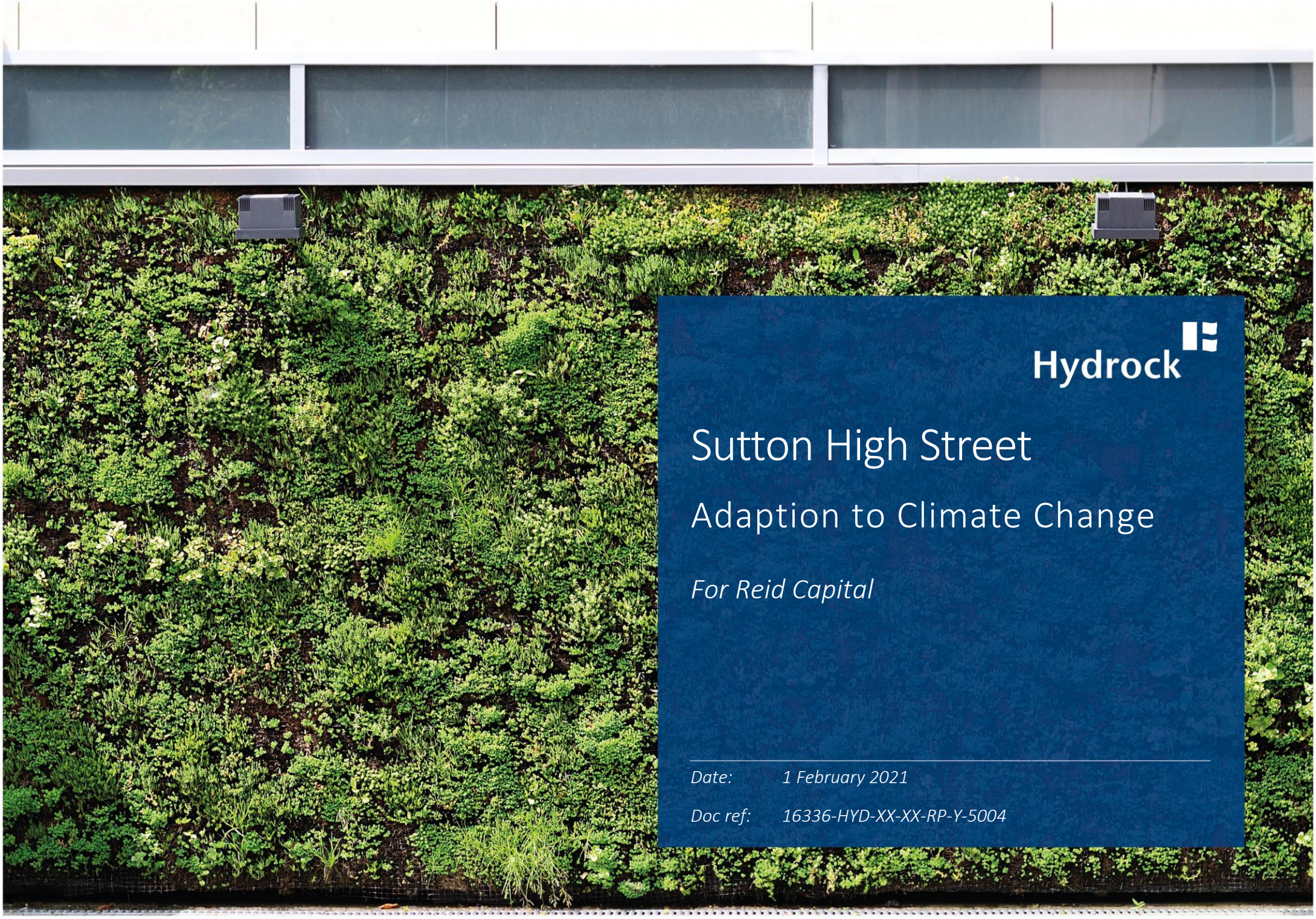

Hydrock

Sutton High Street

Adaption to Climate Change

For Reid Capital

Date: *1 February 2021*

Doc ref: *16336-HYD-XX-XX-RP-Y-5004*

DOCUMENT CONTROL SHEET

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Introduction

1. SITE CONTEXT

Sutton High Street is approximately 11 miles south of London. The site is currently a three-storey building with a small Argos store at ground level. Sutton High Street is pedestrianised and within walking distance to a number of key transport links into London. The site itself is bounded by Sutton High Street to the east, the ASDA superstore to the north, and existing high street buildings to the south. There is a new development under construction to the southwest of the proposed development.

2. DEVELOPMENT DETAILS

The proposed development includes 36 no. units with a mix of one- and two-bedroom apartments. The development is split across 9 storeys plus a basement, with a communal roof garden at fourth floor level. The ground floor proposals consist of a single A1/A3 use commercial unit, and apartment concierge spaces.

The building is proposed to be steel frame construction, with a concrete core and flat slabs. The foundations are piled throughout and the façade consists of a variety of brickwork and cladding types. The windows will be aluminium framed.

3. PURPOSE OF REPORT

This study aims to identify potential hazards due to the long-term effects of climate change that are likely to occur during the lifespan of the building and proposes mitigation measures that have been adopted in the design at RIBA Stage 2.

This study is based on a qualitative risk assessment using a standard probability matrix.

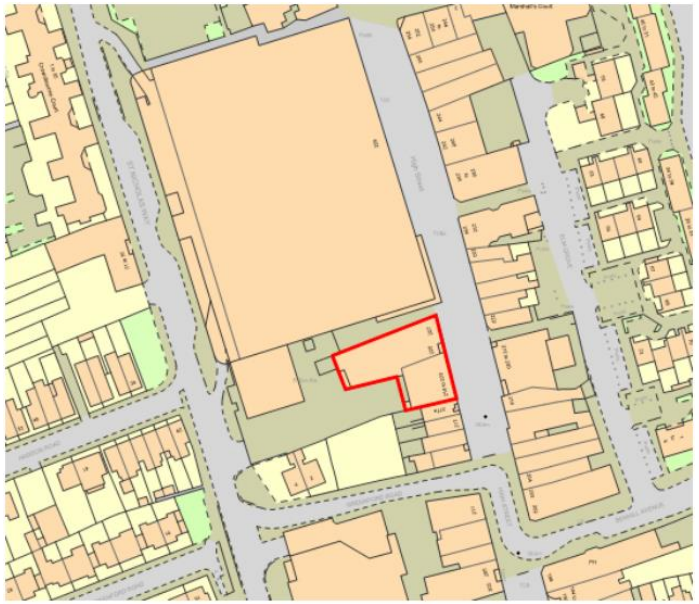

Figure 1 - Site location plan

Hazard Identification

The main building elements that would be affected by changing climate have been identified. These elements are classified under the following four main categories:

- Foundations
- Structural frame
- Façade and cladding
- Roof

Some of the hazards and risks presented within the BREEAM technical guidance have not been assessed in detail as these are not relevant to the project.

4. FOUNDATIONS

One of the potential effects of climate change is the concentration of precipitation into less frequent but higher intensity rainfall events. Summers are projected to be hotter and drier whilst winters become colder on average with more concentrated rainfall. This will likely have a considerable effect on the water content of the soil and affect shallow foundations because of shrinkage and expansion.

Piled foundations are proposed throughout the site, the integrity of these are dependent on the subsurface geology of the site rather than surface soil factors. Any retaining walls and ground floor slabs will be designed to withstand the anticipated water pressures caused by intense rainfall events. Extreme weather events are unlikely to affect the proposed foundations.

5. STRUCTURAL FRAME

As mentioned above, it is predicted that climate change will cause warmer summers and colder winters, and in general more extreme weather events including potentially increased wind speeds.

To combat the more extreme weather conditions, the project will be steel framed construction with concrete cores. Steel does expand and contract with heat, but this expansion is accounted for within the frame design. The structure is fully internal within the thermal envelope so the overall effect of expansion and contraction will be minimal. This will also provide protection from the increased rainfall events, acid rain and increased wind speeds. This overall impact of the effects of climate change on the steel frame will be minimal.

6. FAÇADE AND CLADDING

The building is proposed to have a brick façade to reflect the design of the surrounding buildings. Bricks can be subject to weathering during intense rain and wind events, these events are likely to become more frequent with the changing climate.

One of the most damaging processes to external brick is the effect of freeze-thaw weathering. This can cause significant damage to brickwork over the life of the building, this is not deemed to be a significant problem in terms of adaptation to climate change.

7. ROOF

Roofs are proposed to be a mix of flat roofs over concrete slabs, and pitched roofs. The flat roof will also be used as communal amenity for the apartments, this will include a variety of soft landscaping. The flat roof has been designed with a fall to stop the ponding of water that could be expected in intense rainfall events. Some rainwater storage will be provided on the flat roof for irrigation purposes. The planting strategy and rainwater storage will allow the roof to cope better with sudden, intense rainfall events associated with climate change.

Hazard Assessment

Item	Cause	Hazard Description
Foundations		
1.1	Drafts	Loss of soil moisture resulting in subsidence (soil shrinkage), cracks etc.
1.2	Extreme precipitation	Deeper penetration of moisture in a façade, affecting hygric expansion with accompanying stresses. Deeper penetration may, especially by small dimensions, result in water seepage through walls.
1.3	Extreme precipitation	Soil Stability impacted due to extreme precipitation - increase of loading to retaining walls
1.4	Extreme temperature	Liquid in pipes freezing resulting in pipe damage, leaks and associated building damage
1.5	Extreme precipitation	Pluvial Flood risk.
1.6	Extreme precipitation	Tidal water flooding risk.
1.7	Extreme precipitation	Surface water flooding
Structural Frame		
2.1	Changes to wind speed - high speed winds)	Increase of wind load to building causing overstressing of stability elements.
Façade and cladding		
3.1	Changes to thermal action - Temperature increase, hotter summers	Glazing and façade tolerances not allowing for movement causing stress in façade fixings
3.2	Changes to thermal action - Temperature decrease, colder winter	Interstitial condensation occurring between the layers of the building envelope leading to mould, damp, corrosion of fabric, poor performance of insulation.
3.3	UV Damage	To cladding materials, seals etc.
3.4	Wind loading	Wind lifting materials / buffeting and reducing strength / design life. Wind affecting glazed panels.
3.5	Maintenance (dust, cleaning)	Exposure to greater levels of air pollution. Abrasive material causing damage to finishes
3.6	Extreme temperature (Heat)	Material melting (i.e. building membranes.
3.7	Extreme temperature (Cold)	Material cracking, freeze thaw action and effects on pipes.
3.8	Extreme precipitation	Deeper penetration of moisture in a façade, affecting hygric expansion with accompanying stresses. Deeper penetration may, especially by small dimensions, result in water seepage through walls.

Item	Cause	Hazard Description
Roof		
4.1	Extreme temperature / precipitation	Structural loading issues from heavy snow, causing building damage or roof collapse.
4.2	Extreme precipitation	Ponding / loading on roof. Persistent ponding of water reducing design life of roof components such as membranes, seams and potentially structure. Eventually could result in leaks.
4.3	Extreme precipitation	Increased precipitation increasing surface water drainage loading.

Risk Estimation

The appraisal is based on a qualitative risk assessment by a standard probability / harm matrix as shown below. The risk is evaluated along two axes, one being the scale of probability, or the occurrence of the hazard and the other being the scale of harm that is caused by the hazard. This matrix is shown in the table below.

Table 1 - Risk matrix

Harm	Probability				
	Negligible	Remote	Occasional	Probable	Frequent
Very Serious	Low	Medium	Medium high	High	High
Serious	Low	Medium	Medium high	Medium high	High
Significant	Low	Low	Medium	Medium	Medium high
Marginal	Negligible	Low	Low	Low	Medium
Negligible	Negligible	Negligible	Negligible	Negligible	Low

Risk Evaluation and Mitigation

Item	Cause	Hazard Description	Risk Estimation	Risk Evaluation			Action to Mitigate	Residual Risk		
				Harm	Probability	Risk		Harm	Probability	Risk
Foundations										
1.1	Draughts	Loss of soil moisture resulting in subsidence (soil shrinkage), cracks etc.	Building is in an urban area with little percolation into soil	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
1.2	Extreme precipitation	Deeper penetration of moisture in a façade, affecting hygric expansion with accompanying stresses. Deeper penetration may, especially by small dimensions, result in water seepage through walls.	Building not significantly affected by water table level. Building is in an urban area with little percolation into soil.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
1.3	Extreme precipitation	Soil Stability impacted due to extreme precipitation - increase of loading to retaining walls	Building not significantly affected by water table level. Building is in an urban area with little percolation into soil.	Significant	Negligible	Low	N/A	Significant	Negligible	Low

Item	Cause	Hazard Description	Risk Estimation	Risk Evaluation			Action to Mitigate	Residual Risk		
				Harm	Probability	Risk		Harm	Probability	Risk
Foundations										
1.4	Extreme temperature	Liquid in pipes freezing resulting in pipe damage, leaks and associated building damage	Mitigation measures required.	Significant	Negligible	Medium	Sufficient levels of insulation to all exposed pipework and protection from external elements. Ensure all new below ground drainage adequately insulated or located sufficiently deep to avoid risk of freezing	Marginal	Remote	Low
1.5	Extreme precipitation	Pluvial Flood risk.	Site is in an area of Low Risk of surface water flooding.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
1.6	Extreme precipitation	Tidal water flooding risk.	No tidal sources located within site vicinity.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
1.7	Extreme precipitation	Surface water flooding	Site is in an area of Low Risk of surface water flooding.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
Structural Frame										
2.1	Changes to wind speed - high speed winds)	Increase of wind load to building causing overstressing of stability elements.	No evidence of changes to design wind speeds in UKCP18 data. Low Risk. Development has been designed in accordance with BS EN 1991 to determine the applied wind loading based on location and elevation	Significant	Negligible	Low	N/A	Significant	Negligible	Low

Item	Cause	Hazard Description	Risk Estimation	Risk Evaluation			Action to Mitigate	Residual Risk		
				Harm	Probability	Risk		Harm	Probability	Risk
Façade and cladding										
3.1	Changes to thermal action - Temperature increase, hotter summers	Glazing and façade tolerances not allowing for movement causing stress in façade fixings	Steel frame façade construction tolerances allow for thermal movement of panels without jamming.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
3.2	Changes to thermal action - Temperature decrease, colder winter	Interstitial condensation occurring between the layers of the building envelope leading to mould, damp, corrosion of fabric, poor performance of insulation.	Wall buildup includes vapour control layers to prevent vapour entering insulating materials.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
3.3	UV Damage	To cladding materials, seals etc.	Brick and concrete façade panels are resilient to UV damage, metal window frame finishes to be UV resistant.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
3.4	Wind loading	Wind lifting materials / buffeting and reducing strength / design life. Wind affecting glazed panels.	No evidence of changes to design wind speeds in UKCP18 data. Brick and cladding are resilient to high winds.	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible

Item	Cause	Hazard Description	Risk Estimation	Risk Evaluation			Action to Mitigate	Residual Risk		
				Harm	Probability	Risk		Harm	Probability	Risk
Façade and cladding										
3.5	Maintenance (dust, cleaning)	Exposure to greater levels of air pollution. Abrasive material causing damage to finishes	Concrete and brick surfaces prone to carbonation.	Significant	Occasional	Medium	Periodic cleaning to exterior may be required	Significant	Negligible	Low
3.6	Extreme temperature (Heat)	Material melting (i.e. building membranes.	No thermoplastics or other low melting point materials are used on the façade	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
3.7	Extreme temperature (Cold)	Material cracking, freeze thaw action and effects on pipes.	Mitigation measures required.	Significant	Occasional	Medium	Sufficient levels of insulation to all exposed pipework. Reduce area that have potential for freeze thaw action to take place	Marginal	Remote	Low
3.8	Extreme precipitation	Deeper penetration of moisture in a façade, affecting hygric expansion with accompanying stresses. Deeper penetration may, especially by small dimensions, result in water seepage through walls.	Façade is made from bricks which have a low porosity value	Marginal	Negligible	Negligible	N/A	Marginal	Negligible	Negligible
Roof										
4.1	Extreme temperature / precipitation	Structural loading issues from heavy snow, causing building damage or roof collapse.	Mitigation measures required.	Significant	Occasional	Medium	Design in a robust tolerance for loading into the design of the roof structure. i.e. appropriate snow loading. The roof loading has been designed in accordance with BS EN 1991.	Marginal	Occasional	Low

Item	Cause	Hazard Description	Risk Estimation	Risk Evaluation			Action to Mitigate	Residual Risk		
				Harm	Probability	Risk		Harm	Probability	Risk
4.2	Extreme precipitation	Ponding / loading on roof. Persistent ponding of water reducing design life of roof components such as membranes, seams and potentially structure. Eventually could result in leaks.	Mitigation measures required.	Significant	Occasional	Medium	Adequately robost roof design with falls leading to drainage points	Marginal	Occasional	Low
4.3	Extreme precipitation	Increased precipitation increasing surface water drainage loading.	Surface water drainage feeding into existing drainage system. Mitigation measures required.	Significant	Occasional	Medium	Underground drainage network and attenuation has been designed to achieve no flooding for a 1 in 100 year return period plus 40% for climate change. External Levels design should be designed to direct exceedance flood flows away from buildings and critical infrastructure to prevent damage.	Marginal	Occasional	Low