

Appendix A – Table 1: Strategic Approach

ASPECT	PHASE / BUILDING / AREA	STEERING APPROACH	EXPLANATION	TARGET	SUPPORTING ANALYSIS /STUDIES / SURVEYS/ AUDITS
Circular Economy approach for the new development	Construction	Sustainable Sourcing	Project to use a Sustainable Procurement plan Materials to be sustainably sourced Local suppliers to be preferred where possible, to reduce transport distances	100% FSC/PEFC certified timber 100% concrete BES 6001 certified. Steel, where possible, to be sourced under the CARES scheme Other materials to be certified under an Environmental Management System (eg ISO 14001	Sustainable Procurement Plan
		Construction Waste	Contractor to record total construction waste and how it will be disposed of. Measures to be implemented to manage and reduce construction waste (eg segregation on site, greater use of pre-fabrication / MMC off-site)	< 7.5m3 construction waste (excl excavation) per 100m2 GIA	OWMS
		Durability	Durable, long lasting materials (eg brick for external walls) will be used.		Material Durability report.
		Optimise Material Use	Materials to be use efficiently to reduce wastage on site.		Sustainable Procurement Plan Material efficiency report
		Functional Adapatability	Design for adaptability and flexibility eg. possible to change heat source to District Heating should it become available	Ability to swap Heat Pumps for DHN. Ability to add passive cooling and/or NOx filtration to any apartment, without any opening up works required.	Functional adaptability strategy
		Reuse and recycling at end of life	Design for disassembly and deconstruction, to ensure materials are retained in a high value state.	95% Diversion from Landfill (GLA target)	Specifications and reports from Design Team
Circular economy approach for the Existing Site	Demolition	Maximise recovery, reuse and recycling of demolition waste	Concrete will be crushed, grated and stockpiled on site prior to being re-used Bricks will be cleaned for re-use Metal will be separated for recycling	>95% of demolition waste to be diverted from landfill	Pre-demolition audit Site Waste Management Plan
Circular economy approach for municipal waste	Operation	Storage and Segregation of Municipal Waste	On-site bin store to accommodate sufficient storage for both recyclable and landfill waste	>65% of municipal waste diverted from landfill	Operational waste management strategy

Appendix B – Table 2: Key Commitments

Layer	Site	Substructure	Superstructure	Shell/skin	Services	Space	Stuff	Construction Stuff	Summary	Challenges	Counter-Actions + who + when	Plan to improve quality
	A CONSERVE RESOURCES											
Minimising quantities of materials used	Re-use materials from demolition. Avoid major	Minimise volume of concrete used and use alternatives to high cement mix	Minimise volume of concrete used and use alternatives to high cement mix	Use recycled and or recyclable brick	Fabric first approach resulting in very small central plant.	Aerated block partitions instead of plasterboard, to allow greater longevity and end-of life re-use /	Induction hobs instead of gas to avoid need for gas to building.	Suppliers will agree to reduce packaging. Prefabrication where possible / MMC. JIT delivery to reduce stockpiling	Lean design principles. Prefabrication and standardisation where possible.	Ensure structural design (sub & super) optimised	Structural Engineer and Architect	When design finalised for tender compare to benchmarks
Minimise quantities of other resources (energy, water, land)	Increasing number of dwellings / habitable rooms maximises use of land	WLC Assessment to reduce Embodied Carbon.	WLC Assessment. A Functional Adaptation Strategy (FAS) will be produced – looking at expandability, adaptation and re-use.	WLC & FAS. Envelope will have enhanced U-values & airtightness (see energy statement) as part of Net zero Carbon in use	Fabric first energy strategy minimises plant space. Zero-Carbon in use strategy minimises operational energy Low flow fittings reduce water consumption to <105l/person	Unheated common parts reduce overall energy consumption	Induction hobs reduce energy consumption. EV chargers encourage uptake of low carbon transport	The contractor will be required to monitor and report energy and water use on site	A functional Adaptation Strategy Study and Plan will be adhered to. Monitoring and reporting of energy use on site. Net Zero Carbon in use will minimise operational energy.	Making sure the Heat Pumps perform as well in the real world as they do in the MCS certificates.	Design Team: Heat pumps to have; Airflow, Drainage.,24-hr operaton, Low water temps,	Detailed design of Heat Pump installation, not D&B. Named supplier at Tender. Insist on adequate commissioning before handover and seasonal commissioning after.
Specifying & sourcing responsibly	Sustainable Procurement Plan Prioritise locally sourced materials and labour where possible	Prioritise Certified products and materials -EPDs -Iso 14001 -BES6001 -FSC -PEFC -CARES Concrete GGBS content to be optimised Seek to use materials that can be reused at end of life	Prioritise products certified with BES6001 ‘Good’ Concrete GGBS content to be optimised Recycled content to be optimised	Prioritise façade systems with EPD’s	Use MCS certified Heat Pumps and PVs. Use MCS Certified installers. Prioritise products certified with -EPDS -PHC			Sustainable Procurement Plan to forma part of Tender package and contractual requirement. Review with contractor during pr construction supply chain engagement and contractor’s proposals sign-off	Use best practice when specifying and also when approving contractor’s proposals.	“Value Engineering”	Design Team to prepare Tender that insists on rigorous approvals procedure for Contractors proposals	See previous column
	SECTION B: DESIGN TO ELIMINATE WASTE (AND FOR EASE OF MAINTEMANCE)											
Designing for reusability /recoverability/longevity/adaptability/flexibility	-	The following aspects have been considered: Flexible floorplates Avoidance of toxic finishes Floor to ceiling heights Placement of core Standard components	The following have been considered: -MMC -Diissassmbly Strategy -Standardised Compnenents	A brick façade was chosen for its longevity, ease of cleaning and ease of disassembly at end of life	The following aspects have been considered: -Avoid HIU’s and / or HW Cyl’s in each apartment. -MVHR units maintained from corridor. -Central plant easily replaced. Easy NOx filters retrofit	Blockwork partition walls were chosen for their greater robustness, lower maintenance and reclaimability at end of life	-	Sustainable procurement plan Advice from Contractor and Supply Chain will be sought on ways to improve reusability /recoverability/longevity/adaptability /flexibility of the tendered design	Design spaces for flexibility whilst enabling access to all elements that could be re-used / replaced.	Avoid design solutions which could constrain disassembly / recovery	Disassembly recovery review (Design Team, Contractor and Supply chain) prior to commencement on site.	See previous

Designing out construction demolition, excavation, industrial and municipal waste arising		The ground floor slab and foundations will be demolished and crushed to a 6F2 specification for reuse within the site .	The following have been considered: - MMC - DfMA - Supplier take-back - JIT delivery	The following have been considered: - MMC - DfMA - Supplier take-back - JIT delivery	The following have been considered: - MMC - DfMA - Supplier take-back - JIT delivery	The following have been considered: - MMC - DfMA - Supplier take-back - JIT delivery		Accurately forecasting the amount of materials needed, using larger pack sizes to reduce the amount of packaging per unit and by using cardboard packaging instead of plastic where possible.	Designing out waste through regular / modular design. Consideration for just-in-time delivery, reducing packaging, and supplier take back scheme	Supplier take-back schemes are still not widespread in the UK	Review at Design Stage, and site stage.	Review procurement plan with contractor and contractor's supply chain
---	--	---	--	--	--	--	--	---	--	---	---	---

Layer	Site	Substructure	Superstructure	Shell/skin	Services	Space	Stuff	Construction Stuff	Summary	Challenges	Counter-Actions + who + when	Plan to improve quality
	SECTION C: MANAGE WASTE											
Demolition waste flow (how waste from demolition of the layers will be managed)	Aim to achieve 95% diversion from land fill	The substructure of the current buildings is likely to be shallow strip foundations, which will be dug out and crushed to be re-used on this site or off site.	Solid brick walls and potentially some steel will be considered for reuse. Otherwise will be recycled. The ground floor concrete slab and foundations are most likely constructed of concrete, all will be demolished and crushed to a 6F2 specification for reuse within the site. Clean concrete will be processed back to aggregate for concrete constructio	Mainly bricks. Where possible these will be salvaged and re-used either on or off site. The roofing materials are likely to be landfilled as they are fibre cement products. Where possible any insulation will be recovered at the recycling facility for reprocessing. Contaminated insulation will need to be forwarded for disposal.	Copper pipework: recycle PVC, pipework recycled Electrical installations: recycled Extract fans+ ductwork: recycled.		Some ferrous and non ferrous metal, suitable for reuse can be sold and reused.	Waste relating to the demolition phase will be managed through the implementation of a D&SWMP to be submitted prior to above-ground works, with a primary aim to minimise waste during this period. The contractor will support the segregation of recoverable and non-recoverable waste streams and indicative vehicle routes will be mapped, focusing on reducing vehicle mileage	Pre-demolition audit will be undertaken, targeting 95% of waste diversion from landfill.	Ensuring 95% of waste is diverted from landfill	Pre-demolition audit, pre contract engagement with demolition contractor	Demolition SWMP records
Excavation waste	No basement is proposed; no off-site soil removals proposed by the landscape Architect	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Layer	Site	Substructure	Superstructure	Shell/skin	Services	Space	Stuff	Construction Stuff	Summary	Challenges	Counter-Actions + who + when	Plan to improve quality
Construction waste (how waste arising from construction of the layers will be reused or recycled)	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	Aim to achieve 95% diversion from landfill. Overall project target waste arisals <6.5 ton/100m2 GIFA of non hazardous construction waste.	N/A	N/A	N/A
Municipal and industrial waste (how the design will support operational waste management)	Refuse storage planned in conjunction with site waste management strategy	-	-	-	-	-	Space will be provided for segregation of recyclables and bulk items so that they can be collected for recycling.	-	Space will be provided for segregation of recyclables and bulk items so that they can be collected for recycling.	Provide sufficient space for future improvements in council waste collections	Architect: As per previous column	As per previous column

Appendix C - Bill of Materials

Layer	Element	Material Quantity (kg)	Material Intensity (kg/m2 GIA)	Recycled Contentt (% by value)	Reused content (% by value)	Estimated Reusable Materials (kg/m2)	Estimated Recyclable Materials (kg/m2)	Source
Structure	Foundations							
	Concrete for piles , ground beams, retaining walls, GF slab	15,281,460	671	Min 20% ambition				RICS Building weight calculation by PQS
	Steel reinforcement	1,107,384	49	Min 60% ambition				RICS Building weight calculation by PQS
	Floors							
	Concrete for Upper floors, walls, columns & stairs	15,715,240	690	Min 20% ambition				RICS Building weight calculation by PQS
	Steel reinforcement	1,309,603	58	Min 20% ambition				RICS Building weight calculation by PQS
	Roof							
	Concrete	3,413,239	Durable, long lasting materials (eg brick for external walls) will be used.	Min 20% ambition				RICS Building weight calculation by PQS
	Steel reinforcement	284,437	12	Min 20% ambition				RICS Building weight calculation by PQS
Shell/Skin	Envelope							
	Ext Walls, Brickwork outer leaf	4,347,200	191	Min 20% ambition				RICS Building weight calculation by PQS
	Ext Walls, Blockwork inner leaf	1,358,500	60	Min 20% ambition				RICS Building weight calculation by PQS
	Glazing	244,560	11	Min 20% ambition				RICS Building weight calculation by PQS
Space	Block Partitions	1,779,700	78	Min 20% ambition				RICS Building weight calculation by PQS
	Ceilings plasterboard	204,948	9	Min 20% ambition				RICS Building weight calculation by PQS
	Floor finishes	2,277,200	100	Min 20% ambition				RICS Building weight calculation by PQS

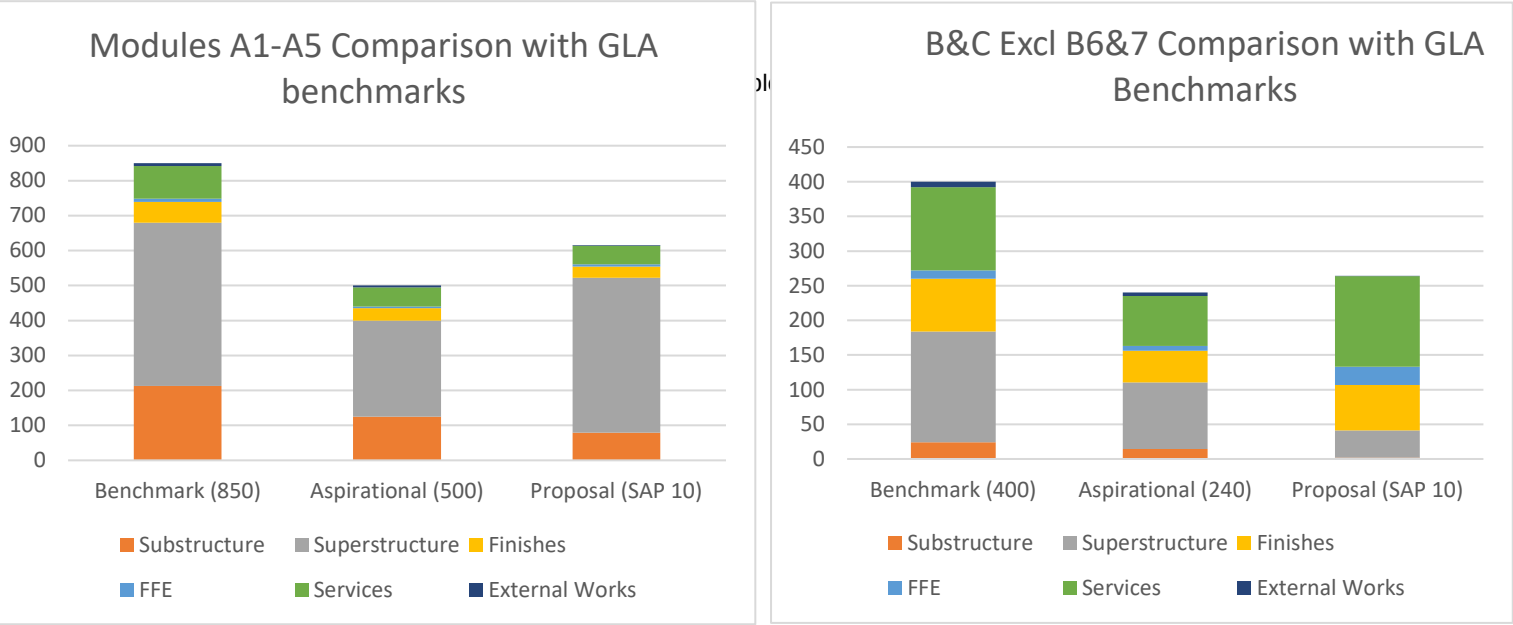
Appendix D - Recycling and Waste Reporting Form

Category	Total Estimate		Of which...				Source of Information...
	Total tonnage	t/m2 GIA	% reused or recycled onsite	% reused or recycled offsite	% not reused or recycled max 5%		
					% to landfill	% to other management	
Excavation Waste	4029	0.18	100%	0%	0%		Project QS Bill of Materials
Demolition Waste	13853	0.61	50%	45%	5%		Project QS Bill of Materials
Construction Waste	13663	0.60	95%	5%	5%		Project QS Bill of Materials
Tonnage			% reused on site	% recycled or composted off site	% not reused or recycled		
					% to landfill	% to other management	
Municipal Waste	247		0	65%	Max 35% and no recyclable or compostable waste		Project QS Advice
					35%	65%	
Industrial waste (if applicable)	N/A		N/A	N/A	Max 35% and no recyclable or compostable waste		N/A

Appendix E – Whole Life Carbon Assessment

A whole life carbon assessment has been undertaken for the Proposed Development. The assessment has been undertaken in line with the guidance given in the draft guidance provided by the GLA in the Whole Life-Cycle Carbon Assessments guidance Pre-consultation draft, April 2020.

The study demonstrates compliance with GLA benchmarks.



Notes on Methodology:
This assessment has been undertaken in line with the draft GLA guidance for undertaking WLC Assessments and therefore in line with the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment.

In line with the draft GLA guidance, the operational carbon emissions are calculated based on the Part L assessments undertaken for the Proposed Development as part of the Energy Strategy for planning. This encompasses carbon emissions related to both regulated and unregulated energy uses (in line with Part L definitions), accumulated over a 60-year study period.

To assess the embodied carbon for the project, a Life Cycle Assessment (LCA) tool – One Click LCA – has been used to make allocations for the anticipated materials quantities in an inventory analysis. The materials are represented within the model by using materials with associated Environmental Product Declarations (EPDs).

EPDs are produced by manufacturers and identify the carbon emissions of a product. By scheduling the materials proposed for the development, the overall carbon emissions can be approximated. It should be noted here that the LCA tool has a limited database of materials. In the scenario where a specified material isn't included in the database, the most similar material in terms of material composition is selected instead.

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

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

Together with these stages, the contribution of life cycle stage A5 has also been explored separately, giving an estimate of the emissions related to the construction. I.e. the electrical consumption and waste disposal. In line with the draft GLA guidance, the assessment includes the following elements:

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

In line with the guidance given in the draft GLA guidance to Whole Life Carbon assessments, the assessment has been undertaken based on two sets of carbon emissions: SAP 10 and "future decarbonisation". The first set of figures is based on the current status of the electricity grid and provides a point-in-time assessment. For materials manufactured in the UK, SAP 10 emission factors are used in line with the GLA's Energy Assessment Guidance. Products sourced from outside the UK use data appropriate to the local energy grid at that location.

This set of figures is used in the comparison to the WLC benchmarks. The second assessment uses the National Grid's latest edition (2019) of the Steady Progression scenario was chosen as this more closely maps the departments of Business Energy and Industrial Strategy (BEIS) declared grid carbon projection.

Inputs

The following lists the building elements covered by the assessment, in line with the Royal Institute of Chartered Surveyors (RICS) Professional Statement: Whole Life Carbon assessment for the built environment.

- 1.1 Substructure: Quantities obtained from PQS, Bill of materials, Type (steel reinforced concrete for piles, pile caps and, ground beams and GF slab) selected from OneClick database
- 2.1 Frame: Included in 2.2.
- 2.2 Upper floors: Quantities obtained from PQS' Bill of materials, Types (concrete frame) from OneClick Database
- 2.3 Roof and 2.4 Stairs included in 2.2
- 2.5 External Walls : Quantities obtained from PQS, Bill of materials, Types (Brick / block) from OneClick Database
- 2.6 Windows & External doors: Quantities obtained from PQS' Bill of materials, Types (block) from OneClick Database
- 2.7 Internal walls: Quantities obtained from PQS, Bill of materials, Types (block) from OneClick Database
- 2.8 Internal Door: Quantities from Architect drawings, type form OneClick database
- 3 Finishes: Quantities of screed and plasterboard from PQS' Bill of materials, type from OneClick database
4. FF&E: Quantities of kitchen & bathroom cupboards from Architect drawings, type form OneClick database
5. MEP: Quantities from MEP Engineer, type from oneClick.
- 6&7 Not used
8. External Works: Quantities from Landscape drawings, Type from OneClick

Lifecycle Modules:
A1-A3. Construction Materials: Raw material supply (A1) includes emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed. Loss of raw material and energy are also taken into account. Transport impacts (A2) include exhaust emissions resulting from the transport of all raw materials from suppliers to the manufacturer's production plant as well as impacts of production of fuels. Production impacts (A3) cover the manufacturing of the production materials and fuels used by machines, as well as handling of waste formed in the production processes at the manufacturer's production plants until end-of-waste state. *Calculated using EPD's which align with the exact product (where known) or the most applicable similar product*

A4. Transport: A4 includes exhaust emissions resulting from the transport of building products from manufacturer's production plant to building site as well as the environmental impacts of production of the used fuel. *Transport distances were estimated based on typical average transport distances based on material type & project location, provided by OneClick LCA*

A5 Construction Process: A5 covers the exhaust emissions resulting from using energy during the site operations, the environmental impacts of production processes of fuel and energy and water as well as handling of waste until the end-of-waste state. *Due to lack of site-specific construction data, the climate zone average construction impact was used and sized based upon scale of the development*

B1-B5 Maintenance and Replacement: The environmental impacts of maintenance and material replacements (B1-B5) include environmental impacts from replacing building products after they reach the end of their service life. The emissions cover impacts from raw material supply, transportation and production of the replaced new material as well as the impacts from manufacturing the replaced material and handling of waste until the end-of-waste state. *Use (B1) include the impact of refrigerant leakage at leakage rate of 3% a year and 98% end of life recovery. Other than MVHR filter replacement, maintenance (B2) and repair (B3) have not been considered due to accurate data being unavailable yet. Replacement (B4) and Refurbishment (B5) account for the technical service life of the building components "BCIS Life expectancy of building components"*

B6 Operational Energy. Both the Regulated energy use (heating, hot water, fans&pumps and lighting) and unregulated (appliances and cooking) were calculated for the energy statement, using Elmhurst Part L SAP software.

B7 Water consumption: based on Building Regulations Part G 'Enhanced consumption' of 105 l/p/d and multiplied by predicted occupancy of the development, using the EPD for Thames Water

C1-C4 Deconstruction: The impacts of deconstruction include impacts for processing recyclable construction waste flows for recycling (C3) until the end-of-waste stage or the impacts of pre-processing and landfilling for waste streams that cannot be recycled (C4) based on type of material. Additionally, deconstruction impacts include emissions caused by waste energy recovery. *C1 deconstruction/demolition and C2 (Transport) are based on default values. C3 (Waste Processing) and C4 (Disposal) use OneClick LCA's default end of life scenarios*

D External impacts/end-of-life benefits. External benefits for re-used or recycled material types include the positive impact of replacing virgin-based material with recycled material and the benefits of the energy which can be recovered from the materials. *D (End of Life) use OneClick LCA's default end of life scenarios.*

ASSESSMENT 1 RESULTS FROM ONECLICK-LCA

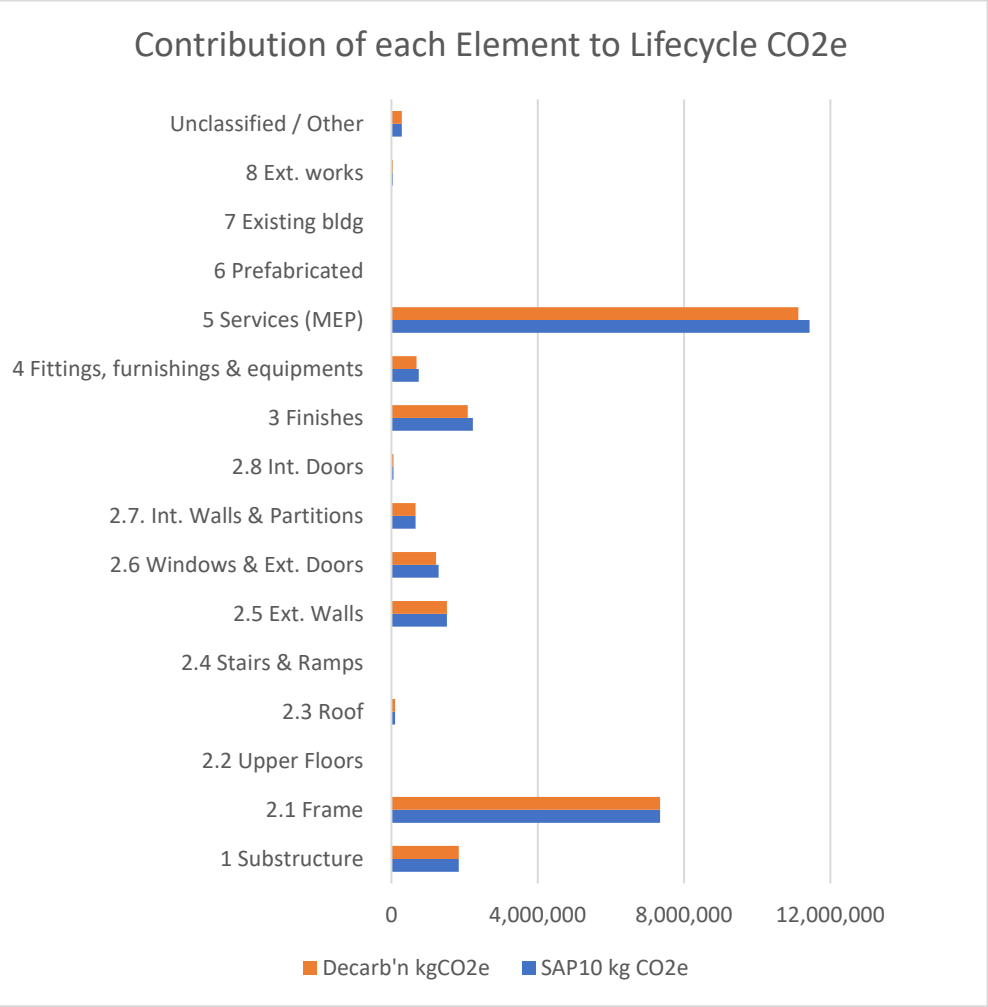
Result category	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material replacement	B5 Material refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1 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													77424.8				77424.8	
0.3 Supports																		
0.4 Groundworks																		
0.5 Diversion																		
1 Substructure	0	1530219	178753.9	84903.98			0							42404.61	2409.22		1838691	-2559796
2.1 Frame	0	6241273	623345.7	303088.1			0							161729.3	15369.96		7344806	-4820626
2.2 Upper Floors	0	1226.82	404.54	165.7			0	1226.82	0					14.56	11.08		3049.53	-5502.16
2.3 Roof	0	43861.17	32544.78	7044.85			0	12945.44	0					382.11	0	339.54	97117.9	
2.4 Stairs & Ramps	0	0		0			0								0		0	
2.5 Ext. Walls	0	1057525	370669.3	86852.03			0							3975.2	469.89		1519491	-762584
2.6 Windows & Ext. Doors	-1833.33	638256.3	7187.1	0			0	638256.3	0					9368.67	1907.55	0.52	1293143	-6401.76
2.7. Int. Walls & Partitions	0	498316	113589.4	46329.65			0							5207.71	615.58		664058	-43666.8
2.8 Int. Doors	-14070.6	27237.06	3446.55	0			0	27237.06	0					41.36	14181.71	5.62	58078.7	0
3 Finishes	0	549528.6	82180.46	100530.1			0	1246278	0					11631.27	236236.5	29.93	2226415	-969403
4 Fittings, furnishings & equipment	0	120119.5	23218.65	6860.34			0	555833.8	0					12538.52	28320	52	746943	-55084.8
5 Services (MEP)	0	1174337	22598.86	2151.51	114578	286.93	0	2858746	0	2108283	5146218	1241.7		5753.76	511.01	95.53	1.1E+07	-3.07E+06
6 Prefabricated																		
7 Existing bldg																		
8 Ext. works	0	27652.68	11105.55	0			0							1884.85	1135.24	154.94	41933.3	-6335.13
Unclassified / Other				840000	-559758	1960.56											282203	
TOTAL kg CO2e	-15904	11909552	1469045	1477926	-445180	2247.49	0	5340523	0	2108283	5146218	1241.7	77424.8	254932	301167.7	678.08	2.8E+07	-1.20E+07

ASSESSMENT 2 RESULTS FROM ONECLICK-LCA

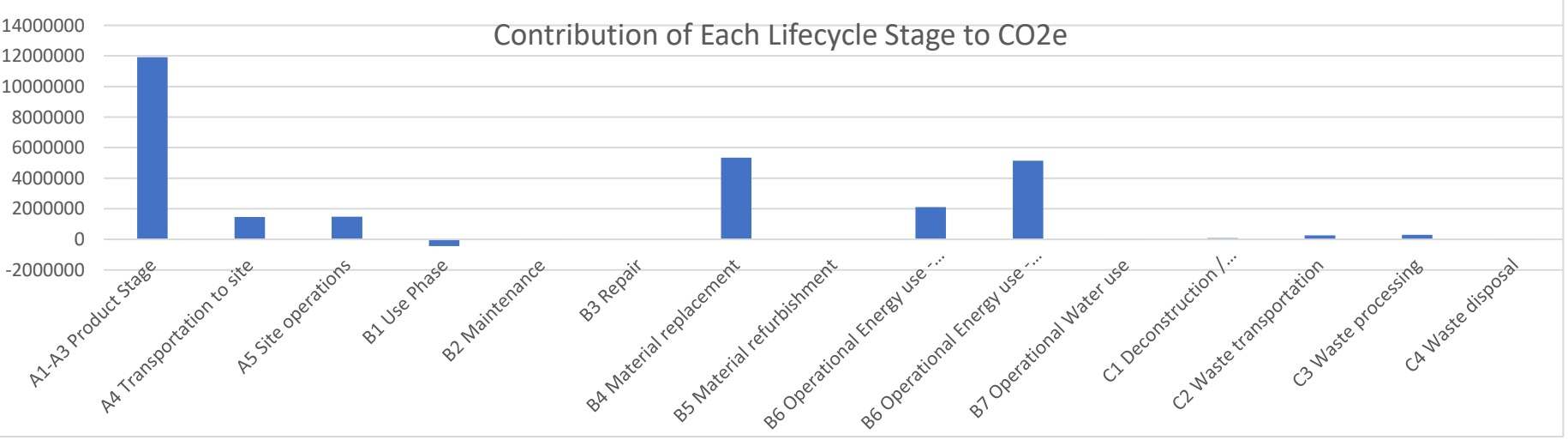
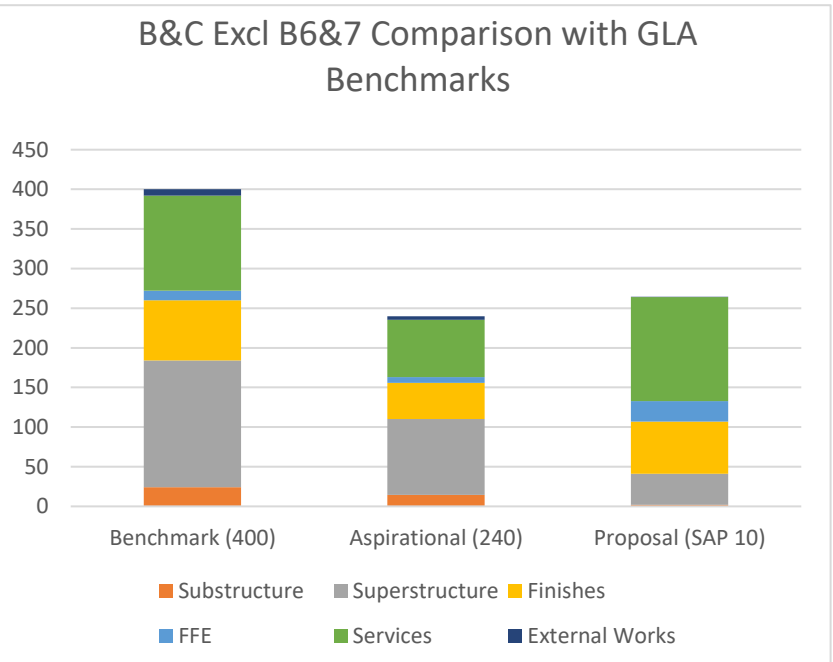
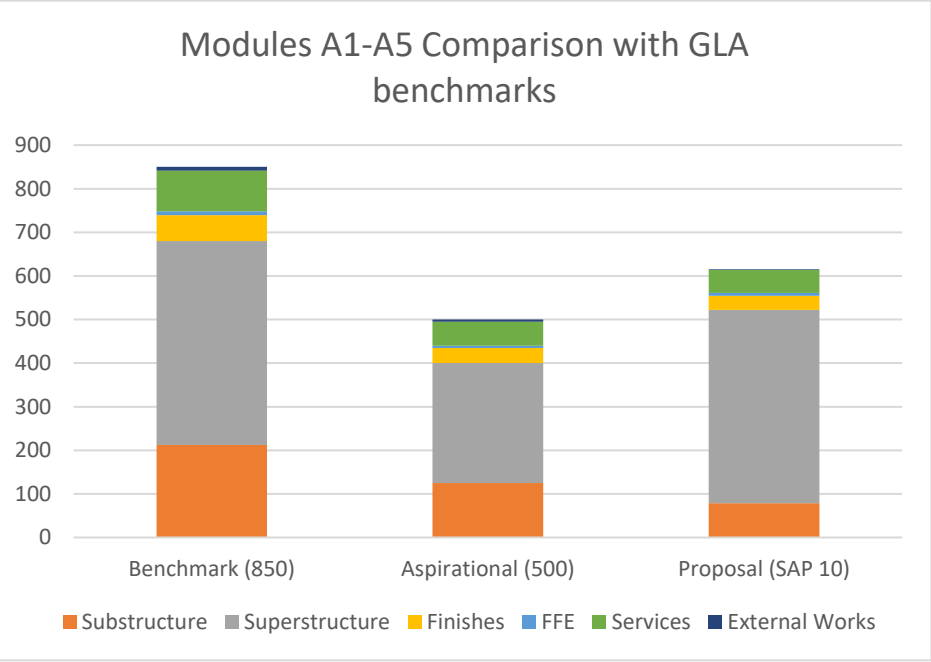
Result category	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material replacement	B5 Material refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1 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													77424.8				77424.8	
0.3 Supports																		
0.4 Groundworks																		
0.5 Diversion																		
1 Substructure	0	1530219	178753.9	84903.98			0							42404.61	2409.22		1838691	-2274579
2.1 Frame	0	6241273	623345.7	303088.1			0							161729.3	15369.96		7344806	-4282469
2.2 Upper Floors	0	1226.82	404.54	165.7			0	1083.5	0					14.56	11.08		2906.21	-4889.98
2.3 Roof	0	43861.17	32544.78	7044.85			0	11433.08	0					382.11	0	339.54	95605.5	
2.4 Stairs & Ramps	0	0		0			0								0		0	
2.5 Ext. Walls	0	1057525	370669.3	86852.03			0							3975.2	469.89		1519491	-678230
2.6 Windows & Ext. Doors	-1833.33	638256.3	7187.1	0			0	563691.5	0					9368.67	1907.55	0.52	1218578	-5653.87
2.7. Int. Walls & Partitions	0	498316	113589.4	46329.65			0							5207.71	615.58		664058	-38921.3
2.8 Int. Doors	-14070.6	27237.06	3446.55	0			0	24055.07	0					41.36	14181.71	5.62	54896.7	0
3 Finishes	0	549528.6	82180.46	100530.1			0	1109414	0					11631.27	236236.5	29.93	2089551	-865744
4 Fittings, furnishings & equipment	0	120119.5	23218.65	6860.34			0	496402.7	0					12538.52	28320	52	687512	-49149.4
5 Services (MEP)	0	1174337	22598.86	2151.51	114578	258.44	0	2547465	0	2108283	5146218	1241.7		5753.76	511.01	95.53	1.1E+07	-2.72E+06
6 Prefabricated																		
7 Existing bldg																		
8 Ext. works	0	27652.68	11105.55	0			0							1884.85	1135.24	154.94	41933.3	-5595.03
Unclassified / Other				840000	-559758	1960.56											282203	
TOTAL kg CO2e	-15904	11909552	1469045	1477926	-445180	2219	0	4753545	0	2108283	5146218	1241.7	77424.8	254932	301167.7	678.08	2.7E+07	-1.10E+07

COLLECTED RESULTS AND SUMMARY

Result category	22772 m2 GIFA			
	SAP10 kg CO2e	Decarb'n kgCO2e	SAP10 kg CO2e/m2	Decarb'n kgCO2e/m2
0.1 Toxic Mat.	0	0	0.0	0.0
0.2 Demolition	77,425	77,425	3.4	3.4
0.3 Supports	0	0	0.0	0.0
0.4 Groundworks	0	0	0.0	0.0
0.5 Diversion	0	0	0.0	0.0
1 Substructure	1,838,691	1,838,691	80.7	80.7
2.1 Frame	7,344,806	7,344,806	322.5	322.5
2.2 Upper Floors	3,050	2,906	0.1	0.1
2.3 Roof	97,118	95,606	4.3	4.2
2.4 Stairs & Ramps	0	0	0.0	0.0
2.5 Ext. Walls	1,519,491	1,519,491	66.7	66.7
2.6 Windows & Ext. Doors	1,293,143	1,218,578	56.8	53.5
2.7. Int. Walls & Partitions	664,058	664,058	29.2	29.2
2.8 Int. Doors	58,079	54,897	2.6	2.4
3 Finishes	2,226,415	2,089,551	97.8	91.8
4 Fittings, furnishings & equipment	746,943	687,512	32.8	30.2
5 Services (MEP)	11,434,801	11,123,492	502.1	488.5
6 Prefabricated	0	0	0.0	0.0
7 Existing bldg	0	0	0.0	0.0
8 Ext. works	41,933	41,933	1.8	1.8
Unclassified / Other	282,203	282,203	12.4	12.4
TOTAL kg CO2e	27,628,154	27,041,148	1,213.3	1,187.5



	Benchmark (850)	B'mark Lower	Aspirational (500)	Aspirational Lower	Proposal (SAP 10)	Proposal (Decarb.)
	850	750	500	450	615.5	615.5
Typical A1-A5						
25% Substructure	212.5	187.5	125	112.5	78.8	78.8
55% Superstructure	467.5	412.5	275	247.5	443.6	443.6
7% Finishes	59.5	52.5	35	31.5	32.2	32.2
1% FFE	8.5	7.5	5	4.5	6.6	6.6
11% Services	93.5	82.5	55	49.5	52.7	52.7
1% External Works	8.5	7.5	5	4.5	1.7	1.7
100%						
	Benchmark (400)	B'mark Lower (300)	Aspirational (240)	Aspirational Lower	Proposal (SAP 10)	Proposal (Decarb.)
	400	300	240	180	264.0	238.2
B&C excl B6&7						
6% Substructure	24	18	14.4	10.8	2.0	2.0
40% Superstructure	160	120	96	72	39.2	35.7
19% Finishes	76	57	45.6	34.2	65.6	59.6
3% FFE	12	9	7.2	5.4	26.2	23.6
30% Services	120	90	72	54	130.9	117.2
2% External Works	8	6	4.8	3.6	0.1	0.1



Appendix F - Sources used by One-click

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verification	Year	Country	Upstream database	Density	Product Category Rules (PCR)
Air / water heat pump, per unit	87.6 kg/unit, refrigerant liquid R410A	Eria-N	Chappée	INIES	CHAP-00006-V01.01-FR, 26320	PEP	EN15804+A1	Third-party verified (as per ISO 14025)	2021	france	ecoinvent		PEP-PCR-ed3-FR-2015 04 02
Autoclaved aerated concrete blocks	460-760 kg/m3	Aircrete	BPCF	IBU	EPD-BPC-20170093-CCD1-EN	EPD UK Manufactured Precast Aerated Concrete Blocks as produced by members of the Aircrete Products Association (APA) a product group of British Precast	EN15804+A1	Third-party verified (as per ISO 14025)	2017	unitedKingdom	GaBi	600	PCR Aerated concrete, 07/2014
Cabinet	51.6 kg/unit	22772	Aarsland Møbelfabrikk AS	EPD Norge	NEPD-1417-473-EN	EPD Flexi cabinet F331 Aarsland Møbelfabrikk AS	EN15804+A1	Internally verified	2017	norway	ecoinvent		PCR for furniture, NPCR 021
Concrete paving	15.4 m2/m3, 96 units/m3	Andover Textured	Aggregate Industries	International EPD System	S-P-00684	EPD for precast concrete paving	EN15804+A1	Third-party verified (as per ISO 14025)	2015	unitedKingdom	ecoinvent	2400	PCR 2013:02 Concrete, ver. 1.02, UN CPC 375
Electric radiator	per 1kW / unit			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2019	LOCAL	ecoinvent		EN15804+A1
Electricity cabling, room area m2				One Click LCA	-	One Click LCA	ISO14040	Internally verified	2013	LOCAL	ecoinvent		-
Elevator, 1000 kg capacity (5 floors), for passenger use	2.2 m x 1.6 m x 1.4 m, 724 tkm, 4961 kg/unit	N MonoSpace®	KONE	RTS	RTS_65_20	EPD KONE N MonoSpace®, KONE N MonoSpace® DX	EN15804+A1	Third-party verified (as per ISO 14025)	2020	china, OCLEPD	ecoinvent		RTS PCR (English version, 14.6.2018)
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	Durable, long lasting materials (eg brick for external walls) will be used.	MRPI	1.1.00023.2017	EPD Dulux Trade Supermatt	EN15804+A1	Third-party verified (as per ISO 14025)	2017	unitedKingdom	ecoinvent		EN15804+A1
Excavation works		kg or m3 of removed masses	Required for IMPACT calculations	One Click LCA	-		EN15804	Internally verified	2013	unitedKingdom	ecoinvent	1760	EN15804
Extensive green roof system	40mm, 23.34 kg/m2	Urbanspace	Knauf	IBU	EPD-KNI-20160071-CBA1-EN	EPD URBANSCAPE Extensive Green Roof System	EN15804+A1	Third-party verified (as per ISO 14025)	2016	germany	GaBi	583.5	PCR Part B Prevegetated green roof system for extensive use, 03/2016
External wood door				One Click LCA	-	OneClickLCA	EN15804+A1	Internally verified	2011	LOCAL	ecoinvent		-
Floor screed mortar, cement screed	1500 kg/m3, EPD coverage: > 1500 kg/m3		quick-mix Gruppe GmbH & Co. KG	IBU	EPD-QMX-20160208-IBC1-DE	Oekobau.dat 2017-I, EPD Mineralische Werkmörtel: Estrichmörtel - Zementestrich quick-mix Gruppe GmbH & Co. KG	EN15804+A1	Third-party verified (as per ISO 14025)	2014	germany	GaBi	1500	PCR Mineralische Werkmörtel, 10/2012

Galvanized profiled steel decking, for composite floor slabs/decks	1.2 mm sheet thickness, 17.03 kg/m2	ComFlor® 51 1.2mm	Tata Steel Europe, Tata Steel International (2021)	TATA Steel	EPD-TS-2021-008	EPD ComFlor® 51 1.2mm steel structural floor deck	EN15804+A1	Third-party verified (as per 2021 ISO 14025)	2021	unitedKingdom, unitedArabEmirates	GaBi		EN15804+A1
Generic aggregate for concrete, asphalt, fill material or landscaping application			Tarmac CRH	BRE	BREG EN EPD000105	EPD Generic Aggregate, Tarmac CRH 2016	EN15804+A1	Third-party verified (as per 2016 ISO 14025)	2016	unitedKingdom	ecoinvent	1600	EN15804+A1
Geotextile, generic	312 g/m2 (1.02 oz/ft2), Composition: PP net, non-woven PE felt			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent		EN15804+A1
Gypsum plasterboard, tapered or square edges	12.5 mm, 8.44 kg/m2, 675 kg/m3, 10µ water vapour resistance	Gyproc WallBoard	British Gypsum (2019)	International EPD System	S-P-00506, ver.2	EPD for Gyproc WallBoard, ver. 2	EN15804+A1	Third-party verified (as per 2019 ISO 14025)	2019	unitedKingdom	ecoinvent	675	PCR 2012:01 version 2.2 for Construction Products
Heat distribution system (water heat distribution) for residential building	per m2 GFA			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2019	LOCAL	ecoinvent		EN15804+A1
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	INIES	DDTH-00001-V01.01-FR, 9005	PEP	-	Third-party verified (as per 2018 ISO 14025)	2018	france	ecoinvent		EN15804+A1
Insulating Glass Unit (IGU), fire-resistant ,double glazed	CFL60 (5/5), 14 mm, 31 kg/m2	CFL60 (5/5)	VETROTECH	International EPD System	S-P-01704	EPD CONTRAFLAM LITE 60	EN15804+A1	Third-party verified (as per 2019 ISO 14025)	2019	unitedKingdom, germany, poland, switzerland	GaBi		PCR 2012:01 Construction products and Construction services, ver. 2.3
Interior wooden door with frame and sills	2040 x 830 mm (vantail), 13.509kg/m2, biogenic CO2 not subtracted (for CML)		JH INDUSTRIES	INIES	INIES_IBLO20180924_101740, 27030	FDES	EN15804+A1	Third-party verified (as per 2019 ISO 14025)	2019	france	ecoinvent		EN15804+A1
LED overhead lighting system	4.856 kg/unit	Flight Vitality	Whitecroft Lighting Ltd, Lancashire plant	RTS	RTS_136_21	EPD FLIGHT VITALITY FVWQ9Y34KEP	EN15804+A1, EN15804+A2	Third-party verified (as per 2021 ISO 14025)	2021	unitedKingdom, OCLEPD	ecoinvent		RTS PCR (English version, 26.08.2020)
Low temperature asphalt	-10 to 40 degC	Ultilow	Tarmac CRH	BRE	BREG EN EPD000108	EPD ULTILOW (Low Temperature Asphalt), Tarmac CRH 2016	EN15804+A1	Third-party verified (as per 2016 ISO 14025)	2016	unitedKingdom	ecoinvent	2400	EN15804+A1
PVC floor covering	4.5 mm, 5.003 kg/m2	Art Select, Monet, Van Gogh, Opus, Rubens, Michelangelo, HDC	Karndean	International EPD System	S-P-00879	EPD PRINTED LUXURY POLYVINYL CHLORIDE FLOOR COVERING	EN15804+A1	Third-party verified (as per 2016 ISO 14025)	2016	unitedKingdom	ecoinvent		PCR 2012:01 Construction products and Construction services, ver. 2, 03/03/2015

Perforated dense facing bricks, light coloured	215 x 100 x 65 mm, 2.375 kg/unit, 0.012 m3/unit, 1950 kg/m3, 22.5 N/mm2		Marshall's Bricks and Masonry	International EPD System	S-P-03536	EPD Perforated Dense Facing Bricks	EN15804+A1	Third-party verified (as per ISO 14025)	2021	United Kingdom	ecoinvent			PCR 2012:01 Construction Products and Construction Services, Version 2.33, 2020-09-18
Pipesystem, hot and cold water supply, PEX, per m2 GFA	0.13 kg/m2			One Click LCA	-	Ruuska et al. 2013. Rakennusmateriaalien merkitys ympäristövaikutusten kentässä. VTT.	EN15804	Internally verified	2016	LOCAL	GaBi			EN15804
Ready-mix concrete	C45/55	Mix A DC4 0.35 50%	Hanson Concrete	-	-	EPD Hanson concrete ready-mixed - Euston Station Early Works	-	Self declared	2021	United Kingdom	-	2400	-	
Ready-mix concrete	GEN3 (C20/25), CEM I		Hanson HCG	BRE	BREG EN EPD 000191	EPD GEN3 CEM I	EN15804+A1	Third-party verified (as per ISO 14025)	2018	United Kingdom	ecoinvent	2400		EN15804+A1
Ready-mix concrete, normal-strength, generic	C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2400		EN15804+A1
Ready-mix concrete, normal-strength, generic	C40/50 (5800/7300 PSI), 50% recycled binders in cement (400 kg/m3 / 24.97 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	2400		EN15804+A1
Reinforcement steel (rebar), generic	60% recycled content, A615			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	7850		EN15804+A1
Reinforcement steel (rebar), generic	97% recycled content (typical), A615			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	7850		EN15804+A1
Retaining wall, cast in-situ, L type	3 m (10 ft) height			One Click LCA		Adjusted data based on the specifications of the Swedish Transport Administration (Trafikverket). Original quantities were specified by Tyréns.				LOCAL	Ecoinvent			
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	-	-	EPD Stone Wool Thermal Insulation for buildings	EN15804+A1	Third-party verified (as per ISO 14025)	2021	United Kingdom	ecoinvent	22		EN15804+A1

Rock wool insulation panels, unfaced, generic	L = 0.035 W/mK, R = 2.89 m2K/W (16 ft2°Fh/BTU), 50 kg/m3 (3.12 lbs/ft3) (applicable for densities: 25-50 kg/m3 (1.56-3.12 lbs/ft3)), Lambda=0.0346 W/(m.K)		One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	50	EN15804+A1
Sanitary ceramics	washbasins: 16.3 kg, bidets: 21.7 kg, toilets: 27.1 kg, urinals: 17.9 kg, kitchen sinks: 23.2 kg, cisterns: 12.4 kg	DURAVIT AG	IBU	EPD-DUR-20150032-IBC1-EN	EPD Sanitary ceramic DURAVIT AG, Oekobau.dat 2017-I	EN15804+A1	Third-party verified (as per ISO 14025)	2015	germany	GaBi		PCR Sanitärprodukte aus Verbundwerkstoffen, 09/2017
Sewage water drainage piping network, per m2 GIFA (residential buildings)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2019	LOCAL	ecoinvent		EN15804+A1
Solar panel photovoltaic system, 3 000 Wp		Gaia Solar	One Click LCA	-	One Click LCA	ISO14040	Internally verified	2014	LOCAL	ecoinvent		-
Steel column - for steel and concrete buildings	Square HSS, S355SJ, lenght = 3.2 m		One Click LCA		One Click LCA generic construction definitions				LOCAL	Ecoinvent		
Structural hollow steel sections (HSS), cold rolled, generic	10 % recycled content, circular, square and rectangular profiles, S235, S275 and S355		One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2018	LOCAL	ecoinvent	7850	EN15804+A1
Ventilation ducting	per m linear, D: 125 mm (4.92 in)		One Click LCA	-	One Click LCA	EN15804+A1	Internally verified	2019	LOCAL	ecoinvent		EN15804+A1

Appendix G – OneClick Circular Economy Materials Report

Section	Result category	Material quantity kg	Material intensity kg/m2 GIA	Recycled content by value %	Reused content by value %	Estimated reusable materials kg/m2	Estimated recyclable materials kg/m2
1	1 Substructure	5,136,384	225.56	90	0		48.63
21	2.1 Superstructure: Frame	36,003,980	1581.06	63.05	0		1581.06
2.2	2.2 Superstructure: Upper Floors	2,535	0.11	0	0		0.11
2.3	2.3 Superstructure: Roof	225,415	9.9	14.68	0		0
2.4	2.4 Superstructure: Stairs and Ramps	0	0	0	0		0
2.5	2.5 Superstructure: External Walls	5,807,588	255.03	1.21	0	195.38	59.66
2.6	2.6 Superstructure: Windows and External doors	421,246	18.5	0.012	0		18.41
2.7	2.7 Superstructure: Internal Walls and Partitions	1,779,700	g materials (eg brick for external	0	0		78.15
2.8	2.8 Superstructure: Internal doors	21,600		0	0		
3	3 Finishes	5,716,939		6.01	0		218
4	4 Fittings, furnishings & equipments	803,040	35.26	0	0		
5	5 Services (MEP)	517,603	22.73	0	0		19.2
6	6 Prefabricated buildings and building units						
7	7 Work to existing building						
8	8 External works	504,000	22.13	3.32	0	4.74	4.74
0	0 Unclassified / Other						
total	Total	56,940,030	2500.44	20.74	0	200.12	2027.96