

WHOLE LIFECYCLE CARBON ASSESSMENT

St. Ann's New Neighbourhood

Produced by XCO2 for Hill Residential Limited, Catalyst
Housing Limited and Catalyst By Design Limited

May 2022



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	P01	P02	P03	P04		
Remarks	Draft for comment	Revision	For Issue	Final		
Prepared by	JS	JS	JS	JS		
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Authorised by	KM	KM	KM	KM		
Date	08/04/2022	06/05/2022	18/05/2022	30/05/2022		
Project reference	9.483	9.483	9.483	9.483		

EXECUTIVE SUMMARY

A Whole Lifecycle Carbon (WLC) assessment has been undertaken for the proposed St. Ann's New Neighbourhood. The WLC assessment was carried out in accordance with the latest published *GLA Life-Cycle Carbon Assessments guidance. Whole Life-Cycle Carbon Assessment (March 2022)*. All lifecycle stages are presented in Figure 1.

The estimated whole lifecycle carbon emissions of the proposed development are shown in the table below.

Table 1: Estimated WLC emissions for whole development, including all archetypes, using the current SAP2012 carbon factors.

	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
Archetype					
New Build	79,306,246	18,269,556	Operational carbon emissions and water usage are calculated as singular, site wide figures	9,016,151	-1,518,306
Refurbishment	84,418	118,607		27,162	-28,189
SITE WIDE kg CO₂e	79,390,664	18,388,163	5,282,091	9,043,313	-1,546,495
SITE WIDE kg CO₂e/m² GIA	787	182	52	90	-15

The results show that modules A1-A5 Product and Construction Process stages, are expected to have the largest impact on the total lifecycle carbon emissions. The second largest source of emissions is derived from modules B1-B5 Use Stages, with most of these emissions deriving from Replacement stage (module B4) due to the amount of demolition and rebuild expected to be undertaken on site. The smallest source of emissions is derived from the B6-B7 modules, Operational Energy and Water respectively.

As the detailed design of the development is not yet developed, this assessment was calculated based on the hybrid application site by splitting this indicative design of the scheme into 'WLC archetypes' and using results from previously calculated, similar buildings as benchmarks for each archetype. These figures were then extrapolated to be in line with the estimated floor areas of each archetype. Following the GLA Whole Lifecycle Carbon assessments guidance, the estimated emissions for each archetype have been compared against the most relevant benchmark provided by the GLA in the WLC assessments guidance, Appendix 2. However as the significant majority of the site within the new build portion of the scheme comprises residential, the results of Modules A1-A5 and B & C for the whole site, have been compared against the WLC benchmark for 'Residential', and the Aspirational WLC benchmark, which is based on the World Green Building Council's target to achieve a 40% reduction in WLC emissions by 2030.

To be in line with the WLC benchmarks for 'Residential', developments should aim to achieve less than 850 kgCO₂e/m² for modules A1-A5 (with an aspirational target of less than 500 kgCO₂e/m²); less than 350 kgCO₂e/m² for modules B-C (excluding B6 and B7) (with an aspirational target of less than 300 kgCO₂e/m²); and finally, achieve less than 1200 kgCO₂e/m² for modules A-C, including sequestered carbon (with an aspirational target of less than 800 kgCO₂e/m²).

The anticipated whole life carbon emissions of the proposed development, for modules A1-A5 (736 kgCO₂e/m²), modules B1-B5 and C (272 kgCO₂e/m²) and modules A-C, including sequestered carbon, (1008 kgCO₂e/m²) are all below the WLC benchmark target and approaching the aspirational benchmark target.

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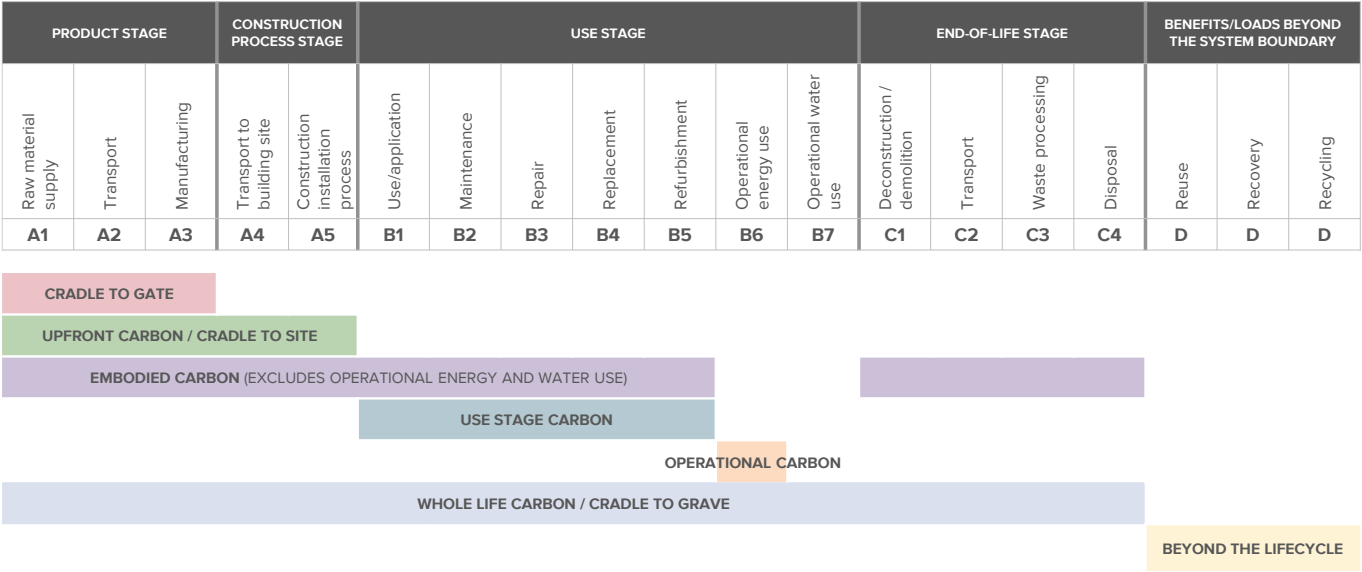


Figure 1: Lifecycle stages (modules) according to EN 15978 and terminology of carbon emissions scopes.

INTRODUCTION

As buildings become more energy efficient, operational carbon emissions will make up a smaller proportion of a development's whole life-cycle carbon emissions. It is therefore becoming increasingly important to calculate and reduce carbon emissions associated with other aspects of a development's life cycle; namely, embodied carbon emissions and unregulated emissions (all operational energy uses not covered by Building Regulations).

St. Ann's New Neighbourhood is a large scale, residential-led, mixed-use development located in the London Borough of Haringey. Seven of the existing hospital buildings are to be retained and altered for a flexible range of uses (Use Class E, F1 / F2).

The proposed development comprises 4,150sqm (GIA) of non-residential uses and up to 995 new homes, of which 60% will be affordable, with Phase 1A delivering 239 of the units. This report details a Whole Life Carbon Assessment for the development as a whole.

SITE DESCRIPTION

The Site is located within the administrative boundary of the London Borough of Haringey and occupies a 7.2ha parcel of land with a number of buildings that use to form part of the St Ann's hospital site. The buildings, the majority of which are no longer in active use, vary in styles from pre-war to refurbished post war buildings. Building heights across the site range from 2-3 storeys.

Vehicular and pedestrian access to the site is from St Ann's Road (which is classified a B Road) only. The site is partially located within the St Ann's Conservation Area. The Conservation Area extends along the northern strip of the site parallel to St Ann's Road. There are no statutory listed buildings at the site. The site includes Mayfield House, a locally listed building.

The site has a relatively flat topography with a gentle fall west to east and north to south. The site has a mix of natural landscaped elements, with the most significant being the SINC to its south boundary, which consists of a woodland Tree Protection Order (TPO). There are some stand-alone mature trees covered by individual TPO's located towards the north of the site, and a lawned area in the centre, known as the 'Peace Garden'.

POLICY FRAMEWORK

The London Plan 2021 has included, under Policy SI2 - Minimising greenhouse gas emissions, a requirement for a Whole Life-Cycle Carbon Assessment for all referable development proposals.

F. 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.

The GLA has also published a draft Whole Life-Cycle Carbon Assessments Guidance (March 2022) which explains how to prepare a WLC assessment for planning applications. As outlined in the guidance, applicants are required to take action at the following stages:

- Pre-application
- Stage 1 submission (i.e. RIBA Stage 2/3)
- Post-construction (i.e. upon commencement of RIBA Stage 6 and prior to the building being handed over, if applicable. Generally, it is expected that the assessment would be received three months post-construction)

The guidance is accompanied by a WLC assessment template, which provides separate tabs outlining the information that should be submitted at each stage. This is included as an appendix to the assessment report provided here.

METHODOLOGY

The methodology followed in preparing this report is in line with the GLA Life-Cycle Carbon Assessments Guidance and the RICS *Professional Statement* (PS) for undertaking detailed carbon assessments. The RICS *Whole life carbon assessment for the built environment* (2017), follows the European standard EN 15978. As the detailed design of the development is not yet developed, this assessment for the development as a whole, was calculated based on the hybrid application site by splitting this indicative design of the St. Ann's New Neighbourhood into 'WLC archetypes' and using results from previously calculated, similar buildings as benchmark for each archetype. These figures were then extrapolated to be in line with the estimated floor areas of each archetype. The archetypes used in the assessment were:

- New Build
- Refurbishment

Each of the individual benchmark assessments used to make up the archetypes above was based on at least 95% of the capital cost being allocated to each building element category.

Prior to completing the WLC assessment, an analysis of the existing buildings across the site was carried out to determine the potential for retaining and refurbishing buildings. It was determined that 7 buildings across the site were suitable to be retained and upgraded. These will be designed as shell and core to accommodate a variety of uses.

This report should be read in conjunction with the GLAs WLC Assessment Template, which has been submitted as part of this planning application, and appended to this report in Appendix A. The template has been filled in for both Pre-app stage and Outline Planning stage. The Pre-app tab describes the design principles adopted in the scheme to reduce the whole life-cycle carbon of the development. This report summarises the actions taken during the hybrid submission (outline Phases 1b, 2 and 3, and detail for Phase 1A). The applicant recognises that the WLC calculations presented in this report will need to be revisited and updated for each detailed development plot coming forward as part of the Reserved Matters Application (RMA) process (at the time of RMA submission, and again upon completion of RIBA Stage 5).

LIFE CYCLE STAGES

The life cycle stages covered by the RICS methodology refer to EN 15978, which includes a modular approach to a built asset's life cycle, breaking it down into different stages. The four main modules are Product stage [A1 – A3], Construction Process stage [A4 – A5], Use stage [B1 – B7] and End of Life stage [C1 – C4]. Module D consists of the potential environmental benefits or burdens of materials beyond the life of the project, this is usually reported separately to the cradle to grave modules [A – C]. Table 2 shows the life cycle stages that were considered for the assessment and the assumptions made for some stages due to limitations of the software used.

Table 2: Life cycle stages.

Product Stage			Construction Process Stage		Use Stage							End-of-Life Stage				Benefits and loads beyond system boundary		
Raw material supply	Transport	Manufacturing	Transport to building site	Installation into building	Use/application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling
A1	A2	A3	A4	A5	B1	B2*	B3†	B4	B5†	B6	B7	C1	C2	C3	C4	D	D	D
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

* B2 has been estimated by extrapolating the results of B3 assuming these correspond to 25% of B2 emissions (RICS PS).

‡ B3: a repair/year% has been added for some building components as indicated in the RICS PS (2.3 Roofs, 2.5 External walls, windows, 2.6 Windows, 3 Finishes and 5 Services).

BUILDING ELEMENTS

The WLC assessment covers all building elements listed in Table 3 (where applicable to the Proposed Development). Development plot areas have been provided by the Architects, and are reported in Appendix B. As part of the benchmarks used for each archetype in the calculations, a minimum of at least 95% of the cost allocated to each building element category has been accounted for, where information has been given, in line with GLA policy.

Table 3: Building elements as per RICS NRM.

Group	Building Element	Applicable	Included
0. Demolition & facilitating works	0.1. Toxic / hazardous / contaminated material treatment	Y	Y
	0.2. Major demolition works	Y	Y
	0.3. & 0.5. Temporary / enabling works	N	N
	0.4. Specialist groundworks	Y	Y
1. Substructure	1.1. Substructure	Y	Y
2. Superstructure	2.1. Frame	Y	Y
	2.2. Upper floors incl. balconies	Y	Y
	2.3. Roof	Y	Y
	2.4. Stairs & ramps	Y	Y
	2.5. External walls	Y	Y
	2.6. Windows & external doors	Y	Y
	2.7. Internal walls & partitions	Y	Y
	2.8 Internal doors	Y	Y
3 Finishes	3.1 Wall finishes	Y	Y
	3.2 Floor finishes	Y	Y
	3.3 Ceiling finishes	Y	Y
4 FFE	4.1 Fittings, furnishings & equipment	Y	Y
5 Building services / MEP	5.1–5.14 Services	Y	Y
6 Prefabricated Buildings and Building Units	6.1 Prefabricated buildings and building unit	N	N
7 Work to existing building	7.1 Minor demolition and alteration works	Y	Y
8 External works	8.1 Site preparation works	Y	Y
	8.2 Roads, paths, paving's and surfacing's	Y	Y
	8.3 Soft landscaping, planting and irrigation systems	Y	Y
	8.4 Fencing, railings and walls	Y	Y
	8.5 External fixtures	N	N
	8.6 External drainage	Y	Y
	8.7 External services	Y	Y
	8.8 Minor building works and ancillary buildings	N	N

SOFTWARE TOOLS

The tool used to model the life cycle impacts of each individual benchmark assessment, that fed the assessment figures, was the eToolLCA, which follows BS EN 15978, is IMPACT-compliant and BRE certified and listed in the GLA Life-Cycle Carbon Assessments Guidance as an acceptable tool.

eToolLCA uses third party background processes aggregated as mid-point indicators and stored in a number of libraries within the software which are coupled with algorithms and user inputs to output the environmental impact assessment. A map of user inputs, data sources and algorithms (outputs) is given in Figure 2.

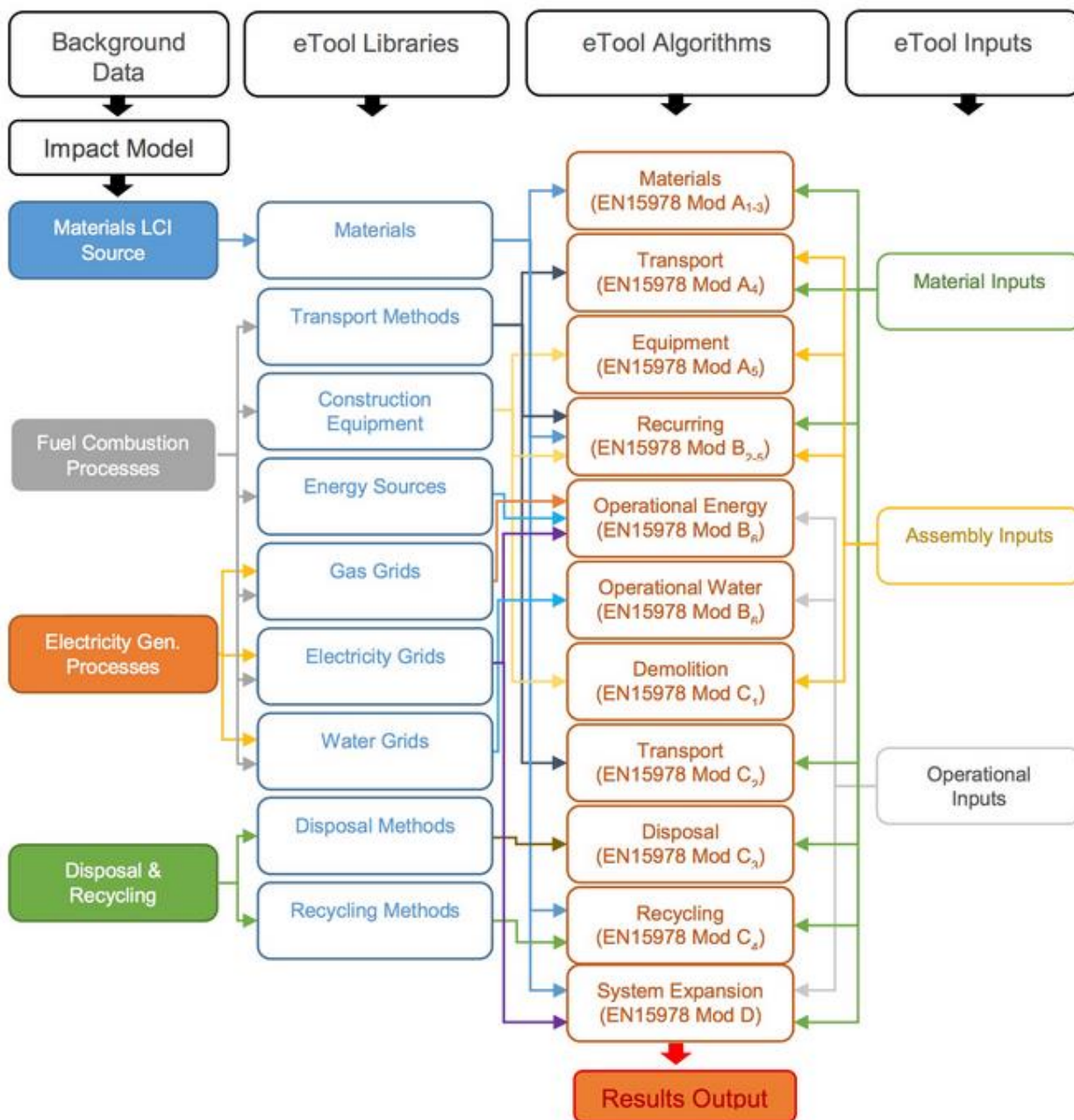


Figure 2: Map of eTool user inputs, data sources and algorithms

MATERIALS & PRODUCTS

WLC calculations for each benchmark used have been carried out using:

- Type III environmental declarations (Environmental Product Declarations¹ and equivalent) and datasets in accordance with BS EN 15804; and,
- EPDs and datasets in accordance with ISO 14025 and ISO 14040/44.

Sequestered (biogenic) carbon, particularly from the use of timber products, is deducted from the global warming potential (GWP) emissions in A1-A3, and in C3 the same amount of carbon is added as it is expected the sequestered carbon would be released back to the atmosphere at this stage. This results in no overall impact on the total carbon emissions from sequestered carbon over the lifetime of the development. As indicated in the GLA WLC guidance, sequestered carbon has been reported separately in the GLA WLC template.

Embodied carbon is difficult to calculate for many MEP systems due to a lack of available data. For the present assessment, results were derived from the benchmark assessments; with the figures extrapolated as appropriate for the areas of each archetype. It is expected these figures will be updated at Reserved Matters design stage for each detailed development phase once MEP specifications have been produced.

BASELINE

As this application is currently at a hybrid planning stage (outline Phases 1b, 2 and 3, and detail for Phase 1A), the assessment was calculated based on the site as a whole, by splitting this indicative design of the development into 'WLC archetypes', using results from previously calculated projects as a benchmark for each archetype. As a result, the figures presented will need updating for each detailed development plot in Reserved Matters Applications.

The substructure, superstructure, walls and roofs constructions vary between the archetypes. See table 4 below for expected constructions of each element for each archetype:

Table 4: Expected constructions of each archetype.

Archetype	Substructure	Superstructure	Walls	Roof
New Build	Concrete piling foundation	Concrete and steel frame	Brickwork cavity and ceramic cladding / curtain walling	RC concrete slabs
Refurbishment	Reinforced concrete (RC) ground floor slabs			
		Existing frame	Existing walls	Existing roof with new insulation

The WLC assessment for each benchmark assessment used to form each archetype was carried out initially with baseline specifications that are considered typical, which determined the Baseline scenarios, such as CEMI (100% cement) for all reinforced concrete (RC) elements and typical recycled content for steel. The RICS PS was followed and expected lifespans were assigned to all materials following *Table 9: Indicative component lifespans*, as the GLA guidance suggests.

The energy demand of the buildings will be minimised by following a fabric-first approach and proposing energy efficiency measures in line with the London Plan Energy Hierarchy. The heating and domestic hot water demand is being supplied through phased energy centres with communal air source heat pumps (ASHPs) to the new build

¹ An Environmental Product Declaration EPD is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products in a credible way (Environdec)

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apartment blocks and individual ASHPs for retained buildings and terrace housing. This is described further in the Energy Statement submitted in support of this planning application.

POTENTIAL REDUCTION MEASURES

The following reduction measures indicate ways that whole life carbon emissions can be reduced within the development. Their inclusion should be investigated further in the detailed design stages to help reduce the whole life carbon emissions from the proposed development during detailed design stages:

1. **Cement replacement (CEMIII-A).** This proposed measure considers the specification of CEMIII-A (BS 8500) as a partial replacement for cement across the construction. The cement combination will consist of Ordinary Portland Cement (OPC) and 36% cement replacement with GGBS.
2. **Aluminium Hybrid Windows.** The proposed measure consists of specifying aluminium timber hybrid windows as opposed to standard aluminium frame windows. This would reduce the quantity of carbon intensive aluminium required.

OPERATIONAL CARBON AND WATER

As required by the GLA, operational carbon emission figures have been presented based on the current status of the electricity grid (SAP10 carbon factors).

OPERATIONAL CARBON EMISSIONS

Operational carbon emissions were calculated for the St. Ann's New Neighbourhood development as part of the Energy Statement (please refer to the accompanying Energy Statement for further information).

- The St. Ann's New Neighbourhood development is proposing a phased energy centre strategy with communal ASHPs to the new build apartment blocks and individual ASHPs for the retained buildings and terraced housing.

RESULTS

Table 5 and Figure 3: below show the results of the site wide assessment, which includes all archetypes. The results show that as expected, the highest contribution to the whole life carbon of the project is the *A1-A5 Product stages*, which accounts for approximately 79,390 tCO₂e (70%). This is primarily due to the majority of the site comprising medium rise buildings; which require reinforced piling foundations.

The second largest contributor is *B2-B5 Maintenance, repair, replacement, and refurbishment*, which accounts for about 16% of the total carbon emissions of the building during its lifetime.

The third largest contributor is the *Transport of Waste Offsite* category with 5,700 tCO₂e (5%).

Table 5: Estimated WLC emissions for each individual module across the whole site.

	A1-A3 Product Stage	A4 Transport to Construction Site	A5 Construction Installation	B1 General Use	B2-B5 Maintenance, Repair, Replacement and Refurbishment	B6-B6+ Operational Energy
TOTAL kg CO ₂ e	54,471,000	14,472,000	10,176,000	-406,000	18,794,000	1,206,000
	B7 Operational Water Use	C1 Deconstruction and Demolition	C2 Transport of Waste Offsite	C3 Waste Processin g	C4 Disposal	D Benefits and Loads Beyond the System Boundary
TOTAL kg CO ₂ e	4,075,000	0	5,742,000	243,000	3,057,000	-1,546,000

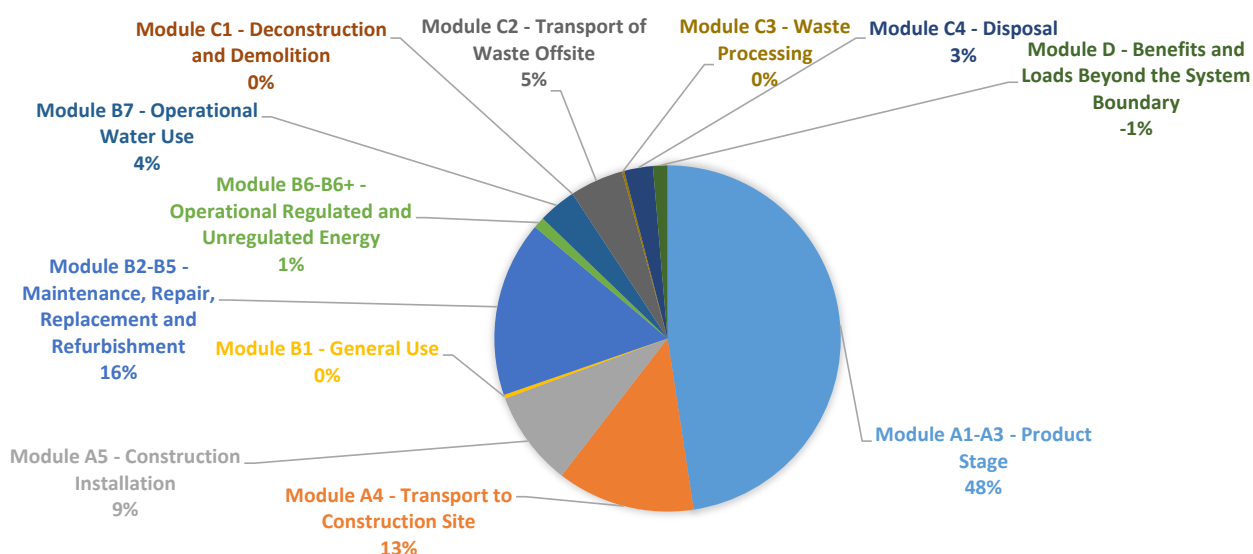


Figure 3: Site wide WLC results for each LCA stage

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Figure 4 below shows a breakdown of the emissions by building element type. As illustrated, the Services category accounts for a large proportion of the emissions (TCO_{2e}), including energy use, the embodied carbon of the M&E equipment during its lifetime and the refrigerant leakage in stage B1. This figure would ordinarily account for an even greater proportion of the total emissions, however, due to the significant savings being targeted within the energy strategy this figure is reduced. As the development includes a number of buildings, with a large proportion of these having at least 5 storeys, the Upper Floors, Substructure, External Walls and Finishes categories also make up a significant amount of the emissions.

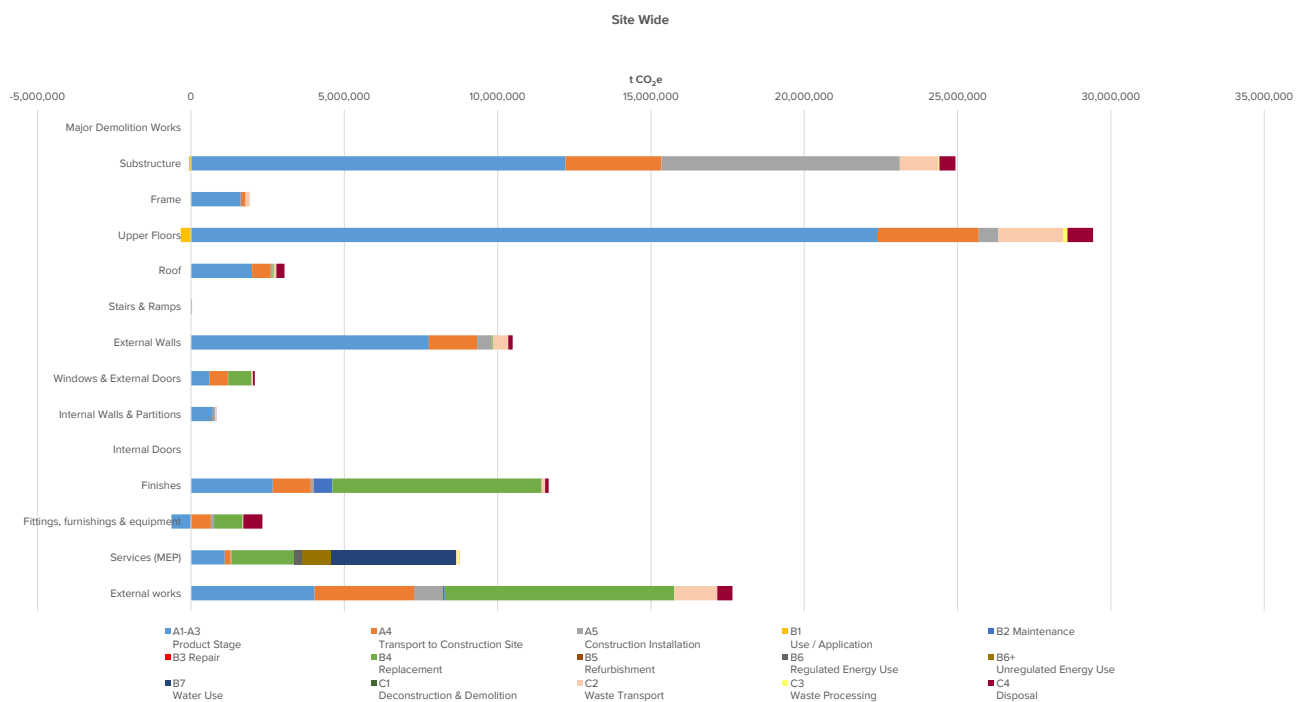


Figure 4: Site wide WLC results for each building element type

Demolition works are often decoupled from new construction projects, hence the responsibility for any emissions arising from demolition is not necessarily solely attributable to the new build project. Therefore, the carbon emissions associated with works are reported separately and not aggregated with the rest of the project emissions.

As a result of the exact carbon emissions associated with pre-demolition construction not yet being known, in line with GLA guidance, a figure of 50 kgCO_{2e}/m² is used to determine the carbon associated. Table 6 below shows the total estimated carbon emissions associated with the pre-demolition construction for the St. Ann's New Neighbourhood development.

Table 6: Total estimated carbon emission associated with the pre-demolition construction

	Estimated area of demolition (m ²)	Assumed benchmark figure	Total carbon emissions
Pre-demolition construction	19,387	50 kg CO _{2e} /m ² GIA	969,350 kg CO _{2e} GIA

BENCHMARKING

Following the GLA Whole Lifecycle Carbon assessments guidance, the estimated emissions have been compared against the benchmarks provided by the GLA in the WLC assessments guidance, Appendix 2. The Aspirational WLC benchmark is based on the World Green Building Council's target to achieve a 40% reduction in WLC emissions by 2030. The results in

Table 7 and 8 below show the WLC Benchmark figures for residential and office buildings (benchmark considered a closest fit to commercial use categories proposed), and estimated carbon emissions of each archetype within the development. Table 9 shows the WLC Benchmark figures alongside estimated carbon emissions of the proposed development as a whole. The results of Modules A1-A5 and B & C, have been compared against the WLC residential benchmark for the whole site due to over 95% of the site comprising residential uses, and the residential providing the most ambitious of the benchmarks applicable.

Table 7: WLC figures for archetypes under the Residential building type benchmark.

	WLC benchmark	Aspirational WLC benchmark	Residential/New build
Modules A1-A5	<850 kg CO ₂ e/m ² GIA	<500 kg CO ₂ e/m ² GIA	812 kg CO ₂ e/m ² GIA
Modules B-C (excluding B6 & B7)	<350 kg CO ₂ e/m ² GIA	<300 kg CO ₂ e/m ² GIA	279 kg CO ₂ e/m ² GIA
A-C (excluding B6&B7, including sequestration)	<1200 kg CO ₂ e/m ² GIA	<800 kg CO ₂ e/m ² GIA	1039 kg CO ₂ e/m ² GIA

Table 8: WLC figures for archetypes under the Commercial (office) building type benchmark.

	WLC benchmark	Aspirational WLC benchmark	Refurbishment/Commercial
Modules A1-A5	<950 kg CO ₂ e/m ² GIA	<600 kg CO ₂ e/m ² GIA	26 kg CO ₂ e/m ² GIA
Modules B-C (excluding B6 & B7)	<450 kg CO ₂ e/m ² GIA	<370 kg CO ₂ e/m ² GIA	46 kg CO ₂ e/m ² GIA
A-C (excluding B6&B7, including sequestration)	<1400 kg CO ₂ e/m ² GIA	<970 kg CO ₂ e/m ² GIA	51 kg CO ₂ e/m ² GIA

Table 9: WLC Benchmark for the whole site against the Residential building type benchmark (pro-rated by area).

	WLC benchmark	Aspirational WLC benchmark	St. Ann's New Neighbourhood
Modules A1-A5	<850 kg CO ₂ e/m ² GIA	<500 kg CO ₂ e/m ² GIA	787 kg CO ₂ e/m ² GIA
Modules B-C (excluding B6 & B7)	<350 kg CO ₂ e/m ² GIA	<300 kg CO ₂ e/m ² GIA	272 kg CO ₂ e/m ² GIA
A-C (excluding B6&B7, including sequestration)	<1200 kg CO ₂ e/m ² GIA	<800 kg CO ₂ e/m ² GIA	1008 kg CO ₂ e/m ² GIA

The anticipated whole life carbon emissions of the proposed development, for modules A1-A5 are lower than the WLC benchmarks and approaching the aspirational benchmarks. The anticipated whole life carbon emissions of the proposed development for modules B1-B5 and C are lower than both WLC benchmark and the aspirational benchmark. The anticipated whole life carbon emissions of the proposed development for modules A-C, including the sequestered carbon, are also lower than the WLC benchmark and approaching the aspirational benchmark.

Breakdowns of the emissions are shown in Appendix C which are consistent with the breakdowns provided in the GLA guidance for these types of buildings. The results show the estimated emissions for the proposed development have been calculated based on the information available to date provided by the design team.

APPENDIX A – GLA WHOLE LIFE CARBON REPORTING SPREADSHEET

Project details	
Project name	St, Ann's New Neighbourhood
Planning application reference number (if applicable)	
Use Type	Residential led mixed-use
Brief description of the project	Located in the south of the London Borough of Haringey, the proposed development comprises of a small area of flexible uses and up to 995 new homes, of which 60% will be affordable, with Phase 1A delivering 239 of the units. There are a number of existing hospital buildings on the site, as well as an operational car park and a public garden named the 'Peace Garden'. The St Ann's New Neighbourhood area is circa 7.2Ha and will involve the redevelopment of two thirds of the former St Ann's Hospital site. Seven of these buildings are to be retained and refurbished in the proposed masterplan.
GIA (m²)	100,871
Authors (organisation or individuals)	XCO2 / KCA Architects / Price and Myers / AWA / Hill Residential Limited / Catalyst Housing Limited and Catalyst Design Limited
Date of assessment	13/01/2022

WLC reduction principles		Key benefits	Provide examples of how reduction principle has been used, or give reasons why it cannot be used.	
1	Reuse and retrofit of existing buildings	Significant retention and reuse of structures is carbon efficient and reduces construction costs.	Confirmation that options for retaining existing buildings and structures have been fully explored before considering substantial demolition	7 buildings will be retained for reuse on site and improvements made to extend their life.
			Carbon emissions associated with pre-construction demolition (kgCO ₂ -e)	969350
			Estimate of the percentage of the new build development which will be made up of existing elements	n/a
2	Use repurposed or recycled materials	Reduces waste and carbon emissions.	A pre-demolition audit has been carried out and opportunities for reuse have been identified and incorporated into proposals including reuse of bricks in the landscaping, reuse of cobbles, bollards, manholes, and the iron columns supporting the external walkway. The pre-demolition audit also looks at reuse of materials offsite and treatment of materials to avoid landfill, where materials can not be reused on site. Bricks not used in refurbished buildings or landscaping will be segregated on site to create pile mat. Demolition concrete will be crushed on site and used to form the drainage layer.	
3	Material selection	Appropriate material choices are key to carbon reduction. Ensuring that materials are selected with consideration of the planned life expectancy of the building reduces waste, the need for replacements and the in-use costs.	Use of durable finishing materials such as brick cladding. Precast elements will be specified where possible to reduce off-cuts and waste produced on site.	
4	Minimise operational energy use	A 'fabric first' approach should be prioritised to minimise energy demand and reduce carbon and in-use costs.	A 'fabric first' approach has been considered to reduce the energy demand and CO2 emissions, with all elements targeting an improvement upon the Part L 2013 minimum standards. The main objective for the building façade for the proposed scheme is to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter, and limiting summertime solar gains to reduce space cooling demands. Triple glazing will be tracked across the entire site, and the implementation of triple glazing, where suitable, will aid in reducing operational energy and emissions.	
5	Minimise the carbon emissions associated with operational water use	Choice of materials and durability of systems, which help to avoid leakage and subsequent building damage, contribute to reducing the carbon emissions of water use.	Low flow water fittings are being used throughout. Specific flow rates will be defined later but will comply with Approved Document G 'Sanitation, hot water safety and water efficiency' as a minimum.	
6	Disassembly and reuse	Designing for future disassembly ensures that products do not become future waste and that they maintain their environmental and economic value.	Lime mortar could be considered where brick facades are implemented to allow the easier reuse of bricks as well as giving a longer lifespan to the brickwork. The plant replacement strategy ensures that building services equipment can be replaced when required (at end of life) through accessible louvered doors close to road side, without damage to building fabric or structure. It will be possible to disassemble larger items of plant.	
7	Building shape and form	Compact efficient shapes help minimise both operational and embodied carbon emissions from repair and replacement for a given floor area. This leads to a more efficient building overall resulting in lower construction and in use costs.	The development will be designed to mitigate the risk of overheating resulting from climate change with passive shading. Building in layers / layer independence: Where possible building elements and components with different lifespans will form independent layers. This will ensure those layers with shorter lifespans can be replaced without damage to layers which have longer lifespans. This will include the following principal layers: •Structure: foundation and load-bearing elements •Skin: exterior surfaces •Services •Space: the interior layout •Stuff: furnishings and carpets	
8	Regenerative design	Removing carbon emissions from the atmosphere through materials and systems absorbing it makes a direct contribution to carbon reduction.	The concrete frames will absorb CO2 throughout its life and when crushed.	
9	Designing for durability and flexibility	Durability means that repair and replacement is reduced which in turn helps reduce life-time building costs. A building designed for flexibility can respond with minimum environmental impact to future changing requirements and a changing climate, thus avoiding obsolescence which also underwrites future building value.	The Circular Economy strategy for new residential buildings is focused on design for longevity, as their use is unlikely to change in the short and medium term. Use of durable materials with longer life spans are being explored Non residential buildings are designed as shell and core, which provides adaptability and flexibility to end tenants, allowing them to determine how the space is used and avoid materials being stripped out and going to waste. The proposed scheme has been designed to adapt to and mitigate the effects of climate change, specifically in terms of overheating and flood risks. Frames and facades will be designed to meet >60-year lifespans. Including the consideration of brick cladding as these are materials with low maintenance and longevity.	
10	Optimisation of the relationship between operational and embodied carbon	Optimising the relationship between operational and embodied carbon contributes directly to resource efficiency and overall cost reduction.	A 'fabric first' approach has been considered to reduce the energy demand and CO2 emissions, with all elements targeting an improvement upon the Part L 2013 minimum standards. The main objective for the building façade for the proposed scheme is to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter, and limiting summertime solar gains to reduce space cooling demands.	
11	Building life expectancy	Defining building life expectancy gives guidance to project teams as to the most efficient choices for materials and products. This aids overall resource efficiency, including cost efficiency and helps future proof asset value.	Frames and facades will be designed to meet >60-year lifespans. Including the consideration of ceramic and brick cladding as these are materials with low maintenance and longevity.	
12	Local sourcing	Sourcing local materials reduces transport distances and supply chain lengths and has associated local social and economic benefits.	Future contractors should look to source materials as locally as possible.	
13	Minimising waste	Waste represents unnecessary and avoidable carbon emissions. Buildings should be designed to minimise construction waste, and to ease repair and replacement with minimum waste, which helps reduce initial and in-use costs.	Contractor to set targets for total construction waste generation and monitor these throughout construction works. Contractor to implement Site Waste Management Plan / Construction Management Plan to manage/reduce construction waste. The principle contractor will follow the UK Government's 'Waste Management Plan for England 2013', the 'Mayor's Municipal Waste Management Strategy - Rethinking Rubbish in London, and the 'Mayor's Business Waste Management Strategy' in order to reduce the amount of waste generated. The following measures will be investigated to facilitate the minimisation of waste generation: - Concrete structure - twin wall for stair core (off site manufacture) - Agreements with material suppliers to reduce the amount of packaging and use reusable packaging that can be returned to the supplier; - Return of surplus materials to supplier e.g. plasterboard; - Waste to be sorted and recycled on-site into as many of the categories listed in the SWMP as possible. All site waste will be collected by a licensed waste carrier; - Waste management monitoring and recording in line with the BRE SmartWaste Plan; - Attention to material quantity requirements, to avoid over-ordering and generation of waste materials; - Re-use of materials during demolition wherever feasible; - Segregation of waste at source where practical; and, - Re-use and recycling of materials off-site, where re-use on-site is not practical (e.g. through use of an offsite waste segregation facility for direct re-use or re-processing). A ground remediation specialist will carry out remediation, and review the segregation strategy, to reduce disruption to contaminated land and maximise excavated waste that can be used for beneficial use.	
14	Efficient construction	Efficient construction methods (e.g. modular systems, precision manufacturing and modern methods of construction) can contribute to better build quality, reduce construction phase waste and reduce the need for repairs in the post completion and the defects period (snagging).	Modular/ off-site construction could be considered. This would potentially have multiple benefits with regards to minimising waste: •Shorter construction times •Lower risk of damage •No requirement for on-site stockpiling or waste storage	
15	Lightweight construction	Lightweight construction uses less material which reduces the carbon emissions of the building as there is less material to source, fabricate and deliver to site.		
16	Circular economy	The circular economy principle focusses on a more efficient use of materials which in turn leads to carbon and financial efficiencies.	A standalone 'Detailed Circular Economy Statement' has been prepared and submitted as part of the planning application.	

APPENDIX B – WHOLE DEVELOPMENT PLOT AREAS

Development Plot	Area (m ²)	Development Plot	Area (m ²)
A	974.4	M2	3390.1
B	2310.0	M3	3937.7
C1	3503.3	N1	1041.4
C2	3101.8	N2	891.4
C3	3258.6	N2	847.8
D1	3037.6	N3	554.0
D2	2016.0	O	1029.4
D3	4722.0	Administration Block	1037.8
E	1962.5	East Gate Lodge	106.5
F1	4080.8	Mayfield House	454.7
F2	3836.0	Mulberry House	198.1
F3	2753.8	Peace Building	1018.6
G1	3073.1	Water Tower	254.4
G2	4447.2	West Gate Lodge	133.3
H1	2176.7		
H2	5225.1		
H3	3182.9		
H4	4115.9		
J1	4439.1		
J2	3938.9		
J3	3455.1		
K	1399.1		
L1	2509.7		
L2	3431.3		
L3	4486.1		
M1	4538.3		

APPENDIX C –WHOLE DEVELOPMENT RESULTS

Building element		Tonnes of carbon dioxide equivalent																
		Sequestered (biogenic) carbon	A1-A3 Product Stage	A4 Transport to Construction Site	A5 Construction Installation	B1 Use / Application	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Regulated Energy Use	B6+ Unregulated Energy Use	B7 Water Use	C1 Deconstruction & Demolition	C2 Waste Transport	C3 Waste Processing	C4 Disposal	D Benefits & loads beyond the system boundary
0.1	Demolition: Toxic / Hazardous / Contaminated Material Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.2	Major Demolition Works	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.3	Temporary Support to Adjacent Structures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.4	Specialist Ground Works	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.5	Temporary Diversion Works	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	Substructure	-715,085	12,210,716	3,131,728	7,768,258	-64,787	0	0	8,135	0	0	0	0	0	1,249,295	39,748	521,145	101,549
2.1	Frame	116	1,620,632	150,589	11,644	-5,805	0	0	0	0	0	0	0	0	110,431	6,417	1,668	8,266
2.2	Upper Floors	-1,511,716	22,404,847	3,281,885	643,066	-332,758	0	0	0	0	0	0	0	0	2,120,545	134,256	832,636	-395,959
2.3	Roof	-532,631	1,994,480	610,144	54,676	-8	0	0	42,758	0	0	0	0	0	86,662	4	262,861	-1,664
2.4	Stairs & Ramps	-14,556	9,773	7,947	4,077	0	0	0	7,120	0	0	0	0	0	1,097	0	7,417	-3,577
2.5	External Walls	1,976	7,757,095	1,574,936	469,602	-3,096	0	0	40,925	0	0	0	0	0	496,576	7,349	145,261	-117,389
2.6	Windows & External Doors	-777,298	597,568	608,747	8,945	0	0	0	761,974	0	0	0	0	0	46,660	0	58,402	-135,450
2.7	Internal Walls & Partitions	-650	710,039	49,221	34,368	0	0	0	808	0	0	0	0	0	33,436	0	421	-88,229
2.8	Internal Doors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Finishes	-350,586	2,664,861	1,243,764	105,633	0	599,793	0	6,819,960	0	0	0	0	0	118,813	0	111,073	-120,763
4	Fittings, furnishings & equipment	-1,286,421	-633,792	647,254	108,527	0	0	0	927,068	0	0	0	0	0	25,809	0	622,158	-162,385
5	Services (MEP)	-2,907	1,103,341	194,198	23,423	0	0	0	2,045,729	0	267,688	938,467	4,075,936	0	46,601	54,983	679	-589,791
6	Prefabricated Buildings & Building Units	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Work to Existing Building	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	External works	4,065	4,032,101	3,242,068	944,307	0	57,291	0	7,483,056	0	0	0	0	0	1,406,278	526	494,104	-41,101

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