HODKINSON

Whole Life Cycle Carbon Emissions Assessment

Homes for Lambeth

Wootton Street

Final

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ABOUT HODKINSON CONSULTANCY

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry and tailor teams to suit each individual project.

We are able to advise at all stages of projects from planning applications to handover.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for quality and construction efficiency.

Executive Summary

The purpose of a Whole Life Cycle Carbon Emissions (WLCCE) assessment is to gain a better understanding of the environmental impact of the proposed Wootton Street development, in the London Borough of Lambeth, in accordance with relevant benchmarks whilst also determining recommendations to reduce WLCCE, where possible.

WLCCE are the carbon emissions resulting from the construction and the use of a building over its entire life, through four stages described as life-cycle modules; module A1 – A5 (product sourcing and construction), module B1 – B7 (use), module C1 – C4 (end of life) and module D (benefits and loads beyond the system boundary).

They capture a building's operational carbon emissions from both regulated and unregulated energy use, as well as its embodied carbon emissions. Embodied emissions are those associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair, and replacement as well as dismantling, demolition, and eventual material disposal. The assessment provides a picture of a building's carbon impact on the environment.

The following table outlines the assumptions made within this WLCCE assessment:

Table i: WLCCE assumptions

Module	Assumption
Material types	See Appendix A for an overview of assumed materials
Calculation period	60 years
Building areas	3,743m^2
Number of occupants	130

Based on the information provided to date, the total carbon emissions are expected to be **888 kgCO_2/m^2 GIA over 60 years.** The expected WLLCE at Wootton Street are lower than the GLA WLC Benchmark for all modules, as shown in Figure i.

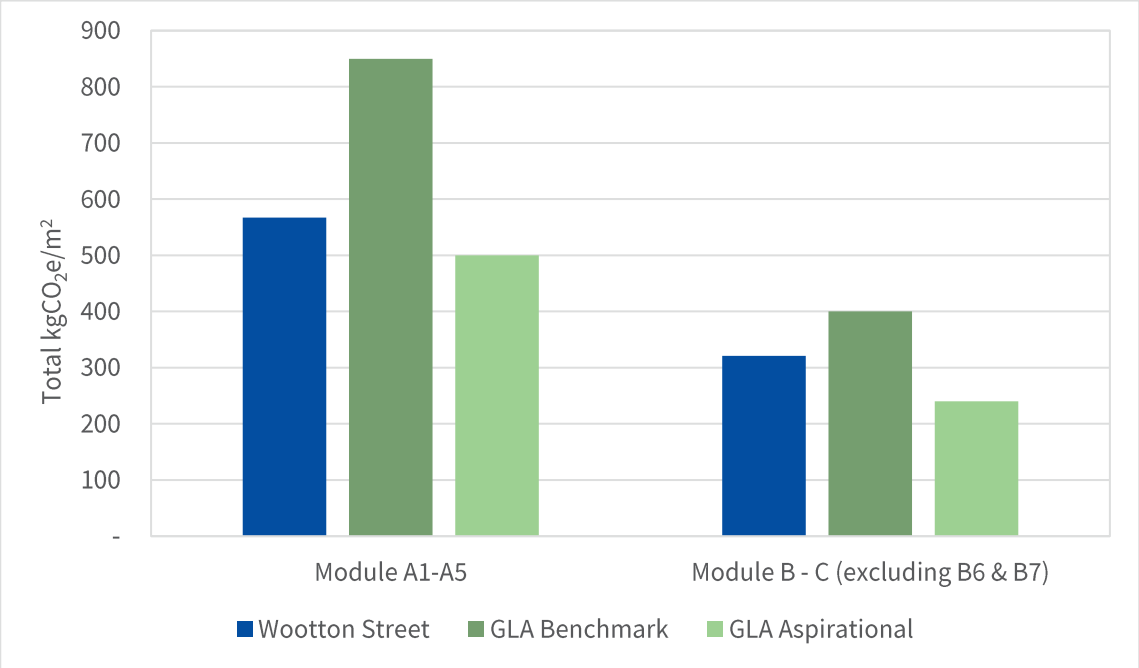

Figure i: Total $kgCO_2$ /m^2 Gross Internal Floor Area (GIA) performance compared to GLA Benchmarks

By accounting for decarbonisation of UK grid electricity, the operational energy is reduced from 47.63% of the overall emissions to just 19.23% (as a proportion of Whole Life Carbon). This is significant and confirms the importance of considering grid decarbonisation when completing carbon emissions assessments on a whole life basis. As operational energy is not included in the GLA benchmarks these decarbonisation figures have not been included in the above graph.

A series of high-level recommendations have also been made. These should be considered as the design progresses to ensure that WLCCE are reduced as much as possible.

CONTENTS

1. INTRODUCTION

1.1 This Whole Life Cycle Carbon Emissions (WLCCE) Assessment has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by Homes for Lambeth.

1.2 Lambeth is facing a housing crisis with a shortage of homes for the 21,000 people on their waiting list. In response to this, Homes for Lambeth have a significant project pipeline covering development of approximately 4,700 residential units across six estates. Wootton Street (formal Coral Day Nursery) forms part of one of these regeneration estates.

1.3 The purpose of a WLCCE assessment is to gain a better understanding of the environmental impact of the proposed development in accordance with relevant benchmarks whilst also determining recommendations to reduce WLCCE where possible.

1.4 This is an initial assessment based on the information available to date which will need to be updated as the project progresses, in line with the latest guidance.

1.5 The assessment of the proposed development will aim to help the design team understand, at concept design stage, the lifetime consequences of their design decisions. This report should be read in conjunction with the 'GLA Whole Life Carbon Assessment Template' within Appendix A.

2. DEVELOPMENT OVERVIEW

Site Location

2.1 The proposed development at the site currently occupied by the former Coral Day Nursery, Wootton Street in the London Borough of Lambeth is bound by Wootton Street to the north, Great Street to the east, Ethelm Street to the south and Windmill Walk House to the west. The site location is shown in Figure 1.

Figure 1: Site Location – Map data © 2020 Google

2.2 The site currently comprises of a single storey block which has previously been a special education needs school (Use Class D1), a play area and a car park are also located within the site boundary.

Proposed Development

2.3 The proposed development is described as follows:

"Demolition and clearance of existing structures and redevelopment comprising construction of a part 5/8/10 storey mixed use building comprising replacement community floorspace on ground floor, 36 no. residential units (Class C3) above with associated residents' amenities, cycle parking, car parking and public realm enhancement."

2.4 Figure 2 illustrates the proposed site layout.

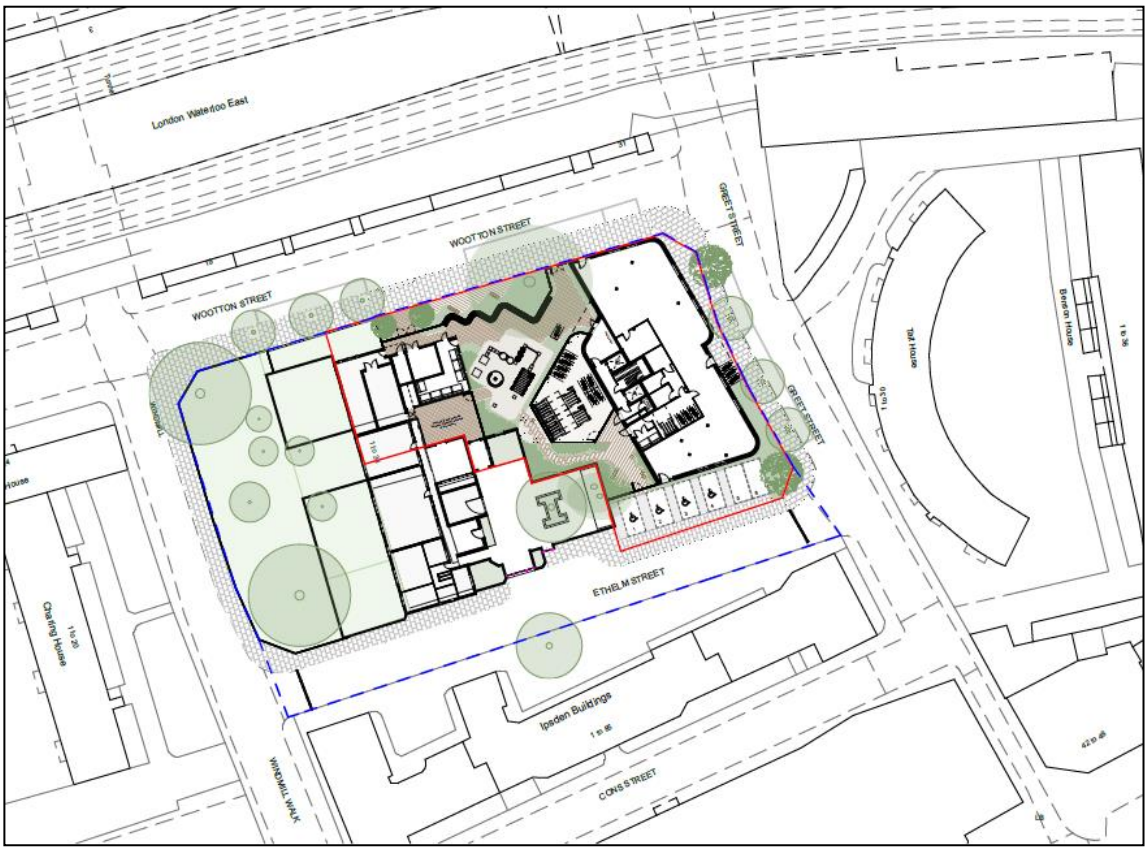

Figure 2: Proposed Site Layout – Stockwool Architects (December 2020)

2.5 The Gross Internal Floor Area (GIA) is provided in Table 1, as required by the GLA guidance. The figures below have been used for calculations within this WLCCE assessment.

Table 1: GIA of Wootton Street

Floor Number	Area (m^2)
Residential	3,360
Non residential	383
Total	**3,743**

3. POLICY AND REGULATIONS

Regional Policy: Adopted London Plan (2021)

3.1 The London Plan sets out an integrated economic, environmental, transport and social framework for the development of London. The following policies are considered relevant to the proposed development and this Statement:

3.2 **Policy SI2 Minimising Greenhouse Gas Emissions, states:**

'Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions:

Operational carbon emissions will make up a declining proportion of a development's whole life-cycle carbon emissions as operational carbon targets become more stringent. To fully capture a development's carbon impact, a whole life-cycle approach is needed to capture its unregulated emissions (i.e. those associated with cooking and small appliances), its embodied emissions (i.e. those associated with raw material extraction, manufacture and transport of building materials and construction) and emissions associated with maintenance, repair and replacement as well as dismantling, demolition and eventual material disposal). Whole life-cycle carbon emission assessments are therefore required for development proposals referable to the Mayor. Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life-cycle carbon assessments. The approach to whole life-cycle carbon emissions assessments, including when they should take place, what they should contain and how information should be reported, will be set out in guidance'.

Local Policy: London Borough of Lambeth Draft Revised Local Plan (2020)

3.3 Consultation on the Draft Revised Lambeth Local Plan and Proposed Changes to the Policies Map took place between October and December 2018. The revised local plan has been the subject of an ongoing sustainability appraisal during its preparation, which includes assessment of equalities and health and wellbeing impacts and was published for consultation at each stage of the plan preparation process. The proposed submission version was published in January 2020 and the plan will be adopted by September 2020. The following policies are considered relevant to this Statement:

3.4 **Policy EN4: Sustainable design and construction** – Lambeth will follow the approach set out in London Plan policies SI1 Improving air quality, SI2 Minimising greenhouse gas emissions, SI4 Managing heat risk, SI5 C and E Water Infrastructure. Development will be required to be resilient to climate change by including appropriate climate change adaptation measures. The council

encourages all development to achieve 20% reduction in CO_2 emissions from on-site renewable energy generation.

Guidance Documents

3.5 Preliminary guidance has been released by the Greater London Authority *"Whole Life-Cycle Carbon Assessments guidance – April 2020".* It outlines how to prepare a WLCCE assessment which should accompany all referable planning applications in line with London Plan Policy SI2. This document is currently out for consultation but has been used and referenced throughout this assessment.

3.6 In addition, the following guidance is available to conduct assessments:

> **BS EN 15978:2011 -** *Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.*

> **ISO 14040:2006 -** *Environmental management — Life cycle assessment — Principles and framework.*

> **RICS Professional Statement Whole life carbon assessment: 2017 -** *Whole life carbon assessment for the built environment.*

4. WHOLE LIFE CYCLE CARBON EMISSIONS ASSESSMENT

4.1 Undertaking WLCCE assessments is a way to fully understand and minimise the carbon emissions associated with building designs over the entire life cycle of the building. This will be done at Wootton Street to quantify the WLCCE that will be released from the proposed development, considering not only operational and embodied emissions but also demolition, construction, and refurbishment/replacement cycles.

4.2 The London Plan has introduced a requirement for all new referable developments to calculate and reduce WLCCE, this is both embodied and operational carbon:

> **Operational carbon** is the energy required to heat and power a building;

> **Embodied carbon** is the carbon that is released in the manufacturing, production, and transportation of the building materials used.

4.3 In addition to the two metrics above there are additional life cycle stages that are considered during WLCCE assessments, these include demolition, end of life and refurbishment/replacement cycles.

4.4 The two metrics (operational and embodied) and the additional life cycle stages, as noted above, have been included in this WLCCE assessment as per GLA guidance.

4.5 Undertaking a WLCCE assessment provides a full overview of the material and building environmental impacts of a building using science-based metrics whilst also identifying the overall best combined opportunities for reducing lifetime emissions, and also helps to avoid any unintended consequences of focusing on operational emissions alone.

Methodology

4.6 WLCCE assessments are sensitive to changes in design and specification and therefore detailed design will impact the results as the schemes progress. As noted in the GLA guidance, planning applicants are required to complete and submit an assessment at the following stages:

> Pre application;

> Stage 1 submission (RIBA 2/3);

> Post construction (RIBA 6).

4.7 Two sets of emission figures are required for both the Stage 1 submission and the post construction submission, the first set based on the current status of the electricity grid and the second set based on the expected decarbonisation of the electricity grid.

4.8 The Stage 1 submission of the assessment has been completed for the proposed development using the building model provided by Stockwool Architects and energy calculations from Hodkinson Consultancy (December 2020).

Operational Carbon

4.9 Operational energy is the inputted energy required for all heating and power needs. It can be split into two variants:

> **Regulated Emissions** - which are assessed using the Government's approved methodology for Building Regulations Part L compliance, the Simplified Building Energy Model (SBEM) for commercial buildings and the Standard Assessment Procedure (SAP) for residential units; and

> **Unregulated Emissions** – energy use as a direct result of user behaviour. This includes cooking, white goods (fridges, washing machines, etc), and plug-in electrical loads (televisions, laptops, lamps, etc).

4.10 Both of the above elements have been accounted for in this WLCCE assessment, these were provided by Hodkinson Consultancy. For clarity, as unregulated energy demands are largely reliant on the behaviour of occupants, they have been considered a fixed entity in the calculations.

Residential

4.11 The estimated energy demand for the residential portion of the development has been calculated using the SAP 2012 methodology. SAP calculates the regulated energy demand for residential dwellings. SAP calculations have been carried out for representative dwelling types.

4.12 These encompass first floor, mid, and top floor flats and represent a fair aggregation of the expected unit mix of the development. In order to calculate the energy demands across the entire scheme, the current accommodation schedule has been used to extrapolate the results from the sample of modelled units.

4.13 The unregulated energy demands for the residential units have been calculated using the methodology outlined in the SAP 2012 document. This calculates the CO_2 emissions associated with appliances and cooking.

Non-Residential

4.14 The estimated energy demand for the non-residential elements of the development has been calculated using SBEM software, using the National Calculation Method (NCM 2015 Edition). SBEM calculates the Regulated energy demands associated with hot water, space heating and fixed electrical items, as well as unregulated energy demands.

Embodied Carbon

One Click LCA

4.15 OneClick LCA is the software that has been used to conduct the WLCCE assessment. This is a web based approved LCA and design software for buildings and infrastructure.

4.16 OneClick LCA consists of a large database of generic and average Life Cycle Indicator (LCI) data, and global Environmental Product Declaration (EPDs). The most suitable option for each material (where available) was chosen from the database in OneClick. The material LCI data has been chosen to be representative of the typical UK supply chain.

4.17 The following life cycle stages (or modules as they are referred to) are included within the WLCCE assessment as standard:

> **A1 - A3 –** This includes all construction materials;

- **A4 –** This includes all transportation to site;
- **A5 –** This includes all construction site impacts;
- **B3 – B5 –** This includes the repair, refurbishment, and replacement of building elements;
- **B6 - B7 –** This includes use the energy, and water;
- **C1 - C4 –** This includes the end-of-life scenarios for building elements;
- **D –** This includes benefits and loads beyond the system boundary.

4.18 In addition to the building information provided by Stockwool Architects, the OneClick Carbon Designer tool has been used to determine the volumes of materials where these were not available. As the design develops, we will update and refine the tool to reflect the quantity and types of materials being used.

Construction Impacts

4.19 In addition to embodied carbon in the materials used for construction, Green House Gas (GHG) emissions will be created by transportation of materials to site and operation of onsite plant and machinery. These emissions are typically materially smaller than embedded GHG emissions. Guidance from the BRE indicates 1.4 tonnes of CO_2e per £100,000 of project value, this is further referenced within the RICS guidance document.

4.20 The project value has been provided by the Applicant, which would result in construction transport GHG emissions of **172 tonnes of CO_2e.**

Water Use

4.21 The carbon impacts associated with water use during the operation of the proposed development is also required to be reported, in accordance with the RICs guidance. Water consumption is based on Building Regulations Part G 'Enhanced Consumption' of 110 litres/per person/per day (including external water use) and multiplied by the intended full occupancy of the development annually.

4.22 130 occupants have been estimated using the number of staff/visitors in the commercial unit and inhabitants of the dwellings e.g., 2B4P would be a 2-bedroom dwelling with 4 expected occupants. This gives an estimated **annual water consumption of 5,220 m^3** for the entire development for 60 years.

Study Period

4.23 The reference study period (RSP) is 60 years, this is based on the principles outlined in BS EN 15978: 2011, section 7.3 and the RICS guidance. RSPs are fixed to enable comparability between whole life

carbon results for different projects. It ensures that the assessment is representative of typical service life of different building elements.

Data Sources

4.24 The assessment has utilised multiple data sources described above and is based on the level of detail available at the current stage of design. The following data sources have been used:

Table 2: Data Sources

Data	Data source
Material types and volumes (A1-A3)	Building model (January 2021) and design and access statement (Stockwool Architects, December 2020)
Transport data (A4)	Default values provided by OneClick
Construction site impacts (A5)	Construction value provided by applicant and baseline target provided by BRE
Repair and Replacement data (B3-B4)	Default values provided by RICS and OneClick EPD database for products inputted into software
Refurbishment (B5)	At present OneClick does not have ways to consider B5 emissions. However, based on the information provided for B3 and B4 it is likely that these have emissions have been accounted for
Operational energy (B6)	Hodkinson Consultancy energy calculations for planning (Energy Statement, December 2020)
Operational water (B7)	Water consumption based on Building Regulations Part G 'Enhanced Consumption' of 110 l/pp/d and multiplied by the intended full occupancy of the development (residential and non-residential)
End of life (C1-C4)	Default values provided by OneClick based on the information within the EPD database. Note that OneClick reports all module C emissions as one figure, it is not yet able to split them across C1-C4.
Building areas	3,743 m^2 Accommodation Schedule produced by Stockwool Architects
Number of occupants	130 occupants within 36 dwellings and expected staff/visitors in the commercial space from Accommodation Schedule produced by Stockwool Architects

4.25 For clarity, all assumptions made within the WLCCE assessment have been noted within this report. The assessment and comments made throughout should be taken within the context of carbon and energy use only.

4.26 Liaison with OneClick has been undertaken who have confirmed that they are actively working on their software to ensure that it aligns with the requirements of the GLA. It is therefore expected that the post construction WLCCE assessment will include updated figures for modules B3-B5.

5. WHOLE LIFE CYCLE CARBON RESULTS

5.1 As noted above, this is an initial assessment based on the best available information which will need to be updated as the project progresses throughout the RIBA stages. The GLA spreadsheet required to accompany this report has been provided in Appendix A.

Benchmark Comparison

5.2 The results when compared to the GLA benchmark values, as noted in the GLA guidance note *"Whole Life-Cycle Carbon Assessments guidance – April 2020"* are shown in Table 3 below:

Table 3: Whole Life Carbon Baseline (GLA Guidance)

	Project kg CO_2/m^2	WLC Benchmark	Aspirational Benchmark
Modules A1 – A5	**567 kg CO_2e/ m^2 GIA**	750 - 850 kg CO_2e/ m^2 GIA	450 - 500 kg CO_2e/ m^2 GIA
Modules B – C (excluding B6 and B7)	**321 kg CO_2e/ m^2 GIA**	300 - 400 kg CO_2e/ m^2 GIA	180 - 240 kg CO_2e/ m^2 GIA

*Carbon sequestering has been included within A1-A5 at 25 kgCO_2/m^2

5.3 It must be noted that no benchmark has been set by the GLA for operational and energy use (life cycle stages B6-B7) due to insufficient data at present. The results for these have therefore been omitted from the totals above. The total emissions, as demonstrated above, based on the GLA guidance is therefore **888 kg CO_2/m^2 GIA over 60 years;** 567 kg CO_2/m^2 for modules A1-A5 and 321 kg CO_2/m^2 for modules B – C.

5.4 When operational energy and water emissions are included in the calculation above the total emissions are expected to be **1,758 kg CO_2/m^2 GIA over 60 years.**

5.5 The benchmarks noted above, as set by the GLA, are used as a guide, and provide a range to work too rather than a set value. If 'benchmark' targets are not met the intent is that the design team will

seek to reduce their emissions, and this is then reflected in the post construction submission of the WLCCE assessment.

5.6 A further set of 'aspirational benchmarks' have been developed which are based on a 40% reduction in WLCCE emissions on the first set of benchmarks. This is based on the World Green Building Council's target to achieve a 40% reduction in carbon emissions by 2030. Applicants who wish to go further are encouraged to consider how they can achieve reductions in line with these.

5.7 The WLCCE for the proposed developments are lower than those set by the GLA for all modules.

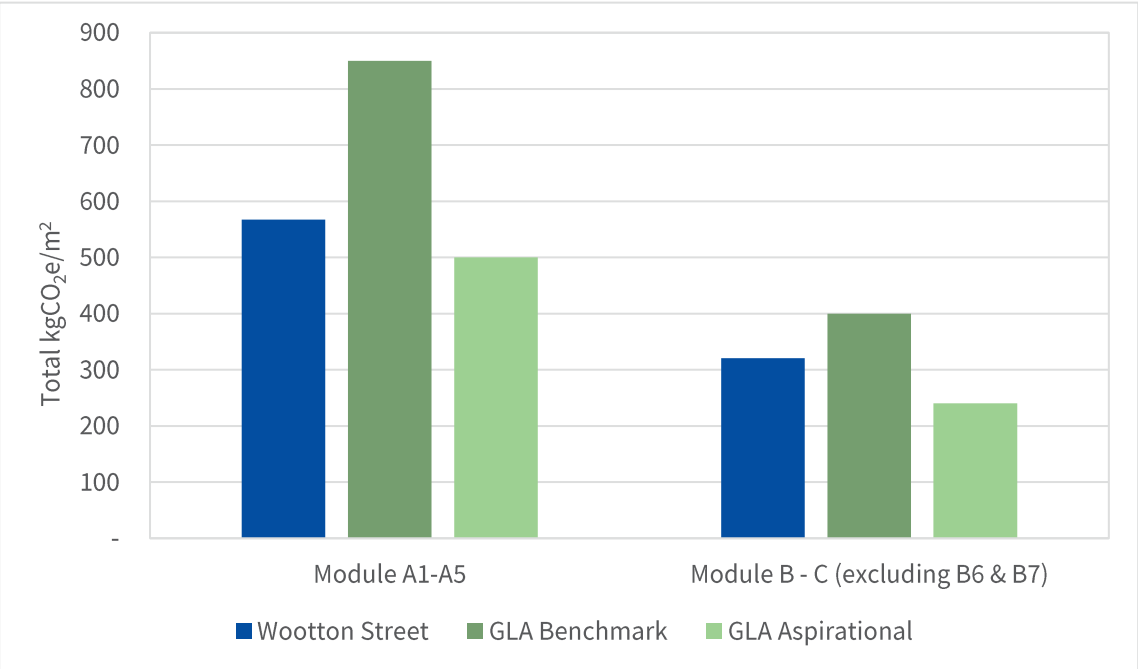

Figure 3: Total $kgCO_2$ performance compared to GLA Benchmarks

5.8 These benchmarks will be subject to change as the WLCCE assessment gets updated in future. The full results are as follows:

Table 4: Full WLCCE Results

Category	Global warming potential	Total $kgCO_2e$ over 60 years
A1-A3	Construction Materials	1,700,066
A4	Transport	23,931
A5	Site operations	304,207
B3	Repair	387,217

B4	Replacement	739,195
B6	Operational energy use	3,134,204
B7	Operational water use	216,833
C1-C4	Re-use, recycling, or disposal	74,235
	Total	**6,579,888**

5.9 The above results demonstrate that **6,580 tonnes** are expected to be emitted over a 60-year period. The operational energy (B6) makes up **47.63%** of the overall emissions for the proposed development whilst materials (A1 – A3) make up **25.84%** of the overall emissions, as demonstrated in Figure 4 below.

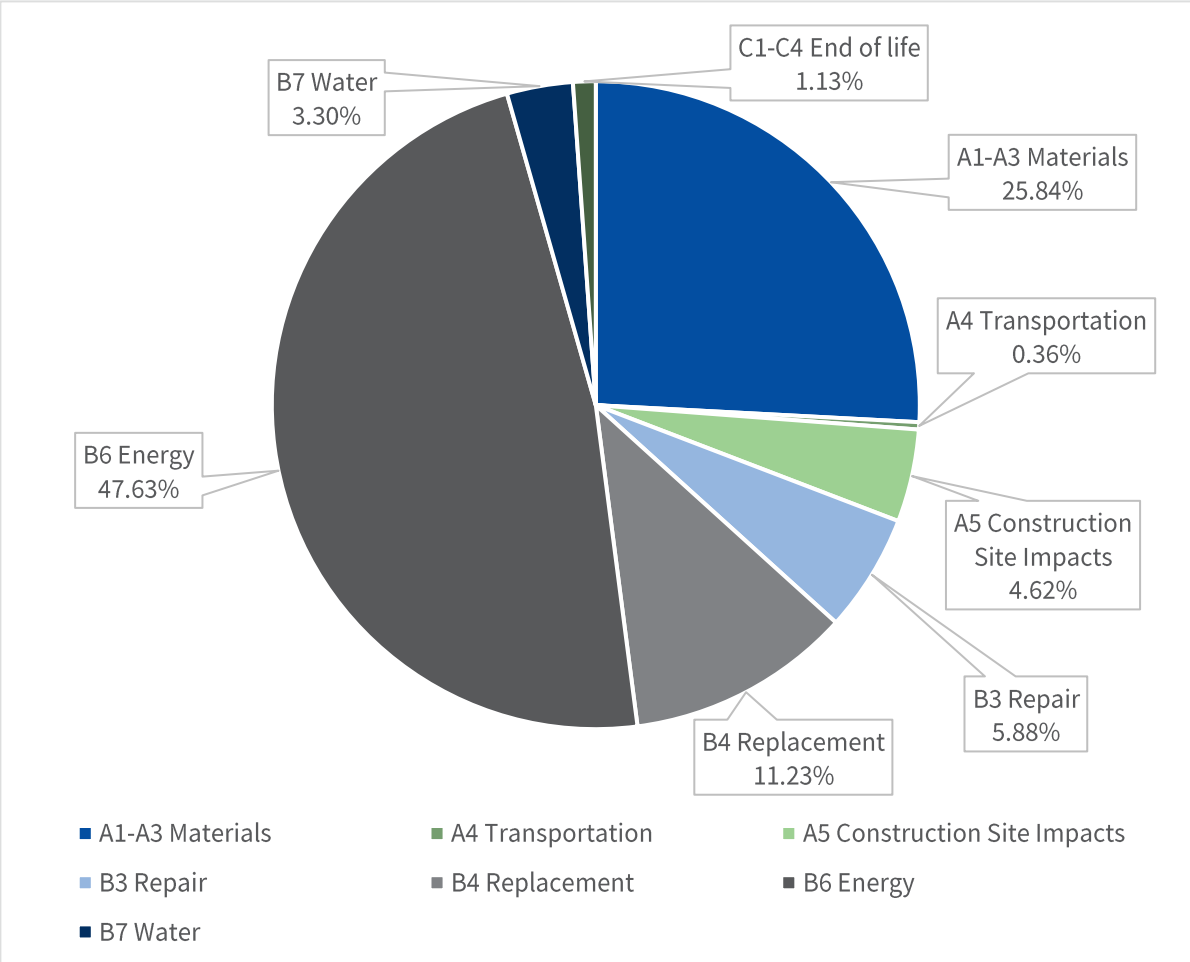

Figure 4: Total $kgCO_2e$ - Life-cycle stages

Result analysis

5.10 The GLA require commentary on the results of the WLCCE assessment where the benchmarks are met. This commentary has been provided in the relevant areas within Appendix A and outlined below.

5.11 At present, the mechanical and electrical design is not developed enough for accurate volumes and types of services to be specified, assumptions have therefore been made. These are likely to change as the design develops and will be updated during the post construction assessment.

5.12 Energy efficient design and renewable technologies will enable a reduction in Regulated CO_2 of 56% which is well above the minimum 35% site target, this goes along way in reducing the emissions in module B6.

Grid Decarbonisation

5.13 It is also important to consider the potential longer-term decarbonisation of the electricity grid and how this may impact on design decisions. The RICS WLCCE guidance and the GLA WLCCE assessment guidance documents refers to use of the "slow progression" scenario from the latest Future Energy Scenarios (FES) developed by the National Grid and refers to the 2015 edition of FES.

5.14 Table 5 below outlines how this changes the results for Operational Energy (Module B6 only).

Table 5: Decarbonisation of the grid

Data	Total $kgCO_2e$	Regulated Energy ($kgCO_2e$)	Unregulated Energy ($kgCO_2e$)
Current Building Regulations	3,134,204	1,394,994	1,739,210
Future Energy Scenarios	820,543	365,213	455,330

5.15 By accounting for decarbonisation of UK grid electricity the emissions from module B6 Operational energy is reduced from 47.63% of the overall emissions to just 19.23% (as a proportion of Whole Life Carbon).

5.16 This is significant and confirms the importance of considering grid decarbonisation when completing carbon emission assessments on a whole life basis.

Future Carbon Scenarios

5.17 Guidance issued by the GLA on WLCCE assessments requests that future climate scenarios are considered within the assessment and reported under 'assessment 2' within the excel document (Appendix A).

5.18 One Click LCA does not yet have the capacity to take future CO_2 factors into account (except for B6). It must be noted that the factors that influence modules B1-7 (e.g., replacement products) are dependent on the future residents of the development as they will be responsible for these.

5.19 Therefore, the design team at Wootton Street will be making their decisions on the design based on Assessment 1 within Appendix A.

6. RECOMMENDATIONS

6.1 A set of recommendations are set out below that could be considered as a part of the detail design post planning to further reduce WLCCE. These are presented from the perspective of carbon only and must be considered alongside other design considerations by other members of the design team but have not yet been accounted for in the design.

Reduce material use

6.2 Using **concrete as a finish** can reduce the need for other finishing materials. In addition, exposed areas of concrete can optimise the thermal mass performance. Thermal mass, with adequate ventilation, can be used to control daytime peak temperatures of a space and therefore reduce or minimise the need for air-conditioning. The areas where this can be done would need to be carefully considered and ensure that other aspects such as acoustics are taken into consideration. The durability of concrete also offers further potential savings through a reduction in the need for maintenance and repair (compared to a painted finish for example).

6.3 The **future demolition and deconstruction** of the development could be considered at the design stage. Consideration to be given to ways to facilitate dismantling, such as keeping the use of welding to a minimum (although it is acknowledged this may not always be possible).

6.4 Similarly, **an extensive maintenance and repair schedule** could also be produced during the design life of the development to ensure that specific materials and pieces of equipment are able to remain in situ during their expected lifespan. This will minimise the need to replace and refurbish and reduce emissions under life cycle stages C1-C4.

Recycled materials

6.5 **Innovative cement mixes** are now increasingly available, using a mixture that is 95% ground granulated furnace slag (GGBS) and 5% as the activator can save up to 90% in emissions. This cement mixture could be investigated further for use at the appropriate stage, and if suitable could be used for building elements such as piles, floors, walls, and reinforced foundations. If implemented this could facilitate the reduction of life cycle stages A1-A3 (materials) quite significantly.

Sustainable procurement

6.6 The transportation of materials from the manufacturing facility to the building site adds to the carbon of the development. Buying from **local sources or utilising off-site manufacturing processes** could help reduce the emissions produced during transportation. There is a balance to be struck between material transport and processes deployed in their manufacture. As such details on this cannot be known until the detailed design phase. This review would have impacts under life cycle A4, emissions from transportation to site.

7. CONCLUSION

7.1 This Whole Life Cycle Carbon Emissions (WLCCE) Assessment has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by Homes for Lambeth.

7.2 The purpose of this WLCCE assessment is to gain a better understanding of the environmental impact of the proposed development in accordance with relevant benchmarks whilst also determining recommendations to reduce WLCCE where possible.

7.3 At this stage of the design the total carbon emissions are estimated to be **888 kg CO_2e/ m^2** over 60 years. The emissions from the proposed development are expected to be lower than the GLA WLC Benchmark for all modules.

7.4 By accounting for decarbonisation of the UK grid electricity the Operational energy is reduced from 47.63% of the overall emissions to just 19.23% (as a proportion of Whole Life Carbon), demonstrating the importance of considering grid decarbonisation.

8. APPENDICES

APPENDIX A: GLA WLC ASSSESSMENT TEMPLATE

Project details	
Project name	Wootton Street
Planning application reference number (if applicable)	
Use Type	Residential and community space
Brief description of the project	"Demolition and clearance of existing structures and redevelopment comprising construction of a part 5/8/10 storey mixed use building comprising replacement community floorspace on ground floor, 36 no. residential units (Class C3) above with associated residents' amenities, cycle parking, car parking and public realm enhancement."
GIA (m^2)	3743
Authors (organisation or individuals)	Zeta Watkins - Hodkinson Consultancy
Date of assessment	15.02.2021
Nationally recognised assessment method used	BS EN 15978, with additional guidance from RICS Professional Statement
Reference study period (if not 60 years)	60
Software tool used	One Click LCA
Source of carbon data for materials and products	One Click LCA
EPD database used	One Click LCA

Estimated WLC emissions (Assessment 1)	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
TOTAL kg CO_2e	2,122,525 kg CO2e	1,126,412 kg CO2e	3,351,037 kg CO2e	74,235 kg CO2e	-596,506 kg CO2e
TOTAL kg CO_2e/m^2 GIA	567.065	300.938	895.281	19.833	-159.366
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 1 was used to inform design decisions	Lower than the benchmarks - due to efficient design and reuse of materials.				

Estimated WLC emissions (Assessment 2)	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
TOTAL kg CO_2e	2,122,525 kg CO2e	1,126,412 kg CO2e	1,402,589 kg CO2e	74,235 kg CO2e	-596,506 kg CO2e
TOTAL kg CO_2e/m^2 GIA	567	301	375	20	-159
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 2 was used to inform design decisions	[Explain the reasons for any divergences from WLC benchmarks, including against the WLC aspirational benchmarks. Please note that grid decarbonisation has not been accounted for in the benchmarks]				

Key site opportunities and constraints in reducing WLC emissions	

Summary of key actions to reduce whole life-cycle carbon emissions that have informed this assessment, including the WLC reductions	Action	WLC reduction (kg CO_2e/m^2 GIA)
	Steel fencing in place of brick walls for landscaping	1.25

Specify further opportunities to reduce the development's whole life-cycle carbon emissions. including the WLC reduction potential	Further potential opportunities	WLC reduction potential (kg CO_2e/m^2 GIA)
	Review alternative lift options to ensure the most energy efficent one is installed	0.5
	Vinyl flooring to be replaced with carpet	1.3

MATERIAL QUANTITY AND END OF LIFE SCENARIOS		Product and Construction Stage (Module A)		Assumptions made with respect to maintenance, repair and replacement cycles (Module B)	Material 'end of life' scenarios (Module C)	Benefits and loads beyond the system boundary	
Building element category		Material type	Material quantity (kg)			Estimated reusable materials (kg)	Estimated recyclable materials (kg)
	Note/example	Breakdown of material type in each category [Insert more lines if needed] e.g. Concrete	65000 kg	For all primary building systems (structure, substructure, envelope, MEP services, internal finishes)	Declare 'end of life' scenario as per project's Circular Economy Statement	0 kg	25 kg
		e.g. Reinforcement	5000 kg			2 kg	8 kg
		e.g. Formwork	250 kg			0 kg	0 kg
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment						
0.2	Major Demolition Works						
0.3	Temporary Support to Adjacent Structures						
0.4	Specialist Ground Works						
1	Substructure	Ready-mix concrete, low-strength, generic, C12/15 (1700/2200 PSI), 0% recycled binders in cement (220 kg/m3 / 13.73 lbs/ft3)		No repair, replacement or maintenance assumed	Crushed and reused		
		Precast concrete ground beam, 2400 kg/m3 (British Precast)	20,000 kg	No repair, replacement or maintenance assumed	Crushed and reused	20,000 kg	
		Reinforcement steel (rebar), generic, 80% recycled content, A615	26,859 kg	No repair, replacement or maintenance assumed	Crushed and reused	26,859 kg	
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 0% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	387,265 kg	No repair, replacement or maintenance assumed	Crushed and reused	387,265 kg	
		EPS Insulation, T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3 (EPS-gruppen)		No repair, replacement or maintenance assumed	Recycled where possible		
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)		No repair, replacement or maintenance assumed	Crushed and reused		
		Plastic vapour control layer, 0.2 mm (Tommen Gram)		No repair, replacement or maintenance assumed	Recycled where possible		
		Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)		No repair, replacement or maintenance assumed	Crushed and reused		
		Reinforcement steel (rebar), generic, 90% recycled content, A615	10,098 kg	No repair, replacement or maintenance assumed	Recovered and recycled		100,988 kg
2.1	Superstructure: Frame	Reinforcement steel (rebar), generic, 90% recycled content, A615	8,640 kg	No repair, replacement or maintenance assumed	Recovered and recycled		8,640 kg
		Reinforcement steel (rebar), generic, 90% recycled content, A615	36,649 kg	No repair, replacement or maintenance assumed	Recovered and recycled		36,649 kg
		Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400 kg/m3 / 24.97 lbs/ft3)	104,160 kg	No repair, replacement or maintenance assumed	Crushed and reused	104,160 kg	
		Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400 kg/m3 / 24.97 lbs/ft3)	449,634 kg	No repair, replacement or maintenance assumed	Crushed and reused	449,634 kg	
2.2	Superstructure: Upper Floors	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)		No repair, replacement or maintenance assumed	Crushed and reused		
		Reinforcement steel (rebar), generic, 90% recycled content, A615	8,976 kg	No repair, replacement or maintenance assumed	Recovered and recycled		8,976 kg
2.3	Superstructure: Roof	PU thermal insulation boards with multi-layer aluminium facing, L = 0.023 W/mK, 31 kg/m3		No repair, replacement or maintenance assumed			
		Filter fabric N2		One Click default values used until more detailed information is available			
		Bitumen-polymer membrane roofing, 2 layer, fully torched (EWA)		One Click default values used until more detailed information is available			
		Ready-mix concrete, normal-strength, generic, C20/25 (2900/3600 PSI), 0% recycled binders in cement (240 kg/m3 / 14.98 lbs/ft3)		No repair, replacement or maintenance assumed	Crushed and reused		
		Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3 (40.6 lbs/ft3), 18 kg/block (39.7 lbs/block), 0.5x0.3x0.185 mm (0.019x0.012x0.007 in)		No repair, replacement or maintenance assumed	Crushed and reused		
		Hollow core concrete slabs, B45 M45, 320x1200 mm, 8 rebars/m2 392 kg/m2, HD 320 (Spenncon)		One Click default values used until more detailed information is available	Crushed and reused		
		EPS Insulation, T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3 (EPS-gruppen)		No repair, replacement or maintenance assumed			
		Plastic vapour control layer, 0.2 mm (Tommen Gram)		No repair, replacement or maintenance assumed	Recycled in full		
		Hollow core concrete slabs, generic, C30/37 (4400/5400 PSI), 0% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3), incl. reinforcement		No repair, replacement or maintenance assumed	Crushed and reused		
		Extensive green roof system, 40mm, 23.34 kg/m2, Urbanspace (Knauf)		One Click default values used until more detailed information is available			
2.4	Superstructure: Stairs and Ramps	Steel and aluminium handrails, 11.83 kg/m, HRB-4CN, HRB-35N HRB-4CCMHLN, HRB-35CMN, HRB-4CM, HRB-4CHLN (Construction Specialties (CS))		No repair, replacement or maintenance assumed	Recovered and recycled		
		Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)		No repair, replacement or maintenance assumed	Crushed and reused		
		Reinforcement steel (rebar), generic, 90% recycled content, A615	6,210 kg	No repair, replacement or maintenance assumed	Recovered and recycled		6,210 kg
2.5	Superstructure: External Walls	Bricks, 226x104x60, 226x85x60 mm, NF with holes & solid, RF (Wienerberger)		One Click default values used until more detailed information is available	Crushed and reused. Where they can be taken apart individually they will be, and reused		
		Masonry mortar, light, 1000 kg/m3 (quick-mix)		No repair, replacement or maintenance assumed	Crushed and reused		
		Rock wool insulation panels, unfaced, generic, L = 0.037 W/mK, R = 2.70 m2K/W (15 ft2°Fh/BTU), 150 kg/m3 (9.36 lbs/ft3) (applicable for densities: 100-150 kg/m3 (6.24-9.36 lbs/ft3)), Lambda=0.037 W/(m.K)		One Click default values used until more detailed information is available			
		Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3 (40.6 lbs/ft3), 18 kg/block (39.7 lbs/block), 0.5x0.3x0.185 mm (0.019x0.012x0.007 in)		No repair, replacement or maintenance assumed	Crushed and reused		
		Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)		One Click default values used until more detailed information is available	Recovered and recycled		
2.6	Superstructure: Windows and External Doors	Aluminium frame, double glazing sliding door, with two vents, per m2, size: 3.00 x 2.18m, glazing: 2 x 11mm glass, 57.74 kg/m2, 377.62 kg/unit, Hi-Finity, type HFI 147 (Reynaers)		One Click default values used until more detailed information is available			
		Aluminium frame window, double glazed, 32.259 kg/m2, 1.23 x 1.48 m, Masterline 8 Standard (Reynaers Aluminium)		One Click default values used until more detailed information is available			
2.7	Superstructure: Internal Walls and Partitions	Water-borne interior paints, 1.36 kg/L, average coverage 8-10 m2/L, Biora, Ekora, Kolibri Sand, Paneelikattomaali, Ranch, Superlateksi, Tapettipohjamaali, Teknospro, Tela, Timantti, Trend (Teknos)		One Click default values used until more detailed information is available			
		Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)		One Click default values used until more detailed information is available			

		Glass wool insulation panels, unfaced, generic, L = 0.031 W/mK, R = 3.23 m2K/W (18 ft2°Fh/BTU), 25 kg/m3 (1.56 lbs/ft3), (applicable for densities: 0-25 kg/m3 (0-1.56 lbs/ft3)), Lambda=0.031 W/(m.K)		One Click default values used until more detailed information is available			
		Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections, S235, S275 and S355		One Click default values used until more detailed information is available			
2.8	Superstructure: Internal Doors	Wooden entrance door, per m2, 809x2053 mm, 42x92 mm frame, 52 mm door leaf (Nordic Dørfabrikk)		One Click default values used until more detailed information is available	To be removed and where in good condition - reused. If not, recycled in full		
3	Finishes	Skirting board, plinthe, MDF, French average, haut. 7cm et ép. 1cm, Donnee par default (MDEGD)		One Click default values used until more detailed information is available			
		Plastic vapour control layer, 0.2 mm (Tommen Gram)		One Click default values used until more detailed information is available			
		Massive wooden flooring/parquet 22-450 x 44-7000 x 8-35 mm, 11.71 kg/m2 (Verband der Deutschen Parkettindustrie)		One Click default values used until more detailed information is available			
		Waterproof, protective, flexible coating, 1.5 kg/l, Lastogum (PCI Augsburg)		One Click default values used until more detailed information is available			
		Tile adhesive, all round, for ceramics, 1-5 mm, 1400 kg/m3,		One Click default values used until more detailed information is availabl			
		Ceramic wall tiles, 7.5 mm, 3000 kg/m2 (Seranit Granit Seramik)		One Click default values used until more detailed information is available			
		Vinyl flooring, Be Natural Be Different Be easy Be Smart (DICKSON-CONSTANT)		One Click default values used until more detailed information is available			
		Emulsion matt paint for allround interior use, Pigment: Lightfast Pigments, binder: PVA Copolymer emulsion , solvent: Water, 1.443 kg/l, 18m2/l, 0.16 kg/m2, Supermatt White, Almond White, Gardenia, Magnolia, Light Base, Medium Base (Dulux Trade)		One Click default values used until more detailed information is available	Non toxic paints to be used to faciliate the reuse and/or recycle the painted materials		
4	Fittings, furnishings & equipment (FFE)						
5	Services (MEP)	Solar panel photovoltaic system, EU average		One Click default values used until more detailed information is available	**recyclesolar** (UK based company) is being reviewed for this. Using these recycling processes 90% of the glass and 95% of the semiconductor materials can be extracted for use in new		
		Air heat pump, 2,2 kW, R410A		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		Air exchanger+heat recovery, 190 liters / s		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		LED lighting, P = 40W, Donnee par default (MDEGD)		One Click default values used until more detailed information is available	Luminaires specified that use materials with a high recycled and recyclable content to facilitate end of		
		Fiber optic cable, French average (MDEGD)		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		Pipesystem, hot and cold water supply, PEX, per m2 GFA, 0.13 kg/m2		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		Drinking water supply piping network, per m2 GIFA (residential buildings)		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		Sewage water drainage piping network, per m2 GIFA (residential buildings)		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		Underfloor heating system PEX, installation pipe spacing: 200mm, 30 mm insulation panel		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
		Electricity cabling, room area m2		One Click default values used until more detailed information is available	To be reclaimed and reused where possible or recycled in full		
6	Prefabricated Buildings and Building Units						
7	Work to Existing Building						
8	External works	Schist slab, for exterior paving, 30mm, 82.7kg/m2, 2757kg/m3, Schiste Infercoa, Quartzite Noire. (CUPA PIERRES)		One Click default values used until more detailed information is available	Crushed and reused		
		Steel fence, French average, haut. 2,5m, Donnee par default (MDEGD)		One Click default values used until more detailed information is available	recycled in full		
		Soil, loose dry density, 1220 kg/m3			reused on next site		
		Gravel, dry bulk density, 1680 kg/m3			reused on next site		
		TOTAL	1,058,491 kg			987,918 kg	161,463 kg
		Material intensity (kg/m2 GIA)	283 kg/m2 GIA			264 kg/m2 GIA	43 kg/m2 GIA

Confirm here whether Assessment 1 | Assessment 1

ASSESSMENT 1 - current status of the electricity grid

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES[1] (kgCO2e)		Sequestered (or biogenic) carbon (negative value) (kgCO2e)	Product stage (kgCO2e)	Construction process stage (kgCO2e)		Use stage (kgCO2e)							End of Life (EoL) stage (kgCO2e)				TOTAL Modules A-C $kgCO_2e$	Benefits and loads beyond the system boundary
			Module A			Module B							Module C					
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		Module D*
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment																0 kg CO2e	
0.2	Major Demolition Works																0 kg CO2e	
0.3	Temporary Support to Adjacent Structures				240,380 kg CO2e	the figure to left is included for construction site impacts as there is no where to put it											240,380 kg CO2e	-52,327 kg CO2e
0.4	Specialist Ground Works																0 kg CO2e	
0.5	Temporary Diversion Works																0 kg CO2e	
1	Substructure		160,145 kg CO2e	6,532 kg CO2e	7,673 kg CO2e			0 kg CO2e	1,333 kg CO2e				9,357 kg CO2e				185,039 kg CO2e	-31,183 kg CO2e
2.1	Superstructure: Frame		115,372 kg CO2e	4,510 kg CO2e	5,321 kg CO2e			0 kg CO2e	0 kg CO2e				6,493 kg CO2e				131,696 kg CO2e	-21,089 kg CO2e
2.2	Superstructure: Upper Floors		274,959 kg CO2e	5,577 kg CO2e	1,271 kg CO2e			0 kg CO2e	0 kg CO2e				6,978 kg CO2e				288,785 kg CO2e	-28,690 kg CO2e
2.3	Superstructure: Roof		61,659 kg CO2e	709 kg CO2e	1,911 kg CO2e			0 kg CO2e	8,619 kg CO2e				6,329 kg CO2e				79,226 kg CO2e	-8,553 kg CO2e
2.4	Superstructure: Stairs and Ramps	17 kg CO2e	51,504 kg CO2e	2,797 kg CO2e	2,448 kg CO2e			131 kg CO2e	0 kg CO2e				4,004 kg CO2e				60,901 kg CO2e	-6,120 kg CO2e
2.5	Superstructure: External Walls		350,643 kg CO2e	2,271 kg CO2e	26,520 kg CO2e			0 kg CO2e	1,237 kg CO2e				13,634 kg CO2e				394,306 kg CO2e	-83,239 kg CO2e
2.6	Superstructure: Windows and External Doors		300,368 kg CO2e	264 kg CO2e	0 kg CO2e			360,810 kg CO2e	300,368 kg CO2e				43 kg CO2e				961,852 kg CO2e	-213,132 kg CO2e
2.7	Superstructure: Internal Walls and Partitions		113,912 kg CO2e	492 kg CO2e	10,312 kg CO2e			0 kg CO2e	17,189 kg CO2e				7,574 kg CO2e				149,480 kg CO2e	-11,580 kg CO2e
2.8	Superstructure: Internal Doors	75,642 kg CO2e	71,390 kg CO2e	232 kg CO2e	0 kg CO2e			0 kg CO2e	71,390 kg CO2e				5,844 kg CO2e				224,498 kg CO2e	-46,903 kg CO2e
3	Finishes	18,473 kg CO2e	45,617 kg CO2e	144 kg CO2e	6,128 kg CO2e			9,033 kg CO2e	63,488 kg CO2e				8,370 kg CO2e				151,254 kg CO2e	-24,152 kg CO2e
4	Fittings, furnishings & equipment																0 kg CO2e	
5	Services (MEP)	189 kg CO2e	148,817 kg CO2e	222 kg CO2e	1,790 kg CO2e			13,766 kg CO2e	275,571 kg CO2e		1,394,994 kg CO2e 1,739,210 kg CO2e	216,833 kg CO2e	5,548 kg CO2e				3,796,940 kg CO2e	-69,076 kg CO2e
6	Prefabricated Buildings and Building Units																0 kg CO2e	
7	Work to Existing Building																0 kg CO2e	
8	External works		5,679 kg CO2e	181 kg CO2e	452 kg CO2e			3,477 kg CO2e	0 kg CO2e				62 kg CO2e				9,852 kg CO2e	-462 kg CO2e
TOTAL kg CO2e		**94,321 kg CO2e**	**1,700,066 kg CO2e**	**23,931 kg CO2e**	**304,207 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**387,217 kg CO2e**	**739,195 kg CO2e**	**0 kg CO2e**	**3,134,204 kg CO2e**	**216,833 kg CO2e**	**74,235 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**6,674,210 kg CO2e**	**-596,506 kg CO2e**
TOTAL - kg CO2e/m2 GIA		**25 kg CO2e/m2 GIA**	**454 kg CO2e/m2 GIA**	**6 kg CO2e/m2 GIA**	**81 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**103 kg CO2e/m2 GIA**	**197 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**837 kg CO2e/m2 GIA**	**58 kg CO2e/m2 GIA**	**20 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**1,783 kg CO2e/m2 GIA**	**-159 kg CO2e/m2 GIA**

Notes:
* Report non-decarbonised values for both material and operational emissions using current status of the electricity grid.

Mandatary cells for completion

ASSESSMENT 2 - expected decarbonisation of the electricity grid

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES[1] (kgCO2e)		Sequestered (or biogenic) carbon (negative value) (kgCO2e)	Product stage (kgCO2e)	Construction process stage (kgCO2e)		Use stage (kgCO2e)							End of Life (EoL) stage (kgCO2e)				TOTAL Modules A-C $kgCO_2e$	Benefits and loads beyond the system boundary
			Module A			Module B							Module C					
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		Module D*
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment																0 kg CO2e	
0.2	Major Demolition Works																0 kg CO2e	
0.3	Temporary Support to Adjacent Structures				240,380 kg CO2e	the figure to left is included for construction site impacts as there is no where to put it											240,380 kg CO2e	-52,327 kg CO2e
0.4	Specialist Ground Works																0 kg CO2e	
0.5	Temporary Diversion Works																0 kg CO2e	
1	Substructure		160,145 kg CO2e	6,532 kg CO2e	7,673 kg CO2e			0 kg CO2e	1,333 kg CO2e				9,357 kg CO2e				185,039 kg CO2e	-31,183 kg CO2e
2.1	Superstructure: Frame		115,372 kg CO2e	4,510 kg CO2e	5,321 kg CO2e			0 kg CO2e	0 kg CO2e				6,493 kg CO2e				131,696 kg CO2e	-21,089 kg CO2e
2.2	Superstructure: Upper Floors		274,959 kg CO2e	5,577 kg CO2e	1,271 kg CO2e			0 kg CO2e	0 kg CO2e				6,978 kg CO2e				288,785 kg CO2e	-28,690 kg CO2e
2.3	Superstructure: Roof		61,659 kg CO2e	709 kg CO2e	1,911 kg CO2e			0 kg CO2e	8,619 kg CO2e				6,329 kg CO2e				79,226 kg CO2e	-8,553 kg CO2e
2.4	Superstructure: Stairs and Ramps	17 kg CO2e	51,504 kg CO2e	2,797 kg CO2e	2,448 kg CO2e			131 kg CO2e	0 kg CO2e				4,004 kg CO2e				60,901 kg CO2e	-6,120 kg CO2e
2.5	Superstructure: External Walls		350,643 kg CO2e	2,271 kg CO2e	26,520 kg CO2e			0 kg CO2e	1,237 kg CO2e				13,634 kg CO2e				394,306 kg CO2e	-83,239 kg CO2e
2.6	Superstructure: Windows and External Doors		300,368 kg CO2e	264 kg CO2e	0 kg CO2e			360,810 kg CO2e	300,368 kg CO2e				43 kg CO2e				961,852 kg CO2e	-213,132 kg CO2e
2.7	Superstructure: Internal Walls and Partitions		113,912 kg CO2e	492 kg CO2e	10,312 kg CO2e			0 kg CO2e	17,189 kg CO2e				7,574 kg CO2e				149,480 kg CO2e	-11,580 kg CO2e
2.8	Superstructure: Internal Doors	75,642 kg CO2e	71,390 kg CO2e	232 kg CO2e	0 kg CO2e			0 kg CO2e	71,390 kg CO2e				5,844 kg CO2e				224,498 kg CO2e	-46,903 kg CO2e
3	Finishes	18,473 kg CO2e	45,617 kg CO2e	144 kg CO2e	6,128 kg CO2e			9,033 kg CO2e	63,488 kg CO2e				8,370 kg CO2e				151,254 kg CO2e	-24,152 kg CO2e
4	Fittings, furnishings & equipment																0 kg CO2e	
5	Services (MEP)	189 kg CO2e	148,817 kg CO2e	222 kg CO2e	1,790 kg CO2e			13,766 kg CO2e	275,571 kg CO2e		820,543 kg CO2e 365,213 kg CO2e	216,833 kg CO2e	5,548 kg CO2e				3,796,940 kg CO2e	-69,076 kg CO2e
6	Prefabricated Buildings and Building Units																0 kg CO2e	
7	Work to Existing Building																0 kg CO2e	
8	External works		5,679 kg CO2e	181 kg CO2e	452 kg CO2e			3,477 kg CO2e	0 kg CO2e				62 kg CO2e				9,852 kg CO2e	-462 kg CO2e
TOTAL kg CO2e		**94,321 kg CO2e**	**1,700,066 kg CO2e**	**23,931 kg CO2e**	**304,207 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**387,217 kg CO2e**	**739,195 kg CO2e**	**0 kg CO2e**	**1,185,756 kg CO2e**	**216,833 kg CO2e**	**74,235 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**6,674,210 kg CO2e**	**-596,506 kg CO2e**
TOTAL - kg CO2e/m2 GIA		**25 kg CO2e/m2 GIA**	**454 kg CO2e/m2 GIA**	**6 kg CO2e/m2 GIA**	**81 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**103 kg CO2e/m2 GIA**	**197 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**317 kg CO2e/m2 GIA**	**58 kg CO2e/m2 GIA**	**20 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**1,783 kg CO2e/m2 GIA**	**-159 kg CO2e/m2 GIA**

Notes:
* Report decarbonised values for both material and operational emissions using expected decarbonisation of the electricity grid.

Mandatary cells for completion