Whole Life Carbon Assessment

(RIBA Stage 2)

Charlton Brown Architecture & Interiors Limited

26 Rosslyn Hill
NW3 1PA
London Borough of Camden

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	28.10.2022	Bo Yang	Callum Nelmes	Yin Mui Tang
1	B	08.11.2022	Bo Yang	-	Yin Mui Tang
1	C	17.11.2022	Bo Yang	-	Yin Mui Tang
1	D	18.11.2022	Bo Yang	-	Yin Mui Tang
2	A	22.02.2023	Callum Nelmes	Cara Palmer	Callum Nelmes
2	B	23.02.2023	Callum Nelmes	Cara Palmer	Callum Nelmes

The figures within this report may be based on indicative modelling and an assumed specification outlined within the relevant sections. Therefore, this modelling may not represent the as built emission or energy use of the Proposed Development and further modelling may need to be undertaken at detailed design stage to confirm precise performance figures. Please contact SRE should you have any questions, or should you wish further modelling to be undertaken post planning.

SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

info@sre.co.uk

www.sre.co.uk

Contents

Executive Summary

Executive Summary

This Whole Life Carbon Assessment (WLCA) has been written by SRE Ltd. for Charlton Brown Architecture and Interiors Limited (The Architect) on behalf Simat Properties Ltd. (The Client) to demonstrate the embodied and operational carbon emissions for the proposed demolition and construction at 26 Rosslyn Hill, London Borough of Camden (the Proposed Development).

The aim of this assessment is to model the Whole Life Carbon (WLC) impact of this proposed design to compare it to an alternative scheme where further areas of the existing building façade including the northern boundary are retained and refurbished. This will allow a judgement to be made in relation to the potential future impacts of the Proposed Development.

Using Elmhurst Design SAP and OneClick LCA software, SRE has undertaken this assessment in line with RICS 'Whole Life Carbon Assessment for the Built Environment 2017', which forms the basis for this initial assessment. The assessment has taken into account embodied and regulated operational energy of the proposed scope of works, commencing from a "cleared flat site" in accordance with RICS guidelines.

The overall results show that the Proposed Development will have a cradle to grave emission of ~13.30 tonnes CO_2e less than projected emissions produced from the Refurbished Scenario.

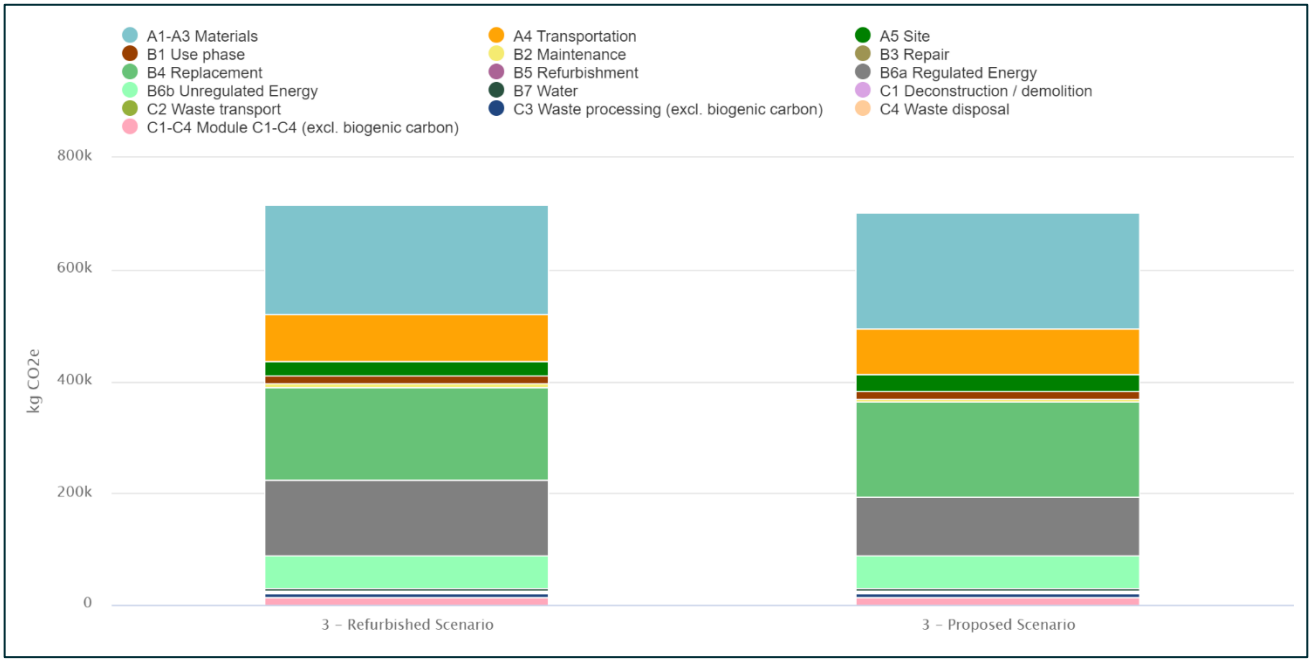

Figure 1 - Carbon Emissions by Life Cycle (OneClick LCA)

Scenarios	Description	Cradle-to-Grave Carbon Emissions ($kgCO_2e$)
Refurbishment	Retention of all Applicable Facades	702,201
Proposed	Retention of West Façade Only	688,897

Table 1: LCA modelling scenarios

Introduction

1.0 Introduction

This Whole Life Carbon Assessment (WLCA) has been written by SRE Ltd. for Charlton Brown Architecture and Interiors Limited (The Architect) on behalf of Simat Properties Ltd. (the Client) to demonstrate the embodied and operational carbon emissions incorporated in the demolition behind the retained façade and partial new construction of the residential dwelling at 26 Rosslyn Hill, London (the Proposed Development) located within the London Borough of Camden.

The WLCA is being undertaken in accordance with the London Plan Whole Life-Cycle Carbon (WLC) emissions in line with Policy SI 2 F whilst also referencing the 'RICS Whole Life Carbon Assessment for the Built Environment' (First Edition, November 2017) where applicable. This methodology provides technical detail and calculation requirements on the practical implementation of the European Standard EN 15978:2011 'Sustainability of Construction Works' principles.

The assessment aims to model the WLC impact of two scenarios: the proposed design (hereafter known as the Proposed Scenario) and compare this to an alternative scheme (hereafter known as the Refurbishment Scenario) where a larger proportion of the existing fabric is retained and enhanced to provide the identical floor area of residential accommodation from which a comparison can be made in relation to the potential future impacts of the Proposed Development.

The assessment utilises recognised industry software and Elmhurst Energy SAP modelling to evaluate the lifecycle carbon content of materials and M&E fittings of the site, over a 60-year lifespan. The assessment of the materials' carbon emissions also includes the replacement of certain items in line with industry standards.

1.1 The Site and Proposed Development

The development is located on the north-east side of Rosslyn Hill. This building is located next to the Former Hampstead Police Station whilst also being situated within the Hampstead Conservation area and is set back from the street front to present a small garden with a mature oak tree.

The scope of the project involves the demolition of most of the existing building fabric, retention of the west (front) façade and the improvement of thermal mass and building services. The main entrance of the dwelling is to be relocated to the side of the property at the upper ground floor level with a new wheelchair accessible approach route added to the new main entrance. The floor to ceiling height at lower ground floor is also set to be increased.

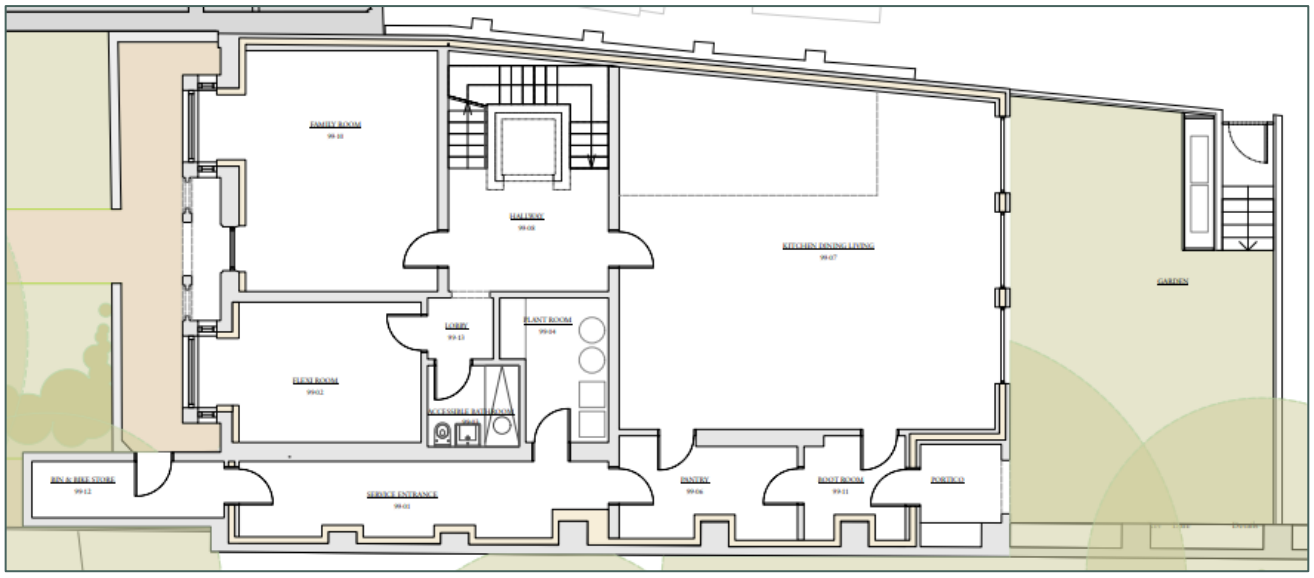

Figure 2 – Lower-Ground Floor Plan of the Proposed Scenario (Charlton Brown Architecture & Interiors)

Methodology and Standards

2.0 Methodology and Standards

There are multiple definitions of Zero Carbon Development which can impact the method of reporting. For the purpose of this assessment, the following definition from the UK Green Building Council has been used:

Net Zero Carbon – Whole Life: "When the amount of carbon emissions associated with the building's embodied and operational impacts over the life of the building, including its disposal, are zero or negative".

To this end, the WLCA has been undertaken in accordance with the 'RICS Whole Life Carbon Assessment for the Built Environment' (First Edition, November 2017) which outlines the process of WLCA as well as what is and is not included. The aim of the RICS document is to provide clarity on the EN 15978: 2011 for the sustainability assessment of buildings and describes the approach required within this methodology as well as including standard practice assumptions for material transport, service life and replacement. Adding to the breadth of the RICS methodology, the London Plan's WLC guidance details the inputs required at each building lifecycle stage in order to capture a thorough assessment, encapsulating all building element groups which can then be inputted into the LCA following RICS standard practice assumptions.

2.1 Lifecycle Stages

The embodied and operational carbon of a site included within a WLC assessment, are separated into the following sections. Those highlighted in bold represent the minimum stages required to be reported for completion of a WLCA according to RICS, 2017.

Stage	Stage Identifier	Stage Name and Scope	Description
Product Stage	**A1 – A3**	**Product Stage**	**Raw material to Product Completion.**
Construction Process Stage	**A4 – A5**	**Construction Process Stage: Transport to site and construction installation process.**	**Transportation of goods to site and installation on-site.**
Use Stage	B1	In Use Emissions	Emissions arising during the life of the building from its components – such as the emissions from GHG and HFC blown insulation, which leeches over time.
	B2	Maintenance, cleaning, and associated works	Emissions associated with energy and products for maintenance.
	B3	Repair Emissions	Reasonable allowance for repairing unpredictable damage over and above the standard maintenance regime.
	B4	**Replacement Emissions**	**Emissions associated with the replacement of items within the building, in accordance with the standard expected lifespan.**
	B6	**Operational Energy Use**	**Emissions associated with the operation of the building through the operation of its technical systems over the life of the building.**
	B7	Operational Water Use	Emissions associated with the water use during the operation of a building during its operational life.
End of Life Stage	C1	Deconstruction and Demolition Emissions	Emissions covered by all site activity required to dismantle, deconstruct and/or demolish the built asset.
	C2	Transport Emissions	Transport emissions associated with discarded items from site.
	C3	Waste Processing for reuse, recovery, or recycling emissions	Processing emissions for waste arising from the demolition of the site when processing for recycling, reuse, or recovery.
	C4	Disposal Emissions	Emissions associated with the disposal of materials which are not being recycled and are to be disposed of.

Table 2 - Outline of all Assessment Elements Covered by the WLCA

In line with the above guidance, the WLCA has been undertaken up to RIBA Stage 2 for planning. The following data has been used to formulate this WLCA model (where any information is not available at the point of assessment, industry assumptions have been implemented):

- OneClick LCA material & component database.
- Drawings, plans, sections, and elevations from Project Team.
- Dynamic Energy Modelling (SAP) results calculated by SRE Ltd.
- Material build-ups provided by the Project Team.

The RICS Document states that all new build projects are assumed to commence from a cleared, flat site with demolition works of the previous structure decoupled from the new construction. It is therefore necessary that any future demolition of the new development is included within its own WLC calculation where this represents the proposed end of life scenario which is not solely attributable to any following schemes.

2.2 Outcomes and Units

The units required to be used within the outputs of the WLCA are clearly defined within the RICS documentation to ensure the equal judgement of developments to peer projects following the principle of normalisation in order to establish different ratings of carbon intensity. Therefore, the following unit is to be implemented within this assessment:

- $kgCO_2e/m^2$ of Net Internal Area.

2.3 Assumptions

By means of incorporating all various emissions sources within this WLCA, certain assumptions are to be drawn dependent on information not available at the time of appointment and study.

The details of the RICS WLCA OneClick inputs and SRE Assumptions Summary is provided in Appendix E.

Transport

Sourcing of materials during the construction phase (Module A) normally requires 2 movement trips - from the area of manufacture to site of storage followed by a vehicle movement from the site of storage to the development location ready for construction. All transportation values for this assessment have been taken from the RICS, 2017 guidance which dictates distance values and method of transportation dependent on each material's country of origin. These values are evidenced within Appendix C of this report.

Materials

All materials inputted into the OneClick LCA software have been selected on a like-for-like basis. All specific materials available within the tool have been inputted with the associated quantity calculated from provided drawings. Where specified materials are not available on the database, the closest alternative has been chosen, where it shares the most similar function, form and carbon intensity to the applied option. A full list of material assumptions can be found within Appendix E.

Replacement

Across the Proposed Development's lifecycle, materials inputted during primary construction will require replacement resulting from damage caused by wear and tear, improper use as well as various environmental factors. The replacement of materials proposed in the development's lifecycle is measured within the LCA tool and based on information stating assumed material service periods within the RICS documentation evidenced in Appendix D. The lifespan of a product is generic and is based on the element type. This will therefore not perfectly represent the replacement ratios of the structure's lifecycle but instead industry standards for replacement rates.

Limitations

The WLCA for the Proposed Development has understandably been conducted as accurately as possible, with consideration and detailing of all inputs undertaken to ensure that the modelling and materials reflect the proposed works and solely capture the embodied carbon linked to the construction. However, as with all material assessments, the products used within this WLCA may not exactly reflect all those being installed on site and is highlighted where this is the case.

The changing of products and plans will alter the embodied carbon information used within the WLCA, in addition to the mileage associated with transport to the site from suppliers and trade workers. Any change in material quantity, wastage, replacement, or transportation will alter emissions values hence the adoption of assumed industry values for these variables.

3.0 Results

3.1 Outcomes per lifecycle stage

The embodied carbon result encapsulates all lifecycle stages (A1-A5, B1-B5, C1-C4) other than Modules B6-B7 (operational energy and water) and module D (benefits beyond the proposed system). Operational carbon emissions are therefore represented within Modules B6 (operational energy demand) and B7 (water demand). The total calculated WLC result for the Proposed Development is 688,896 $kgCO_2e$ (688.90 tonnes CO_2e), and the embodied carbon equates to 522,050 kgCO2e (522.05 tonnes CO_2e), as seen in Table 3 below. Table 4 details the results of the alternative Refurbished Scenario.

Module	Embodied Carbon Emissions ($kgCO_2e$)	Operational Carbon Emissions ($kgCO_2e$)	Whole Life Carbon Emissions ($kgCO_2e$)
A1-A5 Construction Process stage ($kgCO_2e$)	318,217		318,217
Biogenic Carbon ($kgCO_2e$)	-46,071		-46,071
B1-B5 Use Stage ($kgCO_2e$)	190,875		190,875
B6-B7 Operational Demands ($kgCO_2e$)		166,846	166,846
C1-C4 End of Life stage ($kgCO_2e$)	59,029		59,029
Total Carbon Emissions ($kgCO_2e$)	**522,050**	**166,846**	**688,896**
GWP – ($kgCO_2e/m^2$)	**898.53**	**287.17**	**1,185.71**
Module D Benefits to Future Systems ($kgCO_2e$)	**-116,979**		

Table 3 - WLCA Emission Results per Lifecycle Stage of the Proposed Scenario.

Module	Embodied Carbon Emissions	Operational Carbon Emissions	Whole Life Carbon Emissions
A1-A5 Construction Process stage ($kgCO_2e$)	305,356		305,356
Biogenic Carbon ($kgCO_2e$)	-45,451		-45,451
B1-B5 Use Stage ($kgCO_2e$)	184,896		184,896
B6-B7 Operational Demands ($kgCO_2e$)		198,996	198,996
C1-C4 End of Life stage ($kgCO_2e$)	58,403		58,403
Total Carbon Emissions ($kgCO_2e$)	**503,204**	**198,996**	**702,201**
GWP – ($kgCO_2e/m^2$)	**866.10**	**342.51**	**1,208.61**
Module D Benefits to Future Systems ($kgCO_2e$)	**-116,551**		

Table 4 - WLCA Emission Results per Lifecycle Stage of the Refurbished Scenario

It should be noted that the figures presented in Table 3 and Table 4 are representative of a point-in-time assessment, based on the information available at the time of the assessment. As more quantities and details of the components become available, or if the design or specification changes, the WLCA model and report require updating to capture the embodied carbon emissions for the development more accurately.

3.2 Discussion of Results

The WLCA modelling has been carried out for both the Proposed and Refurbishment Scenarios. By completing the WLCA model for both scenarios and reviewing the design information available to date, the following observations have been made.

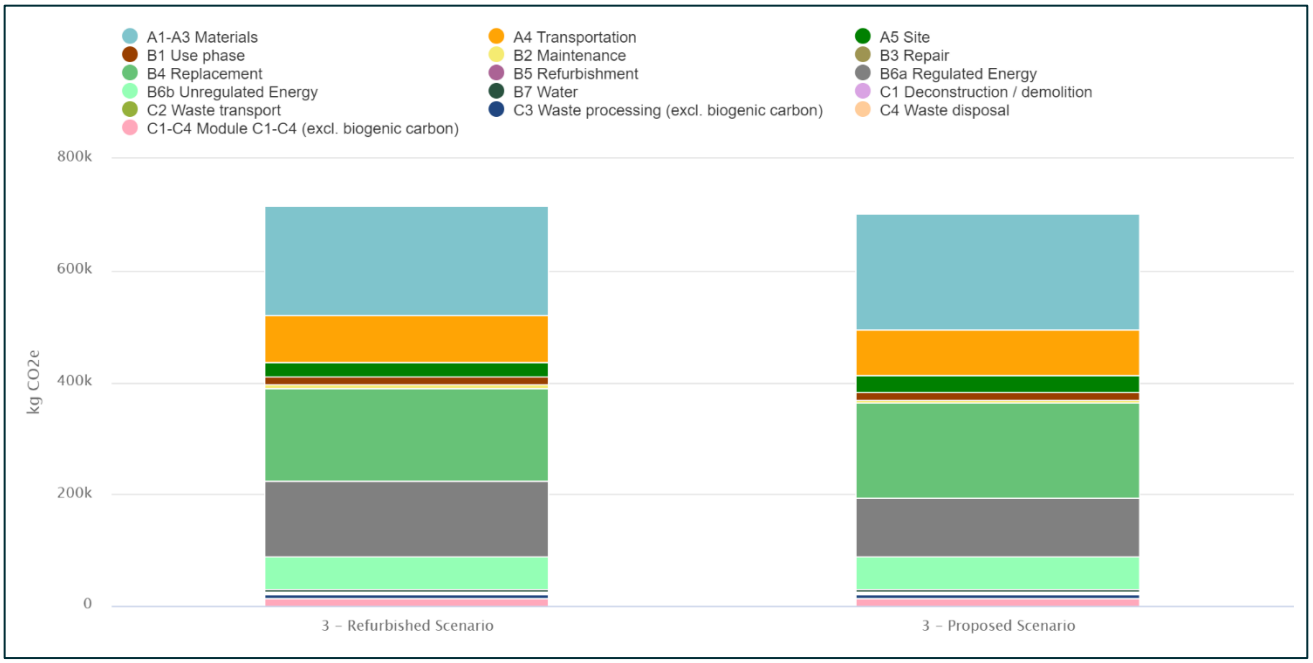

Figure 3 - Comparison of Lifecycle Stage Elements for the Proposed and Refurbishment Scenarios.

Figure 3 above highlights the total carbon impact of both the Proposed and Refurbishment Scenarios at all lifecycle stages from Cradle-to-Grave. As a result of the Proposed Scenario planning a larger proportion of new construction, the embodied carbon associated with the construction phase (Modules A1-A5) is greater when compared to the Refurbished Scenario which incorporates the retention of both the west and north facades.

As a result of the Proposed Scenario consisting of an upgraded fabric structure, Figure 3 above shows that this option will be less carbon intensive when considering all factors. With the new fabric designed to be more efficient with regards to thermal performance, the retention of heat and minimisation of heat loss leads to a lower operational energy demand across the lifecycle of the building and will hence be less carbon intensive in the long run.

The quantities of materials included in the WLCA model are based on information provided from the Design Team to-date, and include estimations of quantities of muck-away, and materials reclaimed from current site. It has also been assumed that the existing structure will have a lifespan of 60 years when in reality, there are parts of the existing building structure that are worn and not in good shape. It is not therefore a reasonable assumption that these later extensions will last the assumed 60 years. This may result in some elements needing to be replaced more often than currently modelled which would lead to higher B3 (Repair) and B4 (Replacement) emissions which cannot be predicted within this assessment. As beforementioned, the lifespan of the products used in the modelling are generic and based on element type as per Appendix D. However, it is likely that the existing structure will need additional works and new materials to address its longevity concerns. This has not been taken into consideration in the present modelling and may therefore result in greater embodied carbon in lifecycle stage B4, Replacement, in the Refurbished Scenario than what is currently modelled.

Listed below are some of the methods as to how the Design Team attempts to lower embodied carbon emissions of the Proposed Scenario.

Bricks

The environmental impact of bricks can be lessened by reducing the quantity of virgin materials used in construction. The project team has aimed for bricks used in the Proposed Scenario to be reclaimed from the demolition for reuse in this structure. Calculated from the OneClick LCA software, the carbon emissions associated with reclaimed bricks are approximately 16.58% of the total emissions of virgin red bricks. Therefore, should in fact virgin bricks be used, the total embodied carbon will increase significantly.

Glass

A detailed Thermal Comfort Analysis has been undertaken by SRE, which reviewed the thermal performance of the specified glazing units. This assessment has been undertaken under a climate change scenario to ensure a thermally comfortable environment can be achieved during the lifespan of the buildings.

The use of timber window frames to support triple glazing would represent a step in reducing carbon emissions through including biogenic storage in wooden materials which can also be easily recycled during the development's End of Life (C) stage.

Transportation

At this stage, the RICS recommended transport distances (see Appendix D) have been adopted. It is recommended that locally sourced materials with an EPD should be used where possible.

Waste Removal

Removal of waste has been taken into account as part of Stage C of the WLCA – This will offset the amount of embodied carbon in the scheme.

3.3 Operational Energy Use

As can be seen in Figure 3, carbon emissions within the lifecycle stage B6, Operational Energy Use, represents the most significant impact on the WLC performance of the scheme.

A SAP model has been completed for the Proposed Development to represent the energy performance of the scheme in line with Part L requirements. Energy use related to building services (heating, cooling, hot water, ventilation) and lighting, known as the regulated energy, has been considered and listed below. Figure 4 shows the operational energy consumption in the Proposed Scenario, and Figure 5 shows the operational energy consumption in the Refurbishment Scenario.

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6911.7588	0.1550	1071.6270 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2001.1327	0.1408	281.7587 (264)
Space and water heating			1353.3857 (265)
Space cooling	14.5722	0.1139	1.6595 (266)
Pumps, fans and electric keep-hot	6613.2150	0.1387	917.3345 (267)
Energy for lighting	534.2735	0.1443	77.1122 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3058.8510	0.1318	-403.2600
PV Unit electricity exported	-257.4486	0.1158	-29.8231
Total			-433.0831 (269)
Total CO2, kg/year			1916.4088 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5600 (273)

Figure 4 - Proposed Scenario Energy Consumption by End Use

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	17736.8274	0.1538	2728.3326	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1736.8085	0.1409	244.7580	(264)
Space and water heating			2973.0906	(265)
Space cooling	7.0914	0.1139	0.8079	(266)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	534.2735	0.1443	77.1122	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3287.7566	0.1314	-431.8873	
PV Unit electricity exported	-28.5430	0.1030	-2.9386	
Total			-434.8259	(269)
Total CO2, kg/year			2616.1848	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8600	(273)

Figure 5 - Refurbishment Scenario Energy Consumption by End Use

As can be seen from Figures 4 and 5 above, the total regulated operational energy in the Refurbishment Scenario accounts to a total of 16,698.70kWh/year, whereas the operational energy in the Proposed Scenario shows a significantly lower level of operational energy at 12,758.65kWh/year. This can be attributed to the ability to improve the building fabric performance to a greater level and consistency across the site in the Proposed Scenario, and as such will ultimately end up being the more carbon sensitive approach in the longer term.

4.0 Conclusion

This WLCA has been completed to compare the WLC emissions for the Proposed and Refurbished Scenarios at 26 Rosslyn Hill, Camden in order to assess the short- and long-term carbon emissions of the two proposed schemes.

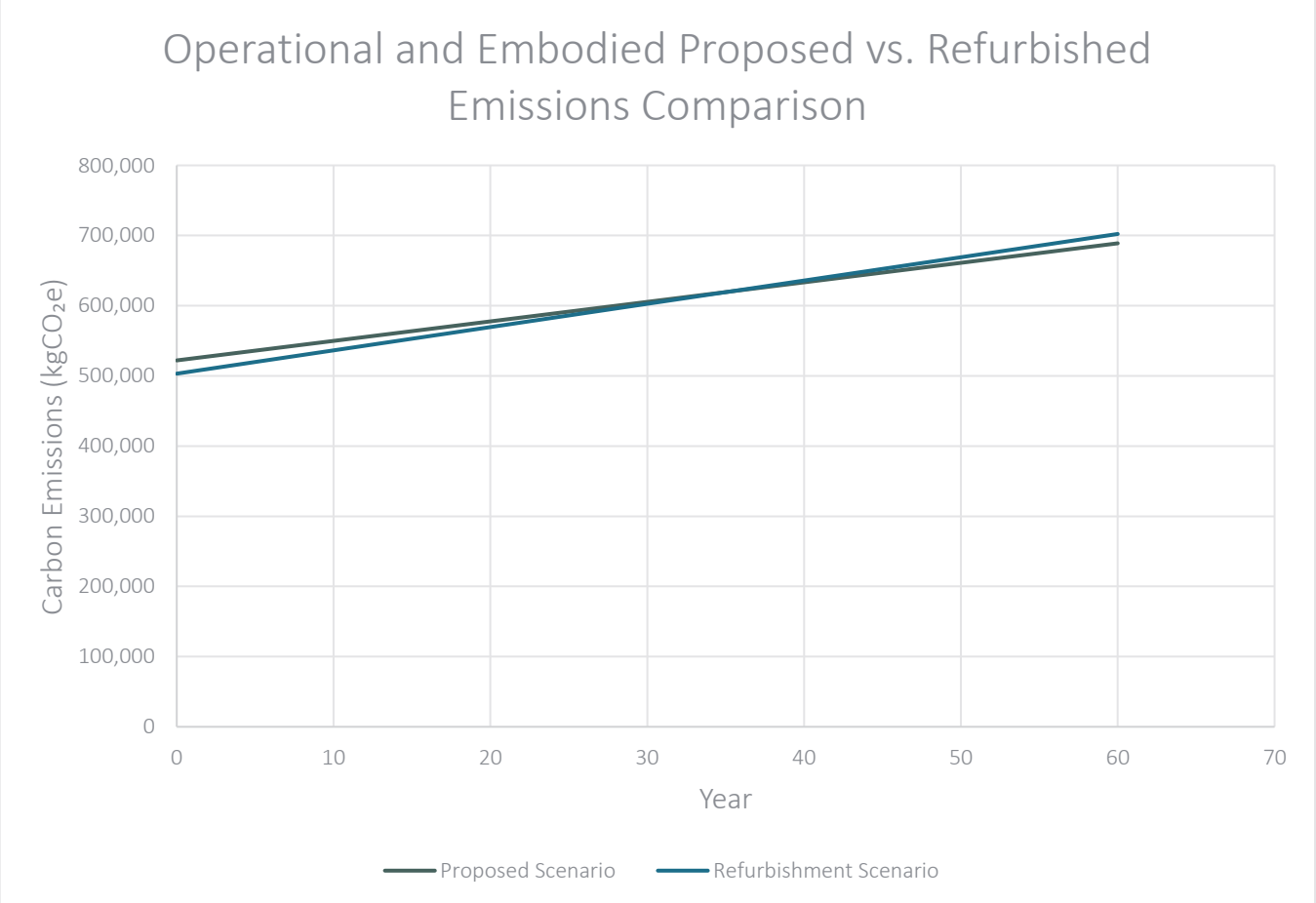

Figure 6 - Graphical Comparison of Carbon Emissions between the Proposed and Refurbished Carbon Emissions.

Analysing the 60-year life cycle of the Proposed Development in Figure 6 above, it can be seen that the difference in operational emissions between the two scenarios will equate to the Proposed Scenario becoming less carbon intensive over the building's lifespan. With embodied materials costs all inputted upon completion, the yearly pro-rata of operational demands upon this material value highlights how the more efficient building fabric despite increasing short term costs, is designed for prolonged carbon reduction, and therefore can be deemed the more environmentally sensitive plan from the two modelled scenarios.

The overall results show that the Proposed Development will have a cradle to grave emission of 13.30 tonnes CO_2e less than projected emissions produced from the Refurbished Scenario. Results from the WCLA modelling indicate that the new construction will ultimately end up being a more carbon sensitive approach in the longer term, taking all factors into account, and is therefore the more sustainable option given that the materials and MEP specifications remain in place through to construction of the development.

Appendices

Appendix A Carbon Reporting – Embodied and Operational emissions (Proposed Scenario)

Result category	Biogenic carbon (kg CO2e)	A1-A3 Product stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material replacement - materials	B5 Material refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.																		
0.2 Demolition													1 788				1 788	
0.3 Supports																		
0.4 Groundworks																		
0.5 Diversion																		
1 Substructure	0	39 803	39 079	2 428			0							1 069	3 688		86 087	−15 540
2.1 Frame	0	44 073	4 822	1 746			0							988	72		51 701	−17 750
2.2 Upper Floors	−33 199	14 507	7 873	3 031			10	9 097	0					304	33 912	10	35 546	−48 058
2.3 Roof	−6 677	5 659	1 302	584			24	2 404	0					37	6 779	7	10 118	−9 848
2.4 Stairs & Ramps	−659	675	16	87			1							2	664		786	−805
2.5 Ext. Walls	−620	36 331	10 149	3 083			128	11 943	0					964	713	153	62 844	−3 663
2.6 Windows & Ext. Doors	−1 247	3 529	296	0			47	3 897	0					71	1 247	1	7 841	−39
2.7. Int. Walls & Partitions	−1 711	1 491	225	196			0							6	1 725	2	1 934	−1 890
2.8 Int. Doors	−1 561	846	272	0			14	1 130	0					3	1 570	0	2 273	0
3 Finishes	0	2 133	531	371			0	2 965	0					292	9		6 300	−63
4 Fittings, furnishings & equipments	−398	971	23	40			12	5 022	0					3	406	0	6 078	0
5 Services (MEP)	0	48 962	365	55	14 322		446	129 909	0	104 111	58 793	3 942		81	7	4	360 997	−11 933
6 Prefabricated																		
7 Existing bldg																		
8 Ext. works	0	9 525	15 957	1 222			0	4 286	0					292	2 137	0	33 419	−7 391
Other or overall site construction																		
Unclassified / Other				15 961		5 222											21 183	
TOTAL kg CO2e	−46 071	208 505	80 910	28 802	14 322	5 222	680	170 651	0	104 111	58 793	3 942	1 788	4 133	52 930	178	688 897	−116 979

Appendix B Carbon Reporting – Embodied and Operational emissions (Refurbishment Scenario)

Result category	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material replacement - materials	B5 Material refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.																		
0.2 Demolition													1 788				1 788	
0.3 Supports																		
0.4 Groundworks																		
0.5 Diversion																		
1 Substructure	0	39 803	39 079	2 428			0							1 089	3 688		86 087	-15 540
2.1 Frame	0	44 073	4 822	1 746			0							988	72		51 701	-17 750
2.2 Upper Floors	-33 199	14 507	7 873	3 031			10	9 097	0					304	33 912	10	35 546	-48 058
2.3 Roof	-6 677	5 659	1 302	584			24	2 404	0					37	6 779	7	10 118	-9 848
2.4 Stairs & Ramps	-659	675	16	87			1							2	664		786	-805
2.5 Ext. Walls	0	21 941	13 088	1 673			132	5 958	0					1 023	111	70	43 997	-3 235
2.6 Windows & Ext. Doors	-1 247	3 529	296	0			47	3 897	0					71	1 247	1	7 841	-39
2.7. Int. Walls & Partitions	-1 711	1 491	225	196			0							6	1 725	2	1 934	-1 890
2.8 Int. Doors	-1 561	846	272	0			14	1 130	0					3	1 570	0	2 273	0
3 Finishes	0	2 133	531	371			0	2 965	0					292	9		6 300	-63
4 Fittings, furnishings & equipments	-398	971	23	40			12	5 022	0					3	406	0	6 078	0
5 Services (MEP)	0	48 962	365	55	14 322		446	129 909	0	136 261	58 793	3 942		81	7	4	393 148	-11 933
6 Prefabricated																		
7 Existing bldg																		
8 Ext. works	0	9 525	15 957	1 222			0	4 286	0					292	2 137	0	33 419	-7 391
Other or overall site construction																		
Unclassified / Other				15 961		5 222											21 183	
TOTAL kg CO2e	-45 451	194 115	83 848	27 393	14 322	5 222	685	164 667	0	136 261	58 793	3 942	1 788	4 192	52 328	95	702 201	-116 551

Appendix C RICS Transportation Values

Transport Scenario	km by road*	km by sea**
Locally manufacturer e.g., Concrete, aggregate, earth	50	-
Nationally manufactured e.g., plasterboard, blockwork, insultation	300	-
European manufacturers e.g. CLT, façade modules, carpet	1,500	-
Globally manufactured e.g., specialist stone cladding	200	10,000

* Means of transport assumed as average rigid HGV with average laden as per BEIS carbon conversion factors.

** Means of transport assumed as average containership

Appendix D RICS Material Replacement Values

Building Part	Building Elements/Components	Expected Lifespan
Roof	Roof Coverings	30 years
Superstructure	Internal partitioning and dry lining	30 years
Finishes	Wall Finishes: render/paint	30/10 years respectively
	Floor finishes: Raised Access Floor (RAF)/Finish Layers	30/10 years respectively
	Ceiling finishes: substrate/paint	20/10 years respectively
Furniture, fixings, and Equipment (FF&E)	Loose furniture and fittings	10 years
Services/MEP	Heat source, e.g. boiler, calorifiers	20 years
	Space heating and air treatment	20 years
	Ductwork	20 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installations and controls	15 years
	Water and disposal installations	25 years
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
Façade	Opaque modular cladding e.g. rain screens, ey panels	30 years
	Glazed cladding/curtain walling	35 years
	Windows and external doors	30 years

Appendix E RICS WLCA OneClick Inputs & Assumptions Summary – Proposed Scenario

RICS Category		Element Description	Material Used	Total Qty	Unit
Foundations and Substructure	Foundation, Sub-Surface, Basement and Retaining Walls	Ready-Mix Concrete	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% GGBS content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA 2022)	66.69	m^3
		Steel Reinforcement	HS2 baseline - Steel reinforcement Bars & cages, EAF 97% Recycled Content (-)	2,959.60	kg
		Artificial Stone Slab	Artificial stone slab (epoxy-resin bound), 20 mm, 52 kg/m2, 2600 kg/m3	232.10	m^2
		Ditra Mat	Laminated high density polyethylene membrane, 0.148 kg/m2, D-Pro (Isola)	232.10	m^2
		Levelling Compound	Levelling compound, for floors, walls and overhead application, modified mortar, 800-1700 kg/m3, PCI Pericret® (FEICA)	1.40	m^3
		Screed	Calcium sulphate screed, 1500 kg/m3	6.96	m^3
		Visqueen	Polypropylene vapour membrane, French average, 0.18 kg/m2 (MDEGD)	232.10	m^2
		Xtratherm	PIR insulation boards, aluminium foil faced, <= 160 mm, L = 0.0215 W/mK, dens. = 32 kg/m3, Various products (Xtratherm)	232.10	m^2
		Cavity Drain	Geogrids from high tenacity polyester tendons and polyethylene sheath, biaxial array, Mesh size = 200 x 500 mm, Width = 24 mm, 0.534 kg/m2, ParaDrain 100/15 (Officine Maccaferri (UK) (2021))	232.10	m^2
		RC Concrete Slab	Reinforced concrete floor slab, 2387.04 kg/m3, C25/30 XC1/XC2 CEM II A (SNBPE)	75.40	m^3
		Concrete Binding	Geotextile, wooven fabric for reinforcement and separation, water permeable, 813 gr/m2, TS(MD/CMD) 300/45 kN/m,PET, 5x100/200/300 m, Stabilenka 300/45 (Huesker Synthetic)	232.10	m^2
RICS Category		**Element Description**	**Material Used**	**Total Qty**	**Unit**
Vertical Structures and Façade	External Walls and Façade Columns and Load-Bearing Vertical Structures	Fibre Insulation Boards	Wood-fibre insulation board, 0.038 W/mK, 40-220 mm, 50 kg/m3, FLEX 50 (Holzwerk Gebr. Schneider)	56.46	m^2
		Natural Clay Plaster	Natural clay lime plaster, Clime (Armourcoat)	226.56	kg
		Steel Handrail	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	20.46	m
		Glass Wool Insulation	Glass wool/mineral wool insulation, cavity wall insulation, L = 0.032 W/mK, T: 50-100 mm, 48 kg/m3, CWS 32 (Isover)	449.22	m^2
		Ready-Mix Concrete	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% GGBS content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA 2022)	449.22	m^2
		Gypsum Finish Plaster	Gypsum finish plaster, damage resistant, 1250 kg/m3, Thistle DuraFinish (British Gypsum Saint Gobain (2021))	43.53	m^3
		Aluminium Privacy Screen	Aluminium framed acrylic privacy screen, 6.8 kg/m2, DONNEE PAR DEFAUT (DED)	17.35	m^2
		Red Brick	Red brick, average production, UK, 215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3 (Brick Development Association (BDA) Ltd (2019))	285.02	m^2
		Reclaimed Brick	Reclaimed brick (One Click LCA)	73,300	kg
		Steel Columns	Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections, S235, S275 and S355	4,689	kg

	Columns and Load-Bearing Vertical Structures	Plasterboard	Gypsum plasterboard, 12.5 mm, 8.985 kg/m2 (average product weight) (Etex Building Performance)	743.78	m^2
		Ready-Mix Concrete	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/A-V, 10% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA 2022)	89,253	kg
		Steel Rebar	Reinforcement steel (rebar), generic, 90% recycled content, A615	2,418	kg
		Glass Wool Insulation	Glass wool insulation rolls and slabs, L = 0.032-0.044 W/mK, 22 kg/m3, Multi Roll 44, Multi Roll 40, Timber and Rafter Roll 040, Timber and Rafter Roll 035, Timber and Rafter Roll 032, Timber and Rafter Batt 040, Timber and Rafter Batt 035, Timber and Rafter Batt 032, Party Wall Roll, Superwall 32 Cavity Wall Batt, Superwall 34 Cavity Wall Batt, Superwall 36 Cavity Wall Batt, Multi-Purpose Acoustic Slab, Multi-Acoustic Roll, Acoustic Partition Roll (APR), Superglass Slab 45, Cladding Mat 032, Cladding Mat 035, Cladding Mat 037, Cladding Mat 040 (Superglass Insulation Limited)	18.59	m^3
	Internal Walls and Non-Bearing Structures	Plasterboard	Gypsum plasterboard, 12.5 mm, 8.985 kg/m2 (average product weight) (Etex Building Performance)	737.12	m^2
		GLT Studs	Glued laminated timber (GLT) stud frame, biogenic CO2 not subtracted (for CML), 497 kg/m3 (Bois de France)	2.22	m^3
		Glass Wool	Glass wool insulation rolls and slabs, L = 0.032-0.044 W/mK, 22 kg/m3, Multi Roll 44, Multi Roll 40, Timber and Rafter Roll 040, Timber and Rafter Roll 035, Timber and Rafter Roll 032, Timber and Rafter Batt 040, Timber and Rafter Batt 035, Timber and Rafter Batt 032, Party Wall Roll, Superwall 32 Cavity Wall Batt, Superwall 34 Cavity Wall Batt, Superwall 36 Cavity Wall Batt, Multi-Purpose Acoustic Slab, Multi-Acoustic Roll, Acoustic Partition Roll (APR), Superglass Slab 45, Cladding Mat 032, Cladding Mat 035, Cladding Mat 037, Cladding Mat 040 (Superglass Insulation Limited)	16.22	m^3
RICS Category		**Element Description**	**Material Used**	**Total Qty**	**Unit**
Horizontal Structures: Beams, Floors and Roofs	Floor Slabs, Ceilings, Roofing Decks, Beams and Roof	Steel Beams	Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections, S235, S275 and S355	11,880	kg
		Floor Slabs w Timber Joists	Floor slab, timber joists, P3 R0 (1…2 krs.) (Single family house/rowhouse/kindergarten), incl. One Click LCA generic data, P3 R0 (1…2 krs.) (Single family house/rowhouse/kindergarten)	348.68	m^2
		Stone Tiles	Natural stone tiles, 10 mm (EURO-ROC)	62.19	m^2
		Waterproofing Membrane	Waterproofing membrane, single component, cold applied, from PU, 1.5 mm, 1.98 kg/m2, Sikalastic-625 (Sika)	62.19	m^2
		Rock Wool Insulation	Rock wool insulation, L = 0.036 W/mK, R = 3.33 m2K/W, 120 mm, 13.2 kg/m2, 110 kg/m3, Hardrock Energy 120mm (Rockwool)	62.19	m^2
		Plywood, Paper	Plywood, paper honeycomb composite board, biogenic CO2 not substracted, 42.6 mm, 12.4 kg/m3, 291 kg/m3, Eurolight décor (Egger)	62.19	m^2
		Plywood	Plywood, generic, 4-50 mm (0.16-1.97 in), 620 kg/m3 (38.7 lbs/ft3)	1.5	m^3
		Rock Wool ETICS	Rock wool insulation for ETICS and flat roofs, R=1 m2K/W, L=0.044 W/mK, 44 mm, 0.97 kg/m2, 22 kg/m3, Lambda=0.044 W/(m.K) (Rockwool)	62.19	m^2
		Sealing Membrane	Sealing membrane, in tiles (glue incl.), French average, ép. 0,7mm, DONNEE PAR DEFAUT (DED)	62.19	m^2
		Suspended Ceiling System	Suspended ceiling system with steel studs and gypsum plaster board, 12.3kg/m2, Plafond Longue Portée Stil Prim® Tech avec Fourrure Stil® F530 et Placoplatre® BA 13 (PLACOPLATRE)	62.19	m^2
		Flat Roof	Flat roof, timber joists, P3 R0 (1…2 krs.), U ≤ 0,09 W/m2K (Single family house/rowhouse/kindergarten), incl. One Click LCA generic data, P3 R0 (1…2 krs.), U ≤ 0,09 W/m2K (Single family house/rowhouse/kindergarten)	74.16	m^2

		Pitched Roof	Pitched roof, timber truss, P3 R0 (1…2 krs.), U ≤ 0,09 W/m2K (Single family house/rowhouse/kindergarten), incl. One Click LCA generic data, P3 R0 (1…2 krs.), U ≤ 0,09 W/m2K (Single family house/rowhouse/kindergarten)	46.51	m^2
RICS Category		**Element Description**	**Material Used**	**Total Qty**	**Unit**
Other Structures and Materials	Other Structures and Materials	Staircase	One storey timber staircase, 2587x225x905 mm, 41.9 deg (Stair Craft)	3	Unit
		Double Bed Frame	Particleboard double bed frame, 1390 x 1950 mm, 77.8 kg/unit, DOUBLE BED FRAME (Bisley)	5	Unit
		Sofa	Feather and oak sofa, 27.14 kg/unit, Arris sofa/feather/oak (MARK Product (2021))	4	Unit
		Office Table	Laminated office table from MDF, 80x80 cm, 22.8 kg/unit (Aarsland Møbelfabrikk AS)	10	Unit
	Windows and Doors	Triple Glazing	Triple glazing windows with wooden frame, 42.6 kg/m2, 1.2 W/m2K, biogenic CO2 not subtracted (for CML), FDES collective utilisable par toute entreprise qui produit en France des fenêtres et portes fenêtres triple vitrage en bois tropicaux. (INSTITUT TECHNOLOGIQUE FCBA)	43.44	m^2
		Rooflight	Domed rooflight (skylight), triple glazed, for residential buildings, 2m2 = 41,3kg (NRK)	242.43	kg
		Wooden Doors	Doors with wooden frame, interior, DONNEE PAR DEFAUT (DED)	65.50	m^2
RICS Category		**Element Description**	**Material Used**	**Total Qty**	**Unit**
External Areas and Elements	Materials and Constructions for External Areas	Geocellular	Geocellular system for sub-base drainage, Permavoid 150 (PVPP150) (Polypipe Civils & Green Urbanisation)	314	Unit
		Geotextile	Geotextile, generic, 312 g/m2 (1.02 oz/ft2), Composition: PP net, non-woven PE felt	78.49	m^2
		Rectangular Paving Tile	Rectangular paving stone, Finnish average, 2700 kg/m3 (KIVI ry)	78.49	m^2
		Red Brick	Red brick, average production, UK, 215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3 (Brick Development Association (BDA) Ltd (2019))	40	m^2
		Privacy Screen	Aluminium framed acrylic privacy screen, 6.8 kg/m2, DONNEE PAR DEFAUT (DED)	17.50	m^2
		Resin Bound Aggregate	Resin bound aggregate decorative paving system, 3-10 mm grain size, 100 - 150 mm, 1060 kg/m3, Addaset, Addabound, Terrabound and Terrabase (Addagrip Terraco)	34.50	m^2
		Concrete Paving	Concrete paving, 15.4 m2/m3, 96 units/m3, Andover Textured (Aggregate Industries)	15.30	m^2
RICS Category		**Element Description**	**Material Used**	**Total Qty**	**Unit**
Building Technology	Building Systems and Installations	ASHP	Air to Water heat pump, 95.8 kg/unit, PUZ-WM85VAA (Mitsubishi Electric)	3	Unit
		UFH	Underfloor heating system PEX, installation pipe spacing: 200mm, 30 mm insulation panel	500	m^2
		DHW	Hot water heater (water cylinder), air/air heatpump powered, KALIKO SPLIT TWH WH-E, KALIKO SPLIT WH 200 E - 7632382 KALIKO SPLIT WH 150 E - 7632383 (De Dietrich)	1	Unit
		Shower Head	Shower head, 0.3 kg/unit, HALO181-3 HALO181-4 (SMART AND BLUE)	7	Unit
		LED	LED overhead lighting system, 8.527 kg/unit, Flight Vitality (Whitecroft Lighting Ltd, Lancashire plant)	118	Unit
		WC	Ceramic toilet, 19.6 kg/unit, - DURAVIT : Starck 3 (420009; 452709; 220209). ME by Starck (452909; 453009). DuraStyle (455209; 457109). // - KOHLER : Struktura (EDE101-00 ; EDF101-00). Patio (EDV101-00 ; E1534-00). Brive (E4345-00) // - ROCA : DEBBA (A346998000 ; A34699L000). VICTORIA (A34630300S). (Association Française des Industries de la Salle de Bains)	7	Unit
		WHB	Acrylic washbasin, faucets not included, 16.4 kg/unit, DONNEE PAR DEFAUT (DED)	7	Unit
		Shower Tray	Enamelled stoneware shower tray, 35 kg/unit, 80 x 80cm (or 70 x 90) to 90 x 90 cm (SFISB)	7	Unit
		Ventilation System	Ventilation system for residential building, per m2 GFA	400	m^2
		VRF	Variable refrigerant flow (VRF) system, 75.15 kg/unit, 5 kW (One Click LCA)	2	Unit
		PV	Photo voltaic module (PV), Monocrystalline	31.7	m^2

SRE Registered Office | Greenforde Farm
Stoner Hill Road | Froxfield
Petersfield | Hampshire | GU32 1DY
01730 710044
info@sre.co.uk
www.sre.co.uk