MEP SERVICES
STAGE 3 REPORT

MECHANICAL, ELECTRICAL AND PUBLIC HEALTH SERVICES AT

8 Lincoln's Inn Fields

ON BEHALF OF

MKSPAMP Group Limited

Date June 2024

Ref: 22037-APC-ZZ-XX-RP-MEP-0002

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EXECUTIVE SUMMARY

This Stage 3 report follows from A Plus' Feasibility Report and the associated decisions taken by the client and provides an outline of the scope of works and design criteria proposals for the mechanical, electrical, and public health works at 8 Lincoln's Inn Fields, London. The aim of the study was to develop a fit for purpose strategy for the scheme's MEP services and energy performance, taking into consideration the Client's objectives, aspiration, priorities (i.e., disengagement from fossil fuels, reduction of carbon footprint, resilience, future proofing), and construction and operation constraints of the asset.

Firstly, carbon reductions are sought through passive measures and in the form of reducing the building's heat losses (base load) by improving the building fabric and insulation as well as reducing the building's energy consumption. The improvements on insulation and glazing are detailed in the Architectural proposals for the scheme. Based on the reduced base load a number of different technologies were assessed and compared. A long list of technologies was filtered down to options that would be viable for 8 Lincoln's Inn Fields. The client has expressed a strong desire to make the new proposals as sustainable as possible and design out the requirement for using fossil fuels on site and therefore the proposed all-electric solutions include for Air Source Heat Pump Chiller and Variable Refrigerant Flow systems.

It was established that the chiller heat pump option would offer the greatest energy savings and consequently the lower running costs and CO_2 emissions through the economic service of the system. It would however require more plant and distribution space. The size of the external plant would be significantly larger and could be challenging in structural and planning terms. The centralised nature of the solution would reduce the system's resilience (number of potential single points of failure) and would be challenging to separate/split different demises in the future, if required.

The VRF solutions examined would also offer significant energy savings with the equipment's efficiencies being slightly higher than that of the heat pump. The VRF would necessitate the inclusion of auxiliary electric heating solutions that offer inferior efficiencies to heat pumps to accommodate the heating provisions (in the non-office areas) and hot water generation.

This report establishes the design strategy for the MEP related installations and summarises the design work carried out to date. It also identifies the fundamentals on which the design has been based and sets out the design work to be carried out in conjunction with the rest of the design team during the next stage of the design (Stage 4).The report mainly outlines the following:

- Providing an outline scope for the MEP services element of the works.
- Setting out the design and commissioning criteria the MEP services will achieve.
- Providing information for other members of the design team.
- Forming the basis for the MEP services detailed design.
- Informing the cost consultant's budget estimates.

UTILITIES

The water supply and meter serving the building are in poor condition and need to be upgraded. Therefore, an application will be made to Thames Water for the updating of the mains water supply. The new pipework will be located on the Lower Ground (LG) floor and in the basement plant room.

The building's electrical supply, currently coming from a dedicated three-phase power supply from the UKPN low-voltage electricity network, may require an upgrade following the initial load assessment of the new design. Ongoing discussions with UKPN aim to clarify the current supply capacity and any requirement for an upgrade.

The building is supplied with a dedicated fibre connection from the local network for data. The Client's IT specialist will investigate the existing connection to ensure it meets the Client's requirements.

MECHANICAL

In conjunction with the rest of the design team, an outline strategy for the services of heating, cooling, ventilation, domestic water, and drainage requirements has been developed. The proposals include for:

- New VRF units for each level to provide heating and cooling to the allocated spaces.
- Various ventilation units to serve the office areas, showers, WCs and back of house. Currently two options are being considered. The results of the flues' surveys will inform the next stage of the design on the viability of utilising the existing flues as ventilation distribution routes.
- Public health services provisions for the showers, WCs blocks and back of house areas.

ELECTRICAL

In conjunction with the rest of the team, an outline strategy for the electrical distribution, small power, data, security, access control, and fire alarm has been developed. The proposals include for:

- The electrical design allows for a new distribution board to be located on the Ground floor to serve all levels via an existing riser opening to supply the small power outlets, lighting, and mechanical equipment.
- New energy efficient LED lighting throughout.
- The IT/data infrastructure will be developed and coordinated with the Client's IT specialist, while the security and access control proposal will be confirmed with the client prior to the system being developed further.

1 INTRODUCTION

1.1 BRIEF

8 Lincoln's Inn Fields is located in the Holborn area which itself is within the London Borough of Camden. The building is located on the north side of the Fields and is described in the listing description as an early C18th town house with C19th additions and alterations. Much historic fabric survives in the front part of the house before further conversion and modernisation took place in the later C20th. The property is Listed Grade II and consists of 5 floors, inclusive of lower ground and ground levels. The building was used as office accommodation up until it was acquired by MKSPAMP Group Limited.

The proposed conversion consists of office spaces, a flat roof on the first floor, and back-of-house areas.

A Plus Consulting was instructed by MKS PAMP Group Limited to undertake the design, based on GQA's proposed layouts.

The report outlines the scope of works and design criteria for the mechanical, electrical, and public health works. The aim is to develop and confirm the Client's brief, record the basis of the design, provide information for the other members of the design team, and establish the basis of design for the MEP services specification and drawings.

The report also identifies key assumptions, design development requirements, compliance with sustainability and budget targets, design risks, and client decisions for the project.

This document is divided into a description of the brief, design criteria, sustainability and environmental considerations, updates on utilities strategies and quotations, the MEP services scope of works, and appendices, which include indicative layouts of the proposed systems and equipment.

The initial mechanical and electrical layouts, with an indicative distribution strategy identifying the major services routes and risers, can be found in the appendices section of this report.

Following the review and comments on this report and supporting documentation by the Client and the rest of the design team, we expect to arrive at a final approved Stage 3 design scheme. This will form the basis for the next stage of the design (Stage 4) to be developed.

1.2 INFORMATION

During our surveys we did not find any record information relating to the existing MEP services installations. There are no other record or as-built drawings identifying the different services and routes. Similarly, there are no Operation & Maintenance manuals available or a User's Guide to identify the different systems and/or controls. A series of investigation works have been recommended by A Plus and the rest of the professional team to identify existing routes and confirm a number of assumptions made during the initial surveys.

1.3 DESIGN CRITERIA

The MEP services for the proposed scheme will be designed and installed to achieve the design criteria set out below and will be in accordance with the recommendations of the following:

1. A Plus' Feasibility Study (22037.7 Feasibility)
2. A Plus' Stage 2 Report (22037-APC-ZZ-XX-RP-MEP-0001)
3. GQA Architects 9821 - Stage 2-3 Proposals PLBC
4. CIBSE and SLL Guides
5. BCO Guidelines
6. Statutory undertakings
7. Health and Safety Executive (HSE) Guidance and all relevant legislation
8. CDM regulations
9. Pressure system safety regulations
10. Relevant British Standards

1.3.1 EXTERNAL AMBIENT

Summer – 35°C dry bulb / 20°C wet bulb
Winter – -4°C saturated
External design conditions for thermal load calculations and plant sizing will be determined in accordance with CBSE Guide, Section A2, Weather and Solar Data.

External plant to be suitable for operation in external ambient conditions of 35°C dry bulb 50% RH. Humidity can be expected to be in the range of 30% to 70%

1.3.2 INTERNAL CONDITIONS

Room	Winter	Summer
Open Plan Office Space	21ºC minimum	22ºC + 2ºC maximum
Meeting Rooms	21ºC minimum	22ºC + 2ºC maximum
WCs	19°C ±2°C	Uncontrolled Note 1
Showers	20°C ±2°C	Uncontrolled Note 1
Circulation Spaces	18°C ±2°C	Uncontrolled Note 1
Break Out	20ºC minimum	22ºC + 2ºC maximum
Reception	21°C ±2°C	23°C ±2°C
Stores	18°C ±2°C	Uncontrolled
Plant Rooms	18°C ±2°C	Uncontrolled

1.3.3 VENTILATION

The following typical extract ventilation rates are proposed in accordance with Building Regulations Approved Document F:

Room	Ventilation Rate
Open Plan Office Space	12 litres/person
Meeting Rooms	10 litres/person
WCs	8 air changes per hour (min)
Showers	8 air changes per hour (min)
Circulation Spaces	Natural Ventilation
Break Out	10 litres/person
Reception	12 litres/person
Stores	2 air changes per hour
Plant Rooms	2 air changes per hour

1.3.4 NOISE CRITERIA

Room	Noise Criteria
Open Plan Office Space	NR38
Meeting Rooms	NR35
Break Out	NR38
Reception	NR38

1.3.5 OCCUPANCY

Room	Occupancy Rate
Open Plan Office Space	As per Architectural Layouts (TBC), currently allowed for 30 occupants in total

1.3.6 OCCUPANT HEAT GAINS

Sensible	75 W/person
Latent	55 W/person

1.3.7 EQUIPMENT HEAT GAINS

Room	Design Criteria
Open Plan Office Space	15 W/m²

1.3.8 LIGHTING HEAT GAINS

Room	Design Criteria
Open Plan Office Space	8 W/m²

1.3.9 LIGHTING

The design illuminance levels refer to the levels required as an average value and generally exclude a perimeter zone of 0.5m within each space.

The following table provides an overview of the lighting levels to be provided at finished floor level, unless indicated otherwise.

Room	Average Maintained Illuminance Levels (lux)
Office Space/ Meeting Rooms	300 (General) 500 (Desk level)
WCs	150
Circulation Spaces	100
Reception	300
Stores	100
Plant Rooms	200

1.3.10 SMALL POWER

Room	
Office Space/ Meeting Rooms	15 W/m^2
General spaces including circulation spaces	8 – 10 W/m^2
Storage	5 W/m^2

1.3.11 FIRE ALARM

Room	Classification
Category of detection (BS 5839-1)	Category L1

1.3.12 THERMAL PERFORMANCE OF BUILDING STRUCTURES

Element	U-value
External Wall	2.13 W/m^2K
Roof	0.18 W/m^2K
Windows	2.0 W/m^2K

1.3.13 PUBLIC HEALTH DESIGN CRITERIA

Domestic Water Services

The systems shall be set up to provide the following conditions at point of control:

Water Pressure

Hot and cold-water pressure at taps and appliances: Minimum 1 bar, maximum 3 bar balanced.

Domestic Hot Water

Supply Temperature:	60°C
Thermostatic mixing valve setting at basins:	41°C
Pressure drop:	300P/m (maximum)
Velocity:	1.5 m/s (maximum)
Drainage:	All systems to be designed in line with BS EN 12056.

2 SUSTAINABILITY

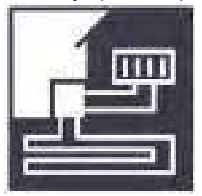
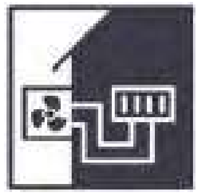
2.1 RENEWABLE & LOW CARBON ENERGY SYSTEMS – LONG LIST

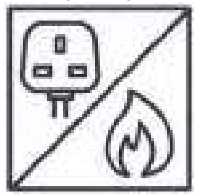
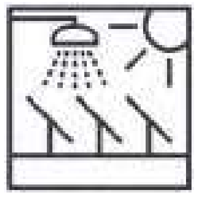
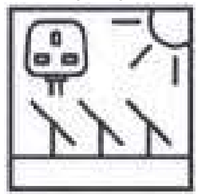
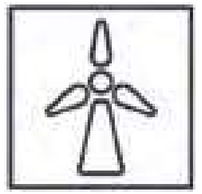
Various renewable and low carbon technologies have been considered. Renewable energy, refers to energy that comes from natural sources or processes that are constantly replenished, including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat.

Currently the building at 8 Lincoln's Inn Field is served by:

- 2No condensing gas fired boiler serving radiators throughout the building.
- Dedicated heat pump units providing cooling to meeting rooms, board room and Comms room.

The most suitable solutions have been assessed. The table below outlines a number of renewable and low carbon technologies that have been considered for the site and identifies those which we consider to be technically and operationally viable.

Technology	Key Considerations	Technical viability
Biomass  Thermal energy	• Best suited for relatively continuous operation. • Requires a large plant room and fuel store. • Considered as nearly carbon neutral provided the fuel comes from a sustainable source. • Needs good access to site for fuel deliveries. • Works with traditional radiator heating systems. *Not recommended – an energy centre and large fuel store facility would need to be constructed. Site cannot provide that level of plant space.*	✘
Ground Source Heat Pump (GSHP)  Thermal energy	• Requires space for ground collector- with boreholes or horizontal trenches. • Heat pumps are most suitable for low temperature heating systems such as underfloor heating. • The capital cost of GSHPs is significantly higher that fossil-fuel boiler. • Greatest carbon savings when combined with renewable electricity-generating technologies. *Not recommended – a large area would be needed to accommodate the vertical boreholes. Horizontal trenches are not a viable option in an urban environment. Site cannot provide that level of plant space.*	✘
Air Source Heat Pump (ASHP)  Thermal energy	• Requires a suitable location for the external unit. • The noise generated by the external unit must be considered. • Efficiency and output greatly affected by external air temperatures. • Lower capital cost than GSHPs. • Poor efficiency when running at higher temperatures. *Viable in principle – Recommended for use in existing 'historic' buildings when heating system can be replaced with underfloor heating, fan coil units (FCUs)or similar, not ideal with existing radiators as efficiency likely to be poor. Larger radiators required when comparing to conventional fossil fuel systems. Location of external units to be considered and treated in terms of acoustics, aesthetics and planning.*	✓

Technology	Key Considerations	Technical viability
Combined Heat & Power (CHP)  Thermal and electrical energy	• CHP requires predictable and fairly constant electricity and heating loads for best performance. • CHP units are best suited for hotels, residential homes, student accommodation, hospitals, and schools. • The unit should be sized on heat demands, rather than electrical requirements - units are usually sized on the building's hot water load as this is continuous throughout the year. *Not recommended – Technology utilises gas and the client's intended pattern of use do not offer consistent electrical or hot water load.*	✘
Solar Thermal  Thermal energy	• Most effective in a south-facing position on an incline of 30-40 degrees. • Panel locations should be clear of obstructions and over shading. • Requires space for a hot water cylinder close to the collectors. • Most economically viable in buildings with a high hot water demand or where a building is not on the national gas grid. • Typically, only sized to cover 50-60% of hot water demand. *Not recommended – Restricted to hot water generation only. Very limited space on the roof and due to the nature of the building use (offices) limited hot water generation.*	✘
Photovoltaic (PV)  Electrical energy	• The position of the PV array will affect the energy generation and, consequently the carbon and financial savings. • PV panels may require cleaning to avoid a reduction in efficiency. • PV panels should be free from shading from adjacent buildings/trees. • Permission is required from the DNO (Distribution Network Operator) to connect the array to the grid (the cost of this grid connection is dependent on the size of the array and its location on the grid). *Viable in principle for generating electrical energy, however very limited space available for the panels. South facing sections of roof are limited and there will be planning considerations due to the site's locality. Large sections of the south facing sections of the roof and 1st floor flat roof will be shaded reducing the panels' output.*	✘
Wind  Electrical energy	• Rural areas are better suited than urban areas as the wind speeds are higher and less turbulent. • Pay-back periods are strongly dependent on wind conditions plus the length of cabling required to connect the turbine to the building. • Planning permission is required and is often a contentious issue. • Site-specific wind measurements required to predict performance accurately. *Not recommended - Planning would be very contentious, particularly on an urban environment and performance very uncertain without significant site monitoring beforehand.*	✘

Short List

The following systems have been identified as viable for a site-wide energy strategy:

- Air Source Heat Pump

The following sections outline how each technology could be implemented, and the predicted performance in terms of energy consumption and running costs.

2.2 RENEWABLE & LOW CARBON ENERGY SYSTEMS –ANALYSIS

We have estimated the energy demands of the existing building based on:

- Thermal model.
- Rule of thumb for space heating requirements for a building of this age.
- Hot water calculated on the basis of the number of occupants and typical daily consumption figures.
- Electrical consumption based on data for average UK buildings.

These estimates will be further refined as the project evolves and there will be an opportunity to produce detailed calculations based on more detailed thermal modelling and overall load assessments during the design stage.

2.2 AIR SOURCE HEAT PUMP (ASHP)

ASHP is considered a low carbon technology because electrically powered heat pumps and exchangers extract heat from outside air. ASHPs work by having an external evaporator unit with a fan linked to an internal condenser unit to release the heat. ASHPs come in a range of sizes, performances and designs and are sub-categorised into two different types:

1. Air-to-water systems transfer heat to a wet heating system. As ASHP's heat water to a lower temperature than a standard boiler system they are more suited to under floor heating systems.
2. Air-to-air systems produce warm air which is circulated by fans to heat the space. This requires an air distribution system within the building rather than conventional 'wet' heat emitters. A separate hot water supply is also required.

An ASHP will have a Coefficient of Performance typically around 2.7 - 3.2 due to the lower average temperature of outside air and greater variance across the year. Key considerations for ASHPs:

- There must be a suitable location to mount the external unit(s) to the building and planning permission may be required.
- The noise generated by the external unit must be considered as part of the design.
- ASHPs are most effective when providing space heating via systems designed to operate at lower temperatures of around 40°C- 50°C (underfloor heating, FCUs etc.).
- ASHPs are easier and cheaper to install and maintain.

Viability for 8 Lincoln's Inn Fields

Suitable space could be found on site for the external units (roof and LG lightwell). Noise and aesthetics would be a consideration and suitable noise treatment solutions can be developed in collaboration with GQA. The lower temperatures generated by the ASHP means the most efficient heat emitter type would be low temperature solutions like under floor heating and FCUs rather than traditional radiators. The capital cost is relatively low (when comparing with other heat pump solutions), and there are significant carbon savings. Three different solutions, utilising heat pump technology, have been considered:

- Air cooled heat pump chiller provides heating, cooling, and hot water.
- Variable Refrigerant Flow (VRF) system provides heating and cooling.
- Hybrid VRF system providing heating and cooling utilising water and reducing the amount of refrigerant used.

System 1

Consists of an air-cooled heat pump chiller which produces both low temperature hot water (LTHW) for space heating and domestic hot water generation as well as chilled water (CHW) for comfort cooling. Services are pumped throughout the building to serve FCUs on the floors which satisfy the space heating and comfort cooling demands. FCUs would floor mounted type and will generally be installed where the current radiators are located. The FCUs will be enclosed in dedicated boxing to be detailed and designed in conjunction with GQA. The non-office areas (circulation, WCs, etc) could be served by the heat pump and can include wet underfloor heating and/or radiators.

Domestic Hot Water (DHW) can also be generated by the heat pump with the option of electric coils to top up the hot water temperatures. The heat pump unit will be external and could be located at roof level or LG courtyard. This will need to be further investigated with GQA, during the next stage, in terms of planning implications, acoustic treatment requirements and access for maintenance. The system will also need additional plant space for the circulation pumps, buffer vessels, pressurisation units and water treatment. These can be located within the existing boiler/plantroom.

Advantages

- All heating and hot water requirements can be accommodated by the heat pump, eliminating the need for supplementary electric heating systems.
- Energy savings and consequently cost savings throughout the year due to their high efficiency.
- Reduced CO_2 emissions and carbon footprint.
- Improved EPC rating.
- Control of indoor units is more refined.
- Limited amount of refrigerant utilized and that is sealed within the external unit. Improved embodied carbon footprint and reduced Global warming potential for the asset.

Disadvantages

- Increased capital cost for the installation of the complete heat pump system.
- Reduced resilience due to the centralized nature of the solution. Numerous single points of failure.
- Increased riser, distribution, and plant space requirements.
- Increased maintenance requirements.
- The system does not offer easy separation between floors/demises for billing, maintenance, and management purposes, if the building's use and letting strategy was to be altered in the future.
- It requires separate BMS, although it is recommended to install a basic version.

System 2

Consists of VRF heating and cooling systems (one per floor) with external condensing units located at roof level and 1st floor flat roof. Refrigerant pipework distributed to each floor to serve FCUs to satisfy the heating and comfort cooling requirements (photos of condensing unit and indoor chassis unit). FCUs to be of the floor mounted type and will generally be installed where the current radiators are located. The FCUs will be enclosed in dedicated boxing to be detailed and designed in conjunction with GQA. The non-office areas (circulation, WCs, etc) will be served by dedicated electric heating systems, these can include electric underfloor heating and/or electric panels. DHW is to be generated by direct electric water heaters.

Advantages

- Historically the capital cost for the installation of VRF systems is marginally lower than that of the traditional four pipe system equivalent.
- The VRF system would provide heating and cooling without the need for central chiller or boiler plant. The reduction in central plant will 'free up' space for other uses.
- VRF systems can provide simultaneous heating and cooling, provide energy savings, and consequently cost savings throughout the year, particularly during the mid seasons (autumn and spring).
- Riser and plant space requirements are reduced compared to that of a traditional four pipe system.
- Offers better separation between floors/demises for billing, maintenance, and management purposes. For example, there can be a dedicated VRF system for each floor/demise depending on any future letting strategy.
- It does not require separate BMS, although it is recommended to install a basic version for the remainder of the systems,

Disadvantages

- The control of the indoor units' supply air temperature is not as refined as that of a four pipe FCU system.
- The phasing out of refrigerant could affect all VRF systems in the medium term.
- Additional electric heating systems will be required to serve the non-office areas (circulation, staircases, WCs etc.).
- Dedicated electric heating system to provide the hot water requirements.

- The system will include an increased level of refrigerant, adding to the asset's embodied carbon footprint and Global Warming potential.

System 3

Consists of VRF heating and cooling systems (either centralised or two separate systems) with external condensing units located at roof level and LG courtyard. Refrigerant pipework distributed to a control box on each floor. From the box LTHW or CHW is distributed within the floor to serve FCUs to satisfy the heating and comfort cooling requirements. FCUs would be of the floor mounted type and will generally be installed where the current radiators are located. The FCUs will be enclosed in dedicated boxing to be detailed and designed in conjunction with GQA. The non-office areas (circulation, WCs, etc) will be served by dedicated electric heating systems, these can include electric underfloor heating and/or electric panels. DHW is to be generated by direct electric water heaters.

Advantages

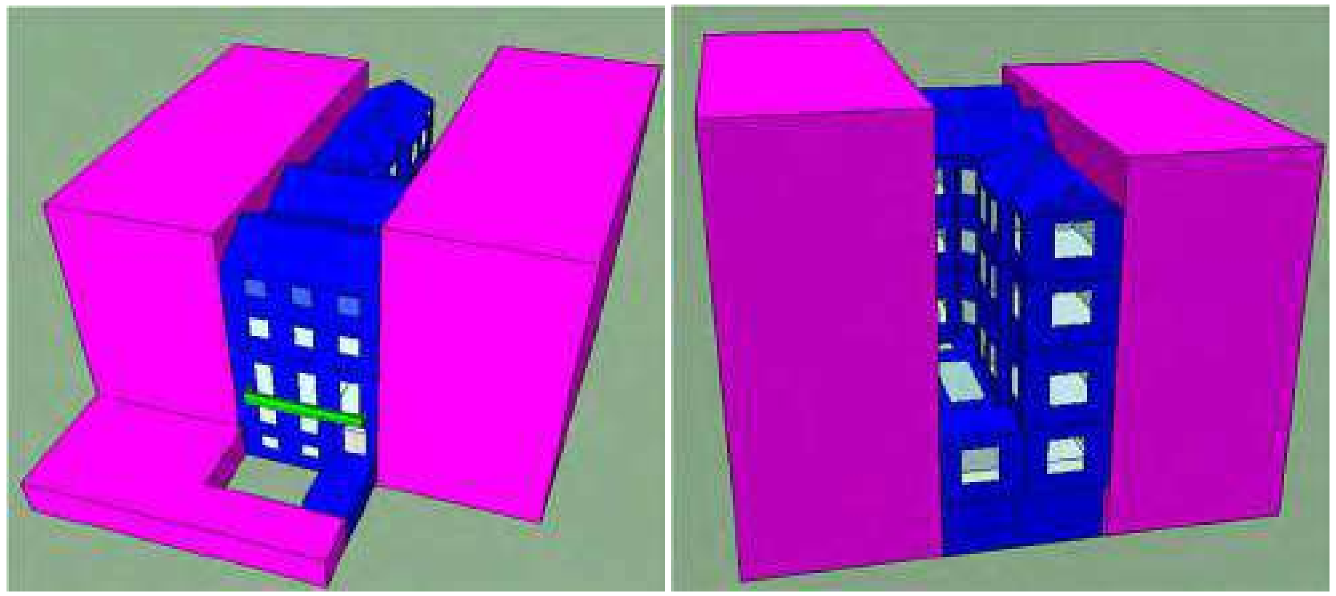
- Historically the capital cost for the installation of VRF systems is marginally lower than that of the traditional four pipe system equivalent.
- The VRF system would provide heating and cooling without the need for central chiller or boiler plant. The reduction in central plant will 'free up' space for other uses.
- VRF systems can provide simultaneous heating and cooling, provide energy savings, and consequently cost savings throughout the year, particularly during the mid seasons (autumn and spring).
- Riser and plant space requirements are reduced compared to that of a traditional four pipe system.
- Offers better separation between floors/demises for billing, maintenance, and management purposes. For example, there can be a dedicated VRF system for each floor/demise depending on any future letting strategy.
- It does not require separate BMS, although it is recommended to install a basic version for the remainder of the systems.
- This option provides a reduced level of refrigerant within the system reducing the asset's embodied carbon footprint and Global Warming potential.
- Reduces the requirement for the installation of refrigerant leak detection within the floors.

Disadvantages

- The refrigerant phasing out could affect all VRF systems in the long term.
- Additional electric heating systems will be required to serve the non-office areas (circulation, staircases, WCs etc.).
- Dedicated electric heating system to provide the hot water requirements.
- Introduction of refrigerant leak detection to eliminate the risk of potential leaks that could result in refrigerant substances within the occupied zones of the building.

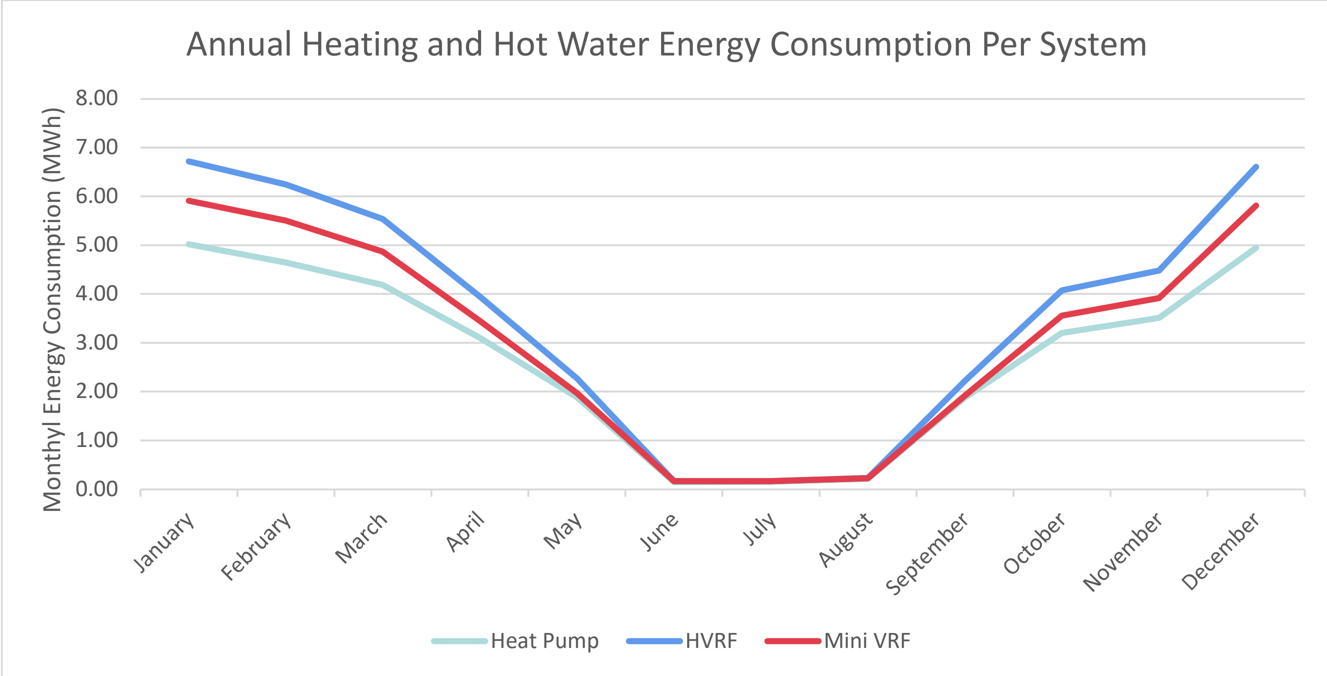
2.3 OPERATIONAL ENERGY COMPARISON

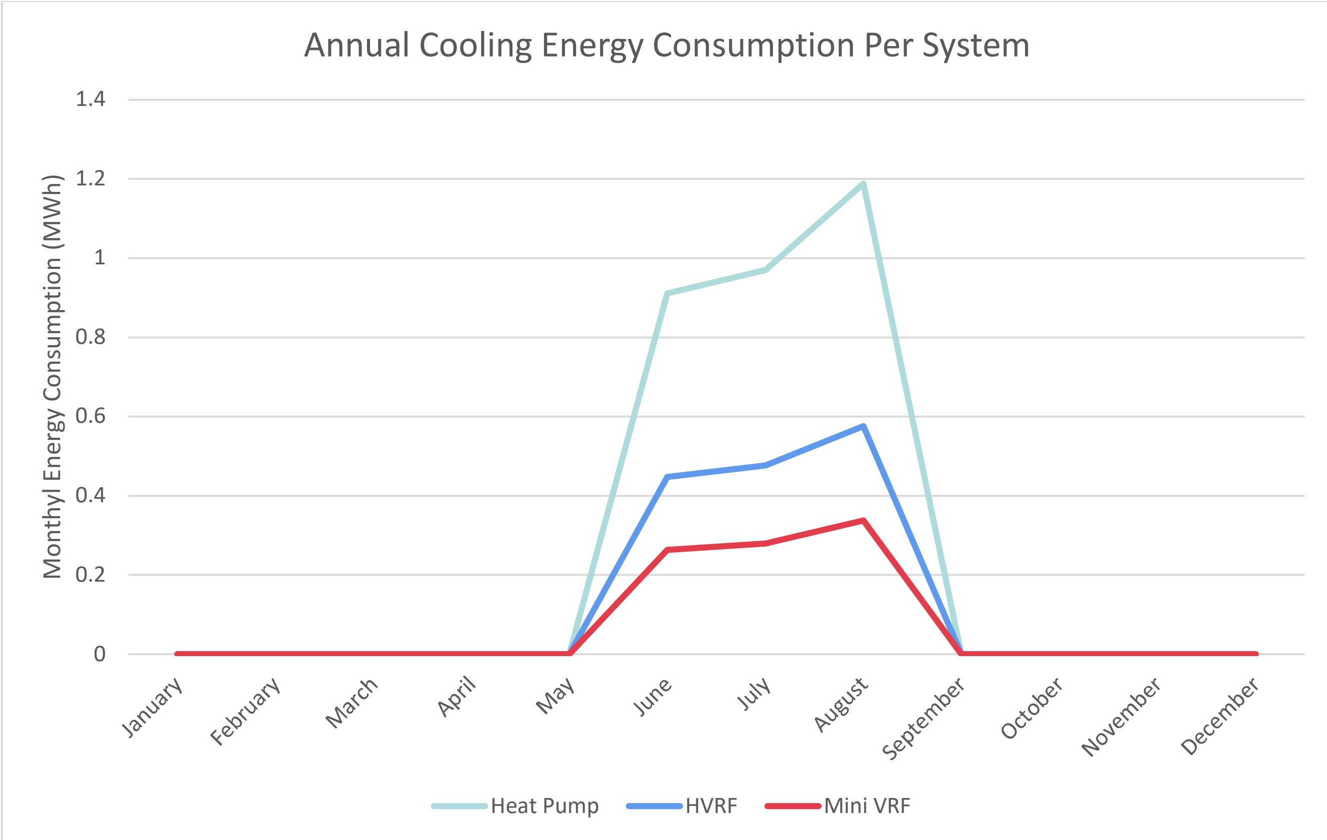
Compliance modelling is not normally deemed suitable for assessing operational energy consumption and as such the building has been thermally modelled with custom profiles to try and provide a more reflective assessment of the energy needs of the building against which a comparison of the three systems can be made.



The heating, cooling, auxiliary and hot water energy demands have been assessed to take into account the differences and benefits that each system provides. For example, the heat pump chiller solution benefits from higher efficiency domestic hot water generation compared to the direct electric water heating associated with the VRF and HVRF solutions, however it requires energy to operate the circulating pumps for the LTHW and CHW systems throughout the year.

The thermal model and corresponding results are not fully developed at this stage of the design and do not include uses other than for heating, cooling, and hot water. They do offer however the opportunity to compare the projected energy consumption of the heating/cooling systems considered.





	Heat Pump	R410a Mini VRF	R32 HVRF
Total Annual Energy Consumption (kWh)	36,176	38, 315	44,128

	Heat Pump	R410a Mini VRF	R32 HVRF
Coefficient of Performance (Heating)	3.04	4.48	3.61
Energy Efficiency Ratio (EER)	2.67	7.57	5.12

The graphs above illustrate the indicative annual energy consumption for each system through heating and hot water generation as well as cooling. It can be seen that the heat pump system consumes the least amount of energy compared to both the R410a Mini VRF and Hybrid VRF systems. This is due to the heat pump system serving all the heating requirements throughout the building, whereas the VRF system only provide heating and cooling to occupied spaces, with the transient spaces being served through electric resistance heating.

The second table indicates the efficiencies used within the initial thermal model. The heat pump system has the lowest heating and cooling efficiencies yet has the lowest indicative annual energy consumption. This is due to the electric resistance heating having a maximum efficiency of 1, whereas the heat pump is three times more efficient, therefore providing greater energy savings. If the systems were compared on a like for like basis where the heat pump, R410a Mini VRF and R32 HVRF systems were compared on only heating the occupied spaces, then the energy savings would be directly proportional to the efficiencies of each system.

2.4 EVALUATION MATRIX

An evaluation matrix has been generated assessing all three HVAC options on the different criteria and information contained within this report. Scores of 1 to 3 are attributed to each option against a list of objectives/criteria, with 1 being the least favourable. The evaluation matrix is produced assuming all criteria carry the same significance. Different weighting factors can be applied depending on the client's priorities and aspirations.

Proposed Heating & Cooling Solutions			
Criteria	**System 1 Heat Pump Chillers**	**System 2 Mini VRF**	**System 3 Hybrid VRF**
Energy consumption (running costs)	3	2	1
Cost (Capital)	3	2	1
Reliability	1	3	2
Plant space requirements	1	3	2
Maintenance requirements (ease of maintenance)	1	3	2
CO_2 emissions (EPC to be confirmed)	3	2	1
Environmental impact	3	1	2
Ease of installation	1	3	2
Flexibility (system separation and future tenant modifications)	1	3	2
Ease of operation; management, billing etc.	1	2	3
Future proofing of asset's energy credentials	3	2	1
Total	**21**	**26**	**19**

The original consented scheme included the use of gas fired boilers for space heating and domestic hot water services as well as a chiller at roof level to produce chilled water for comfort cooling. The consented scheme did not meet Islington's Core Strategy Policy CS10 with regards to CO_2 reduction (30% reduction in regulated and unregulated carbon emissions against 2010 Building Regulations), only achieving a 22.8% CO_2 reduction against 2010 Building Regulations.

The building currently utilises two gas fired boilers and numerous split DX systems for the space heating and domestic hot water generation as well as cooling respectively. The equipment is nearing the ned of its economic service life and should be considered for replacement. The client has expressed a strong desire to make the new proposals as sustainable as possible and design out the requirement for using fossil fuels on site. Based on the assessment above an all-electric solution for the MEP services would be the preferred and a Variable Refrigerant Flow (VRF) heating and cooling system was considered to be the most appropriate solution.

The new proposal is to utilise air source heat pumps for space heating and comfort cooling. Utilising electricity, air source heat pumps in the form of VRF are highly efficient at producing heating and cooling with efficiencies /coefficients of performance (COP) typically above 4 (>400%). With the proposal to have a system serving each floor, the decentralised approach helps to avoid the standing losses and pumping energy usually associated with central systems, ensuring energy is only used when required within a space.

Office buildings typically having low domestic hot water consumption, with the original strategy identifying that the domestic hot water demand was minimal, therefore proposed strategy is to satisfy the demand with direct electric hot water heating. With the carbon factor of electricity being lower than gas and the efficiency of direct electric water heating being higher than gas then opting for this proposal would result in lower energy consumption and lower carbon emissions.

The proposed solution consists of VRF heat pump systems (one per floor) with external condensing units located on the first-floor flat roof and the Roof.

The scheme is not targeting any environmental or energy accreditation.

3 UTILITIES

3.1 WATER SUPPLY

The incoming mains water pipework and meter will need to be updated as they are in a poor condition. An application will be made to Thames Water for updating the mains water supply from the local network. The pipework will run within the LG floor and into the basement plantroom, sized to provide a 2 hour refill time of the tank.

3.2 ELECTRICAL SUPPLY

The building is currently fed by a dedicated three-phase electrical power supply from the UKPN low-voltage electricity network, located in the vault on the Lower Ground Floor.

Following a recent site visit by UKPN and their assessment of the current cut-out, we understand that the site has been equipped with a 100A three-phase supply, which is sufficient. The UKPN engineers were also able to replace the damaged cut-out frame.

3.3 BT – DATA & COMMUNICATIONS

Dedicated fibre connection from the local network is provided to the building. The connection is entering through the vault located in the Lower Ground floor.

The current connection to be investigated by the IT specialist to ensure it is sufficient for the Client's requirements.

4 MECHANICAL SERVICES

4.1 HEATING AND COMFORT COOLING SYSTEMS

4.1.1 OFFICE AREAS, MEETING ROOMS, BREAK OUT & RECEPTION

Heating and cooling will be provided to each office floor by way of multiple 2 pipe heat pump VRF heating and cooling systems consisting of external condensing units at roof level, piped to branch controller (BC) boxes on each floor which serve the fan coil units (FCU) on the floors.

FCUs will be of the floor mounted type and will generally be installed where the current radiators are located. The FCUs will be enclosed in dedicated boxing to be detailed and designed in conjunction with GQA (indicative image). All fan coil units will be provided with thermally insulated discharge plenum boxes, thermally insulated supply plenum boxes and diffusers. Diffusers will be of the high induction type (linear).

Room temperature sensors/controllers will be provided on each room to control the temperature of the heating and cooling systems. A central controller for the all the VRF systems will be provided and will be linked back to the central BMS.

Each office floor shall be provided with the following:

- 1No. High Efficiency Heat Recovery Outdoor Unit
- 1No. 6-10 port BC Controller
- The necessary number of indoor floor mounted concealed FCUs

The provision of leak detection on the VRF installation could be required to comply with IEC60335-2-40 (Ed. 6). A detailed assessment to follow in the next stage of design.

4.1.2 WCS & SHOWERS

Heating will be provided to the WCs and showers by way of direct electric heating – either electric underfloor heating or wall mounted panel heaters. Programmable thermostatic controls will be provided to each area to ensure heating is controlled and only used when required to maintain the internal temperatures as set out in the design criteria.

4.1.3 CIRCULATION SPACES, STORES AND BACK OF HOUSE

Heating will be provided to the stairs, stores and back of house areas by way of wall mounted electric panel heaters with integrated programmable thermostats to ensure heating is controlled properly and only used when required to maintain the internal temperatures as set out in the design criteria.

4.2 VENTILATION SYSTEMS

4.2.1 OFFICE AREAS, MEETING ROOMS & RECEPTION

Currently, mechanical ventilation is provided to all the WCs, Comms, kitchenette, and meeting rooms only. All other ventilation is by natural infiltration and openable windows. These provisions do not guarantee compliance with the minimum fresh air requirements set out by the latest Building Regulations (Part F) or BCO minimum requirements.

Due to the improvements to the glazing (new double glazing and secondary glazing) consideration should be given to providing permanent controlled ventilation to all the occupied areas, in line with Building Regulations (Part F) requirements. This could be achieved by the introduction of new heat recovery ventilation units (Option 1). The units will be providing fresh air and extract stale air and will benefit from heat recovery between the intake and extract air paths to either recover heat in winter or remove heat in summer the heat recovery facility, to reduce energy consumption and associated running costs. The unit will be located on the first floor flat roof and the attic space with intake and exhaust air connections to the atmosphere. The proposals will require planning approval and consideration will be given to noise attenuating measures (silencers) to ensure the installations do not impact the existing background noise levels. The current proposed layouts included in Appendix A represent this option with ductwork routed vertically through the building within dedicated mechanical riser and horizontally onto each floor. Fire dampers will be provided on all lines of compartmentation as identified in the fire strategy and volume control dampers will be provided on all branches to aid with balancing of the ventilation systems.

The exact location of the unit and distribution strategy will be further explored with GQA during the next stage of the design. One of the distribution strategies that could be considered is to utilise, if viable, the existing flues to accommodate the fresh air and extract ductwork. This can be further explored following the results of the flues' survey including in the investigations works package.

An alternative approach to full mechanical heat recovery ventilation would be to introduce permanent controlled intakes into the spaces (i.e., through trickle vents on the new double and secondary glazing) and a clear return air path (natural or fan assisted) that will create an effective air path within the office spaces (Option 2). The viability of this option will be established following the investigations works and surveys on the existing flues.

4.2.2 WCS, SHOWERS AND BACK OF HOUSE AREAS

The WCs, Showers, kitchenette, store rooms and plantrooms will be mechanically ventilated by dedicated extract fans, located at the 1st floor flat roof and roof. Make up air will be provided by the supply section of the mini AHU serving LG and Ground floor office areas. The proposals will require planning approval and consideration will be given to noise attenuating measures (silencers) to ensure the installations do not impact the existing background noise levels. Subject to the background noise acoustic survey noise attenuation measures mig These will be developed in the next stage of the design.

Client to advise/confirm the anticipated usage for the kitchenette (i.e., will it be used for prep and warming up food or actual cooking) as this will determine the level of ventilation to be provided. The assumption currently is that the kitchen will be used for food preparation and re-heating without the need for cooking.

4.2.3 SMOKE EXTRACT

Fire engineering consultant and Building Control consultant to advise of any smoke extract requirements.

4.3 CONTROL SYSTEMS

The building will be provided with a central VRF controller to control the heating and cooling systems. Each controller will be linked back to a central landlord BMS system for monitoring purposes.

The landlord central BMS will also be able to view and control the ventilation and domestic water services plant. All main utility meters and all sub-meters will be connected to the BMS to log and monitor energy usage within the building.

5 PUBLIC HEALTH SERVICES

5.1 DOMESTIC COLD WATER SERVICES

A cold water storage tank will be provided within the LG plant room, sized to meet the Institute of Plumbers design criteria based on the proposed occupancy. The tank will be a GRP sectional tank complete with access hatch, internal and external ladders and a tank division which will allow one side of the tank to be drained down for maintenance whilst the water supply is maintained from the second compartment of the tank.

The outlets from each compartment of the tank will be configured so that they are equal length to ensure equal draw off from both sections and will serve a twin pump booster set configured as duty/standby which will boost the cold water and distribute it around the building.

Boosted cold water distribution will be in copper pipework, routed vertically within the mechanical services riser and horizontally at high level on each floor to serve the WC blocks. The cold water will also be provided to serve the LG showers, kitchenette, and WCs.

5.2 DOMESTIC HOT WATER SERVICES

Domestic Hot Water (DHW) services will be produced by electric hot water storage calorifier located in the LG plantroom.

DHW distribution will be in copper pipework, routed vertically within the mechanical services riser and horizontally at high level on each floor to serve the LG showers, kitchenette, and WC blocks.

Valved and capped hot water flow and return connections will be provided to each office space for future tenant tea point use. Valved and capped DHW flow and return connections will also be provided to the reception area and roof level flat roof for future use e.g., coffee bar or kitchenette.

A DHW return system will be provided for continuous circulation of DHW throughout the building, resulting in any outlet reaching the design hot water temperature within 10 seconds. All wash hand basins and showers will be provided with thermostatic mixing valves to limit the temperature of hot water at the outlet and minimise the risk of scalding.

5.3 CAT 5 WATER DISTRIBUTION

A CAT 5 break tank and booster pump will be provided in the basement to serve areas such as:

- Bike store for washdown facilities
- Bin store wash down facilities
- Flat roof bib tap

5.4 FOUL DRAINAGE INSTALLATION

An above ground drainage system will be provided to serve the following:

- WCs
- Wash hand basins
- Showers
- FCU condensate drainage

A gravity drainage system will be provided with all services being routed to LG level where the above ground drainage will connect to the below ground drainage system and main sewer in the road. The below ground drainage system will be new and will be designed by the SE.

A soil stack will be provided within the mechanical services riser with capped connections provided to each office floor for future tenant use.

5.5 RAINWATER SYSTEM

A rainwater system will be provided to the architect's detail with down pipes routed from roof level to basement where they will be routed to connect to the main sewer in the road.

6 ELECTRICAL SERVICES

6.1 INCOMING SERVICES

The building is supplied with a three-phase electrical power supply from UKPN low-voltage electricity network. The existing supply cable is routed into the services cupboard and store (LG02), located on the Lower Ground floor of the building, where it terminates at a fuse cut-out. A three-phase cable connects the cut-out to a three-phase analogue meter.

Following the recent visit from UKPN, it was noted that the cut-out fuse rating is a 100A three-phase. The cutout frame and any damaged fuses were replaced during their visit.

We've conducted a high-level electrical assessment based on watts per square meter, factoring in allowances made for mechanical elements, including the VRF system. This assessment assumes that the full 100A capacity has been allocated to the building as advised by the UKPN engineer. Given this allocation and considering the equipment requirements for our new proposals, the capacity will be sufficient for the building, with additional capacity for any future expansions.

For the metering strategy, the existing meter will be removed and replaced with a new smart meter to monitor usage and energy consumption. Following initial discussions, we understand that various spaces might be sublet in the future to other divisions within the company. Therefore, the Client/Landlord will be responsible for billing tenants subletting any of the allocated rooms, where each tenant will be charged at a fixed pro-rata, which is the strategy that the current design has allowed for.

If subletting is to be carried out to external third parties, modifications to the proposed electrical infrastructure will be required to allow for accurate readings of energy consumption. These modifications will include, but are not limited to, additional boards located on each level and submeters to monitor energy consumption on each level. The client's input will be required to determine if this strategy is preferred.

6.2 MAIN AND SUB-MAIN DISTRIBUTION

A 24-way, three-phase distribution board is currently situated in a cupboard on the first floor, serving all levels. The outgoing ways are protected via RCD protection devices and type C MCBs.

Cabling from the distribution boards is mainly concealed within partition walls and routed through joists. Final circuits are wired in twin and earth cables. Lighting circuits are typically radial, whereas sockets are primarily ring circuits. The specific path and current access points for the services within the building remain unclear, but these details will be confirmed after an investigation of the existing cable routes.

The primary route for the MEP services has been established by maximizing the use of existing voids in the building, especially on the Lower Ground floor.

Given the location and condition of the board, as well as the M&E services within the riser, it is proposed to replace and relocate the current distribution board. The new board's position will be in a designated cupboard in the receptionist/PA and Admin room (GF05A) on the Ground floor. The board will be wired inline with the new mechanical and electrical design requirements and will be equipped with breakers and protection devices in line with the latest British Standards and amendments (BS 7671 18th Edition).

New cabling for outlets and plants will utilize either SWA or twin and earth cables.

The strategy for the new installation will mirror that of the existing setup, using the existing openings wherever possible and creating new ones only when necessary. Existing risers will also be utilised and extended to accommodate for the all the new MEP services.

New openings will be required between the levels and through the joists, where the size and location will be determined once a survey of the existing openings, the depth of void/ joints throughout and service routes has been completed, following the completion of the opening up works.

6.3 LIGHTING INSTALLATIONS

The rooms are generally illuminated by a mixture of wall mounted lighting, surfaced mounted and recessed lighting. Linear fluorescent lights are installed in various rooms as well. However, the lighting in some rooms appeared to have been either removed or out of service.

The lighting for all spaces will be replaced with new energy efficient LED lighting to reduce energy consumption, running costs and minimise lamp replacement.

The strategy will mainly consist of suspended lights utilising the existing opening in the ceiling for the lights particularly within the historic rooms.

The proposed lighting to the remaining of the spaces will be a combination of wall mounted, and suspended fittings to avoid any damage to the existing ceilings. Recessed fittings will be proposed in areas such as the toilet and showers.

External lighting consisting of wall mounted lighting, and uplight wall washers are proposed for the external entrances, and flat roof spaces.

The final type and style of fittings will be discussed and agreed during the next stage of the design.

Lighting control shall be a combination of presence detection mainly in the circulation spaces and toilets/ showers, dimmable/ manual switching for the offices and lighting control for scene setting capability mainly in meeting rooms. The final control strategy will be discussed and agreed with the client and any selected specialist during the next stage of the design.

The emergency lighting will be a combination of standalone and combined fittings backed up via battery packs.

6.4 SMALL POWER

Small power is currently provided to each room via ring main sockets housed in floor boxes, each completed with a minimum of one double socket outlet. Fused connection units are typically provided to supply fixed equipment and mechanical equipment. Several outlets appear to be damaged and may require significant repairs or replacement.

All small power will be removed and replaced. The strategy will include for new floor boxes within meeting rooms and offices. The quantity for each space will be determined once the room requirements have been agreed.

Wall mounted recessed sockets will be provided where required for the kitchenette, coffee points, and the AV equipment. All fixed appliances and mechanical equipment will be supplied via fused connection units. The outlet finishes to be discussed and agreed during the next stage.

Grommets and wall mounted cleaner socket locations will be as per existing, however, additional sockets might be required to ensure sufficient coverage has been provided.

6.5 FIRE ALARM SYSTEM

The building is provided with several ceiling mounted addressable smoke detectors connected to the main fire alarm panel located on the first floor adjacent to the electrical distribution board with a repeater panel located on the ground floor opposite the staircase. There were no records of certification and testing and the panel appeared to be on fault status at the time of the site visit.

The existing fire alarm system will be removed and replaced with a combination of a standard smoke detectors, and air aspiration system (VESDA) which will be mainly allocated for the historic spaces such as the front offices, Ground floor corridors/ lobbies and staircase.

The system will be design to a an L1 category coverage. The final category and level of protection will be determined once the fire strategy has been agreed.

The location of the fire alarm panel will be modified to be located on the Ground floor in the lobby, and repeater panel will be located at the back of the building on ground floor. The final location will be determined during the next stage in line with the fire consultant recommendations.

6.6 EARTHING AND BONDING

Earthing is provided from the incoming electricity supply cable to the distribution board. Earthing through the building is carried out using the earth wire in the twin & earth cables.

The earthing appears to be in fair condition although in view of the age of the installation, this is unlikely to comply with current standards. The earthing should be brought up to current standards as part of any refurbishment work.

Equipotential bonding will be required for the distribution board internal earth bars, incoming services pipes, ducts, metallic enclosures and other extraneous metal work.

Surge protection shall be provided for the distribution board.

6.7 LIGHTNING PROTECTION

A certified lightning protection specialist will be required to carry the necessary checks and risk assessment on the existing lightning protection system to ensure the minimum level of protection has been met as per the latest British standards.

6.8 ACCESS CONTROL AND SECURITY SYSTEMS

A new system is proposed for the access control, door entry and security system to increase the level of security throughout the building.

The initial brief below has been developed to establish the primary requirement and a preliminary quotation from the selected security specialists. The detailed brief will be developed and discussed with the client and specialist during the next stage of the design.

The current system is based on a Grade III requirement which is intended for properties where there is a high risk of intrusion, and high level of security will need to be incorporated. This will be discussed and confirmed with the client.

The new security system will be connected to the police station via an external monitoring station.

The security proposal currently consists of the following:

Door Entry and Access Control:

- Lower Ground Floor: The door at the front of the building, which is accessible from the main road, will have door entry access - LG03. Additionally, the door connected to the glazed screen between the staircase, circulation, and storage space will have door entry access- LG10.

- Ground floor:
  - Front door & Secondary door: Both doors will have video entry connected to the reception - Main door & GF02.
  - Back door: This door will have video entry connected to the reception - GF10.
  - Secondary door: This door is connected to the glazed screen between the staircase and the multi-use space will have door entry access – GF10
  - First Floor: The door opening onto the flast roof will have door entry access - FF03A.
  - All floors: Each level will have door entry access (fob reader) as a provision, most likely in the private offices (location to be agreed upon). The final location and room will be discussed and agreed upon at a later stage.
  - Panic button: There will be four panic buttons in the building: one at the main entrance (GF02), rear entrance (GF10), at the reception desk (GF05A), and one at another location (To be agreed upon).
  - The proposed system will assign cards to each employee and monitor and log their movement at each point.

Security and Intruder alarm:

- Wired window contacts will be installed at all levels.
- Security PIRs will cover all spaces throughout the building.
- Security keypads will be located in these spaces: LG03, GF02 and GF10.

CCTV:

- External: There will be CCTV cameras at these locations: LG entrance, both entrances externally on the Ground floor, and externally on the first-floor flat roof.
- Internally: There will be CCTV cameras in these spaces as minimum: LG03, LG10, GF02, GF03, GF10, FF3A.

The main monitoring station for the CCTV camera will be at the reception desk. The system will have the capability to be accessed and monitored remotely.

The range and product types will be discussed and agreed during the next stage of design.

6.9 INFORMATION AND COMMUNICATION SYSTEMS

The existing communications connection is located within the vault on the Lower Ground floor, adjacent to the existing gas and electrical supplies. The data cabling throughout appears to be CAT 5E.

The current connection is under review by the client's IT specialist, who will advise if an upgrade is required. All specific requirements and provisions will be discussed with the Client and IT Team to establish the project requirements and further develop the design in the next stage.

The strategy generally comprises an IT rack located within the proposed Comms room in the vaults of the Lower Ground floor. This rack will accommodate all data connections throughout the building and will include a dedicated UPS supply for backup to the IT equipment. The UPS size will be specified by the Client's IT specialist, which will depend on the preferred backup duration. Allowance will also be made within the rack to accommodate the CCTV connection.

The final quantity of racks and space requirements will be discussed and agreed upon during the next stage. The current allocated space may be restrictive depending on the final solution, particularly with regard to the room's height. Once the IT equipment requirements have been confirmed, the possibility of introducing a dedicated A/C system to serve the Comms room will be developed.

Generally, dedicated Wi-Fi points will be provided on each level. Additional dedicated data points will be provided within each room for general use, TV points, and for security and access control connections. This will be discussed and agreed upon in further detail with the Client during the next stage.

6.10 VERTICAL TRANSPORTATION

The vertical transportation works are currently outside A Plus' brief. However, it was investigated as part of our initial survey and observations.

The existing lift is a hydraulic lift with the main machine room located in the lower ground floor adjacent to the lift shaft.

As part of the architectural proposals, the existing lift will be removed and replaced with a new machine room less unit. The size of the lift will be determined by the existing lift shaft to minimise the structural work. The design will be further developed during the next stage alongside the appointed lift specialist.

APPENDIX A STAGE 3 DRAWINGS/PLANNING

DOCUMENT NUMBER	TITLE
22037-APC-ZZ-LG-M-DR-5301	DOMESTIC WATER SERVICES LAYOUT LOWER GROUND FLOOR
22037-APC-ZZ-00-M-DR-5302	DOMESTIC WATER SERVICES LAYOUT GROUND FLOOR
22037-APC-ZZ-01-M-DR-5303	DOMESTIC WATER SERVICES LAYOUT FIRST FLOOR
22037-APC-ZZ-02-M-DR-5304	DOMESTIC WATER SERVICES LAYOUT SECOND FLOOR
22037-APC-ZZ-03-M-DR-5305	DOMESTIC WATER SERVICES LAYOUT THIRD FLOOR
22037-APC-ZZ-LG-M-DR-5601	HEATING AND COOLING SERVICES LAYOUT LOWER GROUND FLOOR
22037-APC-ZZ-00-M-DR-5602	HEATING AND COOLING SERVICES LAYOUT GROUND FLOOR
22037-APC-ZZ-01-M-DR-5603	HEATING AND COOLING SERVICES LAYOUT FIRST FLOOR
22037-APC-ZZ-02-M-DR-5604	HEATING AND COOLING SERVICES LAYOUT SECOND FLOOR
22037-APC-ZZ-03-M-DR-5605	HEATING AND COOLING SERVICES LAYOUT THIRD FLOOR
22037-APC-ZZ-AT-M-DR-5606	HEATING AND COOLING SERVICES LAYOUT ATTIC FLOOR
22037-APC-ZZ-RF-M-DR-5607	HEATING AND COOLING SERVICES LAYOUT ROOF
22037-APC-ZZ-LG-M-DR-5701	VENTILATION SERVICES LAYOUT LOWER GROUND FLOOR
22037-APC-ZZ-00-M-DR-5702	VENTILATION SERVICES LAYOUT GROUND FLOOR
22037-APC-ZZ-01-M-DR-5703	VENTILATION SERVICES LAYOUT FIRST FLOOR
22037-APC-ZZ-02-M-DR-5704	VENTILATION SERVICES LAYOUT SECOND FLOOR
22037-APC-ZZ-03-M-DR-5705	VENTILATION SERVICES LAYOUT THIRD FLOOR
22037-APC-ZZ-AT-M-DR-5706	VENTILATION SERVICES LAYOUT ATTIC FLOOR
22037-APC-ZZ-RF-M-DR-5707	VENTILATION SERVICES LAYOUT ROOF
22037-APC-ZZ-LG-DR-E-6601	ELECTRICAL CONTAINMENT SERVICES LAYOUT LOWER GROUND FLOOR
22037-APC-ZZ-00-DR-E-6602	ELECTRICAL CONTAINMENT SERVICES LAYOUT GROUND FLOOR
22037-APC-ZZ-01-DR-E-6603	ELECTRICAL CONTAINMENT SERVICES LAYOUT FIRST FLOOR
22037-APC-ZZ-02-DR-E-6604	ELECTRICAL CONTAINMENT SERVICES LAYOUT SECOND FLOOR
22037-APC-ZZ-03-DR-E-6605	ELECTRICAL CONTAINMENT SERVICES LAYOUT THIRD FLOOR