ARUP

File Note

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1-2 Stephen Street: Cooling Hierarchy Compliance Statement

This Statement has been prepared in support of proposals for replacement and new plant at 1-2 Stephen Street, in which an existing building is being provided with replacement plant items. The building is to remain fully operational throughout the plant replacement and the design, fabric and configuration of the building is to remain unchanged. The landlord has a contractual obligation to maintain heating, cooling and ventilation to existing tenants and the existing chillers are at the end of their working life. This provides an opportunity to replace these chillers with new high efficiency ASHPs, which provide heating and cooling to the building. This Statement has been prepared with input from Arup who are providing services advice on the project.

1. Cooling Hierarchy

1.1 London Plan

Policy SI 4 - Managing Heat Risk

Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.

Minimise internal heat generation through energy efficient design.

- Manage the heat within the building through exposed internal thermal mass and high ceilings Provide passive ventilation.
- Provide mechanical ventilation.
- Provide active cooling systems.

The policy requires that passive ventilation should be prioritised, taking into account external noise and air quality in determining the most appropriate solution. The increased use of air conditioning systems is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. If active cooling systems, such as air conditioning systems, are unavoidable, these should be designed to reuse the waste heat they produce.

1.2 Camden Council

The Local Plan states that:

- Active cooling (air conditioning) will only be permitted where its need is demonstrated and the steps in the cooling hierarchy are followed (Local Plan policy CC2).
- Development is expected to reduce overheating risk through following the steps in the cooling hierarchy. All new development should submit a statement demonstrating how the cooling hierarchy has been followed (Local Plan policy CC2).
- All developments should seek opportunities to make a positive contribution to green space provision or greening.

Cooling hierarchy

All developments should follow the cooling hierarchy outlined below, to reduce the risk of overheating and subsequent reliance on active cooling:

1. Minimise internal heat generation through energy efficient design, considering the following:
    - Layout and uses: locate any spaces that need to be kept cool or that generate heat on cooler sides of developments.
    - Reducing heat gains e.g. including low energy lighting.
    - Seal/ insulate heat generating processes.
    - Reduce the distance heat needs to travel and insulate pipework.
    - Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.
    - Consider evaporation cooling which cools air through the evaporation of water.
    - Consider ‘free cooling’ or ‘night cooling’, which uses the cooling capacity of ambient air to directly cool the space.

2. Reduce the amount of heat entering a building in summer:
    - Consider the angle of the sun and optimum daylight and solar gain balance.

- Orientate and recess windows and openings to avoid excessive solar gain.
- Consider low g-values and the proportion, size and location of windows.
- Make use of shadowing from other buildings.
- Include adequate insulation.
- Design in shading: e.g. include internal courtyards, large shade-providing trees and vegetation, balconies, louvers, internal or external blinds, and shutters.
- Make use of the albedo effect (use light coloured or reflective materials to reflect the sun's rays).
- Include green infrastructure e.g. green wall, green/blue roofs and landscaping, to regulate temperatures.
- Reduce the amount of heat entering a building in summer.

3. Manage the heat within the building through exposed internal thermal mass and high ceilings.

4. Passive ventilation:
   - Natural ventilation, openable windows, the 'stack effect' system.
   - Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.
   - Consider evaporation cooling which cools air through the evaporation of water.
   - Consider 'free cooling' or 'night cooling' which uses the cooling capacity of ambient air to directly cool the space.

5. Mechanical ventilation:
   - Ensuring the most efficient system possible.
   - Consider mechanical ventilation with heat recovery.

6. Active cooling:
   - Ensuring they are the lowest carbon options.
   - Ground Source Heat Pumps and Air Source Heat Pumps can be used in reverse to provide cooling to buildings.
   - Water based cooling systems also reduce the need for air conditioning by running cold water through pipes in the floor and/or ceiling to cool the air.

2. Stephen Street Design Compliance

The objective of this section is to demonstrate compliance of the proposed works for new plant equipment at Stephen Street with the policies presented above.

Air Source Heat Pumps - The existing building uses 4 no. air cooled chillers for space cooling and gas boilers for space heating. The proposed works involve removing the chillers and boilers and replacing these with 4 no. air-to-water air source heat pumps to provide space heating and cooling.

IT Room Cooling Condensers – The existing building has 7 no. critical cooling DX condensers that provide 24/7 cooling for IT server rooms on levels 8 to 10 below. These units provide cooling to only the IT server rooms. The existing DX condensers need to be relocated to suit the new plant layout as a requirement of the phasing.

The table below summarises the cooling and heating strategy in the building:

Design	Space heating	Space cooling	IT Room cooling
Current	Gas boilers	Chillers	DX Condensers
Proposed	ASHP	ASHP	DX Condensers (relocated)

2.1 Cooling Hierarchy – Design Principles

The need for space heating and cooling in the building has been proven in previous planning applications when original chillers and boilers were installed. The need for heating and cooling has been reviewed and deemed necessary as the building layout and design remains unchanged.

The following is a summary of the passive design features historically applied to the building with the aim to minimise the need for cooling.

- Due to the site layout, the building has significant areas exposed to southern orientations and solar gains throughout.
- The application proposals relate to an existing building within the Conservation Area and opportunities to alter the levels of glazing to the building are minimal and would significantly increase the disruption and embodied carbon of the project.
- In the existing building there are no openable windows, and a deep floor plate, as such no scope for natural ventilation. Facade changes aren't proposed as part of the project. Elsewhere in the building minor changes to facade louvres are proposed but don't change need for cooling. Therefore, energy efficient air conditioning will be considered.
- The existing chillers in the building are at the end of their working life (installed 2009), these require replacing.
- The use of internal blinds will be included to reduce the effects of solar gains and heat transmission through the facade.

- LED lighting and energy efficient services will be specified reducing the internal heat gains within the spaces.
- The implementation of the above energy improvements and the reduction in tenant electrical loads due to more efficient tenant equipment will reduce the existing cooling load within the building.
- The cooling demand in the application is therefore less than the existing installed capacity. High efficiency air source heat pumps will use less energy to cool the building than the original design.
- IT rooms working on a business critical setup require constant cooling which will be provided by existing high efficiency DX condenser units (relocated).

In order to maintain adequate comfort levels, acoustics and indoor air quality, all the spaces within the buildings are intended to be comfort cooled using a new high efficiency air source heat pump system which will replace the existing inefficient chiller. Internal operating temperature ranges will be from 22-25°C as per CIBSE guidance. New ASHPs will be a combination of simultaneous and reversible air to water heat pumps and use R32 and R513a refrigerants.

The new ASHPs will arrive on site in April 2024 and be commissioned between April and October 2024. The ASHPs will provide the entire landlord load in the building, and the majority of the tenant load.

During this commissioning period, one original chiller will remain in place to provide a portion of the cooling in the building for 1 existing tenant. This chiller will be removed before May 2025.

ASHPs will also provide heating to the building system after October 2024 in combination with existing gas boilers (located on level 11). The gas boilers are required to serve 1 existing tenant who is expected to vacate the building in 2029. This is when the gas boilers will be removed from the building.

3. Conclusion

As the project is replacing central plant – the need for heating and cooling in the building remains unchanged. ASHPs will be provided to replace existing chillers and boilers to meet this need.

The Cooling Hierarchy has been fully considered and all appropriate passive measures have been implemented to reduce the cooling demand before consideration has been given to energy efficient air conditioning.

Given the location of the building and in order to maintain adequate comfort levels, acoustics and indoor air quality, all the spaces within the buildings are intended to be comfort cooled to offset remaining heat gains using highly efficient CHW system.