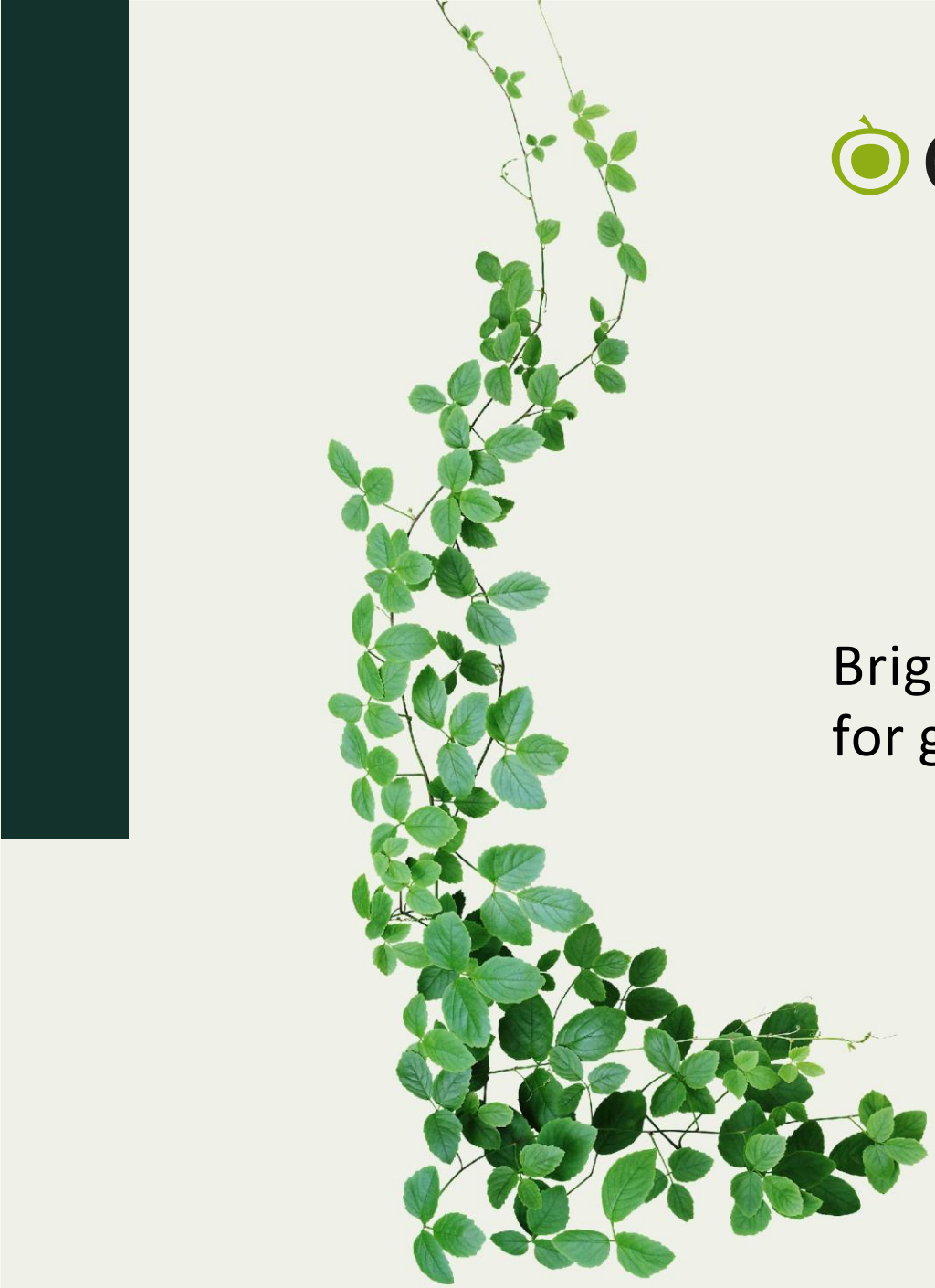
Greengage

Brighter strategies
for greener projects





Client: Clarion Housing Association Limited and Clarion Housing Property Development Services Limited

Project: Former Peacock Centre site and land at Pipewell Avenue

Report: Whole Life Carbon Assessment Report – RIBA Stage 3

QUALITY ASSURANCE

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1.0 EXECUTIVE SUMMARY

Greengage has been appointed by Clarion Housing Association Limited and Clarion Housing Property Development Services Limited (Clarion) to conduct a Whole Life Carbon Assessment (WLCA) for the Former Peacock Centre and Land at Pipewell Avenue, Gorton in respect of the full planning application for the erection of 75 dwellings (Use Class C3), including a 25-unit apartment building and 27 dwellings on the Peacock Centre Site, and 23 dwellings on the Pipewell Avenue Site, with associated access, parking, landscaping, public open space, informal play provision, drainage infrastructure, and enhanced pedestrian and cycle connections.

This WLCA report has been produced in response to the policies and aspirations of the GMCA Places for Everyone Strategy and to Clarion's Sustainability Roadmap 2025 whole life carbon targets and to determine the viability of Clarion's 2030 embodied carbon stretch targets and their impact on both cost and project delivery.

The WLCA has been conducted at RIBA Stage 3 to inform Clarion and the design team on the benchmark Whole Life Carbon (WLC) performance for the proposed residential development located at the Former Peacock Centre site and land at Pipewell Avenue, within Gorton, Manchester.

The assessment follows the EN 15978 calculation methodology and further aligns by the guidelines set out in RICS Professional Statement (RICS PS) UK - Whole Life Carbon Assessment for the Built Environment 2nd edition [1], referencing whole life carbon modules as outlined below.

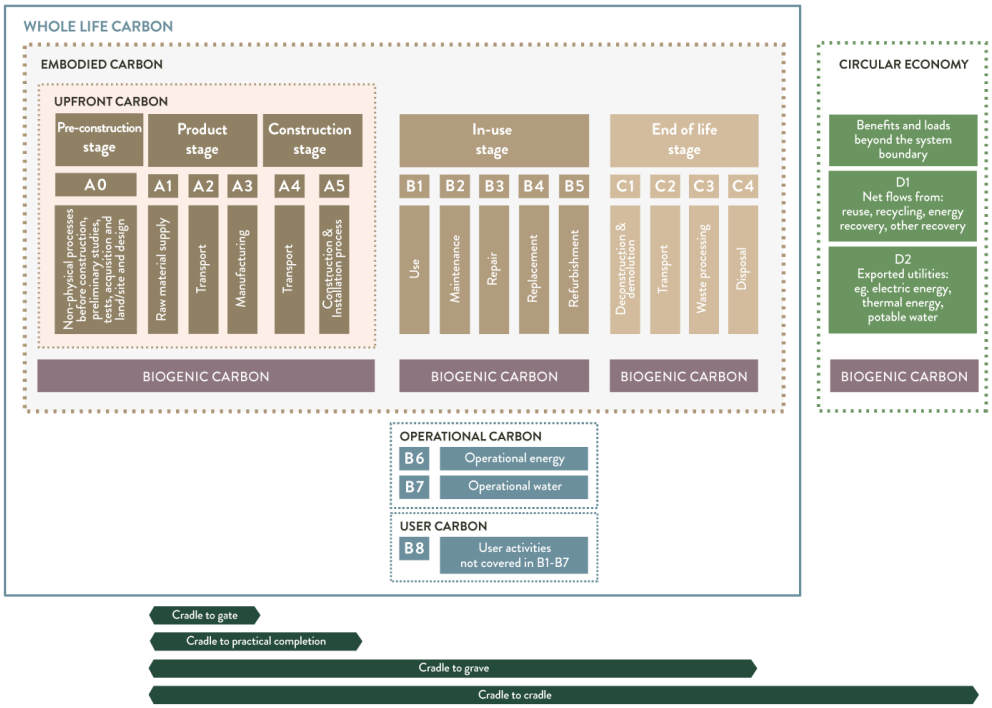


Figure 1.1 *RICS v2 EN 15978 System Boundaries*

The report supports the Manchester City target of Net Zero Carbon by 2038, Greater Manchester joint development plan, Places for Everyone (2024) Policy and Manchester Core strategy (2012-2027) as well as considering the direction of travel for the new emerging Manchester Local Plan.

This assessment captures both scenario tests, with non-decarbonised (existing SAP10.2 carbon emission factors, published by BRE on behalf of BEIS) and decarbonised scenario impacts applied to associated electricity use, production, distribution and storage.

Table 1.2 below sets out the snapshot results, excluding the WLCA uncertainty factors, and how these compare against emerging Manchester Local Plan, Manchester Climate Ready policy and the developing UK Net Zero Carbon Building Standard benchmarks. Results have been displayed for both the non-decarbonised and future energy scenario ('FES') (decarbonised) national power grid scenarios.

The 'RICS Reporting Template - Summary', which contains the summary results including the WLCA uncertainty factor, has been presented within Appendix A for each building level assessment.

Assessment Strategy

Based on information provided within the latest cost plan, Greengage have conducted the following whole life carbon assessment of the Peacock Centre site and Pipewell Avenue masterplan.

To verify performance on a house-by-house basis, modelling has captured Stage 3 cost plan information for each of the individual homes, with a representative house model produced for each included within the masterplan. In doing so, the impact of each construction has been summarised within this report alongside site-wide impacts.

As the design progresses towards detailed design and specification, product and design decisions will be reviewed with the wider team to establish areas for potential carbon reduction, as outlined later in this report. Proposals for options discussed to reduce carbon are detailed in the final sections of this report

Energy Strategy

An energy and sustainability strategy has been produced by CPW for the Proposed Development as a key mechanism for reducing whole life carbon (WLC) of the development.

In addition to a passive design approach, a strategy has been proposed that features highly efficient heat pumps to deliver heating and hot water throughout the development. With heat pumps operating at greater efficiency than traditional gas boilers, the heat pumps can take advantage of the projected decarbonisation of the national grid, resulting in lower carbon operation of the dwellings. Section 7.2 provides further detail on the proposed energy strategy.

Estimated Whole Life Carbon (WLC) Emissions

Table 1.2 and 1.3 overleaf display site-wide summary results from the Proposed Development's assessment using RICS SAP10.2 and FES carbon factors for the non-decarbonised grid scenario (business as usual 'BAU') and future energy scenario ('FES').

Information relating to house-by-house performance has been provided later in this report, with full summary tables provided within the Appendix.

Table 1.2 Breakdown of WLC emissions by RICS Category (Site-wide summary, including external works)

	BAU (Non-decarbonised grid)	FES (Decarbonised grid)

RICS Asset Categories	**Upfront carbon** (A0-A5 excl. sequestration) ($kgCO_2e$)	**WLC** (A-C incl. sequestration, excl. B6-B7) ($kgCO_2e$)	**Upfront Carbon** (A0-A5 excl. sequestration) ($kgCO_2e$)	**WLC** (A-C incl. sequestration, excl. B6-B7) ($kgCO_2e$)
Asset Level Emissions	94	94	94	94
0.1-0.2 Demolition	-	-	-	-
0.3-0.5 Facilitation works	-	-	-	-
1 Substructure	1,166,247	1,295,018	1,166,247	1,250,330
2.1-2.4 Superstructure	636,483	934,893	636,483	844,773
2.5-2.6 Superstructure	592,241	760,639	592,241	682,915
2.7-2.8 Superstructure	188,003	246,953	188,003	217,874
3 Finishes	193,987	531,009	193,987	378,281
4 Fittings, furnishings & equipment (FF&E)	43,908	178,887	43,908	112,925
5 Services (MEP)	451,096	1,147,823	451,096	801,626
6 Prefabricated buildings and building units	-	-	-	-
7 Work to existing building	-	-	-	-
8 External works	356,900	530,183	356,900	439,373
TOTAL – $kgCO_2e$	3,628,960	5,625,499	3,628,960	4,728,190
TOTAL – $kgCO_2e/m^2$	551	855	551	718

Table 1.3 overleaf displays the proposed whole life carbon breakdown by lifecycle module, including the combined external impacts (D1 & D2). This again includes results for both the non-decarbonised and decarbonised grid scenarios and demonstrates how the anticipated grid decarbonisation is predicted to impact the in-use (B), end-of-life (C) and external impact (D) emissions.

The overall site-wide summary found targets for the Clarion 2025-30 target were exceeded by approximately 57% with a figure of 551 $kgCO_2e/m^2$ (A0-A5 excluding sequestration) vs 350$kgCO_2e/m^2$ for the 2025-2030 benchmark. Whilst results demonstrate the proposals fall short of meeting the Clarion current targets, assessment has identified a number of opportunity areas which will result in carbon reductions moving forward. Further details can be found within Section 8.0.

Details on the assessment methodology and modelling inputs can be found within Section 5.0 and 6.0.

Table 1.3 Site-wide summary of Proposed Development's WLC emissions against benchmarks ($kgCO_2e/m^2$)

	Stage 3 Design Non-decarb	Stage 3 Design Decarb	Clarion/ Latimer 2025-2030 Target	Clarion/ Latimer 2030 Target (Stretch)	Places for Everyone	Emerging Local Plan; Manchester Climate Ready 2025-2030	Emerging Local Plan; Manchester Climate Ready 2030-2035	UKNZCBS embodied carbon limits (2025)
Modules A0-A5 (excl. sequestration)	551	551	350	290	homes; ≤500 flats; ≤600	400	300	Single family homes; 430 Flats; 565
Modules B-C (excl. B6 & B7)	303	167	-	-	-	-	-	-
Modules A-C (incl. sequestration, excl. B6 & B7)	855	718	-	-	-	640	470	-

2.0 INTRODUCTION

Greengage has been appointed by Clarion Housing Association Limited and Clarion Housing Property Development Services Limited to undertake a Whole Life Carbon Assessment (WLCA) of Former Peacock Centre site and land at Pipewell Avenue, within the Gorton Manchester.

The proposal is for the planning application for the erection of 75 dwellings (Use Class C3), including a 25-unit apartment building and 27 dwellings on the Peacock Centre Site, and 23 dwellings on the Pipewell Avenue Site, with associated access, parking, landscaping, public open space, informal play provision, drainage infrastructure, and enhanced pedestrian and cycle connections.

This assessment is aligned to the Stage 3 design and cost plan and has been carried out in line with RICS Professional Statement methodology on whole life carbon to establish the WLC impacts for the proposed residential development, defined as 'those carbon emissions resulting from the construction and the use of a built asset over its entire life, including its demolition and disposal.'

This includes:

- Operational carbon; emissions associate with the running and maintaining the development
- Embodied carbon; emissions that relate to pre-construction operations, pre-construction demolition of any existing structure, raw extraction, manufacture and transport of material, construction emissions, maintenance, repair, replacement, refurbishment, user activities, and end of life demolition and disposal.

Operational energy consumption was estimated using the SAP calculations provided by CPW. The average Energy Use Intensity (EUI) derived for each building type was applied in the assessment.

3.0 BACKGROUND

3.1 CONTEXT AND DESCRIPTION OF THE PROPOSED DEVELOPMENT

Located at the Peacock Centre, Peacock Close, Manchester M18 8AX, the site encompasses two pieces of land to the south side of Gorton Lane, Manchester, totalling c.3.28 acres. Both areas are currently vacant with no on-site demotion required as part of the site's redevelopment.

The Peacock Centre held a former Pupil Referral Unit that has since been demolished, with the remaining land consisting of predominantly hardcore surfaces which are now overgrown with vegetation. There are small pockets of trees and growth around the edge of the site. The south section of the site is a level grassed area. An existing brick wall makes up the southern boundary to the Buttress Street houses.

Proposals for the sites also include connection into and extension of existing road network.



Figure 3.1 Proposed site plan: Former Peacocks Centre, (R) Pipewell Avenue (L) (PRP RIBA Design and Access Statement June 2026)

The Proposed Development will comprise the following:

Peacock Centre

The Peacock Centre site contains apartment building accommodating up to 25 one and two-bedroom homes served by a dedicated car parking area. 27 two-storey houses, in terraces and semi-detached dwellings, provide two to four-bedroom homes. The dwellings are positioned to make the most of south-facing gardens, connecting to the existing road networks and framing a central landscaped area providing area for play.

Pipewell Avenue

Pipewell Avenue provides 23 two-storey houses, arranged in terraces and semi-detached dwellings, facing onto the public landscaped area. The houses maximise the south-facing aspect for gardens where possible.

Table 3.1 House type Breakdown

	Building Area (m^2)	Multiplier (Plans)	Total Area by-type (m^2)
Apartment 1	2113	1	2113
Chiltern End	83	10	830
Chiltern Mid	83	9	747
Wychwood	98	3	294
Whiteleaf	72	2	144
Whiteleaf corner	71	2	142
Rendlesham Mid	96	6	576
Rendlesham End	96	6	576
H23.7 Mid	88	2	176
H23.7 End	88	2	176
H24.3 Mid	108	2	216
H24.3 End	108	2	216
H23.1 Mid[1]	*~94*	*2*	*~188*
H23.1 End[2]	*~94*	*2*	*~188*
		50 Houses + Apartment	**6,582**

3.2 BACKGROUND TO WLC ASSESSMENT

Carbon emitted from development proposals can be roughly divided into two overarching categories: the 'upfront' carbon embedded in products, materials, their transportation, and their construction (also referred to as the 'embodied' carbon) and the 'operational' carbon associated with the in-use energy and water consumption of the built asset once constructed.

Carbon emissions from the operational use of built assets have been the subject of regulation for some time and have historically been the primary focus of reducing the carbon impact of built environment projects. However, this focus has been expanded to also include carbon emissions associated with the building materials themselves and the carbon emitted through the construction of built assets, as well as their ongoing maintenance, refurbishment, and end-of-life impacts.

As assets become more energy efficient and national grid decarbonisation continues, operational carbon emissions will be seen to reduce, resulting in embodied carbon becoming a significantly greater portion of the overall whole life carbon emissions[2] of new build development. In acquiring an overall understanding of a built asset's total carbon impact, it is necessary to assess both the anticipated operational and embodied emissions over the whole life of the asset. This is often referred to as a 'whole life carbon assessment' (WLCA) or 'life cycle assessment' (LCA).

A WLC approach identifies the overall best combined opportunities for reducing lifetime emissions and helps to avoid any unintended consequences of focusing on operational emissions alone.

[1] Approximate area measured from Site Plan- actual information was not provided.
[2] Approximate area measured from Site Plan- actual information was not provided.

Circular Economy

The construction and operation of the built environment consume 60% of all materials in the UK. At the end of an asset's life, materials are often diverted from landfill, but in reality, downcycled, reducing their value.

There is growing industry consensus that the way we design, build, operate and dispose of our built assets and associated facilities needs a major overhaul to reduce waste and increase efficiency.

Designing for longevity and adaptability and maximising the use of recycled and renewable materials could reduce greenhouse gas emissions while increasing innovation opportunities and economic growth. Replacing finite and fossil-based materials with responsibly managed renewable materials can decrease carbon emissions whilst reducing dependency on finite resources. There is an incredible breadth of opportunity that this shift in approach will create across the entire supply chain.

By considering the carbon emissions of a development from a whole life perspective, design decisions can be made to not only minimise embodied carbon in construction, but to produce a development that reduces resource consumption throughout its use, extending life cycles of products, maximising re-use of built components and ensuring that all components are considered as a 'product resource', rather than 'product waste'.

Material specifications

Design development of both proposed sites looks to maximise longevity and future adaptability, and use of materials of high recycled content to contribute to reducing whole life carbon of the development whilst supporting innovation.

Replacing finite and fossil-based materials with responsibly sourced, low-impact alternatives will further help to reduce the project impact on finite resources, reducing environmental and biodiversity impacts associated with extraction and waste arisings of a linear economy.

3.3 SUPPORTING DOCUMENTATION

To carry out the WCLA, Greengage has reviewed the following documents to establish the required level of detail:

- PRP Architects – B100705-AD Peacock Centre Design & Access Statement;
- Drees & Sommer - Clarion, Peacock_RIBAStg3CostPlan(v1) (dated June 2026);
- CPW – Mechanical & Electrical Services Outline Energy & Sustainability Statement (DNO385-CPW-XX-XX-RP-ME-00003));
- CPW - DNO385 - energy-and-carbon-proforma_2-0 - Peacock & Pipewell
- Clarion sustainability briefing and policy documentation, including Employers Requirements

4.0 POLICY, REGULATIONS AND GUIDANCE

4.1 POLICY DRIVERS

This section sets out current policy drivers and strategies developed by national governments, and a range of organisations throughout the world, in order to set out the current context and a blueprint for action.

National Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF) was revised in December 2024, replacing the previous NPPF that was first adopted in March 2012 with several subsequent updates. The NPPF sets out the Government's planning policies for England and how they are expected to be applied, providing a framework that aims to achieve sustainable development through three overarching objectives, economic, social and environmental.

At the core of the NPPF is a 'presumption in favour of sustainable development', which applies to both plan-making and decision-making. Local plans are expected to reflect this presumption, providing a clear basis for how it should be applied in their area.

Climate Change Act 2008 (2050 Target Amendment)

On 26th November 2008, the UK Government published the Climate Change Act 2008, the world's first long-term legally binding framework to mitigate against climate change. Within the original framework, the Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad from the 60% target to 80% by 2050. This was amended in 2019 to a revised target of a 100% reduction in carbon emissions by 2050, over the 1990 baseline emissions levels, known as the net-zero target.

Regional Policy

Greater Manchester Combined Authority - Places for Everyone

Places for Everyone is the long-term development plan for nine Greater Manchester boroughs (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan) published by the GMCA on behalf of the nine boroughs; it covers strategy for jobs, new homes, and sustainable growth. It sets out:

Policy JP-S2 Carbon and Energy refers to the zero carbon new and existing development, effective land management and through the provision of infrastructure and new technologies.

There is ‘an expectation that new development will, unless it can be demonstrated that

it is not practicable or financially viable; ‘Be Net Zero Carbon, which applies:

- from adoption (March 2024) – to regulated operational carbon emissions;
- from 2028 - to all emissions ‘in construction’ [including upfront embodied carbon emissions].“

From 2025 –developers should calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions’

For Major Developments:

- both the relevant Energy and Carbon Proforma and an Energy and Carbon Statement should be submitted.
- Materials/ Embodied Carbon should be assessed using the RICS Whole Life Carbon Assessment methodology 2nd edition 2023 to calculate and report upfront embodied carbon and list out the three materials with the highest upfront embodied carbon emissions.

Local Policy

Manchester Core Strategy (2012 - 2027)

The Core Strategy is a key document in Manchester's Local Development Framework, which comprises a collection of planning documents, including The Local Development Scheme, Statement of Community Involvement, Development Plan Documents and Supplementary Planning Documents (SPDs).

The Core Strategy was adopted by Manchester City Council in July 2012, covering a period of 15 years from 2012 to 2027. The strategy outlines the Council's vision for Manchester in 2027 including the planning policies which will be used to deliver that vision.

Whole Life Carbon was not as prevalent in the conversation or strategy when this Local Pan was developed and adopted. Relevant to whole life carbon, the Core Strategy Vision states that by 2027 Manchester will be:

- a successful sustainable and accessible City in the front rank of cities in Europe and the world
- meeting the challenge of climate change at the forefront of environmental initiatives and improvements and continuing to deliver sustainable development and a more effective Green Infrastructure

Below are Manchester's Core Strategy planning policies with specific reference to embodied carbon:

Policy EN 4: Reducing CO2 Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO2 emissions, and rising fossil fuel prices, through the following actions:

The use of building materials with low embodied carbon in new development and refurbishment schemes.

EN4 justification: '12.30 It is beginning to be recognised that carbon is embedded within all activities and goods. It is important that the total carbon footprint of new and refurbished buildings is considered, and that where possible renewable materials and/or those with low embodied carbon are used.'

Supplementary Planning Documents (SPDs)

Manchester City Council introduced SPDs in 2007 to set out the City Council's stance on a wide range of issues which demonstrate their links to the Manchester Unitary Development (UDP) the predecessor to The Core Strategy.

None of the remaining SPDs are relevant to Whole Life Carbon or Embodied carbon.

Local Guidance

Greater Manchester Combined Authority: Design Guidance for Net Zero (March 2025)

Guidance for applicants on how to design to achieve Net Zero Carbon buildings provided to support 'Places for Everyone':

Part 1 – Design Guidance for Net Zero for Places for Everyone policies JP-S2 and JP-S3

Part 3 - Submission guidance for Places for Everyone policies JP-S2 and JP-S3

Greater Manchester Combined Authority Five Year Environment Plan

The GMCA Five Year environment plan sets out the vision, aims objectives and actions for Greater Manchester to ensure everyone that works lives and plays in there has a healthy, nature-rich, low carbon environment in which to live-well, prosper and grow.

Relevant aims and objectives:

Aim 2: Our buildings are sustainable and energy efficient

Detailing the need to consider embodied carbon and the wider environmental impacts of buildings through the planning system, GMCA seek to better understand and factor in embodied carbon in new and refurbished developments.

Objective 8: Ensure all new developments are net zero carbon and sustainable

Use the planning system to accelerate the adoption of high standards for new developments and refurbished buildings. Including; use of the Embodied Carbon Calculator developed for GMCA by UoM to specify and procure retrofit and new build materials with the least embodied carbon impact.

Aim 5: Our city region transitions to a circular economy, and our waste is reduced, reused, recycled or recovered.

'Embedded carbon within construction currently accounts for around 11% of greenhouse gas emissions', however with the projected increase of construction initiatives over the coming decades, it's believed that by 2050 embodied and operational carbon emissions will be the same. To prevent this potential increase, we need to reuse buildings where possible, reuse material, use low carbon concrete mixes, and use carbon-intensive materials. Working with academia and industry to research and pilot new low carbon, circular economy initiatives.'

Objective 21: Increase the consumption of recycled materials

GMCA/LAs: Include circular economy within planning principles and Local Plans, incorporating minimum recycled content materials in tenders and report reuse of materials.

Reduce embedded carbon within the built environment; Consider incorporating whole lifecycle carbon assessments and carbon reduction reporting on residential and non-residential construction projects.

GMCA/LAs: Explore a GMCA-led approach to introducing a mandate for including carbon assessment in public procurement for major schemes over £1m in value.

Manchester Climate Ready - The Plan 2025-2030

Manchester Climate Ready (MCR) are a not-for-profit organisation who provide independent expertise to help accelerate change, champion the delivery of effective climate action, engage and

influence stakeholders and communities to act, and seek to establish Manchester as a world class city for action on climate change. MCR ensures Manchester has a robust climate change strategy and targets and provides evidence-based reporting on the city's progress towards its climate goals. It advises City Council and informs policy on what is needed to meet Manchester's 2038 Zero Carbon City goal.

Relevant aims:

- Our city is zero carbon
- Our economy is resource efficient, innovative and circular, creating a city of opportunity and prosperity for all

Relevant actions:

- Action: Ensure all new developments are zero carbon and sustainable:
  - Developers: Embed circular design principles, using sustainable materials to minimise embodied carbon and planning for future reuse or disassembly.
- Action: Optimise resource use and increase rates of reuse and repair
  - Developers: Measure and report embodied carbon in all major construction and refurbishment projects.
  - Businesses and Organisations: Embed circular economy principles in procurement, operations, product design and business models.
  - National Government: Strengthen regulation and incentives for whole life carbon measurement and reporting in construction.

Draft Manchester Local Plan September 2025

The Manchester Local Plan is currently in development following public consolation which concluded in November 2025 and feedback is being reviewed. The Publication Draft is likely to be available for consultation in Summer 2026 and the anticipated date for adoption is mid-2027.

Policy ZC 1 refers to:

b) Meeting the Places for Everyone Policy JP-S2 and meeting the recommendations for fabric efficiency, in the 'Net Zero for New Buildings' guidance published by the Manchester Climate Change Agency (Now MCR)

c) 'ensuring the efficient use of natural resources and materials accounting for the energy, carbon emissions and other environmental impacts arising from construction and end of life demolition and disposal. For major development the proposals should take action to reduce life-cycle carbon emissions demonstrated through a Whole Life Cycle Carbon Assessment.'

4.2 TECHNICAL GUIDANCE

RICS Professional Statement UK – Whole Life Carbon Assessment for The Built Environment 2nd Edition ("RICS PS")

The RICS PS 2nd edition, effective from July 2024, comprises the update to the de facto standard against which all UK whole life carbon assessments are undertaken. The updated standard has greatly increased the scope of carbon emissions captured within a standard assessment and in

doing so, has also increased the number of life cycle stages assessed. This has included the addition of numerous sub-life cycle stages, in addition to the following all new life cycle stages:

- A0 Pre-construction;
- B5 Refurbishment Sequestration; and
- B8 User Activities

It is now also required that results be reported for both the decarbonised and non-decarbonised grid scenarios. The decarbonised results are applicable to the development's future operations and therefore extends to the material replacement (B4), operational energy use (B6), end-of-life deconstruction and demolition (C1), the transport of demolition waste (C2) and any potential benefits and loads from exported utilities (D2).

UK Net Zero Carbon Buildings Standard (NZCBS)

Through a culmination of input from a range of leading industry groups, including UKGBC, LETI, RIBA, CIBSE and IStructE, Version 1 of the UK NZCBS was produced and released in March 2026 and is set to become the leading UK methodology for accrediting buildings as being 'net zero aligned', in line with the UK carbon budget for limiting global warming to 1.5°C.

The UKNZCBS sets out a range of KPIs for the assessment of both operational (EUI and space heating demand) and embodied carbon emissions (A0-A5 excl. sequestration), for a range of building types, including both new-builds and retrofits. Version 1 published in Feb 2026 only includes KPIs for 'upfront' carbon (A1-A5). The Standard also includes full details of the verification process.

Low Energy Transformation Initiative (LETI) – Climate Emergency Design Guide

LETI is a network of over 1,000 built environment professionals working together to put the UK on the path to a zero-carbon future. The voluntary group is made up of developers, engineers, housing associations, architects, planners, academics, sustainability professionals, contractors and facilities managers, with support and input provided by the GLA and London boroughs.

LETI has been established to support the transition of the UK's built environment to net zero carbon, providing guidance that can be applied across the country.

The Climate Emergency Design Guide covers five key areas: operational energy, embodied carbon, the future of heat, demand response and data disclosure. The methodology includes setting the requirements of four key building archetypes (small scale residential, medium/large scale residential, commercial offices, and schools).

Low Energy Transformation Initiative (LETI) – Embodied Carbon Primer

The LETI Embodied Carbon Primer offers supplementary guidance to the Climate Emergency Design Guide and is intended to provide designers including architects, engineers, interior designers and urban designers with easy-to-follow best practice and toolkits for reducing embodied carbon in buildings.

Low Energy Transformation Initiative (LETI) - Embodied Carbon Target Alignment

This document has been produced to provide alignment in embodied carbon measurement and comparisons across the widely referenced LETI (A1-A5) and RIBA (A-C) embodied carbon targets. The paper summarises the following key points:

- The industry must push for embodied carbon reporting on all projects;

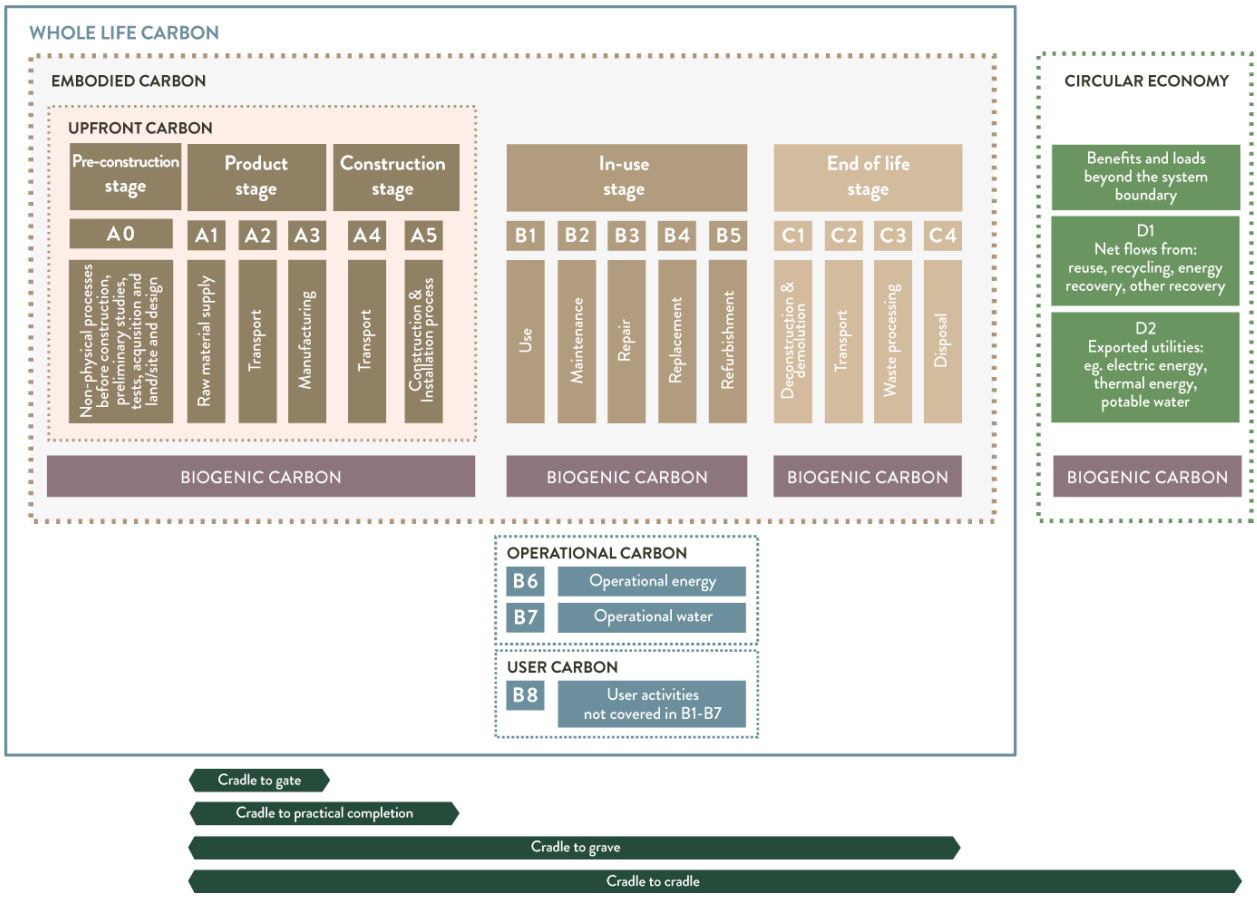
- A rating system should be introduced to allow quick comparison of ambition across various typologies and portfolios;
- Total embodied carbon targets have been introduced;
- Targets for retail have been developed;
- LETI and RIBA now have consistent embodied carbon targets;
- Data disclosure and breakdowns are key to ensuring reporting is valid and comparable; and
- There are two scopes that should be reported against: Upfront Carbon (modules A1-5, excluding sequestration), and total Embodied Carbon (A1-5, B1-5, C1-4, including sequestration).

5.0 METHODOLOGY

5.1 ASSESSMENT BOUNDARIES

The WLC model has included all life cycle stages detailed within the EN 15978 cradle-to-grave system boundary approach, as outlined below in Figure 5.1.

Figure 5.1 RICS v2 EN 15978 System Boundaries



An overview of the system boundaries is described in the below sections.

Pre-construction Stage A0

Pre-construction emissions relate to the any emissions resulting from pre-construction operations, such as travel to/from meetings or both the travel to surveys and the emissions associated with their undertaking, such as ground investigation surveys. It should be noted however that the assessment of this stage is optional and has not been included in this project.

Product Stage A1-A3

One Click LCA's extensive database of building materials was used to calculate the WLC emissions, allowing for the selection of materials that are representative of the materials itemised in the Cost Plan provided.

The Stage 3 Cost Plan has been used to provide an itemised list of materials and quantities, and in accordance with the RICS PS, generic environmental profiles have been allocated to materials where product details have not been specifically stated within the Cost Plan and specifications.

As per the RICS PS, the reference study period (RSP) is 60 years, which aligns with the operational design life of 60 years. The functional unit for the assessment is $kgCO_2e/m^2$ GIA.

Construction Stage & Pre-demolition A4-A5

In accordance with the RICS PS, the transport of materials has, where not known, referred to the RICS defaults outlined within 0. Furthermore, construction activities have been assumed based upon the asset's GIA at $40kgCO_2e/m^2$ to calculate electricity, fuel, waste and transportation impacts of the development's construction.

Under the previous edition of the RICS PS, demolition works were omitted from the totals reported. However, the new version of the standard requires any carbon impacts resulting from pre-construction demolition/demolition, transporting and disposal of waste to be accounted for under the A5.1 life cycle module and reported separately. Where actual carbon impact figures are not available, the default figure of $35kgCO_2e/m^2$ can be applied to the GIA of the existing areas being demolished, where applicable. There is no demolition in this project.

Use Stage B1- B5 (Maintenance etc), B6-B7 (Operational energy/water), B8

Operational carbon emissions (Module B6) have been calculated at this stage of the project partly through SAP calculations provided by CPW. The average Energy Use Intensity (EUI) derived for each building type was used to estimate the regulated energy consumption and the associated carbon emissions. Benchmarking was then factored into the overall calculation to provide an estimate of the unregulated component for each dwelling. Further details and figures used within this assessment are detailed in Section 7.2, Operational Carbon Emissions.

This will account for carbon emissions related to both regulated (B6.1) and unregulated energy (B6.2 & B6.3) uses separately, as outlined within Table 31 of the RICS PS, over the 60-year study period.

This covers the following reporting requirements:

- Heating (B6.1);
- Domestic Hot Water Heating (B6.1);
- Cooling (B6.1);
- Mechanical Ventilation (B6.1);
- Humidification (B6.1);
- Pumps (B6.1);
- Lighting (B6.1);
- Transportation Systems in Building (B6.2);
- Cooking and Catering (B6.2);
- Plug Loads (B6.3);
- Specialist Equipment (B6.2);
- Security and Controls (B6.2);
- Emergency Generator Use and Maintenance Hours (B6.2);
- Other Uses (B6.1); and
- On-site Generation (B6.1).

End-of-Life Stage C1-C4

End-of-life emissions are calculated based upon both the whole asset deconstruction scenario assumptions, in addition to individual end-of-life scenario assumptions. For each of these components, the following scenarios can be selected:

- 'Business as usual';

- 'Good practice'; and
- 'Best practice'.

It is acknowledged that an increased level of material recovery during the 'best practice' deconstruction scenario would amount to an increased programme length. Therein, this scenario amounts to a greater level of C1 emissions, however this is offset by the resulting C2-C4 emissions being lower due to the amount of material being recovered.

5.2 ASSESSMENT SCOPE

The assessment has been undertaken in accordance with RICS Professional Statement which recommends the breakdown of building elements. As a result, the model was broken down into the constituent element groups listed below, using schedules, plans, elevations and sections before conducting the LCA modelling.

1.0 Facilitating works;

2.0 Substructure;

3.0 Superstructure (frame, upper floors, roof, stairs and ramps, external walls, windows and external doors, internal walls and partitions, internal doors);

4.0 Finishes;

5.0 Fittings, furnishings and equipment;

6.0 Building services;

7.0 Prefabricated buildings and building units;

8.0 Work to existing building; and

9.0 External works (hard and soft landscaping, fencing, fixtures, drainage, services).

The guidelines of BS 15978:2011 and the RICS PS have been followed in conducting the LCA and reporting the results. All Environmental Product Declarations (EPDs) used have been produced in line with the requirements of BS EN 15804:2012.

Additionally, as per the requirements, the assessment has taken place analysing the lifecycle stages described in Figure 5.1.

9.0 External works

The cost plan provided external works as a site-wide allowance rather than allocated costs to individual properties. Consequently, external works have been included within the overall site-wide assessment but have not been apportioned to, or included within, the individual house-type assessments.

ASSESSMENT SOFTWARE

In accordance with the RICS PS, One Click LCA has been used to model the LCA impacts of building materials for the development. One Click LCA is an online built environment life cycle assessment software; it is an industry-leading platform developed by Helsinki based developer, Bionova.

Within One Click LCA materials are represented by Environmental Product Declarations (EPDs). EPDs are produced by manufacturers and quantify the carbon emissions of a material or component.

Materials are allocated to, where possible, the exact EPD match or the closest representing material available. In allocating all building materials and elements within the built asset to a relevant EPD, One Click LCA calculates estimated total WLC emissions for the development.

It should be noted that the LCA tool has a limited database of materials (albeit with regular updates). In the scenario where a specified material is not included, the most similar material in terms of its composition would be selected instead.

5.3 DATA SOURCES

The following data sources were used to construct the LCA model for the Proposed Development:

- One Click LCA material/components database;
- A project Cost Plan supplied by the project Quantity Surveyor was used to determine material build ups and material quantities; and
- The remaining elements' quantities and build ups were extracted from plans, elevations and sections and approved by relevant members of the design team, including the Quantity Surveyor. This allowed for an accurate representation of the building materials' environmental impact.

A more detailed list of data used per building element, where information has not been provided or is unavailable, the assumptions taken from the RICS PS were adopted, as displayed within the Appendix. Overall, in line with EN 15804, a minimum of 95% of the capital cost allocated to each building category has been accounted for within the modelling.

5.4 CARBON EMISSIONS FACTORS

In line with the RICS PS, the operational energy emissions of the development have been analysed against the Set 1 carbon factors outlined within the RICS PS, providing a point-in-time assessment, and the future energy scenario (FES) 2023 falling short, excluding negative emissions from bioenergy and carbon capture (BECCS), to account for the grid decarbonisation in the operational energy use, repair and maintenance and end of life deconstruction and transport.

6.0 MODELLING INPUTS

This section summarises the inputs used to assess the WLC of the Proposed Development.

Operational Carbon Assessment

Table 6.1 Energy calculations used (Regulated and unregulated components)

	Energy use intensity per dwelling (kWh/m^2)	Source
Apartments	28.56	CWP calculation summary
Whiteleaf	34.5	CWP calculation summary (Average per house type)
Chiltern	30.8	
Rendlesham	28.5	
H24.3	26.1	
H23.7	30.2	
Wychwood	29.0	

CPW's energy and sustainability strategy applied a robust application of the GMCA energy hierarchy, prioritising demand reduction, high fabric performance, efficient building services and on-site renewable.

The development met or exceeded relevant energy and carbon KPIs, including space heating demands, fossil fuel free operation, overheating compliance and energy use intensity (EUI) targets of 35 kWh/m^2/yr, as shown within Table 6.1.

7.0 RESULTS

7.1 EMBODIED CARBON ASSESSMENT

The following results section is summarised by each house type associated with the wider masterplan. In doing so, assessment results can be easily cross-referenced against benchmarks set out earlier in the report, determining performance on a house-by-house basis.

As per the proposed masterplan the following have been represented below:

Table 7.1 Carbon emissions summary for each of the modelled house types (Modules A0 – A5)

	Carbon emissions summary ($KgCO_2/m^2$)			
House type	A0 – A5 (ex. Sequestration)	Clarion 2025-2030	Clarion 2030 (Stretch)	UKNZCBS (2026)
Apartment	459	350	290	525
Chiltern (End)	501			400
Chiltern (Mid)	466			
Wychwood	504			
Whiteleaf	493			
Whiteleaf (Corner)	503			
Rendlesham (Mid)	535			
Rendlesham (End)	586			
H23.7 (Mid)	487			
H23.7 (End)	554			
H24.3 (Mid)	493			
H24.3 (End)	542			
H23.1 Mid[3]	*520*			
H23.1 End[4]	*592*			

Whilst most homes across the scheme fall short of meeting Clarion targets at present, these should be viewed in the context of Manchester Climate Ready Standards, and UKNZCBS targets, which sit close to many of the houses' tested performance.

Furthermore, potential reduction measures are outlined within Section 8.0, and further improvements have been explored within Section 8.2. These should be sought at the following stage of design to support improved whole life performance across the scheme.

An additional breakdown of results has been included within the Appendix, capturing results for Modules A – C for each house type and the apartment block.

[3] Calculated from the H23.7 (mid) matched typology and pro-rated based on a measured area approximately 7% larger than the reference area.
[4] Calculated from the H23.7 (end) matched typology and pro-rated based on a measured area approximately 7% larger than the reference area.

Comparison to Stage 2

Table 7.2 Carbon emissions comparison by house types, Modules A0 – A5. ($KgCO_2/m^2$)

	A0 – A5 (ex. Sequestration)		
	Stage 2	Stage 3	Change
Apartment	398	459	61
Chiltern (End terrace)	501	501	0
Chiltern (Mid terrace)	459	466	7
Wychwood	467	504	37
Whiteleaf	518	493	-25
Whiteleaf (Corner)	538	503	-35
Rendlesham (Mid terrace)	518	535	17
Rendlesham (End terrace)	550	586	36
H23.7 (Mid)	537	487	-50
H23.7 (End)	530	554	24
H24.3 (Mid)	522	493	-29
H24.3 (End)	515	542	27
H23.1 Mid	NA	520	NA
H23.1 End	NA	592	NA

Across the 13 house types and apartment block, the latest Stage 3 design produces modest change in embodied carbon across the tested homes.

Whilst the adoption of timber frame across all house types is the principal structural change, its embodied carbon benefit is largely absorbed by the addition of greater building services detail, such as MVHR systems and associated ductwork contributions. The most consistent saving comes from a reduction in strip foundation concrete across all house types, reducing volumes by roughly 15 - 25%.

7.2 OPERATIONAL CARBON ASSESSMENT

The operational carbon emissions have been calculated across a 60-year lifetime, with an energy breakdown provided within Table 7.3, based on previously stated EUI figures applied to RICS SAP 10.2 and FES carbon factors.

As the proposed development is 100% electric, there are no regulated gas demands. Energy performance for the homes included in the assessment have been summarised under both the RICS SAP10.2 and FES carbon factors.

Table 7.3 Energy consumption within the development (by modelled dwelling)

Plot	Modelled GIA (m^2)	Regulated - Electricity ($kWh/m^2/yr$)	Unregulated - Electricity (kWh/m2/yr)
Apartment	2,113	43,642.4	16,699.1

Whiteleaf	83	1,752.1	704.3
Chiltern	98	1,869.6	704.3
Rendle	72	2,044.0	704.3
H24.3	96	2,087.8	704.3
H23.7	88	1,942.6	704.3
Wychwood	108	2,153.3	704.3
H23.1[5]	~94	NA	NA

Energy Strategy

The buildings are to be designed to meet a minimum of EPC B (81) and an average EPC B+ (86) as per Clarion Standards and requirements.

The design follows a passive design approach to reduce the buildings operational energy consumption, considered in the context of heat recovery, plant and control efficiency, and minimising hot water usage.

Heat recovery ventilation

Mechanical ventilation with heat recovery (MVHR) is proposed within each of the houses to reduce energy demand and help achieve internal comfort and air quality in high air tightness property. The system passes warm outgoing 'exhaust' air through a heat exchanger (typically a plate heat exchanger) where thermal energy is recovered and transferred to the cold incoming 'supply' air.

Air source heat pump

Air source heat pumps (ASHPs) are utilised for both domestic hot water provision and space heating using LPHW wet systems, delivering hot water to pressed steel radiators. To limit the demand for hot water, the development will be provided with water-efficient fixtures and fittings.

ASHP systems draw power from the electrical supply to the dwelling, with coefficient of performance of at least 3 (for every 1kW of input, 3kW of energy is output), ensuring high year-round efficiency.

Solar control and shading

Analysis to determine shading control will be carried out using dynamic thermal energy modelling. If envelope changes are required to ensure both internal comfort and limit the need for active cooling, measures such as improved low E glazing (improving g-values) will be considered.

The proposed building design will incorporate measures for minimising the negative impact of overexposure and excessive solar heat gains.

Solar photovoltaic (PV) systems

Design has accounted for the provision of rooftop PV for all dwellings across the masterplan, with installation totalling 40% of the ground floor area, fed directly back into the consumer units of each dwelling.

Apartments will have a common landlord PV installation to the flat roof totalling 40% of the ground floor area which will supply landlords' power and lighting distribution.

[5] Not included in SAP calculations provided. Based off H23.7, pro-rated by area.

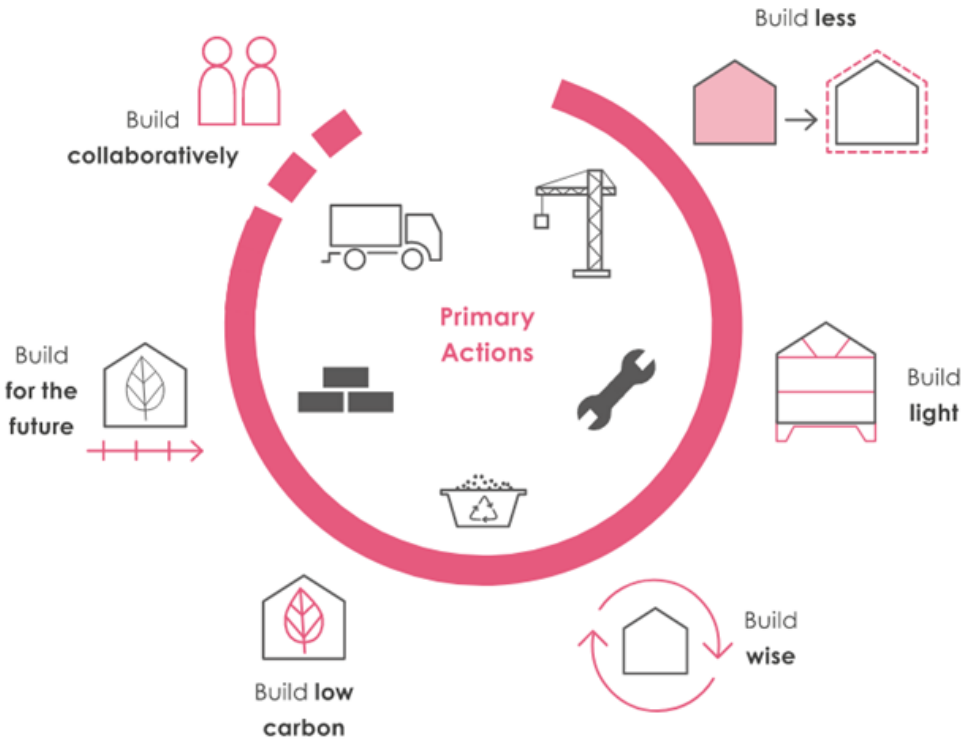
Whilst included within the strategy document, it should be noted that solar PV is not captured within this WLCA as these were not included within the cost plan/bill of materials. The energy benefits associated with on-site energy generation are therefore not quantified within this assessment.

It should be noted that CPW's separate energy calculations submitted as part of this planning application have captured the impacts of onsite renewable energy generation.

8.0 OPPORTUNITIES FOR REDUCING WLC

Greengage produced a summary of observations compiled through the review of the design information provided and the completion of the WLC assessment. In developing these observations, best practice guidance within the LETI Embodied Carbon Primer has been followed, see Figure 8.1 below.

Figure 8.1 Embodied carbon reduction actions from LETI embodied carbon primer



It should be noted that these carbon reduction material suggestions have been considered in reference to carbon embodiment only, and other influencing factors, such as fire safety, cost implications and viability must be taken into account and assessed by suitably qualified team members before adoption in the design.

In general, for the specification of materials for the development, it is encouraged to choose suppliers with established procedures for selection of Environmental Product Declarations (EPDs) and make a clear specification of products and manufacturers during the following stages.

8.1 BEST PRACTICE CARBON REDUCTION CONSIDERATIONS

The following best practice carbon reduction actions have been and should be considered at all stages of the design and construction stage:

- WLCA should be undertaken at every stage of the design process hereafter, in addition to a final assessment undertaken following practical completion, and a lessons learned exercise undertaken to review potential carbon reduction lessons for subsequent projects;

- Material efficiency and lean design considerations will support some of the most significant carbon and cost savings for the scheme;
- Design to consider options to reduce foundation depths through a structural design optimisation process;
- MEP equipment emissions to be considered via the specification of packaged equipment, supported by CIBSE TM65 worksheets, where EPDs do not already exist, in order to ensure that the services can be modelled as accurately as possible;
- Where possible, priority should be afforded to locally sourced material suppliers and material products with a certified Environmental Product Declaration (EPD);
- Recycled aggregates should only be considered within the design when they are available locally in line with Table 8.1, otherwise transportation impacts exceed the intended benefits.

Table 8.1 Indicative embodied carbon for virgin and recycled aggregates (Source: The Concrete Centre)

Material and Delivery Distance	A1-A3 $kgCO_2/t$	A4 $kgCO_2/t$	A1-A4 $kgCO_2/t$	+/- % CO_2
Virgin Aggregates				
+58.5km (delivery and return distance by road)	6.6	2.7	9.3	-
Recycled Construction & Demolition Aggregates Compared to the Use of Virgin Aggregates				
0km (Sourced and used on-site)	7.9	0.0	7.9	-15%
+5km (Delivery distance by road)	7.9	0.5	8.4	-10%
+10km (Delivery distance by road)	7.9	0.9	8.8	-5%
+15km (Delivery distance by road)	7.9	1.4	9.3	0%
+20km (Delivery distance by road)	7.9	1.8	9.7	5%
+58.5km (delivery and return distance by road)	7.9	2.7	10.6	14%

- The re-used or recycled content of all materials procured should be maximised as much as is feasible, with a minimum recycled content of 20% by value. Prioritising the re-use of materials will not only achieve cost and carbon savings, but contribute to embedding circular economy principles in design and construction; and
- Where feasible, design to prioritise off-site manufacturing processes, such as modular construction elements to reduce construction emissions, waste arisings and programme length.

8.2 PROJECT SPECIFIC CARBON SAVING CONSIDERATIONS

A list of the most carbon intensive materials has been set out within Table 8.2 which also addresses some carbon reduction measures that can be implemented to reduce the impact of each material.

Table 8.2 provides a summary of highest carbon contributors in relation to the Stage 3 site-wide design, with potential reduction measures outlined to be explored as the design progresses.

Any actions taken to reduce embodied carbon should be focused on those materials currently identified as having the greatest totals, to obtain the largest payback. As some of these measures require further investigation and specification, some impacts have been unable to be quantified at this stage.

Table 8.2 Top contributing materials and potential reduction measures (non-decarbonised) – Site wide

Material	Current A1-A3 Impacts (tCO_2e)	Reduction Measures	Potential A1-A3 Savings (tCO_2e)
Ready -mix concrete	295	Mix design to consider the application of alternative binds such as limestone and calcined clays. GGBS and PFA should be minimised in line with IStructE guidance on supplementary cementitious materials with verified low-carbon credentials.	Up to 40% carbon reduction based on a 50% GGBS substitution
Brick	112	Consider the specification of low carbon brick options, such a reclaimed or salvaged brick for non-structural applications to support circular economy practices. Alternatively, as brick primarily serves as a cladding material, alternative cladding systems could be explored, such as the use of timber cladding panels.	Up to 10 – 25% dependent on brick specifications
HVAC components and equipment	108	Specify MEP equipment with manufacture specific EPDs where available, use CIBSE TM65 methodology for components without manufacturers EDPS. Refrigerant selection should target low GWP products in line with UKNZCBS limits. Explore heat pump solutions sized to actual loads to avoid oversizing of equipment.	10 – 20%.
XPS (extruded polystyrene) insulation	94	XPS carried a high carbon factor and GWP. Substitute products should be considered such as PIR, EPS or mineral wool (stone wool/glass wool) where thermal performance requirements allow. Substitution of XPS with a lower-carbon alternative presents a significant potential saving on carbon.	50% reduction possible based on XPS baseline.
Concrete masonry units (CMU)	84	Source blocks from manufacturers with verified low embodied carbon EPDs. Explore the use of alternative blockwork or timber framing partitions in non-load bearing applications.	10% - 20%.
Asphalt	76	Recycled tire rubber asphalt could be used as a direct alternative. Alternatively, permeable paving that allows grass to grow and reduced hard surfacing could be considered, especially on driveways.	10 – 20%.

Levelling screeds (for floors)	69	Consider reducing screed depth from 75mm to 50mm.	15 – 30% saving on screed depth reduction.
Pipes (water, heating, sewage)	61	This was estimated using GIFA based assumptions rather than actual measured quantities, as these were not included in the cost plan. Once quantified, pipe lengths and associated should be optimised where appropriate.	5 – 15% with the introduction of accurate HDPE or uPVC piping.
PIR (polyisocyanurate foam) insulation	41	PIR already offers a low carbon alternative to XPS insulation. Ensure specification is optimised for thickness based on the target U-values. Confirm procurement from a manufacturer with verified EPDs.	5 – 15% with optimised input.
Glass facades and glazing	38	Specify glazing units with manufacturers EPDs. Facades design to also consider management of solar gains and consequential overheating risk, with daylight analysis to support the reduction in operational energy demands.	5- 10%.
Gypsum board	37	For housing/ low rise: Biobased boards could be considered in appropriate locations, such as wood fibre board, OSB, clay boards etc.	>10% through biobased products.
PVC frame windows	35	Explore the use of timber or timber-composite frames as a lower embodied carbon alternative to uPVC. Timber should be from FSC/PEFC-certified sources. If uPVC is retained, seek to specify products with a high recycled PVC content where possible.	>10% through timber alternative specification.

Table 8.3 Top contributing materials and potential reduction measures (non-decarbonised) – Apartments only.

Material	Current A1-A3 Impacts (tCO_2e)
Ready-mix concrete for external walls and floors	156
XPS (extruded polystyrene) insulation	94
HVAC components and equipment	72
Brick	69
Leveling screeds (for floors)	47
Aluminium frame curtain wall	38
Pipes (water, heating, sewage)	32

Gypsum board	24
Reinforcement for concrete (rebar)	21
PVC frame windows	19

9.0 CONCLUSIONS

This assessment completed at RIBA Stage 3, informs Clarion Housing Association Limited and Clarion Housing Property Development Services Limited and the design team the Clarion benchmark WLC performance for the proposed plots across the development site. The report has summarised the WLC assessment undertaken for each of the proposed residential buildings at Former Peacock Centre site and land at Pipewell Avenue, against the GMCA and Clarion targets in line with the RICS Professional Statement on Whole Life Cycle Carbon Assessment 2nd edition.

The overall site-wide summary found targets for the Clarion 2025-30 target were exceeded by approximately 35.4% with a figure of 551kgCO_2e/m^2 (A0-A5 excluding sequestration) vs 350kgCO_2e/m^2 for the 2025-2030 benchmark. Whilst currently exceeding benchmarks, there remains considerable opportunity to enhance the design and accuracy of the WLCA as the design develops, with Section 8.0 containing a summary of several carbon reduction options.

The most intensive carbon emitters have been identified to highlight the products that have the most significant contribution to the overall emissions. Suggestions have also been provided to reduce the carbon intensity of these products.

To effectively address WLC throughout the continuation of the design process, it will be important to implement the following next steps:

- The design team will continue to develop the strategy for reducing carbon emissions in the nxt stage with the intention of producing future validation checks as the construction develops, confirming potential reductions in 'as-designed' and 'as-constructed' WLC emissions over the baseline;
- Products and manufacturers with EPDs should be specified and the material's carbon footprint data considered during procurement;
- The proportion of Portland cement replacement in concrete products should be at least 20% to represent the results in this report. Increased quantities should be explored following an assessment of the suitability of the product for the application considered; and
- Publicly disclose and report to the Built Environment Carbon Database (BECD).

Table 9.1 below summarises actions that should be undertaken as the scheme moves through Stage 3, planning application and subsequent detailed design stages.

Table 9.1 WLC actions to undertake after planning approval

Action	Time	Effect on WLC
Update the WLCA model with further project information relating to building services, finishes and FF&E.	Early RIBA Stage 4	WLC will likely increase
Review design options to assess impact on WLC, with a view to developing a strategy to deliver an improvement over the baseline embodied carbon emissions.	Mid RIBA Stage 4	WLC could decrease
Undertake final 'as-designed' WLCA to represent final design.	End of RIBA Stage 4	Neutral change in WLC or possible decrease
Undertake 'as-constructed' WLCA to represent final as-built development.	End of RIBA Stage 5	Neutral change in WLC or possible decrease

- END -

APPENDIX A - APARTMENT AND HOUSE TYPE WLC BREAKDOWN

Apartment block

Table A1 illustrates the total embodied carbon emissions of the Proposed Apartment building, against the benchmarks set by Clarion.

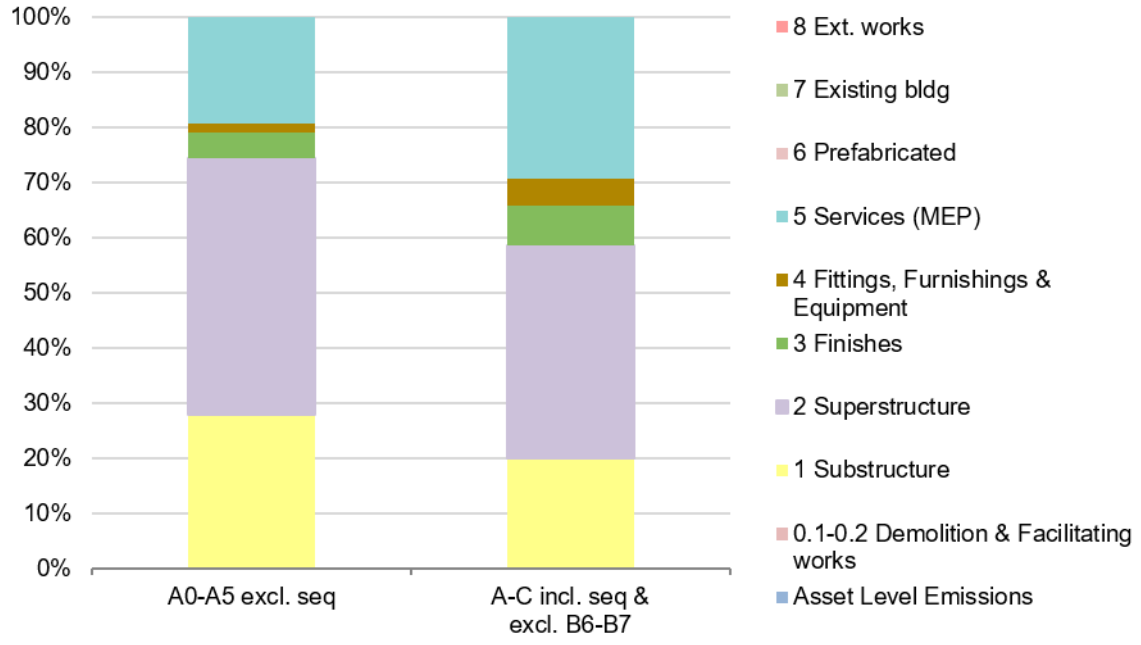
Table A1 Embodied carbon summary for the apartment block, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	459 $kgCO_2e/m^2$	459 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	288 $kgCO_2e/m^2$	173 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	723 $kgCO_2e/m^2$	608 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

The Proposed Apartment block exceeds the current Clarion Targets for 2025-2030 by 109$kgCO_2e/m^2$ (31%) and 169$kgCO_2e/m^2$ (58%) for Stretch targets in relation to Modules A0-A5.

Considering wider Manchester Climate Ready Net Zero new building targets, the proposed development meets targets for Modules A-C for the decarbonised scenario. Furthermore, Figure A1 demonstrates superstructure to be the largest contributor, accounting for approximately 50% of the total, followed by the substructure with 30%.

Figure A1 Estimated non-decarbonised embodied carbon of the proposed apartments, broken down by main building elements (Modules A0-A5 (excl. sequestration) and A-C (incl. sequestration & excl. B6 & B7))



Chiltern (End terrace)

Table A2 illustrates the total embodied carbon emissions of the Proposed Chiltern end of terrace housing, against the benchmarks set by Clarion.

Table A2 Embodied carbon summary for the Chiltern end of terrace, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	501 $kgCO_2e/m^2$	501 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	406 $kgCO_2e/m^2$	270 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	808 $kgCO_2e/m^2$	672 $kgCO_2e/m^2$	-	-	640 $kgCO^2e/m^2$

Chiltern (Mid terrace)

Table A3 illustrates the total embodied carbon emissions of the Proposed Chiltern mid-terrace housing, against the benchmarks set by Clarion.

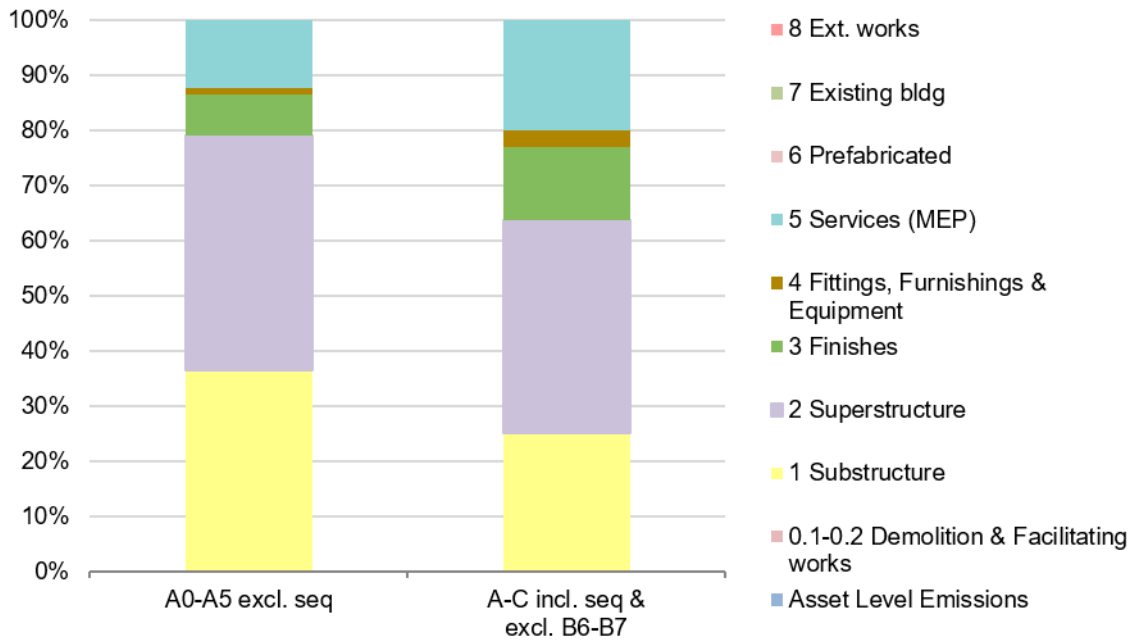
Table A3 Embodied carbon summary for the Chiltern mid-terrace, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	466 $kgCO_2e/m^2$	466 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	389 $kgCO_2e/m^2$	261 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	756 $kgCO_2e/m^2$	629 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

Table A2 and A3 demonstrate that the proposed mid and end Chiltern terrace houses both fall short of Modules A0-A5 for 2025-2030 by 116$kgCO_2e/m^2$ and 151$kgCO_2e/m^2$, respectively.

Figure A2 below demonstrates how the carbon is distributed through the proposed Chiltern end house. The greatest contributions are identified within the superstructure (45%), followed by substructure elements, accounting for approximately 35%, building services account for around 10%.

Figure A2 Estimated non-decarbonised embodied carbon of the proposed Chiltern end of terrace, broken down by main building elements (Modules A0-A5 (excl. sequestration) and A-C (incl. sequestration & excl. B6 & B7))



Wychwood

Table A5 illustrates the total embodied carbon emissions of the Proposed Wychwood housing, against the benchmarks set by Clarion.

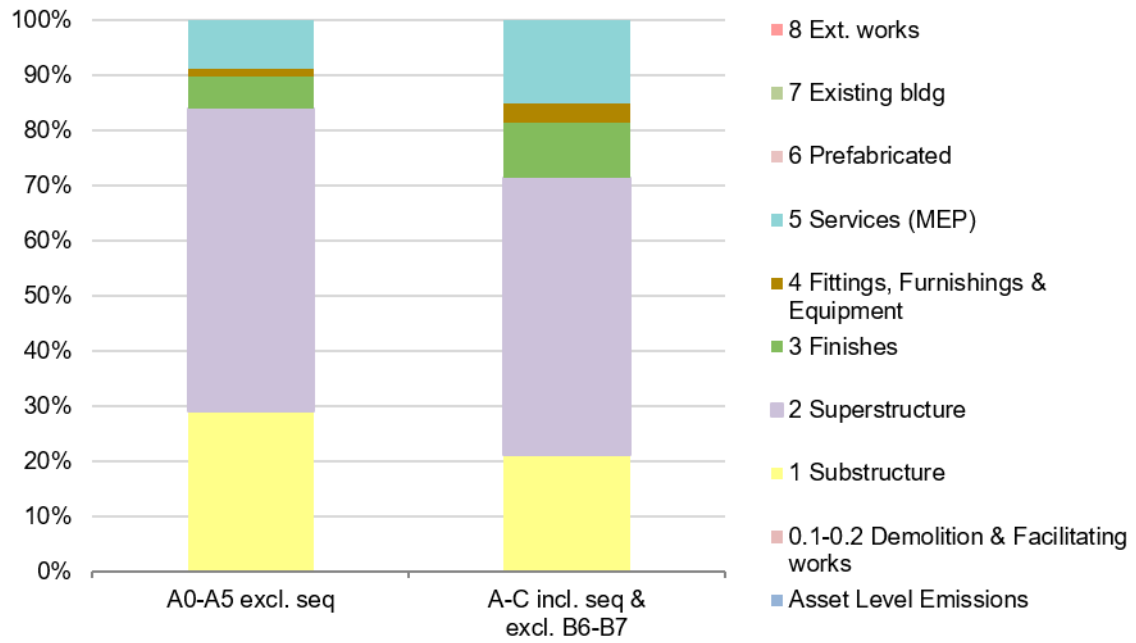
Table A5 Embodied carbon summary for the Wychwood housing, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	504 $kgCO_2e/m^2$	504 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	399 $kgCO_2e/m^2$	278 $kgCO2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	770 $kgCO_2e/m^2$	649 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

Table A5 demonstrates that the proposed Wychwood house fallen short of Modules A0-A5 for 2025-2030 by 306 $kgCO_2e/m^2$. When compared with Manchester Climate ready target, this is equivalent to 256 $kgCO_2e/m^2$.

Figure A3 below demonstrates how the carbon is distributed through the proposed development. The greatest contributions are identified within the superstructure (approximately 50%), followed by substructure, accounting for just over 30%.

Figure A3 Estimated non-decarbonised embodied carbon of the proposed apartments, broken down by main building elements (Modules A0-A5 (excl. sequestration) and A-C (incl. sequestration & excl. B6 & B7))



Whiteleaf

Table A6 and A7 illustrate the total embodied carbon emissions of the Proposed Whiteleaf housing, against the benchmarks set by Clarion.

Table A6 Embodied carbon summary for the Whiteleaf housing, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	493 $kgCO_2e/m^2$	493 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	358 $kgCO_2e/m^2$	232 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	769 $kgCO_2e/m^2$	643 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

Whiteleaf (corner)

Table A7 Embodied carbon summary for the Whiteleaf corner housing, excluding uncertainty factor

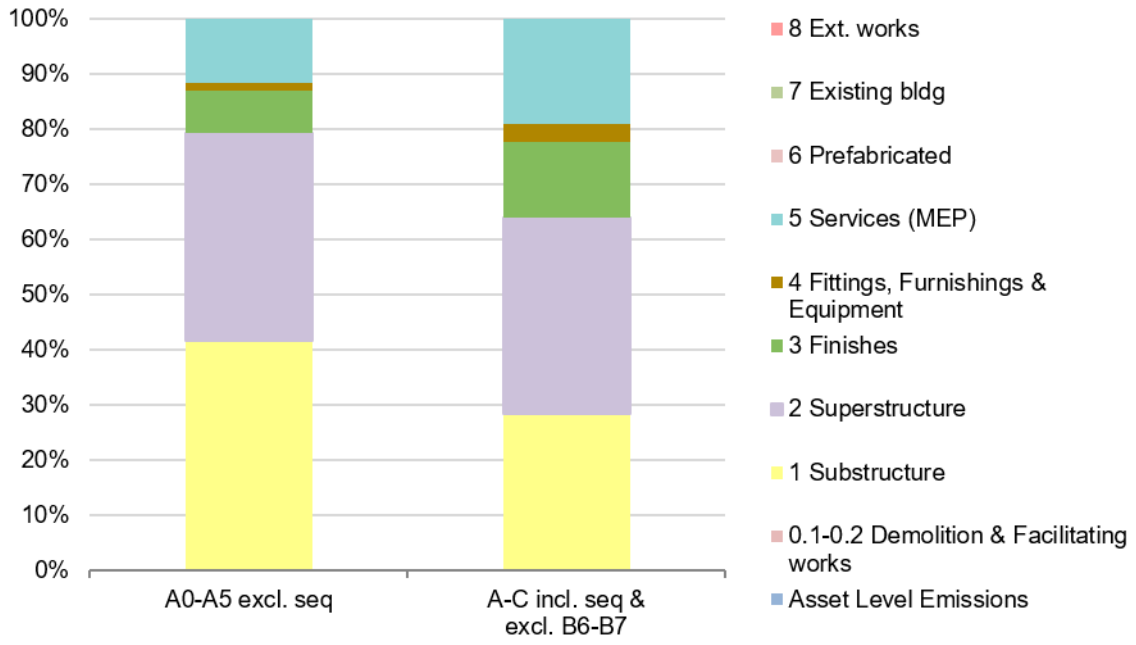
	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	503 $kgCO_2e/m^2$	503 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	403 $kgCO_2e/m^2$	265 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$

Modules A-C (incl. sequestration, excl. B6 & B7)	809 $kgCO_2e/m^2$	671 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

Table A6 and A7 illustrate outputs for both Whiteleaf, mid and end houses with performance of each relatively closely matched, differentiated by the additional exposed external walls in the end house. In both cases, dwellings have fallen short of the Clarion targets for Modules A0 - A5, however, considering the full lifecycle present good opportunities to reduce the gap as the project is progresses.

Currently, Whiteleaf housing has fallen short of Modules A0-A5, for 2025-2030 by 143$kgCO_2e/m^2$ and 279$kgCO_2e/m^2$ for mid and corner, respectively.

Figure 9.1 Estimated non-decarbonised embodied carbon of the proposed apartments, broken down by main building elements (Modules A0-A5 (excl. sequestration) and A-C (incl. sequestration & excl. B6 & B7))



Rendlesham

Table A8 and A9 illustrate the total embodied carbon emissions of the Proposed Rendlesham housing, against the benchmarks set by Clarion.

Table A8 Embodied carbon summary for the Rendlesham (Mid) housing, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	535 $kgCO_2e/m^2$	535 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	391 $kgCO_2e/m^2$	264 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$

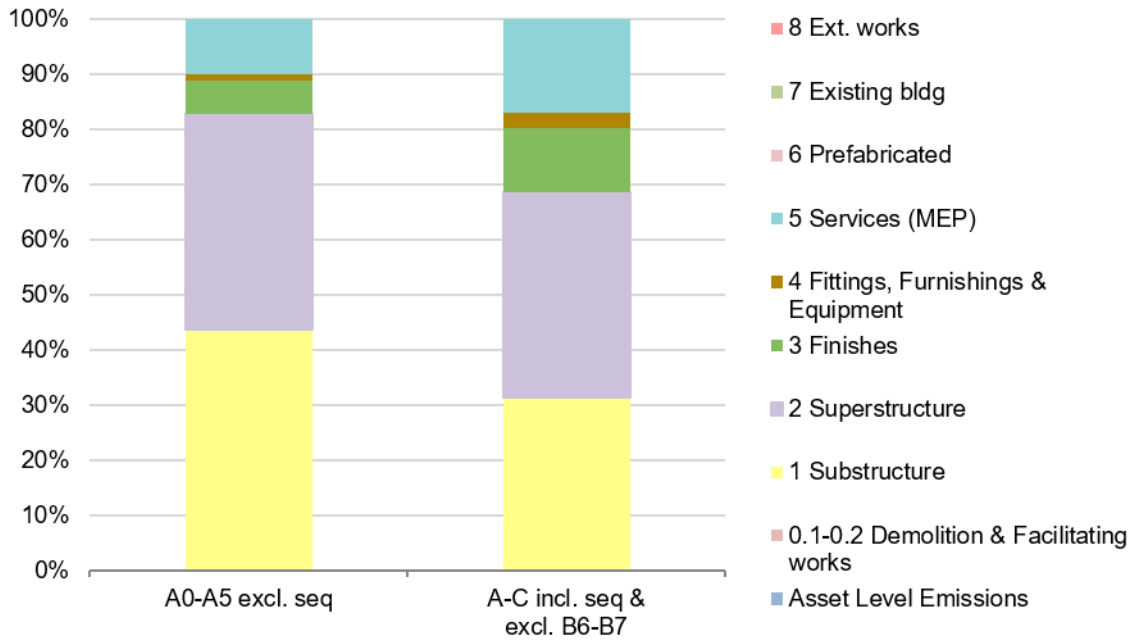
Modules A-C (incl. sequestration, excl. B6 & B7)	826 $kgCO_2e/m^2$	699 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

Rendlesham (End)

Table A9 Embodied carbon summary for the Rendlesham (End) housing, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	586 $kgCO_2e/m^2$	586 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	372 $kgCO_2e/m^2$	247 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	859 $kgCO_2e/m^2$	734 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

Figure 9.2 Estimated non-decarbonised embodied carbon of the proposed apartments, broken down by main building elements (Modules A0-A5 (excl. sequestration) and A-C (incl. sequestration & excl. B6 & B7))



H23.7 (Mid)

Table A10 and A11 illustrate the total embodied carbon emissions of the Proposed H23.7 mid and end dwellings, against the benchmarks set by Clarion.

Table A10 Embodied carbon summary for the H23.7 (Mid) housing, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)

Modules A0-A5 (excl. sequestration)	487 $kgCO_2e/m^2$	487 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	359 $kgCO_2e/m^2$	244 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	746 $kgCO_2e/m^2$	632 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

H23.7 (End)

Table A11 Embodied carbon summary for the H23.7 (End) housing, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	554 $kgCO_2e/m^2$	554 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	364 $kgCO_2e/m^2$	250 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	813 $kgCO_2e/m^2$	698 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

H24.3 (Mid)

Table A12 and A13 illustrate the total embodied carbon emissions of the Proposed H24.3 mid and end dwellings, against the benchmarks set by Clarion.

Table A12 Embodied carbon summary for the H24.3 (Mid) dwelling, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)
Modules A0-A5 (excl. sequestration)	493 $kgCO_2e/m^2$	493 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	391 $kgCO_2e/m^2$	266 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	778 $kgCO_2e/m^2$	653 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

H24.3 (End)

Table A13 Embodied carbon summary for the H24.3 (End) dwelling, excluding uncertainty factor

	Carbonised Performance	Decarbonised Performance	Clarion 2025-2030	Clarion 2030 (Stretch)	Manchester Climate ready (2025 -2030)

Modules A0-A5 (excl. sequestration)	542 $kgCO_2e/m^2$	542 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	290 $kgCO_2e/m^2$	400 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	367 $kgCO_2e/m^2$	246 $kgCO_2e/m^2$	-	-	240 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	805 $kgCO_2e/m^2$	684 $kgCO_2e/m^2$	-	-	640 $kgCO_2e/m^2$

External works

Table 9.2 Summary of external works calculations (included within the site-wide summary)

	Carbonised Performance	Decarbonised Performance
Modules A0-A5 (excl. sequestration)	54 $kgCO_2e/m^2$	54 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	54 $kgCO_2e/m^2$	40 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	80 $kgCO_2e/m^2$	67 $kgCO_2e/m^2$

APPENDIX B WLC EMISSIONS SUMMARY

Proposed apartment development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	94	-	-	-	-	-	749,000	72,400	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-27	219,000	11,900	37,900	-	-	-	-	-	-	-	-	-	-	5,980	18,200	9,600	35	-32,500	-
2 Superstructure - Structural Elements	-	-11	137,750	10,748	30,031	-	-	6,000	-	-	-	-	-	-	-	3,769	6,264	54,900	15	-6,334	-
2 Superstructure - Building Envelope	-	-	159,200	15,910	24,657	-	-	20,100	-	-	-	-	-	-	-	4,340	7,809	215	64	-6,150	-
2 Superstructure - Internal Elements	-	-27,600	52,500	11,980	8,973	-	-	31,700	-	-	-	-	-	-	-	1,425	4,645	27,100	112	-6,020	-
3 Finishes	-	-5,156	35,920	1,898	6,621	-	-	56,900	-	-	-	-	-	-	-	979	1,077	6,932	3,435	-1,609	-
4 Fittings, furnishings & equipment	-	-18,600	12,300	3,070	2,035	-		56,500	-	-	-	-	-	-	-	336	187	19,500	109	-2,970	-
5 Services (MEP)	-	-281	157,800	12,100	17,505	-	-	255,700	-	-	-	-	-	-	-	4,305	996	127	7	-60,350	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-51,675	774,470	67,606	127,816	-	-	426,900	-	-	749,000	72,400	-	-	-	21,134	39,178	118,374	3,777	-115,933	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-51,675	774,470	67,606	127,816	-	-	426,900	-	-	749,000	72,400	-	-	-	21,134	39,178	118,374	3,777	-115,933	-

Proposed apartment development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	94	-	-	-	-	-	222,000	14,500	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-27	219,000	11,900	37,900	-	-	-	-	-	-	-	-	-	-	2,990	9,090	9,600	35	-16,200	-
2 Superstructure - Structural Elements	-	-11	137,750	10,748	30,031	-	-	3,050	-	-	-	-	-	-	-	1,885	3,132	54,900	15	-3,167	-
2 Superstructure - Building Envelope	-	-	159,200	15,910	24,657	-	-	10,000	-	-	-	-	-	-	-	2,174	3,905	215	64	-3,080	-
2 Superstructure - Internal Elements	-	-27,600	52,500	11,980	8,973	-	-	15,850	-	-	-	-	-	-	-	714	2,323	27,100	112	-3,010	-
3 Finishes	-	-5,156	35,920	1,898	6,621	-	-	28,460	-	-	-	-	-	-	-	489	539	6,932	3,435	-804	-
4 Fittings, furnishings & equipment	-	-18,600	12,300	3,070	2,035	-		28,300	-	-	-	-	-	-	-	168	94	19,500	109	-1,490	-
5 Services (MEP)	-	-281	157,800	12,100	17,505	-	-	127,900	-	-	-	-	-	-	-	2,150	498	127	7	-30,240	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-51,675	774,470	67,606	127,816	-	-	213,560	-	-	222,000	14,500	-	-	-	10,570	19,581	118,374	3,777	-57,990	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-51,675	774,470	67,606	127,816	-	-	213,560	-	-	222,000	14,500	-	-	-	10,570	19,581	118,374	3,777	-57,990	-

Proposed Chiltern (Corner House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	41,000	3,760	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	13,240	748	2,110	-	-	60	-	-	-	-	-	-	-	-	1,097	552	2	-1,970	-
2 Superstructure - Structural Elements	-	-5,220	5,803	201	1,003	-	-	3,560	-	-	-	-	-	-	-	-	103	6,501	12	-1,735	-
2 Superstructure - Building Envelope	-	-41	6,430	441	1,024	-	-	2,000	-	-	-	-	-	-	-	-	335	285	3	-99	-
2 Superstructure - Internal Elements	-	-2,089	1,564	91	259	-	-	348	-	-	-	-	-	-	-	-	67	2,062	204	-284	-
3 Finishes	-	-236	2,274	186	384	-	-	4,760	-	-	-	-	-	-	-	-	98	472	348	-203	-
4 Fittings, furnishings & equipment	-	-554	370	11	54	-		1,330	-	-	-	-	-	-	-		6	588	3	-88	-
5 Services (MEP)	-	-18	4,660	233	468	-	-	8,770	-	-	-	-	-	-	-	-	19	104	0	-1,302	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	*-8,160*	*34,341*	*1,911*	*5,301*	-	-	*20,828*	-	-	*41,000*	*3,760*	-	-	-	-	*1,726*	*10,564*	*573*	*-5,680*	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	**-**	**-8,160**	**34,341**	**1,911**	**5,301**	**-**	**-**	**20,828**	**-**	**-**	**41,000**	**3,760**	**-**	**-**	**-**	**-**	**1,726**	**10,564**	**573**	**-5,680**	**-**

Proposed Chiltern (Corner House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	12,100	752	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	13,240	748	2,110	-	-	-	-	-	-	-	-	-	-	-	548	552	2	-985	-
2 Superstructure - Structural Elements	-	-5,220	5,803	201	1,003	-	-	1,780	-	-	-	-	-	-	-	-	52	6,501	12	-868	-
2 Superstructure - Building Envelope	-	-41	6,430	441	1,024	-	-	1,000	-	-	-	-	-	-	-	-	168	285	3	-49	-
2 Superstructure - Internal Elements	-	-2,089	1,564	91	259	-	-	174	-	-	-	-	-	-	-	-	34	2,062	204	-143	-
3 Finishes	-	-236	2,274	186	384	-	-	2,374	-	-	-	-	-	-	-	-	49	472	348	-101	-
4 Fittings, furnishings & equipment	-	-554	370	11	54	-		667	-	-	-	-	-	-	-		3	588	3	-44	-
5 Services (MEP)	-	-18	4,660	233	468	-	-	4,390	-	-	-	-	-	-	-	-	10	104	0	-650	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-8,160	34,341	1,911	5,301	-	-	10,385	-	-	12,100	752	-	-	-	-	863	10,564	573	-2,840	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-8,160	34,341	1,911	5,301	-	-	10,385	-	-	12,100	752	-	-	-	-	863	10,564	573	-2,840	-

Proposed Chiltern (Mid House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	41,000	3,760	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	11,500	700	1,933	-	-	60	-	-	-	-	-	-	-	-	950	548	2	-1,670	-
2 Superstructure - Structural Elements	-	-5,220	7,633	249	1,345	-	-	3,560	-	-	-	-	-	-	-	-	133	6,501	12	-1,960	-
2 Superstructure - Building Envelope	-	-41	3,950	396	662	-	-	1,780	-	-	-	-	-	-	-	-	244	265	2	-155	-
2 Superstructure - Internal Elements	-	-2,089	1,564	91	555	-	-	348	-	-	-	-	-	-	-	-	67	2,062	204	-284	-
3 Finishes	-	-236	2,273	175	403	-	-	4,803	-	-	-	-	-	-	-	-	98	472	357	-192	-
4 Fittings, furnishings & equipment	-	-554	370	11	58	-		1,330	-	-	-	-	-	-	-		6	588	3	-88	-
5 Services (MEP)	-	-20	4,142	219	458	-	-	7,746	-	-	-	-	-	-	-	-	19	103	0	-1,238	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	*-8,161*	*31,432*	*1,841*	*5,413*	-	-	*19,627*	-	-	*41,000*	*3,760*	-	-	-	-	*1,517*	*10,539*	*580*	*-5,586*	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	**-**	**-8,161**	**31,432**	**1,841**	**5,413**	**-**	**-**	**19,627**	**-**	**-**	**41,000**	**3,760**	**-**	**-**	**-**	**-**	**1,517**	**10,539**	**580**	**-5,586**	**-**

Proposed Chiltern (Mid House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	12,100	752	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	11,500	700	1,933	-	-	30	-	-	-	-	-	-	-	-	475	548	2	-836	-
2 Superstructure - Structural Elements	-	-5,220	7,633	249	1,345	-	-	1,780	-	-	-	-	-	-	-	-	66	6,501	12	-978	-
2 Superstructure - Building Envelope	-	-41	3,950	396	662	-	-	892	-	-	-	-	-	-	-	-	122	265	2	-77	-
2 Superstructure - Internal Elements	-	-2,089	1,564	91	555	-	-	174	-	-	-	-	-	-	-	-	34	2,062	204	-143	-
3 Finishes	-	-236	2,273	175	403	-	-	2,401	-	-	-	-	-	-	-	-	49	472	357	-96	-
4 Fittings, furnishings & equipment	-	-554	370	11	58	-		667	-	-	-	-	-	-	-		3	588	3	-44	-
5 Services (MEP)	-	-20	4,142	219	458	-	-	3,874	-	-	-	-	-	-	-	-	9	103	0	-619	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-8,161	31,432	1,841	5,413	-	-	9,818	-	-	12,100	752	-	-	-	-	758	10,539	580	-2,792	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-8,161	31,432	1,841	5,413	-	-	9,818	-	-	12,100	752	-	-	-	-	758	10,539	580	-2,792	-

Proposed Wychwood (House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	45,500	4,700	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	11,960	776	1,598	-	-	-	-	-	-	-	-	-	-	-	995	636	2	-1,730	-
2 Superstructure - Structural Elements	-	-9,290	10,603	389	1,435	-	-	5,480	-	-	-	-	-	-	-	-	161	11,101	19	-3,420	-
2 Superstructure - Building Envelope	-	-41	9,440	1,146	1,248	-	-	2,560	-	-	-	-	-	-	-	-	706	340	5	-445	-
2 Superstructure - Internal Elements	-	-2,552	2,400	138	324	-	-	391	-	-	-	-	-	-	-	-	16	1,850	10	-251	-
3 Finishes	-	-277	2,411	175	315	-	-	4,267	-	-	-	-	-	-	-	-	118	21	440	-21	-
4 Fittings, furnishings & equipment	-	-868	601	27	69	-	-	1,950	-	-	-	-	-	-	-	-	9	899	5	-125	-
5 Services (MEP)	-	-28	3,899	186	301	-	-	6,956	-	-	-	-	-	-	-	-	18	103	0	-1,063	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-13,059	41,314	2,838	5,289	-	-	21,604	-	-	45,500	4,700	-	-	-	-	2,023	14,950	481	-7,054	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-13,059	41,314	2,838	5,289	-	-	21,604	-	-	45,500	4,700	-	-	-	-	2,023	14,950	481	-7,054	-

Proposed Wychwood (House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	13,500	940	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	11,960	776	1,598	-	-	-	-	-	-	-	-	-	-	-	497	636	2	-863	-
2 Superstructure - Structural Elements	-	-9,290	10,603	389	1,435	-	-	2,740	-	-	-	-	-	-	-	-	80	11,101	19	-1,712	-
2 Superstructure - Building Envelope	-	-41	9,440	1,146	1,248	-	-	1,280	-	-	-	-	-	-	-	-	353	340	5	-222	-
2 Superstructure - Internal Elements	-	-2,552	2,400	138	324	-	-	196	-	-	-	-	-	-	-	-	8	1,850	10	-126	-
3 Finishes	-	-277	2,411	175	315	-	-	2,129	-	-	-	-	-	-	-	-	59	21	440	-11	-
4 Fittings, furnishings & equipment	-	-868	601	27	69	-	-	979	-	-	-	-	-	-	-	-	4	899	5	-63	-
5 Services (MEP)	-	-28	3,899	186	301	-	-	3,484	-	-	-	-	-	-	-	-	9	103	0	-531	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-13,059	41,314	2,838	5,289	-	-	10,808	-	-	13,500	940	-	-	-	-	1,011	14,950	481	-3,527	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-13,059	41,314	2,838	5,289	-	-	10,808	-	-	13,500	940	-	-	-	-	1,011	14,950	481	-3,527	-

Proposed Whiteleaf (House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	39,100	2,820	-	-	-		-	-	-	-	-25
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	12,300	686	1,983	-	-	-	-	-	-	-	-	-	-	-	1,010	574	2	-1,800	-
2 Superstructure - Structural Elements	-	-4,230	2,608	150	415	-	-	37	-	-	-	-	-	-	-	-	83	4,251	17	-767	-
2 Superstructure - Building Envelope	-	-41	5,760	397	938	-	-	1,780	-	-	-	-	-	-	-	-	302	267	3	-89	-
2 Superstructure - Internal Elements	-	-832	1,604	175	250	-	-	441	-	-	-	-	-	-	-	-	54	820	195	-61	-
3 Finishes	-	-213	2,279	142	381	-	-	4,776	-	-	-	-	-	-	-	-	96	489	337	-43	-
4 Fittings, furnishings & equipment	-	-552	370	11	55	-	-	1,330	-	-	-	-	-	-	-	-	6	586	3	-88	-
5 Services (MEP)	-	-18	4,350	217	447	-	-	8,159	-	-	-	-	-	-	-	-	19	104	0	-1,220	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-5,888	29,271	1,778	4,467	-	-	16,523	-	-	39,100	2,820	-	-	-	-	1,569	7,091	558	-4,067	-25
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-5,888	29,271	1,778	4,467	-	-	16,523	-	-	39,100	2,820	-	-	-	-	1,569	7,091	558	-4,067	-25

Proposed Whiteleaf (House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	43,100	564	-	-	-		-	-	-	-	-12
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	12,300	686	1,983	-	-	-	-	-	-	-	-	-	-	-	504	574	2	-902	-
2 Superstructure - Structural Elements	-	-4,230	2,608	150	415	-	-	19	-	-	-	-	-	-	-	-	41	4,251	17	-383	-
2 Superstructure - Building Envelope	-	-41	5,760	397	938	-	-	892	-	-	-	-	-	-	-	-	151	267	3	-44	-
2 Superstructure - Internal Elements	-	-832	1,604	175	250	-	-	221	-	-	-	-	-	-	-	-	27	820	195	-31	-
3 Finishes	-	-213	2,279	142	381	-	-	2,382	-	-	-	-	-	-	-	-	48	489	337	-22	-
4 Fittings, furnishings & equipment	-	-552	370	11	55	-	-	667	-	-	-	-	-	-	-	-	3	586	3	-44	-
5 Services (MEP)	-	-18	4,350	217	447	-	-	4,086	-	-	-	-	-	-	-	-	9	104	0	-610	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-5,888	29,271	1,778	4,467	-	-	8,267	-	-	43,100	564	-	-	-	-	784	7,091	558	-2,035	-12
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-5,888	29,271	1,778	4,467	-	-	8,267	-	-	43,100	564	-	-	-	-	784	7,091	558	-2,035	-12

Proposed Whiteleaf (Corner House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	39,100	2,820	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	12,260	687	1,962	-	-	-	-	-	-	-	-	-	-	-	884	575	2	-1,717	-
2 Superstructure - Structural Elements	-	-4,210	3,153	154	523	-	-	3,040	-	-	-	-	-	-	-	-	85	4,621	17	-761	-
2 Superstructure - Building Envelope	-	-41	6,370	422	1,006	-	-	2,230	-	-	-	-	-	-	-	-	322	304	3	-95	-
2 Superstructure - Internal Elements	-	-1,868	1,497	87	247	-	-	304	-	-	-	-	-	-	-	-	64	1,851	198	-254	-
3 Finishes	-	-212	2,193	137	362	-	-	4,512	-	-	-	-	-	-	-	-	94	443	331	-41	-
4 Fittings, furnishings & equipment	-	-554	423	13	60	-		1,330	-	-	-	-	-	-	-		6	588	3	-88	-
5 Services (MEP)	-	-18	3,634	163	373	-	-	6,716	-	-	-	-	-	-	-	-	16	103	0	-958	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-6,905	29,530	1,662	4,532	-	-	18,132	-	-	39,100	2,820	-	-	-	-	1,471	8,485	555	-3,914	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-6,905	29,530	1,662	4,532	-	-	18,132	-	-	39,100	2,820	-	-	-	-	1,471	8,485	555	-3,914	-

Proposed Whiteleaf (Corner House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	11,600	564	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	12,260	687	1,962	-	-	-	-	-	-	-	-	-	-	-	443	575	2	-860	-
2 Superstructure - Structural Elements	-	-4,210	3,153	154	523	-	-	1,520	-	-	-	-	-	-	-	-	43	4,621	17	-380	-
2 Superstructure - Building Envelope	-	-41	6,370	422	1,006	-	-	1,110	-	-	-	-	-	-	-	-	160	304	3	-47	-
2 Superstructure - Internal Elements	-	-1,868	1,497	87	247	-	-	152	-	-	-	-	-	-	-	-	32	1,851	198	-127	-
3 Finishes	-	-212	2,193	137	362	-	-	2,261	-	-	-	-	-	-	-	-	47	443	331	-21	-
4 Fittings, furnishings & equipment	-	-554	423	13	60	-		667	-	-	-	-	-	-	-		3	588	3	-44	-
5 Services (MEP)	-	-18	3,634	163	373	-	-	3,363	-	-	-	-	-	-	-	-	8	103	0	-479	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-6,905	29,530	1,662	4,532	-	-	9,073	-	-	11,600	564	-	-	-	-	736	8,485	555	-1,958	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-6,905	29,530	1,662	4,532	-	-	9,073	-	-	11,600	564	-	-	-	-	736	8,485	555	-1,958	-

Proposed Rendal (Mid House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	43,700	4,700	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,800	1,020	2,620	-	-	77	-	-	-	-	-	-	-	-	1,550	714	3	-2,800	-
2 Superstructure - Structural Elements	-	-6,040	9,103	283	1,338	-	-	4,060	-	-	-	-	-	-	-	-	148	7,521	13	-2,320	-
2 Superstructure - Building Envelope	-	-41	5,210	505	695	-	-	2,450	-	-	-	-	-	-	-	-	312	322	3	-198	-
2 Superstructure - Internal Elements	-	-2,479	2,180	126	569	-	-	391	-	-	-	-	-	-	-	-	93	2,464	293	-340	-
3 Finishes	-	-250	2,528	199	374	-	-	5,346	-	-	-	-	-	-	-	-	112	522	417	-214	-
4 Fittings, furnishings & equipment	-	-679	493	23	62	-	-	1,510	-	-	-	-	-	-	-	-	7	710	4	-99	-
5 Services (MEP)	-	-30	4,571	240	385	-	-	8,332	-	-	-	-	-	-	-	-	21	104	0	-1,329	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-9,521	42,885	2,394	6,043	-	-	22,166	-	-	43,700	4,700	-	-	-	-	2,242	12,357	733	-7,298	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-9,521	42,885	2,394	6,043	-	-	22,166	-	-	43,700	4,700	-	-	-	-	2,242	12,357	733	-7,298	-

Proposed Rendal (Mid House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	13,000	940	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,800	1,020	2,620	-	-	39	-	-	-	-	-	-	-	-	775	714	3	-1,400	-
2 Superstructure - Structural Elements	-	-6,040	9,103	283	1,338	-	-	2,030	-	-	-	-	-	-	-	-	74	7,521	13	-1,160	-
2 Superstructure - Building Envelope	-	-41	5,210	505	695	-	-	1,220	-	-	-	-	-	-	-	-	156	322	3	-99	-
2 Superstructure - Internal Elements	-	-2,479	2,180	126	569	-	-	196	-	-	-	-	-	-	-	-	47	2,464	293	-170	-
3 Finishes	-	-250	2,528	199	374	-	-	2,674	-	-	-	-	-	-	-	-	56	522	417	-108	-
4 Fittings, furnishings & equipment	-	-679	493	23	62	-	-	756	-	-	-	-	-	-	-	-	3	710	4	-49	-
5 Services (MEP)	-	-30	4,571	240	385	-	-	4,172	-	-	-	-	-	-	-	-	10	104	0	-664	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-9,521	42,885	2,394	6,043	-	-	11,087	-	-	13,000	940	-	-	-	-	1,121	12,357	733	-3,649	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-9,521	42,885	2,394	6,043	-	-	11,087	-	-	13,000	940	-	-	-	-	1,121	12,357	733	-3,649	-

Proposed Rendal (End House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	43,700	4,700	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,800	1,020	2,490	-	-	77	-	-	-	-	-	-	-	-	1,550	714	3	-2,800	-
2 Superstructure - Structural Elements	-	-6,040	9,103	283	1,275	-	-	4,060	-	-	-	-	-	-	-	-	148	7,521	13	-2,320	-
2 Superstructure - Building Envelope	-	-41	8,870	1,142	1,210	-	-	2,000	-	-	-	-	-	-	-	-	701	294	4	-450	-
2 Superstructure - Internal Elements	-	-2,479	2,180	126	298	-	-	391	-	-	-	-	-	-	-	-	16	1,850	10	-251	-
3 Finishes	-	-250	2,531	200	358	-	-	4,036	-	-	-	-	-	-	-	-	109	23	416	-7	-
4 Fittings, furnishings & equipment	-	-679	493	23	59	-	-	1,510	-	-	-	-	-	-	-	-	7	710	4	-99	-
5 Services (MEP)	-	-28	5,117	255	389	-	-	9,466	-	-	-	-	-	-	-	-	21	104	0	-1,408	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-9,519	47,094	3,048	6,079	-	-	21,540	-	-	43,700	4,700	-	-	-	-	2,553	11,216	450	-7,334	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-9,519	47,094	3,048	6,079	-	-	21,540	-	-	43,700	4,700	-	-	-	-	2,553	11,216	450	-7,334	-

Proposed Rendal (End House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	13,000	940	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,800	1,020	2,490	-	-	39	-	-	-	-	-	-	-	-	775	714	3	-1,400	-
2 Superstructure - Structural Elements	-	-6,040	9,103	283	1,275	-	-	2,030	-	-	-	-	-	-	-	-	74	7,521	13	-1,160	-
2 Superstructure - Building Envelope	-	-41	8,870	1,142	1,210	-	-	1,000	-	-	-	-	-	-	-	-	351	294	4	-225	-
2 Superstructure - Internal Elements	-	-2,479	2,180	126	298	-	-	196	-	-	-	-	-	-	-	-	8	1,850	10	-126	-
3 Finishes	-	-250	2,531	200	358	-	-	2,018	-	-	-	-	-	-	-	-	55	23	416	-4	-
4 Fittings, furnishings & equipment	-	-679	493	23	59	-	-	756	-	-	-	-	-	-	-	-	3	710	4	-49	-
5 Services (MEP)	-	-28	5,117	255	389	-	-	4,734	-	-	-	-	-	-	-	-	11	104	0	-702	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-9,519	47,094	3,048	6,079	-	-	10,773	-	-	13,000	940	-	-	-	-	1,277	11,216	450	-3,666	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-9,519	47,094	3,048	6,079	-	-	10,773	-	-	13,000	940	-	-	-	-	1,277	11,216	450	-3,666	-

Proposed H23.7 (Mid House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	42,100	3,750	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	14,920	793	2,294	-	-	63	-	-	-	-	-	-	-	-	1,218	581	2	-2,221	-
2 Superstructure - Structural Elements	-	-6,462	7,893	280	1,245	-	-	52	-	-	-	-	-	-	-	-	147	7,351	22	-1,555	-
2 Superstructure - Building Envelope	-	-41	3,660	182	540	-	-	2,110	-	-	-	-	-	-	-	-	138	291	2	-48	-
2 Superstructure - Internal Elements	-	-1,204	1,568	90	244	-	-	152	-	-	-	-	-	-	-	-	66	1,198	225	-167	-
3 Finishes	-	-257	2,512	193	416	-	-	5,402	-	-	-	-	-	-	-	-	105	541	376	-229	-
4 Fittings, furnishings & equipment	-	-754	456	14	73	-		1,510	-	-	-	-	-	-	-		7	782	4	-99	-
5 Services (MEP)	-	-20	4,768	240	462	-	-	9,086	-	-	-	-	-	-	-	-	20	104	0	-1,334	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-8,739	35,777	1,792	5,275	-	-	18,374	-	-	42,100	3,750	-	-	-	-	1,701	10,847	632	-5,652	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-8,739	35,777	1,792	5,275	-	-	18,374	-	-	42,100	3,750	-	-	-	-	1,701	10,847	632	-5,652	-

Proposed H23.7 (Mid House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	12,500	750	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	14,920	793	2,294	-	-	-	-	-	-	-	-	-	-	-	609	581	2	-1,111	-
2 Superstructure - Structural Elements	-	-6,462	7,893	280	1,245	-	-	26	-	-	-	-	-	-	-	-	73	7,351	22	-777	-
2 Superstructure - Building Envelope	-	-41	3,660	182	540	-	-	1,060	-	-	-	-	-	-	-	-	69	291	2	-24	-
2 Superstructure - Internal Elements	-	-1,204	1,568	90	244	-	-	76	-	-	-	-	-	-	-	-	33	1,198	225	-83	-
3 Finishes	-	-257	2,512	193	416	-	-	2,703	-	-	-	-	-	-	-	-	53	541	376	-115	-
4 Fittings, furnishings & equipment	-	-754	456	14	73	-		756	-	-	-	-	-	-	-		4	782	4	-50	-
5 Services (MEP)	-	-20	4,768	240	462	-	-	4,544	-	-	-	-	-	-	-	-	10	104	0	-668	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-8,739	35,777	1,792	5,275	-	-	9,165	-	-	12,500	750	-	-	-	-	851	10,847	632	-2,827	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-8,739	35,777	1,792	5,275	-	-	9,165	-	-	12,500	750	-	-	-	-	851	10,847	632	-2,827	-

Proposed H23.7 (End House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	42,100	3,750	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	14,920	793	2,139	-	-	63	-	-	-	-	-	-	-	-	1,218	581	2	-2,221	-
2 Superstructure - Structural Elements	-	-6,380	7,843	265	1,154	-	-	51	-	-	-	-	-	-	-	-	139	7,271	18	-2,034	-
2 Superstructure - Building Envelope	-	-41	8,320	1,071	1,234	-	-	1,890	-	-	-	-	-	-	-	-	659	284	4	-424	-
2 Superstructure - Internal Elements	-	-1,935	1,697	98	252	-	-	304	-	-	-	-	-	-	-	-	73	1,919	229	-264	-
3 Finishes	-	-257	2,413	191	374	-	-	4,908	-	-	-	-	-	-	-	-	103	536	370	-230	-
4 Fittings, furnishings & equipment	-	-659	423	13	57	-		1,510	-	-	-	-	-	-	-		7	691	4	-99	-
5 Services (MEP)	-	-19	4,840	242	416	-	-	9,086	-	-	-	-	-	-	-	-	20	104	0	-1,351	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	*-9,292*	*40,456*	*2,674*	*5,625*	-	-	*17,812*	-	-	*42,100*	*3,750*	-	-	-	-	*2,218*	*11,385*	*627*	*-6,622*	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	**-**	**-9,292**	**40,456**	**2,674**	**5,625**	**-**	**-**	**17,812**	**-**	**-**	**42,100**	**3,750**	**-**	**-**	**-**	**-**	**2,218**	**11,385**	**627**	**-6,622**	**-**

Proposed H23.7 (End House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	12,500	750	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	14,920	793	2,139	-	-	-	-	-	-	-	-	-	-	-	609	581	2	-1,111	-
2 Superstructure - Structural Elements	-	-6,380	7,843	265	1,154	-	-	25	-	-	-	-	-	-	-	-	69	7,271	18	-1,016	-
2 Superstructure - Building Envelope	-	-41	8,320	1,071	1,234	-	-	948	-	-	-	-	-	-	-	-	329	284	4	-212	-
2 Superstructure - Internal Elements	-	-1,935	1,697	98	252	-	-	152	-	-	-	-	-	-	-	-	36	1,919	229	-132	-
3 Finishes	-	-257	2,413	191	374	-	-	2,456	-	-	-	-	-	-	-	-	52	536	370	-115	-
4 Fittings, furnishings & equipment	-	-659	423	13	57	-		756	-	-	-	-	-	-	-		3	691	4	-49	-
5 Services (MEP)	-	-19	4,840	242	416	-	-	4,544	-	-	-	-	-	-	-	-	10	104	0	-676	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-9,292	40,456	2,674	5,625	-	-	8,881	-	-	12,500	750	-	-	-	-	1,109	11,385	627	-3,311	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-9,292	40,456	2,674	5,625	-	-	8,881	-	-	12,500	750	-	-	-	-	1,109	11,385	627	-3,311	-

Proposed H24.3 (mid House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	44,400	5,650	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,880	1,030	2,563	-	-	77	-	-	-	-	-	-	-	-	1,552	714	3	-2,812	-
2 Superstructure - Structural Elements	-	-7,360	10,233	321	1,465	-	-	4,560	-	-	-	-	-	-	-	-	168	9,031	19	-2,490	-
2 Superstructure - Building Envelope	-	-41	4,750	503	648	-	-	1,890	-	-	-	-	-	-	-	-	312	276	3	-196	-
2 Superstructure - Internal Elements	-	-2,412	1,980	114	552	-	-	391	-	-	-	-	-	-	-	-	85	2,396	262	-330	-
3 Finishes	-	-301	2,729	225	403	-	-	5,757	-	-	-	-	-	-	-	-	116	604	407	-259	-
4 Fittings, furnishings & equipment	-	-1,290	683	23	115	-		1,950	-	-	-	-	-	-	-		12	1,300	7	-127	-
5 Services (MEP)	-	-20	5,363	271	420	-	-	10,196	-	-	-	-	-	-	-	-	22	104	0	-1,495	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-11,426	44,618	2,487	6,165	-	-	24,821	-	-	44,400	5,650	-	-	-	-	2,265	14,425	701	-7,708	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-11,426	44,618	2,487	6,165	-	-	24,821	-	-	44,400	5,650	-	-	-	-	2,265	14,425	701	-7,708	-

Proposed H24.3 (Mid House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	13,200	1,130	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,880	1,030	2,563	-	-	39	-	-	-	-	-	-	-	-	776	714	3	-1,401	-
2 Superstructure - Structural Elements	-	-7,360	10,233	321	1,465	-	-	2,280	-	-	-	-	-	-	-	-	84	9,031	19	-1,244	-
2 Superstructure - Building Envelope	-	-41	4,750	503	648	-	-	948	-	-	-	-	-	-	-	-	155	276	3	-98	-
2 Superstructure - Internal Elements	-	-2,412	1,980	114	552	-	-	196	-	-	-	-	-	-	-	-	42	2,396	262	-165	-
3 Finishes	-	-301	2,729	225	403	-	-	2,882	-	-	-	-	-	-	-	-	58	604	407	-130	-
4 Fittings, furnishings & equipment	-	-1,290	683	23	115	-		979	-	-	-	-	-	-	-		6	1,300	7	-63	-
5 Services (MEP)	-	-20	5,363	271	420	-	-	5,094	-	-	-	-	-	-	-	-	11	104	0	-746	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-11,426	44,618	2,487	6,165	-	-	12,418	-	-	13,200	1,130	-	-	-	-	1,132	14,425	701	-3,848	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-11,426	44,618	2,487	6,165	-	-	12,418	-	-	13,200	1,130	-	-	-	-	1,132	14,425	701	-3,848	-

Proposed H24.3 (End House) Development: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	44,400	5,650	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,900	1,030	2,440	-	-	77	-	-	-	-	-	-	-	-	1,550	714	3	-2,810	-
2 Superstructure - Structural Elements	-	-7,350	10,253	322	1,398	-	-	4,560	-	-	-	-	-	-	-	-	169	9,011	19	-2,490	-
2 Superstructure - Building Envelope	-	-41	9,300	1,212	1,246	-	-	2,000	-	-	-	-	-	-	-	-	744	295	4	-480	-
2 Superstructure - Internal Elements	-	-2,412	1,980	114	266	-	-	391	-	-	-	-	-	-	-	-	16	1,850	10	-251	-
3 Finishes	-	-301	2,727	225	384	-	-	4,277	-	-	-	-	-	-	-	-	110	19	406	-9	-
4 Fittings, furnishings & equipment	-	-1,050	600	20	84	-	-	1,950	-	-	-	-	-	-	-	-	10	1,070	6	-126	-
5 Services (MEP)	-	-20	5,337	269	381	-	-	10,196	-	-	-	-	-	-	-	-	21	104	0	-1,481	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-11,176	49,097	3,192	6,198	-	-	23,451	-	-	44,400	5,650	-	-	-	-	2,621	13,063	449	-7,647	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-11,176	49,097	3,192	6,198	-	-	23,451	-	-	44,400	5,650	-	-	-	-	2,621	13,063	449	-7,647	-

Proposed H24.3 (End House) Development: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	13,200	1,130	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-2	18,900	1,030	2,440	-	-	39	-	-	-	-	-	-	-	-	777	714	3	-1,410	-
2 Superstructure - Structural Elements	-	-7,350	10,253	322	1,398	-	-	2,280	-	-	-	-	-	-	-	-	84	9,011	19	-1,247	-
2 Superstructure - Building Envelope	-	-41	9,300	1,212	1,246	-	-	1,000	-	-	-	-	-	-	-	-	372	295	4	-240	-
2 Superstructure - Internal Elements	-	-2,412	1,980	114	266	-	-	196	-	-	-	-	-	-	-	-	8	1,850	10	-126	-
3 Finishes	-	-301	2,727	225	384	-	-	2,144	-	-	-	-	-	-	-	-	55	19	406	-5	-
4 Fittings, furnishings & equipment	-	-1,050	600	20	84	-	-	979	-	-	-	-	-	-	-	-	5	1,070	6	-63	-
5 Services (MEP)	-	-20	5,337	269	381	-	-	5,094	-	-	-	-	-	-	-	-	11	104	0	-740	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	-	-11,176	49,097	3,192	6,198	-	-	11,732	-	-	13,200	1,130	-	-	-	-	1,312	13,063	449	-3,830	-
8 Ext. works (within boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-11,176	49,097	3,192	6,198	-	-	11,732	-	-	13,200	1,130	-	-	-	-	1,312	13,063	449	-3,830	-

Proposed External Works: Estimated non-decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising RICS SAP10.2 carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Superstructure - Structural Elements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Superstructure - Building Envelope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Superstructure - Internal Elements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3 Finishes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4 Fittings, furnishings & equipment	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
5 Services (MEP)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (within boundary)	-	-181,000	262,000	73,700	21,200	-	-	173,000	-	-	-	-	-	-	-	-	8,220	173,000	63	-238,000	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-181,000	262,000	73,700	21,200	-	-	173,000	-	-	-	-	-	-	-	-	8,220	173,000	63	-238,000	-

Proposed External Works: Estimated decarbonised WLC emissions

Results evidencing WLC emissions for all modules, utilising FES carbon factors for operational energy use

Building element group	A0 Pre-construction	A1-A3 Sequestered Carbon	A1-A3 Product Stage	A4 Transportation to site	A5.1-A5.4 Pre-construction Demolition & Site Ops	B1 Use Phase	B2 - B3 Maintenance & Repair	B4 Replacement	B5 Refurbishment	B5 Material Refurbishment Sequestration	B6.1-B6.3 Regulated & Unregulated Energy	B7.1 Water used by Essential Systems	B7.2 Water used by Other Integrated Systems	B7.3 Water used by non-integrated Systems	B8.1-B8.2 User Activities	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	D1 Potential net benefits/loads from reuse, recycling, energy or other recovery	D2 Potential benefits and loads from exported utilities
Asset Level Emissions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
0.1 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.2 Facilitating Works	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Substructure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Superstructure - Structural Elements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Superstructure - Building Envelope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Superstructure - Internal Elements	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3 Finishes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4 Fittings, furnishings & equipment	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
5 Services (MEP)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6 Pre-fabricated Units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Works to Existing Buildings	-	-	-	-	-	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Sub-total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Ext. works (within boundary)	-	-181,000	262,000	73,700	21,200	-	-	86,300	-	-	-	-	-	-	-	-	4,110	173,000	63	-119,000	-
8 Ext. works (outside of boundary)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kgCO2e/m2)	-	-181,000	262,000	73,700	21,200	-	-	86,300	-	-	-	-	-	-	-	-	4,110	173,000	63	-119,000	-

APPENDIX C – BUILDING ELEMENT ASSESSMENT BASIS

Embodied Carbon and End-of-Life Assessment

The building elements assessed within this report align with the RICS PS and can be found within Table 0.1 below. Please note that in accordance with RICS, where asset level emissions have been generated using GIA measurements e.g. A5.2, B2, B3 & C1, these have been allocated to each building element category.

Table 0.1 Data used to assess the embodied carbon of the Proposed Development

Building Element Group	Building Element (Granularity Level 2)	Basis for Information
0.1 Treatment and Demolition Works and Facilitating Works	0.1 Toxic/hazardous/ contaminated material treatment	Figures not accounted for within the WLC.
	0.2 Major demolition works	The default figure of 35kgCO_2e/m^2 (GIA) has been applied to the full extent of the existing site, based upon the GIA of the existing structures. Furthermore, the One Click LCA default figure of 3.4kgCO_2e/m^2 (GIA) has been applied to account for the end-of-life deconstruction impact.
1 Substructure	1.1 Substructure	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
2 Superstructure	2.1 Frame	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
	2.2-2.3 Upper Floors and Roof	
	2.4 Stairs and ramps	
2 Superstructure	2.5 External Walls and Roof Finishes	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
	2.6 Windows and External Doors	
2 Superstructure	2.7 Internal Walls	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
	2.8 Internal Doors	
3 Finishes	3.1 Wall finishes	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
	3.2 Floor finishes	
	3.3 Ceiling finishes	

4 Fittings, furnishing and equipment (FF&E)	4. FF&E	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
5 Building Services / MEP	5.1 Public health	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
	5.2 Heating, Ventilation and Cooling (HVAC)	
	5.3 Electrical installations	
	5.4 On-site renewable energy generation	
	5.5 Systems including Life safety, Fuel installations, Lift and conveyor installations, Services equipment Disposal installations, Specialist installations, Builders work in connection with services	
6 Prefabricated Buildings and Building Units	6.1 Prefabricated Buildings and Building Units	Not applicable to the assessment.
7 Work to Existing Building	7. Works to Existing Buildings	Not accounted for within the assessment.
8 External Works (Within the Project Boundary)	8.1 Roads, Paths, Paving, Surfacing, Fencing, Railings, Walls and External Fixtures	Specification and material quantities sourced from the RIBA Stage 3 Cost Plan.
	8.2 Soft Landscaping, Planting	
	8.3 External Drainage, External Services and Minor Building Works and Ancillary Buildings	
8 External Works (Outside the Project Boundary)	8.1 Roads, Paths, Paving, Surfacing, Fencing, Railings, Walls and External Fixtures	Not accounted for within the assessment.
	8.2 Soft Landscaping, Planting	
	8.3 External Drainage, External Services and Minor Building Works and Ancillary Buildings	

Table 0.2 below highlights the life cycle modules utilised in assessing the built asset's life cycle impacts, alongside details on the source for such modules within the LCA conducted for this report.

Table 0.2 Comments on the data source used in each life cycle module included in the assessment

Module	Description	Data Source
A0 Pre-construction	Pre-construction activities include non-physical processes before construction such as preliminary studies, impact assessments, risk assessments, stakeholder engagement, design and technical studies, product/material tests, site surveys and acquisition of land and design. Whilst these are deemed to typically have a much lower impact than other life cycle stages, where feasible these should be quantified, however the stage is optional. For the house specific modelling exercise, A0 pre-construction calculations for have been omitted in lieu of site information.	For the house and apartment specific modelling exercise, A0 pre-construction calculations for have been omitted in lieu of site information.
A1-A3 Product Stage	Raw material supply (A1) includes emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed. Loss of raw material and energy are also taken into account. Transport impacts (A2) include exhaust emissions resulting from the transport of all raw materials from suppliers to the manufacturer's production plant as well as impacts of production of fuels. Production impacts (A3) cover the manufacturing of materials and fuels used by machines, as well as handling of waste formed in the production processes at the manufacturer's production plants until the end-of-waste state.	Utilised EPDs within the One Click software which align with the products specified (where known) or the most applicable similar product.
A4 Transportation to Site	A4 includes exhaust emissions resulting from the transport of building products from manufacturers' production plants to building site, as well as the environmental impacts of production of the used fuel.	Transport distances were estimated based on typical average transport distances based on material type and project location, in line with the RICS defaults.

A5 Construction/ installation process	A5 covers the exhaust emissions resulting from using energy during the site operations, the environmental impacts of production processes of fuel and energy and water as well as handling of waste until the end-of-waste state.	At this stage of design, the average construction site impacts were estimated based upon the GIA at a rate of 40kgCO_2e/m^2. No demolition emissions have been included given the current site condition.
B1-B5 Maintenance and material replacement	The environmental impacts from in-use emissions are quantified within B1 and predominantly relate to refrigerant leakage and the benefits from the carbonation of concrete. Modules B2-B5 cover the environmental impacts of material maintenance, repair, replacement and overall building refurbishment. The emissions cover impacts from raw material supply, transportation and production of the replaced new material as well as the impacts from manufacturing the replaced material and handling of waste until the end-of-waste state.	Resultant emissions from refrigerant leakage have been captured within B1, which accounts for the annual and end-of-life leakage rates. The design team is yet to create a maintenance schedule for the Proposed Development due to the early stage of the design process. As such, figures for maintenance (B2) have been estimated at 10kgCO_2e/m^2 (GIA). Furthermore, figures for repair (B3) have been estimated at 25% of the B2 emissions for relevant items, and 10% of A1-A3 for MEP. Replacement (B4) emissions have followed the RICS default figures, as set out in 0.
B6 Energy use	Operational energy consumption (B6) impacts include exhaust emissions from any building level energy production as well as the environmental impacts of production processes of fuel and externally produced energy. Energy transmission losses are also considered.	Energy consumption was based on provided energy model data
B7 Water use	Operational water consumption (B7) impacts include the environmental impacts of production processes of fresh water and the impacts from wastewater treatment.	Water consumption was calculated based upon BSRIA 'Rules of Thumb (5th edition) Table 22 in lieu of detailed information at this stage of the project.
B8 User Activities	Quantification of the impacts from user activities related to the built asset, however any explicit requirement to assess impacts from user activities would typically depend on the nature	User activities have not been accounted for within the WLCA due to the nature of the development making it difficult to quantify at this stage.

	of the project and/or the specific assessment brief. As such, B8 is an optional module and the information constitutes additional information.	If feasible, this will seek to be updated in the latter design stages.
C1-C4 Deconstruction	The impacts of deconstruction include impacts of physically deconstructing the asset (C1), transporting (C2) and processing recyclable construction waste flows for recycling (C3) until the end-of-waste stage or the impacts of pre-processing and landfilling for waste streams that cannot be recycled (C4) based on type of material.	Both the end-of-life asset-level and individual material-level deconstruction/demolition (C1) impacts have been estimated based upon three potential scenarios explored within Section 5.1. 0 provides a detailed summary of each of the material-level scenarios assumed to have a better than 'business as usual' scenario, agreed through consultations with the design team. The remaining end-of-life transport (C2), waste processing (C3) and disposal (C4) impacts have been estimated based upon the above end-of-life assumptions. RICS assumes default C4 emissions rates for materials not expected to be re-used, depending on the landfill or incineration of materials.
D External impacts/end-of life benefits	External benefits for re-used or recycled material types include the positive impact of replacing virgin-based material with recycled material and the benefits of the energy which can be recovered from the materials.	As discussed above, the end-of-Life impacts have incorporated the anticipated scenarios agreed with the design team. Where these have yet to be agreed, the Proposed Development's asset-level end-of-life scenario of 'business as usual' has been assumed. See 0 for more detail.

APPENDIX D ASSUMPTIONS FROM RICS PROFESSIONAL STATEMENT

RICS Table 16 Specifications for main building materials

Material	Details	Baseline Specification Representative of Standard Practice (UK)
Concrete, cast in situ (ready-mix concrete) Assumptions for reinforcement provided separately)	Piling and foundations	Reinforced concrete, C32/40, 25% cement replacement
	Vertical structural elements, e.g. columns, walls	Reinforced concrete, up to 20 storeys (in situ, C32/40, 25% cement replacement, excluding reinforcement) Structure, concrete, over 20 storeys (in situ, C40/50, 25% cement replacement
	Horizontal structural elements, e.g. beams, slabs	Reinforced concrete (C32/40, 25% cement replacement)
	Facilitating/auxiliary works	Reinforced concrete (C16/20, 25% cement replacement)
	Backfill	Reinforced concrete (C8/10, 25% cement replacement)
Concrete, precast	Structural elements: beams, segments, slabs, etc. pours of <25m^3	Reinforced concrete (C40/50, 0% cement replacement)
	Structural elements: beams, segments, slabs, etc. pours of >25m^3	Reinforced concrete (C40/50, 25% cement replacement, excluding reinforcement)
	Cladding panels	C16/20, 0% cement replacement
Concrete, sprayed	Tunnel/shaft linings Curved surfaces: roof shells, domes, etc.	Fibre reinforced concrete, C32/40, 0% cement replacement
Concrete reinforcement	Reinforcement bars	UK CARES sector average (EAF production, typically 96% recycled content in UK)
Steel	Sheet piling	Blended EAF/BOF
	Structural steel sections – rolled sections	Blended market rate of 60% BOF/40% EAF production
	Structural steel sections – plate and closed	100% BOF production
	Studwork/support frames	Galvanised steel, 15% recycled content
	Galvanised profiled sheet	UK TATA Comflor
Masonry	Precast concrete blocks	Lightweight aerated autoclaved concrete (AAC, such as Aircrete) blocks for non-structural uses (600kg/m^3)
		Medium-density blocks for structural uses (1425kg/m^3)
	Brickwork	Generic UK clay brick, dry brick weight 2.13kg
Timber	Manufactured structural timber: cross-laminated timber (CLT), Glulam, laminated veneered lumber (LVL), etc.	Engineered wood, sustainably sourced
	Studwork (e.g. secondary members such as internal partitions)	Softwood, C16, sustainably sourced
	Framing (e.g. primary members such as joists)	Softwood, C24, sustainably sourced

	Formwork	Plywood, sustainably sourced
Aluminium	Sheet	Aluminium sheet, 31% recycled content
	Extruded Profiles	Aluminium extrusions, 31% recycled content
Plasterboard	Partitioning/ceilings	FGD gypsum plasterboard (approximately 10% recycled content)
Insulation	For floors and external walls	Mineral wool
	For roof – polyisocyanurate (PIR)/ rigid polyurethane (PU)	Polyurethane (PU) rigid foam
Aggregates/granular material	Fill material	Aggregates and sand, general UK fill material, mixture of land won, marine, secondary and recycled, bulk, loose
Glass	Glass: general, glazing, toughened, multilayer safety, skylight, fibreglass, expanded glass	Relevant generic datasets
Plastics	Plastics (various)	Relevant generic datasets
Coatings	Paints: general, waterborne, solvent-borne	Relevant generic datasets
	Intumescent coating for steel	Amotherm steel WB
	Cementitious spray	Isolatek international product average
Asphalt	For highway and pavement construction	Asphalt, 5% binder content
Bitumen	For road construction, roofing, waterproofing and other applications	Straight run bitumen
MEP products	All	CIBSE TM65 (specification of MEP constituent materials rather than composite assemblies in Table 2.1 from TM65: 2021)
Façade build up	All types	Centre for Window and Cladding Technology (CWCT) How to calculate the embodied carbon of facades: a methodology (refer to Appendix B and Appendix C

RICS Table 17 Default transport scenarios for UK projects

Transport scenario (both road and sea to be used)	km by road*	km by sea**
Locally manufactured (ready-mixed concrete)	20	-
Locally manufactured (general), e.g. aggregate, earth, asphalt	50	-
Regionally manufactured, e.g. plasterboard, blockwork, insulation, carpet, glass	80	-
Nationally manufactured, e.g. structural timber, structural steelwork, reinforcement, precast concrete	120	-
European manufactured, e.g. cross-laminated timber (CLT), facade modules	1,500	100
Globally manufactured, e.g. specialist stone cladding	500	10,000

* Means of transport assumed as average of all average rigid HGVs or other road vehicles where details available (average laden).

** Means of transport assumed as average container ship.

RICS Table 18 Recommended waste rate data, primarily from BRE Global Product Category Rules

Material/product	WR (waste rate)

Concrete in situ	5%
Concrete precast (floor, beams and frames)	1%
Concrete (sprayed)	10%
Steel reinforcement	5%
Steel frame (beams, columns, braces)	1%
Concrete blocks (lightweight AAC)	10%
Concrete blocks (dense/medium density)	5%
Brickwork (clay)	6%
Stone (cladding)	5%
Stone (landscaping)	10%
Mortar and render (internal and external)	4%
Screed	8%
Floor finish (tile)	6%
Floor finish (carpet)	6%
Timber frames (beams, columns, joists, braces	2%
Timber floors (boards)	10%
Timber formwork	10% (in addition to end-of-life usage rates)
Aluminium sheet	1%
Aluminium extruded profiles/frames	1%
Plasterboard	4%
Insulation	7%
Aggregate	10%
Glass	1%
Coatings (paint, intumescent coatings)	6%
Sprayed cementitious fire protection to steel	10%
Asphalt	6%
Bitumen	6%
Roof cladding	5%

RICS Table 20 Indicative component lifespans

Building Part	Building Elements/Components	Expected Lifespan
Substructure	Piling and foundations	60 years (or building life span)
	Lowest ground floor	60 years (or building life span)
Superstructure	Structural elements, e.g. columns, walls, beams, upper floor and roof structure	60 years (or building life span)
Façade	Opaque modular cladding:	
	Rain screens. Timber panels	30 years
	Brick, stone, block and precast concrete panels	60 years
	Glazed cladded/curtain walling	35 years
	Windows and external doors:	
	Hardwood/steel/aluminium windows	30 years
	Doors	20 years
Roof	Roof covering:	
	Single-ply membrane	30 years

	Standing seam metal	30 years
	Tiles, clay and concrete	60 years
Superstructure	Internal partitioning and dry lining:	
	Studwork	30 years
	Blockwork	60 years
Finishes	Wall Finishes:	
	Render/paint	30/5 years respectively
	Floor Finishes:	
	Carpet/vinyl	7 years
	Stone tiles	25 years
	Raised access floor (RAF) pedestal/tile	50/30 years respectively
	Ceiling Finishes:	
	Substrate/paint	10 years
	Suspended grid (ceiling system)	25 years
FF&E	Loose furniture and fittings	10 years
Services/MEP	Heat source, e.g. boilers, calorifiers	20 years
	Heat source, e.g. heat pumps (except GSHP)	15 years (20 years)
	Space heating and air treatment	20 years
	Central cooling systems (cooling only), e.g. fan coil systems, variable air volume, variable refrigerant volume	15 years
	Galvanised ductwork	40 years
	Plastic or flexible ductwork	15 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installation and controls	15 years
	Water and disposal installations	25 years
	Rainwater harvesting and greywater collection	30 years
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
External Works	Asphalt	35 years
	Concrete and stone paving	60 years
	Timber decking	15 years

APPENDIX E END-OF-LIFE ASSUMED SCENARIOS

RICS Table 22 end-of-life (EoL) processes and routes

EoL Process	EoL Route	Module	Output Flow	Loads and Benefits
Re-use	Re-use on-site	C3	Material for re-use	Net output flow of material for re-use in Module D1
	Reuse off-site without preparation for re-use required	C3		
Recovery	Re-use with preparation for re-use	C3	Material for re-use	Net output flow of material for re-use in Module D1
	Recycling	C3	Secondary material	Net output flow of secondary material in Module D1
	Other recovery e.g. composting, backfill	C3		
	Recovery as secondary fuel	C3	Secondary fuel	Net output flow of secondary material in Module D1
	Energy recovery (with R1* status)	C3	Exported Energy	Output flow in Module D1
Disposal	Landfilling (incl. use of captured landfill gas)	C4	Exported Energy	Output flow in Module D1
	Incineration (without R1* status)	C4		

* R1 status calculates the efficiency at which the energy produced from incineration and energy from waste are utilised

RICS Table 23 Detailed UK BAU percentages for various end-of-life routes

Material	Details	Default end-of-life routes			
		Re-use	Recycling	Incineration with/without energy from waste	Disposal (landfill and losses)
Concrete	Cast in-situ	0%	97.5%	0%	2.5%
	Precast	<1%	96.5%	0%	2.5%
Steel	Hot-rolled structural sections, including plate and tubes	7%	93%	0%	0%
	Light gauge galvanised steelwork e.g. studwork, cladding, framing	5%	93%	0%	2%
	Piles (sheet or bearing)	15%	71%	0%	14%
	Rebar	0%	98%	0%	2%
Masonry	Blockwork	0%	97.5%	0%	2.5%
	Brickwork	<1%	97.5%	0%	2.5%
Timber	Solid timber (untreated, uncoated)	<1%	78%	20%	1%
	Treated, coated timber (non-hazardous)	0%	30%	69%	1%
	Engineered timber (CLT, glulam etc.)	5%	35%	59%	1%
	Wood-panel products	0%	0%	99%	1%
Aluminium	Sheet	0%	96%	0%	4%
	Profile	<1%	96%	0%	4%

Plasterboard	General	<1%	17%	0%	83%
Glass	All types	0%	61%	0%	39%
Plastics	All types	-	-	100%	-
Coatings	Paints, intumescent coatings, cementitious sprays	0%	0%	0%	100%
Insulation	Mineral-based	-	<1%	-	99%
	Hydrocarbon-based	-	-	95%	5%
	Biobased	-	-	95%	5%
Asphalt	All types	0%	97.5%	0%	2.5%
Unbound aggregate	All types	0%	97.5%	0%	2.5%
Soils	Includes topsoil and inert non-hazardous earth	0%	97.5%	0%	2.5%
MEP equipment	Heat-generation equipment	0%	70%	0%	30%
	Pipes	0%	90%	0%	10%
	Lights	0%	45%	0%	55%
	Ventilation system	0%	40%	0%	60%
	Radiators	0%	80%	0%	20%
	Wire cables	0%	50%	0%	50%

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[2] *Low Energy Transformation Initiative, "Climate Emergency Design Guide," 2020. (Online). Available: https://b80d7a04-1c28-45e2-b904-e0715cface93.filesusr.com/ugd/252d09_3b0f2acf2bb24c019f5ed9173fc5d9f4.pdf [Accessed November 2021]*