to strengthen the global response to the threat of climate change by "increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development."

3.9 The Glasgow Climate Pact adopted at COP26 in 2021 included a package of agreements including to build resilience to climate change, curb greenhouse gas emissions and provide the necessary finance for this. Collectively parties agreed to work to reduce the gap between existing emission reduction plans and that required to limit global temperature rise to 1.5 degrees.

UN Sustainable Development Goals

3.10 The 2030 Agenda for Sustainable Development[9], adopted by all United Nations Members States in 2015, provides a shared blueprint with 17 Sustainable Development Goals (SDGs) which are calls to action, at its heart. These recognise that ending poverty and other deprivations must go alongside strategies that improve health and education, reduce inequality, and spur economic growth whilst also tackling climate change.

3.11 SDGs concerned specifically with waste management and climate change are:

- *SDG 12. Responsible consumption and production: ensure sustainable consumption and production patterns*
- *SDG 13. Climate action: take urgent action to combat climate change and its impacts*

3.12 The link between the SDGs and waste management is expressly recognised in the government's Resources and Waste Strategy (see below).

United Nations Environment Programme- Emissions Gap Report 2023

3.13 This Emissions Gap Report is the 14th edition in a series that brings together many of the world's top climate scientists to look at future trends in greenhouse gas emissions and provide potential solutions to the challenge of global warming. The report finds that there has been progress since the Paris Agreement was signed in 2015. Greenhouse gas emissions in 2030, based on

[9] United Nations, 2020. *Sustainable Development Goals: Sustainable Development Knowledge Platform*. https://sustainabledevelopment.un.org/?menu=1300

policies in place, were projected to increase by 16 per cent at the time of the agreement's adoption. Today, the projected increase is 3 per cent. However, predicted 2030 greenhouse gas emissions still must fall by 28 per cent for the Paris Agreement 2°C pathway and 42 per cent for the 1.5°C pathway.

3.14 Fully implementing unconditional Nationally Determined Contributions (NDCs) made under the Paris Agreement is modelled as putting the world on track for limiting temperature rise to 2.9°C above pre-industrial levels this century. Fully implementing conditional NDCs would lower this to 2.5°C.

3.15 The report calls for all nations to accelerate economy-wide, low-carbon development transformations. Countries with greater capacity and responsibility for emissions will need to take more ambitious action and support developing nations as they pursue low-emissions development growth.

EU Waste Framework Directive

3.16 The retained Waste Framework Directive (WFD) sets requirements for the management of waste including application of the 'waste hierarchy'. The Waste Hierarchy is explained in more detail below.

Waste hierarchy

3.17 The waste hierarchy ranks waste management options according to what is considered to deliver the best environmental outcome. National and international policy emphasises the importance of the waste hierarchy in guiding decisions on the sustainable management of waste and of driving the management of waste up the hierarchy unless life cycle assessment shows it not to deliver the best environmental outcome. The waste hierarchy is therefore central to informing decisions on waste management options and is illustrated in Figure 3 below.

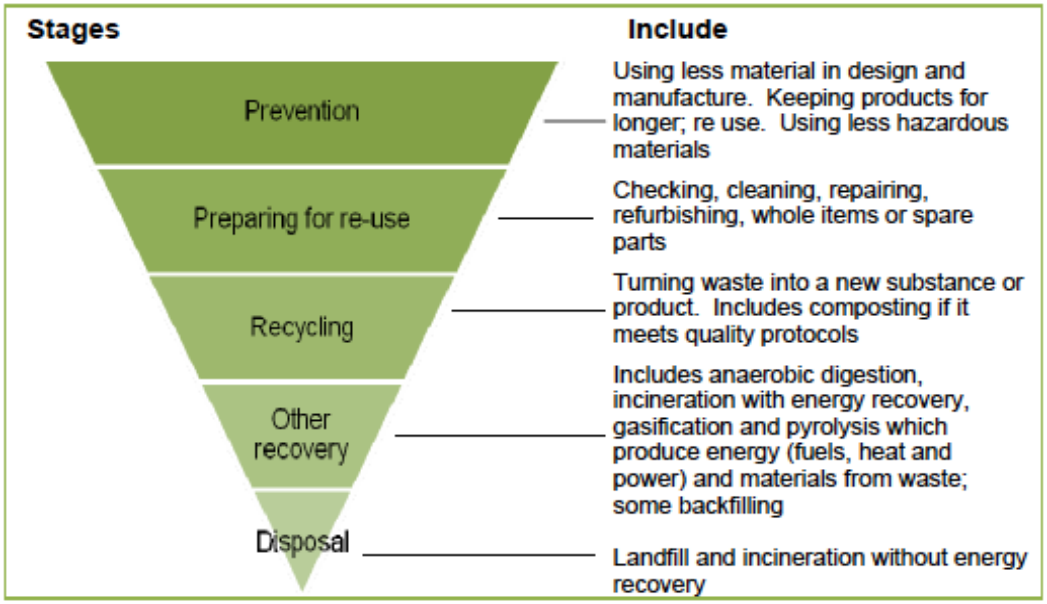

Figure 3: The Waste Hierarchy[10]

EU Landfill Directive

3.18 The retained EU Landfill Directive sets out requirements for the location, management, engineering, closure and monitoring of landfills. The Landfill Directive includes national targets for the reduction in the landfilling of biodegradable municipal waste.

National

Climate Change Act 2008

3.19 The UK was the first country to introduce long-term, legally-binding national legislation to tackle climate change through the 2008 Climate Change Act. The Act provides the UK with a legal framework including a 2050 target for emissions reductions, five-yearly 'carbon budgets' (limits on emissions over a set time period which act as stepping stones towards the 2050 target), and the development of a climate change adaptation plan.

3.20 The Act also introduced a requirement that the Government regularly assess the risks to the UK of the current and predicted impact of climate change every five years (Section 57(3) of Climate Change Act 2008); to set out climate adaptation objectives and to set out proposals and policies for meeting these objectives.

[10] Defra, 2011. *Guidance on applying the Waste Hierarchy.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf

Planning and Compulsory Purchase Act 2004 (as amended)

3.21 Local planning authorities are bound by the legal duty set out in Section 19 of the 2004 Planning and Compulsory Purchase Act, as amended by the 2008 Planning Act, to ensure that, taken as whole, plan policy contributes to the mitigation of, and adaptation to, climate change. This is a matter that is specifically tested at the independent examination of Local Plans.

The Waste (England and Wales) Regulations 2011

3.22 The Waste (England and Wales) Regulations 2011 transposed the obligation to comply with the waste hierarchy, included in the WFD, into English law. It places an obligation on any entity which has control of waste to take "all such measures available to it as are reasonable in the circumstances to apply the waste hierarchy as a priority order. However, they may depart from the priority order where this is justified by life-cycle thinking on the overall impacts of the generation and management of the waste so as to achieve the best overall environmental outcome.

3.23 When considering the overall impacts, the following considerations must be taken into account:

a) the general environmental protection principles of precaution and sustainability;
b) technical feasibility and economic viability;
c) protection of resources;
d) the overall environmental, human health, economic and social impacts.

National Planning Policy Framework

3.24 The National Planning Policy Framework (NPPF) (December 2023) includes specific policy on climate change which relates to all forms of development. It is a key mechanism by which the government seeks to meet its obligations under the Climate Change Act at a local level. While the NPPF does not specifically relate to waste, that being addressed specifically by the stand-alone policy document National Planning Policy for Waste, the policies on climate change do apply to development associated with waste management.

3.25 NPPF requires that local plans are to 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, biodiversity and landscapes, and the risk of overheating from rising temperatures. It requires that "…policies in local plans are expected to support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts." (Paragraph 158).

3.26 The NPPF requires developments to be planned in ways that:

a. avoid increased vulnerability to the range and impacts arising from climate change
b. can help to reduce greenhouse gas emissions, such as through location, orientation and design.

3.27 In determining planning applications, local planning authorities should expect new developments to:

a. Comply with any new development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant that this is not feasible or viable; and
b. take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

3.28 In relation to flood risk, the NPPF requires that "…*inappropriate development in areas of flooding should be avoided*" (paragraph 165) and "…*strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources*" (paragraph 166).

3.29 Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical change to the coast. In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans as well.

National Planning Policy for Waste

3.30 The National Planning Policy for Waste (NPPW) was published in 2014. It is to be read in conjunction with the NPPF, the Waste Management Plan for England (2013) and National Policy Statements for Waste Water (2012) and Hazardous Waste (2013). All local authorities are expected to have regard to its policies when planning for waste management. It is also a material consideration in planning decisions for waste management facilities.

3.31 The NPPW considers that positive planning will deliver sustainable development and resource efficiency, including provision of modern infrastructure, local employment opportunities and wider climate change benefits, by driving waste management up the waste hierarchy.

3.32 When identifying suitable sites and areas for new or enhanced waste management facilities, the NPPW requires local authorities to recognise the need for a mix of types and scale of facilities, and that adequate provision must then be made for waste disposal (Section 4 – identifying suitable sites and areas).

3.33 When determining planning applications, the NPPW expects applications to waste planning authorities to demonstrate that waste disposal facilities not in line with the Local Plan, will not undermine the objectives of the Local Plan through prejudiced movement up the waste hierarchy (Section 7).

3.34 On energy production from waste NPPW states:

"Where a low carbon energy recovery facility is considered as an appropriate type of development, waste planning authorities should consider the suitable siting of such facilities to enable the utilisation of heat produced as an energy source in close proximity to suitable potential heat customers." (Section 4 – Identifying suitable sites and areas)

National Planning Practice Guidance

3.35 The Planning Practice Guidance (PPG) chapter on climate change (Paragraphs 001 - 012) provides additional guidance on the operation of the NPPF and NPPW.

3.36 Local Plans are to address climate change and enable the delivery of sustainable development in accordance with policies in the NPPF. These include the requirement for local authorities to adopt proactive strategies to mitigate and adapt to climate change (paragraphs 157 to 179) in line with the provisions and objectives of the Climate Change Act 2008.

National Agenda for Carbon Reduction

3.37 The Committee on Climate Change (the CCC) is an independent statutory body established under the Climate Change Act 2008. Its purpose is to advise the UK Government and Devolved Administrations on emissions targets and report to Parliament on progress made in reducing greenhouse gas emissions and preparing for climate change against the Climate Change Act obligations.

3.38 In May 2019 it published Net Zero – The UK's contribution to stopping global warming. The CCC recommended a new emissions target for the UK of net-zero greenhouse gases by 2050. In relation to waste this means:

- Eliminate food waste from households as far as possible and separate food waste collections to be provided wherever possible in addition to reducing, reusing and recycling other waste.
- After 2025 no biodegradable waste should be sent to landfill. This will require regulation and enforcement, with supporting actions through the waste chain, including for example mandatory separation of biodegradable waste from remaining waste.

Second National Infrastructure Assessment 2023

3.39 The Second National Infrastructure Assessment (NIA) 2023 was prepared by the National Infrastructure Commission and makes recommendations to government on the UK's infrastructure needs. Key areas for improvement identified includes the following:

- *without further delay, implement and provide clear guidance on how the collection reforms, known as 'simpler recycling', packaging extended producer responsibility scheme and deposit return scheme will work*
- *by 2026, develop individual recycling targets for all local authorities and provide financial support for transitional costs*
- *expand the single use plastics ban to cover a wider range of hard to recycle plastic items*
- *introduce a measurement system, from 2025, on the composition and waste treatment destinations for commercial and industrial waste in England. Where*

the market is not likely to deliver improved recycling of this waste, government should develop future policies to increase recycling rates further.

- *with immediate effect, local authorities should not sign or renew long term contracts for waste services relying on energy from waste without credible plans for carbon capture and storage*
- *local authorities with existing long term contracts should transition away from unabated energy from waste at end of contract, or at break clauses where possible*
- *government should deliver its commitment to bring energy from waste into the Emissions Trading Scheme in 2028.*

3.40 The most beneficial waste infrastructure pathway options to reduce GHG emissions arising from waste management include increasing organic waste recycling through the segregation of food and other biodegradable waste; increased plastics recycling via kerbside collection; and higher recycling of a variety of organic and dry recyclable materials.

A Green Future: Our 25 Year Plan to Improve the Environment (2018)

3.41 The 25 Year Environment Plan, amongst other matters, sets out how the UK is to tackle the effect of climate change. A key target is mitigating and adapting to climate change. The Plan sets out how the government will go about its goal of mitigating and adapting to climate change. Three key areas are identified:

- *Continuing to cut greenhouse gas emissions including from land use, land use change, the agricultural and waste sectors and the use of fluorinated gas*
- *Making sure that all policies, programmes and investment decisions take into account the possible extent of climate change the century; and*
- *Implementing a sustainable and effective second National Adaptation Programme*.

3.42 Chapter 4 sets out the Plan's strategy for increasing resource efficiency and reducing pollution and waste. Resource efficiency is important for mitigating and adapting to climate change because it reduces the amount of carbon dioxide and other greenhouse gases released into the atmosphere as a consequence of manufacturing and supply chains and associated uses of resources. In 2022 energy supply in the UK emitted 82.2MtCO2e, while transport emitted 112.5MtCO2e and business 61.9MtCO2e[11]. Increasing resource efficiency can help reduce the greenhouse gases released through business, manufacturing, supply chains and transport and support the move towards a circular economy. The Environment Plan identifies the need to look at the whole life-cycle of products from production to usage as well as end of life. i.e. how they are managed as waste.

[11] Department for Business, Energy & Industrial Strategy and National Statistics. *2022 UK Greenhouse Gas Emissions, Provisional Figures*. chrome-https://assets.publishing.service.gov.uk/media/6424b8b83d885d000fdade9b/2022_Provisional_emissions_statistics_report.pdf Accessed April 2024

3.43 A key goal and target of the Plan is increasing resource efficiency and reducing pollution and waste (Chapter 4). This is to be achieved by:

- Working towards zero avoidable waste by 2050.
- Working towards eliminating avoidable plastic waste by end of 2042.
- Meeting all existing waste targets – including those on landfill, reuse and recycling – and developing ambitious new future targets and milestones.
- Seek to eliminate waste crime and illegal waste sites over the lifetime of the Plan, prioritising those of highest risk. Delivering a substantial reduction in litter and littering behaviour.
- Significantly reducing and, where possible, preventing all kinds of marine plastic pollution – in particular material from land.

Mission Zero- Independent review of net zero

3.44 An Independent Review of Net Zero was commissioned in September 2022, to consider how the UK could better meet its net zero commitments, taking account of global changes. It was commissioned also to consider how the UK might deliver its own net zero targets in a manner that was both more affordable, more efficient, and in a pro-business and pro-enterprise way.

3.45 The following key points were identified in relation to products and waste:

- A circular economy can benefit in multiple ways.
- Many people are taking action to reduce greenhouse gas emissions from the things they consume.
- People need to understand the benefits of moving to a circular economy and need clear advice to inform their purchasing decisions.
- A proposed public engagement strategy should be used to communicate the value of a circular economy and consumers' roles in it.
- Reducing waste saves people money and reduces emissions.
- Repairing products should be affordable.
- Accessing repairs should be easy.
- Clear, nationwide collection and recycling is key.

Committee on Climate Change- Progress Report to Parliament 2023

3.46 The Progress in reducing UK emissions- 2023 report to Parliament noted that the continued growth in the use of Energy from Waste (EfW) plants is undermining efforts to reduce emissions within the waste sector. In addition, incoming reforms to recycling collections and packaging should improve recycling rates and divert waste from EfW and landfill, but stronger signals and policies to limit further EfW growth, divert biodegradable waste from landfill and prioritise waste prevention, are needed. This is largely unchanged from

their 2022 assessment as they continue to wait for key waste policies to be implemented.

3.47 The key messages are:

- *Energy from Waste:* EfW emissions are already higher than the Government's Carbon Budget Delivery Plan (CBDP) anticipates and EfW capacity is set to increase in the coming years. A comprehensive systems approach to control and reduce EfW emissions is urgently needed, including a moratorium on additional EfW capacity until a review of capacity needs has been completed.
- *Recycling:* Improving England and Scotland's stalled recycling rates is key to reducing dependence on EfW and landfill – implementation of planned reforms to recycling and packaging must not be delayed.
- *Landfill:* The Government has indicated that additional policies will be needed to meet the aim of preventing biodegradable waste from going to landfill, still the largest source of emissions in the sector. Clarity on these policies is needed urgently.
- *Carbon capture and storage:* Good progress has been made in developing plans to support the first EfW facilities to install carbon capture technology as part of the industrial carbon capture and storage (CCS) cluster programme – but a more strategic approach to decarbonising the fleet is needed.
- *Overall strategy:* More generally, greater strategic coordination of plans to decarbonise the waste sector is needed, including much greater emphasis on waste prevention, clarity on future residual waste capacity needs, the suitability of incentives and interactions with other sectors such as waste as a feedstock for Sustainable Aviation Fuels.

Waste Management Plan for England (2021)

3.48 The Waste Management Plan for England sets out the government will preserve material resources by minimising waste, promoting resource efficiency and moving towards a circular economy in England. It sets out the government will minimise the damage caused to our natural environment by reducing and managing waste safely and carefully, and by tackling waste crime.

3.49 The Plan considers current and future actions in line with the 25 Year Environment Plan. It is our blueprint for eliminating avoidable plastic waste over the lifetime of the 25 Year Environment Plan, doubling resource productivity, and eliminating avoidable waste of all kinds by 2050.

3.50 The Plan works towards eliminating food waste to landfill by 2030. This Plan builds on the Resource and Waste Strategy for England (2018) by exploring policies to eliminate all biodegradable waste from entering landfill by 2030.

Environmental Permitting legislation

3.51 The Environment Agency has updated their Environment Permit application forms to incorporate consideration of climate change adaptation. The Environment Agency has also issued more general guidance on climate change adaptation in environmental permitting and water resources planning[12].

Environmental Services Association – A net-zero greenhouse gas emissions strategy for the UK recycling and waste sector

3.52 The ESA is the trade association for the waste industry. Its strategy identifies how to achieve net zero as a sector by 2040. It identifies key priorities for the sector as: investing in recycling infrastructure to make recycling more efficient; decarbonising non-recyclable waste treatment by removing organics from landfill by 2030 and plastics from energy recovery facilities and deploying carbon capture utilisation and storage; and transitioning vehicles and fuel use to zero emission sources.

Local & Regional

London Plan

3.53 The London Plan forms part of the Development Plan in London and includes a number of policies relating to climate change mitigation and adaptation, including:

- Policy GG6 Increasing efficiency and resilience:
  - *Seeks to improve energy efficiency & low carbon circular economy;*
  - *Ensure building and infrastructure are designed to adapt to climate change through water efficiency, reduce impacts from flooding, and avoid urban heat island effect;*
  - *Create environment resilient to impact of emergencies.*

- Policy SI2 Minimising greenhouse gas emissions:
  - *Major development should be zero carbon – be efficient, use local energy, maximise renewable energy;*
  - *Major development proposals to include detailed energy strategy to demonstrate how zero carbon target will be met;*
  - *Minimum on-site reduction of at least 35% beyond Building Regulations, including through offsetting if cannot be delivered on-site;*
  - *Major development should minimise carbon emissions from any part of the development including plant or equipment;*
  - *Development referrable to the Mayor should calculate whole-life cycle carbon emissions.*

- Policy SI3 Energy infrastructure:
  - *Energy masterplans for large-scale development*

[12] https://www.gov.uk/government/collections/environment-agency-and-climate-change-adaptation

- Policy SI4 Managing heat risk:
  - *Minimise urban heat island effect*
  - *Major development to demonstrate through energy strategy how potential for over-heating will be achieved following 'cooling hierarchy'.*

- Policy SI5 Water infrastructure
  - *Development should achieve water consumption reduction targets and incorporate water saving & recycling measures*

- Policy SI7 Reducing waste and supporting the circular economy
  - *Requires resource conservation, waste reduction, increasing re-use and recycling, and reduction in waste for disposal to be achieved through:*
  - *Promote more circular economy;*
  - *Encourage waste minimisation and prevention;*
  - *Zero biodegradable waste to landfill by 2026;*
  - *Meet or exceed 65% municipal waste recycling by 2030;*
  - *Meet or exceed 95% C&D waste re-use, recycling or recovery, and 95% excavation waste put to beneficial use;*
  - *Design developments with adequate space for storage and collection of recyclable waste;*
  - *Referable applications to include Circular Economy Statement demonstrating how materials will be re-used and recycled, how demand for materials will be reduced and buildings designed for disassembly and re-use, on-site waste management, adequate space for storage and collection, management of waste in line with the waste hierarchy.*

- Policy SI 12 Flood risk management:
  - *Development plans to use London Regional Flood Risk Appraisal, Strategic Flood Risk Assessments and Local Flood Risk Management Strategies to identify where risk exists and seek to reduce these;*
  - *Development to ensure flood risk minimised and mitigated;*
  - *Contribute to delivery of Thames Estuary 2100 Plan;*
  - *Utilities to be designed to remain operational under flood conditions and buildings designed for quick recovery following a flood;*
  - *Protect flood defences;*
  - *Deploy natural flood management methods.*

- Policy SI 13 Sustainable drainage:
  - *Identify areas with surface water management issues and reduce risks;*
  - *Development to achieve greenfield run-off rates and manage water as close to source as possible;*
  - *Apply drainage hierarchy – use rainwater as resource, rainwater infiltration to ground, rainwater attenuation in green infrastructure, rainwater discharge to watercourse, controlled discharge to sewer or drain, controlled discharge to combined sewer;*
  - *Resist proposals for impermeable surfacing;*
  - *Drainage to deliver multiple benefits.*

London Council's 'Resilient and Green' Action Plan

3.54 In June 2020, London Councils established the 'Resilient and Green' Working Group to develop and Action Plan.

3.55 In developing the action plan, they have addressed each of the main adaptation risks to the UK, namely overheating, flooding, water scarcity, trade and food security, pests and diseases and loss of natural capital. They shaped the action plans with the following understanding of boroughs' role in each area:

- *Overheating:* statutory duty to address overheating in building and public realm through Local Plans and planning decisions/ development control, management of social housing and housing for vulnerable residents, management and/ or control of green and blue infrastructure, management and/ or control over highways;
- *Flooding:* statutory duty to complete a Strategic Flood Risk Assessment and to avoid development in flood-prone areas, and to prepare a Flood Risk Management Plan, delivery of flood risk projects, working collaboratively to manage increasing tidal flood risk due to rising sea levels, management and/ or control of green and blue infrastructure, management and/ or control over highways;
- *Water scarcity:* reducing water demand through Local Plans and planning decisions/ development control, community water saving projects and leadership, liaison with water companies over water supply and demand management;
- *Trade and food security:* local authorities do not have a substantive role in how trade and food security are affected by (global) climate change, and these risks are therefore not addressed in this action plan;
- *Pests and diseases:* statutory duty around food safety regulation, statutory duty to deliver public health functions in relation to disease surveillance and management, management and/ or control of green and blue infrastructure. In this plan, actions relating to pests and diseases have been placed within the natural capital and ecological emergency section, given the large crossover between the two;
- *Loss of natural capital:* statutory duty to conserve and enhance biodiversity and the natural environment through Local Plans and planning decisions/ development control, management and/ or control of green and blue infrastructure, Local Nature Recovery Strategies which will include planning for biodiversity net gain and green infrastructure more generally.

Climate Action Plans

London Borough of Barking and Dagenham Inclusive Growth 2022 to 2026[13]

Priorities for a net zero cleaner, greener borough are:

- *Retrofitting homes (make changes to existing buildings so that energy consumption and emissions are reduced)*
- *zero carbon businesses and supply chains**
- *energy efficient businesses and industries**
- *reducing waste through reusing , recycling and repair*
- *shift to active travel and low emission vehicles*
- *using nature to remove emissions*

London Borough of Havering Climate Change Action Plan

- *Continue education and awareness-raising on waste prevention.*
- *Include requirement in contracts with external contractors for waste management services that they undertake measures to minimise their carbon emissions. (e.g. disposal, sorting, recycling, transport)*
- *Monitor of fuel consumed and estimate of CO2 emissions of contractors.*
- *Identify departments which have significant contributions to Council waste production on waste prevention and streams and (through paper, catering, recycling. opportunities for grounds maintenance, etc.), and develop and implement ways to reduce waste. Reduce waste Investigate impact of changes to cleaning regime on waste & recycling in Council facilities.*
- *Continue increasing number of home composters sold. Introduce site-based compost units to schools/flats for largescale food waste composting.*
- *Investigate and support opportunities for waste-to energy facilities.*
- *Investigate opportunities for the Council to find more cost effective ways to manage and reduce waste. Investigate recycling facilities for non-corporate council buildings e.g. libraries, children's' centres etc*
- *Investigate opportunities for Parks, Cemeteries and Highways to find more cost-effective ways to manage and reduce waste.*

London Borough of Newham Climate Emergency Action Plan

- *Move to Weekly Recycling and associated management of "contamination" and excess waste*
- *Borough wide roll out Communication Campaigns Ecobot Recycling Character*
- *Recycling Improvement Projects and Activities*

[13] https://www.lbbd.gov.uk/council-and-democracy/plans-and-priorities/inclusive-growth-2022-2026

- *Introduce boundary collection and remodel refuse collection rounds*
- *Create an identifiable "brand" for all communications around waste and recycling that residents recognise.*
- *Minimise the reliance on written instructions. The character will be used in "cartoon" style messaging to enable pictorial demonstrations of how to recycle and minimise waste, helping overcome language barriers.*
- *Reduce Waste and Increase Re-use by:*
    - *Decreasing the number of free collections each household receives for bulky waste to two per household per year, alongside signposting residents to reuse options like Homestore and Reclaim at the Lane and Freecycle.*
    - *Promote circular economy initiatives and work with local reuse and repair organisations.*
    - *Restricting waste: Identifying households that have a larger bin and do not have six or more residents and switching bins for the standard*

London Borough of Redbridge Climate Change Action Plan

- *Extend the wheelie bin roll-out across the borough.*
- *Engage with ELWA to understand opportunities for increasing re-use at Chigwell Road Reuse and Recycling Centre (RRC).*
- *Subject to successful trials, implement specific sacks/containers for flats above shops.*
- *Develop a recycling improvement plan for the borough.*
- *Introduce a containerisation or restriction of residual waste for all suitable properties in Redbridge.*
- *Using the findings from the 2019 Waste and Recycling Survey review the barriers to waste reduction and recycling in the borough.*
- *Working with ELWA identify opportunities for increasing re-use at Chigwell Road RRC.*
- *Develop a detailed waste and recycling communications plan for the period until 2027.*
- *Lobby ELWA to increase recycling offer in the borough. Mar-23 Reduce Redbridge's residual waste arising per household to less than 65kg per household per year.*
- *Develop and integrate a waste reduction plan for the borough.*
- *Reduce avoidable food waste disposed of as residual waste by 10% against 2016/2017 levels.*
- *To have worked successfully with ELWA to enable the introduction of separate food waste collections to all street level properties in Redbridge.*
- *Review current recycling offer in schools and commercial waste to further levels of recycling.*

- *Eliminate single use items for all London Borough of Redbridge offices and buildings.*

Local Plans

3.56 All of the Borough Councils in East London have an adopted Local Plan. A summary of the relevant policies is included in Appendix A.

4. How Waste Management Contributes Towards Climate Change

Emissions from waste management

Overview

4.1 National statistics[14] indicate that greenhouse gas emissions from waste management in 2021 in the UK were 18.8 million tonnes of carbon dioxide equivalent ($MtCO_2e$). In 2022 emissions from waste management represented 5% of total emissions. This has declined from 64.9$MtCO_2e$ in 1990 (8% of total emissions).

4.2 In 2020, the majority of greenhouse emissions were from landfill (12.8 $MtCO_2e$, 73%), wastewater treatment (2.7 $MtCO_2e$, 15%), incineration (0.3 $MtCO_2e$, 1.7%), composting (0.9 $MtCO_2e$, 5%), Mechanical Biological Treatment (MBT) (0.8 $MtCO_2e$, 4.5%) and anaerobic digestion (0.2 $MtCO_2e$, 1.1%). See Figure 4 below.

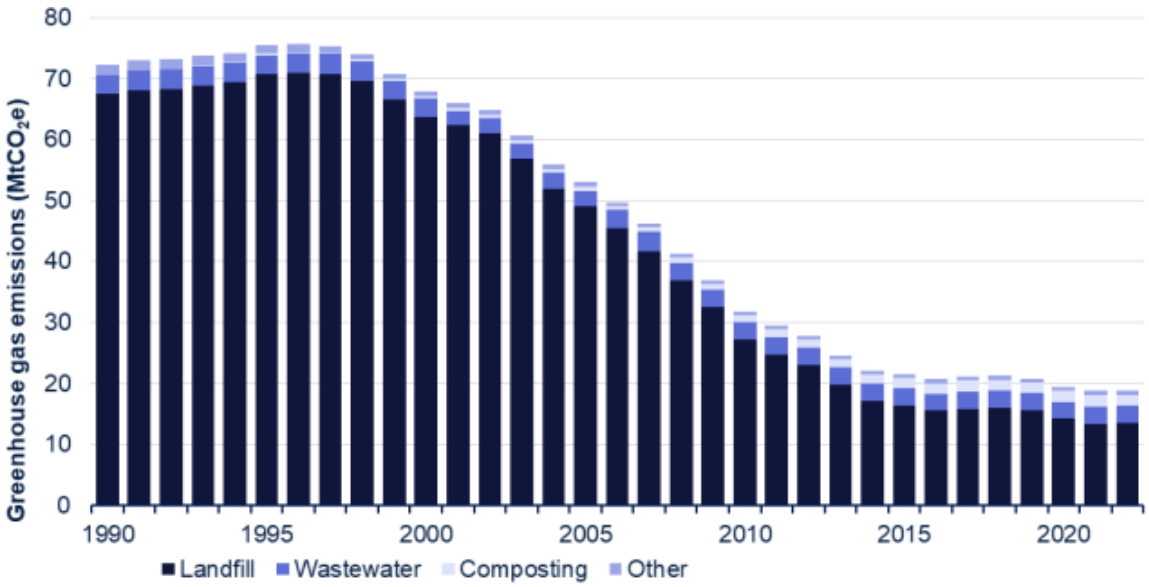

Figure 4 - Greenhouse gas emission from waste 1990 to 2022($MTCO_2e$)

Waste re-use

4.3 After prevention of waste generation in the first place (the top priority in the waste hierarchy) the preparation for re-use of products and materials, such as domestic appliances and clothing arising from household waste stream and bricks and timber from construction and demolition, can also be effective in reducing greenhouse gas emissions by reducing the demand for new raw materials to be extracted, transported, processed, and used in manufacture of new products, and in turn treated or processed when the products and materials become waste.

[14] https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2022

4.4 Re-use also includes repair of existing goods and infrastructure such as roads and buildings.

4.5 Land-use associated with re-use includes the following:
- Storage and distribution e.g. reclamation yards and depots
- Light industrial e.g. vehicle repair workshops
- Retail e.g. second hand clothes shops

Recycling and composting

4.6 Recycling reduces the demand for and need for the extraction of virgin materials, and the associated carbon emission burden. Recycling still normally requires an energy input to convert waste materials into different products e.g. smelting old cans to produce steel, and if this energy comes from burning fossil fuels carbon dioxide will be generated. However, on balance recycling generally reduces greenhouse gas emissions. This is illustrated in the table below.

Table 2: An indication of energy and resource savings that can be achieved by recycling waste[15]

Recycled material	Greenhouse gas	Energy	Water	Air	Materials
Paper/card	Recycling 1 tonne newspaper saves 900kg of CO2 equivalent	Consumes up to 70% less energy compared to use of new pulp (depending on transport distances)	Saves at least 300,000 litres of water	Reduces emissions to air by up to 95%	Avoids the need to fell 7 mature spruce trees
Glass	Recycling halves the CO2 emissions. Recycling 1 tonne saves 300kg CO2 equivalent	Saves 50% of the energy over new glass	Reduces water discharges by 50%	Reduces emissions to air by 20%	Saves raw materials (saves 1.2 tonnes per tonne recycled)
Steel	Recycling 1 tonne saves 1800kg CO2 equivalent	Uses up to 74% less energy	Uses 40% less water	Reduces emissions to air by about 30%	Saves raw materials (each tonne recycled saves 1.5 tonnes of iron ore
Aluminium	Recycling 1 tonne saves 9800kg CO2 equivalent	Uses 95% less energy compared to new aluminium	Reduces water discharges by 97%	Reduces emissions to air about 95%	Saves raw materials (each tonne recycled saves 8 tonnes of bauxite and 4 tonnes of chemical products)

[15] Adapted from 'More from Less', Hampshire County Council

4.7 The composting of garden and kitchen waste produces carbon dioxide as part of the aerobic decomposition process. At a commercial scale, in-vessel composting, and anaerobic digestion of biodegradable waste (including sewage) produces methane and carbon dioxide, however because the digesters or vessels are sealed and enclosed, the 'biogas' (methane and carbon dioxide) can be collected, treated, and then used as a fuel. This may displace the use of fossil fuels to produce electricity and/or heat, and also means that only carbon dioxide, which is a less potent greenhouse gas than methane, is released after combustion of the biogas. National guidance includes specific support for anaerobic digestion.

'Other Recovery'

4.8 Where waste cannot be practicably recycled, composted or re-used, it may be subject to treatment through a range of technologies that primarily focus on utilising the energy value of the residual waste stream. To be classed as 'other recovery', the production of energy using waste must achieve a minimum efficiency to ensure that the calorific value of the waste is being harnessed effectively rather than the waste simply being disposed by incineration with minimal energy recovery.

4.9 Incineration of mixed waste with energy recovery is an established technology; normally this involves capturing the heat and converting it into electricity. Sometimes such plants also capture the surplus heat following power production and distribute this offsite for use as space heating; this type of plant is referred to as combined heat and power plant (CHP).

4.10 Supply of electricity from a waste recovery facility can displace electricity generated using fossil fuels, and where the feedstock to the EfW plant is of biogenic origin the carbon emissions that might have arisen from the displaced source may be deemed to have been avoided. However, where the feedstock is of fossil origin, such as non-biodegradable plastic, then the avoided emission benefit is not gained. Where such plants supply heat for space heating purposes, it too may result in avoided emissions if the displaced heat source was of fossil origin, such as gas.

4.11 Incineration of biodegradable waste materials prevents the release of methane into the atmosphere that would occur if that waste was sent to landfill and the gas was not captured effectively. However, the management of biodegradable waste by anaerobic digestion to produce a useable biogas is a more effective carbon reduction route.

4.12 Advanced thermal treatment technologies, including pyrolysis and gasification, are used to convert the calorific value of waste into a gas (syngas) which may then be used as a flexible fuel. While carbon dioxide will be released upon combustion of the syngas, an avoided carbon benefit may be gained if fossil fuels are displaced.

4.13 Certain energy recovery technologies qualify under the UK Government's Contracts for Difference (CfD) scheme which is the main mechanism for supporting low-carbon electricity generation replacing the Renewable

Obligation Certificate support system. The CfD scheme has stricter qualifying criteria so a more limited range of energy from waste technologies may benefit, with a focus on advanced thermal technologies, biomass with CHP and anaerobic digestion.

Landfill

4.14 Waste produced by most households and many businesses contains organic matter such as kitchen and garden waste, and paper and card which biodegrade. When organic matter biodegrades in the presence of air, carbon dioxide is released. Under certain conditions when organic matter biodegrades in the absence of air, the greenhouse gas methane is produced. Weight for weight, methane is 25 times more damaging than carbon dioxide as a greenhouse gas[16].

4.15 Currently around 25% of total waste in the UK (and in East London) is landfilled[17] and 40% of the UK's 14.8 million tonnes of food waste ends up in landfill.[18] This generates a significant proportion of UK methane emissions. Methane emissions from landfill are not directly measured, however it is estimated emissions from landfill account for 35% of all UK methane emissions[19], which equals about 3% of UK greenhouse gas emissions[20].

4.16 Figure 5 below is taken from the Committee on Climate Change's factsheet on Waste and shows projected reductions in greenhouse gas emissions from reducing biodegradable waste sent to landfill in accordance with targets in the retained EU Landfill Directive plus some further potential reductions if more waste is diverted. This shows that by 2030, emissions from waste management could fall to 10 million tonnes of CO_2 equivalent.

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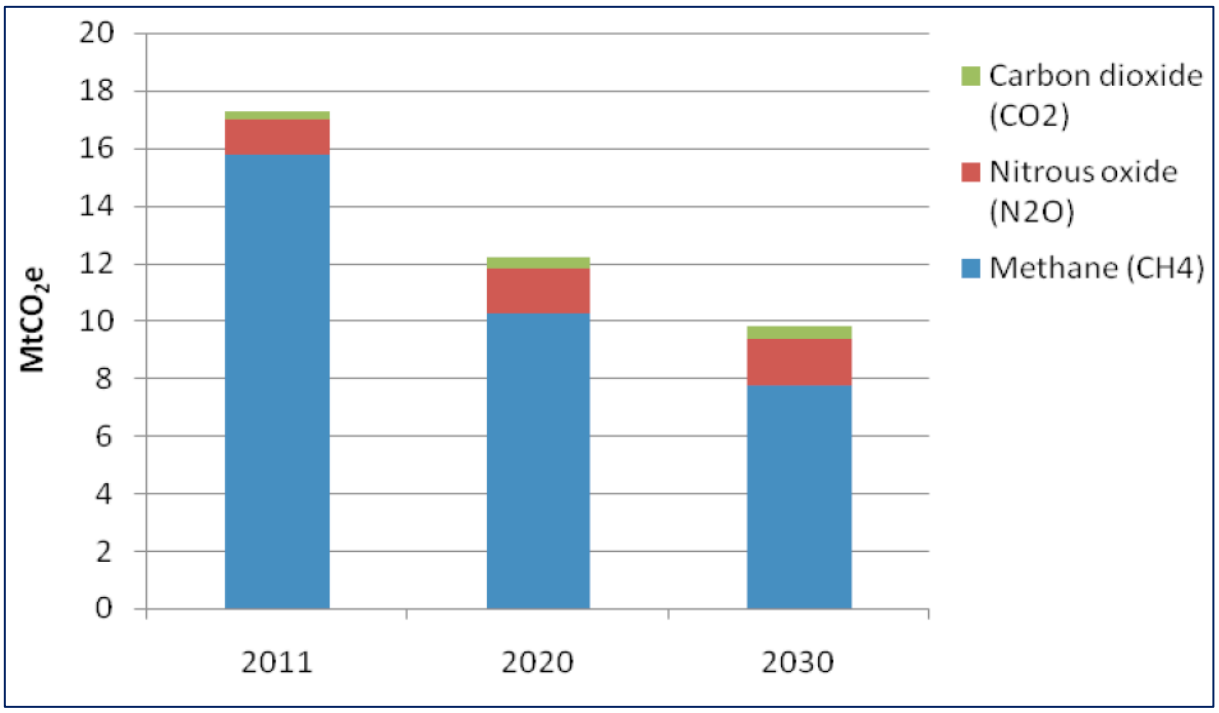
[16] HM Government, 2018. *Our Waste, Our Resources: A Strategy For England*. Page 19. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf

[17] Department for Environment, Food & Rural Affairs, 2020. *UK Statistics On Waste*. p. 12, Table 8. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/874265/UK_Statistics_on_Waste_statistical_notice_March_2020_accessible_FINAL_rev_v0.5.pdf

[18] Vision 2020, 2019. *UK Roadmap To Zero Food Waste To Landfill*. Available at: https://www.vision2020.info/assets/pdf/Vision_2020_roadmap.pdf

[19] Assets.publishing.service.gov.uk. 2020. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48424/5556-methane-factsheet.pdf

[20] Theccc.org.uk. 2020. Available at: https://www.theccc.org.uk/wp-content/uploads/2013/04/Waste-factsheet.pdf



Source: Committee on Climate Change Factsheet: Waste, 2013[21]

Figure 5. Projected emissions from waste management 2011 – 2030

Landfill Gas Utilisation

4.17 Well managed and regulated landfills, such as those currently operating in East London, which accept biodegradable wastes, are engineered to control the release of methane, enabling its capture and use as a fuel. Most commonly this is in the form of electricity production using gas engines located on the landfill site. Captured methane may also be converted into a gaseous fuel used for road vehicles. Burning the methane does produce carbon dioxide, but this has a much lower global warming potential than methane and where its use displaces fossil fuels avoided emissions benefits are gained.

4.18 The landfilling of non-biodegradable waste, such as plastic, does not result in the generation of greenhouse gases as those materials do not decompose to produce methane. However proper management of such wastes provides an opportunity to mitigate indirect emissions because if they are recycled, new primary resources do not have to be extracted and new materials produced which results in the avoidance of the use of additional energy associated with these activities[22].

[21] Committee on Climate Change, 2013. *Waste Factsheet*. https://www.theccc.org.uk/publication/carbon-footprint-and-competitiveness/waste-factsheet/

[22] It has been suggested that the deposit of plastics, in particular in a landfill, may be preferable from a greenhouse gas emissions mitigation point of view to its immediate conversion to carbon dioxide when burnt as a fuel. However, disposal of such material means that new raw material needs to be extracted and processed to replace the lost materials which will, in themselves, involve the use of energy.

Transportation of waste

4.19 The relationship between waste and climate change is wider than just the use of different technologies or management methods. The transportation of waste can also generate greenhouse gases. The level of greenhouse gas emissions is largely dependent on the amount of road borne waste movements currently largely driven by fossil fuels.

4.20 Measures that may be taken to reduce greenhouse gas emissions from transport include the following:

- Reduced no. and length of vehicle movements. This can be achieved by:
    - Ensuring final fate facilities are proximate to sources of waste
    - Bulking up waste at transfer stations to facilitate a reduced no. of movements
- Use of non fossil derived energy sources e.g., renewable electricity, biogas;
- Use of rail transport, particularly where electrically powered and the electricity comes from non fossil fuelled sources.; and,
- Use of water transport - offer significant carbon reduction benefits tonne for tonne.

4.21 As an example, the waste management company Biffa in its Sustainability Strategy 2020-2030, has set out an ambition to cease using fossil-fuelled HGVs by 2030. It intends to achieve this as follows:

- Trialling new technologies, including electric collection vehicles. Electric Refuse Collection Vehicles (RCVs) are being trialled in Manchester.
- Developing an alternative fuel strategy to establish best means for operations.
- Developing rail transport capabilities. Currently 27% of specialist waste types, destined for landfill, are transported by rail. Biffa claims this has resulted in a 75% reduction in transport emissions in comparison to road haulage.
- Improving waste collection density (the number of stops made by RCVs in a given area) with an aim to increase route efficiency by a further 20% by 2030. In the last four years Biffa claims to have improved its collection density by 11%.

5. How the Management of Waste can Mitigate Climate Change

5.1 Climate change mitigation is defined in the NPPF as: *"Action to reduce the impact of human activity on the climate system, primarily through reducing greenhouse gas emissions."*

5.2 The modes of production of greenhouse gases associated with waste are as follows:

- Production of waste;
- Treatment and management of waste; and,
- Transport of waste.

5.3 Key principles when considering how the management of waste may contribute towards climate change mitigation are:

- The waste hierarchy;
- Life cycle assessment; and
- A circular economy approach.

Life Cycle Thinking & Assessment

5.4 Generally, applying the waste hierarchy should lead to waste being dealt with in the most beneficial way. However, the Waste Framework Directive allows for the use of Life Cycle Thinking (LCT) to justify deviation from the waste hierarchy on a case-by-case basis.

5.5 Within the concept of LCT, Life Cycle Assessment (LCA) is a structured and internationally standardised method that quantifies all relevant emissions, resources consumed/depleted, and the related environmental and health impacts associated with delivery of any good or service. When LCT/LCA are applied to waste management services, typically the assessment focuses on a comparison of different waste management options. So, for example, an LCA considers the direct impacts of the operations on the environment (e.g. stack emissions from an incinerator) and the indirect benefits of recovering materials and energy from the waste (e.g. through combined heat and power and ferrous metal recycling) vs the use of the materials for recycling.

5.6 These impacts and benefits are then expressed through indicators for different environmental impact categories – such as climate change, water consumption or toxicity (referred to as environmental burdens).

5.7 The UK government has produced guidance to assist in the selection of options for the management of different waste, drawing on the best available LCA research at the time[23]. This concludes that for most materials, the waste hierarchy ranking applies. However, for the materials below, the evidence suggests that certain waste management options which are not consistent with the waste hierarchy order are better for the environment:

[23] Guidance on applying the waste hierarchy, DEFRA, 2011
www.gov.uk/government/publications/guidance-on-applying-the-waste-hierarchy

- For food, anaerobic digestion is environmentally better than composting (and other recovery options);
- for garden waste and for mixtures of food waste, anaerobic digestion followed by composting is environmentally better than composting alone;
- for lower grade wood such as particle or chip board, energy recovery options are more suitable than recycling.

5.8 The outcome of the evidence review was summarised in Figure 6 reproduced below.

5.9 It should be noted that the LCAs reviewed were produced a decade or so ago, and there may be more recent studies that indicate other outcomes as technologies evolve and operating conditions change.

5.10 A number of LCA models have been developed to compare waste management options. In the UK the Environment Agency funded the development of one such model known as WRATE (waste and resources assessment tool for the environment) in 2007. WRATE calculates the potential impacts arising from all processes in the waste management system including the collection, transportation, transfer, treatment, disposal and recycling of materials. The model takes account of the construction and operation of infrastructure and vehicles, and offsets this burden against the avoided burdens associated with materials and energy recovery.

Paper and Card	Food	Garden Waste	Textiles	Wood	Glass	Metals	Plastics±	WEEE	Tyres	Residual 'black bag'
Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention
Preparation for re-use			Preparation for re-use	Preparation for re-use	Preparation for re-use	Preparation for re-use	Preparation for re-use	Preparation for re-use	Re-treading	
Recycling	Anaerobic Digestion	Anaerobic Digestion (dry)[2]	Recycling	Recycling; energy recovery♦ (preferable to recycling for lower grade materials)	Recycling in a remelt process	Recycling	Closed loop recycling	Recycling (esp. suitable for metals and high quality plastic)	Recovery: use in road surfaces	Solid recovered fuel derived from MHT or MBT, where it replaces coal*
	Composting; other energy recovery technologies	Composting; other energy recovery technologies			Other recycling		Other recycling		Energy recovery in cement kilns	Energy Recovery, all technologies (Heat Only)
Energy recovery♦ (esp. suitable for short fibres or contaminated materials)			Energy recovery♦		Energy recovery♦	Recycling after energy recovery	Energy recovery♦	Energy recovery♦ (esp. suitable for non-hazardous mixed plastic)	Energy recovery through pyrolysis	Energy Recovery, all technologies (CHP)
									Other recovery (eg drainage fill & sea defences)	Energy Recovery, all technologies (Electricity Only)
									Gasification /incineration with EfW	MBT or MHT outputs used as fuel (but do not replace coal) or *
Disposal	Disposal	Disposal	Disposal	Disposal	Disposal	Disposal	Disposal	Disposal	Microwave treatment	Disposal

*the impact of CHP technology, which can improve the efficiency of each of these options, is not illustrated here

± the hierarchy may be different for some forms of bio-based plastics

♦'energy recovery' covers a range of technologies, some of which will be more environmentally beneficial than others. Future versions will differentiate between technologies as more scientific evidence becomes available.

*2009 AEA – Report to the Welsh Assembly Government: *Modelling of Impacts for Selected Residual Waste Plant Options using WRATE*

Figure 6. Best environmental options for management of different materials

Circular economy

5.11 The circular economy aims to redefine growth by decoupling economic activity from the consumption of finite resources, and designing waste out of the system[24]. The circular economy model is based on three principles:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

5.12 Approaches such as industrial symbiosis (where synergies between activities can be exploited such as the use of a waste or by-product of an industry by another) can be particularly beneficial.

5.13 More information on the circular economy can be found in the separate topic paper about the circular economy.

Management of Waste

5.14 As shown above while there are some exceptions, the waste hierarchy offers a guide to reduce the production of greenhouse gases.

5.15 Driving waste up the hierarchy should yield the following benefits in terms of emissions reduction:

Diversion from Disposal to Other Recovery or Recycling

- Reducing methane emissions where biodegradable waste is diverted from landfill,
- Gaining some avoided emission benefit from the calorific value of non-biogenic waste where it is diverted from incineration with no or inefficient energy recovery[25];

Diversion from Other Recovery to Recycling

- Gaining greater 'avoided emission' benefit by exploiting the material value of biogenic and non-biogenic waste substituting for virgin materials and its associated emission burden, rather than its value being exploited only once as a fuel regardless of the efficiency of energy recovery

Diversion from Recycling to Reuse

- Extending the life of products and hence reducing the need to manufacture new replacement product (avoiding the associated emissions from

[24] Ellen MacArthur Foundation. 2020. *What is a Circular Economy?*. Available from: https://www.ellenmacarthurfoundation.org/circular-economy/concept [25 March 2020].

[25] Energy recovery that fails to meet the minimum standard required by the R1 formula (see glossary).

production as well as the avoided burden from virgin material extraction)[26]; and

Prevention

- Avoid the creation of the waste in the first place through such actions as 'servitisation' i.e. replacing products with services. This would avoid emissions of production, and subsequent management, although may carry its own emissions burden if the energy used to support delivery is not sourced from entirely renewable sources.

5.16 In reality maximising the carbon reduction benefits involves moving the management of wastes as close to the top of the hierarchy as possible rather than moving it up on a tier by tier basis. That is to say applying it in priority order from the top down, rather than from the bottom up. The carbon benefits will also vary according to:

- The materials actually under consideration, for example biogenic vs non biogenic materials,
- the application to which a material is put, for example anaerobic digestion of organic waste to produce a biogas that may substitute for diesel as a fuel in HGVs vs composting to produce a soil enhancer; and
- the level of waste transportation associated with the management of waste at different levels of the hierarchy e.g. waste management by recycling will likely involve greater transportation than by more local energy from waste.

5.17 Given the complexity of the issue a systematic framework is required to allow analysis of options in their local context. This is where lifecycle assessment comes in.

Transportation of waste

5.18 While transport of waste is another source of carbon emissions, most LCA models have shown that the transport of waste represents a relatively small contribution to the overall emissions arising from the waste management chain and so may not in itself be a key determinant to the selection of a particular management method. This has been shown to be the case even where long distance transport of recyclate to the Far East is involved[27].

[26] Some of the carbon benefit of reuse may be offset by the poor energy efficiency of domestic appliances that are kept in use vs their early replacement.

[27] Gentil, E Boldrin, A, & Potter, A (2008): Carbon Footprinting of Second-life Materials Using Life Cycle Thinking South-East Regional Assembly https://waste-management-world.com/a/carbon-footprinting

Climate Change Committee recommendations

5.19 In December 2020, the Climate Change Committee (CCC) published its Sixth Carbon Budget[28] that considered measures required to achieve the UK Government target net zero carbon emissions by 2050. The UK Government accepted the report's key recommendation of a 78% reduction in UK territorial emissions between 1990 and 2035 which essentially brought the UK's previous target of 80% reduction by 2050 forward by 15 years[29].

5.20 The Committee's Sixth Carbon Budget noted that emissions associated with waste management accounted for 6% of UK GHG emissions in 2018. While they have fallen to 63% of 1990 levels, due to a reduction in biodegradable waste being landfilled, in recent years emissions have stopped falling due to a plateau in recycling and significant growth in carbon emissions from the fossil sourced component (i.e. oil based plastics) of Energy from Waste plant feedstock.

5.21 Broadly, the Committee's Budget concludes that the management of waste in accordance with the waste hierarchy is consistent with the achievement of reductions in carbon emissions and includes the following specific recommendations:

- A ban on landfilling biodegradable waste by 2025;
- recycling increasing to 70% by 2030;
- additional focus through the chain from manufacturing to the consumer to reduce the amount of waste; and,
- All energy from waste facilities plants to be fitted with Carbon Capture and Storage (CCS) by 2040.

5.22 In its June 2023 report, 'Progress in reducing emissions 2023 Report to Parliament', the CCC summarised its findings in regard to the progress made within the waste management sector to reducing emissions as follows:

'Greater strategic coordination of plans to decarbonise the waste sector is needed including: much greater emphasis on waste prevention, clarity on future residual waste capacity needs, and the suitability of incentives and interactions with other sectors such as waste as a feedstock for Sustainable Aviation Fuels. Energy from Waste (EfW) emissions are already higher than the Government's CBDP[30] anticipates and EfW capacity is set to increase in the coming years. A comprehensive systems-approach to control and reduce EfW emissions is urgently needed, including clarity on carbon pricing. We recommend a moratorium on additional EfW capacity until a review of capacity

[28] The Sixth Carbon Budget The UK's path to Net Zero Committee on Climate Change December 2020 Presented to the Secretary of State pursuant to section 34 of the Climate Change Act 2008

[29] UK enshrines new target in law to slash emissions by 78% by 2035, Government Press Release, April 2021

[30] CBDP = Carbon Budget Delivery Plan

requirements has been completed and an updated assessment of residual waste treatment capacity requirements published.'

5.23 The most recent 2024 (18 July) report[31] includes the following on waste management:

'the waste sector saw good initial progress, with emissions falling from 41.9 MtCO2e in 2008 to 25.9 MtCO2e in 2013. This was towards the upper end of our projected reductions and came almost exclusively via a reduction in methane emissions from landfill, caused by the 1996 Landfill Tax. However, when comparing to targets set by the Government in 2012, landfill methane capture rates have been lower than expected, there has been insufficient progress on recycling and composting, and energy from waste emissions have substantially increased, meaning progress in reducing waste emissions has stalled more recently.'

5.24 The report recommends addressing rising energy from waste emissions as a priority action.

Environmental Services Association Net Zero Strategy[32]

5.25 In 2021 the Environmental Services Association published a Net Zero Strategy[33] that includes the following targets:

- Start fitting Carbon Capture, Utilisation and Storage (CCUS) technologies to EfW facilities from 2025, with all plants fitted with CCUS where feasible by 2040.
- Ensure that all new EfW plants are built with CCUS fitted or are CCUS-ready from 2025 onwards.

National Infrastructure Commission Recommendations

5.26 In May 2024, the National Infrastructure Commission published its latest review of infrastructure in England[34]. The review summarises the position on waste management as follows:
'…Significant delays to key reforms have created uncertainty and prevented the necessary investment in new and improved recycling capacity. Recent initiatives have provided more clarity, and the government should now sustain this momentum as it moves to implement its collection and packaging reforms. It should also create stronger incentives to invest in recycling infrastructure by sending a clear signal on the future of energy from waste in a circular economy.'

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[31] https://www.theccc.org.uk/wp-content/uploads/2024/07/Progress-in-reducing-emissions-2024-Report-to-Parliament-Web.pdf

[32] The Environmental Services Association (ESA) is the trade association for the waste management industry in the UK.

[33] http://www.esauk.org/application/files/7316/2496/7294/ESA-Net-Zero-Exec-Summary.pdf

[34] Infrastructure Progress Review 2024

5.27 The following is included amongst the reports' recommended priorities for actions for government: *'…bans future energy from waste capacity that does not include carbon capture and storage…''…delivers on its commitment to bring energy from waste into the Emissions Trading Scheme from 2028'*

5.28 In relation to the latter recommendation, in June 2024, the Government has consulted on how it should expand the UK Emissions Trading Scheme (ETS) to include energy from waste (EfW)[35]. The following four objectives are proposed in relation to the implementation of ETS for EfW:

- Give greater certainty on the delivery of emissions reductions in line with the UK and devolved nation carbon budget and net zero targets.
- Support wider waste policies and drive decarbonisation of waste management, particularly:
    - The extended producer responsibility scheme;
    - increasing higher levels of high-quality recycling; and,
    - investment in technology such as CCS.
- Maintain a level playing field by covering a broad range of thermal treatment technologies (including advanced conversion technologies).
- Reduce the risk of any perverse incentives, particularly related to increases in landfill and waste exports.

[35] UK Emissions Trading Scheme scope expansion: waste

6. How the Management of Waste Can Adapt to Climate Change

Introduction

6.1 Even with ambitious measures and actions to reduce greenhouse gas emissions, further climate change is inevitable. Therefore, adaptation to the potential effects of climate change is needed alongside mitigation. The effects of climate change may be physical (weather events and their effects) and behavioural (changes in consumption and waste generation) which may impact on waste management services.

6.2 Climate change adaptation is defined in the NPPF as follows: *"Adjustments made to natural or human systems in response to the actual or anticipated impacts of climate change, to mitigate harm or exploit beneficial opportunities."*

6.3 Decision-making on the basis of historic climate is no longer robust as the past is not an indication of future climate. In addition, planned adaptation is likely to be more effective than last minute reactive adaptation.

National Risk Assessment and Adaptation Guidance

6.4 The 2017 UK Climate Change Risk Assessment (CCRA)[36] identifies the top areas of inter-related climate change risks for the UK as:

- **Flooding & coastal change** risks to communities, businesses and infrastructure
- Risks to **health, wellbeing and productivity** from high temperatures
- Risks of shortages in the **water supply** for, agriculture, energy generation and industry as well as the public
- Risks to **natural capital**, including ecosystems, soils and biodiversity
- Risks to domestic and international **food production and trade**

6.5 The direct climate change-related threats considered to be of most relevance to waste planning and management are:

- increases in the probability and severity of flooding,
- exposure to high temperatures and heatwaves and
- shortages in water.

6.6 While the assessment is at UK level, these risks apply equally to East London.

6.7 The level of disruption to business will depend on the vulnerability and resilience of infrastructure including energy, telecoms and transport. There may be knock-on effects on supply chains and distribution and on staff (with business and reputational damage) with reduced productivity and potentially reduced access to capital.

[36] UK Climate Change Risk Assessment, DEFRA, 2017. https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2017

6.8 Levels of flood risk (fluvial, surface and groundwater) will be location and site specific. Managing risk from flooding may be possible and affordable in some locations, while in some areas risks and costs of management will increase.

6.9 The Committee on Climate Change Adaptation Sub-Committee[37] set out measures that the UK is undertaking by delivering the National Adaptation Programme (NAP). These are fairly high-level and generic, and do not specifically address waste management.

6.10 These are summarised in the following table (Table 3).

[37]Committee on Climate Change, 2017. *How the UK is preparing.* https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/how-the-uk-is-preparing/

Table 3 - Summary of UK Climate Change Risk Assessment and National Adaptation Programme of relevance to waste management

Potential Climate Change effect	CCRA Potential impact	Risks and Impacts for East London Waste Management	NAP (Planning; Business & Industry)
Increased frequency & severity of flooding (fluvial, coastal, surface, groundwater, sewer)	Coastal infrastructure, especially ports, at risk from rising sea levels and storms.	Risk to exports of material [for recycling]	NPPF requirements for local plans and decisions to take account of climate change including ensuring resilience of communities and infrastructure. Assess cumulative impacts of flood risk. Minimise new building in areas at high flood and erosion risk. Invest in flood and coastal defences Ensure land use decisions reflect the level of current and future flood risk. Greater use of natural flood management solutions including Sustainable Urban Drainage Systems (SUDS) Design property and infrastructure to be resilient to withstand flooding and be able to recover quickly
	High waves accelerate erosion	Damage to property	
	Infrastructure near rivers esp. bridges, cables and pipelines will become vulnerable	Disruption to power supply at waste facilities	
	Increased frequency and severity of flooding of buildings/property in risk areas	Disruption to material supply and export from facilities Damage to property and disruption to operations to waste facilities and supply chain in flood prone areas.	
	Disruption to communities and services	Impact on personnel availability & productivity. Also impact on access to waste set out. Generation of waste from flood damaged property	
	Risk of buckling railway track, sagging of electricity cables, softening road tarmac, over	Disruption to material supply and movement to and from waste facilities	

Potential Climate Change effect	CCRA Potential impact	Risks and Impacts for East London Waste Management	NAP (Planning; Business & Industry)
Changes in temperature and rainfall	heating signalling causing disruption to transport		
	Water demand exceeding supply [and implications for permitting and abstraction licensing]	Availability of water for waste treatment processes that require water including that related to dust suppression.	Encourage water saving and reducing wastage Strengthening resilience of supply
	Embankment failures and landslides, resulting in damage and disruption	Disruption to material supply and movement to and from facilities	
	Overheating of buildings and public transport	Productivity of workers – may be reduced through operation design Increased risk of odours from material – may be reduced through building and process design, handling and storage, and sheeting/enclosed transport Increased risk of dust generation – may be reduced through dust management measures	Green infrastructure
	Longer growing season	Increased green and garden waste generation requiring management	
Increased wind speeds and storms	Overhead power cable damage and disruption	Security of power supply to and from waste facilities	

Potential Climate Change effect	CCRA Potential impact	Risks and Impacts for East London Waste Management	NAP (Planning; Business & Industry)
	Transport disruption – fallen trees, high sided vehicles	Disruption to material supply and movement to and from facilities	

Adaptation to climate change by waste management

6.11 The UK Climate Impacts Programme 'Adaptation Wizard'[38] provides a step-by-step process through which organisations can assess vulnerability to climate change and potential adaptive responses. This approach provides a logical way of considering vulnerabilities, risks and responses. The key stages are:

- **Assess current vulnerability:**
  - experience of how previous weather events have affected the organisation (or site, service etc),
  - how it coped
  - adaptive capacity, and
  - consideration of thresholds which, if exceeded, would cause unacceptable consequences.
- **Assess future climate vulnerability**:
  - considering how the climate is likely to change (as described previously)
  - the main direct and indirect impacts likely,
  - the risks these will pose and
  - what are the priorities that require a response. The types of risks will vary but include those to infrastructure, operations, legal and regulatory changes, and financial. The Wizard provides examples of impacts on business functions[39] and sectors[40] which are relevant to waste management both as a function and service.
- **Adaptation options:**
  - Identifying the range of options (accepting risk, offsetting damage, avoiding or reducing exposure, identifying new opportunities, building capacity to adapt) and whether these are temporary or permanent, managerial of technical, strategic or local
  - Evaluate options on effectiveness, efficiency, flexibility, no/low regrets etc
  - Develop implementation plan and implement selected appropriate adaptation

6.12 This exercise does not include an assessment of the current vulnerability to weather events of the waste management service or facilities within East London, as this requires knowledge, experience, and input from the operators. This would help focus attention on priorities for adaptation and the response.

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[38]UKCIP, 2020. *Getting* started. https://www.ukcip.org.uk/wizard/getting-started/

[39]UKCIP, 2020. *Business functions.* https://www.ukcip.org.uk/wizard/future-climate-vulnerability/bacliat/business-functions/

[40] UKCIP, 2020. *Sector* Examples. https://www.ukcip.org.uk/wizard/future-climate-vulnerability/bacliat/sectoral-examples/

6.13 Taking account of the national and regional climate projections, and the national CCRA and NAP, and applying this logical approach, the following potential impacts on waste management in East London, and potential adaptation responses, have been identified in Table 4 below.

6.14 In addition, as identified in the CCRA, there may be 'cascade' effects where there are inter-dependencies on other sectors, and a number of vulnerabilities and impacts coincide, which need to be considered. This may include:

- Transport: Damage and disruption to roads and railways (flooding, embankment failures, signage and signalling etc.) which would disrupt waste collection, movement of materials to and from waste management facilities and availability of staff. Contingency plans, including alternative routes, contingency outlets or increased storage, may be required.
- Energy: Disruptions to power and gas supply if cables and pipelines are damaged, for example by storms. Opportunities to use local heat and power networks, potentially through co-location of facilities, may help improve resilience of supply
- Water: Shortages in periods of drought or implementation of abstraction licenses may reduce availability for processes and site management. Water efficiency, on-site storage rainwater harvesting and greywater recycling would help to reduce reliance on external supplies.

6.15 Waste management should not, therefore, be considered in isolation. A strategic approach, across the four boroughs working with other public and private service providers is required.

Table 4 Risk Assessment & Adaptation Options for waste management

Climate Variable	Likely impacts	Potential effect	Risk & vulnerability	Adaptation Response Options
Temperature	Hotter mean and summer temperatures	Heat stress	• Poor working conditions, health & safety of operatives • Increased odour from waste decomposition at households, out for collection, in transit, and on site • Increased dust arising and blow • Demand for water for processes and site management e.g. dust suppression • Reduced efficiency of composting • Increased fire risk from stored materials	• Site layout and design, covering/enclosure of facilities and operations where possible, to reduce effect of heat on processes and personnel, and reduce odour and dust risk • Dust suppression on plant and within site • Source separation of biodegradable waste for home composting or separate collection • Fire Prevention & Response Plans
	Milder winters	Less frost/snow longer growing season	• Potential for less disruption to service and transport • Increased vermin and odour into winter • Increased amount of green/garden waste requiring collection & management	• More vigilant controls on site operations especially with regard to controls on vermin and odour • Review of garden waste arisings, management capacity and collection arrangements
Precipitation & humidity	Wetter winters Intense rainfall events	High river & groundwater levels	• Flooding (fluvial, groundwater, surface, sewer) of sites, facilities and infrastructure with associated disruption to processes • Flooding and damage to transport infrastructure, disruption to collection, supply, processing and export of materials from facilities	• Avoidance of flood zones 2 & 3 (*as per NPPF – see section 6*) and for location of new facilities/development • Flood resilient and resistant site and facility design e.g. raising of services and vulnerable uses above flood level. • Flood Management Plans for sites and facilities demonstrating safe

			• Increase risk of pollution if site drainage systems get overwhelmed. • Increased waste arising from flood damage • Erosion of caps and bunds, increased leachate(landfill)	operation, storage and containment of materials in event of flooding • Sizing of drainage systems with climate change contingency and retention arrangements if required. • Contingency plans for waste collection, delivery and export including collection routes avoiding flooded areas • Monitoring of site integrity and leachate • Monitoring of sites
	Drier Summers	Water shortages Subsidence	• Abstraction licensing reducing supply • Disruption to processes requiring water • Integrity of landfill caps and bunds	• Water efficiency in processes and site management including rainwater harvesting and recycling of greywater for use on site
Storminess	Extreme events	Intense rainfall & surface flooding High winds	• Surface water/flash flooding • Increased litter blow from street collection and sites • Increase risk of pollution if site drainage systems get overwhelmed. • Reliability of collection frequency/service	• Incorporation of adequate and sustainable drainage and flood storage on site where feasible • Sizing of drainage systems with climate change contingency and retention arrangements if required. • Enclosure of sites & secure boundary treatment
Sea level rise		Coastal erosion and flooding	• Flooding and damage to facilities, infrastructure, communities • Disruption to transport, collections, and export	• Avoid location of facilities in areas that may be at risk of coastal flooding and erosion

Components of the Waste Management system that may be affected and need to adapt

6.16 All components of waste management may be affected by climate change and need to plan to adapt[41]. This is outlined in Table 5 below.

Table 5. Climate Adaptation Options for waste management

Waste management component	Vulnerability & Impacts	Adaptation option
Collection	• Increased odour from biodegradable waste • Increased green waste generation • Health & safety of operatives	• Increase frequency of collection • Increase management capacity from provision of larger wheelie bins through to larger sites noting that composting requires a minimum time period to occur. • Timing of collections/Shifts
Civic Amenity/Recycling sites	• Surface water flooding • Changes in types of waste – increased garden waste • Increased odour from biodegradable waste • Dust nuisance • Fire risk	• Site layout, access & drainage • Containment of materials in skips • Frequency of emptying containers • Sweeping and dousing • Fire Prevention & Response Plans
Built facilities	• Flood risk – surface, and depending on location fluvial or groundwater • Increased odour and dust • H&S of operatives • Water availability • Fire risk – stored materials	• Site drainage and layout with built in contingency capacity. • Flood resilient design – raising services and vulnerable uses above flood level, • Dust suppression • Enclose/cover storage and processes • Water efficiency & recycling for processes and site management • Fire Prevention & Response Plans
Open air facilities (esp. composting)	• Increased arisings of green waste • Efficiency of compost process	• Monitor & review green waste capacity requirements for composting & AD

[41] The various climate change impacts will not necessarily occur at the same time or with the same frequency, although the evidence indicates that the severity and frequency of impacts is likely to increase overall.

	• Increased odour/bioaerosols due to slowing down of processes (if material dries out) so greater exposure time	• Separation distances >250m from receptors to be maintained
Landfill	• Erosion of caps and bunds • Changes in leachate volumes and concentrations	• Regular site monitoring • Alternative management solutions

Adaptation Conclusions

6.17 The first stage in considering specific vulnerabilities of the waste management service and specific assets and sites[42], is a review of recent past experience of impacts of weather events to consider the vulnerability, the effectiveness of responses undertaken, and the capacity to adapt (physical, organisational, financial). This would then inform a more detailed assessment of future vulnerabilities and recommendations for adaptation measures.

6.18 However, reviewing the evidence of predicted climate change effects, it has been possible to identify the most likely impacts on waste management in East London. This has also enabled initial consideration of potential vulnerabilities and adaptation options and opportunities. Further, more detailed consideration of these, and appraisal of options and their feasibility and cost, is needed.

6.19 Adaptation responses will be necessary at various levels. Site specific assessments of vulnerabilities and adaptation options, reflecting the specific site/facility characteristics.

6.20 Increased winter rainfall and frequency of extreme weather events, particularly heavy rainfall, is likely to be the most significant potential impact that requires adaptation, as this can have rapid and catastrophic consequences on business activity and infrastructure.

6.21 There is a great deal of national and local planning policy and guidance on assessment and avoidance of flood risk. However, existing sites (and services) will also require adaptation and resilience measures. Detailed national guidance[43] on measures to improve resilience of buildings tends to focus on residential properties, but the principles can be taken to apply to all built development.

[42] UKCIP, 2020. *Current Climate Vulnerability.* https://www.ukcip.org.uk/wizard/current-climate-vulnerability/

[43] CLG & Environment Agency, 2007. Improving the Flood Performance of New Buildings – Flood Resilient *Construction* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7730/flood_performance.pdf

6.22 Generic adaptation options are identified above as a basis for considering what may be undertaken. The feasibility and cost (including potential cost of not undertaking them i.e. associated regret) needs to be considered drawing on local knowledge and experience, in order to determine which may be taken forward.

7. Role of Waste Planning in Mitigation of, and Adaptation to, Climate Change

Introduction

Mitigation:

7.1 Measures include energy efficiency and increasing the use and supply of renewable and low carbon energy and heat, including identifying opportunities for development to draw energy from decentralised systems and co-location of potential heat customers and suppliers[44].

7.2 In terms of transport, the NPPF also expects that planning should manage patterns of growth and focus significant development in locations which are or can be made sustainable through limiting travel or using sustainable modes, to help reduce overall emissions. It recognises that opportunities for sustainable solutions will vary between urban and rural areas[45].

7.3 National Planning Policy for Waste requires disposal of waste and recovery of mixed municipal waste in line with the proximity principle (thus reducing the distance material will be transported). It sets out locational criteria to be used in plan preparation and testing site allocations which include relevant factors to climate change mitigation and adaptation including:

a) Water quality, resources and flood risk: These are likely to be exacerbated by climate change due to changing rainfall patterns and extreme events and storms (adaptation response);

b) Land instability: Which may be affected by wetter winters and extreme rainfall events, and hotter drier summers (adaptation response);

f) Traffic and access: Modes and distance travelled will affect greenhouse gas emissions (mitigation response)

g) Air emissions including dust: Exacerbated by hotter drier summers and prolonged hot dry periods (adaptation response);

h) Odours: Exacerbated by hotter drier summers (adaptation response);

i) Vermin: Potentially exacerbated by milder winters (adaptation response);

k) Litter: Potentially exacerbated by storms and wind (adaptation response);

Adaptation:

7.4 Adaptation responses include ensuring future resilience of properties, businesses and infrastructure. New development should be planned for in ways that avoid increased vulnerability to impacts. When new development is planned in vulnerable areas, care should be taken to ensure risks can be managed through suitable adaptation measures[46].

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[44] NPPF Paragraph 160(c)

[45] NPPF Paragraph 109

[46] NPPF Paragraph 159(a)

7.5 The NPPF and Planning Practice Guidance set out in some detail how to plan for flood risk[47], which applies to all development types including waste management. The key principle is to avoid development in areas of high probability of flooding where possible, and if development in these areas is demonstrated to be necessary, to ensure that it is flood resistant and resilient. It also requires local plans to reduce the risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating impacts of physical changes at the coast[48].

7.6 Plans are required to take a sequential risk-based approach to location of development in flood risk areas which take into account climate change effects (on probability and severity of flooding). The 'sequential test' steers development to areas at lowest flood risk, informed by Strategic Flood Risk Assessments (SFRAs). If development has to be located in areas at higher flood risk (Flood Zones 2 and 3), the 'exception test' to demonstrate whether there are wider sustainable development benefits that outweigh the flood risk, or that the development will be safe for its lifetime without increasing risk elsewhere[49].

7.7 In terms of flood risk and its assessment, landfill and sites used for management of hazardous waste are classified as 'more vulnerable' types of development, and so generally are not compatible with or appropriate in Flood Zone 3a (high probability of flooding) unless it passes the Exception Test. Other waste treatment is considered as 'less vulnerable' which is generally compatible and appropriate in all areas apart from 3b (functional floodplain).

7.8 Planning Practice Guidance (PPG)[50] sets out examples of adaptation measures as:

- Considering future climate change risks when allocating sites to ensure risks are understood over the development's lifetime
- Promoting design responses to flood risk and coastal change for the lifetime of the development
- Considering availability of water and water infrastructure.

7.9 It advises that mitigation and adaptation measures may be integrated, for example, through designing buildings with natural ventilation, through district heating networks, and provision of green infrastructure. It also recommends adopting low or no-risk options that deliver multiple benefits, and building in flexibility to allow future adaptation.

[47] NPPF Paragraphs 165-175

[48] NPPF Paragraphs 177

[49] NPPF Paragraphs 167

[50] PPG Paragraphs ID 6-003 to 6-006-20140306

7.10 Further, informal, guidance is provided in the Town & Country Planning Association/RTPI guide on climate change[51] which builds on NPPF and PPG.

Role of Waste Planning

7.11 Planning can address mitigation and adaptation in two main ways – steering the spatial distribution of development, and controlling and influencing its type, design, layout and operation. This applies to all types of development, including waste management. Waste planning can also direct and control the type and quantity of waste being managed, and the management method, at given facilities.

Spatial distribution - mitigation:

7.12 The spatial strategy can influence greenhouse gas emissions, for example through:

- Reducing the need for transport of collected waste to treatment facilities, particularly by road, including through location of facilities proximate to major sources of waste (consistent with the proximity principle where it involves the management of mixed municipal waste in particular), and encouraging use of low carbon transport modes through locating development where transport by water or rail may be viable;
- Encouraging co-location of synergistic waste management developments that offer opportunities to share energy or resources or simply allows waste to be converted to a final product in proximity to its source/point of origin or market;
- Encouraging synergies between waste management facilities and other existing or planned development, for example through combined heat and power and offtake of heat from energy-from-waste facilities with distribution through local heat networks to serve commercial, leisure or residential demand.

Spatial distribution – adaptation:

7.13 The spatial strategy can influence adaptation, for example through:

- Identifying and avoiding inappropriate waste development in areas of current vulnerability particularly to all types of flooding, water resource availability and water quality guided by the sequential approach outlined previously
- Identifying and avoiding inappropriate waste development in areas of future vulnerability due to climate change, particularly where all types of flooding may be more frequent and severe, where water resource availability may be reduced, and water quality may deteriorate (with implications for abstraction and discharge licensing)
- Identifying and avoiding waste development in areas vulnerable to other climate change effects, particularly sea level rise and coastal erosion, and unstable land.

Development type, design, layout and operation - mitigation:

[51] TCPA/RTPI, 2018. *Climate Change – A Guide for Local Authorities.*

7.14 Planning policy provides the basis for development management decisions, with determination of applications to be in accordance with the development plan unless material considerations indicate otherwise. Planning policy can control and influence the type, design, layout and (through conditions) operation of development to some degree, which can help to mitigate climate change, for example:

- Implementing the waste hierarchy, to minimise landfill (and associated emissions of methane in particular from biodegradable waste) and enable greater resource efficiency through maximising recycling and recovery of materials and energy seeking the best or lowest carbon solution available, through identifying and enabling development of appropriate facilities reflecting hierarchy priorities, and assessed needs where applicable;
- Design and operation of built waste management facilities to maximise energy efficiency of the building, its fabric and operations;
- Encouraging and enabling use of renewable and low carbon energy sources including that produced on-site where relevant and also through district heating/local networks.
- Electric vehicle charging points or biogas production for use in vehicles or supply into the gas grid.

Development type, design, layout and operation – adaptation:

7.15 Planning policy can control and influence the type, design, layout and (through conditions) operation of development to some degree, which can help to adapt to climate change:

- Flood resistance (e.g. barriers) and resilience (e.g. services and floor levels raised above projected flood level; containment of materials within part of site; location of vulnerable uses within site away from areas liable to flood risk),
- Enclosure of processes to reduce escape of odour, dust and litter, and maintain healthy conditions for personnel given predicted extremes
- Incorporation of water efficiency measures including recycling of water in processes and plant, and on site management e.g. dust suppression
- Incorporation of water storage on site – through sustainable drainage schemes where feasible or through tanks and flow restriction (informed by drainage assessments to reduce run-off to greenfield standards)
- Conditions controlling operation and control of site e.g. dust management plans, flood management plans, emergency evacuation plans.

Application in East London

Adopted East London Waste Plan

7.16 The adopted Joint Waste Development Plan, and supporting documentation and evidence[52], do not currently incorporate explicit consideration of existing and future vulnerability, and of mitigation and adaptation to climate change.

[52] https://www.havering.gov.uk/downloads/file/3944/adopted_joint_waste_dpd

7.17 Policy W5 *General Considerations with regard to Waste Proposals* sets out what information is required in support of planning applications. This includes measures relevant to mitigation of and adaptation to climate change, including to mitigate, minimise and avoid adverse impacts and compensate for loses including:
(ii) production of greenhouse gases
(iii) development on sites likely to be at greater risk of climate change over the lifetime of the development;
(iv) increase in pressure on resources with climate change;
(vi) drainage and risk of flooding;
(vii) water consumption and water management;
(viii) groundwater and hydrogeology;
(x) demonstration of sustainable construction and drainage;
(xii) opportunities for sustainable transport.

7.18 Policy W5 therefore covers many of the actions required to mitigate and adapt to climate change of planning applications. However, it does not include a great deal of detail on how compliance can be demonstrated. This may be through climate change appraisals accompanying applications which identify specific mitigation and adaptation measures. Policy or text in the new Plan could make this explicit and signpost measures that should be considered.

7.19 While new sites for waste management are unlikely to be required to be identified and allocated in the new Plan, spatial factors such as flood risk, should be applied in assessing sites for de-allocation and release from waste safeguarding and their suitability for alternative use and development.

Conclusion and Recommendations

7.20 Planning has a critical role in determining the scale, type, and spatial distribution of waste management development. It can also influence the design, layout and operation (in conjunction with environmental permitting) of waste management facilities. In doing so it can require and enable both the mitigation of, and adaptation to, climate change of the sector.

7.21 A degree of pragmatism needs to be applied when considering options and what planning can achieve, balanced in particular against commercial and practical realities including the opportunities presented by making best use of existing capacity at existing facilities.

7.22 There is strong and clear national planning policy and guidance on climate change mitigation and adaptation, with which development plans need to be consistent.

7.23 The adopted Joint Waste Plan Policy W5 already requires consideration of the key issues and ways in which waste development can contribute to mitigation and adaptation in East London. The local plans of the boroughs also include policies requiring climate change mitigation and adaptation.

7.24 Climate change mitigation and adaptation considerations are embedded throughout the new Joint Waste Plan reflecting current requirements, knowledge, and best practice as described in this report. These are summarised below:

- ***Draft Vision:***

'By 2041, the principles of the circular economy will be fully integrated into all forms of development within East London'

'Waste management facilities will be located to protect and enhance communities and the natural environment, and be resilient to climate change.'

'Net zero in waste management will have been achieved in East London through an understanding, and reduction, of lifecycle carbon impacts and incorporating renewable energy in waste management and transportation'

- ***Strategic Objectives:***
    - Strategic Objective 1: Significantly Reduce Waste Production Overall
    - Strategic Objective 2: All Built Development Will Contribute to the Achievement of a Fully Functioning Circular Economy by 2041
    - Strategic Objective 3: Appropriately Locate Waste Management Capacity
    - Strategic Objective 5: Achieve Net Zero Waste Management
    - Strategic Objective 7: Minimise Transportation and Establish Alternative Infrastructure
    - Strategic Objective 8: Restrict Landfilling to Exceptional Circumstances

- ***Policies:***
    - JWP1: Circular Economy
    - JWP2: Safeguarding and Provision of Waste Capacity
    - JWP3: Prevention of Encroachment
    - JWP4: Design of Waste Management Facilities
    - JWP5: Energy from Waste
    - JWP6: Deposit of Waste on Land

Appendix A – Summary of Climate Change Related Policies in the Adopted East London Joint Waste Plan and other Local Plans in East London

The following tables sets out planning policies in the East London Joint Waste Plan and borough Local Plans in East London which are intended to ensure that development adapts to and/or mitigates climate change. These policies cover matters such as design, the use of energy, transport, flooding, water use and waste management.

East London Adopted Joint Waste DPD

Policy	Summary of requirement
Policy W1 Sustainable Waste Management	Requires the waste planning authority to work in partnership with the general public and the business community in the ELWA area to provide information and advice and raise awareness. Development is required to reuse construction, excavation and demolition waste during new developments, such as the Thames Gateway, with on-site recycling and use of recycled aggregate wherever possible and encourage use of sustainable transport modes where the movement of waste is necessary.
Policy W3 Energy Recovery	Incorporation of energy recovery and treatment facilities within major developments.
Policy W4 Disposal of inert waste by landfilling	Landfill only permitted where waste cannot be re-used and it is essential for restoration of land.
Policy W5 General considerations with regard to waste proposals	Proposals must demonstrate lack of alternative facility more proximate to non-apportioned waste arising. Applications must demonstrate mitigation and avoidance of adverse impacts from emissions of greenhouse gases, risk from climate change, drainage and flood risk, water consumption, transport impact

Borough Local Plan (inc. link to website)	Policy (no. and title)	Summary of requirement
Barking and Dagenham *https://www.lbbd.gov.uk/planning-building-control-and-local-land-charges/planning-guidance-and-policies/local-plan* Barking and Dagenham Emerging Local Plan Part 1 Reg 19 Submission	Strategic Policy SP2	(g) adopt Circular Economy principles in design – reduce resource use and embodied carbon throughout the lifecycle of a development and aim to achieve net zero waste.
	Strategic Policy SP6: Green & Blue Infrastructure	Protect and enhance quality of natural environment including biodiversity & green spaces and links.
	Strategic Policy SP7: Securing a clean, green and sustainable borough	Encourage innovative approaches to tackling climate change, reduce pollution, flood risk, heat risk and promote sustainable infrastructure. Major development to be net zero carbon and employ low carbon technologies to minimise greenhouse gas emissions, and encourage connection to District Energy networks. Minimise risk of internal over-heating. Reduce flood risk through use of Sustainable Drainage Systems and address cross-border risks. Zero biodegradable waste to landfill by 2026.
	Policy DMSI 1: Sustainable design & construction	Incorporate sustainable design & construction relating to scale, nature, orientation, layout and form. Incorporate sustainability principles, materials and low carbon technologies.
	Policy DMSI 2: Energy, heat and carbon emissions	Major development to contribute to meeting and exceeding target of carbon neutrality by 2050 by maximising energy efficiency and carbon reduction and net zero buildings. Major developments accompanied by Energy Assessment demonstrating how development is designed in accordance with energy hierarchy. If net zero cannot be achieved on-site, financial contribution to carbon offsetting required. Development should prioritise decentralised energy and adhere to heat hierarchy. Incorporation of low carbon and renewable energy required. Overheating risk to be minimised through design, layout, orientation, materials and incorporation of green infrastructure.

Borough Local Plan (inc. link to website)	Policy (no. and title)	Summary of requirement
	Policy DMSI 6: Flood risk and defences	Development to deliver neutral impact or reduction in flood risk through design. Flood Risk Assessments required. Protect flood defences and raise these to required standards on TE2100, and safeguard land for future raising of defences.
	Policy DMSI 7: Water management	Utilise permeable surfaces, and SuDS. Aim for greenfield run-off rates and manage run-off water as close to source as possible. Reduced water consumption required
	Policy DMSI 8: Demolition and operational waste	Develop construction waste management plan to reduce, re-use, recycle and recover waste to mitigate environmental impact. Consider use of river for waste transport where appropriate. Strategy for operational waste minimisation, collection and recycling to be incorporated into development. Major residential developments to incorporate high quality on-site storage and collection systems such as underground storage and vacuum systems.
	Strategic Policy SP8: Planning for integrated and sustainable transport	Sustainable transport of freight to reduce highway congestion and environmental impacts.
Havering https://www.havering.gov.uk/info/20034/planning/183/planning_policy/2 Local Plan adopted 2021 and covers the period 2016-2031.	Policy 32: Flood management	Avid flood risk and manage residual risk by applying Sequential Test and if necessary Exception Test. Strategic Flood Risk Assessment is starting point. Surface water flooding reduced through reducing surface water run-off through SuDS and applying London Plan drainage hierarchy achieving greenfield run-off rates.
	Policy 35: Waste management	Support provision of space in development for storage for waste and recyclables, separate collection of re-usable and recyclable materials, include on-site waste management which minimises need for transfer. All major development to include waste management plan.
	Policy 36: Low carbon design and renewable energy	Optimise energy efficiency in buildings and support low carbon and renewable energy developments. Major development to include energy assessment to demonstrate how targets for carbon dioxide emissions reduction will be met.

Borough Local Plan (inc. link to website)	Policy (no. and title)	Summary of requirement
		Contribution to offsetting required to secure carbon savings. Major development to prioritise connection to decentralised energy networks and integrate CHP on site.
	Policy 39: Secondary aggregate	Applicants to minimise primary aggregate and resources and waste through design, good practice and recycling of construction materials containing minerals. Maximise recovery from CDE waste through on-site re-use and recycling
Newham *https://www.newham.gov.uk/planning-development-conservation/planning-policy-local-plan/2* Newham Local Plan adopted 2018 and covers the period until 2033.	Policy SC1: Environmental resilience	Design, construction and operation of development to respond to climate change effects including extreme weather, geohazard, water scarcity and warmer temperatures. Development to be resource efficient. Promote local production, labour and procurement. Design to implement SuDS hierarchy and deliver benefits to biodiversity, pollution control and flood risk reduction. All development to incorporate water efficiency, demonstrate over-heating risks have been addressed, and landscaping to consider climate change effects of higher temperatures and water scarcity.
	Policy SC2: Energy and Zero Carbon	All development to minimise and reduce carbon emissions following energy hierarchy. Decentralised energy networks will be a central component of growth in the Arc of Opportunity. Development to maximise natural and waste energy sources. All major development to be supported by Energy Strategy/Assessment including prioritising connection to heat networks.
	Policy SC3: Flood Risk & Drainage	Development to avoid increasing flood risk and be informed by SFRA. Flood Risk Assessments required in line with national policy. Development located in areas at lowest risk of flooding demonstrated by sequential Test and if necessary Exceptions Test. Development set back from flood defences. Development in FZ2&3 to be flood resilient. All development to incorporate SuDS to reduce surface run-off and in Critical Drainage Area achieve greenfield run-off and include Surface Water Drainage Strategy.
	Policy INF3: Waste & Recycling	Follow waste hierarchy, prioritise rail and water transport, observe Proximity Principle dealing with waste as close to source as possible. Development to include on-site handling and storage to meet needs and include innovative approaches to sustainable waste management. Major development to be accompanied by Site Waste Management Plans

Borough Local Plan (inc. link to website)	Policy (no. and title)	Summary of requirement
	Policy INF4: Utilities Infrastructure	Expansion of decentralised energy networks and use of innovative energy technologies (including waste energy) encouraged to reduce fossil fuel use and emissions. All energy sources >50Mwe to provide connection to heat networks. Major development to prioritise connection to heat network.
Redbridge https://www.redbridge.gov.uk/planning-and-building/planning-policy/local-plan/ Redbridge Local Plan adopted 2018 and covers the period 2015-2030	Policy LP19: Climate Change Mitigation	Promotion of zero carbon development – all development to reduce carbon dioxide emissions through applying energy hierarchy. All major development to demonstrate how London Plan targets for carbon dioxide emissions have been met. Location of development to minimise need to travel by car and to support decentralised energy networks.
	Policy LP20: Low Carbon and Renewable Energy	Major developments to demonstrate accordance with energy hierarchy through energy assessments. Protect existing decentralised energy networks and support their expansion. Support district heating schemes and on-site renewable energy. Major development to consider feasibility of CHP, make financial contribution to programme for carbon reduction, ensure design is district energy network connection ready.
	Policy LP21: Water and Flooding	Development to avoid increasing flood risk, safeguard flood plain where water can flow and be stored, direct vulnerable land uses away from areas of highest flood risk as identified in SFRA and to comply with Sequential and Exceptions Tests. Site specific flood risk assessments for sites meting NPPF/PPG criteria. Require flood resistant and resilient measures to be incorporated into design in areas prone to flooding. Utilise SuDS to achieve greenfield run-off rates and deliver wider benefits for biodiversity and water quality. Resist impermeable surfacing and culverting of watercourses

Borough Local Plan (inc. link to website)	Policy (no. and title)	Summary of requirement
	Policy LP22: Promoting Sustainable Transport	Direct development generating high transport demand to highly accessible locations, facilitate safe reliable and efficient movement of freight.
	Policy LP24: Pollution	Waste facilities to mitigate impact on environmental considerations by fully enclosing facilities.
	Policy LP2: Promoting High Quality Design	Development to incorporate sustainable design and construction including best practice in energy efficiency and climate change mitigation.
	Policy LP32: Sustainable Design & Construction	All development to contribute towards mitigation of the effects of climate change. Promote zero carbon development including adherence to energy hierarchy, show how London Plan targets for carbon emissions will be achieved, reduce travel by car, promote decentralised energy networks, re-use existing buildings, optimise resource efficiency. Adopt climate change adaptation measures including green infrastructure and protection of green space, use permeable surfacing and SuDS, green roofs, minimise water consumption, measures to reduce overheating. Promotion of sustainable design & construction through seeking BREEAM Excellent ratings in new non-domestic buildings >1000m^2.