London Road Fire Station

M&E Services
Energy statement



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1.0 Introduction

1.1 General

London Road Fire Station (LRFS) is a Grade II* listed building, originally constructed in the early 1900's and is of significant historical value.

The redevelopment proposals include the provision of a hotel, workspaces and a variety of food and beverage/leisure (F&B) outlets.

1.2 Scope of Report

This report provides a description of the energy efficiency strategies proposed for the redevelopment of LRFS.

Reference should also be made to the following accompanying reports:

- M&E servicing strategy report produced by CWC.
- Environmental Standards Statement produced by Element Sustainability.
- BREEAM pre-assessment produced by Element Sustainability.

These descriptions are supported by the following drawings produced by Crookes Walker Consulting:

Drawing No.	Description
ME01	Basement Level Space & Volume
ME02	Ground Floor Space & Volume
ME03	1st Floor Space & Volume
ME04	2nd Floor Space & Volume
ME05	3rd Floor Space & Volume
ME06	Roof Level Space & Volume
ME27	Workspace Servicing Strategy plans and sections
ME29	Old Engine House restaurants servicing Strategy plans and sections

2.0 Design Strategy

2.1 Introduction

The listed status of the existing building, and its overall configuration with minimal riser space and absence of significant plant areas, have been the overriding factors in the selection of servicing strategies which minimise the impact on the existing building envelope.

As a consequence a comprehensive, quantitative comparison of servicing methods to arrive at an optimum design based on KW energy demand or CO2 emissions has not been carried out.

Approximate annual energy consumption figures are included below for the principal space users, based on current benchmarks:

Space	Area (m^2)	No of rooms	Annual energy Kwh/Sqm	
			Good practice	Typical
Hotel	1774	Approx 40	2,111,200	3,377,920
F&B/leisure/retail	3673	-	5,244,750	5,934,060
Workspaces	3687	-	160,200	287,648

- Benchmark data taken from CIBSE Guide F Energy Efficiency in buildings 2012.

For subsequent design stages, the building will be modelled with accredited software packages, based on the energy efficiencies of the proposed servicing strategies, to provide predicted energy demand and CO2 emissions values, against which further design improvements can be assessed (such as secondary glazing and roof insulation – refer to 2.2 below) against the above benchmarks.

The approach will therefore be to achieve a building performance that is as energy efficient as possible, without impacting on the building's historical appearance, utilising the 'energy hierarchy' as indicated below:

- Improve efficiency of building fabric.
- Utilise plant that meets current energy efficiency standards.
- Consider use of low and zero carbon technologies.

2.2 Building Regulations Part L (2013)

London Road Fire Station is a Grade II* listed building; whilst it is intended to comply with current Part L requirements as far as practicable, there will be many areas where planning and heritage concerns have to take priority.

2.2.1 Building Fabric

The strategy outlined below will be developed as the design progresses and the practicalities of improving the thermal envelope of the building become clearer.

Due to the heritage significance of LRFS, it is proposed to retain the existing external fabric of the building, although substantial window repair/replacement is in progress due to current poor condition. This presents an opportunity to enhance the performance of the building envelope in terms of thermal performance and air permeability. The scope of this currently includes new secondary glazing; this is primarily for acoustic reasons, but will have significant thermal performance benefits.

It is assumed that no thermal insulation is currently in place within the pitched roof voids. The addition of thermal insulation in these areas will significantly improve building performance.

The level of improvement achieved will be assessed as the design develops, but the following improvements in U-values are anticipated:

Element	Existing estimated U-value	Anticipated new U-value	Comments
Glazing	5.5-6.0	2.5-3.0	All single glazing throughout at present. New U-value based on secondary glazing with large air gap
Pitched roof	Approx 2.3	0.18-0.25	U-value of 0.18 based on current Part L 2B requirements

2.2.2 Glazing, Daylighting and Solar Gains

Where feasible, and without impacting upon the historical appearance of the building, the building fabric and servicing strategies will be further refined to establish the optimum design to minimise on-site energy demand and carbon emissions of the development and promote sustainability and a high quality local environment.

A fundamental element of the above is the glazing strategy. For London Road Fire Station, the number of feasible options will be very limited due to its listed status and historical significance, particularly for the ornate, outward facing facades. However, the following assessment will be carried out to ensure the design is as energy efficient as possible:

- There are three key energy criteria when considering the glazing strategy for a development. These are energy efficiency, natural daylighting factors and summertime internal temperatures. These are intrinsically linked and should be considered holistically to determine the optimum strategy to achieve a comfortable, productive and healthy environment in all weather conditions, whilst making best use of the sun as a natural heating source.

- The main factors in optimising the above are the size, orientation and specification of the glazing in relation to the occupancy and usage patterns of the buildings.

- Through the modelling exercise the effect of high external temperatures will be assessed and measures taken to minimise the heat gain and temperature rise within the building. Solar control film application to the glazing, secondary glazing, ventilation and free cooling, thermal massing strategies (e.g. leaving existing thermal mass exposed to exploit its properties) shall be considered to minimise the need for cooling.

A significant source of solar gain is the existing roof structure which incorporates dark roofing tiles with minimal or no insulation between this structure and the occupied space below. During the summertime, this roof is likely to be irradiated by the sun and then pass this heat through to the space below. It is therefore proposed to investigate insulating the roof in order to minimise the heat gains and therefore minimise the cooling requirements.

This strategy also has the benefit that the insulation will keep vital heat in during the colder winter months which will minimise the heat input required.

2.3 M&E Design Strategy

The descriptions below provide a brief summary of the M&E servicing methods. More detailed descriptions can be found in the CWC M&E servicing strategy report.

2.3.1 Workspaces

Workspace design will be progressed in the spirit of Part L2A Conservation of fuel and power in new buildings other than dwellings, subject to the heritage constraints outlined above.

The design of building services will be based on achieving the minimum efficiencies specified in the Domestic Building Services Compliance guide, utilising the following technologies:

- Mechanical ventilation with heat recovery.
- High efficiency, gas fired centralised boiler plant for space heating and generation of domestic hot water.

- Comfort cooling via water cooled a/c equipment, with efficiencies in excess of the minimum standards.
- High efficiency LED lighting and automatic lighting controls.

2.3.2 F&B and Hotel

The design for these areas will be developed on the basis of Part L2B conservation of fuel and power in existing buildings other than dwellings, again subject to the heritage constraints outlined above

The services design will be based on achieving or exceeding the minimum efficiencies specified in the Non-Domestic Building Services Compliance guide, utilising the following technologies:

- Mechanical ventilation with heat recovery.
- High efficiency, gas fired centralised boiler plant for space heating and generation of domestic hot water.
- Space heating and comfort cooling via water cooled a/c equipment, with efficiencies in excess of the minimum standards.
- High efficiency LED lighting and automatic controls.

3.0 Energy Efficiency

3.1 Introduction

The Manchester Core Strategy and Guide to Development in Manchester Supplementary Planning Document, provides advice on achieving sustainable development.

The redevelopment of LRFS intends to follow the aspirations of the guide, by achieving sustainable design solutions, within the constraints of the existing building.

3.2 Energy and Resource Conservation

3.2.1 Energy Efficiency

In building design, it is critical to address energy efficiency from the outset of the process to minimise reliance on fossil fuels and other natural resources.

Due to the heritage significance of London Road Fire Station, it is a requirement to retain as much of the existing fabric of the building as possible. This brings with it energy efficiency challenges, particularly in relation to the existing external envelope.

To facilitate the re-development, the following elements will be further considered through the design process from both an energy efficiency and thermal comfort perspective:

- Fabric insulation levels – balancing thermal performance and internal temperatures.
- Building air permeability – this is a constraint due to the nature of the existing building, but enhanced glazing and improvements to roof insulation will be of significant benefit.
- Thermal mass – exploiting the properties of exposed, heavyweight structure to benefit the internal environment.
- Glazing strategy – optimising the use of the sun as a natural resource through careful glazing specification.
- Ventilation strategy – The city centre location of the building drives the need for mechanical ventilation throughout. Modern, highly efficient heat recovery ventilation systems will therefore be utilised in all areas, to minimise heat being wastefully vented to atmosphere.
- Heating strategy – using low energy sources of heating.
- Cooling strategy – eradicated as far as possible and provided as efficiently as feasible.
- Water consumption strategy.

The design solutions considered thus far have concentrated on achieving intrinsically energy efficient services systems, and currently include the following:

a) Provision of a sitewide 'condenser water loop', allowing the use of water source heat pumps and VRF type systems. Water source units are very energy efficient, approaching double the efficiency of conventional air cooled systems for a well-designed system.

b) High efficiency, gas fired condensing boilers as the principal heat source for the building.

c) Potential future heating input from district heating system.

d) Variable speed cooling towers for heat rejection from the condenser water loop, facilitating the use of cool ambient conditions in winter months for reducing energy consumption for space cooling.

e) Heat recovery mechanical ventilation throughout.

f) Energy efficient LED lighting.

g) Occupancy and daylight linked lighting controls.

h) Water conserving sanitary ware.

3.2.2 Renewable Energy

A variety of LZC technologies have been considered in the early stages of the design, as summarised in the table below.

The provision of heating and comfort cooling from LZC sources have been considered, with preliminary feasibility studies undertaken investigating the potential use of ground source water and tri-generation/CHP technologies

Copies of these feasibility studies are issued separately, with the associated executive summaries included in appendix 1.0. The main conclusion being that the use of CHP may be viable for the hotel DHW load.

Energy source	CWC comments	Use on LRFS
Biomass boilers	Limited fuel storage and plant space preclude this option.	NO
Ground source water	Feasibility study undertaken for closed and open loop designs. Not viable due to limited ground water availability and space limitations of the site.	NO
Tri-generation	Feasibility study undertaken. Not viable due to insufficient plant space.	NO

Energy source	CWC comments	Use on LRFS
CHP	CHP feasibility study undertaken. Potentially viable for hotel, depending on minimum DHW load.	Possible
Solar thermal	Hotels have a high hot water demand; therefore solar hot water heating utilising roof mounted solar panels could be technically viable. The large area of panels required to service the hotel may be physically feasible, although listed building/planning constraints are likely to render this option unacceptable.	Unlikely
Photovoltaic	Courtyard and roof presents an opportunity to incorporate integral PV panels. Listed building and planning constraints are likely to prevent their use.	NO
Wind	Large scale wind turbines would be difficult to install on this site, and a small scale scheme would have limited output. Energy generation very dependent upon wind availability. Planning approval would be an issue on this listed building and is not therefore considered viable.	NO

Appendix 1 - LZC Reports

The following executive summaries are taken from two reports prepared by CWC during the course of the design. The full reports are issued as separate documents.

Ground Source Energy Review - Executive Summary

a) The requirement for extensive plant space for mechanical heating and cooling equipment has highlighted the possible advantages of utilising ground water for heating/cooling, with respect to reducing the plant space requirements.

b) The use of ground water at the LRFS site will require the drilling of several boreholes to allow water to be abstracted from the local aquifer.

c) All groundwater schemes have to be licensed by the Environment Agency (EA), who also dictates extensive testing and monitoring requirements.

d) LRFS sits within a 'restricted water' zone, meaning that currently licensed abstractions exceed recharge to the aquifer. As a result, the EA will require the LRFS scheme to be non-consumptive (ie all abstracted water must be returned to the aquifer via recharge boreholes, rather than being pumped to a nearby watercourse or sewer).

e) The EA will require an extensive testing and monitoring process to be undertaken by the developer, designed to assess the impact of the proposed LRFS scheme on local water features such as other boreholes, wells, watercourses, springs etc. This testing would possibly have to last at least 6 months to cover a variety of seasons.

f) There is a relatively high risk that the scheme will prove to be non-viable, but establishing this fact may take 6-12 months.

g) Given the uncertainties of groundwater availability, the lengthy process required to establish its viability and the current project programme, the use of a ground source system is not considered to be practicable for this project

Trigeneration Energy Review - Executive Summary

a) The requirement for extensive plant space for mechanical heating and cooling equipment has led to the investigation of using trigeneration technology to reduce the overall plant space requirements.

b) Trigeneration involves the use of a generator to provide electrical power, with the resultant waste heat also being used for both heating and cooling; cooling being produced by an absorption type chiller, which uses heat as an energy source for producing chilled water.

c) Overall, the trigeneration plant would occupy a plant area similar to that required for conventional equipment.

d) To provide resilience of power availability, the electrical utility supply would still have to be sized at 100% capacity, to cater for the generator being out of service (planned or unplanned). This is normal practice.

e) To ensure resilience of heating and cooling, the trigeneration plant would have to be broken down into two or three parts, increasing the plant space requirements beyond what is currently available.

f) Trigeneration equipment requires free access to outdoor air for combustion purposes and exhaust of fumes. A rooftop location would therefore be preferable; this carries risks from plant noise and vibration 24 hours per day, particularly as the plant area would be in close proximity to the hotel guestrooms.

g) The use of trigeneration does not offer any reduction in plant space requirements, principally due to the need to provide sufficient resilience for heating and cooling in the event of equipment failure.

   The plant space required exceeds what is available, and for this reason trigeneration is not considered a practical option for this project.