Appendix 10.2 Climate Risk Assessment

10.1 Introduction

10.1.1 This appendix to Chapter 10 of the Environmental Statement (ES) summarises potential changes in climatic parameters at the Proposed Development location and considers whether there is potential for likely significant environmental effects in construction or operation.

10.1.2 The climate change risk assessment methodology outlined in the UKGBC 'A Framework for Measuring and Reporting of Climate-related Physical Risks to Build Assets' (2022)[1] has been used to determine the potential for significant effects arising from a future changing climate.

10.1.3 In addition to the direct climate risks to the Proposed Development itself, there are potential inter relationships between climate change and several other environmental topic areas, explored further in Appendix 10.3 and assessed in the respective ES topic chapters as applicable.

10.2 Climate Change Projections

10.2.1 The Met Office Hadley Centre (MOHC) publishes both probabilistic climate change projections and downscaled global circulation model outputs for the UK at various spatial scales. This is called the UKCP18 dataset, first published in November 2018 and at v2.7.0 (MOHC, 2022[2]) at the time of writing. The projections are based on representative concentration pathway (RCP) scenarios used by the Intergovernmental Panel on Climate Change, thereby giving a low-high range in potential global GHG reduction initiatives and resulting rate of climatic effects over a given time period.

10.2.2 The UKCP18 dataset publishes climate change anomalies for a range of spatial scales and global GHG emissions pathway scenarios; for the purposes of this assessment, a 25km grid square spatial scale has been used, which shows a range of projection values that reflect uncertainty in modelled outcomes. Given the predicted completion year of the Proposed Development (2039) and the potential longevity of its operational lifetime, probabilistic climate change anomaly projections have been provided for the time periods 2030-2059 and 2070-2099.

10.2.3 The UKCP18 dataset used in this assessment is the probabilistic climate change anomaly projections. Probabilistic climate variable anomalies refer to the difference of a future climate variable compared to a past or present climate. Anomalies can be expressed in absolute values (e.g. degrees Celsius change) or relative values (e.g. percentage change for precipitation). For the purpose of this assessment, temperature, precipitation and humidity anomalies have been considered. The Proposed Development is not in a coastal location, so sea level change and storm surge have not been relevant to consider. Fluvial and pluvial

[1] UKGBC (2022): A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets. [Online], available at: https://ukgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/02/09114419/UKGBC-Measuring-andReporting-Physical-risk-Report.pdf, last accessed 16/01/24.

[2] MOHC (2022): UK Climate Projections User Interface. [Online], available at: https://ukclimateprojectionsui.metoffice.gov.uk/ui/home, last accessed 16/01/24.

flood risk has been assessed quantitatively in the Flood Risk Assessment appended to the ES, with allowance for climate change, and is not repeated here.

10.2.4 In general, as detailed in the UKCP18 'Science Overview Report' (2018)[3], the UK will experience a trend of warmer, wetter winters and hotter, drier summers, though natural variations in that pattern from year to year will persist. Changes to wind speeds and storminess cannot be easily predicted and the data currently published cannot make projections for local conditions and wind gusts. However, it is expected that the frequency and intensity of storms will increase in the future and so this has qualitatively been taken into account in this assessment.

10.2.5 Table 10.1 and Table 10.2 show climate change anomaly projections from the UKCP18 probabilistic dataset for each of the respective 2030-2059 and 2070-2099 time periods, relative to the 1981-2010 baseline for the 25 km grid square in which the Site is located. As a conservative (worst-case) approach to assessment, the data presented here is for the 'business as usual' global emissions pathway RCP8.5.

10.2.6 In summary, the data within Table 10.1 and 10.2 shows increased intensity in seasonal and monthly precipitation trends: precipitation is predicted to decrease during the driest season and month, and increase during the wettest season and month. Temperatures are anticipated to increase annually relative to the 1981-2010 baseline, both during the coldest and hottest seasons and months. Finally, humidity is also expected to increase during both the summer and winter, and hence the annual average will increase.

Table 10.1 Climate Change Parameter Projections 2030-2059

Parameter*	Unit	10th Percentile	Median Value	90th Percentile
Precipitation – annual average	%	-8.22	-0.86	6.54
Precipitation – driest season	%	-39.26	-15.08	8.13
Precipitation – wettest season	%	-9.85	2.14	14.86
Precipitation – driest month	%	-47.53	-15.37	15.50
Precipitation – wettest month	%	-11.33	8.84	32.22
Temperature – annual average	ºC	0.31	1.38	2.57
Temperature – hottest season average	ºC	0.82	2.06	3.2
Temperature – coldest season average	ºC	0.38	1.30	2.28
Temperature – hottest month maximum	ºC	0.59	2.60	4.61
Temperature – hottest month average	ºC	0.80	2.30	3.84
Temperature – coldest month minimum	ºC	0.26	1.36	2.50
Temperature – coldest month average	ºC	0.24	1.26	2.33
Humidity – annual average	%	2.00	7.73	13.88
Humidity – winter	%	0.37	8.45	16.78

[3] UKCP18 (2018): UKCP18 Science Overview Report. [Online], available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf, last accessed 28/03/24.

Humidity – summer	%	-0.70	7.72	16.17

* daily mean, maximum or minimum, as applicable, averaged over time period specified. Values are for 10th and 90th percentile and median values for scenario RCP8.5

Table 10.2 Climate Change Parameter Projections 2030-2059

Parameter*	Unit	10th Percentile	Median Value	90th Percentile
Precipitation – annual average	%	-12.88	-0.97	10.79
Precipitation – driest season	%	-68.21	-38.44	-0.91
Precipitation – wettest season	%	-12.38	6.49	27.39
Precipitation – driest month	%	-77.91	-42.20	2.85
Precipitation – wettest month	%	-10.45	26.59	69.71
Temperature – annual average	ºC	1.08	3.26	5.75
Temperature – hottest season average	ºC	2.76	5.40	8.12
Temperature – coldest season average	ºC	1.22	3.03	5.03
Temperature – hottest month maximum	ºC	2.89	7.22	11.60
Temperature – hottest month average	ºC	2.92	6.34	9.74
Temperature – coldest month minimum	ºC	1.12	3.31	5.64
Temperature – coldest month average	ºC	0.89	2.93	5.00
Humidity – annual average	%	10.52	20.91	32.20
Humidity – winter	%	6.52	22.73	39.44
Humidity – summer	%	4.57	19.21	34.47

* daily mean, maximum or minimum, as applicable, averaged over time period specified. Values are for 10th and 90th percentile and median values for scenario RCP8.5

10.3 Climate Risk Assessment Method

10.3.1 Based on the information available for the Proposed Development, a high level risk assessment has been undertaken using the UKGBC 'Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets' guidance. As per the guidance, the severity of climate-related risk is based on the probability of a risk occurring and the consequences of such a risk. Table 10.3 to Table 10.4 defines each of these terms.

10.3.2 Given the variability in the nature of the potential effects of climate change on the development, receptors have been identified on a risk-specific basis, whereby all receptors relate to both the physical built assets and to the occupation and use of the Proposed Development by people. The classifications of consequence have therefore been adapted from the UKGBC guidance to add consequences for residents, visitors and workers' health, safety and wellbeing.

10.3.3 By considering the good practice design measures incorporated into the Proposed Development, professional judgement is used in determining whether the potentially significant effects would result in significant adverse or beneficial effects.

Table 10.3 Classification of Risk Probability (UKGCB, 2022)

Probability: reflects both the range of possibility of climatic parameter changes illustrated in CP18 projections and the possible changes would cause the impact being considered.	
Classification	**Definition**
Unlikely	Circumstances are such that it is improbable that an event would occur even in the very long term.
Probability: reflects both the range of possibility of climatic parameter changes illustrated in CP18 projections and the possible changes would cause the impact being considered.	
Classification	**Definition**
Low likelihood	Circumstances under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
Likely	It is probable that an event is not inevitable, but possible in the short term and probable in the long term.
High likelihood	The hazard event appears very likely in the short term and almost inevitable over the long term.

Table 10.4 Classification of Risk Consequence (UKGCB, 2022)

Consequence: the likely consequences and severity of such consequences of the impact should it occur.	
Classification	**Definition**
Minor	Impact to the built asset likely to result in no or very low levels of damage to business/property. No or limited business interruption that may result in no or negligible financial loss or expenditure to resolve. Built asset has negligible exposure to a potential loss. Efforts have been made to strengthen resilience of built asset. Damage to buildings/structures/services or the environment rendering limited areas of the building unsafe to occupy on a very short-term basis. Damage to vulnerable buildings/structures services or the environment. No or limited effect on the health and safety of residents and workers or on residential amenity.

Mild	Impact to the built asset likely to result in low levels of damage to business/property. Limited business interruption or direct damage resulting in limited financial loss or expenditure to resolve. Built asset has some exposure to potential loss. Efforts have been made to strengthen resilience of built asset. Damage to vulnerable buildings/structures/services or the environment. Damage to buildings/structures/services rendering limited areas of the building unsafe to occupy on a short-term basis. Mild effect on the health and safety of residents and workers, not constituting injury/incident. Mild effect on residential amenity affecting comfort of residents.
Medium	Impact to the built asset likely to result in high levels of damage to buildings/property, substantial re-build or substantial reduction in asset value. Business interruption or direct damage resulting in substantial financial loss. Insurance premiums on asset rises substantially. Built asset has substantial exposure to a potential loss. Limited effort to strengthen resilience of built asset. Damage to key buildings/structures/services or the environment rendering asset unsafe to occupy.
Consequence: the likely consequences and severity of such consequences of the impact should it occur.	
Classification	**Definition**
	Residents or workers experience measurable changes in health outcomes, but not to the extent that warrant hospitalisation or long-term health consequences. Moderate effect on residential amenity affecting comfort of residents.
Severe	Impact to the built asset likely to result in catastrophic damage to building/property. Business interruption or direct damage resulting in total financial loss. Asset becomes uninsurable. Built asset has substantial exposure to a potential loss. No or negligible effort to strengthen resilience of built asset. Damage to buildings/structures or services or the environment rendering asset unsafe to occupy. Residents or workers suffer measurable changes in health outcomes resulting in hospitalisation or long-term health consequences. The effect on residential amenity is substantial.

10.3.4 The definitions in Table 10.5 determine the impact of the risk as per the probability of a risk occurring and its consequences. As per the significance effects thresholds, a risk rating of ‘Moderate risk’ to ‘Very high risk’ is deemed significant in EIA terms.

Table 10.5 Definition of Risk (UKGBC, 2022)

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

10.4 Risk Assessment

10.4.1 Table 10.6 shows the climate change risks to the Proposed Development that have been identified and the impact of those risks

Table 10.6 Climate Change Risk Assessment for the Proposed Development during construction and occupation

	Medium Term (2030-2059)		Long Term (2070-2099)			
Hazard	**Probability of risk occurring**	**Consequence of risk occurring**	**Probability of risk occurring**	**Consequence of risk occurring**	**Risk rating (highest)**	**Mitigation**
Flooding of the site Flooding of access routes to the site	Flood risk is assessed in the Flood Risk Assessment accompanying the planning application with allowance for climate change in accordance with EA guidance.					
During construction, workforce affected by high temperature and/or humidity conditions	(Short term) Likely	(Short term) Medium	n/a	n/a	Moderate risk	Workforce health and safety policy; PPE and monitoring of working conditions to prevent workforce overheating.
During construction, increase in construction dust caused by increased temperatures and drought conditions	(Short term) Likely	(Short term) Minor	n/a	n/a	Low risk	Dust mitigation measures included within a CEMP (e.g. reduce dust emissions through the effective transport and storage of materials)
During construction, programme disruption as a result of poor weather conditions, e.g. snow / ice, high wind or waterlogged ground.	(Short term) Likely	(Short term) Mild	n/a	n/a	Low risk	Not considered to differ significantly from conditions experienced at present, which construction contractors are routinely adapted.

	Medium Term (2030-2059)		Long Term (2070-2099)			
Hazard	**Probability of risk occurring**	**Consequence of risk occurring**	**Probability of risk occurring**	**Consequence of risk occurring**	**Risk rating (highest)**	**Mitigation**
Overheating of buildings during occupation affecting residents. New homes with higher energy efficiency rating are more likely to experience overheating if adequate ventilation not considered appropriately.	Likely	Minor	High likelihood	Mild	Moderate risk	Building fabric design subject to overheating assessment. Overheating strategy to incorporate mechanical ventilation if necessary which can provide variable cooling capacity to meet a range of temperature conditions. Green infrastructure (landscaping) to reduce urban heat island temperatures.
Decline in water resource supply or quality caused by drought	Low likelihood	Mild	Likely	Mild	Low risk	Southern Water has an obligation to have 25-year plan for customer supplies. SuDS and water efficiency measures to be incorporated in Proposed Development.
Structural damage caused by extreme storm and wind events	Low likelihood	Medium	Low likelihood	Medium	Moderate/low risk	Building Regulations for structural design with safety margin.
Disruption to road network surrounding Site caused by extreme storm events	Low likelihood	Mild	Low likelihood	Mild	Low risk	Proposed Development is not at a remote location and multiple access points to the Site exist.

	Medium Term (2030-2059)		Long Term (2070-2099)			
Hazard	**Probability of risk occurring**	**Consequence of risk occurring**	**Probability of risk occurring**	**Consequence of risk occurring**	**Risk rating (highest)**	**Mitigation**
Shrinking and swelling of soils due to excessive rainfall and drought cycles, leading to subsidence. Mainly affects clay soils.	Unlikely	Medium	Low likelihood	Medium	Moderate/low risk	Appropriate geotechnical investigation and design prior to construction. Compliance with Building Regulations for structural design.
Heat stress to building structures, fixtures and fittings from high temperatures can lead to expansion and buckling.	Low likelihood	Medium	Low likelihood	Medium	Moderate/low risk	Building regulations for structural design.
Building fabric damage due to condensation/mould from increased rainfall and humidity	Unlikely	Mild	Low likelihood	Mild	Low risk	Mechanical ventilation system to be installed where applicable to prevent condensation/mould accumulation.
Increase in cooling demand from hotter summers leading to increase in fuel poverty of residents	Low likelihood	Minor	Likely	Minor	Low risk	Incorporation of renewable energy (solar PV for example) in Proposed Development design to reduce the cost of cooling.
High external temperatures may reduce indoor air quality due to changes in behaviours such as patterns of window opening	Unlikely	Mild	Low likelihood	Mild	Low risk	Ventilation strategy to incorporate mechanical ventilation if necessary so as to not rely solely on open windows for cooling.
Landscaping/habitat failure or increased watering or maintenance requirements	Low likelihood	Minor	Likely	Minor	Low risk	Landscaping design to include climate-resilient species that can adapt to the changing climate.

Summary and Conclusions

10.4.2 The main risks identified in Table 10.6 are those associated with extreme weather events and summer heatwave conditions. Short-term extreme weather events, and the long-term climate trend of increased peak summer temperatures, could therefore present a risk to the Proposed Development. However, these risks are capable of being influenced or mitigated through design.

10.4.3 Increased summer temperatures, or summer heatwave conditions, may affect the thermal comfort of occupants of both the residential and non-residential elements of the Proposed Development. This can be mitigated through building fabric and ventilation design, preliminary details of which are further discussed in the Climate Change Statement accompanying the planning application. For Building Regulations compliance, it is expected that an overheating assessment and appropriate design responses will be detailed as part of future Reserved Matters applications.

10.4.4 Furthermore, any significant decrease in annual or dry season summer rainfall could exacerbate water stress in the region. The water supply company has an obligation to plan for resilience, including taking into account the effects of climate change. Additionally, water demand can be influenced through choice of fittings, rainwater harvesting and landscaping/SuDS design. Water demand management is discussed in the Climate Change Statement accompanying the planning application.

10.4.5 Although the degree of climatic change during the construction period (from 2027 to completion in 2042) are likely to be lesser than the operational period studied, there is also potential for health and safety risks to the construction workforce (e.g. in heatwave conditions) or risk of programme disruption (e.g. due to prolonged heavy rainfall). However, it is considered that near-term climatic changes are likely remain similar to present-day weather extremes, which are routinely planned for and managed by construction contractors.

10.4.6 Overall, it is considered that the significant risks screened in Table 10.6 do not represent new or unexpected issues, and that good practice for the design of the Proposed Development would mitigate against the likelihood of significant adverse effects, thereby reducing the effect to a non-significant level.