Whole Life Carbon Assessment Report

Prepared by Scotch Partners

Submitted on behalf of Lab Selkirk House Ltd

Selkirk House, 166 High Holborn and 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR

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ScotchPartners
Building Services Engineering | Sustainability | Acoustics

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Lab Selkirk House Ltd

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Rev 06c

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Project Particulars

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06c	Updated cost info	29/06/2023	Seb Dimarco

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1 Executive Summary

1.1 Overall Sustainability Objectives and Aspirations

The London Borough of Camden and the Mayor of London have declared a 'Climate Emergency' with Camden's declaration including an 'Ecological Emergency'. Both have an aspiration to achieve a Net Zero Carbon borough and city by 2030, 20 years ahead of the national target. In June 2020, Camden approved a 5-year 'Climate Action Plan' which creates a framework for action across all aspects of the borough with the aim of achieving zero carbon by 2030.

Health and wellness are critical social issues and the Camden Health and Wellbeing Strategy 2022-30 is one of the Council's initiatives to improve the health and wellbeing of Camden residents and reduce health inequalities across the borough.

The Applicant and the project team have fully embraced the sustainability and Net Zero Carbon objectives of Camden and the Mayor of London. They are keen for the proposed development to fully support these objectives and to go further by adopting both mandatory and voluntary standards (such as WELL and WiredScore) in order to maximise longevity, market relevance and social sustainability, and minimise environmental impact over the buildings' life cycle. The intention of the scheme is to act in support of Camden's sustainability aspirations & commitments for the coming years.

Targeting these accreditations ensures the scheme will provide a good balance of proposals, including a focus on both public and private outdoor amenity, a highly-tuned facade providing passive environmental shading and cooling measures, all electric heating/cooling and significant contributions to local biodiversity.

The proposed, new-build strategy offers the opportunity to achieve cutting-edge improved environmental performance for the office space that a refurbishment scheme cannot match, which in turn, improves performance of a newbuild scheme on a life cycle basis.

The proposed development has been designed to also consider the key policies relating to sustainable design and construction, focusing primarily on the following documents:

- Camden Local Plan 2017
- Camden Planning Guidance (CPG) Energy efficiency and adaptation, January 2021
- CPG Planning for Health and Wellbeing, January 2021
- CPG Biodiversity, March 2018
- The London Plan 2021

This Statement forms part of a suite of sustainability documents that collectively demonstrate how the development proposals have responded to both Camden and the Applicant's sustainability objectives, and its performance against mandatory and voluntary sustainability targets. As such, this document should be read in parallel with the following reports submitted with the planning application:

- Sustainability Statement
- Energy Statement
- Circular Economy Statement
- 1MS-Selkirk Retention Report

1.2 This Report

Scotch Partners LLP have undertaken a Whole Life Carbon (WLC) Assessment for the proposed development of Selkirk House in the London Borough of Camden.

The assessment has been undertaken in line with the GLA Whole Life-Cycle Carbon Assessments guidance, March 2022. This report should be read in conjunction with the GLA Whole Life Carbon Assessment Template's issued in Microsoft Excel Format (Appendix A). Following feedback, templates have been provided for each building, as well as a site wide template.

The report concludes that the site is estimated to produce emissions in line with the GLA benchmarks set out in the Guidance document.

Please note, the results in this report cannot be compared to assessments completed for previous submissions. This assessment includes changes to the design since the previous assessment, and the methodology has been improved in line with third party comments.

This assessment has been third-party peer reviewed by Greengage Environmental (see Appendix A).

1.3 Estimated Carbon Emissions

Table 1 Results

	Upfront Embodied Carbon (Module A) (kgCO2e/m2 GIA)	Embodied Carbon (Modules A-C exc. B6&B&) (kgCO2e/m2 GIA)
1 Museum Street	752	1194
High Holborn	822	1258
West Central Street	581	934
Vine Lane	904	1258
Development Total	**747**	**1173**

1.4 Energy Strategy

With an emphasis on the global climate crisis many local authorities (including Camden and the GLA), institutions and businesses have declared a 'Climate Emergency'. There is a growing commitment to achieving Net Zero Carbon (NZC) buildings by 2030, meaning many new developments need to consider now how far they can go to design in features to enable the lowest carbon performance possible.

The energy strategy for the project is a key mechanism for reducing Whole Life Carbon of the development. A passive design strategy has been proposed, which features enhanced fabric elements for the proposed development with consideration for compatibility with the façade design and geometry, construction type and method. For full details, refer to the Energy Statement, also submitted within this application.

1.5 Circular Economy

The proposed development has taken care to consider Circular Economy in its design. The Circular Economy statement details the strategy for recovery of materials in line with the circular economy model. For full details please read the full Circular Economy Statement.

1.6 Conclusion

This report has set out the Whole Life Carbon emissions estimated for the site. This follows the GLA Whole Life-Cycle Carbon Assessments guidance, March 2022 and results in embodied carbon and whole life carbon figures that fall within the GLA benchmarks.

2 Introduction

Scotch Partners have prepared this Whole Life Cycle Carbon Assessment on behalf of Lab Selkirk House Ltd, referred to hereafter as "the Applicant", in support of the proposed development of the Selkirk House, 166 High Holborn, 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, and referred to hereafter as "the Site".

The aim of this assessment is to assess the WLC for the Proposed Developments, defined as 'those carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal.' This assessment captures the operational carbon emissions for the Proposed Development from both regulated and unregulated energy use, as well as its embodied carbon emissions, i.e. those associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair and replacement as well as dismantling, demolition and eventual material disposal.

This report should be read in conjunction with the associated GLA Whole Life Cycle Carbon Assessment Templates issued in Microsoft Excel forma for each building, in addition to the aggregated development GLA template also submitted.

2.1 Description of Development

2.1.1 Existing Site

The existing site comprises of 0.52 hectares and is bounded by High Holborn to the south, Museum Street to the east and New Oxford Street to the north, with the rear of the properties fronting Grape Street forming the western boundary.

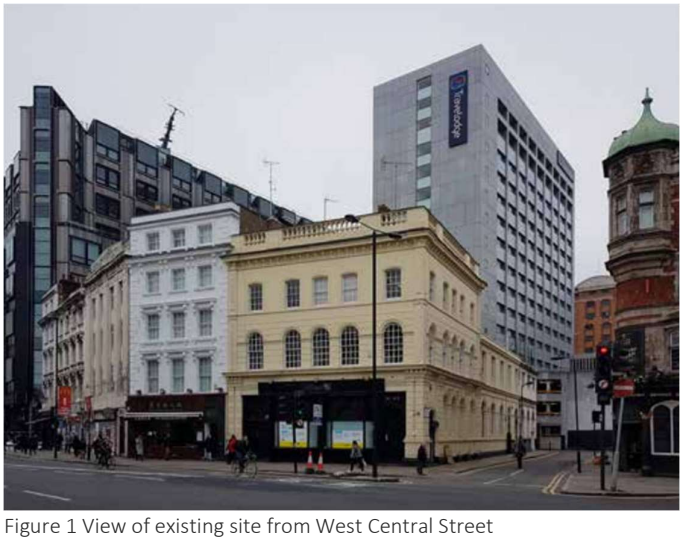

Figure 1 View of existing site from West Central Street

2.1.2 Proposed Development

The proposed development comprises of redevelopment and extension to provide a mixed-use scheme of affordable housing, town centre uses and 24,791m^2 of office floor space within the new 19 storey building on Museum Street. 500 cycle parking spaces to be allocated and a high proportion of open spaces across the site providing a public realm.

Figure 2 Proposed Development from Bloomsbury Way

The proposed development falls within a one red line area and comprises of the following components:

- Museum Street (24,791 m2 GIA) - a single new building rising to 19 storeys, providing office (Class E(g)(i)) accommodation on upper levels and a range of flexible town centre uses (Class E) at ground level.

- High Holborn (493 m2 GIA) - a single new building rising to 6 storeys, providing residential (Class C3) accommodation on upper levels and a flexible town centre use (Class E) at ground level.

- Vine Lane (2,449 m2 GIA) - a single new building rising to 5 storeys, providing market residential units with a flexible town centre use (Class E) at ground level. The office (Class E(g)(i)) floorspace within this building will be operated by LABS as a co-working offer.

- West Central Street (3,247 m2 GIA) ¬- a series of new and refurbished buildings rising to 5 storeys, providing residential accommodation (market, LCR and Intermediate) on upper levels (Class C3) and flexible town centre uses (Class E) at ground level.

Please note, GIAs have been measured in accordance with IPMS (International Property Measurement Standards). All GIAs within this report have been measured and reported in line with this as the industry standard to include all internal areas with the following exceptions:

- Any area between a Notional Boundary and the external perimeter of External Walls;
- Sheltered Areas;
- External Floor Areas;
- Enclosed walkways or passages connecting separate Buildings;
- Enclosed rooftop plant such as mechanical, electrical and lift motor rooms;
- External stairs that lead to upper levels, excluding open framework fire escapes, which are excluded; and
- Limited use area(s) not otherwise identified above.

In a number of the supporting technical reports including the Circular Economy GLA Template and WLCA, it is necessary to calculate the GIA without the exceptions listed above. In these instances GIA includes all internal areas without any of the exceptions listed above to give the totals used in this assessment.

2.2 Background to whole life cycle assessments

Global climate change is widely considered to be one of the most pressing challenges at a regional, national and international level. Industrialisation has resulted in the use of refined and unrefined fossil fuels as an energy source and since the start of the industrial revolution, use of fossil fuels and their resultant release of carbon dioxide into the atmosphere has caused an exponential increase in the concentration of carbon dioxide and other pollutants that are generally agreed to result in increasing global average surface temperature.

It is outside the scope of this report to describe the wide-ranging impacts of climate change; however urgent action is required to limit carbon dioxide and limit the impacts of climate change.

Carbon emissions from operational use of buildings has been the subject of regulation for some time and has historically been the primary focus of reducing the impact of built environment projects. More recently, this focus has been expanded to also include carbon emission associated with the building materials themselves.

Studies have historically suggested that 10 – 20% of the total carbon emissions for buildings over their lifetime are due to embodied carbon. With increasing energy efficiency within buildings and an increasingly decarbonised electricity supply, building operational carbon emission are being acknowledged to be rapidly reducing. As this occurs, the significance of embodied carbon emissions increases and the potential for reduction of overall carbon emissions through structural design choice and material selection becomes greater.

The WLC Emissions are those emissions resulting from the construction and use of a building over its entire life, including its demolition and disposal. Calculating the WLC emissions will provide a capture of the buildings operational carbon emissions (from both regulated and unregulated energy use) as week as the embodied carbon emissions.

2.3 RICS Whole Life Carbon

The RICS professional statement: Whole Life Carbon Assessment (WLC) for the Built Environment, released in 2017, seeks to standardise WLC assessment and enhance consistency in outputs by providing guidance on implementing the broad appraisal methodology set out in BS EN 15978: Sustainability of Construction Works. The Greater London Authority have adopted the RICS WLC methodology in their guidance methodology for Whole Life Carbon assessment of referable planning applications.

2.4 UK Green Building Council (GBC) Net Zero Carbon

As a response to mainstream scientific consensus on the urgent need to reduce carbon emissions, the UK Government has legislated to achieve Net Zero carbon by 2050. As part of the definition of Net Zero, the UK Green Building Council has developed a Framework Definition that includes embodied carbon emissions, and this definition is widely being used to develop a roadmap to the 2050 Net Zero target. It's worth noting that the UKGBC approach has not set out a methodology for the appraisal of Whole Life Carbon, which is still being developed.

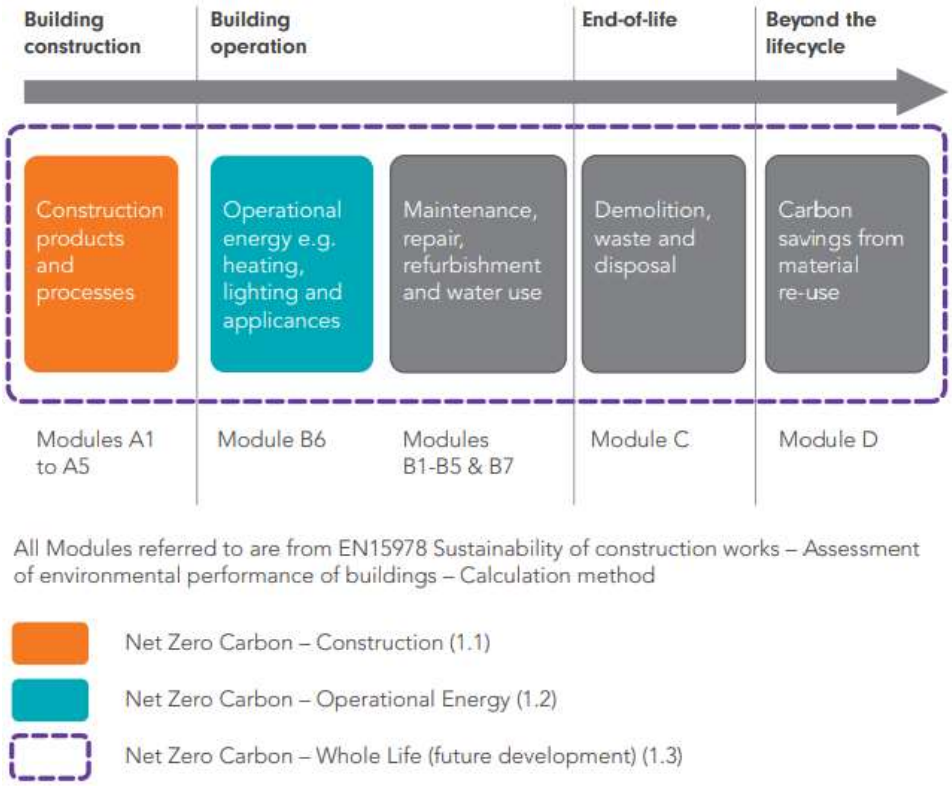

Figure 3 UKGBC Advancing Net Zero Carbon Framework Approach

2.5 The Circular Economy

Currently, the construction industry largely follows a single use "take-make-dispose" model. In order to reduce the negative impact, the industry is having on the environment, and participate in the wider move to long-term sustainable buildings, it is vital the construction industry moves across to a more circular model, in which the value in materials and buildings are both realised and kept in the model for as long as possible.

Full details of the Circular Economy strategy can be found in the accompanying Circular Economy Statement submitted as part of the planning submission.

2.6 Case for Refurbishment

In line with the Waste Hierarchy, first the condition of the existing site must be considered for any opportunities for a refurbishment in order to prevent waste prior to a new building being developed. This approach was considered for the development, with a further study looking into potential retention options prepared separately to this report. This further study includes embodied carbon results for each option.

All options demonstrate a level of embodied carbon impact as the retention options appraisal has determined that it would not be feasible to retain the existing building and structure in its entirety. An important factor is also be the age, quality and structural integrity of the existing building. The WLCA will reflect the need for replacement of some original building elements far in advance of any new materials/structure being added, and also the need for structural reinforcement in some areas, all of which will add embodied carbon. Full details are provided with the 1MS-Selkirk Retention Report submitted as part of this application.

2.7 Changes from previous report

A Whole Life Carbon Assessment was previously carried out on 30/04/2021 and 21/09/2022 for the previous applications. The results of this assessment reflect the changes in the design and specifications, and results can't be directly compared to the previous report as a result.

Third Party comments made against the original applications have been considered throughout this application, with an additional Third Party review taken for this submission. This process has led to try and give as robust and accurate a report as possible in line with the current RICS methodology and working within the limitations of the software. The assessment methodology has also changed, with this report using OneClickLCA software.

The changes to West Central Street has also been implemented in this assessment from the previous application.

3 Methodology

3.1 Assessment Scope

The assessment of Whole Life Carbon (WLC) emissions consists of the following sections: total operational carbon emissions (regulated plus unregulated); embodied carbon emissions; and any future potential carbon emissions 'benefits', post end-of-life, including benefits from reuse and recycling of building structure and materials.

This assessment has been undertaken in line with the GLA guidance (March 2022) for undertaking WLC Assessments and therefore in line with the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment.

Operational Carbon Emissions

In line with RICS and GLA guidance, operational carbon emissions have been provided by the Energy assessor using TM54 calculations. These calculations have been provided as part of the Energy Strategy for planning. For full details on the methodology, please refer to the Energy Strategy.

The results provided by the Energy assessor included all buildings in kWh per year, and were split into regulated and unregulated energy. These results were inputted into OneClick LCA to calculate the carbon, using the OneClick carbon coefficient of 0.14kgCO2e/kwh.

The results do not account for the decarbonisation of the UK grid, as per GLA methodology.

Operational Water Emissions

The operational water emissions have been based upon calculations undertaken by the Public Health Engineer for the project. Using freshwater and wastewater figures provided, these were inputted into the relevant OneClickLCA template. The carbon coefficient for the applicable water use is outlined below;

- Clean tap water, Thames Water - 0.01926kgCO2e/m3
- Wastewater- 0.39kgCO2e/m3

Embodied Carbon Assessment and end of life emissions

To assess the embodied carbon for the project a Life Cycle Assessment (LCA) tool – OneClickLCA – has been used to make allocations for the anticipated materials quantities in an inventory analysis. The materials are represented within the model by using materials with associated Environmental Product Declarations (EPDs). EPDs are produced by manufacturers and identify the carbon emissions of a product. By scheduling the materials proposed for the development, the overall carbon emissions can be approximated.

It should be noted here that the LCA tool has a limited database of materials. In the scenario where a specified material isn't included in the database, the most similar material in terms of material composition is selected instead.

In line with standard UK practice, the LCA process and results included by this report have been assessed in line with BS 15978:2011 and the RICS Professional Statement: Whole Life Carbon assessment for the built environment. All EPDs used have been produced in line with the requirements of BS EN 15804:2012. Hence, each material has been assessed against the following lifecycle stage:

- A1-A3: Product stage
- A4: Material transportation to site
- B4-B5: Replacement and maintenance
- C1-C4: End of life

Together with these stages, the contribution of life cycle stage A5 has also been explored separately, giving an estimate of the emissions related to the construction. I.e. the electrical consumption and waste disposal.

In line with the GLA guidance, the assessment includes the following elements:

- Demolition
- Facilitating works
- Substructure
- Superstructure (frame, upper floors, roof, stairs and ramps, external walls, windows and external doors, internal walls and partitions, internal doors)
- Finishes
- Fittings, furnishings and equipment
- Building services
- Prefabricated buildings and building units
- Work to existing building
- External works (hard and soft landscaping, fencing, fixtures, drainage, services)

3.2 Life Cycle Assessment Impacts

A building Life Cycle Assessment considers a range of environmental indicators that assess the relevant overall impacts of the materials selections. Whilst ideally an LCA assessment would consider all environmental factors relevant to the product or material, due to lack of information in some cases, and lack of consensus in how to calculate Key Performance Indicators (KPIs) within the industry, not all environmental impacts can be considered.

Standard ratios are used to convert the various greenhouse gases into equivalent amounts of CO2. These ratios are based on the global warming potential (GWP) of each gas. GWP is a relative measure of how much a given mass of greenhouse gas is estimated to contribute to global warming over a given time interval – usually 100 years. It is expressed relative to carbon dioxide which is set as the baseline which other emitters are compared against, and which therefore has a GWP of 1.

This assessment thus reports on the embodied carbon of the development as 'global warming potential' with the annotation 'CO2 equivalent (CO_2e)'.

3.3 Data Sources

There are a number of approaches to complete a building specific life cycle assessment. In particular, a flexible approach is needed when utilising a dataset of product specific environmental product declarations and more generic data calculated within the LCA tool.

Table 2 Types of data required for a WLC assessment

Quantity Data	Material Data	Comments	Provided by
Cost Plan	Cost Plan	Cost plans can be useful for calculation of uncertain quantities which are not product specific, however often an allowance is made at early design stages which may reduce accuracy.	Gardiner & Theobald (Cost Consultants)
Architectural Drawings and Area Schedule	Architecture Build-up	A more traditional and slower approach to determining quantity of building elements, if build-ups are available to support.	DSDHA Architects (Project Architect) Eckersley O'Callaghan Engineers (Façade)
Structural Drawings and Schedule	Structural Layouts		Meinhardt & HTS (Structural Engineers)
Mechanical and Electrical Schedules	M&E Specifications		Scotch Partners (M&E Engineer)

The assessment has utilised multiple data sources described above and is based on the level of detail available at the current stage of design.

3.4 Clarifications

Please see below a list of clarifications and assumptions made as part of the methodology for the WLCA assessment.

- This assessment has been done independently from the previous assessment completed due to the changes in design and change in software.
- All results, unless stated, have been provided by OneClickLCA, following RICS and GLA methodology.
- Structural assumptions have been made in collaboration with the structural consultants on the project, as outlined below. These structural assumptions have improved since the previous submission due to a higher quantum of more sustainable products being specified for the project.

Table 3- Structural Assumptions

	Sub Structure Concrete	Super Structure Concrete	Steel Reinforcement	Structural Steel
1MS	70% GGBS	30% GGBS	97% recycled rate	60% recycled rate
Vine Lane, WCS, High Holborn	70% GGBS	50% GGBS	97% recycled rate	80% recycled rate

- Architectural assumptions have been made in collaboration with the lead architectural consultants on the project.
- Operational energy carbon figures have been calculated by OneClickLCA and may differ from the results in the energy statement due to different carbon coefficients used.
- Quantities have been provided by the design team and the latest cost plan.
- Where assumptions needed to be made, reasonable assumptions were made by the design team and the OneClick software.
- Contingency (10%) to include coverage included in total figures. This has been applied to all Modules in line with RICS 2nd Edition (in consultation)
- Pre-construction demolition based upon GLA 50kgCO2e figure, using following quantities of demolition. This has been reported in the relevant section of the GLA templates.
    - 1MS – 16,000 m2
    - WCS- 2,286 m2
    - Vine Lane- 3,199 m2
    - High Holborn- 486 m2
- End of life demolition based upon RICS rate of 3.4 kgCO2e using GIA of buildings.
- Construction site impacts for Module A5 have been estimated in line with the RICS WLCA Guidance document (1st edition) at 1,400kgCO2e per £100k.
- Finishes and services have been based on Cat A.
- Intumescent paint quantities have been based of a figure of 20m2 per tonne of steel, suggested by manufacturer.
- Life Cycle assumptions have been based upon RICS Life Cycles through the OneClick RICS Parameter option. This has been reviewed to be in line with 3rd Party

comments and RICS guidelines unless the design team have specified the life expectancy differs from RICS standards.

- Residential internal partitions have been assumed to have a 60 year life cycle, this includes the insulation, studwork and plasterboard as part of the build-up. This is based upon the project teams assumptions for this building type.
- Mineral or rockwool have been specified for the project instead of the RICS assumption of PIR for all insulation types.
- B2 not reported as part of OneCLickLCA , included in B3.
- Cost consultant has provided cost plans accounting for 96.87% of the development.
- Transport Impacts (A4) calculated as part of OneClickLCA templates with RICS UK parameter. This has been reviewed and updated in line with third party comments. Any changes from RICS transport assumptions have been based upon client decisions and specifications from the design team.
- All steelwork has been specified to be sourced from European markets, as a result the transport for all steel products has been changed from RICS assumptions.
- Refrigerant assumptions and Leakage impacts (B1) have been calculated by MEP engineer based upon manufacturer information.

3.4.1 Quality Assurance

This assessment has undergone the following quality assurance checks.

- Scotch Partners LLP internal QA process
- OneClickLCA
- Third Party Peer review by Atelier 10 for initial submission
- Third Party review by Camden by Hilson Moran for previous submission (September 2022).
- Third Party review by GreenGage Environmental for this submission. Please see Appendix A for compliance report.
- Cost-consultant confirmation that 96.87% of cost allocated to each building element category has been accounted for in the assessment- this confirmation is in progress and will be updated.

3.5 Benchmarking

The results of the whole life carbon assessment will be compared against the benchmarks highlighted in the GLA Whole Life-Cycle Carbon Assessment Guide (March 2022). Table 3 displays he benchmarks from this document.

Table 4- GLA WLCA Benchmarks (2022)

Benchmark	Embodied Carbon (Modules A1-A5)	Modules A-C (excluding B6 & B7)
GLA WLC Office Benchmark	<950 $kgCO_2e/m^2$	<1400 $kgCO_2e/m^2$

GLA WLC Office Aspirational Benchmark	<600 $kgCO_2e/m^2$	<970 $kgCO_2e/m^2$
GLA WLC Residential Benchmark	<850 $kgCO_2e/m^2$	<1200 $kgCO_2e/m^2$
GLA WLC Residential Aspirational Benchmark	<500 $kgCO_2e/m^2$	<800 $kgCO_2e/m^2$

4 Results

This section summarises the results for the development. Detailed results for each building can be found in the relevant GLA Template.

4.1 Upfront Embodied Carbon Emissions

The upfront embodied carbon emissions for the proposed development include Modules A1-A5. The results of which are displayed in Table 4 below, with breakdowns for each building.

Table 5 Upfront Embodied Carbon Results

Module	*Module Description*	*Totals (KgCO2)*
A1-A3	Product Stages	17,356,244,395
A4	Transport of Equipment and Materials	2,378,610
A5	Construction	3,424,892
Total		**23,159,747**

The results of the assessment displayed a total of 23,159,747kgCO2e for the upfront embodied carbon stages. This results in embodied carbon emissions of 747kgCO2e/m2.

4.1.1 1 Museum Street Results

Table 6- 1 Museum Street Upfront Embodied Carbon

Module	Module Description	Totals (KgCO2)
A1-A3	Product Stages	14,333,809
A4	Transport of Equipment and Materials	1,847,009
A5	Construction	2,469,095
Total		**18,649,912**

1 Museum Street displays a total of 18,649,912 kgCO2e for the upfront embodied carbon stages. This results in embodied carbon emissions of 752kgCO2e/m2.

4.1.2 High Holborn Results

Table 7- High Holborn Upfront Embodied Carbon

Module	Module Description	Totals (KgCO2)
A1-A3	Product Stages	270,296
A4	Transport of Equipment and Materials	52,579
A5	Construction	82,487
Total		**405,362**

The High Holborn assessment displayed a total of 405,362 kgCO2e for the upfront embodied carbon stages. This results in embodied carbon emissions of 822 kgCO2e/m2.

4.1.3 Vine Line Results

Table 8- Vine Lane Upfront Embodied Carbon

Module	Module Description	Totals (KgCO2)
A1-A3	Product Stages	1,470,791
A4	Transport of Equipment and Materials	291,536
A5	Construction	453,119
Total		**2,215,446**

Vine Lane results in a total of 2,215,446 kgCO2e/m2 GIA for the upfront embodied carbon stages. This results in embodied carbon emissions of 904kgCO2e/m2.

4.1.4 West Central Street Results

Table 9- West Central Street Upfront Embodied Carbon

Module	Module Description	Totals (KgCO2)
A1-A3	Product Stages	1,281,349
A4	Transport of Equipment and Materials	187,486
A5	Construction	420,191
Total		**1,880,027**

West Central Street displays a total of 1,880,027 kgCO2e for the upfront embodied carbon stages. This results in embodied carbon emissions of 581kgCO2e/m2.

4.2 Embodied Carbon Emissions

The embodied carbon emissions for the proposed development include use stages A-C (exc. B6&B7 incl. sequestration). The results of which are displayed in Table 5 below.

Table 10 Embodied Carbon Emission Results

Module	Module Description	Totals (KgCO2)
Sequestration		-856,797
A1-A5	Product Stages	23,159,747
B1-B5	Transport of Equipment and Materials	12,539,395
C1-C4	Construction	1,502,430
Total		**36,344,774**

The overall embodied carbon across the proposed development displays a total of 36,344,774 $kgCO_2e$ for the embodied carbon stages. This results in embodied carbon emissions of 1,173 kgCO2e/m2.

4.2.1 1 Museum Street Results

Table 11- 1 Museum Street Embodied Carbon

Module	Module Description	Totals (KgCO2)
Sequestration		-728,822
A1-A5	Product Stages	18,649,912
B1-B5	Transport of Equipment and Materials	10,458,779
C1-C4	Construction	1,229,560
Total		**29,609,429**

The 1 Museum Street assessment displays a total of 29,609,429 $kgCO_2e$ for the embodied carbon stages. This results in embodied carbon emissions of 1,194 kgCO2e/m2 GIA.

4.2.2 High Holborn Results

Table 12- High Holborn Embodied Carbon

Module	Module Description	Totals (KgCO2)
Sequestration		-7,772
A1-A5	Product Stages	405,362
B1-B5	Transport of Equipment and Materials	202,196
C1-C4	Construction	20,445
Total		**620,231**

The overall embodied carbon for High Holborn is 620,231 $kgCO_2e$ resulting in embodied carbon emissions of 1,258 kgCO2e/m2.

4.2.3 Vine Lane Results

Table 13- Vine Lane Embodied Carbon

Module	Module Description	Totals (KgCO2)
Sequestration		-11,191
A1-A5	Product Stages	2,215,446
B1-B5	Transport of Equipment and Materials	783,580
C1-C4	Construction	93,951
Total		**3,081,785**

Vine Lane displays a total of 3,081,785 $kgCO_2e$ for the embodied carbon stages. This results in embodied carbon emissions of 1,258 kgCO2e/m2.

4.2.4 West Central Street Results

Table 14- West Central Street Embodied Carbon

Module	Module Description	Totals (KgCO2)
Sequestration		-109,013
A1-A5	Product Stages	1,880,027
B1-B5	Transport of Equipment and Materials	1,094,840
C1-C4	Construction	158,475
Total		**3,033,328**

The West Central Street assessment displays a total of 3,033,328 $kgCO_2e$ for the embodied carbon stages. This results in embodied carbon emissions of 934 kgCO2e/m2.

4.3 Operational Carbon Emissions

Table 15 Operational Carbon Emissions Results

Category	Totals ($kgCO_2e$)
Operational Energy- Regulated	8,981,278
Operational Energy- Unregulated	8,734,395
Operational Water	77,852
Total	**17,793,524**

The Operational Carbon emissions for the development are estimated to be 574 kgCO2e/m2 GIA.

4.3.1 1 Museum Street Results

Table 16- 1 Museum Street Operational Carbon

Category	Totals ($kgCO_2e$)
Operational Energy- Regulated	6,462,681
Operational Energy- Unregulated	7,722,208
Operational Water	51,417
Total	**14,236,306**

The Operational Carbon emissions for 1 Museum Street are estimated to be 574 kgCO2e/m2 GIA.

4.3.2 High Holborn Results

Table 17- High Holborn Operational Carbon

Category	Totals ($kgCO_2e$)
Operational Energy- Regulated	120,194
Operational Energy- Unregulated	84,422
Operational Water	856
Total	**205,472**

The total operational energy and water emissions for High Holborn are estimated to be 416 kgCO2e/m2 GIA.

4.3.3 Vine Lane Results

Table 18- Vine Lane Operational Carbon

Category	Totals ($kgCO_2e$)
Operational Energy- Regulated	860,994
Operational Energy- Unregulated	383,259
Operational Water	15,244
Total	**1,259,477**

Vine Lane has a total operational energy and water emissions of 514 kgCO2e/m2 GIA.

4.3.4 West Central Street Results

Table 19- West Central Street Operational Carbon

Category	Totals ($kgCO_2e$)
Operational Energy- Regulated	1,537,409
Operational Energy- Unregulated	544,506
Operational Water	10,356
Total	**2,092,271**

The Operational Carbon emissions associated with West Central Steet are estimated to be 644 kgCO2e/m2 GIA.

4.4 Estimated Whole Life Carbon (WLC) Emissions

Table 20 WLC Results

Module	Module Description	Totals (KgCO2e)
A1-A3	Product Stages	17,356,244
A4	Transport of Equipment and Materials	2,378,510
A5	Construction	3,424,892
B1-B5	Use	12,539,395
B6-B7		17,793,524
C1-C4	End of Life	1,502,430
Sequestered Carbon		-856,797
Total		**54,138,299**
D	Benefits and Loads beyond the System Boundary (not included in totals)	-6,573,243

The assessment results in a total WLC emissions of 1,748 $kgCO_2e$/m2 GIA as displayed in Table 21 for the whole development. The table displays the breakdown in the different life cycle modules.

4.5 Performance against benchmarks

Table 21- Performance Against Benchmarks

Indicator	Benchmark	Aspiration	Achieved
Embodied Carbon (Modules A1-A5)	<950 $kgCO_2e/m^2$	<600 $kgCO_2e/m^2$	**747** $kgCO_2e/m^2$
Modules B-C (exc. B6 & B7) (Office)	<450 $kgCO_2e/m^2$	<370 $kgCO_2e/m^2$	**453** $kgCO_2e/m^2$
Modules A-C (exc. B6 & B7; inc. sequestered carbon)	<1400 $kgCO_2e/m^2$	<970 $kgCO_2e/m^2$	**1,173**$kgCO_2e/m^2$

The table above shows the performance of the development against GLA benchmarks. As outlined earlier, this has been compared against an office building benchmark due to the largest percentage of area across the site being this building type. The results show the site performing within both the upfront and embodied carbon benchmarks across the site, however they do not achieve the aspirational benchmarks.

4.5.1 Performance against benchmarks – 1 Museum Street

Table 22 1 Museum Street Results

Indicator	Benchmark	Aspiration	Achieved
Embodied Carbon (Modules A1-A5)	<950 $kgCO_2e/m^2$	<600 $kgCO_2e/m^2$	**752** $kgCO_2e/m^2$
Modules B-C (exc. B6 & B7) (Office)	<450 $kgCO_2e/m^2$	<370 $kgCO_2e/m^2$	**471** $kgCO_2e/m^2$
Modules A-C (exc. B6 & B7; inc. sequestered carbon)	<1400 $kgCO_2e/m^2$	<970 $kgCO_2e/m^2$	**1194** $kgCO_2e/m^2$

Comparing the 1 Museum Street results to the benchmarks, the upfront and overall embodied carbon performs lower than the benchmarks but not the aspirational benchmarks. Module B-C is currently higher than the benchmarks, largely due to higher replacement of services and external wall elements. During the next work stage, the design team will explore specification to reduce the B module with focus on MEP specifications with lower embodied carbon and better replacement cycles.

4.5.2 Performance against benchmarks – High Holborn

Table 23 High Holborn Results

Indicator	Benchmark	Aspiration	Achieved
Embodied Carbon (Modules A1-A5)	<850 $kgCO_2e/m^2$	<500 $kgCO_2e/m^2$	**822** $kgCO_2e/m^2$
Modules B-C (exc. B6 & B7) (Office)	<350 $kgCO_2e/m^2$	<300 $kgCO_2e/m^2$	**451** $kgCO_2e/m^2$
Modules A-C (exc. B6 & B7; inc. sequestered carbon)	<1200 $kgCO_2e/m^2$	<800 $kgCO_2e/m^2$	**1258** $kgCO_2e/m^2$

The High Holborn results displayed above in Table 23, show that the upfront embodied carbon results to be within the benchmarks, with the overall embodied carbon being outside benchmark. The B-C module is currently outside the benchmarks, due to high replacement associated with MEP services. This will be prioritised as part of the next work stage to specify products with higher life cycle and lower embodied carbon.

4.5.3 Performance against benchmarks- Vine Lane

Table 24 Vine Lane Results

Indicator	Benchmark	Aspiration	Achieved
Embodied Carbon (Modules A1-A5)	<850 $kgCO_2e/m^2$	<500 $kgCO_2e/m^2$	**904** $kgCO_2e/m^2$
Modules B-C (exc. B6 & B7) (Office)	<350 $kgCO_2e/m^2$	<300 $kgCO_2e/m^2$	**358** $kgCO_2e/m^2$
Modules A-C (exc. B6 & B7; inc. sequestered carbon)	<1200 $kgCO_2e/m^2$	<800 $kgCO_2e/m^2$	**1258** $kgCO_2e/m^2$

The comparison with benchmarks for Vine Lane, shown in Table 24, show that the upfront embodied carbon results to be outside the benchmarks. This is largely due to high embodied carbon associated with both the construction site impacts and substructure for Module A. This, along with other opportunities, will be worked on during the next work stage to reduce the upfront embodied carbon. Module B-C are slightly outside benchmarks set out, this will be reduced through design and specification in the next workstage.

4.5.4 Performance against benchmarks- West Central Street

Table 25 West Central Street results

Indicator	Benchmark	Aspiration	Achieved
Embodied Carbon (Modules A1-A5)	<850 $kgCO_2e/m^2$	<500 $kgCO_2e/m^2$	**581** $kgCO_2e/m^2$
Modules B-C (exc. B6 & B7) (Office)	<350 $kgCO_2e/m^2$	<300 $kgCO_2e/m^2$	**385** $kgCO_2e/m^2$
Modules A-C (exc. B6 & B7; inc. sequestered carbon)	<1200 $kgCO_2e/m^2$	<800 $kgCO_2e/m^2$	**934** $kgCO_2e/m^2$

The results for West Central Steet show that the upfront embodied carbon is lower considerably lower than the benchmark set out, largely due to the part retention and refurbishment. The comparison, however, shows the Modules B-C outside the benchmarks. Similar to the other buildings, this is largely due to the higher replacement associated with the MEP services. This will be reduced during the next work stage through specification of lower carbon products, with higher life cycles.

5 Opportunities for reducing WLC

5.1 Maximise Recycled Content

By specifying products with high contents of recycled material, the product life cycle emissions can be significantly reduced, compared to products procured with virgin material. Therefore the embodied carbon can be reduced at the technical design stage through choice of materials.

5.2 Influence of Product Specification

The specific requirements of a product can significantly impact the carbon emissions at the product stage, often due the components of the product requiring more carbon intensive treatment and subsequent transportation prior to fabrication.

5.3 Site specific opportunities – actions taken

Throughout the design process, workshops have regularly taken place between the design team to discuss how both the embodied and whole life carbon can reduce for the site. Due to the nature of the development, and feedback from previous applications, this has conversation has increased for this submission. This has resulted in various positive actions being taken across the development to reduce the carbon of the buildings. This has been through design changes and specifications where possible. Table 27 outlines some of these actions that have been taken throughout the design process for this whole life carbon assessment.

Table 26- Actions Taken

Action Taken	Building
1. Retention of basement to main office block to reduce embodied carbon of substructure	1 Museum Street
2. Increase in GGBS % for substructure to 70%	High Holborn, West Central Street and Vine Lane
3. 80% recycled rate of steel structural profiles specified	High Holborn, West Central Street and Vine Lane
4. 60% recycled rate of steel structural profiles specified	1 Museum Street
5. 50% GGBS in superstructure specified	High Holborn, West Central Street and Vine Lane
6. Raised access flooring changed from generic higher embodied carbon to Kingspan RMg600+ lower carbon alternative	1 Museum Street

7. Residential insulation specified as mineral/rock wool, replacing higher embodied carbon PIR insulation (RICS assumption where not specified)	High Holborn, West Central Street and Vine Lane
8. Steel transport reduced by specifying steel to be EU sourced, rather than globally sourced (as per RICS assumptions)	1 Museum Street, High Holborn, West Central Street and Vine Lane
9. Residential insulation and drylining assumed for 60 year life cycle due to less likely changes in internal fit out, specified by the team (RICS assumption for 20 years)	High Holborn, West Central Street and Vine Lane
10. Increase in GGBS % for substructure to 50%	1 Museum Street

In addition to the high level actions highlighted in this document, building specific actions have been outlined in each respective GLA template.

5.4 Site specific opportunities – opportunities

As the design develops, there are opportunities to reduce both the embodied and whole life carbon of the development through design and specification. A selection of building specific opportunities have been highlighted in the respective GLA templates for each building, however opportunities are not restricted to these. The design team will continue to explore any lower carbon design and specifications, where appropriate, as part of the next work stages.

The results of this study have shown that the B module for replacement, is particularly high throughout the buildings. This is largely due to high replacement associated with replacement of MEP services. This will be reduced as the design develops with MEP products specified, where possible, with lower embodied carbon and larger replacement cycles.

Additionally, the current results are based upon the current design assumptions, and as the project proceeds, all elements will have more accurate specifications. The team is committed to reducing embodied carbon, wherever appropriate and feasible, and as a result the Stage 4 WLCA report should display more accurate and lower embodied carbon specifications in line with specified products.

Please see the building specific GLA templates for more information on further opportunities.

6 Conclusion

This report has set out the Embodied Carbon emissions estimated for the Site to be 1,173 $kgCO_2e/m^2$ (Modules A-C exc. B6 & B7; inc. sequestered carbon). The aim of this report was to ascertain the performance of the Site against the GLA targets as outlined by the Whole Life Carbon Assessment Guidance document (March, 2022).

6.1 Performance against benchmarks - Development

Table 27- Performance Against Benchmarks

Indicator	Benchmark	Aspiration	Achieved
Embodied Carbon (Modules A1-A5)	<950 $kgCO_2e/m^2$	<600 $kgCO_2e/m^2$	**747** $kgCO_2e/m^2$
Modules B-C (exc. B6 & B7) (Office)	<450 $kgCO_2e/m^2$	<370 $kgCO_2e/m^2$	**453** $kgCO_2e/m^2$
Modules A-C (exc. B6 & B7; inc. sequestered carbon)	<1400 $kgCO_2e/m^2$	<970 $kgCO_2e/m^2$	**1,173** $kgCO_2e/m^2$

Table 27, above, displays the development wide results when compared to the GLA benchmarks for an office building. This shows that both upfront embodied (Module A1-A5) and overall embodied carbon (Modules A-C exc. B6&B7, inc. sequestered carbon) is within the Greater London Authority Whole Life Carbon Guidance (2022) benchmarks, however they do not achieve aspirational benchmarks.

The results in section 4 also displays that, generally, the buildings perform within the benchmarks throughout the development, although Module B is higher than expected throughout due to replacement cycles.

6.2 Conclusion

The results of this Whole Life Carbon Assessment show that the Site currently performs within the benchmarks, however they do not achieve the aspirational targets across the site.

This report has highlighted actions taken to date for the site, and has outlined potential further opportunities. This report has taken on comprehensive comments from peer reviews, and has followed RICS and GLA guidance throughout to be as robust and consistent as possible at this stage of design.

Whilst the results are promising for the development, it should be noted the current results are largely based on best available design information and does include assumptions from the design team where required due to the stage of the project and if more accurate results are needed a further study would be required to reflect any design

decisions. The results have also been limited by the use of the OneClickLCA outputs, more detailed embodied carbon can be completed when more accurate design information is available at a later design stage.

During the next work stage, the design team will work to reduce the embodied carbon of the buildings, through design and specification, to further reduce the results of the whole life carbon of the development.

7 Appendix A Greengage Environmental Third Party Review

Greengage

Brighter strategies
for greener projects

Client: Lab Selkirk House Ltd

Project: 1 Museum Street

Report: Whole Life Carbon (WLCA) 3rd Party Review

QUALITY ASSURANCE

Issue/Revision:	Draft	Draft 2	Final
Date:	June 2023	June 2023	June 2023
Comments:	Draft for Comment		Final version
Prepared by:	Cameron Parker	Cameron Parker	Cameron Parker
Authorised by:	Liz Grove	Liz Grove	Liz Grove
File Reference:	552402cp26Jun23FV01_WLCA-Review.docx	552402cp26Jun23FV01_WLCA-Review.docx	552402cp26Jun23FV01_WLCA-Review.docx

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1.0 VERIFICATION STATEMENT

Greengage Environmental have been appointed by the client to provide an independent third-party assessment of the whole life carbon assessment (WLCA) report and OneClick LCA model(s) for the Proposed Development at Selkirk House, 166 High Holborn and 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR.

This verification report aims to:

- Verify that that the assumptions made for the baseline models are adequate, transparent, and consistent; and
- Confirm that the results have been developed in line with the RICS Professional Statement on 'Whole Life Carbon for the Built Environment'[1] and the GLA London Plan Guidance on 'Whole Life-Cycle Carbon Assessments'[2].

As a result of our review, we can confirm that it is our professional opinion that the WLCA undertaken and results produced are in line with the required guidance and standards (as set out above) for calculation and reporting.

1.1 SCOPE

Greengage's verification assessed whether the methodology to develop the reported LCA results was in compliance with the RICS/ GLA whole life carbon assessment guidance. The verification process included a review of the models provided against the reported carbon emission results.

Greengage's review has considered the following:

- Completeness of full RICS scope of WLCA, including building element categories and life-cycle stages;
- Consideration for assessment requirements, as per GLA WLCA guidance (March 2022); and
- Consideration for WLCA model inputs (i.e. materials and quantities), with a focus on items which typically have a significant impact.

The information reviewed by Greengage includes the following:

- One Click LCA Stage 2/3 proposed models; and
- Project's Stage 2 Cost Plans.

This verification is independent of the RICS WLCA guidance requirement for the inclusion of min. 95% of the capital cost that has been allocated to each building element category (section 3.2.2) and should therefore be confirmed by the assessor.

1.2 REVIEWER QUALIFICATIONS AND INDEPENDENCE

Greengage's appointed WLCA reviewer is Cameron Parker, BSc, PIEMA.

Cameron has been responsible for conducting and overseeing the undertaking of WLCA since 2019. Within this time, Cameron has undertaken formal training and a follow-up exam with eToolLCD in 2019. Cameron has worked on numerous projects within this timeframe, amounting to over 10 assessments for submission to the GLA, in addition to being selected for the UKGBC's Embodied Carbon Task Group.

Cameron has 7+ years' experience working within the sustainability industry and holds a Geography BSc degree.

2.0 VERIFICATION REPORT

The following table outlines the comments observed by the reviewer, regarding any discrepancies identified between the relevant applicable guidance and the 4no. One Click LCA models.

Key:

MS = Museum Street; VS = Vine Lane; WCS = West Central Street; HH = High Holborn

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
A5 Distances	All transport distances should align with the RICS defaults. These can be enacted through changing of the parameters to 'UK - RICS'.	All	This has been amended. Steel has been specified to be sourced from EU, so differs from RICS	Comment addressed
RICS Categories	'Average Site Impacts' should be allocated to 'Other' or allocated by proportion of cost, as outlined within the Cost Plan.	ALL	This has been amended	Comment addressed
	'Structural Steel Profile' ref 1.1 sits within the substructure section and has RICS Code 2.1.1.	HH, WCS	Both should be under RICS Code 1.1 as part of Substructure. This has been amended.	Comment addressed
	Core Walls are currently listed under 2.7.1 and should fall under RICS Code 2.1.4.	HH, WCS	This has been amended	Comment addressed
	All paint, plaster and plasterboard should fall under the relevant '3 Internal Finishes' allocation	HH, VL, WCS	This has been amended	Comment addressed
	Roof Slab has been wrongly allocated to 2.2.	HH	This has been amended	Comment addressed

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
	Steel Frame Paint should be similarly allocated to RICS 2.1.	HH	This has been amended	Comment addressed
	Item ref 2.4 Concrete has been wrongly allocated to RICS 2.5.	HH	This has been amended	Comment addressed
	Throughout the assessment, all materials should be correctly allocated under their relevant RICS sub-categories i.e. 3. Internal Finishes should be sub-divided into 3.1, 3.2, 3.3 to facilitate future reviews. Once rectified, select issues can be fully audited.	ALL	Reviewed and updated	Comment addressed
	If Lift Shafts have been included within the Core Walls total, these should be separated and reallocated under 2.7.1.	ALL	Included as part of the Core Walls total, not possible to separate.	Comment addressed
	Internal Walls Steel Stud should be allocated to 2.7.1 and should be cold rolled steel in lieu of hot rolled.	VL, MS, WCS	Allocated to 2.7.1	Comment addressed
	Core Walls under ref 1.7 should fall under RICS 2.1.	MS	This has been amended	Comment addressed
	Reinforced Concrete Shear Wall has concrete allocated to 2.5 instead of 2.7.1. Furthermore, if this wall represents a Core Wall, it should fall under RICS 2.1.4.	MS	Amended to 2.1.4.	Addressed as per modeller response

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
	Roof Steel has been wrongly allocated to RICS 2.1.1.	MS	This has been amended	Comment addressed
	Insulation has been entered as part of the floor finishes. Also has this been confirmed, otherwise it should be entered as PIR in line with RICS.	MS, WCS	Insulation changed to PIR	Comment addressed
	Balustrades allocated under 2.7.1 instead of RICS 2.7.2.	WCS	This has been amended	Comment addressed
Missing Materials	No internal doors allocated.	VL	Incorrectly allocated. This has been amended.	Comment addressed
	There is no Roof Structure allocated.	HH, VL, MS	Not separated as part of cost plan, this is included in overall frame. Now allocated	Comment addressed
	The 'Triple Glazing' has been entered without a frame and should therefore have the accompanying frame entered as a separate item.	HH	Framing as part of aluminium stick-built curtain wall	Comment addressed
	No windows have been allocated. Are these instead represented by the curtain walling?	VL	Windows included in "Double glazed glass curtain wall with aluminium frame" as part of façade.	Comment addressed

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
	There are no materials allocated for the lowest floor construction.	HH, VL, WCS	Included as part of substructure concrete	Would recommend to separate as best practice but not essential for planning compliant reporting, therefore no further comment.
	All substructure components should be input with as much clarity and detail as Museum Street until it can be fully reviewed.	HH, VL, WCS	This has been amended	Comment addressed
	The Fire Alarm system should also be added to accompany the sprinklers.	ALL	This has been added	Comment addressed
	The Roof Slab Hollow core does not have any accompanying rebar.	HH, WCS	This has been added	Comment addressed
	Full bathroom spec should be included based upon the accommodation schedule. Where included, faucets should also be added as these tend not to be included within sanitaryware EPDs.	ALL	This has been added	Comment addressed
	Where feasible, FF&E should be included based upon the drawings and information available, including kitchen sinks. All inputs' services life should align with the RICS defaults.	ALL	This has been added	Comment addressed

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
	Insulation is missing or sparse throughout the models. This should be input as PIR insulation in line with the RICS default where unknown.	ALL	Mineral/Rock wool has been specified by design team. Where not known, this has been changed to PIR	Comment addressed
	All Cladding should include framing components and a backing material to fix the cladding to.	HH, VL	Included as part of template	Comment addressed
	Staircase Finishes should also be included.	ALL	This has been added	Comment addressed
Specification Queries	Clean and wastewater should be input as separate items under the more up to date Thames Water figures.	ALL	Figures updated using calculations for Public Health engineer	Comment addressed
	Has the grade of concrete been dictated by the Structural Engineer throughout the design? Where not, these should align with the RICS Standards.	ALL	Dictated by SE as confirmed in report	Comment addressed
	Structural Steelwork should have 20% default recycled content. Have the quantities input been verified by the Structural Engineer?	ALL	Confirmed by SE as confirmed in report	Comment addressed
	All refrigerant leakage rates should be input in line with those outlined within TM65.	ALL	Rates confirmed by manufacturer	Comment addressed
	Steel under ref 2.7 entered as 'Steel Sheets' instead of 'Steel Profile'.	WCS	This has been amended	Comment addressed

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
RICS Service Life	All applicable Roof Coverings do not align with RICS default service life (30 years).	VL, MS, WCS	This has been amended	Comment addressed
	All applicable Internal Partitions and Dry Lining do not align with RICS default service life (30 years).	ALL	This has been amended for 1MS. HH, VL and WCS has been specified at 60 by design team.	Comment addressed
	All applicable wall render/paint finishes do not align with RICS default service life (30/10 years respectively).	ALL	This has been amended	Comment addressed
	All applicable raised access floors/floor finish layers do not align with RICS default service life (30/10 years respectively).	ALL	This has been amended	Comment addressed
	All applicable raised ceiling substrate/paint finish layers do not align with RICS default service life (20/10 years respectively).	ALL	This has been amended	Comment addressed
	All applicable FF&E do not align with RICS default service life 30 years.	HH	This has been amended	Comment addressed
	All applicable heat sources do not align with RICS default service life 20 years.	ALL	This has been amended	Comment addressed
	All applicable space heating and air treatment components do not align with RICS default service life 20 years.	ALL	This has been amended	Comment addressed

Issue	Reviewer Comment	Model	Modeller Response	Final Greengage Comment
	All applicable ductwork does not align with RICS default service life 20 years.	HH, VL, WCS	This has been amended	Comment addressed
	All applicable light fittings do not align with RICS default service life 15 years.	ALL	This has been amended	Comment addressed
	All applicable water and disposal installations do not align with RICS default service life 25 years.	ALL	This has been amended	Comment addressed
	All applicable sanitaryware does not align with RICS default service life 20 years.	HH, VL, WCS	This has been amended	Comment addressed
	All applicable lift and conveyor installations do not align with RICS default service life 20 years.	ALL	This has been amended	Comment addressed
	All applicable opaque modular cladding does not align with RICS service life (30 years).	HH, VL	This has been amended	Comment addressed
	All applicable glazed curtain walling does not align with RICS service life (35 years).	HH, VL	This has been amended	Comment addressed
	All applicable windows & external doors do not align with RICS service life (35 years).	MS, WCS	This has been amended	Comment addressed

REFERENCES

[1] *RICS, "RICS Professional Statement UK – Whole Life Carbon Assessment for The Built Environment," 2017. (Online). Available: https://www.rics.org/globalassets/rics-webSite/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf*

[2] *Greater London Authority . London Plan Guidance - Whole Life-Cycle Carbon Assessment March 2022. (Online). Available: https://www.london.gov.uk/Sites/default/files/lpg_-_wlca_guidance.pdf*

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