CANARY WHARF
GROUP PLC

NQ.PA.16

North Quay
Sustainability Statement

Max Fordham
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Executive Summary

Introduction

This Sustainability Statement sets out the sustainability ambition for the Proposed Development and how the key relevant sustainability policies are being addressed. One of the key principles of the Proposed Development is Sustainable Design.

Key Principle: Sustainable Design

A sensible and holistic approach incorporating biodiversity measures and sustainable strategies, to form an intelligent response to environmental issues relating to operational and embodied energy, circular economy principles, water use, pollution, ecology and habitat, and the promotion of health and wellbeing.

Building upon 30 years of successful regeneration of the area, Canary Wharf (North Quay) Ltd ("the Applicant") have set out a 2030 vision for delivering a sustainable mixed-use community at North Quay, one that responds to local context and prioritises environmental performance.

The Proposed Development is informed by a comprehensive set of sustainability and wellbeing policies in place as part of the Applicant's corporate sustainability strategy. Key sustainability priorities for the Proposed Development has been set by the Applicant to include Net Zero Carbon, applying circular economy principles, low embodied carbon materials and developing a site wide health and well-being strategy. All these documents are included within the appendices.

This statement sets out the design approach adopted to meet the Applicant's aspirations, including meeting BREEAM Excellent rating. Where there is limited detailed design information for individual buildings to demonstrate how specific requirements will be achieved e.g. minimising overheating risk at building level, the statement identifies actions to be investigated in future schemes.

As the Reserved Matters Applications come forward, the detailed design strategy and supporting documents for respective schemes will demonstrate how the Applicant's sustainability requirements have been secured.

Climate change adaptation

Project specific climate change risks have been identified through a climate change risk assessment (Appendix III). The design team identified that increase in temperature, extreme weather and water stress would require particular design decisions to reduce the need of cooling or to increase water efficiency.

In 2019 the Applicant commenced the process to establish approved Science Based Targets in line with the latest climate science, and the Paris Climate Accord. In May 2020 the Applicant submitted target proposals to the Science Based Targets Initiative (SBTI) - an absolute emissions target and a supplier target, as follows:

- The Applicant commits to reduce absolute Scope 1, 2 and 3 GHG emissions from downstream leased assets by 65% by 2030 from a 2017 baseline;
- The Applicant commits that 60% of its suppliers by emissions covering purchased good and services will have Science Based Targets by 2025.

The Applicant is also a member of the Better Buildings Partnership (BBP) Climate Change Commitment. With the support of BBP the Applicant developed guidance on net zero carbon pathway, including:

- Reduce scope 1 and 2 emissions in line with climate science, and work towards a Science Based Target approach to scope 3 emissions reduction
- Aspire to be net zero carbon across all scope 1 and 2 activities
- Aspire to be net zero carbon by 2050 for all developments and work towards becoming net positive carbon

The design approach adopted in the Proposed Development incorporates various design measures that would future-proof against climatic challenges while maintaining low carbon impact. The subsequent Reserved Matters Applications (RMAs) will demonstrate how risk levels for overheating are minimised based on modelling results as per TM52 (non-domestic buildings) and TM59 (domestic buildings) modelling using DSY 2 and DSY 3 or similar approved methodology. Further details are outlined below and expanded on in Appendix III – Climate Change Adaptation Risk Assessment.

Energy

The Proposed Development will be the Applicant's first Net Zero Carbon development. This will be achieved through reducing energy demand of each building, maximising the opportunities for passive cooling and integrating renewables. The Proposed Development will be all electric to reduce fossil fuel consumption. The North Quay Energy Statement (NQ.PA.17), submitted as part of this Outline Planning Application (OPA) offers further details on the net zero strategy for the Site.

Non-domestic: The New London Plan target of 15% carbon emissions reduction at 'Be Lean' has been achieved. However, the percentage savings achieved at 'Be Green' stage are far higher than the minimum 35% required by the London Plan. The current non-domestic emissions savings following 'Be Green' stage is 47%.

Domestic :The New London Plan target of 10% carbon emissions reduction at 'Be Lean' has been achieved. However, the percentage savings achieved at 'Be Green' stage are far higher than the minimum 35% required. The current domestic emissions savings following 'Be Green' stage is 53%. This increases to a 64% saving with the contribution from the secondary waste heat from the non-domestic buildings.

The Applicant has signed up to the Better Building Performance Partnership Climate change commitment to be net zero carbon. To this end the Proposed Development will focus on delivering realistic operational energy including following the principles of Design for Performance including implementing Post Occupancy Evaluation on all new buildings. Implementation of this as per the Applicant's Corporate (See Appendix IX) Sustainable Design and Construction Strategy will be demonstrated as the Reserved Matters Applications come forward for individual schemes.

Whole lifecycle carbon strategy

Initial life cycle analysis (LCA) (Appendix IV) reviewed a 'base case' for a similar development to the Proposed Development and proposed an alternative 'best case' scenario to reduce embodied carbon for sub-structure, frame, external walls and upper floors.

The RMAs for individual plots will review the 'best case' and provide a full a full LCA based on the RICS Whole Life Carbon assessment method in order to demonstrate how lifecycle carbon in use is optimised.

Water and surface water run-off

A key concept for the Proposed Development is the integration of sustainable drainage within the green infrastructure. Surface water run-off is managed through tree planting, shrubs, landscape geometry and permeable grounds are integral part of the design. Details over the reduction of surface water runoff through planting and Sustainable drainage systems to be found within Canary Wharf Group's Biodiversity Action Plan 2018 – 2028[i], and the Flood Risk Assessment and Drainage Strategy (NQ.PA.30).

High-efficient sanitaryware will be specified at building level to reduce water consumption to meet the residential benchmark of 105 L/person/day and at least 2 Wat 01 BREEAM credits (25% reduction over a baseline). Where feasible, rainwater collection will be considered to reduce unregulated demands such as irrigation for planting or toilet flushing.

[i]Available online at https://group.canarywharf.com/corporate-responsibility/biodiversity-action-plan/

Health and wellbeing

Wellbeing is at the heart of the Applicant's approach to design and delivery and the Applicant's comprehensive Health and Wellbeing Strategy (Appendix VIII) applies to all stages of development.

The Proposed Development addresses health and wellbeing principles through the following design interventions:

- Playable space is integrated into open spaces with opportunity for engagement, predominantly pedestrian routes, and some internal play space and activities.
- Biodiversity enhancement has been considered from the start of the development process. The landscape design responds to these requirements by creating several specific outdoor spaces that have been planned in relation to the wider open and green space context. A tree strategy has developed with a broad selection of trees provided.
- The development has been designed in line with the ten healthy streets indicators to create an environment which will encourage walking, cycling and public transport. A Healthy Streets Transport Assessment (TA) has been undertaken in support of this OPA which considers all aspects of movement by employees, visitors and residents
- Overheating is managed externally through self-shading and greenery. Internally heat distribution will be designed to minimise pipe lengths in communal corridors. Ultra-low temperature ambient loop networks for residential buildings and very low temperature distribution networks for commercial buildings are proposed. Developments will consider shading measures such as overhanging balconies. The Indicative Scheme considers external shading on all buildings on critical facades. Where air quality and noise levels permit, all buildings are expected to have openable windows with additional security and rain protection details to allow for purge ventilation at night. Noise levels across the Site means that active cooling will be required in all buildings to control overheating. During design development modelling will be undertaken in line with the guidance in CIBSE TM59 and TM49 and as required by the GLA in the Energy Assessment Guidance (2018) in the RMAs

Materials, Circular Economy Statement and Waste

The Applicant has produced a Sustainable Design and Construction Strategy and Sustainable and Healthy Materials brief (Appendix VII), and a Sustainable Procurement Plan (Appendix VI) which set a detailed vision for reducing material related lifecycle environmental impacts and enable a circular economy. As the Reserved Matters Applications come forward, the detailed design strategy and supporting documents for respective schemes will demonstrate how the materials and circularity requirements have been achieved.

The detailed design for individual plots will follow design for waste efficient principles to meet zero waste to landfill for the proposed development. Based on this appropriate Key Performance Indicators (KPIs) and targets for waste will be included in contracts and construction site waste management plan.

Circular Economy Alignment

A circular economy workshop was held to identify opportunities on the Site alongside the Applicant's policies this forms the basis of the Circular Economy Statement (see – Chapter 8). Measures will be implemented where possible through relevant BREEAM credits

Maximising Residual Value on the Existing Site

The Site will be investigated in detail at the detailed design and RMA stages and any materials that can be reused in terms of providing piling platforms or suitable for backfilling, subject to storage space on Site, will be used. The concrete and reinforcement from the Quay demolition will be separated to allow steel being recycled.

Existing buildings will be deconstructed and reused in a similar or more valuable state where possible, or alternatively resale or donation.

Potential reuse options were identified including steel edging from recovered metal from on Site, Block paving from recovered materials and excavated & treated soil on site.

Opportunities related to disassembly and recycling of existing structures includes recycling aggregates from false quay and using existing rocks in landscape or as aggregates. Procurement related actions for the demolition phase have also been set out.

Maximising Lifetime value of New Buildings, Infrastructure and Public Realm

The Site will be developed in Phases over up to 2029. A hierarchical waste management strategy will be employed during the design, construction and operation of the Proposed Development.

The implementation of key principles of circular design strategy – Longevity, Adaptability, Flexibility, Reusability and Recoverability will be reviewed at detailed design stage for each plot in the relevant RMA. This includes employing where practice offsite fabrication to reduce waste, and lean design carried out to reduce to a minimum quantity of material used.

Designing for longevity will be a key consideration for rarely changing elements (lifespan in excess of 25 years).

Designing for adaptability will be a key consideration for intermediate lifespan elements (5-25 years).

The detailed design for floor plates within individual plots will incorporate flexibility within fit-out elements and services which are likely to change during tenant fit-out [e.g. retail] in less than 5 years to allow for reuse or recycle.

Site wide resource sharing and digital approach

The design will consider the resource requirements for individual phases and identify ways for sharing to allow reuse of materials and existing buildings that are in temporary use from previous phases. Material data collection or 'tagging' of building elements and materials will be considered on a case by case basis expected to become viable within the timeframe of the Proposed Development and therefore become part of the Applicant's internal resource management strategy.

Waste

The detailed design for individual plots will follow design for waste efficient principles to meet zero waste to landfill for the Proposed Development. Based on this appropriate Key Performance Indicators (KPIs) and targets for waste will be included in contracts and construction site waste management plan.

Transport

The Proposed Development has reduced the dominance of vehicles, by proposing a car-free development aside from accessible parking (The Draft London Plan - Intend to Publish version (December 2019) - T6 'Car Parking) and improving the connectivity to the adjacent neighbourhoods and public transport by prioritising of pedestrian and cycling routes (Draft London Plan - T2 'Healthy streets') with supporting parking provision as per Draft London Plan (Policy S.TR1 and T5 'Cycling').

Air Quality

Air quality survey and modelling have been undertaken to identify the levels of existing air pollution on the Site as required in Part B.2c of the Draft London Plan (Policy SI1 and Policy D.ES2-2). The Proposed Development has carefully considered the implications of these factors, and incorporated strategies to mitigate potential impact of the Site.

The Proposed Development will have a non-significant effect on air quality, during both the construction and operational phases. The Proposed Development is better than 'air quality neutral' (NQ.PA.8 Environment Statement), in line with the LB Tower Hamlets Planning

Obligations Supplementary Planning Document (September 2016), Policy D.ES2-1 requirement to meet ‘air quality neutral’ standard.

The Applicant’s Biodiversity Action Plan sets out ambitious targets for increasing biodiversity net gains across Canary Wharf Estate. The Proposed Development’s landscaping and design teams have been working closely with the specialist ecologist to maximise net gains across the scheme. The design, however, also considers the potential of air-pollution from Aspen Way. This has influenced the type of vegetation proposed to be able to mitigate and filtrate pollutants,

The Proposed Development brings publicly accessible green and open spaces into an area that is limited in access to green areas and has incorporated green energy through a comprehensive strategy utilising multiple space types including walls and roofs.

Environmental Certification

The Applicant recognises the value of pursuing environmental certification as validation of sustainable development. All the Applicant’s residential developments have been certified against Code for Sustainable Homes (CfSH) methodology and have achieved Level 4 status. However, recognising the evolving nature of certification and corresponding requirements the Applicant is committed to adopt a relevant up-to-date methodology, such as Home Quality Mark (HQM). The Site is targeting BREEAM Excellent for non-residential developments

1 Introduction

Overview

1.1 Canary Wharf (North Quay) Ltd ("the Applicant") are submitting applications for Outline Planning Permission (OPP) and Listed Building Consent (LBC) to enable the redevelopment of the North Quay site, Aspen Way, London ("the Site"). Two separate applications are being submitted for the works. The applications will seek permission for:

- Application NQ.1: Outline Planning Application (all matters reserved) - Application for the mixed-use redevelopment of the Site comprising demolition of existing buildings and structures and the erection of buildings comprising business floorspace, hotel/serviced apartments, residential, co-living, student housing, retail, community and leisure and sui generis uses with associated infrastructure, parking and servicing space, public realm, highways and access works.
- Application NQ.2: Listed Building Consent - Application to stabilise listed quay wall and any associated/necessary remedial works as well as demolition of the false quay in connection with Application NQ.1

1.2 The Outline Planning Application ("OPA") includes three Control Documents which define the Specified Parameters for the Proposed Development. These Control Documents are – (1) the Development Specification; (2) the Parameter Plans; and (3) the Design Guidelines.

1.3 At the time of making the OPA, the Applicant is unable to determine exactly how much of the Proposed Development is likely to come forward in which land use and for this reason the OPA is made for ranges of floorspace within each proposed land use category. These ranges ensure that the Proposed Development must deliver a quantum of development within each land use within the range that has been specified.

1.4 The Parameter Plans indicate which Development Zones may be suitable for which use and therefore manage where the proposed uses could arrive on the OPA Site. The Parameter Plans also identify features such as maximum building heights; areas of public realm; and access and circulation routes. The Parameter Plans are set up to provide a level of flexibility for the detailed design of the scheme at a later date which will need to be approved by the local planning authority through subsequent Reserved Matters Applications ("RMAs").

Site Description

1.5 The North Quay site ("the Site") is located in the north of the Isle of Dogs, within the administrative boundary of the London Borough of Tower Hamlets (LBTH), at Canary Wharf. It is bounded by Canary Wharf Crossrail Station to the south, Aspen Way (A1261) to the north, Hertsmere Road to the west and Billingsgate Market to the east. The West India Quay Docklands Light Railway

(DLR) station and Delta Junction are located on the western side of the Site and the Site also incorporates parts of North Dock, Upper Bank Street and Aspen Way.

1.6 The Site is 3.28 hectares (ha) in area. Currently the Site comprises mostly cleared land, being previously used as a construction laydown site for the Canary Wharf Crossrail Station. There are some temporary uses currently on site, including the LBTH Employment and Training Services, WorkPath and advertising structures.

1.7 A Grade I Listed brick dock wall (Banana Wall) exists below the surface of part of the Site, which originally formed the dockside until it was extended over to the south.

1.8 Existing access to the Site for vehicles is from Upper Bank Street to the east and Hertsmere Road to the west, which both link to Aspen Way. The Site is not currently accessible to the public, however pedestrian routes are located on each side of the Site (Aspen Way, Hertsmere Road, Upper Bank Street, and the western part of the dockside to the south). The Aspen Way footbridge which leads to Poplar also lands on the southern side of Aspen Way.

1.9 The Site is highly accessible by public transport. The West India Quay DLR station is located on the Site, the Poplar DLR station is accessed directly from the Aspen Way Footbridge, the Canary Wharf Crossrail Station is located immediately to the south of the Site, beyond which are the Canary Wharf underground and DLR stations. The Site currently has a PTAL level of 5. This will rise to 6a when Crossrail services commence at Canary Wharf. The level of 6a is categorised as 'Excellent'.

1.10 Beyond the Site, a Marriot Hotel (35 storeys) and 13 storey residential building are located to the west, adjacent to the DLR tracks. Beyond these, along Hertsmere Road is a cinema, museum, shops, restaurants and other leisure facilities, forming part of the West India Quay Centre. Billingsgate Market is located to the east of the Site, on the opposite side of Upper Bank Street. Billingsgate Market is identified as a Site Allocation (4.2: Billingsgate Market) for redevelopment in LB Tower Hamlet's Local Plan.

1.11 To the north of the Site on the other side of Aspen Way are the Tower Hamlets College and The Workhouse leisure facility. They comprise part of a Site Allocation (4.1: Aspen Way) for redevelopment in LB Tower Hamlet's Local Plan. In close proximity to these there are lower rise residential properties (some with shops beneath them) as well as the Poplar Recreation Ground.

1.12 Beyond the Crossrail station to the south of the Site is the Canary Wharf commercial core including the HSBC (200m AOD), Bank of America and One Canada Square buildings (235m AOD)

Listed Building Works

1.13 Towards the south of the Site, the edge of the dock is defined by a quay wall known as the Banana Wall. The brickwork has a profile and counterfort buttresses, on a gravel bed. The Banana Wall was constructed between 1800-1802 and was Listed Grade I in 1983.

1.14 The Proposed Development will span over the Banana Wall with piles on either side of the wall providing support to the new structures. The new structures will leave a void or compressible material above to avoid permanent loading of the wall. The adjacent existing false quay deck will be removed. The excavation of the basement may induce ground movements affecting the Banana Wall, as such any necessary stabilisation works will be undertaken to ensure movements are within satisfactory limits. Remedial works to the Banana Wall will also be undertaken if required.

Purpose of this document

1.15 The Sustainability Statement is a submission document as part of NQ.1 Outline Planning Application for the mixed-use redevelopment of the North Quay Site. The sustainability design approach for the Proposed Development is holistic and branches out towards all aspects of the works. This document also acts as an intersection of various consultants' reports, including Canary Wharf Group's Sustainability policies.

1.16 This statement sets out the design approach adopted to meet the Applicant's aspirations. These are concerned with the wider Site and the Proposed Development only. Where there is limited detailed design information for individual buildings to demonstrate how specific requirements will be achieved e.g. minimising overheating risk at building level, the statement identifies actions to be investigated in future schemes.

1.17 The BREEAM Shell & Core pre-assessment application are concerned with the wider Site and the Proposed Development only, and any induvial building design would require further considerations.

1.18 As the Reserved Matters Applications come forward, the detailed design strategy and supporting documents for respective schemes will demonstrate how the Applicant's sustainability requirements have been secured.

Design and Access Statement

1.19 For a summary on the design and the sustainability strategy in the context of the rest of the technical constrains, refer to NQ.PA.07 Design and Access Statement.

2 Sustainability Vision

2.1 This Sustainability Statement sets out the sustainability ambition for the Proposed Development and how the key relevant sustainability policies are being addressed. One of the key principles of the Proposed Development is Sustainable Design.

Key Principle: Sustainable Design

A sensible and holistic approach incorporating biodiversity measures and sustainable strategies, to form an intelligent response to environmental issues relating to operational and embodied energy, circular economy principles, water use, pollution, ecology and habitat, and the promotion of health and wellbeing.

2.2 Building upon 30 years of successful regeneration of the area, the Applicant has set out a 2030 vision for delivering a sustainable mixed-use community that responds to local context and prioritises environmental performance. The Proposed Development is informed by a comprehensive set of sustainability and wellbeing policies in place as part of the Applicant's corporate Sustainable Design and Construction strategy (Appendix IX).

Canary Wharf Group Policies

2.3 The Applicant, as a subsidiary of CWG, has a well-established Sustainability Strategy (Appendix IX) that applies to all development works. The strategy embeds sustainability in design process, construction activities, procurement and performance. As a developer the Applicant is able to build on experience of delivering high quality environments that meet and surpass challenging targets set out in the Draft London Plan. The Applicant is committed to improving the Estate for the benefit of both people and biodiversity, achieving a synergy of technical skill and considerate approach.

2.4 Both the Applicant and the CWG sees North Quay as an opportunity to develop a truly Sustainable Estate. This vision is defined by the Applicant's approach to wellbeing and biodiversity, climate change adaptation, improving air quality and the ambition to achieve net zero carbon and establish a local circular economy. Internal design workshops carried out for the Proposed Development identified number of opportunities to develop a detailed implementation plan for circular economy and other sustainability aspirations through close collaboration with the local community and prospective residents.

Wellbeing and Biodiversity

2.5 Wellbeing is at the heart of the Applicant's approach to design and delivery. The Applicant's comprehensive Health and Wellbeing Strategy (see - Appendix VIII) applies to all stages of development. The strategy focuses on maximising natural light, thermal comfort and connection

with nature by creating a high-quality biodiversity rich environment for all. Public realm will offer recreational and reflective spaces. The Applicant's Biodiversity Action Plan[ii] sets out ambitious targets for increasing biodiversity net gains across Canary Wharf Estate. The Proposed Development's landscaping and design teams have been working closely with the specialist ecologist to maximise net gains across the scheme.

Net Zero Carbon

2.6 The Proposed Development will be the Applicant's first Net Zero Carbon development as outlined in the energy Statement. This will be achieved through reducing energy demand of each building, maximising opportunities for passive cooling and integrating renewables. A significant proportion of the Applicant's commitment to net zero rests on engagement with the tenants and residents. The Applicant recognises that everyone has a part to play in achieving ambitious carbon reduction targets and are keen to unlock potential for productive and innovative collaboration. The zero carbon requirements set out by the Draft London Plan and the 45% reduction in carbon relative to Part L 2013 of the Building Regulations, required by LBTH Local Plan Policy D.ES7: A zero carbon borough. The North Quay Energy Statement (NQ.PA.17) submitted as part of this application offers further details on how the Applicant intends to implement a net zero strategy at North Quay.

Materials and Waste

2.7 The Applicant's aspiration is to achieve true circularity applies to both waste and design development strategies. The Applicant targets zero waste to landfill in operations and construction. Working closely with suppliers and tenants the Applicant has been able to achieve Zero Plastic Community status. Principles of circular economy are embedded in all of the Applicant's building assets by maximising opportunities for adaptability and reuse as well as responsible procurement. Detailed Responsible Procurement Plan (see - Appendix VI) has been developed alongside North Quay Circular Economy Statement (see – Chapter 8). Requirements detailed in these plans will be integrated into specifications as design progresses. Whole life and embodied carbon assessments of the development will enable further integration of circular economy principles. Life Cycle Assessment provided in Chapter 5 – Energy details the Applicant's approach to reducing embodied carbon and optimising material efficiency across the development.

2.8 The Applicant has out a defined set of requirements for material specification to reduce impact of materials on wellbeing. See Appendix VII Sustainable and Healthy Materials Brief.

Climate Change Adaptation

2.9 The Applicant takes a proactive approach to climate change, focusing on adaptation measures in line with the latest industry guidance. Design strategy detailed in the Climate Change Adaptation Risk Assessment (see - Appendix III) focuses on addressing risks of flooding and

[ii]Available online at https://group.canarywharf.com/corporate-responsibility/biodiversity-action-plan/

overheating as well as reducing potable water use and energy demand. Sustainable drainage solutions and rainwater harvesting systems will be integrated into buildings and the public realm to reduce cumulative impact of development, with biodiversity features contributing to the local microclimate. Requirements detailed in the assessment will be integrated into specifications as design progresses.

Air Quality Positive

2.10 Air quality is integral to the Applicant's approach to wellbeing. The Applicant is a founding member of Business Clean Air Task Force and a keen advocate for achieving a positive impact on local air quality through all electric building systems and logistics. The Applicant intends to extend the network of air quality sensors to North Quay and integrate biodiversity features such as a planted wall along Aspen way that will act as a natural air filtration system.

2.11 The air quality assessment has considered sensitive locations within the Proposed Development at a range of locations, which are based on the GA plans produced for the Indicative Scheme, but take account of the parameter plans for the Site and possible land uses that will be brought forward at RMA stage. The locations of the receptors within the Proposed Development are therefore representative of the Indicative Scheme and do not identify any potential exceedances of relevant air quality objectives at the Site.

Environmental Certification

2.12 All of the Applicant's residential developments have been certified against Code for Sustainable Homes (CfSH) methodology and have achieved Level 4 status. However, recognising the evolving nature of certification and corresponding requirements the Applicant is committed to adopt a relevant up-to-date methodology, such as Home Quality Mark (HQM). The Site is targeting BREEAM Excellent for non-residential developments.

3 Planning Policy Context

The Proposed Development is submitted within the context of national, regional and local planning policies and guidance that seek to address the challenges of climate change and sustainable development. The policies outlined below by the Government, the Mayor of London, and LBTH are endeavouring to improve the way energy and other resources are used in London's building stock. Individual chapters of this Sustainability Statement outline specific policy criteria and provide a response on how the requirements are satisfied in the Proposed Development. See Appendix II for detailed Policy Response Mapping.

Figure 1 Hierarchy of legislative sustainability policy

National Legislation and Policy

The Climate Change Act (2008)

3.1 The Climate Change Act (2008) commits the UK to a reduction of greenhouse gas emissions (GHGs) by at least 80% by 2050 from 1990 levels.

3.2 The UK legislated to bring all greenhouse gas emissions to net zero by 2050, under Climate Change Act 2008 Order 2019, Net Zero Emissions law.

National Planning Policy Framework (2019)

3.3 The National Planning Policy Framework (NPPF) sets out the Government's planning policies on the delivery of sustainable development through the planning system and how these are expected to be applied.

Section 9, Paragraph 108 to 111, Promoting Sustainable Transport - Developments to consider the environmental implications of traffic and mitigate the impacts.

Section 14, Meeting the challenge of climate change, flooding and coastal change - Planning system should support the transition to low carbon future in a changing climate, taking full account of long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and risk of overheating from rising temperatures.

Section 15, Conserving and enhancing the natural environment - Policies and decisions should contribute to enhance the natural and local environment.

Current 2013 Part L of the Building Regulations for England & Wales:

3.4 Reduction in CO_2 emissions of 9% compared to 2010 regulations for non-domestic and 6% for domestic. Further considerations are made under the light of the Future Homes Standard, and potential changes to the Part L Building Regulations.

Regional Policy

The London Plan – the Spatial Development Strategy for London Consolidated with Alterations since 2011 (Adopted March 2016)

3.5 The following core policies in the current London Plan are deemed relevant to the sustainability strategy of the Proposed Development.

Policy 5.1 'Climate Change Mitigation' - London's carbon dioxide emissions are to reduce by 60% (below 1990 levels) by 2025 and the GLA will monitor progress towards its achievement annually.

Policy 5.2 'Minimising Carbon Dioxide Emissions'- Developments should reduce carbon dioxide emissions in accordance with the energy hierarchy.

Policy 5.3 'Sustainable Design & Construction' – The highest standards of sustainable design and construction should be achieved to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

Policy 5.6 'Decentralised Energy in Development Proposals' - Major development proposals should select energy systems in accordance with the following hierarchy:

- Connecting to existing heating or cooling networks
- Site-wide CHP network
- Communal heating and cooling

Policy 5.7 'Renewable Energy' - All major developments to reduce carbon dioxide emissions by at least 20% through the use of on-site renewable energy generation wherever feasible.

Policy 5.9 'Overheating and Cooling'- Reduce the impact of the urban heat island effect in London and encourage the design of places and spaces to avoid overheating and excessive heat generation and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Policy 5.10 'Urban Greening' - Promote and support urban greening such as new planting in the public realm (including streets, squares and plazas) and multifunctional green infrastructure, to contribute to the adaptation to, and reduction of, the effects of climate change.

Policy 5.12 'Flood Risk Management' - Developments are to comply with the flood risk assessment and management requirements set out in the NPPF.

Policy 5.13 'Sustainable Drainage' - Developments should utilize Sustainable Urban Drainage Systems (SUDS), unless there are practical reasons for not doing so.

Policy 5.15 'Water Use and Supplies' - To protect and conserve water supplies and resources in order to secure London's needs in a sustainable manner. Development should minimise the use of mains water.

Policy 6.11 'Smoothing traffic flow and tackling congestion' – supports a city which is easy, safe and convenient for everyone to access jobs, opportunities and facilities. Pursue of an efficient and effective transport system which actively encourages more walking and cycling.

Policy 7.14 'Improving air quality''- Improving air quality to London's development and the health and wellbeing, of people, through reduction in pollutant emissions and minimise the public exposure to pollution. Developments should be at least 'air quality neutral'.

The Draft London Plan – Intend to Publish version (December 2019):

3.6 In December 2019 the GLA issued the Intend to publish version of The London Plan. The new plan sets out an integrated approach to address the challenges of climate change and deliver sustainable growth for London. The Proposed Development will align with the new framework, particularly regarding the below key areas:

Policy G1 – 'Green Infrastructure'- Proposed Development to provide elements of green infrastructure.

Policy G4 – 'Open Space' - Proposals to enhance open spaces to provide a wider benefit to Londoners will be encouraged.

Policy G5 – 'Urban Greening'- The Proposed Development should contribute to the greening of London by including urban greening as a fundamental element of site and building design. Predominantly commercially led developments should aim for an urban greening factor of 0.3 and residential 0.4.

Policy G6 – 'Biodiversity and access to nature' - Development proposals should manage impacts on biodiversity an aim to secure net biodiversity gain.

Policy SI1 'Improving air quality' – Masterplans and development briefs for large-scale development (…) should consider how local air quality can be improved (…) as part of an air quality positive approach.

Policy SI2 'Minimising greenhouse gas emissions' – Major developments should be net zero-carbon. All non-domestic to improve 35 per cent beyond Building Regulations 2013; Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Short fall from net zero to be met by carbon offset fund

Policy SI3 'Energy infrastructure' – (…) establish the most effective energy supply options.

Policy SI4 'Managing heat – Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure

Policy SI5 'Water Infrastructure' - In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.

Policy SI7 – 'Reducing Waste and Supporting the Circular Economy' - Resource conservation, waste reduction, increases in material re-use and recycling, and reductions in waste going for disposal shall be achieved (…). Referable applications should promote circular economy outcomes and aim to be net zero-waste.

Policy SI12 – 'Flood Risk Management' – Development proposals should ensure that flood risk is minimized and mitigated, and that residual risk is addressed.

Policy SI13 - 'Sustainable Drainage' - Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with (…) drainage hierarchy.

Policy T2 – 'Healthy Streets' - Development proposals (…) should deliver patterns of land use that facilitate residents making shorter, regular trips by walking or cycling.

Policy T5 'Cycling' - (…) development proposals should help remove barriers to cycling and create a healthy environment in which people choose to cycle.

Policy T6 'Car Parking' – Car parking should be restricted in line with levels of existing and future public transport accessibility and connectivity.

Local Policy

London Borough of Tower Hamlets Local Plan 2031

Managing growth and sharing benefits (Adopted January 2020): The Local Plan sets out how the borough of Tower Hamlets will grow and develop from until 2031.

Policy D.DH2: Attractive streets, spaces and public realm – Development is required to contribute to improving and enhancing connectivity, permeability and legibility (…) ensuring well connected, joined-up and easily accessible street network (…).

Policy D.OWS3: Open space and green grid networks - Development will be required to provide or contribute to the delivery of an improved network of open spaces in accordance with the Council's Green Grid Strategy and Open Space Strategy.

Policy D.ES2: Air Quality - Development is required to meet or exceed the 'air quality neutral' standard, including promoting the use of low or zero emission transport and reducing the reliance on private motor vehicles.

Policy D.ES3: Urban Greening and biodiversity – Development is required to protect and enhance biodiversity (…)

Policy D.ES4: Flood Risk – Development is required to be in areas suitable for the vulnerability level of the proposed uses (…).

Policy D.ES5: Sustainable drainage - Development will be required to reduce risk of surface water flooding (…)

Policy D.ES6: Sustainable water and wastewater management – Development is required to reduce water consumption.

Policy D.ES7: A **zero carbon borough** – Development is required to meet the carbon dioxide emission reduction standards.

All new non-residential development over 500m^2 (…) are expected meet or exceed BREEAM 'Excellent' rating. As a minimum, all self-contained residential proposals will be strongly encouraged to meet the Home Quality Mark.

Policy D.ES10: Overheating – New Development is required to ensure that buildings (…) and the spaces around them are designed to avoid overheating and excessive heat generation, while minimising the need for internal air conditioning systems

Policy S.MW1: Managing our waste – Tower Hamlets is seeking to increase proportion of construction, demolition and excavation waste which is reused and recycled to 95% by 2020 in line with London Plan.

Policy S.TR1 – Sustainable travel – Prioritise the needs of pedestrians and cyclists as well as access to public transport (…) before vehicular modes of transport.

4 Climate Change Adaptation

Policy response

4.1 The London Plan, Policy 5.1 ‘Climate Change Mitigation’ - London’s carbon dioxide emissions are to reduce by 60% (below 1990 levels) by 2025 – the overall aim for the policy is to bring down carbon emissions through emissions savings.

4.2 The London Plan Policy 5.9 ‘Overheating and Cooling’, and Draft London Plan Policy SI4 ‘Managing heat and LBTH Local Plan Policy D.ES10: Overheating, all require reduction in overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

4.3 The Applicant’s Sustainable Design and Construction Strategy for the Proposed Development requires the project team to identify future climatic changes to the Site and areas of risk that each change might bring and propose suitable mitigation measures.

4.4 The Applicant takes a proactive approach to climate change, focusing on adaptation measures in line with the latest industry guidance. Design strategy detailed in Climate Change Adaptation Risk Assessment (Appendix III) focuses on addressing risks of flooding and overheating as well as reducing potable water use and energy demand. Sustainable drainage solutions and rainwater harvesting systems will be integrated into buildings and the public realm to reduce cumulative impact of development, with biodiversity features contributing to the local microclimate. Requirements detailed in the assessment will be integrated into specifications as design progresses.

4.5 In response to these requirements, a climate change risk assessment workshop was undertaken to identify risks and adaptation measures, for further detailing by respective members of the project team. The design team identified that increase in temperature, extreme weather and water stress would require particular design decisions to reduce the need of cooling or to increase water efficiency. The design approach adopted in the Proposed Development incorporates various design measures that would future-proof against climatic challenges while maintaining low carbon impact. Further details are outlined below and expanded in Appendix III – Climate Change Adaptation Risk Assessment.

4.6 Design and Access Statement (NQ.PA.07) Principle Eight states that the building heights and massing of the Proposed Development ensures local microclimatic conditions are optimised for wind and overshadowing. See Design Guidelines (NQ.PA.04) Section 3.1.2 Public Realm for strategies that will be considered to retain a pleasant microclimate that can be enjoyed while standing still or seated, increasing the success of any outdoor events and encouraging the use of outdoor seating provisions.

4.7 See Chapter 5 of this report and the Energy Statement (NQ.PA.17) demonstrating how the Proposed Development is designed to avoid overheating and excessive heat generation at individual building level. See Chapter 6 of this report for the strategies adopted within the scheme to manage waster distress in response to Draft London Plan Policy SI5 'Water Infrastructure'. Also see Chapter 11, on Policy G5 Urban Greening approaches adopted to address overheating and managing microclimate within the public realm.

4.8 Implementation of specific measures to mitigate the risks identified here will be confirmed by the Applicant for each plot as the Reserved Matters Applications come forward.

Summary of Climate Change Risk Assessment

Figure 2 Overarching general climate change hazards

4.9 The assessment was carried out prior the end of RIBA Stage 1 with inputs of the design team and the Applicant. During the workshop the main areas of concern were structural stability, structural robustness, weather proofing and detailing, material durability, pest control, and health and safety.

4.10 The Climate Change Adaptation Risk Assessment is based on the Committee on Climate Change – UK Climate Change Risk Assessment (CCRA) 2017 Evidence Report. CCRA Evidence Report identifies the below climatic changes for the UK, as shown below:

- Annual average UK land temperature increased by 0.9°C in 2005 – 2014 compared to 1961 – 1990, with 2014 being the warmest individual year.iii
- Annual rainfall over Scotland has increased since 1970, to a level more than 10% above the average observed during the early decades of the 20th
- UK sea level has risen at a best-estimate rate of 1.4mm/year since 1901, which is close to the estimated rate for global sea level.
- Warming by 2081-2100 is likely to lie in the range 1.4-3.2°C under the scenario with the highest level of greenhouse gas mitigation, whereas for the highest emissions scenario, the corresponding range is 3.4 – 6.2°Civ

Climate change hazards

4.11 The key hazards of London that will result from climate change are an increase in annual temperature, more extreme weather conditions and an increase in water related issues. The key risks identified for the Site are:

- Risk of Overheating (Interior) – impact on comfort and energy consumption
- Risk of Overheating (Exterior) – outdoor comfort, Urban Heat Island Effect
- Risk to Natural Habitat (Risk for biodiversity and from pests) – emerging risks from pests reviewed further below
- Risks of Excessive Heating Energy Consumption
- Risks of Underheating – wetter winters, and extreme temperature fluctuations;
- Risks to Building Structure and Services:
- Risk to Structural Integrity due to Subsidence and Shrinkage of Soils
- Risk to Structural Integrity due to Excessive Wind Loading
- Risk to Material Degradation from Driving Rain
- Risk to Moisture Ingress from Change in Humidity
- Risk of Lack of Water Supply (Interior)
- Risk of Lack of Water Supply (Exterior)
- Risk of Surface Water Flooding

[iii] Prognosis of 2020 on track to be the hottest year on record – NOAA,U.S Department of Commerce, Available from: https://www.noaa.gov/

[iv] Humphrey K., Murphy J., 2017 UK Climate Change Risk Assessment 2017 Evidence Report Chapter 1, Available online from https://www.theccc.org.uk/

- Risk of River/ Coastal Flooding (Impact location dependent)
- Risk of Drainage Capacity Failure
- Risk of Foul Drainage Failure
- Risks of Pests and Invasive Species
- Risks of Air-Quality Degradation

Proposed risk mitigation actions for the Site

4.12 The following risk mitigation measures, where appropriate, have been incorporated in the design considerations for the Proposed Development. Individual plot specific approaches will also be implemented through the credit requirements for BREEAM Wst 05 – Adaptation to Climate Change #1 - Structural, Fabric & Building Services Resilience credit.

4.13 The details of specification for the following actions will be developed at the detailed design stage for individual plots as RMAs come forward. See Appendix III – Climate Change Adaptation Risk Assessment for further details of the actions outlined below:

- Designing to keep cool (Interior) – optimising passive design measures, optimising solar gain and glazing ratio and providing active cooling and control (whenever needed).
- Designing to keep cool (Exterior) – providing adaptive exterior environments
- Designing to enhance nature and biodiversity - Provide Ecosystem Service Valuation (ESV)
- Designing to keep warm - Provide Controlled Heating Systems, Optimise Passive Heating Strategies
- Mitigating the impact of cold snaps - Mitigating the Effect of Extreme Drops on Temperature (Façade)
- Design for structural stability (below ground) – deep piled foundations, stabilised slopes
- Design for structural stability (above ground) – a qualitative assessment was done to establish the impacts of wind microclimate and Project vulnerability to major natural hazards. See NQ.PA.08 Environmental Statement. The details of specification for the mitigative actions will be developed at the detailed design stage for individual plots as Reserved Matters Application comes forward.
- Design for Material Durability, Resilience and Quality – durable construction materials, moisture control
- Design for Water Conservation – potable water conservation, irrigation water conservation
- Design for Flooding Protection - sustainable urban drainage systems, river/coastal flooding protection.
- Design for Drainage Management – large capacity drainage
- Pest control – remove invasive plant species, remove and inhibit pests
- Air- pollution control – landscape considerations, walkable spaces, natural ventilation measures.

4.14 As RMAs for individual schemes come forward, the detailed design strategy and supporting documents for respective schemes will demonstrate how the requirements for the following have been secured.

4.15 Overheating in summer, combined with high noise levels and increased air pollution from Aspen Way limit passive cooling opportunities. See NQ.PA.17 Energy Statement. The RMAs to demonstrate how risk levels for overheating are minimised based on modelling results as per TM52 (non-domestic buildings) and TM59 (domestic buildings) modelling using DSY 2 and DSY 3 or similar approved methodology.

4.16 Changes in precipitation and increased winds, particularly for high rise buildings, are also posing medium risk to the structural integrity and ground level conditions. Drainage strategies and roof design considerations, including wind tunnel testing are encouraged to ensure that structures are resilient and such risks are mitigated.

4.17 Porous solutions and sustainable drainage systems (SuDS) are proposed to both help with the run-off water and cooling. Further attenuation strategy includes the use of blue and green roofs, with potential increase of drainage by 40% to allow for weather extremes.

4.18 Diverse planting that is draught resistant will be incorporated in the detailed landscape proposals to mitigate landscape degradation and pest invasion.

4.19 The Applicant have set up a Biodiversity Action plan 2018 - 2028 which will be implemented on the site. See Chapter 11, Biodiversity in this report for the design measures specified to meet the action plan and mitigate loss of biodiversity as a result of climate change.

4.20 See Chapter 6 for the details of how the risk from river and coastal flooding are addressed through various mitigation measures.

5 Energy

The Energy Statement NQ.PA.17 submitted in support of this OPA has been developed by Max Fordham and details the proposed energy strategies for the Indicative Scheme for the Site.

Policy Response

5.1 The energy assessment follows the GLA Energy Assessment Guidance (October 2018) and takes account of the draft GLA Energy Assessment Guidance (March 2020). It aims to:

- Demonstrate approach to compliance with Building Regulations Part L, primarily that the building emission rate (BER) is less than the target emission rate (TER);
- Demonstrate how the Proposed Development could comply with the Draft London Plan Energy Hierarchy – 'Be lean, be clean, be green, and be seen';
- Demonstrate how the Proposed Development could comply with the LBTH Local Plan Energy requirements;
- Show the measures adopted in the Indicative Scheme to reduce the cooling demand, by following the Cooling Hierarchy, whilst also ensuring the risk from overheating is reduced.

5.2 The Draft London Plan 'Policy SI2 Minimising greenhouse gas emissions' requires calculation of whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and to demonstrate actions taken to reduce life-cycle carbon emissions. To deliver zero carbon developments as per the LBTH Local Plan Policy D.ES7 'A zero carbon Borough', developments will need to demonstrate reduction in emissions associated with materials.

5.3 Draft London Plan Policy SI3 'Energy infrastructure' requires establishing of the most effective energy supply options- heat loads, secondary heat sources, waste heat, heat networks and the use of code of practice for designing the networks.

5.4 The Applicant have signed up to Better Building Partnership (BBP) Climate Change commitment to be net zero carbon and implementation of Design for Performance standards to ensure operational performance. All buildings delivered will be monitored for in-use performance and a Post Occupancy Evaluation (POE) will be carried out as part of the Applicant's commitment within the Sustainable Design and Construction Strategy (see Appendix IX).

5.5 The Proposed Development will be the Applicant's first Net Zero Carbon development. This will be achieved through reducing energy demand of each building, maximising opportunities for passive cooling and integrating renewables. Significant proportion of the Applicant's commitment to net zero rests on engagement with tenants and residents. The Applicant recognise that everyone has a part to play in achieving ambitious carbon reduction targets and are keen to unlock potential for productive and innovative collaboration. The North Quay Energy Statement,

(NQ.PA.17), submitted as part of this application offers further details on the net zero strategy for the site.

5.6 An initial embodied carbon options appraisal (see Appendix IV) based on a typical development has been carried out:

- To demonstrate emission reductions that are possible for the Proposed Development
- To identify target areas for maximum reductions in embodied carbon
- To guide the detailed design to achieve higher score for BREEAM criteria Mat 01 - Environmental impacts from construction products: Building life cycle assessment

Energy strategy summary

5.7 A high-performance building fabric (Be Lean): excellent U-Values and low g-values, low air-permeability, low thermal bridging; façade performance criteria which maximises daylight whilst limiting solar gains in summer, optimised ratio of solid to glass on facades appropriate for each building type, appropriate external shading to suit each building type.

5.8 Energy efficient services such as (Be Lean): heat recovery and demand driven ventilation on fresh air supplies; night cooling from fresh air supplies in commercial building; energy efficient lighting with intelligent controls; mixed mode ventilation where appropriate and feasible; energy saving controls.

5.9 Energy efficient sources (Be Clean): There are no existing heat networks in the immediate vicinity that could be viably connected to the Site; A distributed heat pump energy centre approach rather than a single energy centre is proposed, as the Indicative Scheme will have 4 phases and will consists of predominately commercial buildings; Commercial building cooling heat rejection will be used as a secondary heat source for the residential buildings in conjunction with local ambient-loop heat pumps; Thermal storage will be included in each heat network for optimising system performance and balancing surplus heating and cooling energy production; The heat networks will be designed with provision for future connections to a suitable low carbon heat network, if one becomes available in the local vicinity of the Site.

5.10 Renewable energy technologies being considered including (Be Green): Ambient loop heat pump systems for residential building heating, hot water, and cooling; 4-pipe multifunction ground and air source heat pumps for retail and commercial building simultaneous heating, cooling, and hot water preheat; Water cooled high temperature heat pumps and air source heat pumps for commercial hot water generation; Photovoltaic panels above suitable roof areas that are not intended for occupant access or heat rejection plant; Heat recovery from building foul waste;

5.11 Monitoring and reporting on Energy Performance (Be Seen): Extensive metering and energy monitoring will be included within each building network and Site wide secondary heat connections to enable system performance optimisation and accurate billing;

5.12 Emerging new technologies will be investigated during each RMA for each phase as they are submitted to take account of technology development at the time of each submission.

All Electric Energy Strategy

5.13 The electrical grid in the UK has been decarbonising and is projected to continue doing so. This means using grid electricity becomes a lower carbon source of energy than gas. This favours electrically powered heat pump networks for heating and means that CHP is no longer beneficial in carbon terms. The proposed all-electric energy strategy has no additional local emissions to account for, so there is no air quality impact from the Proposed Development.

Future connection to low carbon district heating network

5.14 The Site infrastructure will allow space and routes to install connections to all the buildings from a suitable low carbon heat network in the future, if commercially and technically viable.

Low to Zero Carbon Technologies

5.15 A renewable energy assessment has been conducted to confirm which renewable energy technologies are considered both practical and viable to serve the Proposed Development. The assessment identified ground and air source heat pumps, photovoltaic panels (PV), and heat from waste as the most appropriate LTZC solutions for the Proposed Development.

5.16 The Indicative Scheme incorporates the maximum quantity of PV panels that can feasibly be installed on suitable roof areas across the Proposed Development.

Summary of Energy Assessment Results

5.17 **Non-Domestic:**

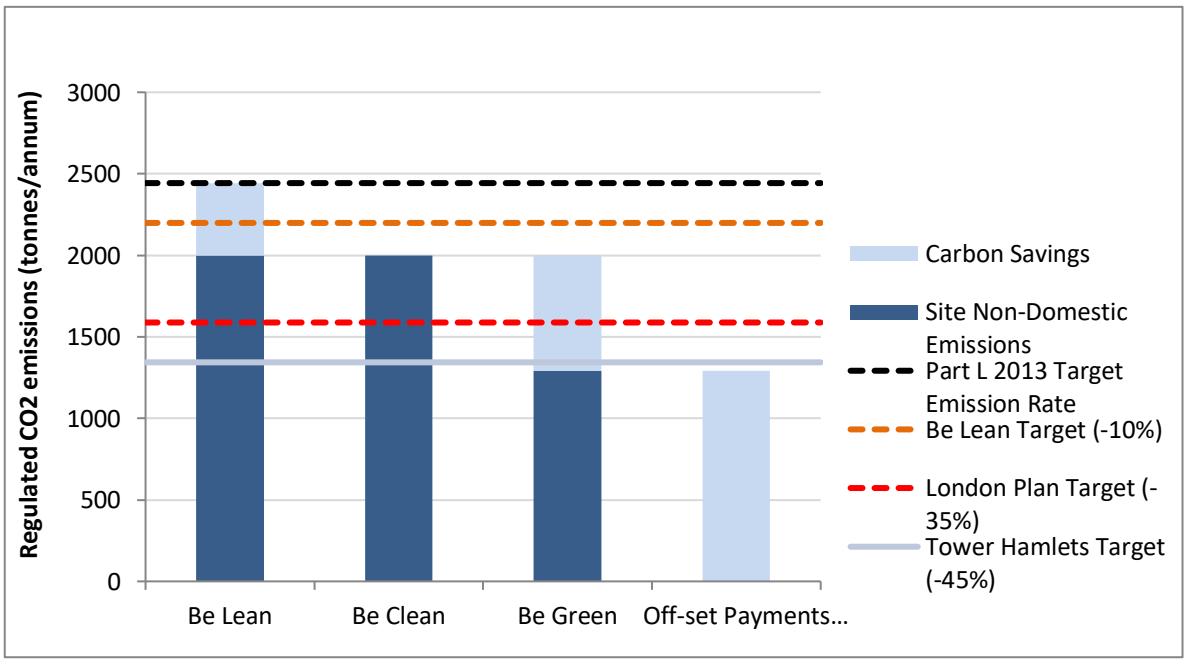

Figure 3: Site-wide energy hierarchy graph and targets (non-domestic)

As can be seen in Figure 3 the target of 15% carbon emissions reduction at 'Be Lean' has been achieved. However, the percentage savings achieved at 'Be Green' stage are far higher than the minimum 35% required by the London Plan. The current non-domestic emissions savings following 'Be Green' stage is 47%.

5.18 **Domestic**:

As can be seen in the tables below (See Figure 4), the target of 10% carbon emissions reduction at 'Be Lean' has been achieved. However, the percentage savings achieved at 'Be Green' stage are far higher than the minimum 35% required. The current domestic emissions savings following 'Be Green' stage is 53%. This increases to a 64 % saving with the contribution from the secondary waste heat from the non-domestic buildings, than the required 35%.

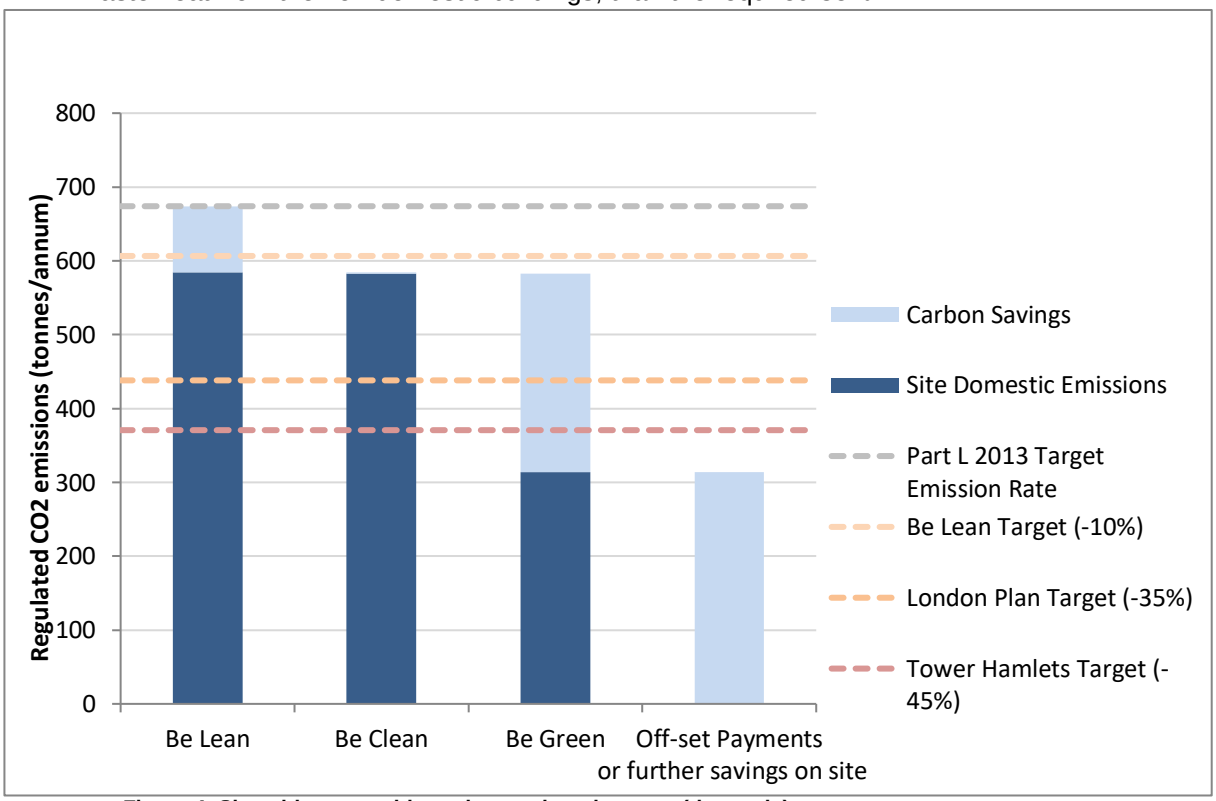

Figure 4: Site-wide energy hierarchy graph and targets (domestic)

5.19 The remaining savings to reach zero carbon will be achieved via an additional off-set cash-in-lieu contribution

5.20 Further details of measures and strategies refer to The Energy Statement NQ.PA.17.

Performance in Use:

5.21 The Applicant is a member of the BBP Partnership Climate change commitment to be net zero carbon. To this end the Proposed Development will focus on delivering realistic operational

energy including following the principles of Design for Performance. The Applicant's Sustainable Design and Construction Strategy (Appendix IX) includes a requirement for Post Occupancy Evaluation on all new buildings.

Whole lifecycle carbon strategy

5.22 The building designs and materiality will be part of RMAs. At this stage an initial Life Cycle Analysis (LCA) options appraisal has been prepared (Appendix IV).

5.23 The analysis reviewed a 'base case' for a similar development to the Proposed Development and proposed an alternative 'best case' scenario to reduce embodied carbon for sub-structure, frame, external walls and upper floors. It showed that the highest impact elements are: Upper floors (37%), substructure (23%), frame (19%) and external Walls (9%).

5.24 The RMAs for individual plots will review the 'best case' and provide a full LCA based on the RICS Whole Life Carbon assessment method in order to demonstrate how lifecycle carbon in use is optimised.

5.25 In addition to this LCA, as part of the BREEAM LCA requirements office buildings are subject to benchmarking using BRE Ecopoints, which considers 13 different environmental factors [e.g. Acid rain] rather than just embodied carbon. The Proposed Development aspires for a maximum score of 4 in the BREEAM Mat 01 credit. The 'best case' option was reviewed for BREEAM Ecopoints score, which showed that it is possible to achieve all of the available credits.

5.26 The RMAs for individual plots will review the 'best case' and provide a full LCA through design development in order to optimise whole lifecycle carbon in use, including options appraisal and benchmarking for BREEAM Mat 01. The review will incorporate the following recommendations:

- Upper floors: Hollow core slab with a high recycled content (GGBS) & Cross Laminated timber
- Sub-structure: Recycled content (GGBS) in foundations and slabs
- Super structure: Concrete frame with a high recycled content (GGBS) & recycled content in steel
- Façade: External wall cladding options to be reviewed as per the detailed design for individual plots. In this analysis, concrete panels had lower emissions compared to brick slip and aluminium cladding.

6 Water and surface water run-off

Policy Response

6.1 The London Plan Policy 5.12 'Flood Risk Management' , Draft London Plan Policy SI12 – 'Flood Risk Management' and LBTH Local Plan, Policy D.ES4: Flood Risk states development proposals must comply with the flood risk assessment and management requirements set out in the NPPF on flood risk over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 and Catchment Flood Management Plans. Development adjacent to flood defences will be required to protect the integrity of existing flood defences and wherever possible should aim to be set back from the banks of watercourses and those defences to allow their management, maintenance and upgrading to be undertaken in a sustainable and cost effective way. In addition, developments which are required to pass the Exceptions Test set out in the NPPF will need to address flood resilient design and emergency planning.

6.2 London Plan Policy 5.13 'Sustainable Drainage', Draft London Plan Policy SI13 - 'Sustainable Drainage' and LBTH Policy D.ES5: Sustainable drainage state that developments are to utilise Sustainable Urban Drainage Systems (SuDS) unless there are practical reasons for not doing so, and should aim to achieve Greenfield runoff rates and ensure that surface water runoff is managed as close to its source as possible.

6.3 London Plan Policy 5.15 'Water Use and Supplies' and Draft London Plan Policy SI5 "Water Infrastructure" sets a water consumption benchmark of 105l/pp will be achieved to be in line with the BREEAM requirements for Excellent. LBTH Policy D.ES6: Sustainable water and wastewater management states that *'Development must also address London's water stress by reducing water use'.*

6.4 A series of structural, public realm and ground floor measures are proposed to mitigate the potential for rising sea levels. For further information on what mitigation measures have been specified see the NQ.PA.30 Floor Risk Assessment and Drainage Strategy. A summary of measures incorporated are outlined below.

Flood risk management

6.5 The majority of the Proposed Development is in high risk Flood Zone 3, and rest of the site in Zone 2.

6.6 Flood Zone 3 is considered high risk with land assessed as having a 1% or greater annual probability of river flooding, or a 1 in 200 annual probability of sea flooding. Flood Zone 2 is medium risk, with land assessed as having a 0.1% to 1% annual probability of river flooding.

6.7 The Site benefits from the protection of the Thames Tidal Defences and as such the EA classify the Site as having a low residual flood risk. In addition, there are secondary flood defences within

the docks in the form of dock walls. The Thames Barrier and associated defence system has a 1 in 1000-year standard. Due to the defences, the EA has confirmed that it considers the Proposed Development area to be defended to a very high standard by the Thames Tidal flood defences despite being located within Flood Zone 3. See the Environmental Statement that accompanies the OPA (NQ.PA.08) and as well as the Flood Risk Assessment and Drainage Strategy (NQ.PA.30).

6.8 The existing dock water level lies at approximately +4.23m AOD, with the 1 in 10-year flood level at approximately +5.0m AOD. All entrances will be covered, and the thresholds will be levelled. As far as possible, entrance lobby levels will also be raised above 1:100-year flood levels. On the north side of the Proposed Development the proposed building edge and landscaping will be raised to provide adequate protection in the event of a breach in the Thames Tidal Defences. See the Design and Access statement (NQ.PA.07).

6.9 Most of the surface water will be discharged to the docks. This is considered the best sustainable solution for the Site and is generally preferred by the EA and the Canal & River Trust (CRT). The proposed drainage system will provide enough capacity to cater for up to the 1 in 100-year storm event, incorporating the latest guidance regarding climate change. In the next stage of the design development details of how this is incorporated within individual plots will be outlined as the Reserved Matters Applications come forward. See NQ.PA.30 Flood Risk Assessment and Drainage strategy.

Water Strategy

6.10 The overarching principle for the Proposed Development is to provide efficient systems and services that mitigate excessive demand at point of use, while still meeting the expected demands of occupants. There are two main strategies – at site level and at a building level.

6.11 A key concept for the Proposed Development is the integration of sustainable drainage. Surface water run-off is managed through tree planting, shrubs, landscape geometry and permeable grounds are integral part of the design. The Proposed Development provides a sustainable urban drainage systems (SuDS) which also includes a rain garden, rainwater harvesting for irrigation and ‘blue and green roof’ systems. Details over the reduction of surface water runoff through planting and SuDS can be found within the Applicant’ Biodiversity Action Plan 2018 – 2028 and the Flood Risk Assessment and Drainage Strategy (NQ.PA.30).

Site-wide water strategy

6.12 The Draft London Plan hierarchical approach to water management and rainwater attenuation (refer to Policy SI13 – Sustainable drainage) has been used to inform design. Water management strategies include slot/channelled drains, blue roof attenuation and surfaces

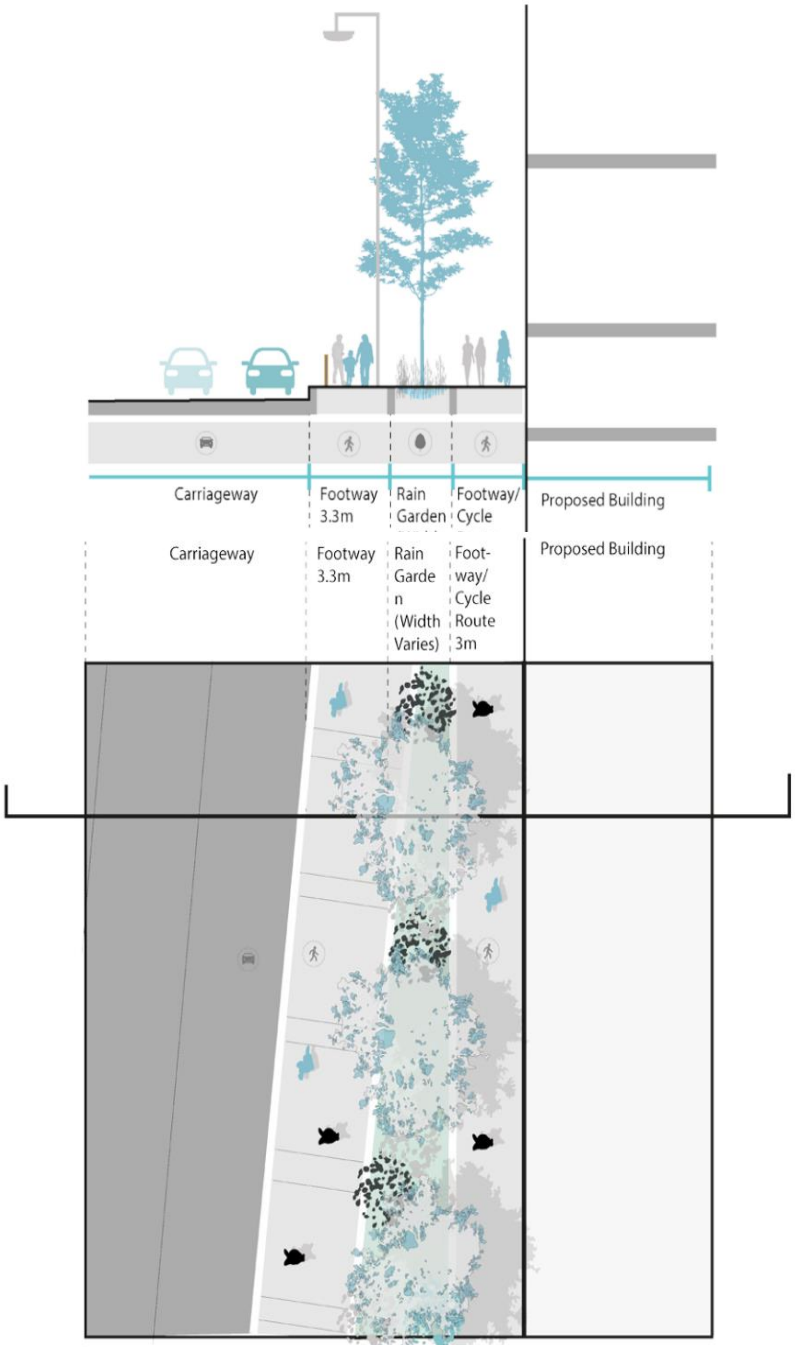

Figure 5 SUDS strategy – LDA Design

draining to rain gardens. The use of blue roof is proposed to slow the egress of water across site. Example shown in Figure 5.

Building level strategy

6.13 The Proposed Development will achieve an internal mains water consumption of no more than 105 litres per person per day for residential buildings. A 25% reduction in water-use through low-flow fittings will be targeted in the non-residential buildings to meet BREEAM requirements. Where feasible, rainwater collection will be considered to reduce unregulated demands such as irrigation for planting.

6.14 At the next stage of the design development for individual plots as part of RMA preparation the project team will review opportunities for incorporating recycled water for irrigation and maintenance of soft landscape.

6.15 In line with BREEAM Excellent assessment, credits Wat 01, Wat 02 and Wat 03 will be achieved by water monitoring and leak detection systems. Wat 04 – water efficient equipment has been addressed by the water management and engineering design of the public realm.

6.16 Opportunities for further water consumption reductions will be developed during the development of each Phase or Zone.

7 Health and Well-being

7.1 Wellbeing is at the heart of the Applicant's approach to design and delivery and the Applicant's comprehensive Health and Wellbeing Strategy (Appendix VIII) applies to all stages of development. This covers the key themes shown in Figure 6 below.

Figure 6 Canary Wharf framework health and wellbeing themes

7.2 The proposed design goes above and beyond planning requirements and includes specifications for individual buildings and public realm such as that all projects must comply with the Applicant's Sustainable and Healthy Materials Brief (see Appendix VII), and that workplaces should have physical activity space provided at no extra cost to employees, and to develop and implement a Biophilia Strategy for the building and its surrounds.

7.3 This section sets out the policies relevant to the Proposed Development and the design response. Draft London Plan Policy S4 Play and informal recreation requires development proposals for schemes that are likely to be used by children and young people to: increase opportunities for play and informal recreation and enable children and young people to be independently mobile. LBTH Policy D. OWS3: Open space and green grid networks states that *'the opportunities for delivery of new open space and for enhancing accessibility and connectivity to the wider network, which is considered crucial to addressing the borough's open space deficiency'*

7.4 The Draft London Plan (Policy T2 Healthy Streets) requires that development proposals should: demonstrate how they will deliver improvements that support the ten Healthy Streets Indicators in line with Transport for London guidance. Reduce the dominance of vehicles on London's streets whether stationary or moving. be permeable by foot and cycle and connect to local walking

and cycling networks as well as public transport. Local Plan Policy D.DH2: Attractive streets, spaces and public realm has several requirements aimed at making the streetscape pleasant and safe and to promote wellness.

7.5 The London Plan Policy 5.9 Overheating and Cooling

Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the cooling hierarchy. […] Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meets its cooling needs.

7.6 Draft London Plan Policy SI4 “Managing heat risk”

Development proposals should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

Show steps to minimise overheating and avoid active cooling reduce the potential for overheating and reliance on air conditioning systems in accordance with the cooling hierarchy

Play areas and green spaces

7.7 The Proposed Development meets these requirements by providing several open spaces with interest and opportunity for engagement. The predominantly pedestrian routes help to support independent mobility. Within the Indicative Scheme, both residential buildings are designed to accommodate internal play spaces. The play spaces could include quiet areas such as a library and reading stage with other more active areas including a trampoline, sand pit, balls pit and slide, table tennis and climbing wall. Adjacent to the play space in building NQ. A1 are a series of internal communal amenity areas for the residents which include a residents' lounge, a multi-purpose room which could be used for exercise classes, a community meeting/events space and furniture storage areas.

Figure 7: Illustrative Aerial view of Dock Gardens / Garden Square: Source LDA

7.8 Draft London Plan Policy G1 (Green infrastructure) aims to make London at least 50 per cent green by 2050. And Policy G4 (Open Space) encourages the creation of new areas of publicly-accessible green space and that open space should be supported, especially in areas of deficiency in access to public open space., Green and open space needs should be planned in line with objectives in green infrastructure strategies in order to deliver multiple benefits.

7.9 See Chapter 11 of this report for response for Policy G4 Urban Greening Policy, G6 Biodiversity and access to nature and Policy G7 Trees and woodlands. Policy G4 requires major development proposals to contribute to the greening of London and a target score of 0.3 for predominantly commercial development is set. Biodiversity enhancement has been considered from the start of the development process. The landscape design responds to these requirements by creating several specific outdoor spaces that have been planned in relation to the wider open and green space context. A tree strategy has developed with a broad selection of trees provided.

7.10 Air-quality is addressed in more detail within this report under Chapter 10. For full response to the Draft London Plan (Policy SI 1 Improving air quality) - see Chapter 10.

Healthy Streets

7.11 The Proposed Development has been designed in line with the ten healthy streets indicators (See Figure 8) to create an environment which will encourage walking, cycling and public transport. A Healthy Streets Transport Assessment (TA) has been undertaken in support of this OPA which considers all aspects of movement by employees, visitors and residents. For further details see NQ.PA.10. Transport Assessment.

Trips associated with the proposed development

84% by public transport and

14% by foot or cycle.

Figure 8: The Ten Healthy Street Indicators. Source: Draft New London Plan and NQ.PA.10. Transport Assessment

7.12 Consultation has also taken place with Applicant's head of security and also a Metropolitan Police Secure By Design Officer to ensure safety and security has been incorporated into the external proposals. This is in line with BREEAM Hea 06 requirements and Local Plan Policy D.DH2: Attractive streets, spaces and public realm.

Overheating and summertime comfort

7.13 New developments must manage heat risk by minimising internal heat gains and the impact of the urban heat island. See Chapter 4, for detailed response in relation to the Draft London Plan Policy SI4 'Managing heat risk and LBTH Local Plan Policy D.ES10: Overheating. The design responds to these requirements through the following measures:

Externally:

7.14 The key methods of reducing the urban heat island are through self-shading and greenery. The RMAs should explore further opportunity for reducing heat absorption through high albedo materials.

Internally:

Minimising internal heat gains through efficient design:

7.15 Heat distribution infrastructure within the developments will be designed to minimise pipe lengths in communal corridors to reduce the risk of overheating.

7.16 Ultra-low temperature ambient loop networks for residential buildings and very low temperature distribution networks for commercial buildings are proposed.

Reducing the amount of heat entering the building in summer:

7.17 Developments will consider shading measures such as overhanging balconies. The Indicative Scheme considers external shading on all buildings on critical facades.

7.18 High performance solar control glazing will be selected as appropriate for each building type, balancing solar gain with daylighting.

Passive ventilation:

7.19 Where air quality and noise levels permit, all buildings are expected to have openable windows with additional security and rain protection details to allow for purge ventilation at night. The design will also strive to maximise dual aspect where feasible for cross ventilation.

7.20 There may be the possibility to develop mixed mode strategies on some of the commercial buildings on facades facing south and these will be considered within the RMAs for each building and phase.

7.21 Noise levels across the Site means that active cooling will be required in all buildings to control overheating. There may be the possibility to develop mixed mode strategies on some of the commercial buildings, on facades facing south and these will be considered within the RMAs for each building and phase.

Overheating risk analysis

7.22 Each residential building will need to be tested against Criterion 3 of Part L1A of the Building Regulations, which relates to limiting the effect of solar heat gains in the summer

7.23 In order to help identify potential overheating risks dynamic simulation modelling will be undertaken in line with the guidance in CIBSE TM59 and TM49 and as required by the GLA in the Energy Assessment Guidance (2018) in the RMAs.

Active Cooling

7.24 Active cooling will be required on all residential buildings. The use of the ambient loop heat pump solutions for heating and hot water production also has the added advantage of allowing active cooling to apartments from the same distribution network providing heat recovery opportunities and the lowest operational and embodied carbon compared to more traditional systems.

7.25 For further details see Energy Statement (NQ.PA.17).

8 Materials, Circular Economy Statement and Waste

Policy Response

8.1 The Draft London Plan Policy SI7 (Reducing waste and supporting the circular economy) requires the use of circular economy principles to improve resource efficiency and minimise waste with the aim to become net zero-waste to landfill in construction. The policy sets a target of 95% of construction and demolition waste to be reused, recycled or recovered; 95% of excavated waste to be put to beneficial use. LBTH Local Plan Policy S.MW1: Managing our waste requires developments to be in line with the London Plan requirements.

8.2 All planning applications referred to the Mayor of London, will need to include a Circular Economy Statement to demonstrate how the Proposed Development will deliver resource conservation, waste reduction, increase material re-use and recycling promoting a more circular economy.

8.3 The GLA has published *Design for A Circular Economy Primer* (2019) as guidance for producing the circular economy statement which is a requirement for the Draft London Plan. Developers are encouraged to adopt circular economy principles and include these in their brief for their project team.

8.4 The guidance includes a decision-making tree which the design teams are expected to use to explore how circular principles can inform the concept design. This requires demonstrating how materials from the existing site can be utilised to maximise their residual value either within the Proposed Development or elsewhere. In addition, the Applicant is to illustrate how circular design considerations have informed the decisions behind the choice of various building elements. These aspects were reviewed by the Proposed Development design team via a circular economy workshop to develop a strategy for the Site.

8.5 The Applicant's aspiration to achieve true circularity applies to both waste and design development strategies. The Applicant is targeting zero waste to landfill in operations and construction. Working closely with suppliers and tenants they have been able to achieve Zero Plastic Community status. Principles of circular economy are embedded in all the Applicant's building assets by maximising opportunities for adaptability and reuse as well as responsible procurement. A detailed Responsible Procurement Plan (Appendix VI) has been developed alongside North Quay Circular Economy Statement outlined in this Chapter. Requirements detailed in these plans will be integrated into specifications as design progresses. Whole life and embodied carbon assessments of the development will enable further integration of circular economy principles. Life Cycle Assessment provided in Chapter 6 and Appendix IV details for the initial LCA analysis recommendations to reduce embodied carbon.

8.6 The Applicant has produced a Sustainable Design and Construction Strategy and Sustainable and Healthy Materials brief, and a Sustainable Procurement Plan which set a detailed vision for

reducing material related lifecycle environmental impacts and enable a circular economy. This includes:

- Develop a circular economy strategy for all in accordance with the London Plan.
- Reuse of existing materials on site
- Achieve Zero waste to landfill on all projects
- Materials with reused or recycled content with benchmarks and targets set based on BREEAM.
- Environmental Performance Declarations (EPDs) for materials
- Minimum product certification responsible sourcing of the following materials – timber, steel, concrete, plasterboard and insulation.

8.7 The onsite waste storage and management proposals detailed within Waste Management Strategy (NQ.PA.22) demonstrate that the proposals have been shown to meet the waste requirements of the Indicative Scheme. At the detailed design stage for each plot the Applicant will ensure that the waste management arrangements are able to react to any changes in best practice regarding opportunities to recycle and any potential to establish a circular economy for operational waste. This will meet the local policy requirement set within LBTH Local Plan Policy D.MW3 'Waste collection facilities in new development'.

8.8 Waste arisings from construction will be segregated by type to enable reuse and recycling. Site Waste management Plans (SWMP) will be produced to ensure that waste production is minimised and that recycling, and reuse is maximised through monitoring, recording, sorting and separating construction waste wherever practicable. See NQ.PA.08 Environmental Statement.

8.9 The following sections illustrate how the Proposed Development is addressing the requirements set out within the Draft London Plan, Policy SI 7 Reducing waste and supporting circular economy. These measures will be implemented through BREEAM Mat 05 - Designing for Durability and Resilience, Mat 06 - Material Efficiency, Wst 01 - Construction Waste Management, Wst 04 - Speculative finishes (Offices only) and Wst 06 - Design for Disassembly and Adaptability. Implementation of material efficiency and circular economy opportunities identified here will be confirmed by the Applicant for each plot as RMAs come forward.

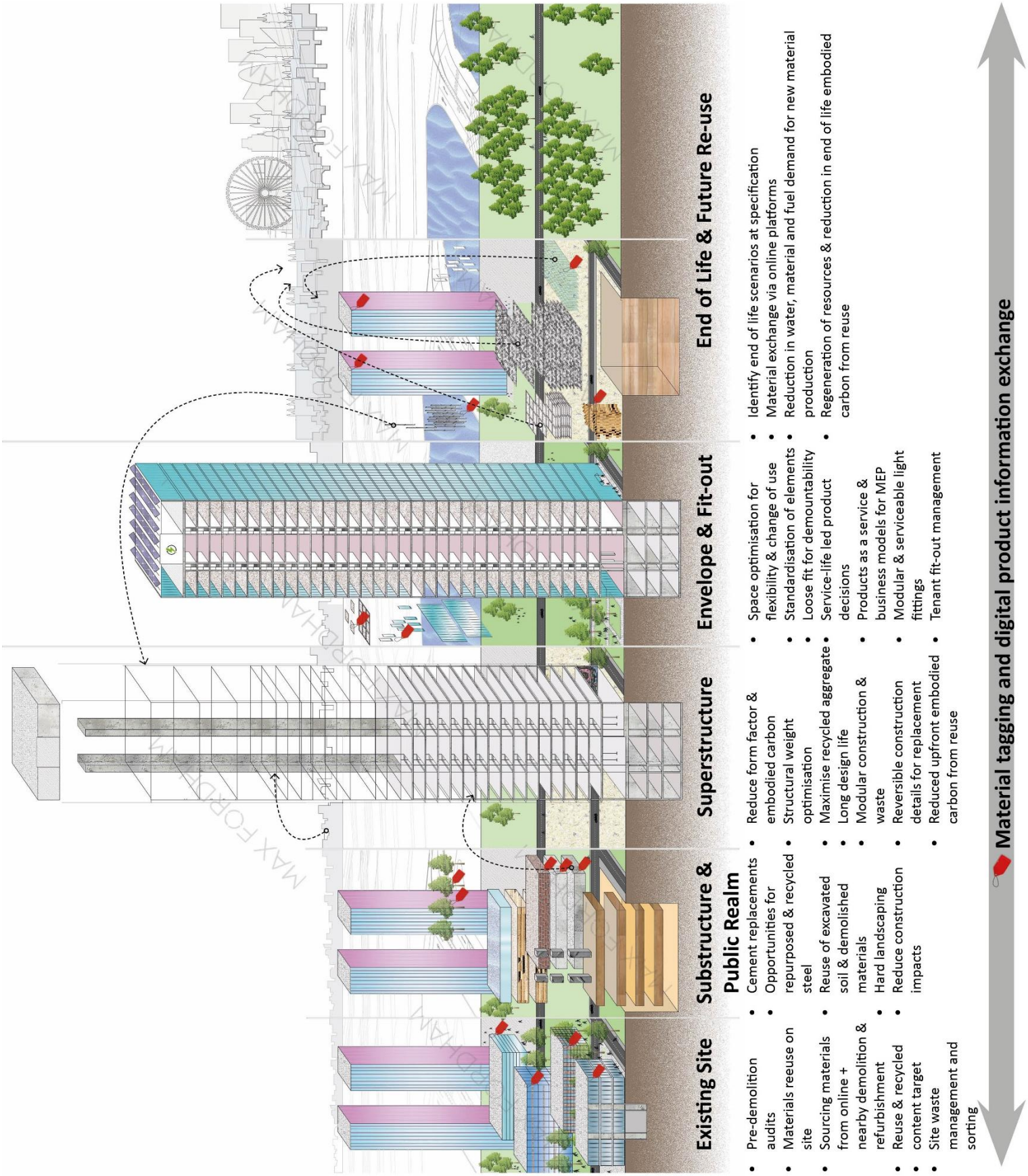

Figure 9 Circular Economy and Material Efficiency processes

Maximising Residual Value on the Existing Site

8.10 Currently the Site comprises mostly cleared land, being previously used as a construction laydown site for the Canary Wharf Crossrail Station. There are some temporary uses currently on site, including the LBTH Employment and Training Services, WorkPath and advertising structures. An initial review of potential opportunities for reuse of the existing structures, and recycling has been carried out as outlined below.

8.11 A pre-demolition audit of any existing buildings, structures or hard surfaces will be carried out before demolition. This will be used to determine whether reuse is feasible and maximise the recovery of demolition material. Contractors will be engaged in the process and actual waste will be monitored against the targets and reported via a Site Waste Management Plan. This will also satisfy the credit requirements for BREEAM Wst 01 - Construction Waste Management.

8.12 The existing site will be investigated in detail at the detailed design stages and any materials that can be reused in terms of providing piling platforms or suitable for backfilling, subject to storage space on site, will be used. The concrete and reinforcement from the Quay demolition will be separated to allow steel to be recycled. The crushed concrete will be used for temporary hard standings or assuming it is not contaminated with salts etc. will be re-cycled

Deconstruction and reuse of existing structures

8.13 Existing buildings which have already been used as on-site offices for previous construction works are considered for re-use in the context of the Site's early works. Where possible these structures on the Site will be deconstructed and reused in a similar or more valuable state. If these temporary on-site office buildings are not suitable for reuse by the Applicant, they will be considered for commercial resale or donation to adjacent community needs where commercial resale is not possible.

8.14 Main material types arising from demolition of the existing structures are steel and concrete. The following potential reuse options were identified during the Circular Economy workshop by the design team as opportunities to recover the residual value of permanent structures on the site. The viability of these will be reviewed in detail within the RMAs identified for further investigation are:

- Steel edging from recovered metal from on site
- Block paving [use of reused pavers & reused bricks]
- Reusing excavated & treated soil on site
- London Clay, a challenging material for reuse, however significant construction projects such as HS2, have managed to incorporate this as light weight aggregate.
- Use of recovered materials for hard landscaping or as public art.

Disassembly and recycling of Existing Structures

8.15 Where the existing structures, elements or materials are not suitable for reuse, they will be demolished and recycled. For example, the existing false quay at the south of the Site, constructed in the 1930's, is a reinforced concrete structure supported on marine piles within the north dock. The structure is in poor condition and cannot be incorporated into the Proposed Development. It is also not feasible to re-use the existing marine piles to support the new permanent works.

8.16 On-site reuse of these materials will be investigated alongside recycling off-site. Some of the opportunities highlighted by the design team for detailed design development and specification includes:

- Recycling aggregates from false quay
- Existing rocks incorporated into landscape / as aggregates

8.17 Procurement-related actions at the demolition phase to be carried out will include:

- Incorporating waste reduction key performance indicators for on-site reuse of site sourced materials, and targets in the procurement specification;
- Using contractual clauses to embed sustainable waste management
- Resource efficiency requirements into the procurement of materials and storage of on-site sourced materials and other waste streams

Maximising Lifetime value of New Buildings, Infrastructure and Public Realm

8.18 The Site will be developed in Phases up to 2029. A hierarchical waste management strategy of "Prevent, Reduce, Reuse, and Recycle" will be employed during the design, construction and operation of the Proposed Development.

8.19 The feasibility of construction excavation waste to be reused on site will be explored, including opportunities for treatment of contaminant in-situ soils with lime or cement and incorporation of it into the final structure. Therefore, reducing earthwork operations and reducing waste, supporting the Applicant's aspiration for zero waste to landfill during construction.

8.20 Through implementation of Mat 06 - Material Efficiency credit requirements design for material optimisation principles will be adopted to establish ways to reduce material use. This will be measured against BREEAM criteria Mat 06 - Material Efficiency. See Chapter 12.

8.21 The implementation of key principles of circular design strategy – Longevity, Adaptability, Flexibility, Reusability and Recoverability will be reviewed at detailed design stage for each plot in the RMAs. This will be measured through meeting respective BREEAM criteria for Design for Disassembly and Adaptability and meeting the requirements set out within the Applicant's Sustainable and Healthy Materials brief

8.22 The structural Design will take on board the requirements of BREEAM and other sustainable requirements applicable at the time of design. All proposed materials will be reviewed with regard to their embodied carbon content and low carbon materials will be specified where the design requirements permit. Offsite fabrication to reduce waste will also be employed where practical, and lean design carried out to reduce to a minimum quantity of material used.

Longevity

8.23 Designing for longevity will be a key consideration for rarely changing elements (lifespan in excess of 25 years). Elements designed for longevity include the site infrastructure, the building structures and most elements of the façade.

8.24 Whole Life Cycle assessments will be carried out to inform the material selection for major building elements and internal fit-outs. The design intent is for specifying shell and core structures with low embodied carbon and long lifespan.

8.25 For tall buildings the design of the sub-structure, frame and the façade will be determined by the structural stability requirements to compensate wind loading. Detailed design of the buildings will focus on maximising the longevity of the structure and façade. In particular, the façade system's service life, replacement and end of life considerations should form part of the options appraisal for potential systems.

Adaptability

8.26 Designing for adaptability will be a key consideration for intermediate lifespan elements (5-25 years). Elements designed for adaptability include office interiors, local services and elements of the site layout.

8.27 Detailed design of the buildings will ensure that the floor plates are designed to be adaptable for multiple functions. This includes exploring block level layout modifications and opportunities for change of use.

Flexibility

8.28 The detailed design for floor plates within individual plots will incorporate flexibility within fit-out elements and services which are likely to change during tenant fit-out [e.g. retail] in less than 5 years to allow for reuse or recycle.

Reusability and recoverability

8.29 Infrastructure and hard landscaping are generally inherently less adaptable than other elements of the built environment - current Proposed Development proposes resilient design such as accessible services and manholes to minimise impact on public realm, enabling servicing and maintainability.

8.30 The detailed design of the site layout should include opportunities to make it adaptable, this could include the use of moveable planters and limiting the use of adhesives and fixings.

8.31 The detailed design specification for major building elements will avoid the use of hazardous materials that might cause issues for future recycling. Where off-site techniques are used in the individual plots, detailed design within the RMAs will establish the recycling potential or recovery options available at the end of life. This will be used to inform the whole lifecycle carbon calculations.

Site wide resource sharing and digital approach

8.32 The design will consider the resource requirements for individual phases and identify ways for sharing to allow reuse of materials and existing buildings that are in temporary use from previous phases. This will be subject to the viability of such an approach being tested on a plot by plot basis.

8.33 The Applicant will require Building Information Modelling (BIM) for the individual plots within the RMAs. The model will be used to collect material data on:

- Bullet Site infrastructure and public realm
- Individual building elements
- Each floor plate fit-out information
- Material properties
- Recycled content,
- Reused content and
- Intended future use
- Environmental certification
- Embodied carbon analysis

8.34 Material data collection or ‘tagging’ of building elements and materials will be considered on a case by case basis. This technology allows the properties of the element to be reliably recorded, enabling reuse as an element on a future project. The use of material tagging is not widespread in the industry, but this is likely to become useful and viable within the timeframe of the Proposed Development.

8.35 This digital materials database will become part of the Applicant’s internal resource management strategy and inform:

- Developing detailed design for individual plots
- Developing construction Site Waste Management Plan (SWMP) for future phases of the Site.
- Identifying materials availability for shared use across the Site
- Embodied carbon data
- Mapping network of partners for reuse

Waste

8.36 The detailed design for individual plots will follow design for waste efficient principles to meet zero waste to landfill for the Proposed Development. Based on this appropriate Key Performance Indicators (KPIs) and targets for waste will be included in contracts and construction site waste management plan.

8.37 All waste and spoil produced during the works, including below ground arisings, construction wastes (such as timber, steel, packaging), hazardous wastes (such as lubricating and hydraulic oils) would be stored and disposed of in accordance with respective regulations.

8.38 A SWMP will be produced prior to the commencement of construction works. Although the statutory requirement to produce such a plan (Site Waste Management Plan Regulations 2008) has now been repealed, the Applicant has committed to prepare such a document on a voluntary basis and the preparation of such a plan remains a good practice requirement under Applicant's procedures. An estimate of expected volume of waste based on BRE's Smart Waste data has been produced to guide the SWMP at the detailed design stage. See Figure 10.

Use	Maximum Floorspace (GIA)	EPI ($m^3/100m^2$)	Waste Arising EPI (m^3)
Ground and above			
Retail (A1-A5)	13,681 m^2	7.5	1,027
Business (B1)	176,004 m^2	7.5	13,200
Hotel (C1)	44,081 m^2	8.1	3,570
Residential (C3)	83,381 m^2	8.1	,754

Figure 10 An Estimate of the Potential Volumes and Types of Waste Arisings During Construction of the Proposed Development (Indicative Scheme) at the Site [Source: NQ.PA.08 Environmental Statement]

8.39 For individual plots within the RMAs, BREEAM criteria Wst 01 - Construction Waste Management will be followed to establish material availability from the existing Site through pre-demolition audits, implementation of a Resource Management Plan, and target to reduce non-hazardous construction waste ≤ 7.5 tonnes/100m^2 of Gross Internal Floor Area.

Sustainable procurement

8.40 During construction phase, the principal contractor will be required to meet the sustainable procurement requirements set out within the Applicant's Sustainable Design and Construction Guide and Sustainable and Healthy Materials brief (Appendix VII).

8.41 A project level material flow strategy will be set in partnership with the Applicant and the principal contractor to establish a network to enable reuse through returning, selling or donating unused,

surplus construction materials to nearby construction projects, or within the contractor organisation, or via online construction materials trading platforms

8.42 A Sustainable Procurement Plan (Appendix VI) has been produced by the design team and contractor to ensure all materials are specified and sourced in a responsible and ethical manner. This meets the requirements set within BREEAM criteria for Mat 03 - Responsible Sourcing of Construction Products. Responsible sourcing of the following materials, which constitute significant proportion of construction, will be ensured through the specification of FSC timber, ISO14001 certified products and the use of BRE's Framework Standard BES 6001 for the responsible sourcing of construction products.

- Brick (including, clay tiles and other ceramics), pavers
- In situ and pre-cast concrete
- Timber (including timber composites, and wood panels)
- Stone and gravel
- Steel, aluminium, copper
- Plasterboard

9 Transport

Policy Response

9.1 The relevant policies relating to sustainable transport are The London Plan policy 6.11 'Smoothing traffic flow and tackling congestion', Draft London Plan policy T2 'Healthy streets', T5 'Cycling' and T6 'Car Parking', and LBTH Local Plan Policy S.TR1 Sustainable travel.

9.2 Steer have undertaken a Transport Assessment in support of the OPA. The Proposed Development aims to put people first, by creating a high-quality environment that encourages active travel. For further information refer to Steer NQ.PA.10 Transport Assessment.

9.3 The Proposed Development has reduced the dominance of vehicles, by proposing a car-free development (Draft London Plan, T6 'Car Parking) and improving the connectivity to the adjacent neighborhoods and public transport by prioritising pedestrian and cycling routes (Draft London Plan, T2 'Healthy streets') with supporting parking provision (Draft London Plan, Policy S.TR1 and T5 'Cycling'), and a (reduced) accessible parking provision.

Public transport

9.4 The Site is very well connected by public transport achieving a PTAL level of 5 across the Site. This could be 6 to the east adjacent to Upper Bank Street, when Crossrail is operational. The opening of the Elizabeth Line will increase the PTAL of the entire site to 6a. This availability of the transport links in the vicinity of the Site has provided the basis for a virtually car-free development (policy T6 'Car Parking'). The Proposed Development builds on and enhances the excellent accessibility to the Site by enabling sustainable modes of transport by prioritizing walking, cycling, rail and bus journeys (Policy S.TR1).

9.5 All credit requirements for Transport credits within BREEAM will be achieved (see Appendix V).

Accessible Parking provision

9.6 The Proposed Development is car-free except for a minimum target of 3% accessible car parking for residential dwellings and a further on-street parking space per commercial building for blue-badge holders. Electrical vehicle charging points are being proposed for 20% of parking spaces with passive provision for all remaining. Loading bay/ Disable parking space will be located on both sides of the road. Generous footpaths with tree planting will create an attractive streetscape. See Figure 11.

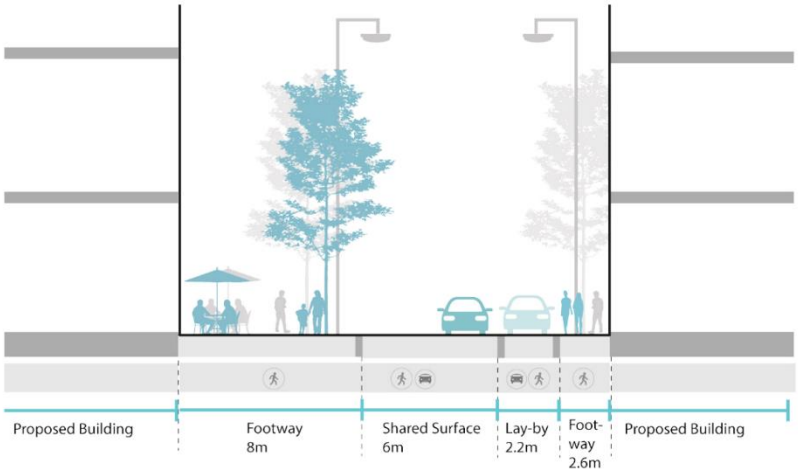

Figure 11 Illustrative section LDA Design

Pedestrian

9.7 The Proposed Development seeks to create new pedestrian routes that are aligned to key desire lines, creating direct north-to-south and east-to-west routes. The pedestrian links follow the Healthy Street principals advocated by the Draft London Plan, encouraging more active travel throughout the Proposed Development. See Figure 12.

9.8 A consistent approach to footway and public realm materials will be adopted to encourage and guide pedestrians around the Site, providing natural and physical orientation for users. Pathways benefit from well-lit and informal surveillance from the active retail frontages at ground level, providing a sense of security. Landscape elements, such as trees, greenery and regular opportunities to stop and rest, will create a pleasant, sheltered and shaded environment. Wide footways with appropriate gradients and dropped kerbs, allow for those with mobility impairment to circulate through the site, further contributing to inclusivity.

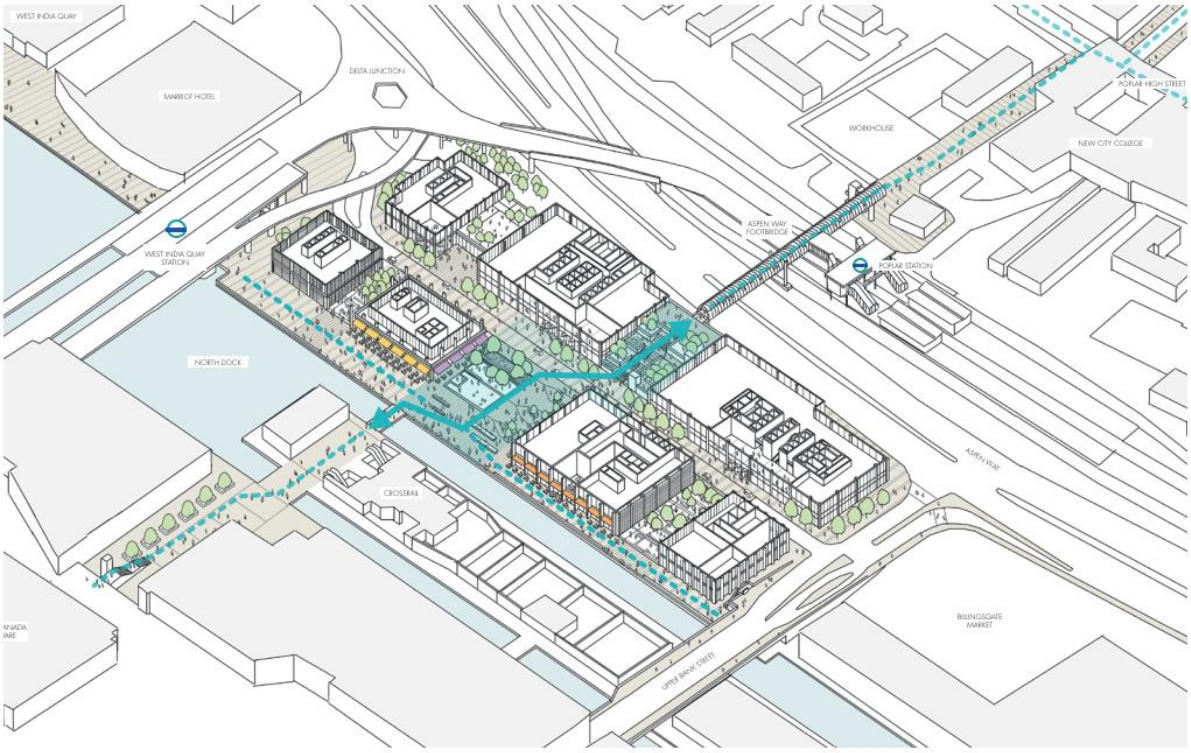

Figure 12: Connectivity with surrounding links and neighbourhoods. Source: NQ.PA.07 Design & Access Statement, Chapter 10

Cycling

9.9 The Proposed Development will comprise a network of orthogonal cycle routes throughout the Site, allowing for easy access on the north-to-south and east-to-west corridors, complementing the pedestrian connection routes. Ample cycle parking provision, for long-stay and short-stay are also being proposed - 3,800 and 340 parking spaces respectively. Provisions of 5% of these will be accessible wider stands, accommodating larger, adapted cycles or bicycles used by disabled cyclists, conforming to the London Cycling Design Standards. See NQ.PA.10 Transport assessment.

9.10 These improvements will support active travel amongst new residents, employees and visitors, contributing to the mode shift towards more sustainable transport modes advocated by the Mayor of London. For full transport proposals please refer to NQ.PA.10 Transport assessment, and NQ.PA.11 Framework Travel Plan and NQ.PA.12 Residential Travel Plan.

10 Air Quality

10.1 Air quality is integral to the Applicant's approach to wellbeing. The Applicant is a founding member of Business Clean Air Task Force and a keen advocate for achieving a positive impact on local air quality through all electric building systems and logistics. The Applicant intend to extend the network of air quality sensors to North Quay and integrate biodiversity features such as a planted wall along Aspen Way that will act as a natural air filtration system.

Policy response

10.2 The relevant policies relating to Air quality are The London Plan Policy 7.14 Improving air quality, 'Draft London Plan' policy SI1 Improving air quality, Local Plan 2031 Policy D.ES2: air quality.

10.3 Air quality survey and modeling have been undertaken to identify the levels of existing air pollution on the Site as required in Part B.2c of policy SI1 and Policy D.ES2-2. See ES Volume 3: Appendix Air Quality, NQ.PA.08 Environment Statement. The Proposed Development has carefully considered the implications of these factors, and incorporated strategies to mitigate potential impact of the site.

10.4 The Draft London Plan Policy SI 1 'Improving Air quality' states that development should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. Good design and best practice measures have been incorporated into the Proposed Development (Part B.2b of policy SI1), both during construction and for the Proposed Development when operational.

10.5 The Proposed Development will have a non-significant effect on air quality, during both the construction and operational phases. The Proposed Development is better than 'air quality neutral' (NQ.PA.10 Environment Statement), in line with LBTH Local Plan, Policy D.ES2-1 requirement to meet 'air quality neutral' standard.

10.6 Detailed Air Quality Plans will be devised for each building as well as public realm. See Chapter 12 for detailed Urban Greening and biodiversity measures implemented in response to Policy G5 – 'Urban Greening' and other related policies.

Risks and proposed mitigation approach

10.7 The most significant risk identified is the dust generated during enabling and construction works and emissions of pollutants from road traffic and emergency diesel generators associated with operation of the Proposed Development. Despite the adoption of a worst-case, conservative approach, the assessment showed that the increase in road traffic on the local road network and emissions from the proposed emergency diesel generators would lead to negligible impacts at all nearby existing receptors. In addition, the assessment demonstrated that air quality for future users and residents of the Proposed Development would also be acceptable.

10.8 A Construction Logistic Plan (CLP) and Construction Environmental Management Plan (CEMP) will be adopted to minimise environmental impacts during the construction works. As the Site has been identified as a Medium Risk site during demolition and a High-Risk site during, earthworks, construction mitigation measures shall be written into a dust management plan (DMP).

There will also be provision for a Delivery and Servicing Plan to minimise the environmental and road traffic related impacts of deliveries to and from the Site and general development servicing. See Chapter 5, Demolition and Construction of the NQ.PA.08 Environment Statement.

10.9 In response to Part C of the Draft London Plan, Policy SI1 Improving Air Quality, design features have been proposed to reduce exposure to pollution. Building on the Site's location and high PTAL score (NQ.PA.10 Transport Assessment), the proposal is essentially car-free. There is provision only for a small number of accessible parking, 20% of which will have an electric vehicle charging point. The Proposed Development layout defines direct connective routes to adjacent neighbourhoods and public transport nodes, encouraging use of sustainable modes of transport such as walking, cycling.

10.10 The landscape proposals include street trees - to improve air quality and resilience to climate change. Air quality improvements proposed include: Specification of tree species with high pollutant absorbent to mitigate air quality and Biodiversity wall along Aspen Way. See NQ.PA. 07. Design and Access Statement.

10.11 In designing the energy strategy as per North Quay Energy Statement (NQ.PA.17), the team has avoided the need for on-site combustion plant for heating and hot water, which is aligned with the concept of being air quality positive. The buildings will have heating, cooling and hot water via air source heat pumps, which effectively means that there will be no local building emissions.

10.12 It was also shown that with the adoption of recommended mitigation measures, the residual effects of enabling and construction dust would be 'not significant', and emissions from construction vehicles will also lead to negligible impacts at existing receptors. See Chapter 5, Demolition and Construction of the NQ.PA.08 Environment Statement.

10.13 The assessment has demonstrated that the Proposed Development will not cause any exceedances of the air quality objectives and that the overall air quality effect of the Proposed Development will be 'not significant'. As such, there is no requirement for mitigation beyond the best practice design measures highlighted above.

11 Biodiversity and Urban Greening

11.1 The current London Plan has some requirements on street tree planting and calls for a reduction of Urban Heat Island effect (Policy 5.10 Urban Greening) but has not specifically set any targets on biodiversity enhancement. Therefore, the biodiversity strategy for the Site is based on the Draft London Plan requirements and a summary of response is outlined below.

- Policy G1 – 'Green Infrastructure' – one of the key requirements is providing green infrastructure as integral element to the economic and social value enhancement efforts. The policy refers to the i-Tree assessment, which is adopted by the Canary Wharf Biodiversity Action Plan 2018 – 2028 as one of the preferred methods in assessing impact of the Proposed Development.
- Policy G4 – 'Local Green and Open Spaces' – 'include improved public access for all, inclusive design, recreation facilities, habitat creation, landscaping improvement or flood storage'. – refer to NQ.PA.07 Design and Access Statement for landscape design proposal.
- Policy G5 – 'Urban Greening' – key requirements are incorporating measures such as a) high-quality landscape, green roofs, green walls and sustainable drainage; b) develop Urban Greening Factor (UGF) (..) with a target score of 0.3 for predominately commercial development and 0.4 for residential.
- Policy G6 'Biodiversity and access to nature' – relevant requirements for the Site are introducing new habitats and positive gains for biodiversity. The Proposed Development, based on ecologist input and landscape design, currently complies with the first criterion for the provision of new habitats.

11.2 LBTH has further identified the open space, green areas and biodiversity needs for the area within Policy D.OWS3: Open space and green grid networks and Policy D.ES3: Urban Greening and Biodiversity. In terms of biodiversity, LBTH further refers to the Local Biodiversity Action Plan – Tower Hamlets Local Biodiversity Action Plan 2019 – 2024. As a response to those requirements, the Proposed Development have identified Black Redstart, Swift and the House Sparrow amongst others as target species. Consultation with ecologist will ensure the proposed vegetation will provide the required habitats.

11.3 The Applicant's Biodiversity Action Plan[i] sets out ambitious targets for increasing biodiversity net gains across Canary Wharf Estate. North Quay landscaping team has been working closely with specialist ecologist to maximise net gains across the development.

[i]Available online at https://group.canarywharf.com/corporate-responsibility/biodiversity-action-plan/

Action Plan for the site

11.4 The Proposed Development brings publicly accessible green and open spaces in an area that is limited in access to green areas.

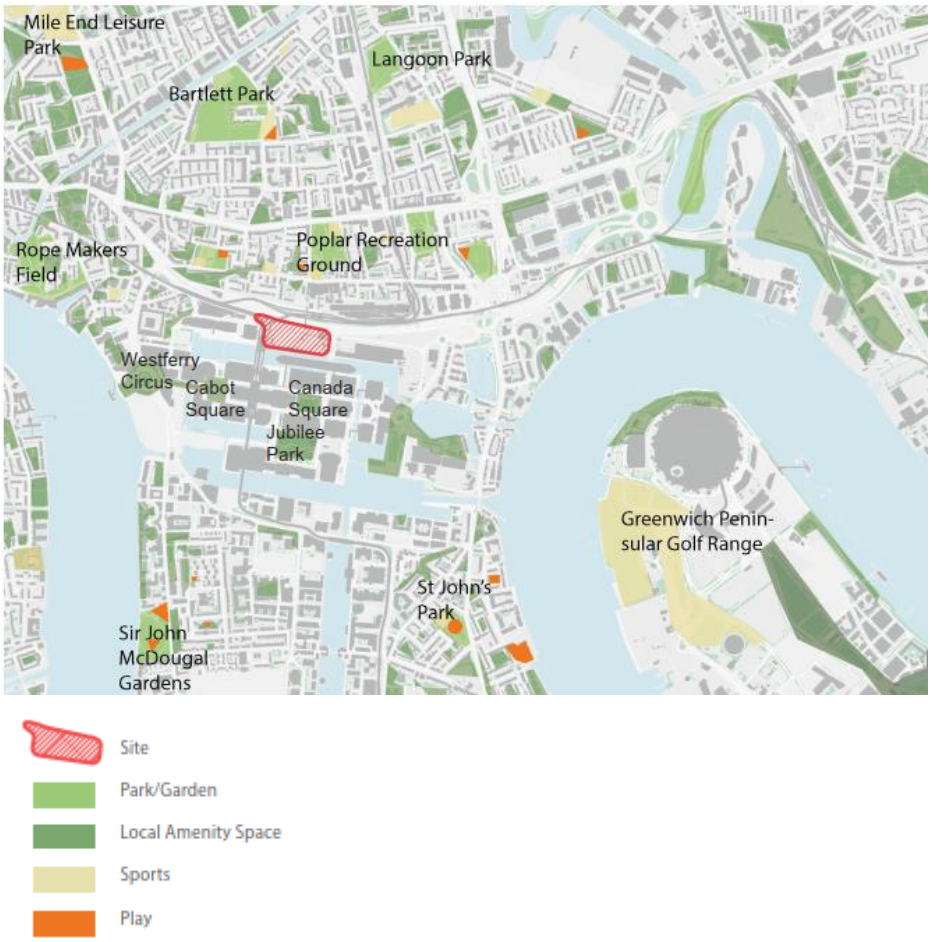

Figure 13: Surrounding open spaces (Image: Design and Access Statement)

11.5 The Applicant is guided by a previously developed Biodiversity Action Plan 2018 – 2028 (BAP), which carefully considers wider implications of biodiversity, including impacts on climate change and human health, wellbeing and productivity. Through the definition of key habitats and species, the BAP aims to embed biodiversity into the design, maximizing opportunities to create and augment green corridors that link with the rest of Tower Hamlets and east London. The BAP 2018-2028 has identified three main evidence-based objectives:

- Objective 1: Embed the biodiversity 'net gains' principle within management and planning decision-making across the estate
- Objective 2: Develop and apply actions for climate change resilience
- Objective 3: Improve ecosystem service value and in particular health, well-being and productivity of Estate users.

11.6 The landscape and public realm of the Site has been designed around the principles of 'First life, The Spaces, Then Buildings' looking at how activities in the spaces can build community cohesion

and sense of place. The strategy consists of a combination of soft landscape, planting and ecological enhancement areas. See Figure 13. The landscape proposals significantly increase the green spaces across the Site compared with the existing site condition, providing increased opportunities for urban wildlife to flourish.

11.7 Current biodiversity and urban greening proposal include considerations of vegetation which is draught resilient and highly adaptable to respond to future climatic changes.

11.8 For the benefit of the future users and created natural habitats, the Proposed Development has recognised that air-quality pollution mitigation measured are required. See Chapter 10 Air Quality.

11.9 A key component of the action plan for the Site is the varied habitats within the Proposed Development, which will enhance biodiversity, encourage pollinators and native birds.

11.10 There are a number of targeted species for the Proposed Development. Through consultation with ecologist, a range of 'ecological features' as well as the planted areas will aim to provide foraging habitats for these species, maximising biodiversity.

11.11 The habitats proposed on the Indicative Scheme include semi-natural vegetation, flower rich perennial planting, intensive and extensive green roofs, green wall, rain gardens, lawns and a number of tree species. See Figure 14. Further proposals for enhancement on each Development Zone will be carried out as part of the RMAs.

Figure 14: Biodiversity Strategy as per the Indicative Scheme (Excerpt from NQ.PA.07 Chapter 7.3)

12 Environmental Certification

Policy response

BREEAM

12.1 The LBTH 'Draft Local Plan states that all new non-residential development and non-self-contained residential accommodation should achieve at least an BREEAM 'Excellent' rating (Strategic Policy D.ES7).

12.2 There are several other LBTH polices that directly cover aspects of the BREEAM assessment that have been taken into account when considering the proposed approach to BREEAM, including but not limited to:

- Sustainable transport (Policy TR1);
- Car parking (Policy TR3); and
- Biodiversity (Policy ES3).

Proposed Approach

12.3 The non-residential buildings the Proposed Development are to be assessed under BREEAM New Construction (NC) 2018. This Sustainability Statement sets out planned routes to BREEAM 'Excellent' for the office, hotel/serviced apartments and retail developments under BREEAM's Shell & Core assessment based on the Indicative Scheme. Although routes to 'Excellent' have not been provided for other aspects of the Proposed Development they will also be based on 'closest match' template presented, e.g. the student housing will use the hotel pre-assessment as a basis.

12.4 A Shell & Core assessment option is available where the Developer's scope of works only covers new-build works to the fabric, substructure and superstructure as well as the core building services. In order to not disadvantage speculative developments certain credits, or individual requirements of credits, are not assessed under a Shell & Core assessment where they relate to the fit-out works or post-construction services. Where a development undergoes a Shell & Core assessment, as opposed to a Fully Fitted assessment, this will be noted on the BREEAM certification. It should be noted that achieving 'Excellent' under Shell & Core can be more challenging as the choice of credits is limited, therefore using shell and core as a template route to 'Excellent' is a robust approach.

12.5 Developing this template route to Excellent for the OPA ensures that the early stage and site wide credits are considered within the Preparation and Briefing stage. For example:

- Site wide Credits - The appointment of an Ecologist for the OPA as much of the Land Use and Ecology section will be assessed through the site-wide landscape strategy submitted for the OPA.
- Early Stage Action – A 'Sustainable and Healthy Materials' brief has been developed by the Applicant, a requirement of BREEAM Issue Mat 03 'Responsible Sourcing of Construction Products' that needs to be in place before Concept Design (RIBA Stage 2). The developed plan will guide procurement on all development across the Proposed Development site and will be revisited for each individual assessed building/typology as they become active projects.

12.6 The pre-assessment submitted as part of this OPA are templates only. It will be down to individual Assessors responsible for assessing individual buildings to implement and adapt the templates on a building-by-building basis as RMAs come forward.

12.7 Should a development that has been certified under a Shell & Core assessment wish to achieve Fully Fitted certification status at the fit-out stage it can then be assessed under BREEAM Refurbishment and Fit-out 2014, Part 3 'Local Services' (localised services including lighting, local heating, cooling and ventilation) and Part 4 (interior design, interior finishes, furniture, fittings and equipment). This would be the responsibility of an incoming tenant and, if successful, would result in that building being issued with a 'Fully Fitted' BREEAM certificate.

North Quay Pre-assessment

12.8 A pre-assessment has been carried out to maximise the BREEAM credits available at the site-wide and landscape level to enable the non-residential buildings to achieve BREEAM 'Excellent' as well as the early stage credits to ensure all assessments to individual buildings are beginning their assessment from a strong position. See Appendix V.

The template BREEAM NC 2018 pre-assessments demonstrate that a score of 77.89%, 74.56% and 77.78% for the office, retail and hotel pre-assessments respectively can be achieved. See Figure 15. The key to summary graph is outlined in

12.9 Table 1.

12.10 Several potential credits have also been identified that cannot either be committed to at this time or that require detailed design, consultation or commitment. These have been listed as potential only to minimise the risk in achieving the required BREEAM rating set by LBTH and their feasibility will be continually reviewed as the project continues.

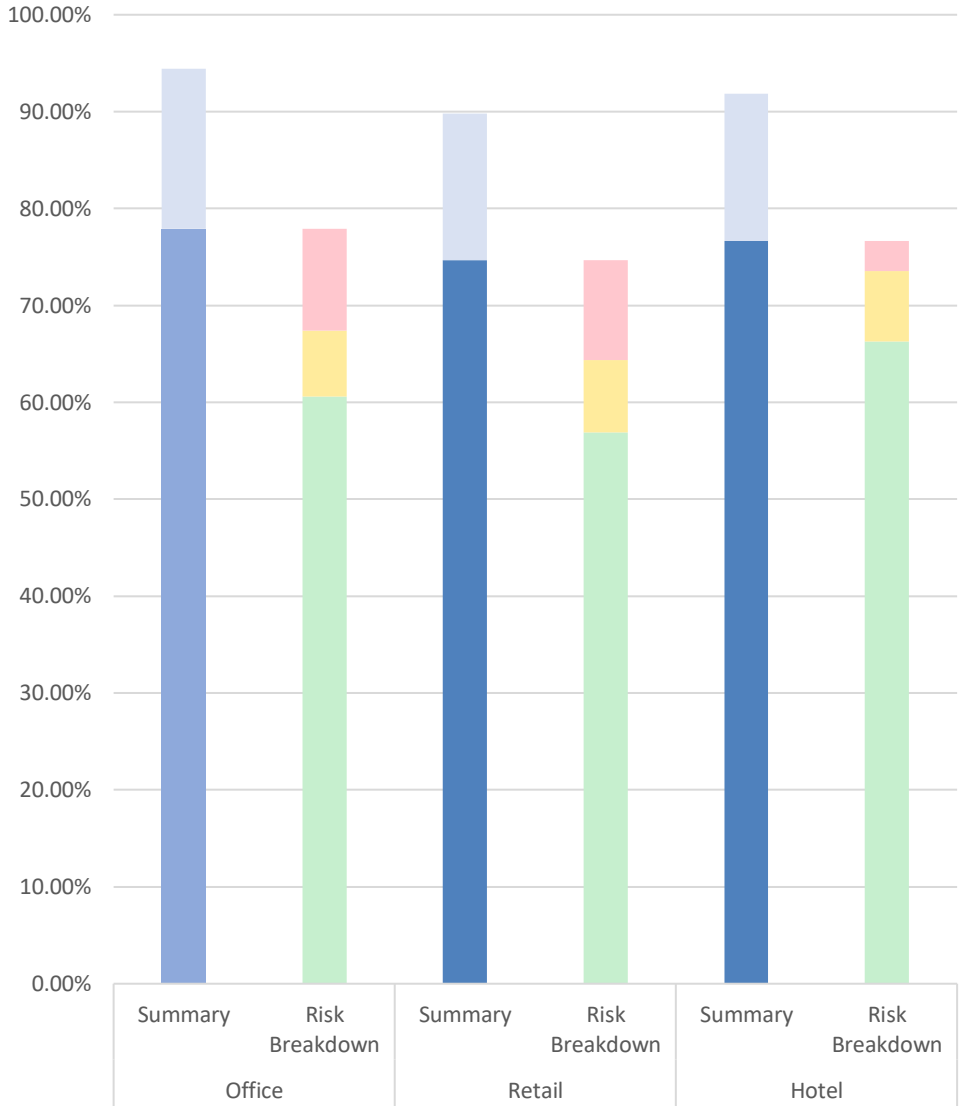

Figure 15: Pre-assessment summary and perceived risk breakdown for the office, retail and hotel parts of the Indicative Scheme

Table 1: Key to pre-assessment summary graph

Category	Colour	Description
Targeted		Considered achievable
Potential		Credit that can potentially be included within the targeted score however further review of the targets/analysis of the proposals or consultation with Project Team members yet to be appointed. These will be periodically reviewed through the design and construction process
Low Risk		Targeted, low risk – thought to be relatively straight forward to achieve
Medium Risk		Targeted, medium risk – some uncertainty and/or technically complex
High Risk		Targeted, high risk – may be highly uncertain, expensive and/or historically difficult to achieve.

12.11 BREEAM sets a number of minimum requirements for each BREEAM rating level. As you move from 'Pass' through to 'Outstanding' the number of minimum requirements increases and for certain minimum requirements, e.g. Ene 01 'Reduction of Energy Use and Carbon Emissions', credit #1 'Energy Performance' the level of performance required increases. For all pre-

assessment prepared for the Proposed Development meet the minimum requirements to achieve 'Excellent'.

12.12 The following section focuses on key aspects of the Proposed Development that are being implemented to maximise the BREEAM score and for which action is required from an early stage.

Sustainable Procurement Brief (BREEAM NC Issue Mat 03)

12.13 BREEAM provides a significant number of credits for responsible and sustainable procurement practices. A site wide sustainable procurement plan has been produced by the Applicant, titled 'Sustainable Procurement Plan' (refer to Appendix VI), this will be developed further in the next stage of works to meet the specific requirements of Mat 03 'Responsible Sourcing of Construction Products'. Once finalised, the BREEAM compliant Sustainable Procurement Plan will out the parameters that the Contractors for the individual buildings may need to address to achieve BREEAM 'Excellent'. The specific credits addressed by this guide are:

- Man 03 – Responsible Construction Practices
- Mat 03 – Responsible sourcing of construction products
- Mat 06 – Material Efficiency
- Wst 01 – Construction Waste Management

Safe and Healthy Surroundings (BREEAM NC Issue Hea 07)

12.14 The Indicative Scheme provides ample external amenity space or the building occupants and will likely achieve the 'Outdoor Space' credit under Hea 07.

Sustainable Transport (BREEAM NC Issues Tra 01/02)

12.15 It is likely that the implemented strategy will enable all assessed buildings on the Site to achieve the maximum number of BREEAM credits available for Transport.

12.16 The Site is very well connected by public transport achieving a PTAL level of 5 across the Site. The opening of the Elizabeth Line will increase the PTAL of the entire site to 6a. West India Quays and Poplar DLR stations, Canary Wharf Jubilee Line station, the future Elizabeth Line station and eight bus services are all within walking distance.

12.17 Cycle facilities including a 32-point docking station, over 3,800 long-stay cycle parking spaces and a minimum of 340 short-stay spaces (170 Sheffield stands) in the public realm, along with shower and locker facilities for residents, employees and visitors will be provided. The proposals for long stay cycle parking and cycle facilities exceed the BREEAM requirements.

12.18 Implementing new pedestrian and cycle routes on the proposed development that have resulted from discussions with the local authority provide additional BREEAM credits.

Adaptation to Climate Change (BREEAM NC Issue Wst 05)

12.19 The project team have produced a Climate Change Risk Assessment (Appendix III – Climate Change Adaptation Risk Assessment) for the Proposed Development. This identifies the likely hazards and possible mitigation measures that should be taken in the design of the Proposed Development and the detailed design of the buildings.

12.20 This risk assessment satisfies the detailed requirements of the first credit.

Flood and Surface Water Management (BREEAM NC Issue Pol 03)

12.21 A Flood Risk Assessment has been undertaken for the Proposed Development and confirms that the Site is in Flood Zone 3 (high risk) and Flood Zone 2 (medium risk) areas however the Site benefits from the protection of the Thames Tidal Defenses and as such the EA classify the site as having a low residual flood risk. This means that one credit for flood risk mitigation is available for the Proposed Development.

12.22 The Indicative Scheme includes a SUDS and attenuation strategy based on the use of blue roof and an increase drainage by 40% to account for climate change.

12.23 Where appropriate these measures have been integrated into the design of the Proposed Development. In many cases the risk assessment identifies actions for the designer working on the RMAs.

Landscape and Ecology (BREEAM NC Issues LE 01 to LE 05)

12.24 The Site has been previously developed and will require some remediation from contamination so both credits for land use are likely to be achieved by buildings on the Site.

12.25 The landscape proposals will result in an uplift in biodiversity on Site and almost all the available BREEAM ecology credits can be achieved by the Proposed Development.

Home Quality Mark

12.26 Policy D.ES7: A zero carbon borough of LBBTH states that, as a minimum, all self-contained residential proposals will be strongly encouraged to meet the Home Quality Mark.

12.27 Environmental certification of the Applicant's residential developments is a key deliverable of the Sustainability Strategy. All of the Applicant's residential developments have historically been certified against Code for Sustainable Homes (CfSH) methodology and have achieved Level 4 status. Since the CfSH has been withdrawn by the Government, the Applicant have continued to comply with requirements on a voluntary basis. However, recognising the evolving nature of certification and corresponding requirements the Applicant are committed to adopt a relevant up to date methodology, such as Home Quality Mark (HQM).

12.28 HQM is an independently assessed certification scheme for new homes that enables and rewards home's design, construction and sustainability. The methodology aligns with Applicant's Sustainability Strategy in terms of delivering spaces that are resilient to climate change,

increasing biodiversity net-gain, leading the way to zero carbon and procuring responsibly sourced materials with low embodied impact. Detailed assessments will be delivered for residential development as part of the RMAs.

Appendix I – Abbreviations

Terminology	Abbreviation (if different)
Applicant	
Canary Wharf (North Quay) Ltd	"the Applicant"
Project/Scheme Title	
North Quay	
Site Address	
North Quay, Aspen Way, London, E14	"the Site"
Planning History	
Please see above. The 2007 planning permission to be referred to as the "2007 consent".	
Application Documentation	
Please refer to Deliverables Tables above for document titles/authors	
Footbridge over Aspen Way	
"Aspen Way Footbridge"	
Key Local Authorities/Statutory Consultees	
London Borough of Tower Hamlets	"LBTH"
Mayor of Tower Hamlets	-
Greater London Authority	"GLA"
Crossrail	"Crossrail"
Key Planning Policy Documents	
National	
National Planning Policy Framework (February 2019)	"NPPF"
National Planning Practice Guidance (first published March 2014)	"NPPG"
Technical Housing Standards - nationally described space standard (March 2015)	-
Regional	
The London Plan – the Spatial Development Strategy for London Consolidated with Alterations since 2011 (March 2016)*	"The London Plan"
The Draft London Plan - Intend to Publish version (December 2019*	"Draft London Plan"
Housing Supplementary Planning Guidance (March 2016)	"Housing SPG"

MAX FORDHAM

Terminology	Abbreviation (if different)
Local	
LB Tower Hamlets Local Plan 2031: Managing growth and sharing the benefits (Adopted January 2020)	"Local Plan"
LB Tower Hamlets Planning Obligations Supplementary Planning Document (September 2016)	"LBTH Planning Obligations SPD"
Development Viability Supplementary Planning Document (Adopted 2nd October 2017)	"Development Viability SPD"
Scheme Terms	
Control Documents	The Specified Parameters are set out in the three Control Documents: the
Development Plot	A building that can arrive within a Development Zone, which is defined by a maximum height and envelope. Development Zones may contain single or multiple Development Plots.
	The Development Specification sets out a written account of the Parameter Plans and describes the OPA and the type and quantity of development that could be provided within each of the Development Zones across the OPA Site as a whole.
Development Zone	Areas within which buildings can arrive, which are defined by a maximum length, w

Terminology	Abbreviation (if different)
Limit of Deviation	The extent to which defined boundaries and levels may deviate from those shown
	The Parameter Plans define the extent of the proposed routes, open spaces and Development Zones across the OPA Site against a series of minimum or maximum dimensions. Each of these component parts is identified as a Development Zone which is identified by a letter (e.g. Development Zone NQ.A).
Permitted Uses	Those uses which are permitted on North Quay, defined in the Development

Appendix II – Policy Response Mapping

MAX FORDHAM - North Quay Policy Matrix

	Climate change risk adaptations	Energy	Water and Surface water run-off	Health and wellbeing	Materials, circular economy and waste	Transport	Air quality	Biodiversity	Environmental certifications
The London Plan									
Policy 5.1 - 'Climate Change Mitigation'	Covered in Section 4								
Policy 5.2 - 'Minimising Carbon Dioxide Emissions'		Covered in Section 5							
Policy 5.3 - 'Sustainable Design & Construction'		Covered in Section 5			Covered in Section 8				Covered in Section 12
Policy 5.6 - 'Decentralised Energy in Development Proposals'		Covered in Section 5							
Policy 5.7 - 'Renewable Energy'		Covered in Section 5							
Policy 5.9 - 'Overheating and Cooling'	Covered in Section 4			Covered in Section 7					
Policy 5.10 - 'Urban Greening'	Covered in Section 11						Covered in Section 11	Covered in Section 11	
Policy 5.12 - 'Flood Risk Management'	Covered in Section 6		Covered in Section 6						
Policy 5.13 - 'Sustainable Drainage'	Covered in Section 6		Covered in Section 6						
Policy 5.15 - 'Water Use and Supplies'			Covered in Section 6						
Policy 6.11 - 'Smoothing traffic flow and tackling congestion'						Covered in Section 9			
Policy 7.14 - 'Improving air quality''							Covered in Section 10	Covered in Section 12	
Draft London Plan									
Policy S4 - Play and Informal Recreation				Covered in Section 7					
Policy G1 – 'Green Infrastructure'				Covered in Section 7				Covered in Section 11	
Policy G4 – 'Open Space'				Covered in Section 7				Covered in Section 11	
Policy G5 – 'Urban Greening'	Covered in Section 11						Covered in Section 11	Covered in Section 11	
Policy G6 – 'Biodiversity and access to nature'				Covered in Section 7				Covered in Section 11	
Policy SI1 - 'Improving air quality'				Covered in Section 7			Covered in Section 10	Covered in Section 11	
Policy SI2 - 'Minimising greenhouse gas emissions'		Covered in Section 5							
Policy SI3 - 'Energy infrastructure'		Covered in Section 5							
Policy SI4 - 'Managing heat risk	Covered in Section 4			Covered in Section 4					
Policy SI5 - 'Water Infrastructure'	Covered in Section 6		Covered in Section 6						Covered in Section 12
Policy SI7 – 'Reducing Waste and Supporting the Circular Economy'					Covered in Section 8				
Policy SI12 – 'Flood Risk Management'	Covered in Section 6		Covered in Section 6						
Policy SI13 - 'Sustainable Drainage'	Covered in Section 6		Covered in Section 6						
Policy T2 – 'Healthy Streets'				Covered in Section 7		Covered in Section 9			
Policy T5 - 'Cycling'						Covered in Section 9			
Policy T6 - 'Car Parking'						Covered in Section 9			
London Borough of Tower Hamlets									
Policy D.DH2 - Attractive streets, spaces and public realm				Covered in Section 7					
Policy D.H3 - Housing Standards and Quality									
Policy D.OWS3 - Open space and green grid networks				Covered in Section 7				Covered in Section 11	Covered in Section 12
Policy D.ES2 - Air Quality							Covered in Section 10	Covered in Section 11	
Policy D.ES3 - Urban Greening and biodiversity							Covered in Section 11	Covered in Section 11	
Policy D.ES4 - Flood Risk	Covered in Section 6		Covered in Section 6						
Policy D.ES5 - Sustainable drainage	Covered in Section 6		Covered in Section 6						
Policy D.ES6 - Sustainable water and wastewater management	Covered in Section 6		Covered in Section 6						
Policy D.ES7 - A zero carbon borough		Covered in Section 5							
Policy D.ES10 - Overheating	Covered in Section 4	Covered in Section 4		Covered in Section 4					
Policy S.MW1 - Managing our waste					Covered in Section 8				
Policy D.MW3 - Waste collection facilities in new development					Covered in Section 8				
Policy S.TR1 - Sustainable travel						Covered in Section 9			

Appendix III – Climate Change Adaptation Risk Assessment

Climate Change Hazard Risk Assessment Matrix: North Quay

Section 1

Climate Change Hazard Risk Assessment Framework

Issue Date: 28/04/2019

Introduction: A Global to Local Response

The Paris Agreement is a significant step forward. 195 nations including the UK will "pursue efforts" to prevent more than a 1.5°C increase in global temperatures. Current commitments to reduce emissions however, even if fully implemented, will lead to an estimated 2.7°C rise. Global emissions would need to peak soon and then decline rapidly for the Paris Agreement goals to be feasible. Even in this scenario the uncertain sensitivity of the climate to greenhouse gases means there would remain at least a small chance of 4°C or more of warming by 2100. It is therefore necessary to prepare for further warming whilst pursuing more stringent emission reductions as part of the global effort. The UK Climate Change Risk Assessment Evidence Report[1] was produced to assess the urgency of further action to tackle current and future risks, and realise opportunities, arising for the UK from climate change. Almost sixty individual risks and opportunities have been assessed by leading academics and other experts as part of this second .

Climate Change cannot be tackled by global policy and agreements alone, so easily put to one side by the whims of nations. To mitigate the impacts of Climate Change we must all play our part and the construction industry is in a position to play a crucial role.

1. https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017

Introduction: This document

This document records the climate change risk assessment carried out for North Quay Development. This study was carried out on 17/12/19, prior to the end of RIBA Stage 1 of the masterplan, and was developed using inputs from all the relevant members of the Design Team.

Evidence was reviewed from relevant bodies to identify and understand the expected impacts of increased extreme weather resulting from climate change on the North Quay Development. During the workshop the impact posed to North Quay from these likely risks was estimated by the group, in particular highlighting the potential risk to structural stability, structural robustness, weather proofing and detailing, material durability, health & safety of building occupants and others, and impacts on building contents and business continuity among other aspects of the design, construction and operation of North Quay.

Risk reduction and mitigation (as far as is practically feasible) were identified. A member of the Design Team was assigned responsibility for developing each reduction and mitigation measure and a series of actions noted against each. The Climate Change Adaption Risk Assessment should be revisited periodically throughout the design and contruction process to ensure that the measures deemed appropriate and feasible are incorproated into the final design of North Quay.

Those risks the participants believed to pose a high risk to North Quay were then evaluated with a tolerable risk threshold set. The sensitivity of the study should be reviewed and areas where the risk posed is unacceptable in terms of health & safety, life cycle assessment and project finances should be identified.

1. Identifying Climate Change Hazard

Climate Change Harazd	Hazard Overview	Hazard Detail
Change in Temperature	Since 1880, there has been a global temperature increase of 0.85°C. This increase is mirrored in the UK climate with the UK has experiencing higher summer temperatures year on year. Average annual UK temperatures over land and the surrounding seas have increased in line with global observations, with a trend towards milder winters and hotter summers in recent decades.	Increase in Summer Temperature - otter, Drier Summers Research indicates that summers will be hotter; by 2050 the average summer day is likely to be 2.7°C warmer and very hot days 6.5°C warmer than the baseline average. 2080 the average day is likely to be 3.9°C hotter and the hottest day of the year 10°C hotter than today's
		Change in Winter Temperature - Warmer, Milder Winters Winters will be warmer; the average, mid-century winter's day being 2.2°C warmer and a very warm winter day 3.5°C above the baseline
		Change in Winter Temperature - Increase Frequency of Cold Snaps Very cold winters will still occur, but will occur less frequently. However there is expected to be an increase in cold snaps
More Extreme Weather	Whilst natural variability in the climate will continue to have a large influence on individual weather events, the recent episodes of severe and sustained rainfall are consistent with projections of climate change. There has been a noticable, significant rise in the rate of rainfall across the UK, exacebated by the increase in golab oceanic temperatures resulting in weather systems capable of carrying increased loads.	Wetter Winters Although the risk to business continuity due to snow is expected to decrease due to the warmer winter temperatures, by 2050 the average winter is projected to be 15% wetter and the wettest winter 33% wetter than the baseline average.
		Extreme Rainfall Events While annual rainfall figures will not change significantly, the distribution through the year will (wetter winters, drier summers). This will increase the intensity of rainfall accodiated with extreme rainfall events.
		Wind/High Wind Speeds The frequency of severe autum and winter wind storms increased between 1950 and 2003. However average wind speeds showed a slight decline over the same period across the UK, bar a slight increase in the south-east, consistent with climate change projections. The UKCOP09 projections remain uncertain with regard to increase in extreme wind. General guidance states that the existing high wind standards (for south east England) combined with the limited evidence that high winds will increase dramatically above those extreme weather events observed over the last 20 years mean that the climate change risk to buildings associated with wind is low
		Increase in Driving Rain Increases in driving rain are expected, most notably to the western areas of the UK which are most exposed to high frequency driving rain events. These events may only increase over time.
		Increase in Temperature and UV With higher temperatures would come an increase in UV radiation. This may put a stain and impact upon building material colour performance and thermal capabilities. Materials with a high movement coefficient/expansion requirements will need more detailing to allow for more movement and space for interfacing between elements.
		Increased Regularity of Rainfall and Humidity Icreases in regular rainfall, and temperature increases may lead to more occurances of high humidity. This can lead to material degredation and possible impacts on moisture being retained within building materials. In turn increased moisture retention can lead to devleopment of growth, mould and dampness impacting people's health and overall environmental quality of interior space.
Increase in Water Issues	Annual rainfall figures across the UK are not expected to significantly change, however the increased seasonal nature will pose very different but equally difficult threats. Sea levels globally and around the UK have risen by 15-20 centimetres since 1900. This is caused by polar and glacier ice caps melting, releasing millions of tonnes of frozen water in to the oceans. Such increase in water can desalinate the water flows of the oceans, changing the capacity for heat to be carried around our oceans and increasing sea levels, thus having a hg impact on low laying areas.	Water Supply Although annual rainfall within the UK is not expected to significantly change due to climate change, the increased seasonal nature of rainfall will lead to greater periods of water scarcity. This scarcity is already driving up the price of water leading to water poverty. Reservoir systems are not designed to cope with regular occurances of drought conditions, esacerbating pressure on other sources whilst the demand for potable water increases.
		Drought and Water Shortage Summers will be drier; by 2050 the average summer is projected to be 19% drier and the driest summer 39% drier than the baseline average. By the end of the century average summers could be 23% drier than today. With increase temperatures evapotranspiration of moisture from soils and plants will also increase. This makes moisture defecits more likely during period of dry weather. The likelihood of summer drought events may increase, with an increase in drought frequency already detected.
		Flooding and River/Sea Level Risk By 2050 the average winter is projected to be 15% wetter and the wettest winter 33% wetter than the current baseline average. This puts an onus on masterplans and infrastructure to be designed to manage both heavier rain events and long term impact of flooding. Key areas of concern are for the management of ground, surface run-off, and fluvial flooding. Increase in storm intensity is also likely to put additional pressure on London's historic sewer system, designed only to cope with a 1 in 30 year storm event.

- Increase in temperatures change
- Risk to peoples comfort, health, productivity, over heating of infrastructure systems and services

- Rain, Flooding and coastal change
- Communities, business, infrastructure, change in local environment

- Drought and Water Supply
- Shortages in public water supply from lack of rain and ground water due to over consumption. Impacting agriculture, biodiversity, ecosystems and soils.

- Natural Capital Assets
- Natural capital impacts
- Risk to natural environments and capital, including terrestrial, costal, marine and freshwater ecosystems, soils and biodiversity

- Emerging Pests
- risk of existing and emerging pest and disease conditions, invasive and non invasive species, that impact people, animals, plants and property

- Agricultural food production
- Risk of domestic and international food production and trade that can be impacted by severe weather, and pests

Climate Change Hazard Risk Assessment Matrix:North Quay Masterplan - for Project team review

1. Hazards → **2. Assessing Climate Change Risk (RIBA Stage 2)** → **3. Addressing Climate Risk: Response and Mitigation (RIBA Stage 2)**

Climate Change Hazard	Key Risk	Impact on Project	Scale of Impact 2020	Scale of Impact 2050	Scale of Risk 2050	Tolerable Risk Level	Risk Mitigation Measure	Risk Mitigation Action and Design Consideration (Tailored to Borough Triangle)	Responsib'ty & Action Owner	Immediate Risk Mitigation Actions and Next Steps
Change in Temperature							**Designing for Comfort**			
Increase in Summer Temperature	Risk of Overheating (Interior)	**Risk of Overheating (Interior) and Impact on Comfort** * Hotter, drier summers present a large risk to occupant comfort within the building. *Poor design (poor insulation, lack of shading, extensive glazing, limited openings) can present risks and have negative impacts on worker productivity affecting business continuity. * Health impacts are possible from increased internal heat gain, i.e. heat stroke. * Changes in temperature can cause discomfort such as lack of sleep, sweating, dehydration.	M	H	H	Acceptable risk level as per TM52 (non-domestic buildings) and TM59 (domestic buildings) using DSY 2 and DSY 3	Designing to Keep Cool (Interior)	**Optimise Passive Design**		
								* Optimise insulation U-value to exclude heat	Architect	* Undertaken overheating model/ thermal model to better understand design and inform strategies. * Currently high noise levels, and unlikely to change significantly * Passive cooling not suitable for some resi-use * Ensure design does not exceed absolute maximum temperatures thresholds in line with national standards for housing. Thresholds should not exceed the following for more than 1% of occupied hours: > 28°C and 25°C set for bedrooms (users less tolerant of high temperatures at night).
								* Provide potential for full future natural ventilation should external noise levels be less of an issue in the future	MEP	
								* Consider passive cooling where noise levels allow (it can include night time cooling, day time purge natural ventilation)	MEP	
								* Airtight construction and detail	Architect	
								Optimise Solar Gain and Glazing		
								*External shading devices and overhangs (self-shading) to limit solar heat gain	Architect	*Design to be developped per Development Zone
								* Optimised glazing ratios and glazing reflectance performance specification.	Architect	*Optimise glazing design prior to planning
		Risk of Overheating (Interior)and Environmental Management * Keeping buildings cool in summer is a challenge in terms of design and energy consumption. * Users do not know how to use buildings properly in response to climate change issues, therefore they consume more energy which counter acts environmental design approaches.	M	H	H	Acceptable risk level as per TM52 (non-domestic buildings) and TM59 (domestic buildings) using DSY 2 and DSY 3		**Provide Active Cooling and Control (where needed)**		
								* Utilise active cooling to stabilise and control interior temperatures.	MEP	* Utilise active cooling to stabilise and control interior temperatures. Such a method is not considered beneficial to carbon emissions as active cooling will use energy from carbon intensive electricity. However it is expected many buildings will need to use active cooling in the future to cope with the increase in temperatures.
								* Mechanical night-time cooling in bedrooms during sleeping hours * Mechanical cooling 24h/day	MEP	* TM59, Criteria for homes predominantly mechanically ventilated: All occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours
	Risk of Overheating (Exterior)	**Risk of Overheating (Exterior) and External Comfort** * Increases in external spaces will impact upon peoples comfort and the local environment. * Urban environments will reflect and radiate heat (urban heat island effect), foliage and planting may become over heated and die off.	L	L	L		Designing to keep cool (Exterior)	**Provide Adaptive Exterior Environments**		
								* Provide mix of surface types (hard, soft, landscaped, shaded, green/ brown roofs)	Landscape Architect	To be considered in the specification of aggregate
								* Provide mix of native and adaptive planting that provides shade and consumes low levels of water.	Landscape Architect	Tree strategy as per DAS and CWC Biodiversity Action Pla
								* Provide deciduous trees that can respond to drier summers, are drought resistant and that provide shade in summer and natural light in winter (leaves drop).	Landscape Architect	Tree strategy as per DAS and CWC Biodiversity Action Plan
								* Select low solar reflectance index (SRI) exterior surfaces to reduce solar heat absorption within the external environment.	Landscape Architect	To be considered in the specification of aggregate
								* Provide 'refuge spaces' for occupants out of the sun	Landscape Architect	Mixture of open and shaded spaces have been proposed
	Risk to Natural Habitats	**Risk for Biodiversity and From Pests** * Emerging risks from pests. * Expansive built up areas leading to nature/biodiversity loss * Urban Heat Island intensification *Air-quality reduction *Soil quality reduction, drier conditions *Extreme weather events	L	M	H	* The London Green Space Factor (GSF)	Designing to enhance nature and biodiversity	**Provide Ecosystem Service Valuation (ESV)**		
								* Sourcing of plants increases bringing of pests to the UK	Ecologist	* Planting should be drought tolerant and reflect climate change risk modelling where appropriate
								* Planting strategy for reduction of the Urban Heat Island effect and promote well-being	Ecologist	*Planting to be approriate to the level of direct and reflected light received *Planting should be drought resilient, in particular where climate change risk modelling identifies heighted UHI risk. *Planting (including internal planting) should be chosen for potential to improve Estate user's health and well-being, based on WELL Biophilia criteria.
								* Regulating processes in place such as carbon cycling, air quality control, water regulation, natural hazard reduction, pollination	Ecologist	* ESV assessment tools - i-Tree and Green Infrastructure Valuation Toolkit
								* Achieve measurable Biodiversity Net Gain	Ecologist	UGF,biodiversity net gain, KPIs - biodiversity
								* Measure climate change modelling results based on proposed interventions, before vs after interventions, to include: PM2.5, PM10, NO2, SO2, and O3 in µg/m3	Ecologist	*Air-quality asssessment on the site to be conducted along with the Environmental Impact Assessment
		Risk of Excessive Heating Energy Consumption						**Provide Controlled Heating Systems**		

Climate Change Hazard	Key Risk	Impact on Project	Scale of Impact 2020	Scale of Impact 2050	Scale of Risk 2050	Tolerable Risk Level	Risk Mitigation Measure	Risk Mitigation Action and Design Consideration (Tailored to Borough Triangle)	Responsib'ty & Action Owner	Immediate Risk Mitigation Actions and Next Steps
Change in Winter Temperature	Risk of Excessive Heating Energy Consumption	* Warmer winters are considered to have a positive effect, less energy can be used to heat. But there is a risk that systems are not designed to react to milder winters, thus consuming more energy than is needed. There needs to be management of energy systems which monitor energy to ensure excess use of resources is not undertaken because automated systems are set up. * Warmer air temperatures must be managed to avoid overheating of the interior of the buildings in winter. Steps should be taken to recover heat to limit over heating of the space.	L	L	L		Designing to keep warm	* Ensure that interior building heating and cooling management systems are calibrated and controlled to respond to actual demand rather than automated annual control settings.	MEP	The proposed building-level heating and cooling communal networks provides a greater security of heating and cooling supply to the Masterplan then district heating. The secondary heat supply from commercial to residential also provides an additional level of resilience.
								* Demand responsive settings can help to reduce energy.	MEP	*Building Management Systems
	Risk of Underheating (Interior)	**Risk of Underheating (Interior)and Impact on Comfort**						**Optimise Passive Heating Strategies**		
		* Intense drops in winter temperature can put pressure on building services and infrastructure heating systems. Older, inefficient buildings are most at risk due to operational costs. * People are impacted through fuel poverty, lack of productive, and major health issues such as respiratory problems.	L	L	L			* Ensure facades are designed to limit heat loss (to be carefully considered in selecting the façade construction system.	Architect	***During concept design of the individual buildings f**açade consultant to design to meet Part L TFEES (Target Fabric Energy Efficacy Standards)
								* Ensure heating systems are sized to accommodate peak demand on extreme weather days.	MEP	The proposed building-level heating and cooling communal networks provides a greater security of heating and cooling supply to the Masterplan then district heating. The secondary heat supply from commercial to residential also provides an additional level of resilience.
	Risk to Building Structure and Services	**Risk to Building Structure and Services**					Mitigating the impact of cold snaps	**Mitigating the Effect of Extreme Drops on Temperature**		
		* External building elements (e.g. canopies, exposed concrete and masonry) and building services (e.g. externally mounted water or fluid filled pipework, roof mounted utilities and services) can be vulnerable from extreme drops in temperature	L	L	L			* Design out risk where possible through services design * Effective management and maintenance strategy that includes comprehensive checks of vulnerable areas in winter months	Architect	During concept design of the individual buildings façade consultant to provide feedback on the maintenance requirements/strategy of the proposed façade and confirm whether climate change impacts have been (or will be) accounted for in the façade materials and seal lifetimes
								* Preparing for periods of unoccupancy during cold periods including timed activation of heating system, water supply shut-off, drain down of piped water services, sufficient pipe lagging and insulation	MEP	
								* Use of robust materials with known design life and serviceable life periods in line with current best practice. Materials should be designed to current best practice operating temperature ranges	Façade Consultant	Should operable temperature range targets be set in excess of current best practice this should be communicated to façade consultant so design can reflect targets.Façade consultant to advise implications
								* Accessible drainage elements to allow ease of maintenance	MEP	*design development
								* Accessible façade elements to allow ease of maintenance	Façade Consultant	façade consultant design input

Climate Change Hazard	Key Risk	Impact on Project	Scale of Impact 2020	Scale of Impact 2050	Scale of Risk 2050	Tolerable Risk Level	Risk Mitigation Measure	Risk Mitigation Action and Design Consideration (Tailored to Borough Triangle)	Responsib'ty & Action Owner	Immediate Risk Mitigation Actions and Next Steps
More Extreme Weather							**Construction Design**			
Changes in Precipitation	Risk to Structural Integrity	**Risk to Structural Integrity due to Subsidence and Shrinkage of Soils** * Changes in rainfall can impact the robustness of soils and clays that buildings are constructed on. * Clay shrinkage is potentially a high risk issue, especially in the South East of the UK due to dense urban make up and increases in winter precipitation. * Changes in rainfall can impact the robustness of soils and clays that buildings are constructed on. * Due to this pipework and infrastructure can be impacted.	L	M	M		Design for structural stability (below ground)	**Structural Stability - Below Ground** * Foundations must be designed for the lifetime of the building and give consideration and design response to the impacts of subsidence and shrinkage. Current design allows for a 50 year design life.	**Structures**	* Deep plied Foundations will be founded at depth into soils which will not be affected by changes in high level water table, design will be based on Site investigation into soils.
								* Due to secant piling any future change in ground water levels is not considered a risk to the development	**Structures**	Site investigation should be carried out to determine ground water level and design will be based on water level plus allowance for variations.
								Structural Stability - Stabilise slopes * Ensure retaining walls and structures are designed robustly to include for drainage strategies. Include for foliage and trees to support slope stability.	**Structures**	Walls to be designed to form part of surface water flooding strategy (façade drainage channels)
Increase in High Wind Speeds		**Risk to Structural Integrity due to Excessive Wind Loading** * Increased in wind speed puts increased structural pressure on buildings, especially in exposed locations, or those that are taller. * Form and shape of buildings can be impacted by wind due to recirculation of wind, wind tunnels and canyons and downdraughts. * Older buildings at risk from high wind speeds if they are poorly maintained and roof elements are not checked.	L	M	M		Design for structural stability (above ground)	**Structural Stability - Above Ground** * Orientate buildings perpendicular to wind direction to mitigate against wind loading on large face of buildings	**Architect**	In places where the roof area will be used as amenity space there is more ballast than you would expect compared to a normal roof improving structural stability.
								* Ensure that buildings are designed to respond to and flex with wind pressure and loading.	**Structures**	Wind pressures are to be determined by wind tunnel testing and buildings will be designed to meet building regulations and comfort requirements of occupants in terms of accelerations
								* Ensure foundations take into account increase in wind speed. Design to longer term standard based on structural loading test model.	**Structures**	Wind pressures are to be determined by wind tunnel testing and foundations will be designed to transmit the resultant forces to the ground
								* Ensure roof design takes into account increases in wind speed, avoid edges that can be lifted.	**Structures**	Wind pressures are to be determined by wind tunnel testing and roofs and coverings are to be designed to resist these forces.
								* Design to worst case scenario (1987 storms), therefore average increased not anticipated to have a significant impact, however extent of risk uncertain.	**Structures**	Facades to be designed to corresponding wind loading factor. To be considered in the design of building details (e.g. corners at highest risk)
								* Undertake wind tunnel testing and where excessive wind loads are identified these should then be examined and reported on by appropriate body (e.g. RWDI, BMT, etc.)	**Structures**	Wind tunnel testing required to ensure occupant and pedestrian comfort and to inform façade/structural design
Increase in Driving Rain	Risk to Material Durability, Resilience and Quality	**Risk to Material Degradation from Driving Rain** * Increased in rain speed and angle may impact upon the weather proofing of buildings. * Potential increase in winter driving rain will mean construction and fixing design needs to be revised, especially in more exposed areas of the UK. * Changes to the climate may impact upon the quality and durability of materials used in construction due to changes in rain occurrence. * While London is considered sheltered, design case should still be the worst case scenario and design to take into account climate change projections	L	L	L		Design for Material Durability, Resilience and Quality	**Provide Durable Construction** * Ensure that construction is well detailed and constructed to reduce ingress of moisture.	**Façade Consultant**	Special consideration into the design of seals to prevent ingress. To be based on projections across the 50 year design life of the building
								* Make preference for elements such as recessed window and door reveals to avoid water ingress at the surface of the façade.	**Architect**	*further design development with Façade consultant
								* Include for projecting cills with drips to expel water from the façade and interior space.	**Façade Consultant**	*further design development with Façade consultant
								* Render finishes	**Architect**	*further design development with Façade consultant
								* Provide greater laps and fixings to the roof and cladding systems	**Architect**	*further design development with Façade consultant
								* Increase pressure testing requirements to 900Pa	**Architect**	Unless CWC Guidelines suggest otherwise Increase pressure testing requirements to 900Pa.
Increase in Temperature and UV Radiation		**Risk to Material Resilience and Durability from Temperature Change and UV** * Changes to the climate may impact upon the quality and durability of materials used in construction due to temperature changes and UV.	L	M	M			**Provide Resilient Materials** * Investigate and assess material build ups thoroughly for durability and resilience to climate impacts	**Architect**	*development during detailed design
								* UV 'resistant' design already a requirement of the specification	**Architect**	Should enhanced operable temperature ranges be required façade consultant will need to be informed so design can reflect these requirements - Façade consultant to advise implications
re		**Risk to Moisture Ingress from Change in Humidity**						**Optimise the Moisture Barrier and Moisture Ingress**		

Climate Change Hazard	Key Risk	Impact on Project	Scale of Impact 2020	Scale of Impact 2050	Scale of Risk 2050	Tolerable Risk Level	Risk Mitigation Measure	Risk Mitigation Action and Design Consideration (Tailored to Borough Triangle)	Responsib'ty & Action Owner	Immediate Risk Mitigation Actions and Next Steps
Increase in Moistur / Dampness	Risk to	* Increases in moisture levels (warmer temperatures can hold more moisture) which can lead to damp and moisture build up within facades, and construction elements, thus damaging material durability, causing damp, mould, poor health if spaces are not properly ventilated.	L	M	M		Design f	* Ensure spaces are well ventilated to reduce chance of moister being retained within spaces.	Architect	*Façade Consultant to confirm during detailed design that it is a default requirement of their specification that all cavities/ rebates are adequately drained and ventilated.
								* Utilise damp roof materials and finishes.	Architect	Similarly all materials/ components are to be damp-proof.

Climate Change Hazard	Key Risk	Impact on Project	Scale of Impact 2020	Scale of Impact 2050	Scale of Risk 2050	Tolerable Risk Level	Risk Mitigation Measure	Risk Mitigation Action and Design Consideration (Tailored to Borough Triangle)	Responsib'ty & Action Owner	Immediate Risk Mitigation Actions and Next Steps
Increase in Water Issues							**Managing Water**			
Water Supply Drought and Water Shortage	Risk of Lack of Water Supply	**Risk of Lack of Water Supply (Interior)** * Rainfall occurrences have changed in the UK and seasonal patterns have altered meaning that some areas are at increased risk of drought, whilst others are at increased risk of rainwater flooding. * Consumers are using increased levels of water. * Risk of drought may be increased by possibility of higher than anticipated water consumption in the future	L	M	M		Design for Water Conservation	**Potable Water Conservation (Interior)** * Ensure potable water consumption is reduced from the outset through the use of low flow and efficient fixtures.	Architect	* reduction of 25% (or higher whenever possible) of water consumption through the use of high-efficient sanitaryware is proposed
								* With roof gardens especially at risk, drought tolerant planting to be specified	Landscape Architect	*rain gardens are proposed, as well as blue roofs to help with irrigation
		Risk of Lack of Water Supply (Exterior) * Changes in rainfall patters have placed greater demand on water supply for irrigation purposes, coupled with increased in temperatures, planting requires more water for nourishment.	L	M	M			**Irrigation Water Conservation** * Ensure preference is made for the selection of native, adaption and drought resistant species to ensure they can cope with changes in available rainfall.	Landscape Architect	*vegetation strategy as per DAS and Canary Wharf Biodiversty Action Plan
								* Ensure irrigation is installed (where required) as a drop fed system, used only at night to avoid evaporative losses.	Landscape Architect	SUDS and ranwater harvesting for irrigation is proposed
								* Avoid the use of excessive lawn space to reduce the need for irrigation.	Landscape Architect	mixture of soft and hard landscaping is proposed
Flooding and River/Sea Level Risk	Risk of Flooding	**Risk of Surface Water Flooding** * Increase of rainfall in the winter, exacerbated by excess water from facades, is likely to lead to the greater rainwater ponding and flooding. * Increases in rain will lead to greater risk of surface water flooding and saturation of the ground. * Intense rainfall for shorter period is likely to lead to the ground becoming saturated and unable to absorb rainfall (which results in ponding). * Long term flooding and flood management/ run off issues * Extreme weather, rainfall events can lead to flash flooding damaging buildings, infrastructure and business continuity. * Greater risk of flooding to basement	L	M	M		Design for Flooding Protection	**Design Sustainable Urban Drainage Systems** * Ensure that SUDS and attenuation strategies are included within building and site design. * Drainage - increase by 40% to account for climate change	Flood Risk Consultant	Surface water flooding and design response is informed by the Flood Risk Assessment
								* Install green/ brown roofs to provide on site attenuation and rainwater attenuation. * Specification of secant walls will significantly design out flood risk to basement (and therefore critical infrastructure located within).	Flood Risk Consultant	*blue and green roofs part of the proposed scheme
								* Install attenuation tanks	Flood Risk Consultant	
								* Install site landscaping and limit non-porous surfaces.	Landscape Architect	*refer to Materials Brief
								* Avoidance of ground level dwellings to reduce flood risk to occupants	Architect	*further considerations during the Development of Zones
								* Protection of critical infrastructure	MEP	back up generattors on the roof multiple heat pumps and chillers with N+1 resilience. heat and coolth storage. local heat pump and heat storage for each residential unit as part of ambient loop system. secondary waste heat from commercial to residential. dual electrical supplies with diverse routes from different UKPN primary substations. back-up generators for life safety in all buildings. back-up generators for operational continuity on a number of commercial buildings.
								* Design out flood risk to basement	Structures	Architectural design will set ground floor levels and access levels to basement areas above the flood level determined by the flood risk assessment to prevent flooding
		Risk of River/ Coastal Flooding (Impact location dependent) * River/ Coastal flooding increases, especially in low laying areas, this could be significant risk to projects located in and around river/ coastal areas. * Damage occurs to infrastructure, housing, businesses * Damage to natural landscapes, and sea land grab where sea areas are enabled to reclaim old land. * Identified as being risk issue to all sectors, both coastal based, and impacted by fluvial, rain and surface water impacts. * Increases in sea level rise means associated landscapes and developments need to respond to river/ coastal flooding issues, high wave levels, overflow of river/ sea barriers. * High risk due to reliance on Thames Barrier, especially if a breach of these defences should occur	L	H	H	More Vulnerable' residential accommodation to be protected against a 1 in 200 yr flood level. EA recommendation is that this should extend to 'less vulnerable' areas (final ground floor design level to be at least 300mm above 1 in 200 yr. event flood level)		**Provide River/ Coastal Flooding Protection** * Design buildings with flood safety zones at ground level to mitigate against sea level rise. * Raise resi to EA extreme level for 2100=5.6m AOD, based on Thames 2100 Strategy * Provide raised landscape & food barrier around north of site to protect against breach from Thames river. * Thames Barrier represents the main flood defence mechanism for this part of London. The project team have agreed that reliance on the Thames Barrier represents the tolerable risk level.	Flood Risk Consultant	* EA TE2100 strategy requirements already
								Development of a flood evacuation management plan and development to be placed on the EA flood warning register	Flood Risk Consultant	*furter consultation from flood risk consultation required

Climate Change Hazard	Key Risk	Impact on Project	Scale of Impact 2020	Scale of Impact 2050	Scale of Risk 2050	Tolerable Risk Level	Risk Mitigation Measure	Risk Mitigation Action and Design Consideration (Tailored to Borough Triangle)	Responsib'ty & Action Owner	Immediate Risk Mitigation Actions and Next Steps
Inadequate drainage capacity	Risk of Drainage Failure	**Risk of Drainage Capacity Failure**					Design for Drainage Management	**Drainage**		
		* Drains may become overwhelmed with extreme rainfall and surface water run off, and debris.	L	M	M			* Design to include for larger capacity building gutters and downpipes to cope with increases in rainfall	Structure/ Landscape architect	*Development design
		Risk of Foul Drainage Failure								
		* Foul drainage systems may fail due to changes in water levels and consumption patters. They may fail due to water levels within them changing, thus impacting how water flows within them.	L	L	L					
Pests	Pests	* The impact of pests are potentially high for building occupants and property continuity. *Warmer, wetter conditions expected by climate change enable some species to expand in population and impact native species.	L	H	H	**Remove Invasive Plant Spec**	Pest Control	**Remove Invasive Plant Species**	Ecologist	
								* Remove and dispose of invasive plant species.	Ecologist	*further considerations during the Development of Zones
						Remove and inhibit pests		**Remove and inhibit pests**		
								* Remove, clear, and contain property from invasive pest species. Reduce interior pest expansion by properly ventilating dwellings, and cleaning space.	Ecologist	*further considerations during the Development of Zones
								* Ensure treatment is put on property entrances to limit the ingress of pests into interior spaces.	Ecologist	*further considerations during the Development of Zones
Air Quality and Pollution	Air Quality Degradation	* Poor interior and exterior air quality can lead to poor health, respiratory issues, maintained issues for ventilation services, dust, cleaning maintenance issues within buildings. It is harder to manage external air pollution issues.	M	H	H		Air Pollution Control	**Air Quality Management**		
								* Ensure that passive design and ventilation takes into account sources of external pollution	Architect/ Landscape	***design takes sources of pollution under consideration**
								* Locate window openings away from sources of pollution (roads, exhausts if feasible)	Architect/ Landscape	*design takes sources of pollution under consideration
								* Ensure cross ventilation is available so that air can be moved through a space efficiently and to reduce PPM settling in an area	Architect/ MEP	*cross ventilation is not always possible due to pollution
								* Implement site construction air quality management plan.	Contractor	
								* Ensure that services flush out is undertaken once installed.	Contractor	
								* Ensure filters are provided within mechanical services to filter out particulates. Ensure filters are maintained and replaced on regular basis	Contractor	

Key- Scale of impact on development	
L	Low Risk
M	Medium Risk
H	High Risk
E	Emerging

Appendix IV – Lifecycle carbon analysis

North Quay

Lifecycle Carbon Analysis

Rev 1

April 2020

MAX FORDHA

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ISSUE HISTORY

Issue	Date	Description
Rev *	20/01/2020	Issued for comment
Rev 1	April 2020	Updated to include benchmarking analysis

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CONTENTS

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

Max Fordham LLP were instructed to perform a high-level Lifecycle Carbon Analysis (LCA) for the North Quay development at outline stage. The conclusions of this report should be used by the design team to inform the selection of low embodied carbon materials and constructions for individual buildings when designed.

Outline planning is being pursued for a masterplan comprising a mix of residential and commercial use and flexible use buildings or varying heights with retail spaces located at the base of each building.

The Wood Wharf D1/D2 building was used as a base case for the assessment, which is of a similar scale, occupancy type and construction to those that will make up the North Quay development. The building construction comprises a composite floor construction on steel frame with precast concrete panel façade cladding and double-glazed windows.

Initially, the base case was modelled to determine the highest impact elements of the building construction, in terms of embodied carbon. Alternative options for the construction of these elements were then assessed to determine where embodied carbon savings can be made. Finally, a benchmarking exercise was conducted to compare the base case and best case (incorporating the least embodied carbon options of the highest impact elements) with the BRE LCA benchmark for office buildings, to ascertain the number of BREEAM credits that could be achieved.

The highest impact elements of the base case building, in terms of embodied carbon, were found to be:

- Upper floors (37%)
- Substructure (23%)
- Frame (19%)
- External walls (9%)

The assessment of the alternative options provided the following outcomes:

- Hollow core slab upper floors with a high recycled content (GGBS) had the lowest embodied carbon of the upper floor options; the embodied carbon was reduced by 29% over the base case. The CLT plank option also performed well; the embodied carbon was reduced by 25% over the base case.
- The only viable alternative option for the substructure, due to the height of the building, was to increase the recycled content (GGBS) of the concrete in the piled foundations; this reduced the embodied carbon by 5%.
- A full concrete frame with a high recycled content (GGBS) performs better than the steel frame in the base case; the embodied carbon was reduced by 57%.
- The base case façade of the external walls, concrete panels, performed best when compared against the alternative options.

1.2 Benchmarking

Although the base case does perform better than the BREEAM LCA benchmark, the best case, incorporating the least embodied carbon options of the frame, upper floors and external walls, performs much better and would score an additional credit in a BREEAM assessment. The benchmarking takes into account the superstructure only.

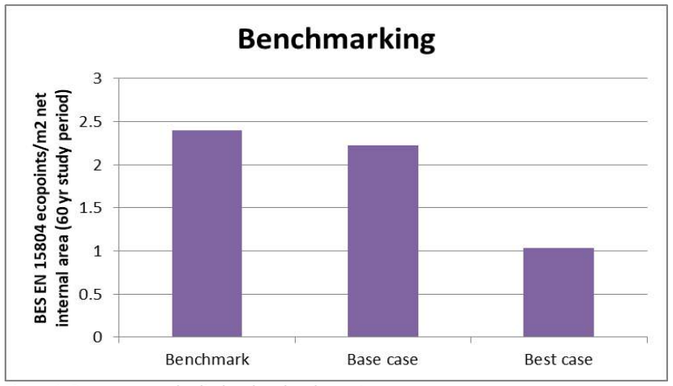

Figure 1: Base case - embodied carbon by element

1.3 BREEAM Mat 01 credit guidance

The total BREEAM Mat 01 credits that the base case would achieve for RIBA Stage 2 is three (superstructure benchmarking and options appraisal), whereas the best case would achieve the maximum available, four. Additional credits would be achievable by including hard landscaping options and core building services options in the assessment.

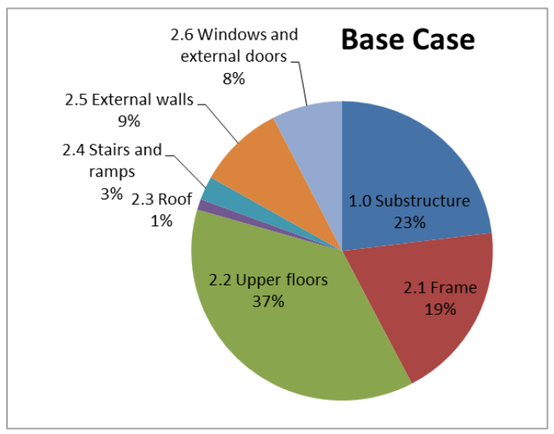

Figure 2: Benchmarking exercise (BES EN 15804 ecopoints/m2 net internal area (60yr study period))

1.4 BREEAM Ecopoint guidance

Further analysis of the BREEAM benchmarking was undertaken to provide additional guidance to inform the selection of construction type in terms of BRE Ecopoints, rather than just embodied carbon.

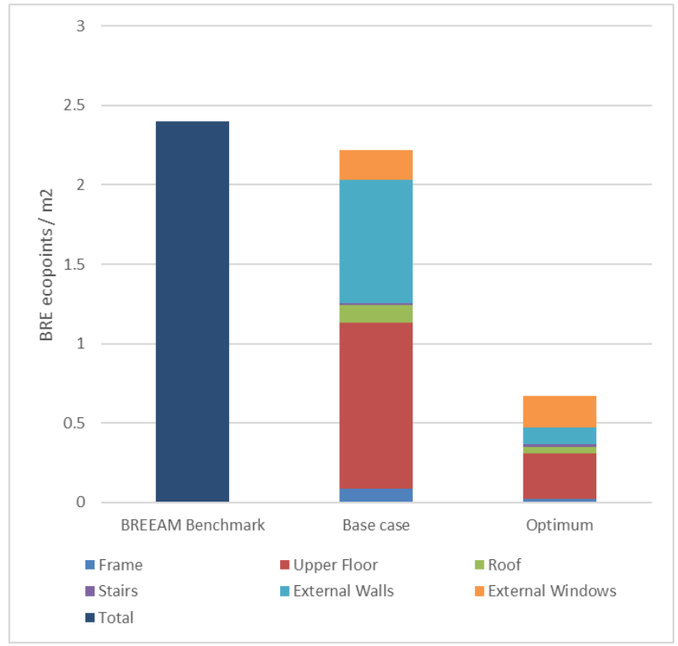

Figure 3: Benchmarking analysis comparing BREEAM benchmark, base case and optimum benchmarking for North Quay (BES EN 15804 ecopoints/m2 net internal area (60 yr study period))

2.0 INTRODUCTION

2.1 North Quay

The North Quay Development site is seeking outline planning permission for a masterplan comprising a mix of commercial use and flexible use buildings with retail spaces located at the base of each building.

2.2 Background to LCA

The use of construction products leads to a wide range of environmental and social impacts across the life cycle through initial procurement, wastage, maintenance and replacement. Construction products contribute significantly to the overall life cycle impact of a building.

The introduction of Part L into the building regulations has led to reductions in the operational energy consumption of buildings and these regulations are being progressively tightened. As a result, greenhouse gas emissions from other aspects of buildings, such as embodied emissions, are becoming increasingly important in terms of reducing the overall emissions. In this context, embodied carbon is the carbon emissions associated with the lifecycle of building materials, from the extraction of raw material to its end of life/disposal accounting for maintenance and replacement during the building's lifetime (see Figure 3).

Conducting a LCA has numerous benefits:

- Helps project teams to understand the overall environmental impact of the building design.
- Ensures that all life cycle emissions are taken into account in the design, not just operational emissions.
- Helps inform design decisions to reduce the impact of the construction industry and construction product industries.
- Assesses the environmental impacts at the building level to provide flexibility when specifying construction products, to take into account project-specific conditions and priorities.
- Allows optimal solutions to be identified and adopted to reduce overall environmental impacts arising from construction product use.

2.3 Purpose

The purpose of this LCA is to conduct a high level analysis considering the high impact areas of the building construction, in order to determine where embodied carbon can be reduced in the building design.

An additional purpose of this analysis is to understand how the design would perform in terms of BREEAM against the targeted credits in the BREEAM pre-assessment. It should be noted that this analysis will not be submitted to BREEAM and will be revisited at a later date to align with specific BREEAM criteria.

2.4 Methodology

The software used to carry out the LCA is OneClick LCA + Carbon Designer. OneClick LCA is a web based tool linked to a database of a large number of generic and proprietary construction materials. It is a building LCA tool recognised by BREEAM. The Carbon Design plugin is an early design optimisation tool that allows different construction types, and the impact they have on the total embodied carbon, to be compared.

The analysis is based on the requirements set out by BREEAM New Construction 2018 – Mat 01 Building LCA credit. The building elements included in the assessment are:

- Superstructure
  - Frame
  - Upper floors
  - Roof
  - Stairs
  - External walls
  - External windows
- Substructure
  - Foundations
  - Lowest floor construction
  - Basement retaining walls

The building elements not included in the assessment are:

- Internal partitions
- Internal and external doors
- Fixtures and fittings
- Floor, wall and ceiling finishings
- Equipment and furniture
- Services
- Hard landscaping (this is usually included in the BREEAM methodology; however, it is not included in this assessment)

Benchmarking
As per BREEAM requirements, office buildings are also required to be compared to the BREEAM LCA benchmark. This is completed using the BREEAM Simplified Building LCA tool.

Lifecycle Impacts
The study period was 60 years. The lifecycle impacts considered follow BS EN 15978 and includes the embodied impacts, transport to site (typical figures are used), construction and installation impacts, refurbishment and replacement, de-construction and disposal as set out in Figure 1.

Significant Difference
In line with the BREEAM requirements, all of the options considered satisfy the significantly different options criteria.

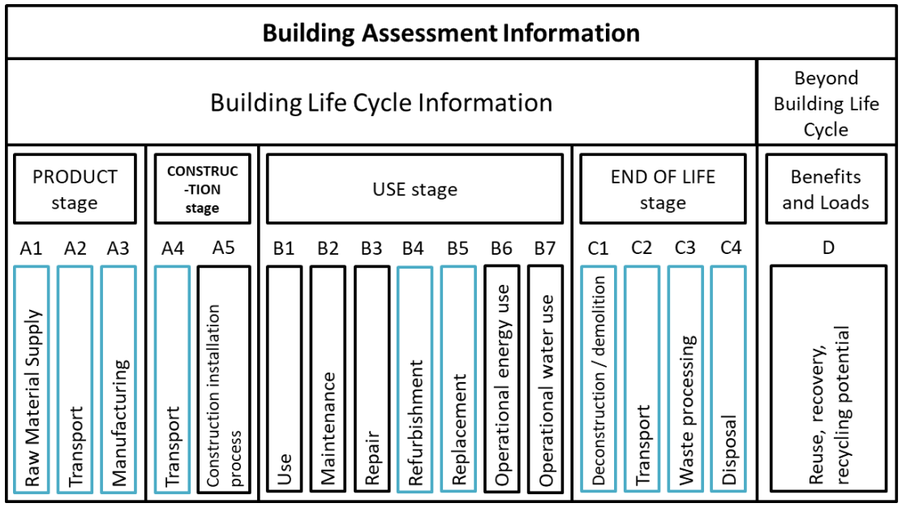

Figure 4: Lifecycle Stages from BS EN 15978

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3.0 LIFECYCLE CARBON ANALYSIS

3.1 Basis for Analysis

The base case is based on Wood Wharf D1/D2 ELCS Report, a copy of which can be found in Appendix A. This is a building of similar scale, occupancy type and construction to those that will make up the North Quay development.

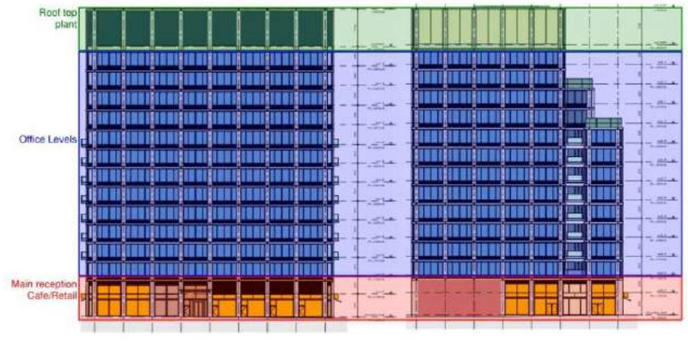

Figure 5: Wood Wharf D1/D2 Building (taken from Wood Wharf D1/D2 ELCS Report)

GIFA: 28,141 m^2

Number of floors above ground: 13

Number of floors below ground: 2

Superstructure

- Frame: Steel frame with concrete frame to 25% of the structure
- Upper floors: Composite deck
- Roof: Galvanised steel roof deck with in-situ concrete structure and concrete roof tiles
- Stairs and ramps: Pre-cast concrete stair cases
- External walls: Light steel studwork with pre-cast concrete façade cladding
- Glazing: Double glazed windows

Substructure

- Substructure: In-situ concrete piles and pile caps with reinforcement
- Lowest floor construction: Composite (steel and reinforced concrete)

3.2 Assumptions

- Floors below ground level are not heated
- All concrete elements assumed to have no recycled content (ground granulated blast furnace slag (GGBS) or pulverised fly ash (PFA))
- For the benchmarking exercise, it is assumed that the majority of the buildings will be offices
- Four staircases (in line with quantities provided for Wood Wharf D1/D2)
- Assume steel framed glazing
- Internal partitions not included in the LCA, in line with BREEAM requirements
- Foundations are piled type at 15m depth (in line with quantities provided for Wood Wharf D1/D2)
- Finishes are not included in the LCA, in line with BREEAM requirements

3.3 Base Case

Initially the base case was modelled to determine the elements of the building construction that make the greatest contribution the overall embodied carbon of the building. Analysing the base case, the elements of the building that have the highest impact in terms of embodied carbon and their contribution are:

- Upper floors – 37%
- Substructure – 23%
- Frame – 19%
- External walls – 9%

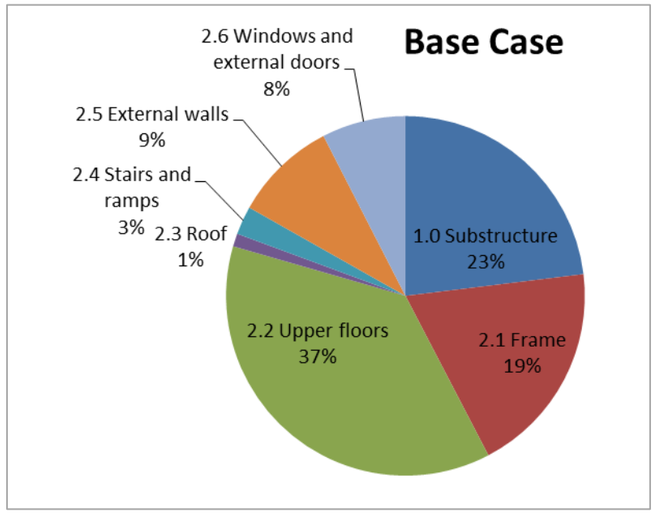

Figure 6: Base case - embodied carbon by element

Figure 7 highlights that the vast majority of the embodied carbon of the building is associated with the Product Stage (A1-A3), accounting for over 93% of the embodied carbon. End of life (C1-C4) accounts for almost 3%, in use stage for over 2% and construction transport for almost 2%.

This indicates that the choice of materials, how they are extracted and manufactured, is the biggest factor affecting embodied carbon.

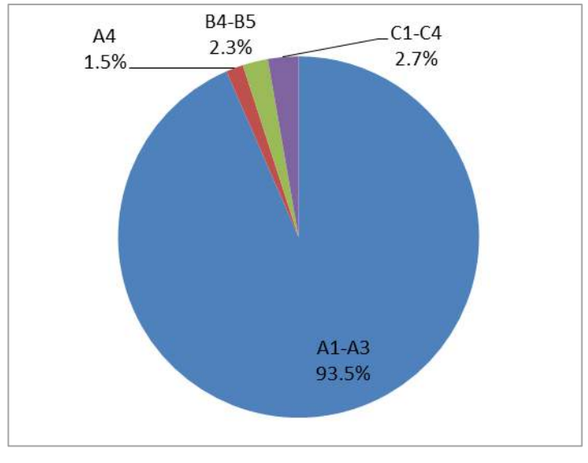

Figure 7: Base case - embodied carbon by stage

3.4 Options

Options for the highest impact elements identified in the base case have been considered separately in the analysis:

Frame

- Full concrete frame
- Recycled content - Increasing the GGBS or PFA content in the concrete elements is an easy way to reduce the embodied carbon of building due to it being more widely available and its use becoming more commonplace.

Upper floors

- Composite deck
- Hollow core concrete planks
- CLT planks
- High GGBS content to the composite deck and hollow core concrete plank options

Façade / External walls

- Brick slip cladding
- Stone rain cladding
- Polyester powder coated (PPC) aluminium

Foundations

Due to the height of the building, foundation options other than piled foundations are not viable. Therefore, the only option that has been considered is increasing the recycled content of the concrete used.

3.5 Findings

Frame
The embodied carbon for a fully concrete frame is 44% less than for a 75% steel / 25% concrete frame, as in the base case. If the recycled content (GGBS) in the concrete is then increased to 55%, a further 13% reduction is seen over the full concrete frame case.

Upper floors
Retaining the composite deck, as in the base case, and increasing the recycled content from 10% to 40%, has reduced the associated embodied carbon by 10%.

Reducing the mass of concrete in the upper floors by specifying hollow core slabs reduces the associated embodied carbon by 13%. By introducing recycled content (GGBS) into the concrete (40%), the embodied carbon is further reduced by an additional 16%.

The CLT plank upper floor option reduces the embodied carbon by 25% over the base case.

Façade / External walls
The concrete panels in the base case provide the lowest embodied carbon option. Both brick slip cladding and stone rain cladding increase the embodied carbon by around 40% and the PPC aluminium cladding increases it by 70%.

It should be noted that only the cladding has been changed in this analysis, the build-up of the external walls remains the same for all four options.

Substructure / Foundations
Increasing the recycled content (GGBS) of the concrete in the piles, pile caps and walls below ground level reduces the associated embodied carbon by 5%. This equates to 3 kg CO_2e/m^2 or 83,000 kg CO_2e.

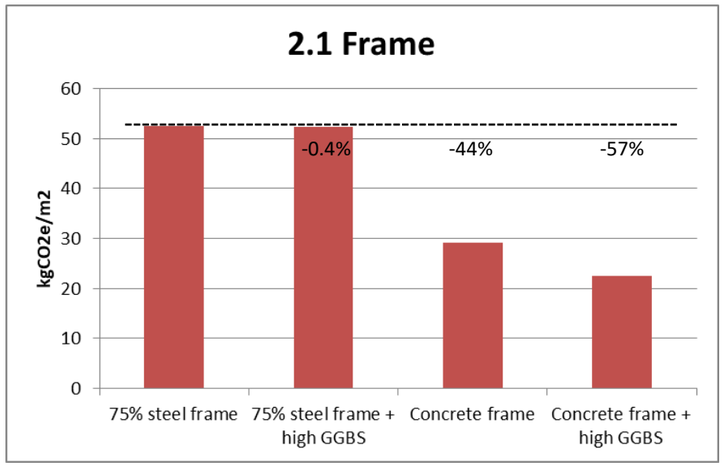

Figure 8: Frame options embodied carbon (kgCO2e/m2)

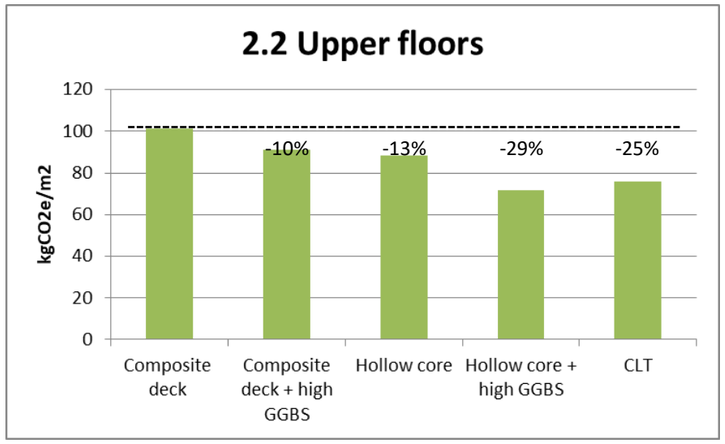

Figure 9: Upper floor options embodied carbon (kgCO2e/m2)

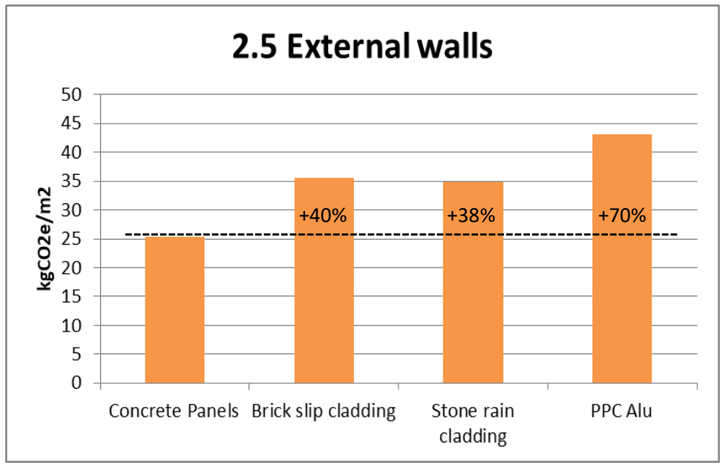

Figure 10: Facade / external wall options embodied carbon (kgCO2e/m2)

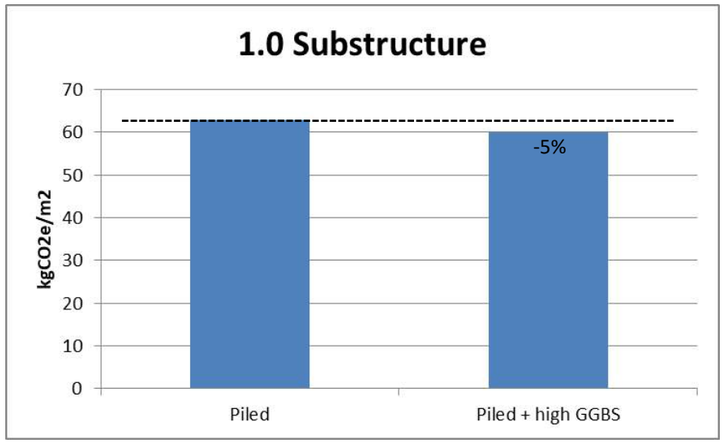

Figure 11: Substructure options embodied carbon (kgCO2e/m2)

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3.6 Benchmarking

As part of the BREEAM LCA requirements, office buildings are subject to benchmarking. Therefore, the base case and the best performing options of the elements analysed in the previous section (best case) have been compared against the BREEAM LCA benchmark for offices, in order to determine how the building would perform.

It should be noted that the best case is for illustrative purposes only to show the sort of reductions that can be realised. Elements should be considered on an individual basis. The design team's experience and knowledge should be used to determine which combination of elements can be used together.

Benchmarking is expressed in terms of BRE Ecopoints rather than kg CO_2e. BRE Ecopoints is a measure of the environmental impact of a unit, product or material, which covers a number of indicators including global warming potential, depletion potential of the stratospheric ozone layer, acidification of soil and water, eutrophication, formation of tropospheric ozone, abiotic depletion of fossil and non-fossil resources, net use of fresh water and disposal of hazardous, non-hazardous and radioactive waste.

The benchmarking takes into consideration the superstructure of the building only. The benchmarking does not have an option for high GGBS content in the frame.

The base case building performs 7% better than the benchmark. The base case scores 2.22 ecopoints / m^2 NIA, whereas the benchmark for office buildings is 2.4 ecopoints / m^2 NIA.

The best case building (best performing elements) is 57% better than the benchmark and scores 1.03 ecopoints / m^2 NIA.

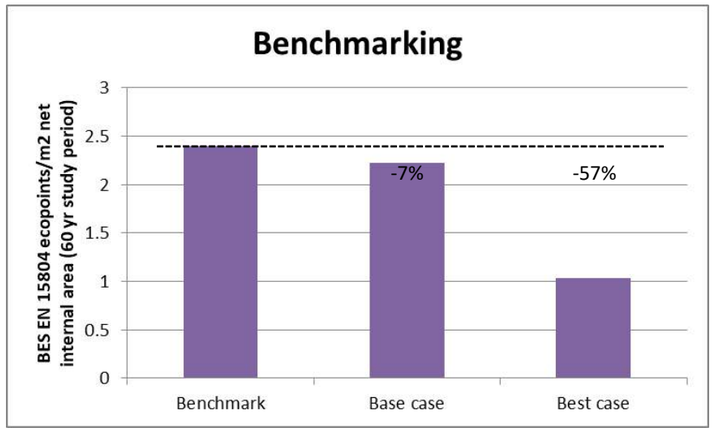

Figure 12: Benchmarking exercise (BES EN 15804 ecopoints/m2 net internal area (60 yr study period))

3.7 Achievable BREEAM Score

Table 1 presents the BREEAM credits that are both available and achievable for both the base case and best case, for the superstructure in Stage 2.

There are 4 credits available for Mat 01 benchmarking and options appraisal at Stage 2. The number of credits for the benchmarking is calculated based on how well the building performs against the BREEAM LCA benchmark, the maximum is 2. The number of credits for the options appraisal is based on the number of superstructure options that are compared, the maximum credits awarded is 2.67 for four options.

The BREEAM pre-assessment that has been completed for the project currently targets 4 credits for Mat 01 #1 Superstructure benchmarking and options appraisal. The base case would achieve 3 credits, whereas the best case would achieve the 4 that have been targeted.

Table 1: BREEAM NC 2018 Mat 01 credit score (Stage 2)

	Benchmarking	Options Appraisal	Total
Credits available	2	2.67	**4**
Base Case	0.7	2.67	**3**
Best Case	1.9	2.67	**4**

Further credits can be achieved by including the following in the Stage 2 assessment:

- Hard landscaping options (1 credit)
- Core building services options (1 credit)

At Stage 4, a further 2 credits can be targeted by considering additional superstructure options and repeating the benchmarking analysis.

4.0 FURTHER GUIDANCE ON BENCHMARKING

Further analysis of the BREEAM benchmarking was undertaken to provide additional guidance to inform the selection of construction type in terms of BRE Ecopoints, rather than just embodied carbon.

As previously stated, BRE Ecopoints takes into account a number of environmental factors rather than just embodied carbon. In order to score well in the BREEAM Mat 01 credit, the building must also perform well in the benchmarking.

A number of graphs, provided in Appendix C (an example shown opposite), show how the different element construction types perform in terms of BRE Ecopoints.

Figure 12 indicates how the base case performs against the BRE benchmark. Also illustrated is the performance of an 'optimum' building. The chosen element constructions for the optimum building were the best performing constructions taken from the graphs in Appendix C, not including wood-based constructions. The external windows and stairs were not changed from the base case, as these constructions performed best. This demonstrates a significant opportunity to reduce the overall embodied environmental impact measuring on the Ecopoint score.

It is recommended that the design team take into consideration how the building elements score in terms of Ecopoints, as well as embodied carbon, throughout the design development.

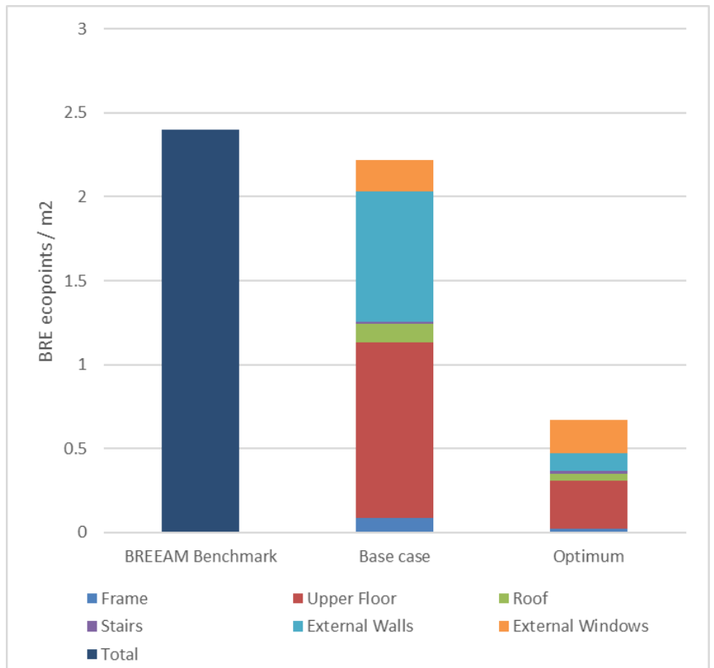

Figure 13: Benchmarking analysis comparing BREEAM benchmark, base case and optimum benchmarking for North Quay (BES EN 15804 ecopoints/m2 net internal area (60 yr study period))

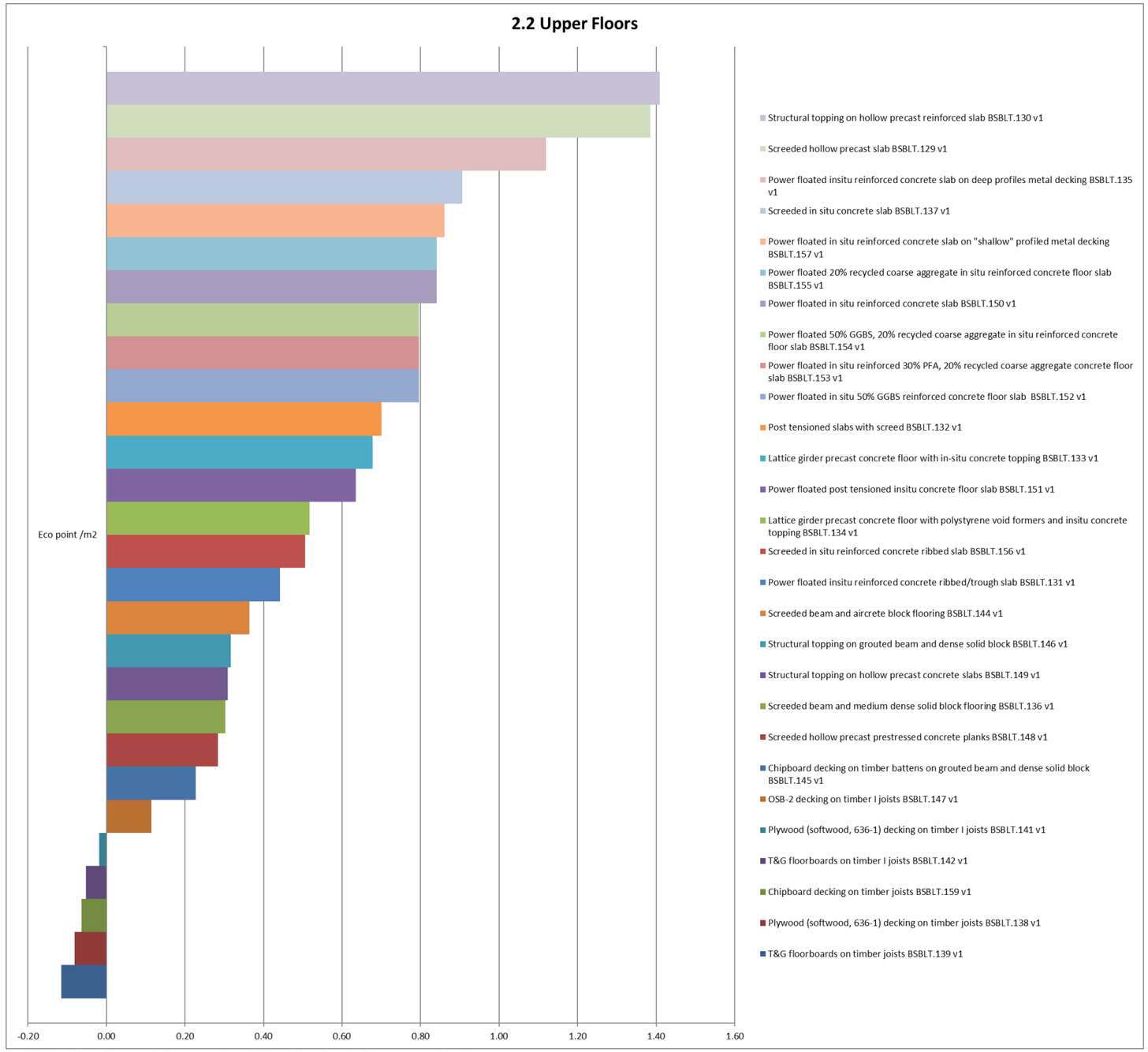

Figure 14 Example of Ecopoint guidance for a single element. In this case Upper Floors

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5.0 CONCLUSIONS

The highest impact elements of the building, in terms of embodied carbon, are the upper floors (37%), substructure (23%), frame (19%) and external walls (9%). Alternative options for the construction of these elements were assessed as part of this LCA to determine where embodied carbon savings can be made.

The following outcomes were established:

- Hollow core slab upper floors with a high recycled content (GGBS) had the lowest embodied carbon of the upper floor options; the embodied carbon was reduced by 29% over the base case. The CLT plank option also performed well; the embodied carbon was reduced by 25% over the base case.
- The only viable alternative option for the substructure was to increase the recycled content (GGBS) of the concrete in the piled foundations; this reduced the embodied carbon by 5%.
- A full concrete frame with a high recycled content (GGBS) performs better than the steel frame in the base case; the embodied carbon was reduced by 57%.
- The base case façade of the external walls, concrete panels, performed best when compared against brick slip, stone rain screen and PPC aluminium cladding types.

Benchmarking
Although the base case does perform better than the BREEAM LCA benchmark, the best case, incorporating the least embodied options of the frame, upper floors and external walls, performs much better and would score an additional credit in a BREEAM assessment. The benchmarking takes into account the superstructure only.

The design team should consult the further guidance when selecting element construction types, in order to ensure environmental factors, other than embodied carbon, are also taken into consideration.

BREEAM
The total BREEAM credits that the base case would achieve for the superstructure benchmarking and options appraisal is three whereas the best case would achieve the maximum available for Stage 2, four. Additional credits would be achievable by including hard landscaping options and core building services option in the assessment.

APPENDIX A – WOOD WHARF D1/D2 ELCS REPORT

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IES IMPACT DATA

GLOSSARY

- BREEAM - British Research Establishment Environmental Assessment Method
- Carbon footprint – greenhouse gas emissions measured in kg or tonnes of carbon dioxide equivalents (CO_2e)
- Cradle-to-gate: Product stage including raw material extraction, processing and manufacturing
- Cradle-to-site: Product stage plus transport from factory gate to site
- ELCA – Environmental Lifecycle Assessment
- EPD – Environmental Product Declaration
- GIA – Gross internal floor area
- GWP – Global Warming Potential (greenhouse gas emissions) measured in kg CO_2e over an impact period of 100 years
- NIA – Net internal floor area
- MNA – Material not accessed

1 EXECUTIVE SUMMARY

The development is in Canary Wharf, London and comprises a new 13 storey commercial office building with some retail at ground level and level 1.

The purpose of the ELCA is to establish a baseline lifecycle carbon footprint of the proposed works and to develop a set of improvement measures as applicable in order to minimise the development's carbon footprint over a predicted 60 year lifecycle. Other environmental indicators will be extracted as well but are not the focus of this assessment.

IES VE IMPACT software was used to carry out the analysis, based on BRE Green Guide 2008 ratings material database.

The baseline carbon footprint was established based on Design Stage D and was calculated as follows:

The total carbon footprint (GWP 100) for the proposed development was calculated for Year 0 and Year 60 as **12,519 tonnes CO_2e**, (**445kg CO_2e per m² GIA**) and **113,670 tonnes CO_2e** (**4,039 kg CO_2e per m² GIA**) respectively.

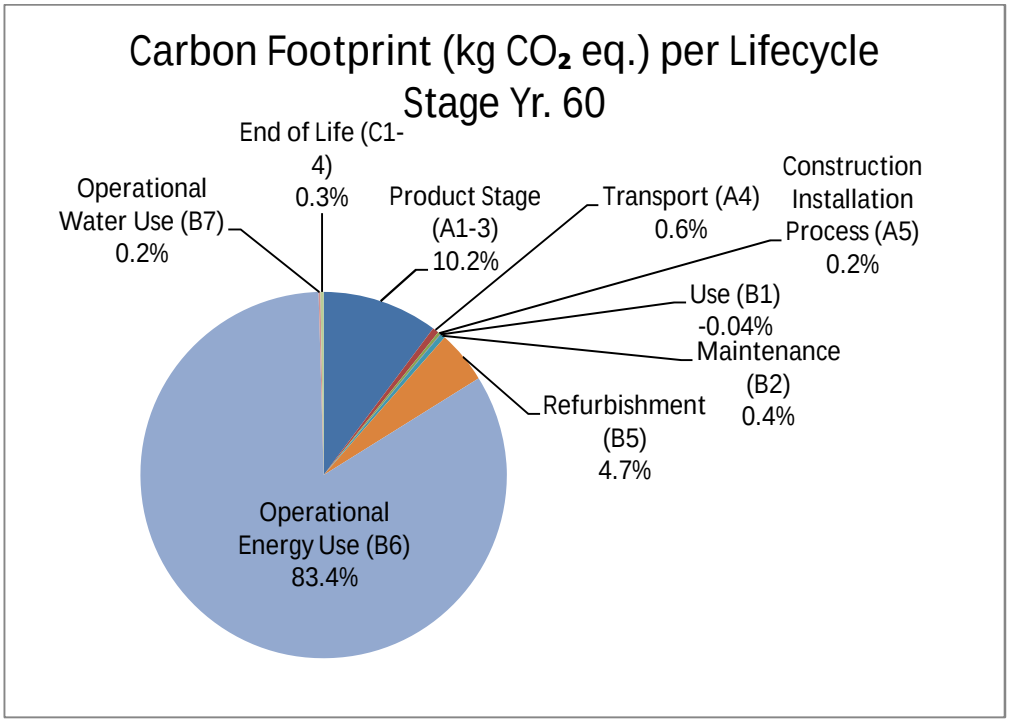

Figure 1-1 Carbon Footprint at Year 60

To date there is very limited data available to benchmark embodied carbon or lifecycle carbon of UK buildings. While there are databases available the quality of data of many of the case studies uploaded is questionable. A few useful embodied carbon analysis results were found for similar buildings located in central London. The results for the Proposed Development suggest relatively low embodied carbon content and fall within the low range of the benchmark results.

A number of 'carbon hot spots' were identified within the cradle to site and construction stage materials and processes (Year 0 impacts) and recommendations for improvement made. It is estimated that were all recommendations taken on board for the Design Stage 4 detailed design and construction, the combined carbon footprint reduction potential would be about **907 tonnes** CO_2e or approx. **7%** of the Year 0 baseline carbon footprint, that is equivalent of **165 UK households'** energy use for one year based on the average UK housing energy fact file report by the department of Energy & Climate Change (2012).

It is suggested to review the findings and recommendations with the Project Team at Design Stage 4 to evaluate the technical and commercial implications of adopting them.

2 PROJECT BACKGROUND

The proposed development comprises the two Master plan plots D1 and D2. The buildings immediately to the west (A2 and A3) and south (E1 and E2) of D1D2 are proposed residential mixed use buildings, which will overlook D1D2. Buildings to the north (B3) and east (D3 and D4) are proposed commercial use buildings.

Figure 2-1 3D

. The building's frame is composite floor construction on steel framing with a precast concrete panel façade cladding and double glazed windows. The building is split into several distinct parts as illustrated on Figure 2-2. Retail units are located on the Ground Level and Level 1, while Office space at level 2-13.

The Proposed development provides the following indicative floor-space (Net Internal Area):

- Office – 19,551 m²
- Retail – 2,404 m²

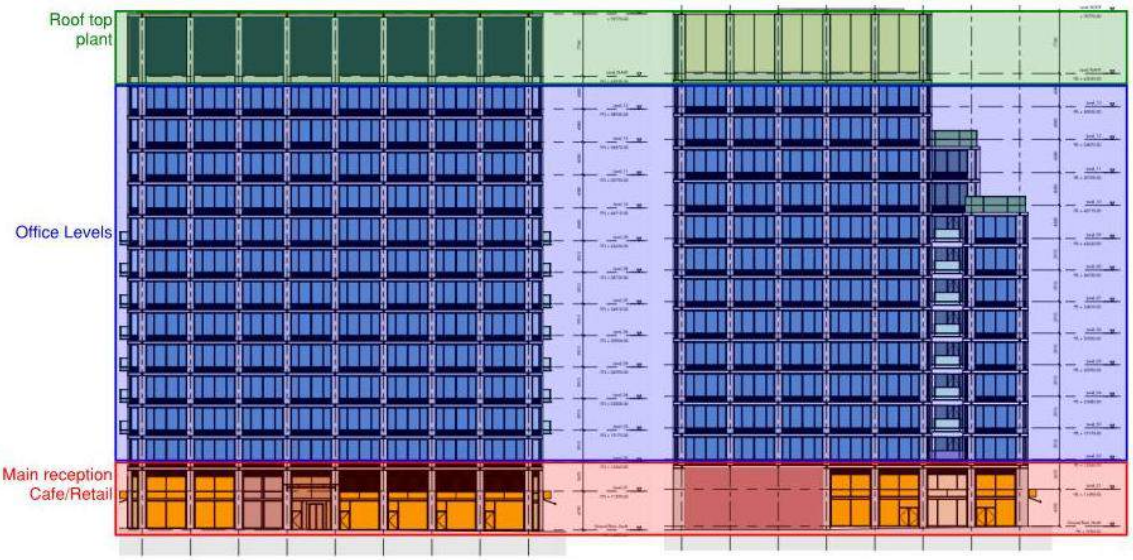

Figure 2-2 Purpose groups in building D1/D2

Four other buildings (residential – Buildings A1, A2/A3 and E1/E2, and commercial – Building B3) are also being developed as part of the Phase 1 development on the site, all of which connect into the common basement. The buildings' relative location and the extent of the basement below are highlighted in Figure 2-3.

3 INTRODUCTION TO ENVIRONMENTAL LIFECYCLE ASSESSMENT

3.1 PURPOSE

The purpose of the ELCA is to establish a baseline lifecycle carbon and energy footprint of the proposed works and to develop a set of improvement measures as applicable in order to minimise the developments carbon footprint over a predicted 60 year lifecycle. Other environmental indicator will be extracted as well but are not the focus of this assessment.

3.2 SCOPE

The object of assessment is the development site D1/D2, including its foundations and external works within the curtilage of the building's site, over its life cycle of 60 years (typical definition of lifespan for LCA purposes). The curtilage used to characterise the site shall be consistent with the definition and intended use of the building.

The functional description is as follows:

- Type of use: Office with non-office type related functional areas
- Total floor area: 28,141 m² GIA (Indicative Area Schedule – Stage 3 Planning report)
- Occupancy: Primarily offices use with retail at Ground level and Level 1.
- Assessed lifespan: The assessed study periods are Year 0 (constructed building prior to first occupancy) and Year 60 (including all impacts over the 60 years in use)
- Energy performance level: The predicted energy performance and comparison to the notional energy model is shown in Table 3-1. The results are presented per 1m² of GIA and only include energy demand for activities accounted for in Part L 2013 and exclude other significant uses such as vertical transportation.

Table 3-1 BRUKL output – Energy consumption per end use

Energy Consumption by End Use [kWh/m²]		
	Actual	**Notional**
Heating	4.28	1.42
Cooling	4.33	6.5
Auxiliary	9.14	11.2
Lighting	11.25	20.67
Hot water	7.01	6.93
Equipment*	45.78	45.78
TOTAL**	**36.03**	**46.71**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

3.3 INTENDED USE

The intended use of this ELCA is to benchmark the proposed RIBA Stage 3 design against that of similar building types, and to allow a comparison of the environmental performance of different design options that may occur at RIBA Stage 4.

Secondly, the results will be used to document the environmental performance of the building for use for BREEAM and LEED certification and marketing.

3.4 STANDARDS

The analysis was carried out in line with BS EN 15978:2011[1].

The approach to the assessment covers all stages of the building life cycle and is based on the BRE's lifecycle impact database. While this was not utilised at this first iteration of analysis, the generic lifecycle impact data could be replaced with data obtained from Environmental Product Declarations (EPD) and their "information modules"(EN 15804) in order to make the results more bespoke to the project. The assessment includes all building related construction products, processes and services, used over the life cycle of the building Figure 3-2summarises the lifecycle stages analysed and included in the study.

3.5 METHODOLOGY

The design as developed by the end of RIBA Stage 3 is used as the baseline for this study.

The specific periods studies are:

- Year 0: The building fully constructed and fitted out (Cat A) prior to first occupancy, including LCA life stages A1, A2, A3, A4 and A5.
- Year 60: The building's emissions over a 60 year operation including LCA life stages A1, A2, A3, A4, A5, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3 and C4.

ELCA SOFTWARE

The software used to carry out the ELCA is IES Virtual Environment (VE) version 2015.1.0.0, IMPACT tool.

Seven construction datasets are provided, each representing a particular building type: Commercial, Domestic, Education, Health, Industrial, Retail (frequent fit-out) and Retail (infrequent fit-out) as illustrated in Figure 3-1.

For the proposed development ELCA analysis, the majority of the construction dataset used is from the Commercial IMPACT dataset and Materials dataset with one exemption, the *ground floor construction* IMPACT dataset used is from the Domestic dataset.

Additionally two materials datasets are provided, one for floor finishes and one for suspended ceiling materials.

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[1] British Standard Institution (2012). BS EN 15978:2011. Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method

IMPACT – ELCA DATASET

The input data is based on the cost/material database '*IMPACT – Integrated Material Profile And Costing Tool*' available within IES VE Software developed in collaboration with

- **BRE** – an independent and impartial, research-based consultancy, testing and training organisation, offering expertise in every aspect of the built environment and associated industries;
- **AEC3** – an international consulting firm that combines a range of capabilities with global expertise to resolve information needs and deliver strategic solutions to the industry;
- **IES** – a world leading software and consultancy company specialising in sustainable building design and operations;
- **WD Re-Thinking Services Ltd** – a leading specialist consultancy;
- **Whole Life Ltd** – an independent consultancy specialising in assessment and measurement of long term performance, cost and value. It specialises in assessment of whole life costs and life cycle cost for a range of sectors and procurement routes.

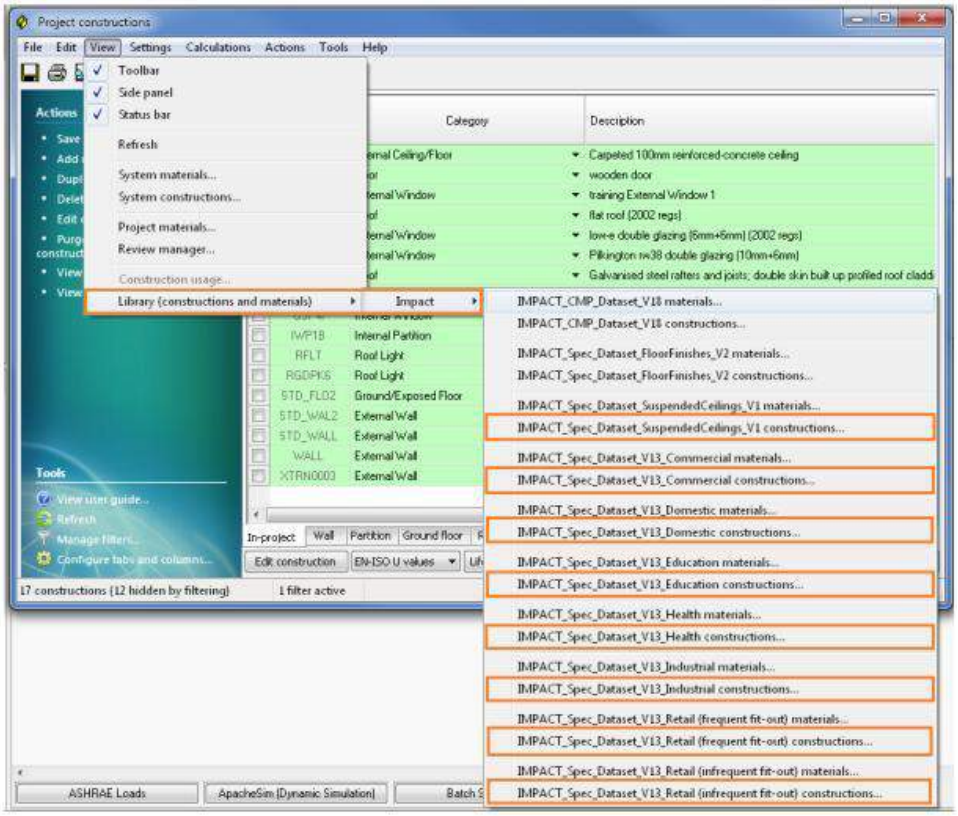

Figure 3-1 IES IMPACT dataset

3.6 IES 'IMPACT' – ELCA CALCULATION

The impacts calculated by IES VE IMPACT are:

- Global warming potential in kg CO_2 eq. (100 yr.)
- Water Extraction in m^3 water extracted (gross)
- Mineral Resource Extraction in tonne of minerals extracted
- Depletion potential of the stratospheric ozone layer in kg CFC-11
- Human Toxicity in kg 1, 4 dichlorobenzene (1, 4-DB) eq.
- Eco-toxicity to freshwater in kg 1, 4 dichlorobenzene (1, 4-DB) eq.
- Nuclear Waste (higher level) in mm^3 high level waste
- Eco-toxicity to Land in kg 1, 4 dichlorobenzene (1, 4-DB) eq.
- Waste Disposal in tonne solid waste
- Fossil fuel Depletion in MJ
- Eutrophication potential in k phosphate (PO4) eq.
- Formation potential of tropospheric ozone photochemical oxidant in kg ethane (C2H4) eq.
- Acidification potential of land and water sources in kg sulphur dioxide (SO2) eq.

While all the above impacts were calculated as part of our modelling exercise, this study is focusing on greenhouse gas emissions (measured in carbon dioxide equivalents, kg CO_2 eq.). Therefore results are presented and recommendation made to reduce greenhouse gas emissions only.

3.7 BOUNDARY CONDITIONS

The system boundary determines the processes that are taken into account during the ELCA study, for the Proposed Development the processes shown in Figure 3-2 are included in the assessment of the building life cycle.

Modules A1 to C4 cover environmental impacts and aspects that are directly linked to processes and operations taking place within the system boundary of the building.

BOUNDARY OF THE PRODUCT STAGE (MODULES A1 TO A3)

The boundary for modules A1 to A3 covers the 'cradle to gate' processes for the materials and services used in the construction including raw material extraction, processing and manufacturing. The rules for determining their impacts and aspects are defined in EN 15804.

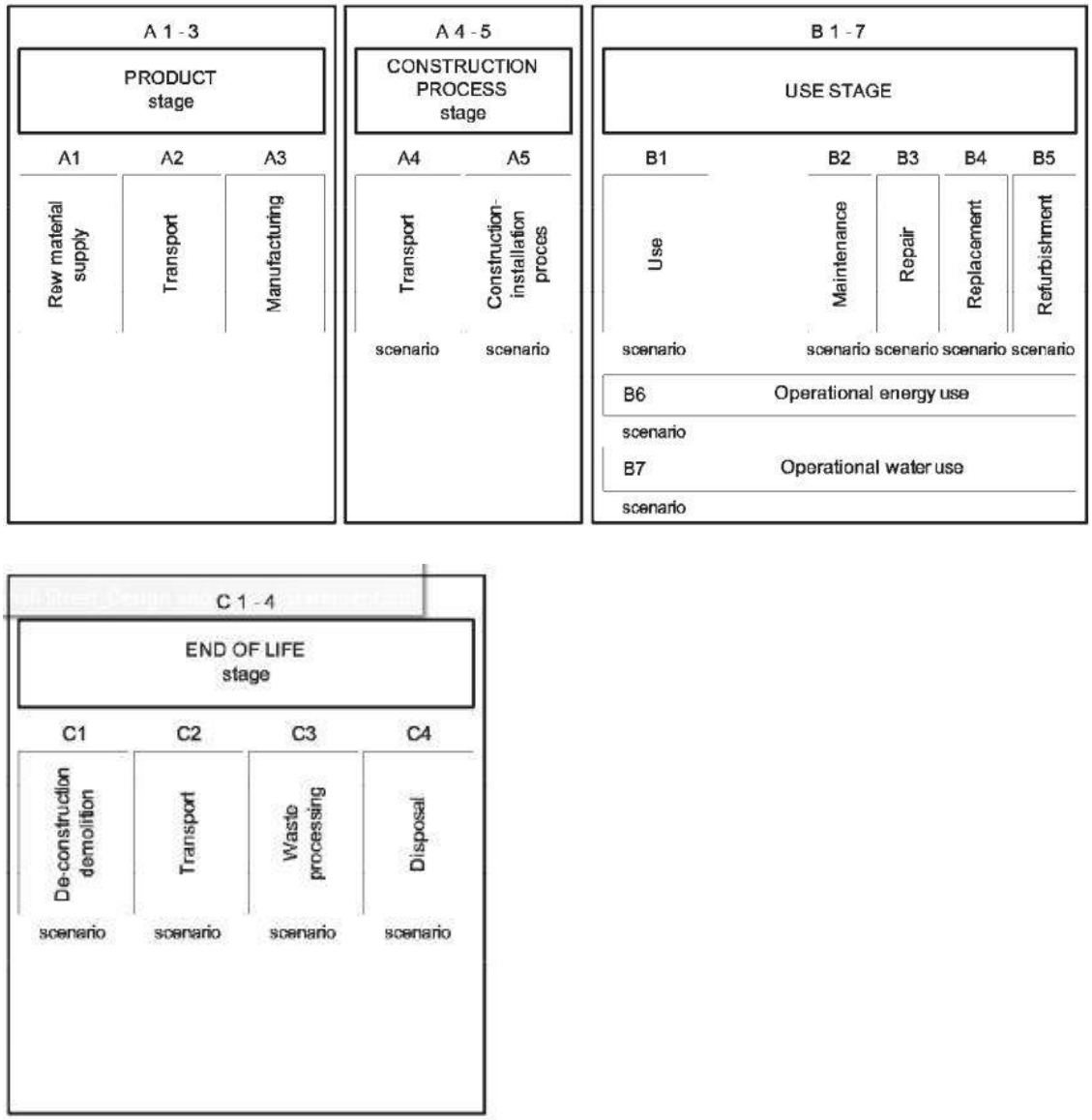

Figure 3-2 LCA Lifecycle Stage (Source: BS EN 15978:2011)

BOUNDARIES OF THE CONSTRUCTION PROCESS STAGE (MODULES A4 AND A5)

The construction process stage covers the processes from the factory gate of the different construction products to the practical completion of the construction work, mainly including the fuel types and amounts used on site.

The boundary for module A4 includes transport of materials and products from the factory gate to the building site, including any transport, intermediate storage and distribution transport of construction equipment (cranes, scaffolding, etc.) to and from the site.

All impacts and aspects related to losses due to the transportation such as waste management of the products and materials that are damaged or otherwise lost during transportation are also included. Not included is the transport of persons to and from the site.

The system boundary of construction installation process module A5 includes the following processes:

- ground works and landscaping;
- storage of products, including the provision of heating, cooling, humidity, etc.;
- transport of materials, products, waste and equipment within the site;
- temporary works, including temporary works located off-site as necessary for the construction installation process;
- on site production and transformation of a product;
- provision of heating, cooling, ventilation, humidity control etc. during the construction process;
- installation of the products into the building including ancillary materials not counted in the EPD of the products e.g. releasing agents in formworks for concrete, formworks discarded at the end of the project;
- water use for cooling of the construction machinery or on-site cleaning;
- waste management processes of other wastes generated on the construction site. This includes all processes (including transportation from the building site) until final disposal or until end of waste state is reached; production, transportation and waste management of products and materials lost during the construction and installation process.

BOUNDARIES OF THE USE STAGE (MODULES B1 - B7)

The use stage covers the period from the practical completion of the construction work to the point of time when the building is deconstructed / demolished.

The system boundary includes the use of construction products and services for protecting, conserving, moderating or controlling the object of assessment, e.g. building services such as heating, cooling, lighting, water supply and internal transports (provided e.g. by lifts and escalators), and scenarios for maintenance including cleaning, operation and replacement of machinery.

The assessment shall include impacts and aspects of the building-integrated technical system and building-related furniture, fixtures and fittings. The system boundary for the assessment shall exclude impacts and aspects of the appliances and furniture, fixtures and fittings that are not building-related.

The impacts and aspects of appliances and furniture, fixtures and fittings that are not building-related[2] may be assessed separately. Where this is the case, these impacts and aspects shall be recorded and reported and communicated separately.

- The boundary of module B1 encompasses the impacts and aspects arising from the normal (i.e. anticipated) conditions of use of components of the building.
- The boundary of maintenance module B2 includes the production and transportation of the components and ancillary products used for maintenance; all cleaning processes of the

[2] Appliances that are not building-related are domestic, commercial and industrial appliances and other non-building related goods - e.g. entertainment electronics, washing machines, refrigerators, cooking appliances, office electronics and appliances of industrial processes. Building-related furniture, fixtures and fittings are products that are fixed to the building, so that the dismantling of the product decreases the performance of the building and the dismantling or replacement of the product constitute construction operations

interior and exterior of the building; all processes for maintaining the functional and technical performance of the building fabric and building-integrated technical systems, as well as aesthetic qualities of the building's interior and exterior components.

- The boundary for repair module B3 includes any repair processes to the building components during the use stage of the building, such as the production and transport of the repaired part of component and ancillary products; waste management of the removed part of the component and of ancillary products and the end of life stage of the removed part of the component and of ancillary products.
- The boundary for replacement module B4 shall include the production and transport of the replaced component and ancillary products; waste management of the removed component and of ancillary products and the end of life stage of the removed component and of ancillary products.
- The boundary for refurbishment module B5 includes the production and transport of the new building components; waste management of the refurbishment process and the end of life stage of replaced building components.
- The boundary of the operational energy use module B6 includes energy used by building-integrated technical systems during the operation of the building. The energy performance of a building is determined on the basis of the calculated or the actual annual energy that is used in order to meet the different needs associated with defined uses of the building, including space heating, domestic hot water supply, air conditioning (cooling and humidification/de-humidification), ventilation, lighting and auxiliary energy used for pumps, control and automation.
- The energy use of other building-integrated technical systems (e.g. lifts, escalators, safety and security installation and communication systems) necessary for the technical and functional performance of the building shall be included in B6 and reported and communicated separately. If the energy use of appliances that are not building-related (plug-in appliances, e.g. computers, washing machines, refrigerators, audio, TV and production or process-related energy in the use of the building) is included within the energy calculation, then this shall be documented and reported and communicated separately.

  The boundary of the operational water use module B7 shall include all water used and its treatment (pre- and post-use) during the normal operation of the building (excluding during maintenance, repair, replacement and refurbishment), together with associated environmental impacts and aspects. Module B7 covers the period from the handover of the construction works to the point in time when the building is deconstructed / demolished. It includes all building-integrated water-consuming processes of the building under operation such as processes for drinking water, water for sanitation, domestic hot water, irrigation, water for heating, cooling, ventilation and humidification and other specific water use of building-integrated systems e.g. fountains and swimming pools. If water use of appliances that are not building-related (e.g. dishwashers, washing machines) is included within the assessment, this shall be reported and communicated separately.

BOUNDARY OF THE END OF LIFE STAGE (MODULES C1-C4)

The end-of-life stage of a building starts when the building is decommissioned and is not intended to have any further use. At this point, the building's demolition/deconstruction may be considered as a multi-output process that provides a source of materials, products and building elements that are to be discarded, recovered, recycled or reused.

- The boundary of the deconstruction process in module C1 includes on-site operations and operations undertaken in temporary works located off-site as necessary for the deconstruction processes after decommissioning up to and including on-site deconstruction, dismantling and/or demolition.

- The boundary for module C2 shall include all impacts due to transportation to disposal and/or until the end-of-waste state is reached. This includes transport to and from possible intermediate storage/processing locations.
- The boundary for waste processing for reuse, recovery or recycling (Module C3) includes all output from dismantling, deconstruction or demolition of the building, from maintenance, repair, replacement or refurbishing processes, all debris, all construction products, materials or construction elements, etc. leaving the building, are at first considered to be waste.
- Boundary for the disposal of module C4 includes the possible post-transportation treatment that is necessary before disposal. Module C4 quantifies all the environmental loads resulting from final disposal of materials (neutralisation, incineration with or without utilisation of energy, landfilling with or without utilisation of landfill gases, etc.). Any environmental benefits from exported energy (i.e. through substitution) shall be reported into module D. For some end-of-life processes such as land-filling, emissions can occur after the time period of the assessment. As a rule, a time period of 100 years is considered appropriate for such long-term processes.

4 ASSUMPTIONS MADE

4.1 SYSTEMS ASSUMPTIONS

- Sanitary systems (water, waste water, piping, pump and fixed equipment): The ELCA study assumes a standard water consumption of 5.5 m^3 per person per annum and applies an equivalent carbon factor to it. Energy consumed by pumps are included if they are part of the Part L energy model.
- Fixed fire-fighting systems are not included in the ELCA model.
- Low temperature hot water for space heating is provided by heat exchangers connected to the district heat network located at the basement level, impacts from the heating therefore is not considered in the ELCA study.
- Mechanical ventilation and air conditioning applies to all spaces. The energy demand related to these systems is included while the embodied impact from the relevant equipment is not.
- Fixed lighting systems: Energy demand from fixed lighting is included in the ELCA while embodied impacts are excluded.
- Transportation inside the building (lifts): The energy demand due to vertical transportation and the embodied carbon impacts of the lifts are not included in this ELCA.
- Drainage system are not included in the ELCA model
- Generic assumptions based on IES IMPACT data for energy consumed on site during construction are included in the ELCA model.
- External lighting is not included in the model.
- A suitable site wastage value of 5% is applied for each layer in the study.
- The external/internal doors were not included in the ELCA model; however the area was included in the 3D model.

4.2 TIME-RELATED CHARACTERISTICS

- The assumed lifespan is 60 years as required for BREEAM LCA studies.
- The replacement cycles for materials and equipment are applied as defined in the BREEAM IMPACT database.
- Assumed occupancy numbers and pattern are defined as per the UK’s Part L energy modelling standards.

5 THE BASELINE MODEL

The IES VE model used for the ELCA was developed by Grontmij[3] to represent the energy strategy for the Proposed Development. It is based on detailed information from the architect and structures engineer and was supplemented with ELCA data by the ELCA analyst. A rendering of the final baseline 3D model is shown in Figure 5-1.

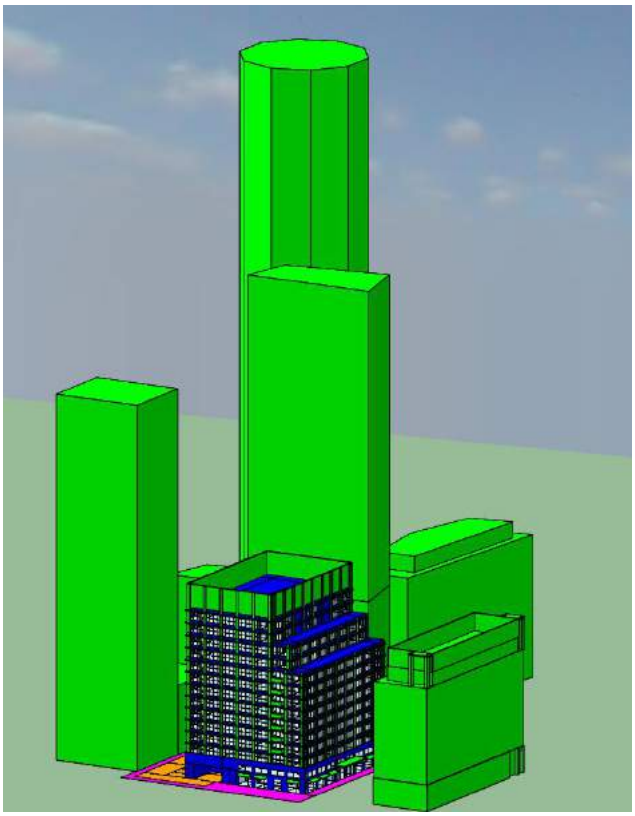

Figure 5-1 3D model

The baseline model includes the new construction elements. The total gross internal floor area (GIA) is 28,141 m² based on the Architect Stage 3 design drawings.

The building's core and shell as well as internal fit-out elements included in the baseline model and their quantities are shown in Table 5-1, as well as the BRE Impact's definitions assigned to them.

[3] Project Name: Building D1D2, Date: Thu Aug 13 13:17:35 2015

Table 5-1 BRE Impact Material Specification

	ELEMENT DESCRIPTION	IES ENERGY MODEL DESCRIPTION	IES MATERIALS DESCRIPTION (BRE IMPACT)	QUANT. (TONNES)
1.1	Substructure			
1.1.1 (a)	Structural Piles – concrete	WSP - FDN_C35 (Structural Piles)	Material ID: [ICMP57] Description: Structure, concrete (in-situ, RC35, excl. reinforcement)	2,500
1.1.1 (b)	Structural Piles - reinforcement	WSP - FDN_REBAR (Structural Piles)	Material ID: [ICMP172] Description: Reinforcement for RC, steel	367
1.1.1 (c)	Pile Caps - concrete	WSP - FDN_C35 (Pile Caps)	Material ID: [ICMP57] Description: Structure, concrete (in-situ, RC35, excl. reinforcement)	74
1.1.1 (d)	Pile caps - reinforcement	WSP - FDN_REBAR (Piles Caps)	Material ID: [ICMP172] Description: Reinforcement for RC, steel	11
1.1.3	Lowest floor construction:			
1.1.3 (a)	Lowest floor construction	Ground/Exposed Floor	Material ID: *Composite Layer = [ICMP57] 'Structure, concrete (in-situ, RC35, excl. rebar) and [ICMP152] 'Floor (screed, bonded), concrete (1:4 cement: sand)* + [ICMP0] 'Floor decking (shallow profiled), steel' + [ICMP172] 'Reinforcement for RC, steel' + [ICMP20] 'Insulation (rigid sheet), EPS + [ICMP96] 'Vapour control layer, polythene' + [ICMP172] + [ICMP57] + [ICMP208] 'General sheet, Chipboard'	3,200
2	Superstructure			
2.1	Frame			
2.1.1 (a)	Structure Steel	WSP - SS_STL	Material ID: [ICMP48] Description: Structure, steel (hot rolled)	801
2.1.1 (b)	Concrete Columns	WSP - SS_C35 (Concrete Columns)	Material ID: [ICMP57] Description: Structure, concrete (in-situ, RC35, excl. reinforcement)	320
2.1.1 (c)	Concrete Columns - reinforcement	WSP - SS_REBAR (Concrete Columns)	Material ID: [ICMP172] Description: Reinforcement for RC, steel	136
2.1.1 (d)	Steel Columns Tonnage	WSP - SS_STL (Columns)	Material ID: [ICMP48] Description: Structure, steel (hot rolled)	562
2.1.1 (e)	Steel Decks Tonnage	WSP - SS_STL (Decks)	Material ID: [ICMP48] Description: Structure, steel (hot rolled)	0.4
2.1.1 (f)	Structure Steel	WSP - SS_STL (Fabricated Beams)	Material ID: [ICMP48] Description: Structure, steel (hot rolled)	39.5
2.2	Upper floors			

	ELEMENT DESCRIPTION	IES ENERGY MODEL DESCRIPTION	IES MATERIALS DESCRIPTION (BRE IMPACT)	QUANT. (TONNES)
2.2.1 (a)	Upper floors (UF)	Internal Ceiling Floor	Material ID: [IFF1533] Description: [Commercial] Carpet Tile - Fibre-bonded. 80/20 polypropylene/polyamide 800 g/m², bitumen backing. FCSS 32/33 + Composite Layer = [ICMP169]*'Floor (raised access, panel/tile), steel encased particle board' and [ICMP77]'Floor (raised access, pedestal), steel'* + Composite Layer = *[ICMP57] and [ICMP152]*+ [ICMP172] + [ICMP0] + [ISC2] 'Suspended plasterboard ceiling, galvanized steel suspension framework and paint'	9,700
2.2.1 (b)	Upper floors (UF)	Internal Ceiling Floor	Material ID: [IFF1533] Description: [Commercial] Carpet Tile - Fibre-bonded. 80/20 polypropylene/polyamide 800 g/m², bitumen backing. FCSS 32/33 + Composite Layer = [ICMP169]*'Floor (raised access, panel/tile), steel encased particle board' and [ICMP77]'Floor (raised access, pedestal), steel'* + Composite Layer = *[ICMP57] and [ICMP152]*+ [ICMP172] + [ICMP0]	2,600
2.3	Roof			
2.3.1 (a)	Roof	Roof (Suspended Ceiling)	Material ID: [ICMP10] 'Roof covering (tiles, interlocking), concrete' + [ICMP118] 'Roof membrane (single ply), PVC' + [ICMP96] 'Vapour Control layer, polythene' + [ICMP20] ' Insulation (rigid sheet), EPS + *Composite Layer = [ICMP57] 'Structure, concrete (in-situ, RC35, excl. reinforcement)' and [ICMP29] 'Roof deck (shallow profiled deck)*, steel (galvanized)' + [ISC23] 'Suspended plasterboard ceiling, galvanized steel suspension framework and paint'	810
2.3.1 (b)	Roof	Roof (Plasterboard Ceiling)	Material ID: [ICMP10] 'Roof covering (tiles, interlocking), concrete' + [ICMP118] 'Roof membrane (single ply), PVC' + [ICMP96] 'Vapour Control layer, polythene' + [ICMP20] ' Insulation (rigid sheet), EPS + *Composite Layer = [ICMP57] 'Structure, concrete (in-situ, RC35, excl. reinforcement)' and [ICMP29] 'Roof deck (shallow profiled deck)*, steel (galvanized)' + [ISC3] 'Plasterboard ceiling and paint'	740
2.4	Stairs and ramps	WSP - STAIRS_C35	Material ID: [ICMP104] Description: Structure, concrete (precast, RC40)	400
2.4	Stairs and ramps (STR)	WSP - STAIRS_C35 (REBAR)	Material ID: [ICMP172] Description: Reinforcement for RC, steel	70

	ELEMENT DESCRIPTION	IES ENERGY MODEL DESCRIPTION	IES MATERIALS DESCRIPTION (BRE IMPACT)	QUANT. (TONNES)
2.5	External walls - opaque			
2.5.1 (a)	External Walls	External Wall	[GGOP2621] 'Reconstructed stone faced precast concrete cladding panel; insulation; light steel studwork; plasterboard; paint	5,947 (m^2)
2.6	External walls - glazing			
2.6.1 (a)	External Walls - Glazing areas	External Window	Material ID: [ICMP154] 'Glazing (double glazed, sealed unit), glass'	5,552 (m^2)
2.7	Internal walls and partitions			
2.7.1 (a)	Internal Partition	Internal Partition - Core Structure	Material ID: [ICMP171] Description: Framework (drywall partitions (jumbo)), steel (galvanized) + Composite layer: [ICMP123] 'Block, concrete (lightweight aggregate) and [ICMP261] 'Mortar, cement: sand (1:4) + [ICMP803] ' Plaster, gypsum' + [ICMP222] 'Paint, gloss (solvent based)'	110
2.7.1 (b)	Internal Partition	Internal Partition	Material ID: [ICMP222] Description: Paint, gloss (solvent based) + [ICMP803] 'Plaster, gypsum' + [ICMP171] 'Framework (drywall partitions (jumbo)), steel (galvanized)' + [ICMP803] 'Plaster, gypsum' + [ICMP222] 'Paint, gloss (solvent based)	750

6 FINDINGS

6.1 YEAR 0

Year 0 includes any impacts resulting from activities prior to first occupation of the building.

The total carbon footprint for Year 0 is **12,519 tonnes CO_2e**, or **445 kg CO_2e** per m² GIA.

It can be seen from Table 6-1 and Figure 6-1 that the key contributor to the footprint is the Product stage (A1-3), accounting for over **92%** of the total carbon footprint. The materials Transport (A4) accounts for over **5%** and Construction activities on site (A5) account for over **2%.**

The results suggest that in order to achieve significant reductions in lifecycle carbon emissions the focus should be on the embodied impacts, which are the greenhouse gas emissions associated with the extraction, processing and manufacturing of materials.

Table 6-1 Actual total carbon footprint (Yr. 0)

LIFE STAGE	KG CO_2 EQ. (100 YR.)	KG CO_2 EQ. (100 YR.) PER GIA
Product Stage (A1-3)	11,587,679	411.77
Transport (A4)	648,262	23.04
Construction Installation Process (A5)	283,483	10.07
Total kg CO_2 eq.	12,519,424	444.88

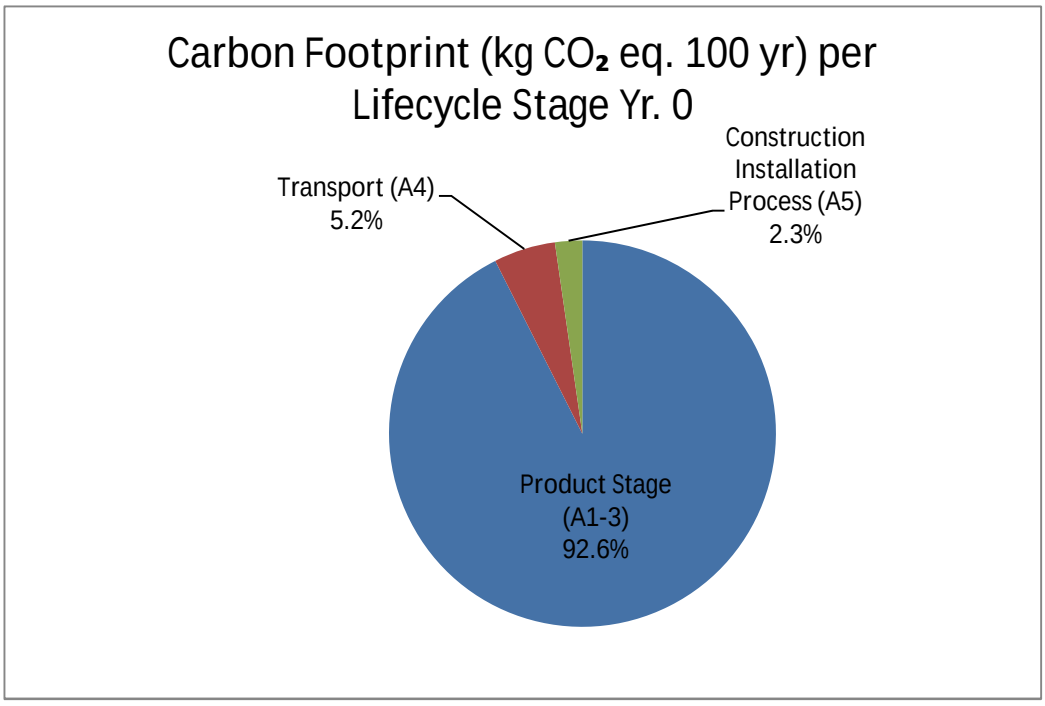

Figure 6-1 Carbon Footprints per Life Stage Yr. 0

The next step of the analysis is therefore a review of the embodied impacts per material element category[4]. It can be seen from Table 6-2 and Figure 6-2 that the 'carbon hot spots' within the embodied impact footprint are:

- **Upper Floors:** The build-up of the upper floors includes the suspended ceiling system as well as the raised access floor and floor finish (carpet). The IES Impact software does not allow measurement of the embodied impact by floor material. A separate floor impact study would be required to fully understand what aspects of the upper floor construction contribute the most to the element footprint at over **6,100 tonnes CO_2e** of the overall carbon footprint.
- **Superstructure – Steel Frame**: The structural steel contributes approx. **3,800 tonnes CO_2e** to the building's carbon footprint, again attributed to the energy intensive steel making process.
- **Foundations:** The concrete component of the foundations contributes to over **400 tonnes CO_2e** to the total embodied impact, while the reinforcement adds a further **700 tonnes CO_2e**. This is primarily due to the large amount of energy required in producing Portland cement and steel.
- **Pre-fabricated external wall and Glazing façade**: The glazed and opaque elements of the façade which excludes any additional shading elements and metal cladding on the plant room at the top level of the Proposed Development contribute more than **1,545 tonnes CO_2e** to the embodied impact of the building.

Table 6-2 Embedded carbon footprint per element category (IES IMPACT)

ELEMENT CATEGORY	KG CO_2 EQ. (100 YR.)	KG CO_2 EQ. (100 YR.) PER GIA
Standard Foundation (1.1.1)	1,115,797	39.7
Lowest Floor Construction (1.1.3)	1,900,000	67.5
Frame (2.1)	3,821,165	135.8
Upper Floors (2.2)	6,100,000	216.8
Stairs	190,582	6.8
Roof (2.3)	1,210,000	43.0
External Walls (2.5)	1,100,000	39.1
External Windows (2.6)	445,000	15.8
Internal Walls and Partitions (2.7)	324,000	11.5
Road, Paths and Paving's (8.2)	0	0.0
Construction Installation (A5)	283,483	10.1
Total kg CO_2 eq.	16,490,027	586.0

[4] It should be noted that IES IMPACT software calculates a 60 year LCA analysis of each element category regardless of the study period selected. Therefore the results showed in Table 6-2 and Table 6-3 are based on the following LCA life stages: A1, A2, A3, A4, A5, B1, B5 and C4. However some elements were excluded such as: the Operational Energy Use (B6) and Operational Water Use (B7).

Table 6-3 Embedded carbon footprint per life stage (IES IMPACT) – Yr. 0

LIFE STAGE	KG CO_2 EQ. (100 YR.)
Product Stage (A1-3)	11,587,679
Transport (A4)	648,262
Construction Installation Process (A5)	283,483
Use (B1)	-48,620
Maintenance (B2)	486,196
Refurbishment (B5)	3,241,309
Operational Energy Use (B6)	0
Operational Water Use (B7)	0
End of Life (C1-4)	291,718
Total kg CO_2 eq.	16,490,027

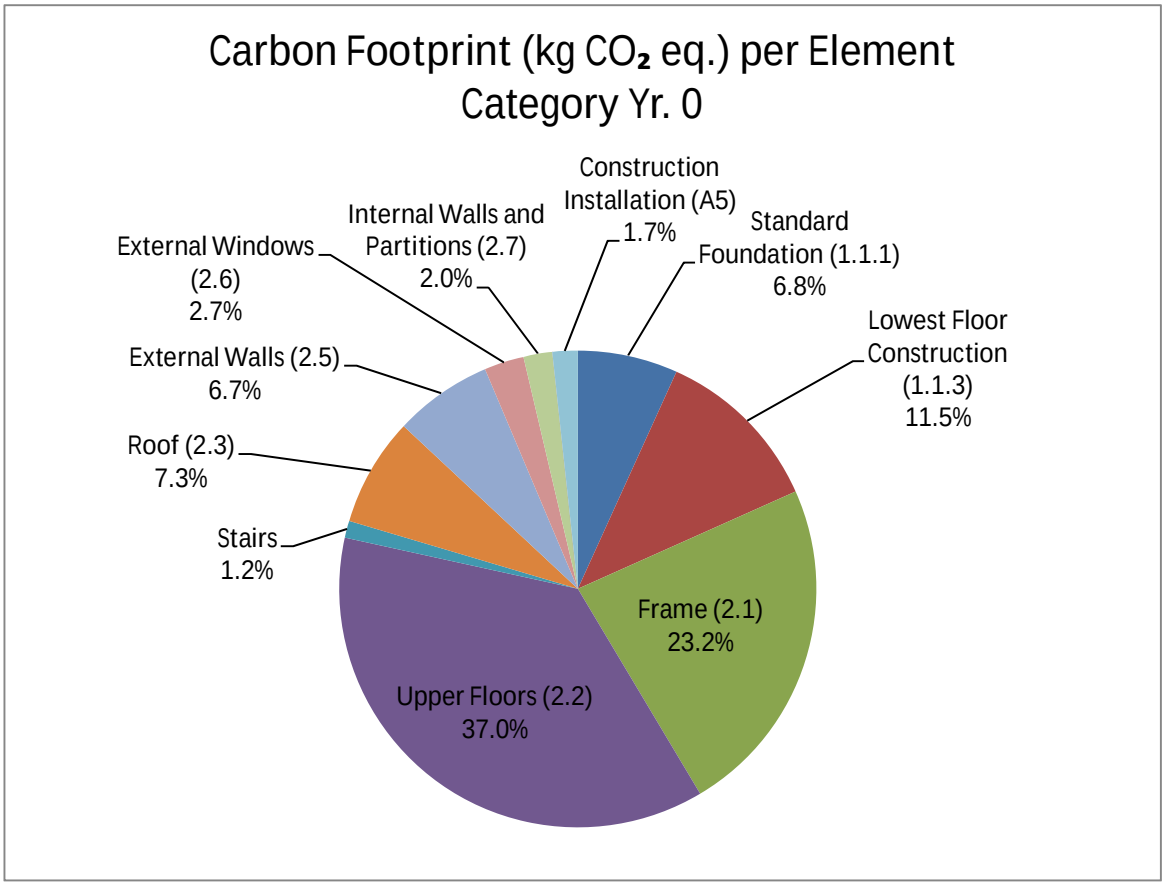

Figure 6-2 Carbon Footprints per Element Category Yr. 0

6.2 YEAR 60

The results for the 'Year 60' model scenario include the embodied and operational impacts over an assumed lifespan of the building of 60 years. The total greenhouse gas emissions footprint for Year 60 is **113,670 tonnes CO_2e**, or **4,039 kg CO_2e** per m² GIA. Excluding the operation energy use the total carbon footprint for Year 60 is 18,547 tonnes CO_2e or 659 kg CO_2e per m² GIA.

It can be seen from Table 6-4 and Figure 6-3 that the carbon hot spots are:

- **Operational Energy Use:** Operational energy use contributes **83%** to Year 60 carbon footprint. As an energy strategy optimisation process took place during design stages B and C this study is not analysing this aspect further. However it should be noted that the operational carbon footprint is not taking into consideration the likely future reductions due to grid decarbonisation.
- **Refurbishment:** This accounts for over 4% of the overall impact footprint although is very minimal in comparison to the operational energy use, a further analysis might be required.

Table 6-4 Embedded carbon footprint per life stage (IES IMPACT) – Yr. 60

LIFE STAGE	KG CO_2 EQ. (100 YR.)	KG CO_2 EQ. (100 YR.) PER GIA
Product Stage (A1-3)	11,587,679	411.77
Transport (A4)	648,262	23.04
Construction Installation Process (A5)	283,483	10.07
Use (B1)	-48,620	-1.73
Maintenance (B2)	486,196	17.28
Refurbishment (B5)	5,298,309	188.28
Operational Energy Use (B6)	94,913,397	3,372.78
Operational Water Use (B7)	210,000	7.46
End of Life (C1-4)	291,718	10.37
Total kg CO_2 eq.	113,670,424	4,039.32

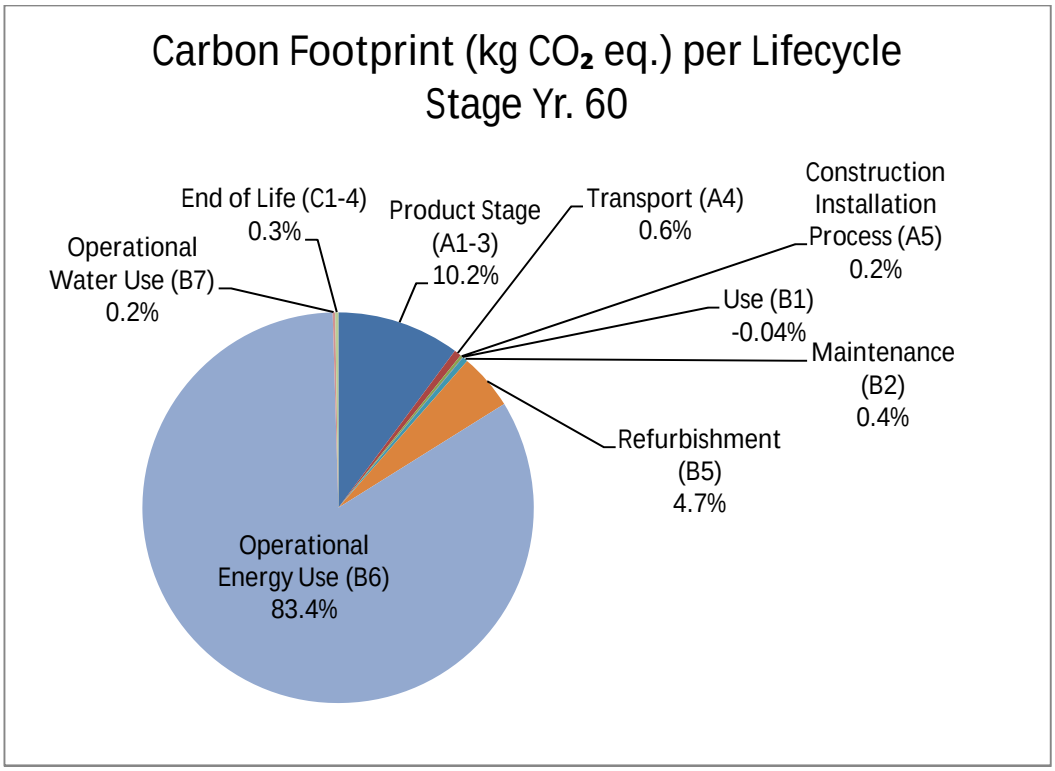

Figure 6-3 Carbon Footprints per Life Stage Yr. 60

6.3 BENCHMARKING

To date there is very limited data available to benchmark embodied carbon or lifecycle carbon of UK buildings. In 2014 the Waste Reduction Action Programme (WRAP) introduced an embodied carbon database that interested parties are able to add their projects to in order to generate a building type/size specific database. However, so far only a handful of projects have been added and the quality of data of many of the case studies uploaded is questionable.

To review the results of the RIBA Stage 3 lifecycle carbon results in the context of other similar buildings we have collated the embodied carbon footprint results of a number of mid-rise and high-rise office/retail developments that are currently design/constructed in London. These are summarised in Table 6-5.

A like-for-like comparison must be treated with caution since the buildings vary greatly in height; each study was carried out using different embodied carbon data sets and included fit-out elements to a varied degree. However the results from our ELCA suggest that the impact of the Proposed Development is at the low range of the results table.

Table 6-5 Embodied Carbon Comparison

PROJECT	USE	NO. OF OCCUPIED STOREYS ABOVE GROUND	NO. OF STOREYS BELOW GROUND	GIA (M^2)	NIA (M^2)	YR. 0 EMBOD. CARBON IN KG CO_2E/M_2 GIA	YR. 0 EMBOD. CARBON IN KG CO_2E/M_2 NIA	DATA SOURCE
B3	Office / Retail	10	2	12,146	9,798	453	561	ELCA using IES Impact
D1D2	**Office / Retail**	**13**	**2**	**28,141**	**21,955**	**445**	**570**	**ELCA using IES Impact**
Confidential office development, London	Office / Retail	34	3	129,000	84,500	445	687	ELCA using IES Impact
5 Broadgate	Office	12	2		65,000		713	British Land case study[5]
Confidential office development, London	Office / Retail / Restaurant	73	4	149,089	92,975	448	717	WSP PB ELCA using IES Impact
Office Building London	Office	10	2	33,020		452		Case study in The Structural Engineer October 2012[6]
Ropemakers Place	Office	21	3	80,840		684		British Land case study[7]
One Kingdom Street	Office / Retail	10	2		25,000		993	Skanska case study, dcarbon8 case study 2008[8]

[5] http://www.britishland.com/~/media/Files/B/British-Land-V2/documents/bl-arup-5-broadgate-embodied-carbon%20report-2014.pdf
[6] http://www.steel-sci.com/SCIContentPDF/Target-Zero-Structural-Engineer.pdf
[7] http://www.britishland.com/~/media/Files/B/British-Land-V2/press-release/2010/BL-Ropemaker-Carbon-Deloitte.pdf
[8] http://www.skanska.co.uk/cdn-1cbb2393e778ba0/Global/About%20Skanska/Sustainability/March%202010/One%20Kingdom%20St,%20UK%20Sustainablility%20Case%20Study.pdf

7 RECOMMENDATIONS

7.1 FOCUS: CONCRETE

Here we see the greatest potential for embodied carbon savings. Based on further iterations of the IES Impact model it is estimated that replacing Portland cement in the concrete mixes with 30% pulverised fly ash (PFA) on average would reduce the greenhouse gas emissions by **660 tonnes** CO_2e. Another alternative would be to use Ground Granulated Blast Furnace Slag (GGBS) which allows even higher cement replacement percentages. However, supplies of PFA have fallen in recent years due to the decline in use of coal by power plants. This in turn has also caused an increased demand for GGBS, specifically from large infrastructure projects such as Crossrail.

The extent to which cement replacement can be used should be discussed with the Structural Engineer and Contractor to fully understand constraints such as strength gain over time, curing times, availability of cement replacement such as PFA and GGBS and cost impacts.

Estimated savings potential – Concrete: **up to 660 tonnes CO_2e**

Estimated cost of carbon savings: **Medium to Low**

Recommended for the Proposed Development: **Yes**

7.1 FOCUS: FACADE

The BRE Impact data selected for the build-up of the façade were: reconstructed stone faced precast concrete cladding panel with insulation, light steel studwork, plasterboard and paint for the external wall and a standard double glazed window for the windows. The Year 0 embodied carbon footprint of the façade is estimated as **1,545 tonnes** CO_2e out of which **1,100 tonnes** CO_2e is attributed to the opaque areas.

While we would assume that the amount of materials specified for the facade is governed by performance requirements (structural, thermal, and aesthetics) there could potentially be significant differences in the embodied carbon content of specific products.

We propose that at Stage 4 the tendering facade manufacturer' are asked to state the embodied carbon content of their products. This is typically done by requiring an EPD for the product proposed. Also taking into account the location of the manufacturing plant and the mode of transport from factory gate to site, this would enable the Project Team to take into account embodied carbon in the selection process of the facade products. We estimate that by selecting the manufacturer with the lowest embodied carbon product (evidenced with an EPD) would reduce the façade footprint by **10%**, or **155 tonnes** CO2e.

A more drastic recommendation that would be difficult to implement post-planning would be to consider the use of timber clad facade (9 kg CO_2/m_2) instead of concrete clad (230 kg CO_2/m_2). We estimate that this could reduce the carbon emission of the façade element by up to **95%**, or **1,045 tonnes** CO2e.

Estimated savings potential – Facade:

→ up to 155 tonnes CO_2e (supplier selection)

→ up to 1,045 tonnes CO_2e (timber cladding)

Estimated cost of carbon savings:	**Medium to Low**
Recommended for the Proposed Development:	**Yes (supplier selection)**
	No (timber cladding, due to planning implications)

7.2 FOCUS: STEEL

With nearly **4,600 tonnes CO_2e** the steel elements contribute a significant amount to the building's carbon footprint.

The high carbon content in construction steel is primarily related to the energy intensive processes involved in making virgin steel. The average recycled content in steel sourced in the UK is about 45%, with reinforcement containing nearly 100% steel strap and other steel products varying in recycled content.

An increased recycled content in steel does reduce the embodied carbon content significantly. However, we would advise against specifying a recycled content for the project that would go beyond the UK average value. Metals are a high value commodity and the value of scrap metal ensures that recycling is maximised. If the specified recycled content for the project was higher than the UK construction industry's average this would most probably increase the material cost for the project and just shift scrap material from elsewhere. It is likely though that it would not lead to any overall (global) environmental benefit.

The energy efficiency of steelmaking facilities vary depending on production route, type of iron ore and fuel (coal) used the product mix, and operation control technology. Selecting the steel fabricator (and thus the steel manufacturer) based on their steel product's carbon footprint as stated in an EPD might be a route to reducing the carbon footprint of the steel sections used for the project, however the location of the steel making plant and thus transport related impacts should be considered also.

Estimated savings potential – Steel:	**About 460 tonnes CO_2e for each 10% recycled content increase in structural steel sections**
Estimated cost of carbon savings:	**High**
Recommended for the Proposed Development:	**No (specifying high recycled content)**
	Yes (supplier selection)

7.3 FOCUS: TRANSPORT AND CONSTRUCTION

Within the ELCA model it is assumed that impacts due to materials transport from factory to site and due to the actual construction activities on site contribute about **930 tonnes** CO_2e to the overall initial (Year 0) carbon footprint of the building.

The appointed Main Contractor and Subcontractors are required to set targets for energy consumption on site and due to material transport to and from site and to monitor these (requirements of the BREEAM Excellent strategy).

There is an opportunity to develop a strategy for minimising energy consumption for site construction and transport. Potential measures that could be reviewed with the Main Contractor are:

- Introduction of a construction materials and waste consolidation centre outside of Central London to collect deliveries and to maximise truck loads to and from site.
- Use of efficient on site machinery and potential use of biofuels to reduce the carbon impact of the energy used
- Use of energy efficient site lighting and optimised controls to minimise energy demand on site
- Preferred use of locally sourced materials to reduce the requirement for road transport and thus to reduce the carbon impact of the transport of material per tonne and km travelled
- Preferred use of alternative modes of transport (other than road) to reduce the carbon impact of the transport of material per tonne and km travelled. In this case transport by barge could be an option.

In the absence of reliable UK benchmark data we estimate that a 10% saving across transport and construction activities is possible by implementing energy conscious material transport modes and construction techniques.

We recommend that the implemented strategies, construction energy data and material transport data collated during construction is made available and feeds into a post-completion carbon footprint exercise that future Canary Wharf projects can draw on.

Estimated savings potential – Transport and Construction:	**up to 93 tonnes CO_2e**
Estimated cost of carbon savings:	**Low**
Recommended for the Proposed Development	**Yes**

8 CONCLUSIONS

The total carbon footprint (GWP 100) for D1D2 was calculated for Year 0 and Year 60 as **12,519 tonnes** CO_2e, (**444 kg CO_2e per m² GIA**) and **113,670 tonnes** CO_2e (**4,039 kg CO_2e per m² GIA**) respectively.

To date there is very limited data available to benchmark embodied carbon or lifecycle carbon of UK buildings. While there are databases available the quality of data of many of the case studies uploaded is questionable. A few useful embodied carbon analysis results were found for similar buildings located in central London. The results for Proposed Development suggest a medium embodied carbon content when compared to similar projects.

A number of 'carbon hot spots' were identified within the cradle to site and construction stage materials and processes (Year 0 impacts) and recommendations for improvement made. It is estimated that were all recommendations taken on board for the RIBA Stage 4/5 detailed design and construction, the combined carbon footprint reduction potential would be about **907 tonnes CO_2e** or approx. **7%** of the Year 0 baseline carbon footprint, that is equivalent of **165 homes'** energy use for one year[9].

It is suggested to review the findings and recommendations with the Project Team at Design Stage 4 to evaluate the technical and commercial implications of adopting them.

[9] Department of Energy and Climate Change – United Kingdom housing energy fact file (2012) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/201167/uk_housing_fact_file_2012.pdf

9 BREEAM

9.1 BREEAM 2014 – MAT 01 INNOVATION CREDIT (ROUTE 2)

D1D2 is targeting BREEAM 2014 for New Construction[10] Excellent rating or better.
As part of the BREEAM Excellent strategy the project is targeting two Innovation credits linked to credit Mat 01 – Life Cycle Impacts.

In order to obtain these two Innovation credits the following requirements apply:

1. The Design Team has used an IMPACT compliant software tool (or equivalent) to measure the environmental impact of the building.
2. The Design Team can demonstrate how the use of an IMPACT compliant software (or equivalent) has benefited the building in terms of measuring and reducing its environmental impact. This should take the form of a short qualitative statement from the Design Team providing comments on the following:
    a. How and at what stages of the design the tool was utilised.
    b. How the tool helped (or did not help) steer the design process to optimise cost and mitigate environmental impacts, giving examples of specific changes to the building's design and/or specification that resulted.
3. The Design Team submits the building information model (BIM) from the IMPACT compliant software tool (or equivalent) for the assessed building to BRE Global (via the project's appointed BREEAM assessor).

9.2 COMPLIANCE STATEMENT

An environmental lifecycle analysis (ELCA) plan was carried out in April and May 2016 during RIBA Stage 3+. The results/findings will be used to inform the RIBA Stage 4 design as well as construction processes in RIBA Stage 5.

An IMPACT compliant software tool was used to measure the environmental impact of the Proposed Development: *IES Virtual Environment (VE) version 2015.1.0.0, IMPACT LCA Material Dataset*.

To fully comply with BREEAM Mat 01 credit, the design team needs to consider the findings and recommendations of this analysis and demonstrate how it has benefited the Proposed Development in terms of measuring and reducing its environmental impact. This should take the form of a short qualitative statement from the Design Team providing comments on how the tool helped (or did not help) steer the design process to optimise cost and mitigate environmental impacts, giving examples of specific changes to the building's design and/or specification that resulted.

[10] BREEAM 2014 for New Construction Manual, Technical Manual: Version: SD5076 – Issue: 4.0 – Issue Date: 05/10/2015

The ELCA was carried out in line with the requirements for BREEAM 2014 for New Construction, Innovation credit Mat 01 and the related guidance note[11].

The IES model (with IMPACT Material Dataset) that was used for the ELCA will be issued with this report to the design team and should then be made available to the BRE as part of the BREEAM evidence gathering.

Provided the design team comply with the 2nd and 3rd requirement of Mat 01 Innovation Credit (Route 2), we conclude that a BREEAM score of 2% related to this Innovation credit can be awarded to the project. This is to be confirmed by the appointed BREEAM assessor during the formal BREEAM assessment commencing at RIBA Stage 4.

In addition there might be secondary benefits for the BREEAM score resulting from the implementation of some of the recommendations. For example, should EPDs be requested from and provided by the successful façade system supplier as recommended in this ELCA , this might positively impact the score under Mat 01 base credit.

[11] British Research Establishment (May 2013). Assessor Guidance Note GN08 - BREEAM UK New Construction – Scope of IMPACT Compliant (or equivalent) Tools and Data Submission Requirements

Appendix A

IES IMPACT DATA

D1D2 CARBON FOOTPRINT AT YEAR 0

D1D2 Carbon Footprint (Yr. 0)												Corrected Values	
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2	Installed Quant. (tonnes)
1.1	Substructure (SUB)	30		m²	0	0	0	0	0	0	0	0		
	[FOUNDAT1] WSP - FDN_C35 (Structural Piles)	6	924.90	m²	2500	120	2100	67	0	510	2700	400000	400,000.00	2,500.00
	[FOUNDAT3] WSP - FDN_REBAR (Structural Piles)	6	46.50	m²	7.3	0.36	13	3	0	0.9	17	*5400*	683,544.30	367.35
	[FOUNDAT4] WSP - FDN_C35 (Pile Caps)	6	27.80	m²	74	3.7	62	2	0	15	80	*12000*	12,000.00	74.00
	[FOUNDAT5] WSP - FDN_REBAR (Piles Caps)	6	1.40	m²	0.22	0.011	0.4	0.089	0	0.027	0.52	160	20,253.16	11.06
..1.3	Lowest floor construction	120		m²	0	0	0	0	0	0	0	0		
	[FLOOR] WSP - Ground Floor_Layered (Concrete+Decking+Rebar+Insulation+Concrete_Slab+Chipboard) / 470	6	4,919.70	m²	3600	200	7400	270	-17	840	8500	1900000	1,900,000.00	3,600.00
											11,280.60	2,329,312.70	3,015,797.47	6,552.41
2	Superstructure (BFM)													
2.1	Frame	133		m²	0	0	0	0	0	0	0	0		
	[SFRAME1] WSP - SS_STL (Beams)	6	101.40	m²	1.3	0.066	5.5	0.64	0	0.16	6.3	1700	1,700,000.00	801.06
	[SFRAME11] WSP - SS_C35 (Concrete Columns)	6	120.40	m²	320	16	270	8.7	0	67	350	52000	52,000.00	320.00
	[SFRAME12] WSP - SS_REBAR (Concrete Columns)	6	17.20	m²	2.7	0.13	5	1.1	0	0.33	6.4	2000	253,164.56	135.88
	[SFRAME14] WSP - SS_STL (Columns)	6	71.10	m²	0.93	0.046	3.8	0.45	0	0.11	4.4	1200	1,200,000.00	561.69
	[SFRAME15] WSP - SS_STL (Decks)	6	31.20	m²	0.41	0.02	1.7	0.2	0	0.05	1.9	530	530,000.00	246.48
	[SFRAME16] WSP - SS_STL (Fabricated Beams)	6	5.00	m²	0.065	0.0033	0.27	0.032	0	0.0081	0.31	86	86,000.00	39.50
2.2	Upper floors (UF)	121		m²	0	0	0	0	0	0	0	0		
	[CEIL2] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking+suspended_ceiling) / 1000	6	26,375.80	m²	9700	470	15000	780	8000	4500	28000	4800000	4,800,000.00	9,700.00
	[CEIL21] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking) / 300	6	6,084.00	m²	2600	130	4900	270	1600	2100	8900	1300000	1,300,000.00	2,600.00
2.3	Roof (ROO)	122		m²	0	0	0	0	0	0	0	0		
	[ROOF1] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+ Insulation+concrete_slab+R_decking+suspended_ceiling) / 1300	6	2,202.30	m²	810	43	2000	79	72	210	2400	530000	530,000.00	810.00
	[ROOF11] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+Insulation+concrete_slab+R_decking+plasterboard_ceiling) / 300	6	1,880.10	m²	740	40	2700	110	61	180	3000	680000	680,000.00	740.00
2.4	Stairs and ramps (STR)	139		m²	0	0	0	0	0	0	0	0		
	[SHPSTRS1] WSP - STAIRS_C35 (REBAR)	6	8.90	m²	1.4	0.07	2.6	0.57	0	0.17	3.3	1000	126,582.28	70.31
	[WSPS0000] WSP - STAIRS_C35	6	149.50	m²	400	20	340	11	0	83	430	*64000*	64,000.00	400.00
2.5	External walls (EWAL)	124		m²	0	0	0	0	0	0	0	0		
	[GGOP262] Reconstructed stone faced precast concrete cladding panel; insulation; light steel studwork; plasterboard; paint	6	5,947.30	m²	1.2	0	4400	280	150	610	5500	1100000	1,100,000.00	1.20
.6.1	External windows	126		m²	0	0	0	0	0	0	0	0		
	[EXTW] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	4,870.00	m²	290	15	1400	110	0	150	1700	390000	390,000.00	290.00
	[EXTW2] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	681.70	m²	41	2	200	16	0	21	230	55000	55,000.00	41.00
.6.1	External windows, seperate frames	140		m	0	0	0	0	0	0	0	0		
2.7	Internal walls and partitions (IWAL)	125		m²	0	0	0	0	0	0	0	0		
	[PART1] WSP - Internal Partition_Layered_Core Structure	6	360.30	m²	110	6.1	100	12	-5.6	47	160	24000	24,000.00	110.00
	[PART11] WSP - Internal Partition_Layered	6	27,650.30	m²	750	36	1500	200	0	1400	3,100.00	300000	300,000.00	750.00
											53,903.60	9,249,576.30	13,190,746.84	17,617.12

D1D2 Carbon Footprint (Yr. 0)													Corrected Values	
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2	Installed Quant. (tonnes)
5	Services (BES)													
	Primary Elec	182	2,837,288.50	kWh	0	0	0	0	0	0	0	0	0.00	0.00
	Primary Gas	183	0.00	kWh	0	0	0	0	0	0	0	0	0.00	0.00
	Water	192	5.5	m³/person	0	0	0	0	0	0	0	0	0.00	0.00
											0	0	0.00	0.00
A5	Construction Installations													
A5	Construction Installations	142	35,386.40	m²	0	0	0	750	0	0	750	280000	280,000.00	0.00
											754.10	283,482.60	283,482.60	0.00
	Lifecycle Total										65,938	11,862,372.00	16,490,026.90	24,169.53

**to correct an error in the software*

D1D2 CARBON FOOTPRINT AT YEAR 60

D1D2 Carbon Footprint (Yr. 60)												Corrected Values	
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2	Installed Quant. (tonnes)
1.1	Substructure (SUB)	30		m²	0	0	0	0	0	0	0	0		
	[FOUNDAT1] WSP - FDN_C35 (Structural Piles)	6	924.90	m²	2500	120	2100	67	0	510	2700	400000	400,000.00	2,500.00
	[FOUNDAT3] WSP - FDN_REBAR (Structural Piles)	6	46.50	m²	7.3	0.36	13	3	0	0.9	17	5400	683,544.30	367.35
	[FOUNDAT4] WSP - FDN_C35 (Pile Caps)	6	27.80	m²	74	3.7	62	2	0	15	80	12000	12,000.00	74.00
	[FOUNDAT5] WSP - FDN_REBAR (Piles Caps)	6	1.40	m²	0.22	0.011	0.4	0.089	0	0.027	0.52	160	20,253.16	11.06
1.1.3	Lowest floor construction	120		m²	0	0	0	0	0	0	0	0		
	[FLOOR] WSP - Ground Floor_Layered (Concrete+Decking+Rebar+Insulation+Concrete_Slab+Chipboard) / 470	6	4,919.70	m²	3600	200	7400	270	-17	840	8500	1900000	1,900,000.00	3,600.00
											11,280.60	2,329,312.70	3,015,797.47	6,552.41
2.1	Frame	133		m²	0	0	0	0	0	0	0	0		
	[SFRAME1] WSP - SS_STL (Beams)	6	101.40	m²	1.3	0.066	5.5	0.64	0	0.16	6.3	1700	1,700,000.00	801.06
	[SFRAME11] WSP - SS_C35 (Concrete Columns)	6	120.40	m²	320	16	270	8.7	0	67	350	52000	52,000.00	320.00
	[SFRAME12] WSP - SS_REBAR (Concrete Columns)	6	17.20	m²	2.7	0.13	5	1.1	0	0.33	6.4	2000	253,164.56	135.88
	[SFRAME14] WSP - SS_STL (Columns)	6	71.10	m²	0.93	0.046	3.8	0.45	0	0.11	4.4	1200	1,200,000.00	561.69
	[SFRAME15] WSP - SS_STL (Decks)	6	31.20	m²	0.41	0.02	1.7	0.2	0	0.05	1.9	530	530,000.00	246.48
	[SFRAME16] WSP - SS_STL (Fabricated Beams)	6	5.00	m²	0.065	0.0033	0.27	0.032	0	0.0081	0.31	86	86,000.00	39.50
2.2	Upper floors (UF)	121		m²	0	0	0	0	0	0	0	0		
	[CEIL2] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking+suspended_ceiling) / 1000	6	26,375.80	m²	11000	500	15000	780	13000	4500	33000	5200000	5,200,000.00	11,000.00
	[CEIL21] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking) / 300	6	6,084.00	m²	3200	160	4900	270	6000	2100	13000	1600000	1,600,000.00	3,200.00
2.3	Roof (ROO)	122		m²	0	0	0	0	0	0	0	0		
	[ROOF1] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+ Insulation+concrete_slab+R_decking+suspended_ceiling) / 1300	6	2,202.30	m²	830	43	2000	79	120	210	2400	540000	540,000.00	830.00
	[ROOF11] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+Insulation+concrete_slab+R_decking+plasterboard_ceiling) / 300	6	1,880.10	m²	740	40	2700	110	73	180	3000	690000	690,000.00	740.00
2.4	Stairs and ramps (STR)	139		m²	0	0	0	0	0	0	0	0		
	[SHPSTRS1] WSP - STAIRS_C35 (REBAR)	6	8.90	m²	1.4	0.07	2.6	0.57	0	0.17	3.3	1000	126,582.28	70.31
	[WSPS0000] WSP - STAIRS_C35	6	149.50	m²	400	20	340	11	0	83	430	64000	64,000.00	400.00
2.5	External walls (EWAL)	124		m²	0	0	0	0	0	0	0	0		
	[GGOP262] Reconstructed stone faced precast concrete cladding panel; insulation; light steel studwork; plasterboard; paint	6	5,947.30	m²	3.6	0	4400	280	150	610	5500	1100000	1,100,000.00	3.60
2.6.1	External windows	126		m²	0	0	0	0	0	0	0	0		
	[EXTW] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	4,870.00	m²	880	44	1400	110	3800	150	5500	1200000	1,200,000.00	880.00
	[EXTW2] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	681.70	m²	120	6.1	200	16	540	21	770	170000	170,000.00	120.00
2.7	Internal walls and partitions (IWAL)	125		m²	0	0	0	0	0	0	0	0		
	[PART1] WSP - Internal Partition_Layered_Core Structure (Plasterboard+Concrete_block+plasterboard+paint)	6	360.30	m²	110	6.2	100	12	14	47	180	26000	26,000.00	110.00
	[PART11] WSP - Internal Partition_Layered (Paint+Plasterboard+partitions_steel+plasterboard+paint)	6	27,650.30	m²	890	50	1500	200	3000	1400	6,000.00	710000	710,000.00	890.00
											70,604.50	11,405,112.10	15,247,746.84	20,348.52

D1D2 Carbon Footprint (Yr. 60)												Corrected Values	
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2	Installed Quant. (tonnes)
5	Services (BES)													
	Primary Elec	182	2,837,288.50	kWh	0	0	0	0	410000	0	410000	95000000	94,913,396.60	0.00
	Primary Gas	183	0.00	kWh	0	0	0	0	0	0	0	0	0.00	0.00
	Water	192	5.5	m³/person	0	0	0	0	35000	0	35,000	210000	210,000.00	0.00
											445,298	95,123,396.60	95,123,396.60	0.00
A5	Construction Installations													
A5	Construction Installations	142	35,386.40	m²	0	0	0	750	0	0	750	280000	283,482.60	0.00
											754.10	283,482.60	283,482.60	0.00
	Lifecycle Total										527,938	109,141,304	113,670,423.50	26,900.93

**to correct an error in the software*

D1D2 CARBON FOOTPRINT WITH 30% PFA CONCRETE SUBSTITUTION

D1D2 Carbon Footprint with 30% PFA Concrete substitution (Yr. 0)												After the 30% PFA	Before the 30% PFA
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2
1	Substructure (BFM)												
1.1	Substructure (SUB)	30		m²	0	0	0	0	0	0	0	0	0
	[FOUNDAT1] WSP - FDN_C35 (Structural Piles)	6	924.90	m²	2200	110	1700	60	0	460	2200	300,000	400,000
	[FOUNDAT3] WSP - FDN_REBAR (Structural Piles)	6	46.50	m²	7.3	0.36	13	3	0	0.9	17	*5400*	5400
	[FOUNDAT4] WSP - FDN_C35 (Pile Caps)	6	27.80	m²	67	3.3	51	1.8	0	14	66	9,100	12,000
	[FOUNDAT5] WSP - FDN_REBAR (Piles Caps)	6	1.40	m²	0.22	0.011	0.4	0.089	0	0.027	0.52	160	160
1.1.3	Lowest floor construction	120		m²	0	0	0	0	0	0	0	0	0
	[FLOOR] WSP - Ground Floor_Layered (Concrete+Decking+Rebar+Insulation+Concrete_Slab+Chipboard) / 470	6	4,919.70	m²	3300	180	7000	260	-17	770	8000	1,800,000	1,900,000
											10,280.50	2,114,806.30	2,329,312.70
													0
2	Superstructure (BFM)												
2.1	Frame	133		m²	0	0	0	0	0	0	0	0	0
	[SFRAME1] WSP - SS_STL (Beams)	6	101.40	m²	1.3	0.066	5.5	0.64	0	0.16	6.3	1700	1700
	[SFRAME11] WSP - SS_C35 (Concrete Columns)	6	120.40	m²	290	14	220	7.8	0	60	290	39,000	52,000
	[SFRAME12] WSP - SS_REBAR (Concrete Columns)	6	17.20	m²	2.7	0.13	5	1.1	0	0.33	6.4	2000	2000
	[SFRAME14] WSP - SS_STL (Columns)	6	71.10	m²	0.93	0.046	3.8	0.45	0	0.11	4.4	1200	1200
	[SFRAME15] WSP - SS_STL (Decks)	6	31.20	m²	0.41	0.02	1.7	0.2	0	0.05	1.9	530	530
	[SFRAME16] WSP - SS_STL (Fabricated Beams)	6	5.00	m²	0.065	0.0033	0.27	0.032	0	0.0081	0.31	86	86
2.2	Upper floors (UF)	121		m²	0	0	0	0	0	0	0	0	0
	[CEIL2] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking+suspended_ceiling) / 1000	6	26,375.80	m²	8900	430	14000	760	8000	4300	27000	4,500,000	4,800,000
	[CEIL21] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking) / 300	6	6,084.00	m²	2400	120	4600	270	1600	2000	8600	1,200,000	1,300,000
2.3	Roof (ROO)	122		m²	0	0	0	0	0	0	0	0	0
	[ROOF1] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+ Insulation+concrete_slab+R_decking+suspended_ceiling) / 1300	6	2,202.30	m²	750	40	1900	78	72	200	2300	510,000	530,000
	[ROOF11] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+Insulation+concrete_slab+R_decking+plaster board_ceiling) / 300	6	1,880.10	m²	690	38	2600	110	61	170	3000	670,000	680,000
2.4	Stairs and ramps (STR)	139		m²	0	0	0	0	0	0	0	0	0
	[SHPSTRS1] WSP - STAIRS_C35 (REBAR)	6	8.90	m²	1.4	0.07	2.6	0.57	0	0.17	3.3	1000	1000
	[WSPS0000] WSP - STAIRS_C35	6	149.50	m²	360	18	270	9.7	0	74	360	49,000	64,000
2.5	External walls (EWAL)	124		m²	0	0	0	0	0	0	0	0	0
	[GGOP262] Reconstructed stone faced precast concrete cladding panel; insulation; light steel studwork; plasterboard; paint	6	5,947.30	m²	1.2	0	4400	280	150	610	5500	1100000	1100000
2.6.1	External windows	126		m²	0	0	0	0	0	0	0	0	0
	[EXTW] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	4,870.00	m²	290	15	1400	110	0	150	1700	390000	390000
	[EXTW2] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	681.70	m²	41	2	200	16	0	21	230	55000	55000
2.6.1	External windows, seperate frames	140		m	0	0	0	0	0	0	0	0	0
2.7	Internal walls and partitions (IWAL)	125		m²	0	0	0	0	0	0	0	0	0
	[PART1] WSP - Internal Partition_Layered_Core Structure (Plasterboard+Concrete_block+plasterboard+paint)	6	360.30	m²	110	6.1	100	12	-5.6	47	160	24000	24000
	[PART11] WSP - Internal Partition_Layered (Paint+Plasterboard+partitions_steel+plasterboard+paint)	6	27,650.30	m²	750	36	1500	200	0	1400	3,100.00	300000	300000

D1D2 Carbon Footprint with 30% PFA Concrete substitution (Yr. 0)												After the 30% PFA	Before the 30% PFA
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2
											51,831.80	8,805,226.20	9,249,576.30
													0
5	Services (BES)												
	Primary Elec	182	2,837,288.50	kWh	0	0	0	0	0	0	0	0	0
	Primary Gas	183	0.00	kWh	0	0	0	0	0	0	0	0	0
	Water	192	5.5	m³/person	0	0	0	0	0	0	*0*	*0*	0
											0	0	0
A5	Construction Installations												
A5	Construction Installations	142	35,386.40	m²	0	0	0	750	0	0	750	280000	280000
											754.10	283,482.60	283,482.60
	Lifecycle Total										62,866	11,203,515.00	11,862,372

Savings	658,857

D1D2 CARBON FOOTPRINT WITH TIMBER CLADDING SUBSTITUTION

D1D2 Carbon Footprint with Timber Cladding substitution (Yr. 0)												Timber Cladding	Concrete Cladding
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2
1	Substructure (BFM)												
1.1	Substructure (SUB)	30		m²	0	0	0	0	0	0	0	0	0
	[FOUNDAT1] WSP - FDN_C35 (Structural Piles)	6	924.90	m²	2200	110	1700	60	0	460	2200	300000	300,000
	[FOUNDAT3] WSP - FDN_REBAR (Structural Piles)	6	46.50	m²	7.3	0.36	13	3	0	0.9	17	*5400*	*5400*
	[FOUNDAT4] WSP - FDN_C35 (Pile Caps)	6	27.80	m²	67	3.3	51	1.8	0	14	66	*9100*	9,100
	[FOUNDAT5] WSP - FDN_REBAR (Piles Caps)	6	1.40	m²	0.22	0.011	0.4	0.089	0	0.027	0.52	160	160
1.1.3	Lowest floor construction	120		m²	0	0	0	0	0	0	0	0	0
	[FLOOR] WSP - Ground Floor_Layered (Concrete+Decking+Rebar+Insulation+Concrete_Slab+Chipboard) / 470	6	4,919.70	m²	3300	180	7000	260	-17	770	8000	1800000	1,800,000
											10,280.50	2,114,806.30	2,114,806.30
2	Superstructure (BFM)												
2.1	Frame	133		m²	0	0	0	0	0	0	0	0	0
	[SFRAME1] WSP - SS_STL (Beams)	6	101.40	m²	1.3	0.066	5.5	0.64	0	0.16	6.3	1700	1700
	[SFRAME11] WSP - SS_C35 (Concrete Columns)	6	120.40	m²	290	14	220	7.8	0	60	290	39000	39,000
	[SFRAME12] WSP - SS_REBAR (Concrete Columns)	6	17.20	m²	2.7	0.13	5	1.1	0	0.33	6.4	2000	2000
	[SFRAME14] WSP - SS_STL (Columns)	6	71.10	m²	0.93	0.046	3.8	0.45	0	0.11	4.4	1200	1200
	[SFRAME15] WSP - SS_STL (Decks)	6	31.20	m²	0.41	0.02	1.7	0.2	0	0.05	1.9	530	530
	[SFRAME16] WSP - SS_STL (Fabricated Beams)	6	5.00	m²	0.065	0.0033	0.27	0.032	0	0.0081	0.31	86	86
2.2	Upper floors (UF)	121		m²	0	0	0	0	0	0	0	0	0
	[CEIL2] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking+suspended_ceiling) / 1000	6	26,375.80	m²	8900	430	14000	760	8000	4300	27000	4500000	4,500,000
	[CEIL21] WSP - Internal Ceiling/Floor_Layered (Carpet+Raised_access_floor+concrete_slab+S_decking) / 300	6	6,084.00	m²	2400	120	4600	270	1600	2000	8600	1200000	1,200,000
2.3	Roof (ROO)	122		m²	0	0	0	0	0	0	0	0	0
	[ROOF1] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+ Insulation+concrete_slab+R_decking+suspended_ceiling) / 1300	6	2,202.30	m²	750	40	1900	78	72	200	2300	510000	510,000
	[ROOF11] WSP - Roof_Layered (Roof_covering+Roof_membrane+VPL+Insulation+concrete_slab+R_decking+plasterboard_ceiling) / 300	6	1,880.10	m²	690	38	2600	110	61	170	3000	670000	670,000
2.4	Stairs and ramps (STR)	139		m²	0	0	0	0	0	0	0	0	0
	[SHPSTRS1] WSP - STAIRS_C35 (REBAR)	6	8.90	m²	1.4	0.07	2.6	0.57	0	0.17	3.3	1000	1000
	[WSPS0000] WSP - STAIRS_C35	6	149.50	m²	360	18	270	9.7	0	74	360	*49000*	49,000
2.5	External walls (EWAL)	124		m²	0	0	0	0	0	0	0	0	0
	[GGOP426] Treated softwood boarding on timber battens; breather membrane; OSB/3 sheathing; insulation; light steel frame; vapour control layer; plasterboard on battens; paint	6	5,947.30	m²	1.2	0	540	93	330	530	1500	74,000.00	1,100,000.00
2.6.1	External windows	126		m²	0	0	0	0	0	0	0	0	0
	[EXTW] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	4,870.00	m²	290	15	1400	110	0	150	1700	390000	390000
	[EXTW2] WSP - External Window_Layered (Double_glazed_sealed_unit)	6	681.70	m²	41	2	200	16	0	21	230	55000	55000
2.6.1	External windows, seperate frames	140		m	0	0	0	0	0	0	0	0	0
2.7	Internal walls and partitions (IWAL)	125		m²	0	0	0	0	0	0	0	0	0
	[PART1] WSP - Internal Partition_Layered_Core Structure (Plasterboard+Concrete_block+plasterboard+paint)	6	360.30	m²	110	6.1	100	12	-5.6	47	160	24000	24000

D1D2 Carbon Footprint with Timber Cladding substitution (Yr. 0)												Timber Cladding	Concrete Cladding
ID2	Description	Code	Quant	Unit	Installed (kg)	Waste (kg)	Product	Constrn	In-use	End of life	Ecopts	kgCO2	kgCO2
	[PART11] WSP - Internal Partition_Layered (Paint+Plasterboard+partitions_steel+plasterboard+paint)	6	27,650.30	m²	750	36	1500	200	0	1400	3,100.00	300000	300000
2.8	Internal doors (IDR)	128		m²	0	0	0	0	0	0	0.00	0	0
2.8	Internal doors (IDR), seperate frames	141		m	0	0	0	0	0	0	0.00	0	0
											47,842.20	7,759,978.10	8,805,226.20
5	Services (BES)												
	Primary Elec	182	2,837,288.50	kWh	0	0	0	0	0	0	0	0	0
	Primary Gas	183	0.00	kWh	0	0	0	0	0	0	0	0	0
	Water	192	5.5	m³/person	0	0	0	0	0	0	*0*	*0*	*0*
											0	0.00	0
A5	Construction Installations												
A5	Construction Installations	142	35,386.40	m²	0	0	0	750	0	0	750	280000	280000
											754.10	283,482.60	283,482.60
	Lifecycle Total										58,877.00	10,158,267.00	11,203,515.00

Savings (Timber Cladding)	1,045,248
Percentage (Timber Cladding)	95.02%
Percentage (Lifecycle Carbon Savings)	9.33%

APPENDIX B – MATERIALS AND QUANTITIES

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement (kg/m^3/m^2)	OneClick LCA Material	Comments / References
Base Case						
2.1 Frame	2.1.1 Steel Frame	Steel columns	96957	kg	Structural hollow steel sections (HSS), cold rolled, generic, 10 % recycled content, circular, square and rectangular profiles	
		Steel beams	510300	kg	Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections	
	2.1.2 Concrete Frame	Concrete columns	123039.0	kg	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400kg/m3)	Based on 567m of concrete column, calculated by Carbon Designer
		Reinforcement	1206.0	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 567m of concrete column, calculated by Carbon Designer
2.2 Upper Floors	2.2.1 Floors	Steel deck	26265	m^2	Profiled steel decking for composite floor slabs/decking, 1mm sheet thickness, ComFlor 60 1.0mm (Tata Steel)	
		In-situ concrete	26265	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300kg/m3)	150 mm thickness
		Reinforcement	174924	kg	Reinforcement steel (rebar), generic, 90% recycled content	A6 steel wire mesh (d. 6 mm, spacing 200x200 mm)
		Glass wool insulation	26265	m^2	Glass wool, acoustic ceiling panel, 20 mm, 4.0 kg/m2, Master Rigid Dp (Ecophon)	20 mm thickness
		Self-levelling mortar	26265	m^2	Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	20 mm thickness
2.3 Roof	2.3.1 Roof Structure	Steel sheet	1876	m^2	Steel sheets, generic, 60% recycled content	1 mm thickness
		Plastic vapour control layer	1876	m^2	Plastic vapour control layer, 0.2 mm (Tommen Gram)	0.2 mm thickness
		Glass wool insulation panels	1876	m^2	Glass wool insulation panels, unfaced, generic, L= 0.031 W/mK, 25 kg/m3, (applicable for densities: 0-25 kg/m3)	300 mm thickness
		Roof fixings	1876	kg	Reinforcement steel (rebar), generic, 90% recycled content	Estimated total of roof fixtures per m2 of roof assembly, calculated by Carbon Designer
	2.3.2 Roof Coverings	Concrete roof tiles	1876	m^2	Concrete roof tiles, Avg. thickness per m2: 22.4 mm, 334x420 mm, 2100 kg/m3 (Eternit)	22.4 mm thickness

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement ($kg/m^3/m^2$)	OneClick LCA Material	Comments / References
2.4 Stairs and Ramps	2.4.1 Stairs	Precast concrete staircase	131	m^3	Precast concrete wall elements (solid, uninsulated), generic, C30/37 (4400/5400 PSI), 0% (typical) recycled binders in cement (300 kg/m3), incl. reinforcement	
2.5 External Walls	2.5.1 External walls above ground	Pre cast concrete panels	8742	m^2	Precast concrete wall elements (solid, uninsulated), generic, C30/37 (4400/5400 PSI), 0% (typical) recycled binders in cement (300 kg/m3), incl. reinforcement	102.5 mm thickness
		Mortar	8742	m^2	Masonry mortar, light, 1000 kg/m3 (quick-mix)	9.5 mm thickness
		Rock wool insulation	8742	m^2	Rock wool insulation panels, unfaced, generic, L= 0.037 W/mK, 150 kg/m3 (applicable for densities: 100-150 kg/m3)	150 mm thickness
		Lightweight concrete block	8742	m^2	Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3, 18 kg/block, 0.5 x 0.3 x 0.185 mm	215 mm thickness
		Plasterboard	8742	m^2	Gypsum plaster board, regular, generic, 6.5 - 25 mm, 10.725 kg/m2 (for 12.5 mm), 858 kg/m3	12.5 mm thickness
		Plaster	8742	m^2	Gypsum plaster, 1100 kg/m3 (Bundesverband der Gipsindustrie)	3 mm thickness
		Steel stud	8742	m^2	Steel stud per m2 of wall area (air gap included), 120 mm, 600 mm spacing	
2.6 Windows and External Doors	2.6.1 External windows	Aluminium frame	20488	kg	Aluminum profile for windows and doors, 2600 kg/m3, Al Profile (Saray)	Based on 4878 m^2, calculated by Carbon Designer
		Float glass	4878	m^2	Float glass, single pane, generic, 3 - 12 mm, 10 kg/m2 (for 4 mm),2500 kg/m3	4mm thickness
		Float glass	4878	m^2	Float glass, single pane, generic, 3 - 12 mm, 10 kg/m2 (for 4 mm),2500 kg/m3	4mm thickness
1.1 Substructure	1.1.1 Standard Foundations	In-situ concrete	353324	kg	Ready-mix concrete, normal-strength, generic, C20/25 (2900/3600 PSI), 10% (typical) recycled binders in cement (240 kg/m3 / 14.98 lbs/ft3)	LCA generic construction - Steel core piling foundation for hard soils, 15 m (50 ft) depth, per GFA, Diameter: ø130 mm (5 1/8''), core pile length/depth to bedrock: 15 m Quantities calculated by Carbon Designer
		Reinforcement	537479	kg	Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections	
	1.1.3 Lowest floor construction	In-situ concrete – 250mm	1876	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	LCA generic construction - Concrete ground slab assembly incl. insulation, 550 mm Quantities calculated by Carbon Designer
		Reinforcement	50652	kg	Reinforcement steel (rebar), generic, 90% recycled content	
		Insulation – 250mm	1876	m^2	EPS Insulation, T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3 (EPS-gruppen)	

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement ($kg/m^3/m^2$)	OneClick LCA Material	Comments / References
		Vapour control layer – 0.2mm	1876	m^2	Plastic vapour control layer, 0.2 mm (Tommen Gram)	
		Self-levelling mortar – 20mm	1876	m^2	Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	
	1.1.5 Basement retaining walls	In-situ concrete – 90mm and 5mm	1910	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 0% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	LCA generic construction - Concrete sandwich element underground wall assembly, incl. EPS insulation Quantities calculated by Carbon Designer
		Reinforcement	27599	kg	Reinforcement steel (rebar), generic, 90% recycled content	
		Waterproofing – 5mm	1910	m^2	Bitumen sheets for waterproofing of roofs, French average, ép. 2,5 mm par couche, Donnee par default (MDEGD)	
Options for frame						
75% steel frame + high GGBS content in concrete						
2.1 Frame	2.1.1 Steel Frame	As base case				
	2.1.2 Concrete Frame	Concrete columns	123039.0	kg	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 50% recycled binders in cement (400kg/m3)	Based on 567m of concrete column, calculated by Carbon Designer
		Reinforcement	1206.0	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 567m of concrete column, calculated by Carbon Designer
2.3 Roof	2.3.1 Roof structure	As base case				
Concrete frame						
2.1 Frame	2.1.2 Concrete Frame	Concrete columns	492156	kg	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400kg/m3)	Based on 2268m of concrete column, calculated by Carbon Designer
		Reinforcement	40824	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 2268m of concrete column, calculated by Carbon Designer
		Concrete beams	3107160	kg	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400kg/m3)	Based on 3780m of concrete beams, calculated by Carbon Designer
		Reinforcement	253260	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 3780m of concrete beams, calculated by Carbon Designer
2.3 Roof	2.3.1 Roof structure	Glass wool insulation panels	1407	m^2	Glass wool insulation panels, unfaced, generic, L= 0.031 W/mK, 25 kg/m3, (applicable for densities: 0-25 kg/m3)	300 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		EPS Insulation	469	m^2	EPS Insulation, T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3 (EPS-gruppen)	300 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement (kg/m^3/m^2)	OneClick LCA Material	Comments / References
		Plastic vapour control layer	1876	m^2	Plastic vapour control layer, 0.2 mm (Tommen Gram)	0.2 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		In-situ concrete	1876	m^2	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400kg/m3)	240 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		Reinforcement	54029	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 1876 m^2 roof area, calculated by Carbon Designer
Concrete frame + high GGBS						
2.1 Frame	2.1.2 Concrete Frame	Concrete columns	492156	kg	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 50% recycled binders in cement (400kg/m3)	Based on 2268m of concrete column, calculated by Carbon Designer
		Reinforcement	40824	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 2268m of concrete column, calculated by Carbon Designer
		Concrete beams	3107160	kg	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 50% recycled binders in cement (400kg/m3)	Based on 3780m of concrete beams, calculated by Carbon Designer
		Reinforcement	253260	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 3780m of concrete beams, calculated by Carbon Designer
2.3 Roof	2.3.1 Roof structure	Glass wool insulation panels	1407	m^2	Glass wool insulation panels, unfaced, generic, L= 0.031 W/mK, 25 kg/m3, (applicable for densities: 0-25 kg/m3)	300 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		EPS Insulation	469	m^2	EPS Insulation, T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3 (EPS-gruppen)	300 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		Plastic vapour control layer	1876	m^2	Plastic vapour control layer, 0.2 mm (Tommen Gram)	0.2 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		In-situ concrete	1876	m^2	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 50% recycled binders in cement (400kg/m3)	240 mm thickness, based on 1876 m^2 roof area, calculated by Carbon Designer
		Reinforcement	54029	kg	Reinforcement steel (rebar), generic, 90% recycled content	Based on 1876 m^2 roof area, calculated by Carbon Designer
Options for upper floors						
Composite deck + high GGBS						
2.2 Upper Floors	2.2.1 Floors	Steel deck	26265	m^2	Profiled steel decking for composite floor slabs/decking, 1mm sheet thickness, ComFlor 60 1.0mm (Tata Steel)	
		In-situ concrete	26265	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 40% recycled binders in cement (300kg/m3)	150 mm thickness
		Reinforcement	174924	kg	Reinforcement steel (rebar), generic, 90% recycled content	A6 steel wire mesh (d. 6 mm, spacing 200x200 mm)

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement ($kg/m^3/m^2$)	OneClick LCA Material	Comments / References
		Glass wool insulation	26265	m^2	Glass wool, acoustic ceiling panel, 20 mm, 4.0 kg/m2, Master Rigid Dp (Ecophon)	20 mm thickness
		Self-levelling mortar	26265	m^2	Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	20 mm thickness
Hollow core						
2.2 Upper Floors	2.2.1 Floors	Hollow core concrete slabs	26265	m^2	Hollow core concrete slabs, generic, C30/37 (4400/5400 PSI), 0% (typical) recycled binders in cement (300 kg/m3), incl. reinforcement	265 mm thickness
		In-situ concrete	26265	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300kg/m3)	50 mm thickness
		Reinforcement	58308	kg	Reinforcement steel (rebar), generic, 90% recycled content	A6 steel wire mesh (d. 6 mm, spacing 200x200 mm)
		Glass wool insulation	26265	m^2	Glass wool, acoustic ceiling panel, 20 mm, 4.0 kg/m2, Master Rigid Dp (Ecophon)	20 mm thickness
		Self-levelling mortar	26265	m^2	Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	20 mm thickness
Hollow core + high GGBS						
2.2 Upper Floors	2.2.1 Floors	Hollow core concrete slabs	26265	m^2	Hollow core concrete slabs, generic, C30/37 (4400/5400 PSI), 40% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3), incl. reinforcement	265 mm thickness
		In-situ concrete	26265	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 40% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	50 mm thickness
		Reinforcement	58308	kg	Reinforcement steel (rebar), generic, 90% recycled content	A6 steel wire mesh (d. 6 mm, spacing 200x200 mm)
		Glass wool insulation	26265	m^2	Glass wool, acoustic ceiling panel, 20 mm, 4.0 kg/m2, Master Rigid Dp (Ecophon)	20 mm thickness
		Self-levelling mortar	26265	m^2	Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	20 mm thickness
CLT planks						
2.2 Upper Floors	2.2.1 Floors	CLT panels – 180mm	26265	m^2	Solid Timber Panels (Cross-Laminated Timber, CLT) (Stora Enso)	LCA generic construction - CLT floor slab assembly, incl. insulation and concrete top layer Quantities calculated by Carbon Designer
		In-situ concrete – 50mm	26265	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300kg/m3)	

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement ($kg/m^3/m^2$)	OneClick LCA Material	Comments / References
		Reinforcement (50,0 kg steel/ m3)	65663	kg	Reinforcement steel (rebar), generic, 90% recycled content	
		Glass wool insulation – 120mm	26265	m^2	Glass wool insulation panels, unfaced, generic, 110 kg/m3 (6.87 lbs/ft3), (applicable for densities: 75-110 kg/m3 (4.68-6.87 lbs/ft3)), Lambda=0.034 W/(m.K)	
Options for external walls						
Brick slip cladding						
2.5 External Walls	2.5.1 External walls above ground	Bricks – 20mm	8742	m^2	Bricks, 226x104x60, 226x85x60 mm, NF with holes & solid, RF (Wienerberger)	LCA generic construction - Insulated system wall with brick slips and medium dense block, U-vaue 0.22, (Part L 2016) Quantities calculated by Carbon Designer
		Mortar – 9.5mm	8742	m^2	Masonry mortar, light, 1000 kg/m3 (quick-mix)	
		Adhesive – 3.mm	8742	m^2	Flexible tile adhesivefor ceramic coverings, 2.2 kg/m2, 2.4 kg/m2, 1200 kg/m3, 1400 kg/m3, Flexmörtel® S1 Rapid, Flexmörtel® S2 Rapid (PCI Augsburg GmbH)	
		Rock wool insulation – 130mm	8742	m^2	Rock wool insulation panels, unfaced, generic, 150 kg/m3 (9.36 lbs/ft3) (applicable for densities: 100-150 kg/m3 (6.24-9.36 lbs/ft3)), Lambda=0.037 W/(m.K)	
		Lightweight concrete block – 215mm	8742	m^2	Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3, 18 kg/block, 0.5 x 0.3 x 0.185 mm	
		Mortar – 13mm	8742	m^2	Masonry mortar, light, 1000 kg/m3 (quick-mix)	
		Plasterboard – 12.5mm	8742	m^2	Gypsum plaster board, regular, generic, 6.5 - 25 mm, 10.725 kg/m2 (for 12.5 mm), 858 kg/m3	
		Plaster – 3mm	8742	m^2	Gypsum plaster, 1100 kg/m3 (Bundesverband der Gipsindustrie)	
Stone rain cladding						
2.5 External Walls	2.5.1 External walls above ground	Stone rain cladding - 8mm	8742	m^2	Olivine basalt facade stone, black, 30 mm, 90.3 kg/m2, 3010 kg/m3 (Naturstein Montering)	LCA generic construction - Rainscreen on reinforced concrete, U-value 0.23, (Part L 2016) Quantities calculated by Carbon Designer
		Rock wool insulation – 250mm	8742	m^2	Rock wool insulation panels, unfaced, generic, L= 0.037 W/mK, 150 kg/m3 (applicable for densities: 100-150 kg/m3)	
		In-situ concrete – 150mm	8742	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300kg/m3)	
		Reinforcement	209808	kg	Reinforcement steel (rebar), generic, 90% recycled content	
		Plasterboard – 12.5mm	8742	m^2	Gypsum plaster board, regular, generic, 6.5 - 25 mm, 10.725 kg/m2 (for 12.5 mm), 858 kg/m3	

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement ($kg/m^3/m^2$)	OneClick LCA Material	Comments / References
		Plaster – 3mm	8742	m^2	Gypsum plaster, 1100 kg/m3 (Bundesverband der Gipsindustrie)	
PPC aluminium cladding						
2.5 External Walls	2.5.1 External walls above ground	PPC aluminium cladding – 1mm	8742	m^2	Aluminium sheet, polyester coated, for roofing, cladding and facades panels, 1mm (Alcoa)	
		Rock wool insulation – 130mm	8742	m^2	Rock wool insulation panels, unfaced, generic, 150 kg/m3 (9.36 lbs/ft3) (applicable for densities: 100-150 kg/m3 (6.24-9.36 lbs/ft3)), Lambda=0.037 W/(m.K)	
		Lightweight concrete block – 215mm	8742	m^2	Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3, 18 kg/block, 0.5 x 0.3 x 0.185 mm	
		Mortar – 13mm	8742	m^2	Masonry mortar, light, 1000 kg/m3 (quick-mix)	
		Plasterboard – 12.5mm	8742	m^2	Gypsum plaster board, regular, generic, 6.5 - 25 mm, 10.725 kg/m2 (for 12.5 mm), 858 kg/m3	
		Plaster – 3mm	8742	m^2	Gypsum plaster, 1100 kg/m3 (Bundesverband der Gipsindustrie)	
Options for superstructure						
High GGBS content piled foundations						
1.1 Substructure	1.1.1 Standard Foundations	In-situ concrete	353324	kg	Ready-mix concrete, normal-strength, generic, C20/25 (2900/3600 PSI), 55% recycled binders in cement (240 kg/m3 / 14.98 lbs/ft3)	LCA generic construction - Steel core piling foundation for hard soils, 15 m (50 ft) depth, per GFA, Diameter: ø130 mm (5 1/8''), core pile length/depth to bedrock: 15 m Quantities calculated by Carbon Designer
		Reinforcement	537479	kg	Structural steel profiles, generic, 60% recycled content, I, H, U, L, and T sections	
	1.1.3 Lowest floor construction	In-situ concrete – 250mm	1876	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 40% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	LCA generic construction - Concrete ground slab assembly incl. insulation, 550 mm Quantities calculated by Carbon Designer
		Reinforcement	50652	kg	Reinforcement steel (rebar), generic, 90% recycled content	
		Insulation – 250mm	1876	m^2	EPS Insulation, T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3 (EPS-gruppen)	
		Vapour control layer – 0.2mm	1876	m^2	Plastic vapour control layer, 0.2 mm (Tommen Gram)	
		Self-levelling mortar – 20mm	1876	m^2	Self levelling mortar, for floors, walls and overhead appl., 3-50 mm, 1400 kg/m3, Pericret (PCI Augsburg)	
	1.1.5 Basement retaining walls	In-situ concrete – 90mm and 5mm	1910	m^2	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 40% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	

Materials and Quantities						
Level 2 - Element	Level 3 - Sub-element	Material	Quantity	Metric of Measurement ($kg/m^3/m^2$)	OneClick LCA Material	Comments / References
		Reinforcement	27599	kg	Reinforcement steel (rebar), generic, 90% recycled content	LCA generic construction - Concrete sandwich element underground wall assembly, incl. EPS insulation Quantities calculated by Carbon Designer
		Waterproofing – 5mm	1910	m^2	Bitumen sheets for waterproofing of roofs, French average, ép. 2,5 mm par couche, Donnee par default (MDEGD)	

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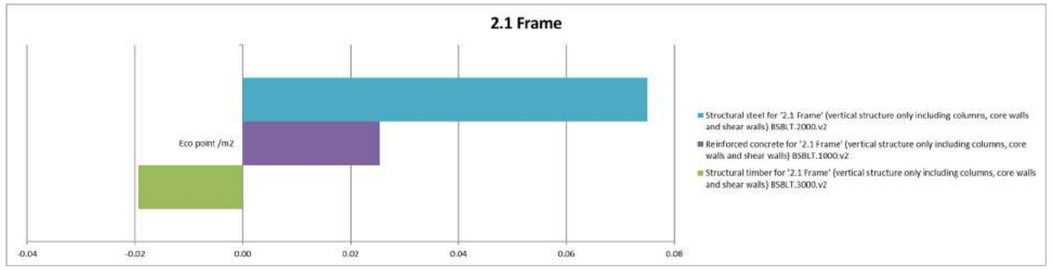
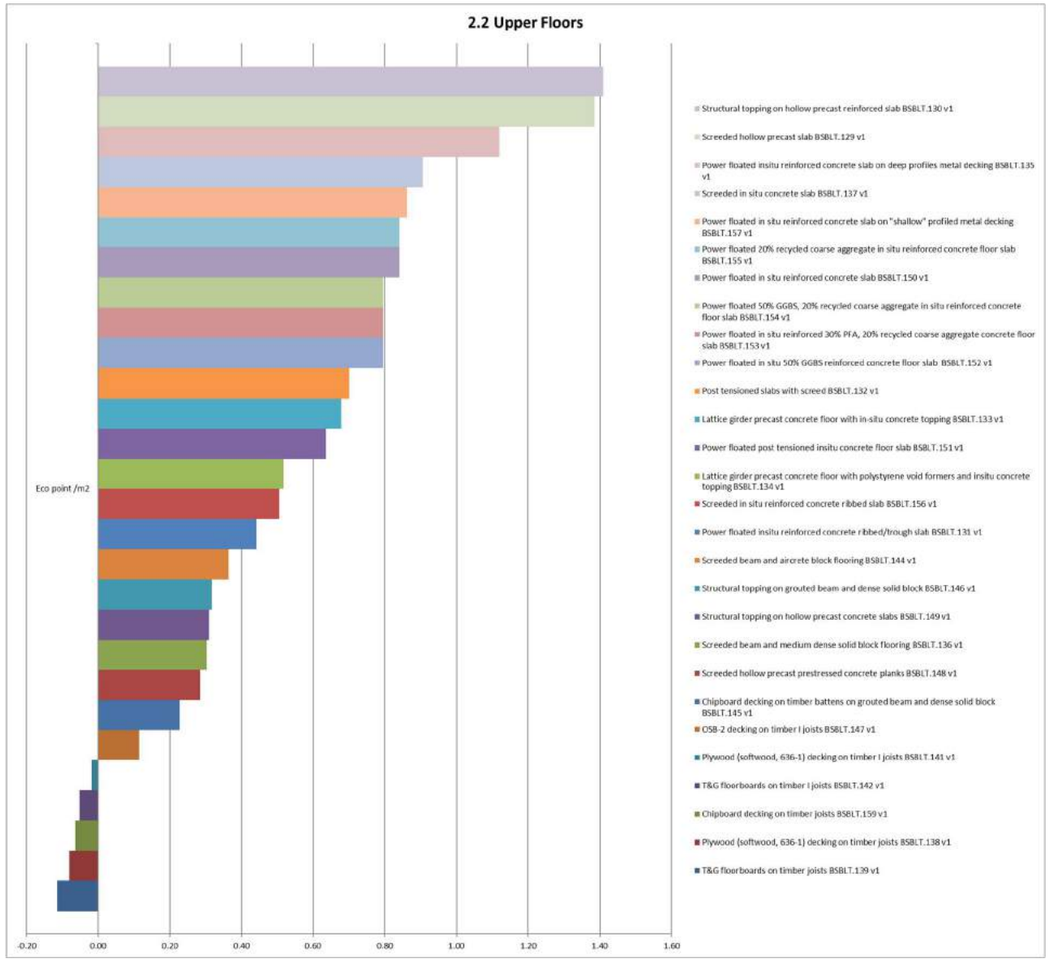
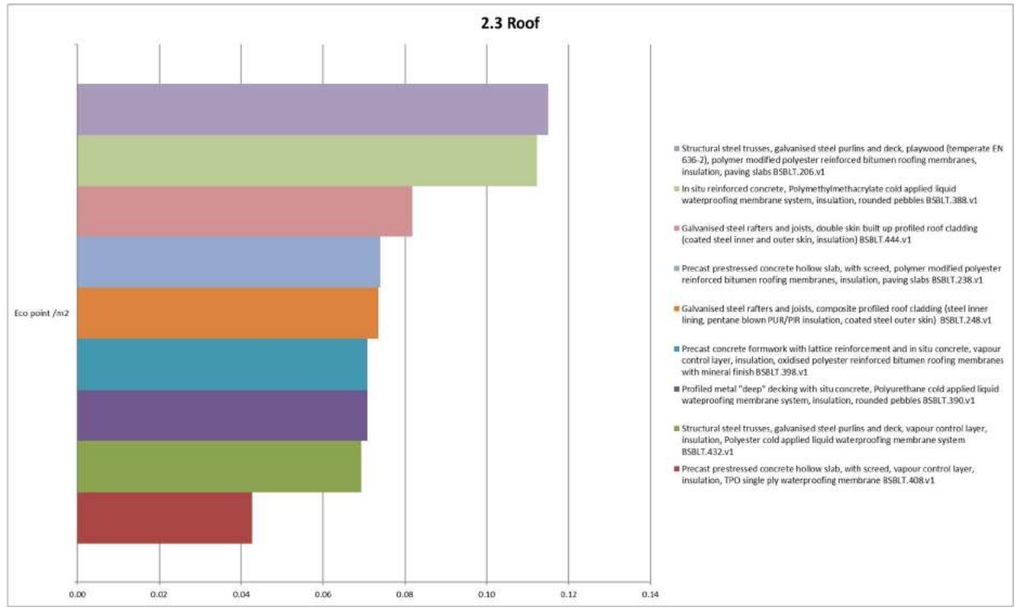
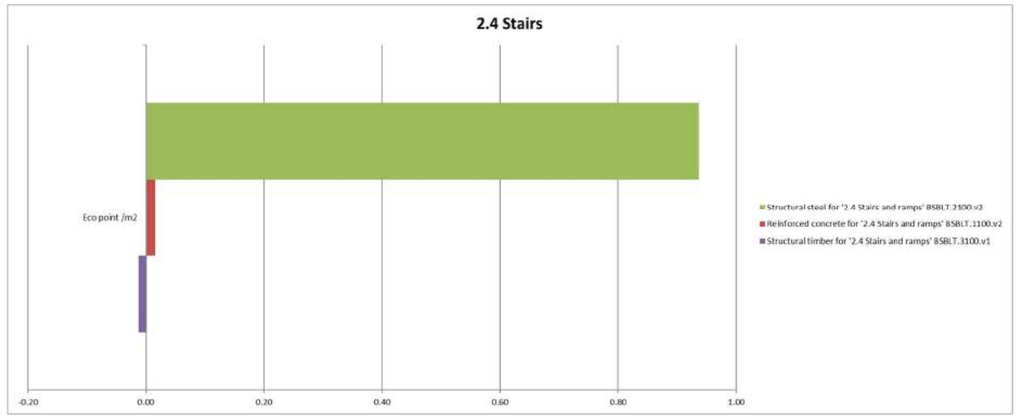
APPENDIX C – ECOPOINTS BY ELEMENT

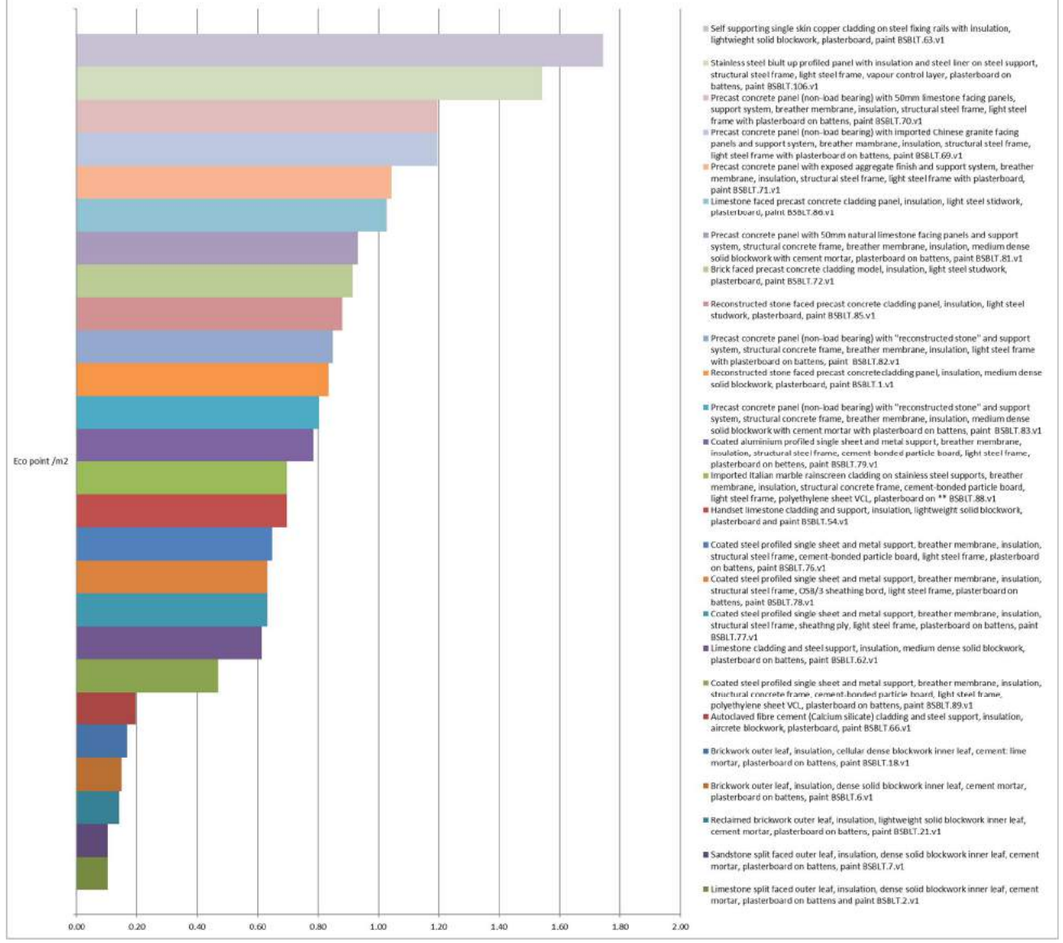




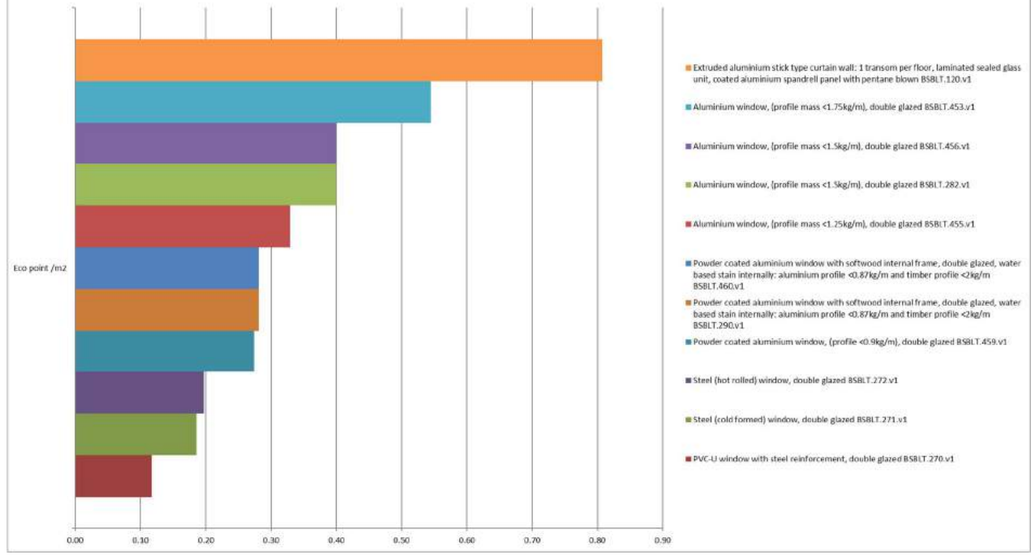




2.5 External Wall



2.6 External Windows



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Appendix V– BREEAM Pre-assessment

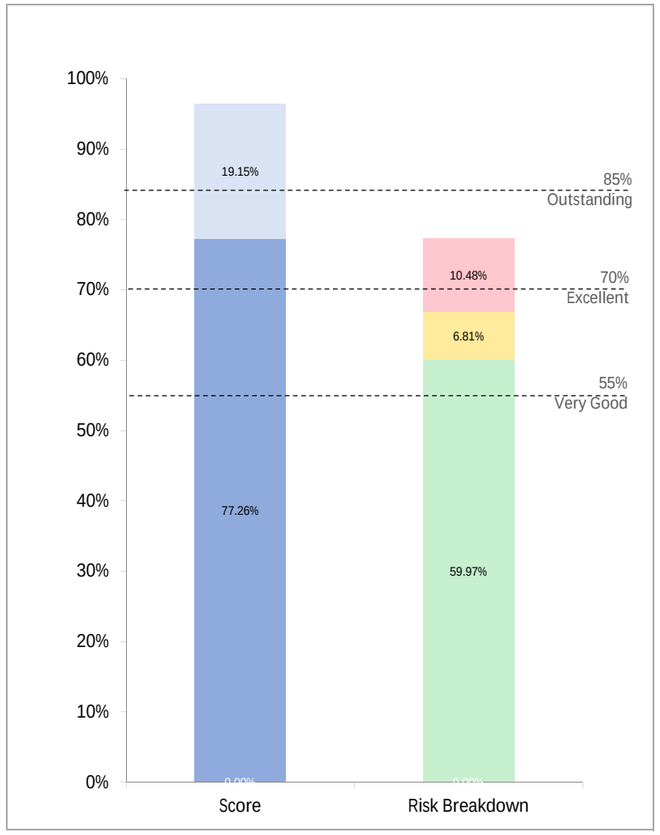
BREEAM 2018 Dashboard

Project: North Quay
Assessor: Max Fordham LLP
BREEAM Scheme: New Construction 2018 v1 UK

Achieved	0.00%	Unclassified
Targeted	77.26%	Excellent
Potential	96.40%	Outstanding

Minimum Requirements

	Achieved	Targeted
Pass	No	Yes
Good	No	Yes
Very Good	No	Yes
Excellent	No	Yes
Outstanding	No	Yes



		Available for all	Minimum Requirements	Targeted	Potential	Risk
Management			Credit Value	0.6%		
Man 01 - Project Brief and Design	#1 - Project delivery planning	1		1	0	L
	#2 - Stakeholder consultation (interested parties)	1		1	0	M
	#3 - BREEAM AP (Concept Design)	1		1	0	L
	#4 - BREEAM AP (Developed Design)	1		1	1	L
Man 02 - Life Cycle Cost and Service Life Planning	#1 - Elemental Life Cycle Cost (LCC)	2		0	2	M
	#2 - Component Level LCC Plan	1		0	1	M
	#3 - Capital Cost Reporting	1		1	0	L
Man 03 - Responsible Construction Practices	*Pre-requisite - Timber Procurement*	-		-	0	L
	#1 - Environmental Management	1		1	0	L
	#2 - BREEAM AP (site)	1		1	0	L
	#3 - Responsible Construction Management	2	1	2	0	M
	« Exemplar Performance - Responsible Construction Management	1		1	0	M
	#4 - Monitoring of construction-site impacts	1		1	0	L
	#5 - Transport of Construction Materials and Waste	1		0	1	H
Man 04 - Commissioning and Handover	#1 - Commissioning: Testing Schedule and Responsibilities	1	1	1	0	L
	#2 - Commissioning: Design and Preparation	1		1	0	L
	#3 - Testing and Inspecting Building Fabric	1		1	0	M
	#4 - Handover	1		1	0	L
Man 05 - Aftercare	#1 - Aftercare Support	0		0	0	
	#2 - Commissioning: Implementation	0	0	0	0	
	#3 - Post Occupancy Evaluation	0		0	0	
Management total:		11.0%		8.6%	2.4%	
Health & Wellbeing			Credit Value	0.7%		
Hea 01 - Visual Comfort	#1 - Glare Control	0		0	0	
	#2 - Daylighting	2		0	0	
	« Exemplar Performance - Daylighting	1		0	0	
	#3 - View Out	1		1	0	L
	#4 - Internal and External Lighting Levels, Zoning and Control	1		1	0	L
	« Exemplar Performance - Internal and External Lighting	0		0	0	
Hea 02 - Indoor Air Quality	*Pre-requisite - Indoor Air Quality (IAQ) Plan*	-		-	0	L
	#2 - Ventilation	1		1	0	H
	#3 - Emissions from construction products	0		0	0	
	#4 - Post-Construction Indoor Air Quality Measurement	0		0	0	
	« Exemplar Performance	0		0	0	
Hea 04 - Thermal Comfort	#1 - Thermal Modelling	1		1	0	L
	#2 - Design for Future Thermal Comfort	1		0	1	H
	#3 - Thermal Zoning and Controls	0		0	0	
0	#1 - Sound insulation	0		0	0	
	#2 - Internal indoor ambient noise levels	1		1	0	L
	#3 - Reverberation	0		0	0	
Hea 06 - Security	#1 - Security of site and building	1		1	0	M
	« Exemplar Performance	1		0	0	
Hea 07 - Safe and Healthy Surroundings	#1 - Safe access	1		0	1	H
	#2 - Outside space	1		1	0	L
Health & Wellbeing total		8.0%		5.1%	1.5%	
Energy			Credit Value			
Ene 01 - Reduction of Energy Use and Carbon Emissions	#1 - Energy Performance	9	4	6	1	L
	#2 - Prediction of operational energy consumption	4	0	0	4	M
	« Exemplar Performance - Zero Regulated Carbon	2		0	0	
	« Exemplar Performance - Carbon Negative	1		0	0	
	« Exemplar Performance - Post Occupancy	2		0	2	
Ene 02 - Energy Monitoring	#1 - Sub-metering of end-use categories	1	1	1	0	L
	#2 - Sub-metering of High Energy Load and Tenancy Areas	1		1	0	L
Ene 03 - External Lighting	#1 - External Lighting	1		1	0	L
Ene 04 - Low Carbon Design	#1 - Passive Design Analysis	1		1	0	L
	#2 - Free Cooling	1		0	0	
	#3 - Low and Zero Carbon Technologies	1		1	0	L
Ene 05 - Energy Efficient Cold Storage	#1 - Refrigeration Energy Consumption	0		0	0	
	#2 - Indirect Greenhouse Gas Emissions	0		0	0	
Ene 06 - Energy Efficient Transportation Systems	#1 - Energy Consumption	1		1	0	L
	#2 - Energy Efficient Features	2		2	0	L
Ene 07 - Energy Efficient Laboratory Systems	#1 - Design Specification	0		0	0	
	#2 - Best Practice Energy Efficient Measures	0		0	0	
Ene 08 - Energy Efficient Equipment	#1 - Energy Efficient Equipment	0		0	0	
Energy totals:		14.0%		8.9%	3.2%	

Key

Achieved	
Targeted	
Potential	
Targeted - Low Risk, thought to be achievable	
Targeted - Medium Risk, some uncertainty and/or technically complex	
Targeted - High Risk, may be highly uncertain, expensive and/or historically difficult to achieve	
Targeted - Critical Risk, requires immediate action	
Credits with minimum requirements	

Note: The risk measure is a quantitative score assigned by the assessor

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		Available for all	Minimum Requirements	Targeted	Potential	Risk
Transport		Credit Value		1.0%		
Tra 01 - Transport Assessment and Travel Plan	#1 - Travel plan	2		2	0	L
Tra 02 - Sustainable transport measures	#1 - Transport options implementation	10		10	0	L
Transport total:		11.5%		11.5%	0.0%	
Water		Credit Value				
Wat 01 - Water Consumption	#1 - Water Consumption	5	1	2	1	L
	« Exemplar Performance	1		0	0	
Wat 02 - Water Monitoring	#1 - Water Monitoring	1		1	0	L
Wat 03 - Water Leak Detection	#1 - Leak Detection System	1		1	0	L
	#2 - Flow Control Devices	1		1	0	L
Wat 04 - Water Efficient Equipment	#1 - Water Efficient Equipment	1		1	0	L
Water total:		7.0%		4.7%	0.8%	
Materials		Credit Value				
Mat 01 - Environmental impacts from construction products: Building life cycle assessment	#1 - Superstructure	6		6	1	H
	#2 - Substructure and Hard Landscaping	1		1	0	L
	« Exemplar Performance - Core Building Services options appraisal	1		0	1	M
	« Exemplar Performance - LCA and LCC alignment	1		0	1	H
	« Exemplar Performance - Third party verification	1		0	1	H
Mat 02 - Environmental Impacts from Construction Products	#1 - Specification of Products with a Recognised EPD	1		0	1	M
Mat 03 - Responsible Sourcing of Construction Products	Pre-requisite - Legally Sourced Timber	-	#1	-	0	L
	#1 - Enabling Sustainable Procurement	1		1	0	L
	#2 - Measuring Responsible Sourcing	3		1	1	L
	« Exemplar Performance	1		0	0	
Mat 05 - Designing for Durability and Resilience	#1 - Protecting Vulnerable Parts of the Building from Damage and Degradation	1		1	0	M
Mat 06 - Material Efficiency	#1 - Material Efficiency	1		1	0	L
Materials total:		17.5%		13.8%	3.8%	
Waste		Credit Value				
Wst 01 - Construction Waste Management	#1 - Pre-demolition audit	1		1	0	M
	#2 - Construction Resource Efficiency	3	0	1	1	
	#3 - Diversion of Resources from Landfill	1		1	0	L
	« Exemplar Performance	1		0	0	
Wst 02 - Use of Recycled and Sustainably Sourced Aggregates	#1 - Project Sustainable Aggregate Points	1		0	0	
	« Exemplar Performance	1		0	0	
Wst 03 - Operational Waste	#1 - Operational Waste	1	1	1	0	L
Wst 04 - Speculative finishes (Offices only)	#1 - Speculative Floor and Ceiling Finishes	1		1	0	L
Wst 05 - Adaptation to Climate Change	#1 - Structural, Fabric & Building Services Resilience	1		1	0	L
	« Exemplar Performance	1		0	0	
Wst 06 - Design for Disassembly and Adaptability	#1 - Recommendations	1		1	0	L
	#2 - Implementation	1		1	0	L
Waste total:		7.0%		5.1%	0.6%	
Land Use & Ecology		Credit Value				
LE 01 - Site Selection	#1 - Previously Occupied Land	1		1	0	L
	#2 - Contaminated Land	1		0	0	
LE 02 - Identifying the Risks and Opportunities	#1 - Survey, Evaluation & Determining the ecological outcomes	2		2	0	L
	« Exemplar Performance	1		0	0	
LE 03 - Managing Negative Impacts on Ecology	Pre-requisite - Identifying Risks	-		-	0	L
	#1 - Planning, liaison, implementation and data	1		1	0	L
	#2 - Managing negative impacts	2		2	0	L
LE 04 - Change and Enhancement of Ecological Value	#1 - Liaison, implementation and data collation	1		1	0	L
	#2 - Enhancement of ecology	3		2	1	L
LE 05 - Long term Ecology Management and Maintenance	Pre-requisite - Roles & Responsibilities	-		-	0	L
	#1 - Planning, Monitoring, Management & Maintenance	1		1	0	L
	#2 - Landscape and ecology management plan	1		1	0	L
Land use & Ecology total:		15.0%		12.7%	1.2%	
Pollution		Credit Value				
Pol 01 - Impact of Refrigerants	#1 - Impact of Refrigerants	3		1	0	M
	0	0		0	0	
	0	0		0	0	
Pol 02 - Local Air Quality	#1 - Local Air Quality	2		2	0	L
Pol 03 - Flood and Surface Water Management	#1 - Flood Resilience	2		1	0	H
	#2 - Surface Water Run-Off - Rate	1		1	0	H
	#3 - Surface Water Run-Off - Volume	1		1	0	H
	#4 - Minimising Watercourse Pollution	1		0	1	H
Pol 04 - Reduction of Night Time Light Pollution	#1 - Reduction of Night Time Light Pollution	1		1	0	L
Pol 05 - Reduction of Noise Pollution	#1 - Reduction of Noise Pollution	1		1	0	L
Pollution total:		9.0%		6.0%	0.8%	
Innovation		Credit Value				
Approved Innovation		1		0	0	
Innovation/Exemplar Performance total:		10.0%		1.0%	5.0%	

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BREEAM New Construction 2018

Max Fordham

Assessment Type	Shell & Core
Project Stage	Outline Planning
Assessor Name	Henry Pelly
Desired Rating	Excellent
Desired Score	75.00%

			North Quay		North Quay		North Quay	
Project Name			North Quay		North Quay		North Quay	
Building Type			Shell & Core Office		Shell & Core Retail		Shell & Core Hotel	
Achieved Score	0.00%	Unclassified			0.00%	Unclassified	0.00%	Unclassified
Target Score	77.26%	Excellent			73.90%	Excellent	77.19%	Excellent
Potential Score	96.40%	Outstanding			91.70%	Outstanding	95.04%	Outstanding

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Management	Man 01 - Project Brief and Design	#1 - Project delivery planning	Prior to completion of the Concept Design, all team members involved in decision making process for the project must meet to define their roles, responsibilities and contribution for each key phase of the project covering a minimum list of points detailed in the manual and the project team must demonstrate how the contributions and outcomes of this consultation process has influenced the brief, project execution plan, communication strategy and concept design.	Must occur no later than RIBA Stage 2		Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	The stage specific requirement, definition of roles and responsibilities for BREEAM defined actions, is project dependent on specific Project Team members. A roles and responsibilities matrix will be completed during the BREEAM commencement workshop for each building's assessment.
		#2 - Stakeholder consultation (interested parties)	Prior to completion of the Concept Design, all interested parties are identified and consulted with by the design team - evidence must be gathered that these consultations influenced the project brief and concept design. Consultation plan must be prepared that includes timescale and method of consultation.	Must occur no later than RIBA Stage 2		Building Specific	1	0.61%	1	0.61%			M	1		M	1		M	A series of pre-application meetings have been held with relevant individuals from the London Borough of Tower Hamlets in addition to pre-app meetings with the GLA , TfL and Historic England. Public consultation sessions have been held in November 2019 and March 2020. The Design and Access Statement submitted for the Outline Planning Application confirms the outcomes of all consultation events and the impact they have had on the scheme. Medium risk due to level of information required.
		#3 - BREEAM AP (Concept Design)	No later than early RIBA Stage 1, BREEAM AP is appointed and the project team including the client formally agree the performance targets. The BREEAM AP works with the project team to help them maximise the BREEAM score, monitor progress against the targets, identify risks and opportunities related to the achievement of credits, provide feedback to the team on evidence provided and monitor and coordinate generation of evidence.	Must occur no later than Stage 2		Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	Max Fordham LLP have fulfilled the BREEAM AP role for the purposes of the Outline Planning Application. An appropriate individual will be appointed on each assessed project as they become active projects.
		#4 - BREEAM AP (Developed Design)	Credit #3 has been achieved. BREEAM AP is appointed to assist the project team in maximising the project's overall performance against BREEAM, monitor progress against the targets, proactively identify risks and opportunities related to the achievement of the BREEAM targets, provide feedback to the project team to support them in taking corrective actions and achieving their agreed BREEAM targets and monitor the generation of BREEAM evidence by the project team throughout Developed Design.			Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	An appropriate individual will be appointed on each assessed project as they become active projects.
	Man 02 - Life Cycle Cost and Service Life Planning	#1 - Elemental Life Cycle Cost (LCC)	A competent person carries out an outline, entire asset LCC plan at RIBA Stage 2 together with any design options appraisals in line with PD 156865: 2008. The LCC analysis shows an outline plan based on the building's basic structure and envelope, appraising a range of options and based on multiple cash flow scenario's e.g.. 20, 30, 50, 60 years and the fabric and servicing strategy for the project outlining services component and fit-out options (if-applicable) over a 15-year period, in the form of an 'elemental LCC Plan'. Demonstrate how the elemental LCC plan has been used to influence building and systems design and specification to minimise life cycle costs and maximise critical value.	Must occur no later than RIBA Stage 2		Building Specific	2	1.22%			2	1.22%	M		2	M		2	M	Project specific, requirements to be reviewed by Quantity Survey on a building-by-building basis. Medium risk as this is an expanded scope for the Quantity Surveyor
		#2 - Component Level LCC Plan	A component level LCC plan has been developed by the end of RIBA Stage 4 and includes the following component types in line with PD 156865:2008 (where present): envelope, services, finishes, external spaces. Demonstrate how the component level LCC plan has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value	Must occur no later than RIBA Stage 4		Building Specific	1	0.61%			1	0.61%	M		1	M		1	H	Project specific, requirements to be reviewed by Quantity Survey on a building-by-building basis. Considered high risk and only set a 'potential' as requirements are beyond a typical Quantity Surveyor's scope
		#3 - Capital Cost Reporting	Report the capital cost for the building in pounds per square metre of gross internal floor area (£k/ m²) as part of the submission to BRE.			Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	Can be awarded independently of other credits under Man 02
	Man 03 - Responsible Construction Practices	Pre-requisite - Timber Procurement	All timber and timber-based products used during the construction process of the project are 'legally harvested and traded timber' (see Definitions)			Site Wide	-	-	-	-			L	-		L	-		L	Requirements to be written into Contractor Prelims
		#1 - Environmental Management	All parties who at any stage manage the construction site (e.g. principle contractor, demolition contractor) operate a compliant Environmental Management System covering their main operations and implement best practice pollution prevention policies and procedures on site in accordance with PPG6, Pollution Prevention Guidelines.			Site Wide	1	0.61%	1	0.61%			L	1		L	1		L	Requirements to be written into Contractor Prelims
		#2 - BREEAM AP (site)	The client and the contractor formally agree BREEAM targets. A BREEAM AP is appointed to assist the project team in maximising the project's overall performance against BREEAM, monitor construction progress against the targets, proactively identify risks and opportunities related to the achievement of the BREEAM targets, provide feedback to the contractors and project team to support them in taking corrective actions and achieving their agreed BREEAM targets and monitor the generation of BREEAM evidence by the project team throughout the Construction, Handover and Close Out stages.			Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	Requirements to be written into Contractor Prelims
		#3 - Responsible Construction Management	The principal contractor achieves items in table 4.1: - 1 credit: All "required" items - 2 credits: All "required" items PLUS 6 additional items		1	Site Wide	2	1.22%	2	1.22%			M	2		M	2		M	Requirements to be written into Contractor Prelims. Medium risk as credit requirements significantly different and more onerous from previous iterations of BREEAM that Contractor may be familiar with.
		★ Exemplar Performance - Responsible Construction Management	Exemplary Credit: Achieve all items in Table 4.1			Site Wide	1	1.00%	1	1.00%			M	1		M	1		M	Requirements to be written into Contractor Prelims Medium risk as credit requirements significantly different and more onerous from previous iterations of BREEAM that Contractor may be familiar with.

Assessment Type	Shell & Core
Project Stage	Outline Planning
Assessor Name	Henry Pelly
Desired Rating	Excellent
Desired Score	75.00%

Project Name	North Quay		North Quay		North Quay			
Building Type	Shell & Core Office		Shell & Core Retail		Shell & Core Hotel			
Achieved Score	0.00%	Unclassified	0.00%	Unclassified	0.00%	Unclassified		
Target Score	77.26%	Excellent	73.90%	Excellent	77.19%	Excellent		
Potential Score	96.40%	Outstanding	91.70%	Outstanding	95.04%	Outstanding		

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
		#4 - Monitoring of construction-site impacts	Responsibility has been assigned to an individual(s) for monitoring, recording and reporting energy use and water consumption resulting from all on-site construction processes (and dedicated off-site monitoring) throughout the build programme.			Site Wide	1	0.61%	1	0.61%			L	1		L	1		L	Requirements to be written into Contractor Prelims
		#5 - Transport of Construction Materials and Waste	Responsibility has been assigned to an individual for monitoring, recording, and reporting data on transport movements and impacts resulting from delivery of the majority of construction materials to site and construction waste from site.			Site Wide	1	0.61%			1	0.61%	H		1	H		1	H	Considered high risk as can be beyond standard practice for Contractors. To be discussed with Contractor when appointed

Assessment Type	Shell & Core
Project Stage	Outline Planning
Assessor Name	Henry Pelly
Desired Rating	Excellent
Desired Score	75.00%

Project Name	North Quay		North Quay		North Quay			
Building Type	Shell & Core Office		Shell & Core Retail		Shell & Core Hotel			
Achieved Score	0.00%	Unclassified	0.00%	Unclassified	0.00%	Unclassified		
Target Score	77.26%	Excellent	73.90%	Excellent	77.19%	Excellent		
Potential Score	96.40%	Outstanding	91.70%	Outstanding	95.04%	Outstanding		

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
	Man 04 - Commissioning and Handover	#1 - Commissioning: Testing Schedule and Responsibilities	Prepare a commissioning schedule detailing all appropriate commissioning standards. Project team member appointed to monitor and programme pre-commissioning, commissioning, and where necessary, re-commissioning. Main contractor accounts for commissioning programme, responsibilities, and criteria within main programme of works.		1	Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	Requirements to be written into Contractor Prelims
		#2 - Commissioning: Design and Preparation	Credit #1 is achieved During the design stage, the client or the principal contractor appoints an appropriate project team member (provided they are not involved in the general installation works) to: a Undertake design reviews and give advice on ease of commissioning. b Provide commissioning management input to construction programming and during installation stages. c Manage commissioning, performance testing and handover or post-handover stages. For buildings with complex building services, this role needs to be carried out by a Specialist Commissioning Manager (see Definitions on page 58).	Must occur no later than RIBA Stage 4		Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	Requirements to be written into Contractor Prelims
		#3 - Testing and Inspecting Building Fabric	Credit #1 has been achieved. The integrity of the building fabric is quality assured through completion of post construction testing and inspection. Through the completion of a thermographic survey as well as airtightness test and inspection by a qualified professional. Any defects must be rectified prior to building handover/close out.			Building Specific	1	0.61%	1	0.61%			M	1		M	1		M	Requirements to be written into Contractor Prelims Medium risk as the credit can have handover programme implications if the testing identifies any issues that need to be rectified.
		#4 - Handover	Prior to handover, two building user guides are developed: a A non-technical user guide for distribution to the building occupiers. b A technical user guide for the premises facilities managers. Drafts are developed and discussed with users first. Prepare two training schedules: a A non-technical training schedule for the building occupiers. b A technical training schedule for the premises facilities managers.		#11 - Building User Guide	Building Specific	1	0.61%	1	0.61%			L	1		L	1		L	Requirements to be written into Contractor Prelims
						Totals - Base	18	11.0%	14	8.56%	4	2.44%		14	4		14	4		
						Total - Innovation	1	1.0%	1	1.00%	0	0.00%		1	0		1	0		
Health and Well-being	Hea 01 - Visual Comfort	#2 - Daylighting	The building achieves good practice daylighting relevant to the building function to ensure appropriate levels of natural light for the building occupants The relevant building areas meet good practice daylight factor(s) and other criterion OR The relevant building areas meet good practice average and minimum point daylight illuminance criteria			Building Specific	2	1.45%												Daylight and Sunlight Consultant confirm difficult to achieve on development of this scale however requirements to be reviewed on a building-by-building basis. Opportunities for daylighting will be maximised as far as feasible regardless of whether the credit is targeted
		★ Exemplar Performance - Daylighting	The building achieves exemplar performance daylight factors relevant to the building function to ensure appropriate levels of natural light for the building occupants			Building Specific	1	1.00%												Daylight and Sunlight Consultant confirm difficult to achieve on development of this scale however requirements to be reviewed on a building-by-building basis. Opportunities for daylighting will be maximised as far as feasible regardless of whether the credit is targeted
		#3 - View Out	95% of the floor area in 95% of spaces for each relevant building area is within 8m of an external wall which has a window or permanent opening that provides an adequate view out. The window/opening must be ≥ 20% of the surrounding wall area where the room depth is greater than 8m.			Building Specific	1	0.73%	1	0.73%			L	1		L	1		L	Although building design specific requirements considered achievable for typical office and retail developments
		#4 - Internal and External Lighting Levels, Zoning and Control	Internal and External lighting provides luminance levels in accordance with the SLL Code for Lighting 2012. For areas where computer screens are regularly used, the lighting design complies with CIBSE Lighting Guide 7 sections 3.3, 4.6, 4.7, 4.8 and 4.9. External lighting provided is specified in accordance with BS 5489-1:2013 Lighting of roads and public amenity areas. Internal lighting is zoned in accordance with all BREEAM criteria.			Building Specific	1	0.73%	1	0.73%			L	1		L	1		L	Typically achievable, requirements to be defined within M&E specification
	Hea 02 - Indoor Air Quality	Pre-requisite - Indoor Air Quality (IAQ) Plan	Indoor air quality Plan (IAQ) produced during design stage	Must occur during design stage		Building Specific	-	-	-	-			L	-		L	-		L	
		#2 - Ventilation	Building has been designed to minimise the concentration and recirculation of pollutants in the building through: - complying with the relevant standard for ventilation - designing ventilation pathways to minimise pollutants inside the building - incorporating suitable filtration as defined in BS EN 13779:2007 - areas subject to large and unpredictable or variable occupancy patterns have carbon dioxide (CO_2) or air quality sensors specified - mechanically ventilated spaces: sensors are linked to the mechanical ventilation system and provide demand-controlled ventilation - naturally ventilated spaces: sensors either have the ability to alarm when CO_2 levels exceed set point, or are linked to controls to adjust the quantity of fresh air & thermal comfort and ventilation rates in accordance with CIBSE AM10.			Building Specific	1	0.73%	1	0.73%			H	1		H	1		H	Requirements simplified for Shell & Corfe assessments. Provision of fresh air into the building in accordance with criteria of relevant standards for ventilation considered standard practice. High risk as required intake and exhaust spacing can be difficult to achieve, as well as distancing from external sources of pollution Co2 sensor functionality requirements to be defined within M&E specification
	Hea 04 - Thermal Comfort	#1 - Thermal Modelling	Thermal modelling has been carried out using software in accordance with CIBSE AM11 and ensures design achieves criteria as set out in CIBSE Guide A Environmental Design.			Building Specific	1	0.73%	1	0.73%			L	1		L	1		L	Thermal modelling considered standard practice
		#2 - Design for Future Thermal Comfort	Credit #1 has been achieved and the modelling has been undertaken against a projected climate change scenario. Project team are to demonstrate how the building has been adapted, or designed to be easily adapted in the future using utilise passive solutions			Building Specific	1	0.73%			1	0.73%	H		1	H		1	H	Thermal modelling required and level of compliance beyond standard practice. High risk as historically very difficult to achieve

Assessment Type	Shell & Core
Project Stage	Outline Planning
Assessor Name	Henry Pelly
Desired Rating	Excellent
Desired Score	75.00%

Project Name	North Quay		North Quay		North Quay			
Building Type	Shell & Core Office		Shell & Core Retail		Shell & Core Hotel			
Achieved Score	0.00%	Unclassified	0.00%	Unclassified	0.00%	Unclassified		
Target Score	77.26%	Excellent	73.90%	Excellent	77.19%	Excellent		
Potential Score	96.40%	Outstanding	91.70%	Outstanding	95.04%	Outstanding		

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
	Hea 05 - Acoustic Performance	#2 - Internal indoor ambient noise levels	Internal indoor ambient noise levels			Building Specific	1	0.73%	1	0.73%			L	1		L	1		L	Requirements to be defined within Acoustic specification
	Hea 06 - Security	#1 - Security of site and building	Suitably Qualified Security Specialist (SWSS) prepares evidence based Security Needs Assessment no later than RIBA Stage 2. Final design must incorporate recommendation from SQSS.	Assessment during or prior to RIBA Stage 2		Building Specific	1	0.73%	1	0.73%			M	1		M	1		M	Architect has met with both Canary Wharf's Head of Security and Secure by Design Officers. Medium risk as recommendations made by Security Consultants can be onerous for such sites
		★ Exemplar Performance	A compliant risk based security rating scheme has been used. The performance against the scheme has been confirmed by independent assessment and verification.			Building Specific	1	1.00%												
	Hea 07 - Safe and Healthy Surroundings	#1 - Safe access	Proper cycle lanes, footpaths, pedestrian lighting are incorporated into the design. Delivery areas are not directly accessed through general parking areas and have their own vehicle manoeuvring areas.			Site Wide	1	0.73%			1	0.73%	H		1	H		1	H	High risk as very difficult to achieve on larger sites such as North Quay. Requirements to be reviewed as the masterplan develops
		#2 - Outside space	Outside space provided and must: – be an outdoor landscaped area, for example a garden, balcony or terrace; the majority of the space should be open to the sky – have appropriate seating areas and be non-smoking, – be located to ensure it is accessible to all building users and avoids areas that will have disturbances from sources of noise (e.g. building services, car parks, busy roads, delivery areas etc.).			Site Wide	1	0.73%	1	0.73%			L	1		L	1		L	Design of the masterplan driven by creation of a high quality public realm. Credit should be achievable and reflective of the aspirations of the project.
						Totals - Base	11	8.00%	7	5.09%	2	1.45%		7	2		7	2		
						Total - Innovation	2	2.00%	0	0.00%	0	0.00%		0	0		0	0		

Assessment Type	Shell & Core	Project Name	North Quay	North Quay	North Quay
Project Stage	Outline Planning	Building Type	Shell & Core Office	Shell & Core Retail	Shell & Core Hotel
Assessor Name	Henry Pelly	Achieved Score	0.00% Unclassified	0.00% Unclassified	0.00% Unclassified
Desired Rating	Excellent	Target Score	77.26% Excellent	73.90% Excellent	77.19% Excellent
Desired Score	75.00%	Potential Score	96.40% Outstanding	91.70% Outstanding	95.04% Outstanding

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Energy	Ene 01 - Reduction of Energy Use and Carbon Emissions	#1 - Energy Performance	Design achieves a minimum Energy Performance Ratio on a scale of 0.1 to 0.9 (1 - 9 credits available).		4	Building Specific	9	5.73%	6	3.82%	1	0.64%	L	6	1	L	6	1	L	Targeted credits based on number achieved by initial office energy modelling. All blocks achieve at least 6 credits with blocks A5, B1 and D3 scoring 7.
		#2 - Prediction of operational energy consumption	During the design stage, design team members hold a workshop on operational energy performance. Undertake energy modelling and produce reports during the design and post-construction stage to predict operational energy consumption. Carry out a risk assessment to highlight any design, technical, and process risks to be monitored and managed throughout construction and commissioning.	Must occur during design stage	0	Building Specific	4	2.55%			4	2.55%	M		4	M		4	M	To be done on a building=-by-building basis as use/occupancy pattern specific Potential only and medium risk a reflection of the expanded scope requirements for relevant Project Team members
		★ Exemplar Performance - Zero Regulated Carbon	The building achieves an EPRnc ≥ 0.9 and zero regulated CO2 emissions Energy generated from on-site and near-site LZC offsets CO2 from unregulated energy use by 10% (1 credit) or 50% (2 credits).			Building Specific	2	2.00%												
		★ Exemplar Performance - Carbon Negative	The development generates an excess of renewable or carbon neutral energy in excess to its own demands in terms of both regulated and unregulated energy			Building Specific	1	1.00%												
		★ Exemplar Performance - Post Occupancy	The client commits funds to pay for the BREEAM Post Occupancy Stage Assessment. This requires an assessor to be appointed to report on the commitments made during the Post Construction Stage Assessment; including but not limited to: in use energy and water consumption, Man 5 aftercare, health and wellbeing issues, LE 5 ecology maintenance. The following credits must also be achieved to award this credit: 1. Ene 01 - 4 credits for Prediction of operational energy consumption 2. Ene 02 Energy monitoring - 2 credits 3. Wat 02 Water monitoring - 1 credit			Building Specific	2	2.00%			2	2.00%			2			2	M	POE commitment outlined in the CWC Sustainable Design and Construction. Medium risk as it requires collaboration with, as of yet, future unknown tenants. The credit can be moved to 'Targeted' from potential if appropriate for a building specific assessment
	Ene 02 - Energy Monitoring	#1 - Sub-metering of end-use categories	Energy metering systems are installed that enable at least 90% of the estimated annual energy consumption of each fuel to be assigned at various end-use categories of energy consuming systems. The energy consuming systems in buildings with a total useful floor area greater than 1,000m2 are metered using an appropriate energy monitoring and management system		1	Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	To be included within the M&E specification
		#2 - Sub-metering of High Energy Load and Tenancy Areas	An accessible energy monitoring and management system or separate accessible energy sub-meters with pulsed or other open protocol communication outputs to enable future connection to an energy monitoring and management system are provided, covering a significant majority of the energy supply to tenanted areas or in the case of single occupancy buildings, relevant function areas or departments within the building/unit			Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	To be included within the M&E specification
	Ene 03 - External Lighting	#1 - External Lighting	Either no external lighting OR Energy efficient external light fittings(with average efficacy of at least 70luminaire lumens per circuit watt) are specified for external areas of the development and are only on when required.			Site Wide	1	0.64%	1	0.64%			L	1		L	1		L	To be included within the M&E specification
	Ene 04 - Low Carbon Design	#1 - Passive Design Analysis	The first Hea 04 Thermal Comfort credit has been achieved and the design team has carried out analysis of the proposed building design/development to influence decisions made during Concept Design stage and identify opportunities for the implementation of passive design solutions. Quantify the reduced total energy demand and carbon dioxide ((CO_2)) emissions resulting from the passive design measures.	Must occur no later than RIBA Stage 2		Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	To be done on a building-by-building basis as will include passive design strategies specific to each building.
		#2 - Free Cooling	Credit #1 has been achieved and the passive design analysis also includes an analysis of free cooling and identifies opportunities for the implementation of free cooling solutions with any of the compliant free cooling strategies specified			Building Specific	1	0.64%												
		#3 - Low and Zero Carbon Technologies	LZC feasibility study carried out no later than RIBA Stage 2 with a local LZC technology/technologies specified in line with the recommendations of the feasibility study. Quantify the reduced regulated carbon dioxide ((CO_2)) emissions resulting from the feasibility study.	Must occur no later than RIBA Stage 2		Site Wide/Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	LZCT Feasibility Sttudy forms part of Max Fordham's "North Quay Masterplan Stage 2 Report" which will be revisited on a building-by-building basis.
	Ene 06 - Energy Efficient Transportation Systems	#1 - Energy Consumption	Analysis for transportation demand and energy consumption for lifts, escalators, and/or moving walkways takes place. Strategy with lowest energy consumption is to be specified.			Building Specific	1	0.64%	1	0.64%			L			L	1		L	It has been assumed that the retail spaces will not have any relevant lifts. Should goods lift with a speed greater than 0.15 m/s be specified the issue will need to be assessed for the retail assessment
		#2 - Energy Efficient Features	Credit #1 has been achieved and compliant energy efficient features are specified			Building Specific	2	1.27%	2	1.27%			L			L	2		L	
						Totals - Base	22	14.00%	14	8.91%	5	3.18%		11	5		14	5		
						Total - Innovation	5	5.00%	0	0.00%	2	2.00%		0	2		0	2		

Assessment Type	Shell & Core	Project Name	North Quay	North Quay	North Quay
Project Stage	Outline Planning	Building Type	Shell & Core Office	Shell & Core Retail	Shell & Core Hotel
Assessor Name	Henry Pelly	Achieved Score	0.00% Unclassified	0.00% Unclassified	0.00% Unclassified
Desired Rating	Excellent	Target Score	77.26% Excellent	73.90% Excellent	77.19% Excellent
Desired Score	75.00%	Potential Score	96.40% Outstanding	91.70% Outstanding	95.04% Outstanding

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Transport	Tra 01 - Transport Assessment and Travel Plan	#1 - Travel plan	During the feasibility and design stages, develop a travel plan based on a site-specific travel assessment or statement including all the points as listed in the BREEAM manual, including calculator of the public transport accessibility index, current facilities available for cyclists, disabled access etc. The travel plan includes recommendations and these must be implemented.	Must occur no later than Stage 2		Building Specific	2	1.92%	2	1.92%			L	2		L	2		L	The Project Team have examined the requirements in detail and opened discussions with the LBTH and TfL over local transport infrastructure improvements. Measures proposed within the Outline Planning Application confirm that 12 credits can be awarded.
	Tra 02 - Sustainable transport measures	#1 - Transport options implementation	Credit #1 must be awarded. Identify and implement sustainable transport measures within Table 7.4 Award credits according to the Accessible Index (AI) and the total number of points achieved for the options implemented, see Table 7.3.			Site Wide/Building Specific	10	9.58%	10	9.58%			L	10		L	10		L	
						Totals - Base	12	11.50%	12	11.50%	0	0.00%		12	0		12.00	0		
Water	Wat 01 - Water Consumption	#1 - Water Consumption	Credits awarded on a sliding scale based on the percentage improvement in water usage over a baseline notional building. Must use the Wat 01 calculator to determine final number of credits awarded. Minimum for one credit is 12.5% improvement, 5 credits awarded for 55% improvement or better. The following domestic scale water consuming components are included: WCs, urinals, taps, showers, baths, dishwashers, washing machines. Grey water and rainwater collection systems are taken into account in the calculator tool.		1	Building Specific	5	3.89%	2	1.56%	1	0.78%	L	2	1	L	2	1	L	To be achieved through water efficient relevant sanitaryware/kitchenware specification. 2 credits equates to a 25% improvement over baseline building water consumption.
		★ Exemplar Performance	The development demonstrates a 65% improvement over baseline building water consumption			Building Specific	1	1.00%												
	Wat 02 - Water Monitoring	#1 - Water Monitoring	Where a water meter with a pulsed output will be installed on the mains supply to each building/unit. Water-consuming plant or building areas that consume 10% or more of the building's total water demand must be fitted with sub meters or have water monitoring equipment with pulsed output enabling it to connect to a BMS system. If the site has an existing BMS belonging to the same owner as the new development, the meters must be connected to this system.		Criterion 1 only	Building Specific	1	0.78%	1	0.78%			L	1		L	1		L	To be included within M&E specification
	Wat 03 - Water Leak Detection	#1 - Leak Detection System	Leak detection system capable of detecting a major water leak on the mains water supply within the building and between the building and the utilities water meter.			Building Specific	1	0.78%	1	0.78%			L	1		L	1		L	To be included within M&E specification
		#2 - Flow Control Devices	Install flow control devices that regulate the water supply to each WC area or sanitary facility according to demand, in order to minimise undetected wastage and leaks from sanitary fittings and supply pipework.			Building Specific	1	0.78%	1	0.78%			L	1		L	1		L	To be included within M&E specification
	Wat 04 - Water Efficient Equipment	#1 - Water Efficient Equipment	Design team has identified all unregulated water demands that could be realistically mitigated or reduced. Systems or processes have been identified to reduce the unregulated water demand, and demonstrate, through either good practice design or specification, a meaningful reduction in the total water demand of the building.			Building Specific	1	0.78%	1	0.78%			L	1		L	1		L	
						Totals - Base	9	7.00%	6	4.67%	1	0.78%		6	1		6	1		
						Total - Innovation	1	1.00%	0	0.00%	0	0.00%		0	0		0	0		

Assessment Type	Shell & Core	Project Name	North Quay	North Quay	North Quay
Project Stage	Outline Planning	Building Type	Shell & Core Office	Shell & Core Retail	Shell & Core Hotel
Assessor Name	Henry Pelly	Achieved Score	0.00% Unclassified	0.00% Unclassified	0.00% Unclassified
Desired Rating	Excellent	Target Score	77.26% Excellent	73.90% Excellent	77.19% Excellent
Desired Score	75.00%	Potential Score	96.40% Outstanding	91.70% Outstanding	95.04% Outstanding

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Materials	Mat 01 - Environmental impacts from construction products: Building life cycle assessment	#1 - Superstructure	Carry out a building LCA on of the superstructure design using either the BREEAM Simplified Building LCA tool or an IMPACT Compliant LCA tool . Comparison to BREEAM benchmarks for offices, industrial and retail building sonly plus for all building types under take option analysis. 4 credits available: concept design analysis 2 credits available: technical design analysis Note technical design credits can still be achieved even if concept design credits have not been awarded. LCA analysis must be submitted to BRE at concept and technical design stages.	Must occur at RIBA Stage 2 & 4		Building Specific	6	7.50%	6	7.50%	1	1.25%	H	6		H	6		L	Initial embodied carbon analysis has been undertaken to inform the indicative scheme based on achieving the targeted credits (Max Fordham's 'Lifecycle Carbon Analysis' issued 20/01/20). This recommendations of the initial analysis will form the base design for the superstructure, substructure and hard landscaping of all individual building proposals. Any deviations will need to perform at least to the same standard in terms of embodied carbon. The initial embodied carbon analysis included an examination of the benchmarking requirement for the office assessment with the aim of achieving maximum credits High risk for the office and retail spaces as benchmarking exercise outcome highly sensitive to change in material specification to assessed elements
		#2 - Substructure and Hard Landscaping	Criteria 3 and 4 are achieved. During Concept Design carry out building LCA options appraisal of a combined total of at least six significantly different substructure or hard landscaping design options (at least two shall be substructure and at least two shall be hard landscaping), using a building LCA tool that is recognised by BREEAM.	Must occur no later than RIBA Stage 2		Building Specific	1	1.25%	1	1.25%			L	1		L	1		L	
		★ Exemplar Performance - Core Building Services options appraisal	Criteria 3 to 4 are achieved. During Concept Design carry out building LCA options appraisal of at least 3 significantly different core building services design options using a building LCA tool that is recognised by BREEAM.	Must occur no later than RIBA Stage 2		Building Specific	1	1.00%			1	1.00%	M		1	M		1	M	Medium risk as credit may involve level of information beyond that typically produced at RIBA Stage 2 and requires significant engagement from MEP Engineer
		★ Exemplar Performance - LCA and LCC alignment	Achieve criteria 3 to 5. Achieve Man 02 #1 Design options that were included in the LCA analysis to be included in the LCC analysis as well. Integrate the aligned LCA and LCC options appraisal activity within the wider design decision-making process and record in an options appraisal summary document.			Building Specific	1	1.00%			1	1.00%	H		1	H		1	H	High risk as requires a significantly expanded scope on the part of the Quantity Surveyor
		★ Exemplar Performance - Third party verification	Criteria 1 to 7 (as applicable to the building type) are achieved. A suitably qualified third party carries out the building LCAs			Building Specific	1	1.00%			1	1.00%	H		1	H		1	H	High risk due to unpredictability of verification process outcome
	Mat 02 - Environmental Impacts from Construction Products	#1 - Specification of Products with a Recognised EPD	Specify construction products with EPD that achieve a total EPD points score of at least 20, as shown in the Mat 01/02 Results Submission Tool.			Building Specific	1	1.25%			1	1.25%	M		1	M		1	M	Medium risk due to the limitations it may place on material procurement however materials with EPDs will be specified wherever possible.
	Mat 03 - Responsible Sourcing of Construction Products	Pre-requisite - Legally Sourced Timber	All timber and timber based products used on the project is 'Legally harvested and traded timber'.		#1 - Timber Procurement	Building Specific	-	-	-	-			L	-		L	-		L	
		#1 - Enabling Sustainable Procurement	The design team must use a sustainable procurement plan to guide specification. The plan must: a Be in place before Concept Design. b Include sustainability aims, objectives and strategic targets c Require the potential to procure construction products locally to be assessed. d Include details of procedures to verify the implementation of the plan. In addition, if the plan is applied to several sites or adopted at an organisational level it must: e Identify the risks and opportunities of procurement against a broad range of social, environmental and economic issues as per BS ISO 20400:2017	Must occur prior to RIBA Stage 2		Site Wide/Building Specific	1	1.25%	1	1.25%			L	1		L	1		L	A 'Health and Sustainable Materials' brief has been developed by Canary Wharf Group and will be developed into a BREEAM compliant brief during the next stage of works. This will act as a guidance document for all individual building proposed as part of the masterplan. The brief will be revisited for each individual building
		#2 - Measuring Responsible Sourcing	Up to 3 credits can be awarded where the applicable building materials are responsibly sourced in accordance with the BREEAM methodology. - 1 credit: Superstructure: ≥ 10% of available points achieved - 2 credits: As above plus: Internal finishes & Substructure & Hard Landscaping ≥ 20% of available points achieved - 3 credits: As above plus: Internal finishes & Substructure & Hard Landscaping ≥ 30% of available points achieved			Building Specific	3	3.75%	1	1.25%	1	1.25%	L	1	1	L	1	1	L	Sustainable Procurement Plan defines targets relating to responsible sourcing and a methodology to achieve them with the aspiration of improving on targeted score
		★ Exemplar Performance	As above, plus core building services ≥50% of available points achieved			Building Specific	1	1.00%												
	Mat 05 - Designing for Durability and Resilience	#1 - Protecting Vulnerable Parts of the Building from Damage and Degradation	- Protection measures are incorporated into the building's design (internal and external) to protect against high pedestrian traffic, vehicle or trolley movement, potential malicious damage to materials in public and common areas. - Design to include protection for exposed parts from degradation through achieving the relevant standard or through detailed assessment. - Convenient access to the roof and facade for cleaning and maintenance - Design to prevent water damage, ingress and ponding			Building Specific	1	1.25%	1	1.25%			M	1		M	1		M	Medium risk as credit requirements more onerous than the equivalent BREEAM 2014. Requirements to be reviewed by Project Teams on a building-by-building basis
	Mat 06 - Material Efficiency	#1 - Material Efficiency	Design/Construction team must identify, investigate, implement and report on measures to optimise material use at all stages of the project.	Must be undertaken at RIBA Stages 1, 2, 3, 4 and 5		Site Wide/Building Specific	1	1.25%	1	1.25%			L	1		L	1		L	Materials Efficient Brief has been developed by Canary Wharf Group and will be developed into a BREEAM compliant brief during the next stage of works. This will act as a guidance document for all individual building proposed as part of the masterplan. The brief will be revisited for each individual building
						Totals - Base	14	17.50%	11	13.75%	3	3.75%		11	2		11	2		
						Total - Innovation	4	4.00%	0	0.00%	3	3.00%		0	3		0	3		

Assessment Type	Shell & Core
Project Stage	Outline Planning
Assessor Name	Henry Pelly
Desired Rating	Excellent
Desired Score	75.00%

Project Name	North Quay		North Quay		North Quay	
Building Type	Shell & Core Office		Shell & Core Retail		Shell & Core Hotel	
Achieved Score	0.00%	Unclassified	0.00%	Unclassified	0.00%	Unclassified
Target Score	77.26%	Excellent	73.90%	Excellent	77.19%	Excellent
Potential Score	96.40%	Outstanding	91.70%	Outstanding	95.04%	Outstanding

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Waste	Wst 01 - Construction Waste Management	#1 - Pre-demolition audit	At Concept design, a competent person completes a pre-demolition audit of any existing buildings, structures or hard surfaces being considered for demolition. This must be used to determine whether refurbishment or reuse is feasible and maximise the recovery of demolition material. The audit must cover the content of Pre-demolition audit scope in the manual. Contractors must be engaged in the process and actual waste must be monitored against the targets and reported in the RMP.	Must occur no later than RIBA Stage 2		Building Specific	1	0.64%	1	0.64%			M	1		M	1		M	Pre-demolition audit will be undertaken on a building-by-building basis.
		#2 - Construction Resource Efficiency	There is a compliant Resource Management Plan. Non-hazardous construction waste (excluding demolition and excavation waste) generated as follows: - One credit - ≤ 13.3m3/100m2 of G.I.F.A (≤ 11.1 tonnes/100m2 of G.I.F.A) - Two credit - ≤ 7.5m3/100m2 of G.I.F.A (≤ 6.5 tonnes/100m2 of G.I.F.A) - Three credit -≤ 3.4m3/100m2 of G.I.F.A (≤ 3.2 tonnes/100m2 of G.I.F.A)		0	Site Wide	3	1.91%	1	0.64%	1	0.64%	L	1	1	L	1	1	L	Requirements to be written into Contractor Prelims. Discussions with the Contractor to take place when appointed to determine whether additional credits can be targeted.
		#3 - Diversion of Resources from Landfill	The following percentages, at a minimum, of non-demolition and demolition waste (where applicable) generated by the project have been diverted from landfill: Non-demolition - 70% by volume or 80% by weight. Demolition - 80% by volume or 90% by weight.			Site Wide	1	0.64%	1	0.64%			L	1		L	1		L	Requirements to be written into Contractor Prelims
		★ Exemplar Performance	The development achieves exemplar levels of waste generation and diversion from landfill. Also all key waste groups are included in the RMP and Waste data obtained from external waste contractors is reliable and verifiable.			Site Wide	1	1.00%												
	Wst 02 - Use of Recycled and Sustainably Sourced Aggregates	#1 - Project Sustainable Aggregate Points	Wst 1 #1 pre-demolition audit must be achieved All aggregate uses and types to be input into the Wst 2 calculator to determine if the credit can be achieved. Region, quantity, distance travelled etc. are all required for the calculator.			Site Wide	1	0.64%												
		★ Exemplar Performance	The Project Sustainable Aggregate Points score from the Wst 2 calculator meets or exceeds the exemplary level performance benchmark.			Site Wide	1	1.00%												
	Wst 03 - Operational Waste	#1 - Operational Waste	Where dedicated, clearly labelled, accessible, and properly sized storage space is provided for recycling. Where consistent generation in large volumes of waste or compostable materials are generated, compactors, balers, and/or composting vessels or facilities with water outlet must be provided.		1	Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	
	Wst 04 - Speculative finishes (Offices only)	#1 - Speculative Floor and Ceiling Finishes	Office building types only 1. For tenanted areas (where the future occupant is not known), prior to full fit-out works, carpets, other floor finishes and ceiling finishes have been installed in a show area only. 2. In a building developed for a specific occupant, that occupant has selected (or agreed to) the specified floor and ceiling finishes OR where only ceiling finishes are installed, the building owner confirms that the first tenants will not be permitted to make substantial alterations to the ceiling finishes.			Building Specific	1	0.64%	1	0.64%			L							Only applicable to office assessment
	Wst 05 - Adaptation to Climate Change	#1 - Structural, Fabric & Building Services Resilience	Conduct a climate change adaptation strategy appraisal for structural, fabric & building services resilience by the end of Concept Design by carrying out a systematic risk assessment to identify and evaluate the impact on the building over its projected life cycle from expected extreme weather conditions arising from climate change. Recommendations are to be implemented in the design.	Must occur no later than RIBA Stage 2		Site Wide	1	0.64%	1	0.64%			L	1		L	1		L	A Climate Change Risk Assessment has been undertaken and will be reviewed as the masterplan develops and on a building-by-building basis
		★ Exemplar Performance	Meet the criteria or achieve credits of the assessment issues given in Table 10.11 for Hea 04, Ene 01, Ene 04, Wat 01, Mat 05, Pol 03.			Building Specific	1	1.00%												Not targeted due to dependency on other credits being achieved, including improving the current targets in some areas (e.g. requires 3 credits under Wat 01)
	Wst 06 - Design for Disassembly and Adaptability	#1 - Recommendations	Conduct a study to explore the ease of disassembly and the functional adaptation potential of different design scenarios by the end of Concept Design. Develop recommendations or solutions to enable and facilitate disassembly and functional adaptation.	Must occur no later than RIBA Stage 2		Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	Formed part of the agenda in the Circular Economy workshop. Dedicated workshops to be held on a building-by-building basis
		#2 - Implementation	- Provide an update, during Technical Design, on how the recommendations or solutions proposed by Concept Design have been implemented and any changes to the recommendations and solutions. - Produce a building adaptability and disassembly guide for prospective tenants.			Building Specific	1	0.64%	1	0.64%			L	1		L	1		L	
						Totals - Base	11	7.00%	8	5.09%	1	0.64%		7	1		7	1		
						Total - Innovation	3	3.00%	0	0.00%	0	0.00%		0	0		0	0		

Assessment Type	Shell & Core
Project Stage	Outline Planning
Assessor Name	Henry Pelly
Desired Rating	Excellent
Desired Score	75.00%

Project Name	North Quay		North Quay		North Quay			
Building Type	Shell & Core Office		Shell & Core Retail		Shell & Core Hotel			
Achieved Score	0.00%	Unclassified	0.00%	Unclassified	0.00%	Unclassified		
Target Score	77.26%	Excellent	73.90%	Excellent	77.19%	Excellent		
Potential Score	96.40%	Outstanding	91.70%	Outstanding	95.04%	Outstanding		

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Land Use and Ecology	LE 01 - Site Selection	#1 - Previously Occupied Land	At least 75% of the proposed footprint is on ab area of land which has previously been occupied by industrial, commercial or domestic buildings or fixed surface infrastructure.			Site Wide	1	1.15%	1	1.15%			L	1		L	1		L	Proposed site is all previously occupied land
		#2 - Contaminated Land	Site is deemed to be significantly contaminated as confirmed by a contaminated land specialist's site investigation, risk assessment, and appraisal. Client must confirm that remediation has occurred in accordance with the remediation strategy set out by the contaminated land specialist.			Site Wide	1	1.15%												
	LE 02 - Identifying the Risks and Opportunities	#1 - Survey, Evaluation & Determining the ecological outcomes	The client or contractor confirms compliance is monitored against all relevant UK and EU or international legislation relating to the ecology of the site. Prior to the completion of the preparation and brief, an appropriate level of survey and evaluation is conducted. An assessment route determined using BREEAM Guidance Note GN34 BREEAM Ecological Risk Evaluation Checklist: Project team member route (Route 1) - 1 credit available Ecologist route (Route 2) - 2 credits available During Concept Design, the project team liaise and collaborate with stakeholders to determine the ecological outcome in line with BREEAM hierarchy.	Must occur no later than RIBA Stage 1		Site Wide	2	2.31%	2	2.31%			L	2		L	2		L	Ecologist, Greengage, have been appointed and will continue to be consulted in order to ensure targeted credits are achieved. Greengage have produced a "North Quay - BREEAM Ecology Credit Report' which has informed the number of credits targeted within the pre-assessment, as well as a 'Preliminary Ecological Appraisal'. Greengage documents should be referred to when building-level strategies are being developed to ensure recommendations are being adhered t'Change in Biodiversity Units' calculation should be revisited as landscape proposals are produced at a building level.
		★ Exemplar Performance	The wider site sustainability-related activities and the potential for ecosystem service related benefits are determined. Also credits under Hea 7, Pol 3 and Pol 5 are achieved.			Site Wide	1	1.00%												
	LE 03 - Managing Negative Impacts on Ecology	Pre-requisite - Identifying Risks	LE 02 has been achieved and the client or contractor has confirmed that compliance is monitored against all relevant UK, and EU or International legislation relating to the ecology of the site.			Site Wide	-	-	-	-			L	-		L	-		L	
		#1 - Planning, liaison, implementation and data	- [2] Roles and responsibilities for managing negative impacts on the ecology have been clearly defined, allocated and implemented at an early enough stage to influence the concept design or design brief. - [3] The potential impact of site preparation and construction works on ecology are identified at an early project stage to optimise benefits and outputs. Site preparation and construction works have been planned for and are implemented at an early project stage to optimise benefits and outputs. - [4] The project team, liaising and collaborating with representative stakeholders and, taking into consideration data collated and shared, have proposed solutions and selected measures to be implemented during site preparation and construction works.	Must occur no later than RIBA Stage 1		Site Wide	1	1.15%	1	1.15%			L	1		L	1		L	Ecologist has been appointed and will continue to be consulted in order to ensure targeted credits are achieved.
		#2 - Managing negative impacts	Route 1: 1 credit: Negative impacts from site preparation and construction works have been managed according to the hierarchy and no net impact has resulted. Route 2: a. No overall loss of ecological value has occurred (2 credits) b The loss of ecological value has been limited as far as possible (1 credit)			Site Wide	2	2.31%	2	2.31%			L	2		L	2		L	
	LE 04 - Change and Enhancement of Ecological Value	#1 - Liaison, implementation and data collation	LE 03 has been achieved. Route 2: The project team implement measures selected in a way that enhances ecological value in the following order: a On site, and where this is not feasible, b Off site within the zone of influence.			Site Wide	1	1.15%	1	1.15%			L	1		L	1		L	Ecologist has been appointed and will continue to be consulted in order to ensure targeted credits are achieved.
		#2 - Enhancement of ecology	LE 03 has been achieved. 1 credit - Route 1: The project team implement measures based on recommendations from recognised 'local' ecological expertise and data collated is provided to the local environmental records centres. Up to 3 credits - Route 2: Credits are awarded based on the calculation of the change in ecological value occurring as a result of the project in accordance withGN 36: 6.a Minimising loss of ecological value (one credit - percentage score of 75-94) 6.b No net loss of ecological value (two credits - percentage score of 95-104) 6.c Net gain of ecological value (three credits - percentage score of 105-109)			Site Wide	3	3.46%	2	2.31%	1	1.15%	L	2	1	L	2	1	L	Ecologist has been appointed and will continue to be consulted in order to ensure targeted credits are achieved.
		★ Exemplar Performance	The change in ecological value under criterion 6 confirms significant net gain has been achieved (as set out in GN36)			Site Wide	1	1.00%												
	LE 05 - Long term Ecology Management and Maintenance	Pre-requisite - Roles & Responsibilities	LE 04 has been achieved.			Site Wide	-	-	-	-			L	-		L	-		L	
		#1 - Planning, Monitoring, Management & Maintenance	- Monitor and review implementation and the effectiveness of measures - Develop and review management and maintenance solutions, actions or measures. - Include information on Ecology and Biodiversity for the owner or occupant to inform of local ecological features, value and biodiversity on or near the site.			Site Wide	1	1.15%	1	1.15%			L	1		L	1		L	Ecologist has been appointed and will continue to be consulted in order to ensure targeted credits are achieved. Contractor requirements to be defined in Contractor Prelims
		#2 - Landscape and ecology management plan	Landscape and ecology management plan, or similar, is developed in accordance with BS 42020:2013 covering as a minimum the first five years after project completion			Site Wide	1	1.15%	1	1.15%			L	1		L	1		L	
						Totals - Base	13	15.00%	11	12.69%	1	1.15%		11	1		11	1		
						Total - Innovation	2	2.00%	0	0.00%	0	0.00%		0	0		0	0		

Assessment Type	Shell & Core	Project Name	North Quay	North Quay	North Quay
Project Stage	Outline Planning	Building Type	Shell & Core Office	Shell & Core Retail	Shell & Core Hotel
Assessor Name	Henry Pelly	Achieved Score	0.00% Unclassified	0.00% Unclassified	0.00% Unclassified
Desired Rating	Excellent	Target Score	77.26% Excellent	73.90% Excellent	77.19% Excellent
Desired Score	75.00%	Potential Score	96.40% Outstanding	91.70% Outstanding	95.04% Outstanding

Category	BREEAM Issue	Credit Number	General Requirements	Stage Requirements	Minimum Requirements	Building Specific/ Site-wide	Available for all		Targeted		Potential		Risk	Targeted	Potential	Risk	Targeted	Potential	Risk	Notes/Progress to Date
							Credits	Percent	Credit	Percent	Credit	Percent		Credit	Credit		Credits	Credits		
Pollution	Pol 01 - Impact of Refrigerants	#1 - Impact of Refrigerants	3 Credits - No Refrigerant Use, OR Up to 2 Credits - All systems (with electric compressors) must comply with the requirements of BS EN 378:2016 and have a Direct Effect Life Cycle CO2 of ≤ 100kgCO2e/kW (2 credits) or ≤ 1000kgCO2e/kW cooling capacity (1 credit), AND 1 Credit - All systems are hermetically sealed OR only use environmentally benign refrigerants OR Permanent automated refrigerant leak detection system OR an in-built automated diagnostic procedure for detecting leakage has been installed.			Building Specific	3	2.25%	1	0.75%			M	2		M	2		M	Number of credits targeted typical of a heat pump based scheme where leak detection is to be installed. Medium risk due to the specific requirements around the leak detection system
	Pol 02 - Local Air Quality	#1 - Local Air Quality	Two credits available if heating and hot water supplied by non-combustion systems, e.g. only powered by electricity. OR, two credits available for all combustion plant that provides space heating and domestic hot water that meets tables 12.4 and 12.5 of the BREEAM technical manual. These tables set NOx emission, particulate matter, and VOC levels.			Building Specific	2	1.50%	2	1.50%			L	2		L	2		L	All heating and cooling is through electrically powered heat pumps, there are no local emissions
	Pol 03 - Flood and Surface Water Management	Pre-requisite - Identifying Risks	An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria.			Building Specific	-	-	-	-				-						Suitably qualified Flood Risk Consultant has been appointed
		#1 - Flood Resilience	Site is Low Flood Risk which is confirmed by a site-specific Flood Risk Assessment (2 credits), or if site is medium or high flood risk and not in a Functional Floodplain, either the ground level of building and access to building and site are at least 600mm above the design flood level or the final design reflects the recommendations of an appropriate consultant- must be confirmed by Flood Risk Assessment.			Site Wide	2	1.50%	1	0.75%			H	1		H	1		H	High risk until requirements have been examined in detail by the Flood Risk Consultant
		Pre-requisite - Surface water run-off	Surface water run-off design solutions must be bespoke, with justification given by the appropriate consultant where water is allowed to leave the site.			Site Wide	1	0.75%	1	0.75%			H	1		H	1		H	High risk until requirements have been examined in detail by the Flood Risk Consultant
		#2 - Surface Water Run-Off - Rate	Pre-requisite achieved. Appropriate consultant appointed to carry out the following analysis: Peak run-off from site to watercourses shows a 30% improvement for the developed site compared with pre-developed site - calcs should include allowance for climate change. Also maintenance agreements set out for all SuDS.																	
		#3 - Surface Water Run-Off - Volume	Appropriate consultant appointed to carry out the following analysis: Flooding will not occur in event of local drainage system failure and either: post development run-off volume, over development lifetime, is no greater than it would have been prior to development - any additional predicted volume for the 100yr 6hr event must be prevented from leaving the site. OR, justification from the consultant that the first option is not achievable and post-development run-off rate is reduced to a limiting discharge. Calcs should include allowance for climate change.			Site Wide	1	0.75%	1	0.75%			H	1		H	1		H	High risk until requirements have been examined in detail by the Flood Risk Consultant
		#4 - Minimising Watercourse Pollution	Appropriate consultant appointed to carry out the following analysis: no discharge from developed site for rainfall up to 5mm. All delivery areas designed in compliance with current best practice planning guidance. If project does not include any areas that are sources of pollution, credit achieved by default.			Site Wide	1	0.75%			1	0.75%	H		1	H		1	H	Historically difficult to achieve, requirements to be reviewed
	Pol 04 - Reduction of Night Time Light Pollution	#1 - Reduction of Night Time Light Pollution	Where the external lighting design is compliant with ILE guidance for the reduction of night time pollution and is automatically switched off between 2300 and 0700.			Site Wide	1	0.75%	1	0.75%			L	1		L	1		L	To be included within M&E specification
	Pol 05 - Reduction of Noise Pollution	#1 - Reduction of Noise Pollution	Noise sources from development do not exceed ambient noise levels. Noise impact assessment to be BS 4142 compliant. Credit achieved by default where there are no noise sensitive areas or buildings within 800m radius of development.			Building Specific	1	0.75%	1	0.75%			L	1		L	1		L	
						Totals - Base	12	9.00%	8	6.00%	1	0.75%		9	1		9	1		
Innovation	Innovation	★ Approved Innovation	One innovation credit can be awarded for each innovation application approved by BRE Global, where the building complies with the criteria defined within an Approved Innovation Application Form			Site Wide/Building Specific	1	1.00%												

Appendix VI – Sustainable procurement plan

CANARY WHARF
CONTRACTORS

NORTH QUAY
SUSTAINABLE PROCUREMENT PLAN

Procedure Owner: CWCL Sustainability Manager

Procedure Number: PP-19-06

REVIEW PERIOD: ANNUALLY

Contents

1.0 General

1.1 Purpose and General Information

This document summarises the sustainable principles and procurement strategy in place at CWCL. The procurement guidelines set up in this document are to be followed by all CWCL staff across all projects.

The aim of this strategy is to guide and monitor procurement practices of all consultants, suppliers and trade contractors working across all CWCL projects, in line with CWCL Sustainability Strategy

The document describes the management systems and procedures that have been put into place to ensure that the CWG sustainable procurement policy is effectively implemented.

This policy is be reviewed on a regular basis (as a minimum, annually) and approved by the Head of Sustainability.

If you have any questions, please contact one of the following members from the Sustainability Team:

Kristina Arsenievich Sustainability Programme Manager	Andy Haigh Project Sustainability Manager

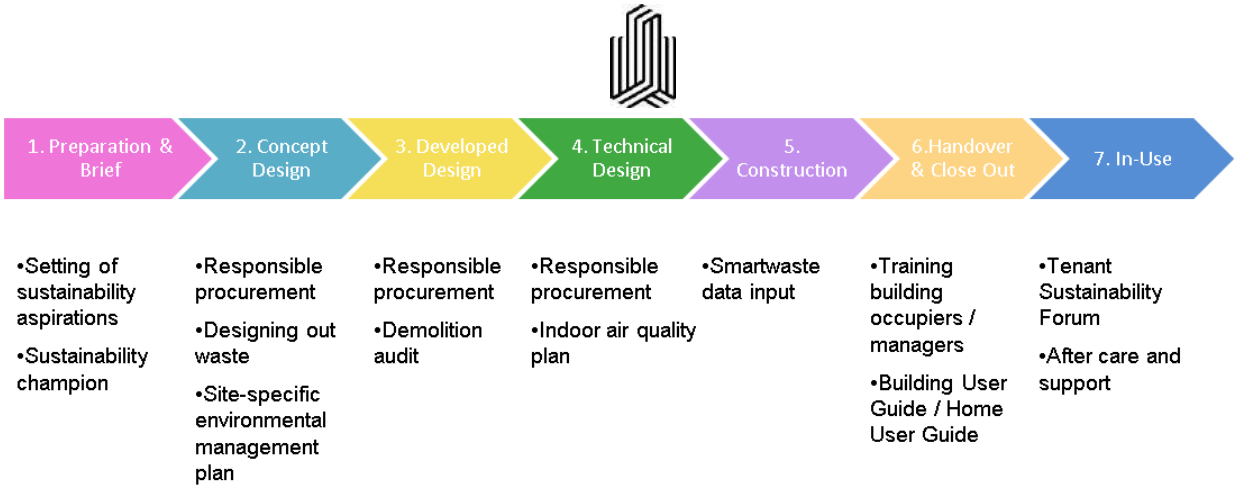
1.2 Risk and Opportunity

The chain of suppliers presents a particular risk to Canary Wharf Group as a Construction Manager. Risk is present when dealing particularly with quality and safety challenges, supply shortages, legal issues, health issues, security problems, climate change and regulatory and environmental compliance.

A systemic management of supply chain procurement for all CWCL projects will minimise inherent risk and has the potential to reduce costs and achieve enhanced environmental performance.

CWCL aims to minimise its impacts in all aspects of its work. The construction industry is notoriously resource intensive and produces large amounts of waste. By implementing a sustainable procurement strategy, CWCL is striving to mitigate its impacts as much as possible.

The Sustainable Procurement Plan aims to complement other mitigating measures put in place by CWCL in their Sustainable Design and Construction Strategy. The figure below demonstrates our efforts to have a positive impact at every stage of a project.



2.0 Responsible Sourcing Standard

2.1 Responsible Sourcing Certification Schemes

The tables below provide a summary of the CWCL minimum responsible sourcing requirements and best practice guidelines, which are aligned with key Environmental Assessment Methods.

The tables include a rating system, which aims to work as an indicator of sustainability for each scheme (10 – most valued, 1 – least valued)

For the purposes of clarifying the processes that are undertaken within the manufacture of a material / product, they have been split into 'key processes' and 'supply chain processes' which we have defined as:

> ***Definition – Key Process***
> *The final major aspects of processing that are carried out for the product/material in question. There may be a single process or multiple processes, depending on the end product.*
>
> ***Definition – Supply Chain Processes***
> *Supply chain processes typically all of the major aspects of processing and extraction involved in the supply chain for the end product. Note that recycled materials (i.e. where the product contains >50% recycled content) are not required to demonstrate a Supply Chain Environmental Management System (EMS) (i.e. ISO 14001 certification). If EMS certification is provided for the Key Processes for recycled materials, supply chain processes are awarded by default.*

2.2 Prohibited Materials

All trade contractors and consultants must ensure that no substances or materials generally known in the United Kingdom construction industry to be prohibited or harmful to health and safety or not in accordance with any applicable standards and codes of practice issued by the BSI Group or under a European Directive relating to standards or good building practice generally accepted in the United Kingdom at the relevant time unless used in accordance with the publication entitled "Good Practice in the Selection of Construction Materials" produced by the British Council for Offices (current edition) be procured.

2.3 CWCL Responsible Procurement – Minimum Standards

The following products must be procured with one of the associated certifications (rated by preference). Any deviation from these standards must obtain prior approval from the CWCL Sustainability Team. Where Chain of Custody of the material is broken please confirm with the Employer on compliance.

Material	Certification Scope	Certification	Rating
Timber & Wood Based Products Virgin Timber, Wood panel and wood based composite products such as Oriented Strand Board, plywood, HPL, chipboard / particle, glulam, LVL, etc.	**Key Process:** Entire product lifecycle captured through Chain of Custody	Reused timber	10
		Forest Stewardship Council (FSC)	5
Primary Structural Steel & Reinforcement (Rebar) Steel, any other metals used within the primary structure, steel reinforcement	**Key Process:** Metal product manufacture, e.g. steel section production	Reused metals	10
		BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5
		CARES Sustainable Constructional Steel (SCS) Scheme	5
		Eco-reinforcement	5
Concrete & Cement Products Ready-mixed concrete, precast concrete products, concrete blocks, cement, Cement bonded particle board	**Key Process:** Ready-mixed concrete plant, Concrete product manufacture **Supply Chain Process:** Cement production, Aggregate extraction and production	Reused concrete	10
		BRE Global, BES 6001 - Framework Standard for Responsible Sourcing (Good)	5
Glass	**Key Process:** Glass production **Supply Chain Process:** Sand extraction Soda ash production or extraction	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5
		EMS – Certified Environmental Management System, key processes and supply chain	2
		EMS – Certified Environmental Management System, key processes only	1
Plasterboard	**Key Process:** Plasterboard or plaster manufacture **Supply Chain Process:** Gypsum extraction synthetic gypsum (from flue gas desulphurisation) by default (recycled content)	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing (Good)	5
Insulation Foam Insulation Wool, Stone wool, glass & cellular glass made using < 50% recycled input	**Key Process:** Insulation / product manufacture **Supply Chain Process:** Main polymer production, e.g. Polystyrene, MDI, Phenolic resin or equivalent	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5

Material	Certification Scope	Certification	Rating
	Any quarried or mined mineral over 20% of input Wool scouring	EMS – Certified Environmental Management System, key processes and supply chain	2

2.4 CWCL Responsible Procurement – Best Practice Guidelines

Preference should be given to products procured with one of the associated environmental certifications (rated by preference).

Material	Certification Scope	Certification	Rating
Metals ***(any use other than primary structural steel or reinforcement)*** Steel, aluminium, etc.	**Key Process:** Metal product manufacture, e.g. cladding production, steel section production **Supply Chain Process:** Metal production: • Steel - *Electric arc furnace or basic oxygen furnace process* • Aluminium – *Ingot production* • Copper - *Ingot or cathode production*	Reused metals	10
		BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5
		CARES Sustainable Constructional Steel (SCS) Scheme	5
		Eco-reinforcement	5
		EMS – Certified Environmental Management System, key and supply chain processes	2
Clay Based Products Bricks, clay tiles, other ceramics	**Key Process:** Product manufacture **Supply Chain Process:** Clay extraction	EMS – Certified Environmental Management System, key and supply chain processes	2
Stone	**Key Process:** Stone product manufacture **Supply Chain Process:** Stone extraction	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5
		EMS – Certified Environmental Management System, key and supply chain processes	2
Plastic, polymer, resin, paint, chemicals and bituminous **Resin based composites and materials** (including GRP and polymeric render) **Bituminous materials** e.g. roofing membranes and asphalt	**Key Process:** Plastic/ rubber manufacture Composite product manufacture **Supply Chain Process:** Main polymer production Glass fibre production (or other principle matrix material) Polymer production Bitumen production, aggregate extraction and production	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5
		EMS – Certified Environmental Management System, key and supply chain processes	2
Any other materials Other mineral-based materials, including fibre cement and calcium silicate Products with 100% recycled content Product with lower percentage of recycled content Any other product	**Key Process:** Key processes is likely to be product manufacture **Supply Chain Process:** Supply chain process/processes for any virgin material in the relevant product type above. Recycled input by default	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing	5
		EMS – Certified Environmental Management System, key and supply chain processes	2

2.5 Volatile Organic Compounds

Volatile Organic Compounds (VOC) are organic compounds which have a high vapour pressure at room temperature and are detrimental to health. Symptoms can include respiratory problems, headaches and nausea. Indoor VOC levels can be up to ten times higher than outdoor and CWCL strives to minimise the VOC levels in its buildings wherever possible.

All products used in CWCL buildings should prioritise materials with low VOC content. Where practicable, a certificate of the testing method used should be requested. In general, the method should adhere to the latest version of BREEAM or equivalent assessment methodology unless otherwise stated. This certificate should be uploaded to A-site by the Trade Contractor or Consultant.

The following product groups fall within the scope of CWCL's VOC requirements:

- [A] Paints and varnishes
- [B] Wood panels (including particle board, fibreboard including MDF, OSB, cement bonded particle board, plywood, solid wood panel and acoustic board)
- [C] Timber structures (e.g. glue laminated timber)
- [D] Wood flooring (e.g. parquet)
- [E] Resilient textile and laminated floor coverings (e.g. vinyl, linoleum, cork, rubber, carpet, laminated wood flooring)
- [F] Suspended ceiling tiles
- [G] Flooring adhesives
- [H] Wall coverings

For each product group, the associated compliant performance standards are detailed below.

[A] Paints and varnishes	
Performance requirements	VOC content limit
Compliant performance standard	EU Directive 2004/42/CE ('Paints Directive')
Compliant testing standard	BS EN ISO 11890-2:2013 – Paints and varnishes – Determination of VOC content, Part 2 – Gas Chromatographic method Compliant alternatives: – Indoor Advantage Gold – Building Materials (only for products certified for the European Market) – EU Ecolabel for paints and varnishes – NF Environment 130 – Indoor Air Comfort/Indoor Air Comfort Gold
Manufacturer also to confirm	Paint to be fungal and algal resistant in wet areas e.g. bathrooms, kitchens, utility rooms

[B] Wood panels (including particle board, fibreboard including MDF, OSB, cement bonded particle board, plywood, solid wood panel and acoustic board)		
Option 1	**Performance requirements**	Formaldehyde E1 class
	Compliant performance standard	BS EN 13986:2004 Wood-based panels for use in construction - Characteristics evaluation of conformity and marking
	Compliant testing standard(s)	BS EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – Indoor Advantage Gold – Building Materials – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – Eco INSTITUT Label
	Manufacturer also to confirm	The absence of prohibited wood preservatives/biocides.

[B] Wood panels (including particle board, fibreboard including MDF, OSB, cement bonded particle board, plywood, solid wood panel and acoustic board)		
Option 2	**Performance requirements**	Formaldehyde level of 0.1mg/m^3
	Compliant testing standard(s)	– BS EN ISO 16000-9:2006 Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method. OR – Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 - Emission testing method for California Specification 01350, Californian Department for Public Health, 2010. Note: For either method the resultant emission/surface area obtained from the chamber test method must be extrapolated to predict what the emissions would be in a theoretical model room (as detailed in the standard) and this extrapolated emission rate compared with the required formaldehyde level of 0.1mg/m^3. Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – Indoor Advantage Gold – Building Materials – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – Eco INSTITUT Label
	Manufacturer also to confirm	The absence of prohibited wood preservatives/biocides.

[C] Timber structures (e.g. glue laminated timber)		
Option 1	**Performance requirements**	Formaldehyde E1 Class
	Compliant performance standards	BE EN 14080:2005 Timber structures - Glues laminated timber - Requirements
	Compliant testing standards	BS EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – Indoor Advantage Gold – Building Materials – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – Eco INSTITUT Label
Option 2	**Performance requirements**	Formaldehyde level of 0.1mg/m^3
	Compliant testing standards	– BS EN ISO 16000-9:2006 Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method. OR – Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 - Emission testing method for California Specification 01350, Californian Department for Public Health, 2010. Note: For either method the resultant emission/surface area obtained from the chamber test method must be extrapolated to predict what the emissions would be in a theoretical model room (as detailed in the standard) and this extrapolated emission rate compared with the required formaldehyde level of 0.1mg/m^3. Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – Indoor Advantage Gold – Building Materials – French VOC Regulation – Class A+/Class A/Class B – AgBB

[C] Timber structures (e.g. glue laminated timber)		
		– M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – Eco INSTITUT Label

[D] Wood flooring (e.g. parquet)		
Option 1	**Performance requirements**	Formaldehyde E1 Class
	Compliant performance standard	BS EN 14342:2005+A1:2008 Wood flooring - Characteristics, evaluation of conformity and marking
	Compliant testing standards	BS EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – FloorScore – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – EU Ecolabel for wooden floor coverings – Belgian VOC Regulation – Eco INSTITUT Label
Option 2	**Performance requirements**	Formaldehyde level of 0.1mg/m^3
	Compliant testing standards	– BS EN ISO 16000-9:2006 Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method. OR – Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 - Emission testing method for California Specification 01350, Californian Department for Public Health, 2010. Note: For either method the resultant emission/surface area obtained from the chamber test method must be extrapolated to predict what the emissions would be in a theoretical model room (as detailed in the standard) and this extrapolated emission rate compared with the required formaldehyde level of 0.1mg/m^3. Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – FloorScore – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – EU Ecolabel for wooden floor coverings – Belgian VOC Regulation – Eco INSTITUT Label

[E] Resilient textile and laminated floor coverings (e.g. vinyl, linoleum, cork, rubber, carpet, laminated wood flooring)		
Option 1	**Performance requirements**	Formaldehyde E1 Class
	Compliant performance standard	BS EN 14041:2006 Resilient, textile and laminate floor coverings - Essential characteristics
	Compliant testing standards	BS EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method Compliant alternatives:

[E] Resilient textile and laminated floor coverings (e.g. vinyl, linoleum, cork, rubber, carpet, laminated wood flooring)		
		– GREENGUARD Certified/GREENGUARD Gold – FloorScore – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Green Label Plus – GUT – Indoor Air Comfort/Indoor Air Comfort Gold – Belgian VOC Regulation – Eco INSTITUT Label
Option 2	**Performance requirements**	Formaldehyde level of 0.1mg/m^3
	Compliant testing standards	– BS EN ISO 16000-9:2006 Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method. OR – Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 - Emission testing method for California Specification 01350, Californian Department for Public Health, 2010. Note: For either method the resultant emission/surface area obtained from the chamber test method must be extrapolated to predict what the emissions would be in a theoretical model room (as detailed in the standard) and this extrapolated emission rate compared with the required formaldehyde level of 0.1mg/m^3. Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – FloorScore – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Green Label Plus – GUT – Indoor Air Comfort/Indoor Air Comfort Gold – Belgian VOC Regulation – Eco INSTITUT Label

[F] Suspended ceiling tiles		
Option 1	**Performance requirements**	Formaldehyde E1 Class
	Compliant performance standard	BS EN 13964:2004+A1:2006 Suspended ceilings - Requirements and test methods
	Compliant testing standards	BS EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method Complaint alternatives: – GREENGUARD Certified/GREENGUARD Gold – Indoor Advantage Gold – Building Materials – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – Eco INSTITUT Label
Option 2	**Performance requirements**	Formaldehyde level of 0.1mg/m^3
	Compliant testing standards	– BS EN ISO 16000-9:2006 Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method. OR

[F] Suspended ceiling tiles		
		– Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 - Emission testing method for California Specification 01350, Californian Department for Public Health, 2010. Note: For either method the resultant emission/surface area obtained from the chamber test method must be extrapolated to predict what the emissions would be in a theoretical model room (as detailed in the standard) and this extrapolated emission rate compared with the required formaldehyde level of 0.1mg/m^3. Compliant alternatives: – GREENGUARD Certified/GREENGUARD Gold – Indoor Advantage Gold – Building Materials – French VOC Regulation – Class A+/Class A/Class B – AgBB – M1 Emission Classification of Building Materials – Indoor Air Comfort/Indoor Air Comfort Gold – Eco INSTITUT Label

[G] Flooring adhesives	
Performance requirements	Carcinogenic or sensitising volatile substances are substantially absent
Compliant performance standard	BS EN 13999-1:2013 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 1: General procedure
Compliant testing standard	– BS EN 13999-1:2013 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 1: General procedure – BS EN 13999-2:2013 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 2: Determination of volatile organic compounds – BS EN 13999-3:2007+A1:2009 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 3: Determination of volatile aldehydes – BS EN 13999-4:2007+A1:2009 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 4: Determination of volatile diisocyanates Complaint alternatives: – AgBB – M1 Emission Classification of Building Materials – EMICODE EC 1PLUS/EMICODE EC 1/EMICODE EC 2 – Indoor Air Comfort/Indoor Air Comfort Gold – Belgian VOC Regulation – Eco INSTITUT Label

[H] Wall coverings	
Performance requirements	– Vinyl chloride monomer (VCM) content – Formaldehyde level – Migration of heavy metals
Compliant performance standard	– BS EN 233:1999 Wallcoverings in roll form - Specification for finished wallpapers, wall vinyls and plastic wall coverings – BS EN 234:1997 Wallcoverings in roll form - Specification for wallcoverings for subsequent decoration 3. – BS EN 259-1:2001 Wallcoverings in roll form - Heavy duty wallcoverings - Part 1: Specifications
Compliant testing standard	BS EN 12149:1998 – Wall coverings in roll form. Determination of migration of heavy metals and certain other elements, of vinyl chloride monomer and of formaldehyde release

	Compliant alternatives: – No current complaint alternatives

3.0 Strategic Aspects

3.1 Goals

Goal	KPI	Verification
As defined under the CWCL Sustainability Strategy, the company aims to achieve Full Project FSC Certification on all applicable projects	100% FSC Certified Timber across all CWCL projects	To ensure an adequate measurement and verification process and to achieve our target of full FSC Project Certification, all projects are verified by an independent certification body.
All projects to achieve at least 36% of the available responsible sourcing points under the BREEAM (or other Environmental Assessment Methodology) Responsible Sourcing Credits	Achieve 80% by volume of certified Responsibly Sourced Major Materials as per the relevant BREEAM guidelines	For each BREEAM project, CWCL aims to maximise the BREEAM score for the responsible sourcing of materials credits. Target achievement is measured and verified by the numbers of BREEAM credits achieved at project completion.

3.2 Environmental Management

Trade contractors, suppliers and consultants, particularly larger companies, are expected to have a formal EMS in place, ideally independently certified to a recognised standard.

It may not be realistic to expect smaller contractors to have an independently certified EMS. However, they will still need to have procedures in place to minimise their environmental impacts, and as a minimum requirement should sign up to CWCL's environmental policy.

3.3 Rationale for standards

Timber
Chain of Custody provides a guarantee from the supplier that the timber or timber product is from a sustainably managed forestry source. Only a sustainable certification scheme will provide any guarantee that the forest is being managed sustainably.

Concrete/Cement
Cement/concrete manufacture is energy intensive. Preference is given to manufacturers that have procedures to minimise their energy use and reduce CO_2 emissions, e.g. by using alternatives to fossil fuels.

Glass
The extraction and manufacture of glass is highly energy intensive and highly dependent on raw material resources. The focus of its procurement should be on prioritising manufacturers that use fuels with low emissions and employ energy efficient processes.

Metals (Steel, Aluminium)
Metals manufacture processes are highly energy intensive, therefore the focus should be on prioritising the use of recycled metals, lowering energy use and reducing emissions as well as the use of harmful substances.

Although it may not be feasible or in some cases even desirable, to attempt to minimise the use of energy intensive materials such as steel, by endeavouring to procure from manufacturers with procedures in place to minimise energy use and carbon emissions, the company can minimise as far as possible the embodied energy in construction materials.

Stone

The major environmental impacts associated with the use of natural stone within construction projects are linked to its extraction and transportation processes. By endeavouring to procure from manufacturers with procedures in place to minimise energy use and carbon emissions and by adopting best practice for the extraction processes, the company can minimise as far as possible the environmental impacts of stone materials.

Insulation
Manufacturers of insulation should have measures in place to minimise energy use, carbon emissions and the use of harmful substances.

For the insulation materials it is particularly relevant to analyse the Global Warming Potential (GWP) and the Ozone Depletion Potential (ODP) of insulation materials, which should be less than 5 for the GWP and 0 for the ODP. This includes all blowing agents.

3.4 Environmental Product Declarations (EPD)

An EPD is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products. It does not certify any environmental performance but acts as a disclosure document. To ensure the standardisation of EPDs, they should comply with recognised standards such as ISO 14025 or EN 15804.

CWCL encourages all Trade Contractors to ask their supply chain to provide EPDs for all materials.

3.5 Embodied Carbon

Embodied carbon is a measure of the total amount of emissions generated to produce an asset. It includes emissions from the extraction, manufacture, transportation and assembly of every component in an asset. It also looks at the maintenance, replacement, deconstruction, disposal and end-of-life aspects of the asset. Operational emissions are omitted from the calculations.

CWCL considers embodied carbon accounting to be good practice and will be comparing the percentage of embodied carbon in buildings against total life-cycle analyses. This will be supported by the sustainable design strategy where targets are being set to reduce embodied carbon. CWCL encourages contractors to disclose life-cycle information about their products, using recognised methods such as EPDs.

4.0 The Procurement Framework

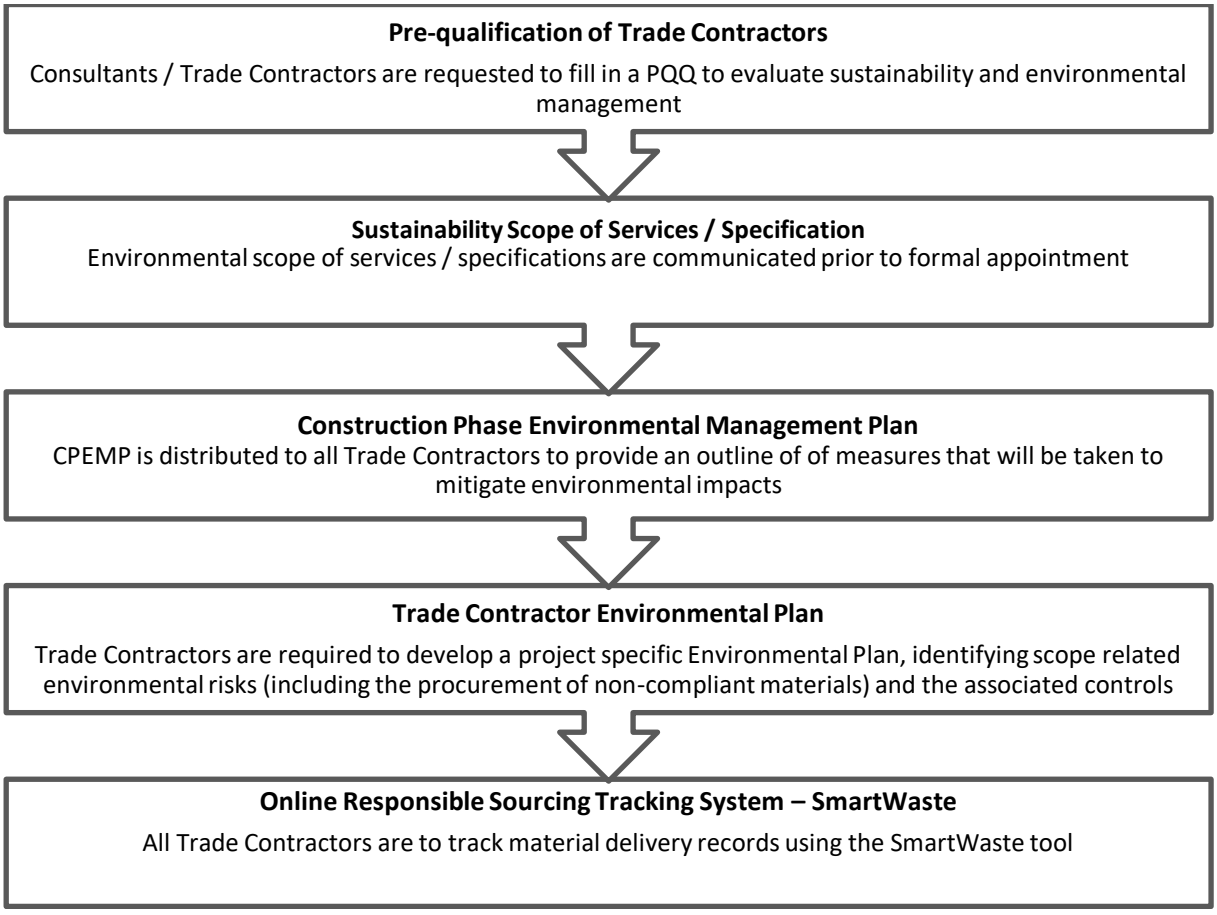
4.1 Overview

CWCL integrates sustainability into its procurement policy and has in place project management processes to integrate sustainability objectives into the supply chain. These processes help deliver sustainability objectives whilst managing risk.

These processes include reporting on sustainability Key Performance Indicators (KPIs) (section 3.1).

Processes have been put into place to ensure projects cannot progress until they demonstrate compliance with all sustainability objectives.

CWCL have developed a robust monitoring and performance evaluation process to ensure target achievement. The procedures in practice are described below:



Pre-Qualification Questionnaires

CWCL PQQs assess the resources and capability of suppliers who express interest in a contract opportunity. The intention of this stage of the procurement process is to identify the suppliers who are most capable of performing the contract and comply with CWCL Sustainability targets. Within the PQQ is a section to evaluate the suitability, capacity and capability of prospective suppliers regarding environmental matters.

Sustainability Scope of Services / Specifications
After the PQQ phase and once the consultants / trade contractor have been pre-selected, a detailed document listing the sustainability scope of services for the project is included within the contractual requirements of the consultant / trade contractor. The Sustainable Procurement Plan is included within the trade contracts.

Construction Phase Environmental Management Plan

The CPEMP document provides an outline of the environmental management controls that are employed to mitigate potential environmental impacts during the construction of the project in accordance with:

- Legislation and other statutory and local requirements; (also refer the CWG Register of Environmental Legislation on Infobase)

- The Canary Wharf Group plc (CWG) Environmental Policy (G-EMS-05), and detailed objectives and targets established by the CWG Environmental Management Review Group to lessen the impact of Significant Environmental Aspects

- Canary Wharf Contractors Ltd project procedure “Environment & Local Issues” (PP-19)

- Project specific objectives and targets established by CWCL and/or the client

- Sustainability Implementation Plans, BREEAM and Code For Sustainable Homes requirements which are applicable to Project Site Management, including the responsible sourcing targets for the project

- Local Authority Planning requirements

- Considerate Constructor Scheme (CCS)

The CPEMP is a guideline for all those involved in the construction of the project (all CWCL personnel, Trade Contractors, etc.) on how the site will operate with respect to the environment, defining the environmental requirements, responsibilities and control measures.

Project Environmental Risk Register

The Risk Register document is a list of hazards, associated risks and controls.

At CWCL, each main project has a Risk Register document, which lists all associated environmental risks. All Risks are defined against the targets of the CWG Sustainability Strategy, Statutory Requirements and Project Specific Requirements.

Specific Design and Construction Environmental Risk assessments are prepared for each project at key project stages, where all aspects are listed and control mechanisms are put in practice. This includes any risks associated with the responsible sourcing of materials.

All trade contractors and consultants are required to submit an environmental risk register specific to their scope of work.

Trade Contractor Environmental Plan

All Trade Contractors are required to complete an environmental management plan that they will be obliged to follow during project implementation.

This document should list specific procedures that the trade contractors will put in place to mitigate specific risks associated with their activities.

Online Responsible Sourcing Tracking System – SmartWaste

The BRE have developed an online monitoring and reporting tool called SmartWaste specific to the construction industry. All Trade Contractors are required to input their evidence of responsible procurement (i.e. delivery notes) into the tool which also tracks energy & water use and waste generation. Access and training will be provided by CWCL. Full details will be provided at the package kick-off meeting.

Verification

All certification / testing datasheets are to be reviewed upon submission of the Trade Contractor Environmental Plan. Delivery tickets are to be provided throughout construction and uploaded to SmartWaste by the trade contractor. This should include any responsible sourcing certificates and certificates of testing methods for products containing VOCs. This process will be audited on a regular basis by CWCL's sustainability team to ensure that appropriate reporting and monitoring is being enforced. Moreover, mid and post tender meetings will be carried out to reinforce the importance of achieving compliance with the procurement policy of CWG.

Section 5.0 Communication

5.1 Awareness and Training

CWCL has a comprehensive awareness and training process in place. The process is focused on two key stakeholders: trade contractors and CWCL staff.

CWCL staff: All new employees at CWCL are to receive adequate training, which covers responsible sourcing of materials and sustainable procurement principles. On-going internal training on environmental and sustainability requirements also takes place during project progress meetings.

Trade contractors and site operatives: Toolbox talks are prepared periodically to improve trade contractors' and site operatives' understanding on the subject and to ensure they monitor and participate in meeting the CWCL requirements. Each Trade Contractor will be required to have nominated person(s) for the upload of information to SmartWaste and an FSC Champion, both roles will receive training from CWCL.

Appendix VII – Sustainable and Healthy Materials Brief

CANARY WHARF
CONTRACTORS

CWCL SUSTAINABLE AND HEALTHY MATERIAL BRIEF

Document Owner: CWCL Sustainability Manager

REVIEW PERIOD: ANNUALLY

Table of Contents

1.0 General

1.1. Purpose and General Information

This brief is aimed at all of Canary Wharf's stakeholders involved in material selection and procurement of a building and temporary works. Attention should be paid to the environmental and health impacts of materials throughout their lifecycle, including extraction, manufacture, procurement, construction, maintenance and disposal.

Priority should be given to the reduction of material used through efficient design or on-site re-use of material. Where this is not possible, this brief should be used to inform the choice and procurement of materials.

This brief will also support CWG's aspirations in terms of environmental assessments such as BREEAM, Code for Sustainable Homes (CfSH), the WELL Standard and the wider corporate sustainability strategy. The assessments relevant to the requirements are highlighted at the beginning of each section.

In the case of any lack of alternatives, doubt, or lack of information, please contact the CWG Sustainability Team. Examples of compliant certification documents are available upon request.

It is expected that the relevant targets will be included in the specifications of respective parties to ensure that these are applied through Canary Wharf's supply chain.

If you have any questions, please contact one of the following members from the Sustainability Team:

Sustainability Team
Canary Wharf Contractors
Sustainability@cwcontractors.com
+44 (0)20 7418 2000

2.0 Prohibited Materials

All Projects – Banned materials	Compulsory

Any substances or materials generally known in the United Kingdom construction industry to be harmful to human health and safety or banned by law or not in accordance with relevant British standards and codes of practice.

In the case that a material is required for fire performance as specified by the Project's fire engineers, then the rules below do not apply. If there is a lack of alternatives for a specific product, please contact the CWG Sustainability Team.

All materials procured by CWG will be reviewed against the following 2 lists which are detailed in **Error! Reference source not found.**:

- Banned list – Materials/ chemicals currently banned under EU legislation, UK regulation or CWG requirement

All Projects – Restricted materials | Recommended

Any substances or materials generally known in the United Kingdom construction industry to be harmful to human health and safety and considered good practice to avoid in construction projects.

- Restricted list – Materials/ Chemicals to be restricted: a detailed justification is required to allow its use (see Appendix B - Material Justification Form)

3.0 Lifecycle Impacts

3.1. BRE Green Guide ratings

BREEAM 2011, BREEAM 2014, CfSH | Compulsory

a. Major building materials with Green Guide Ratings of A and above shall be prioritised wherever possible. This includes external walls, windows, roof, upper floor slab, internal walls and floor finishes / coverings (where applicable).

b. At a minimum, all insulation (acoustic and thermal) shall have a Green Guide rating of A or A+.

c. All refrigerants must have a Global Warming Potential of less than ten and zero Ozone Depleting Potential.

d. Materials used for external hard landscaping shall have a Green Guide rating of A or A+. Where this isn't feasible, please contact the CWG sustainability team.

Useful links: https://bregroup.com/greenguide/podpage.jsp?id=2126

3.2.Environmental Product Declarations (EPDs)

BREEAM (ALL) | Recommended

a. EPDs are independently verified and registered documents that communicate the life-cycle environmental impact of a product. EPDs should be compliant with recognised standards such as ISO 14025, ISO 21930 and BS EN 15804. For an example EPD, please refer to **Error! Reference source not found.**.

b. There are two types of EPDs, both of which are acceptable:

   i. Sector EPD: this is obtained by calculating the average product of multiple companies in a clearly defined sector and / or geographical region. This is not as accurate as product-specific EPDs and therefore such EPDs hold less value.

   ii. Product-specific EPD: this is a more accurate calculation done on the actual material produced by the specific manufacturer and is therefore of higher value than sector EPDs. Product-specific EPDs should always be prioritised.

c. EPDs are not yet available for all material types and some industries are further ahead than others. Insulation, concrete, steel, glazing & façade elements and plasterboard, for example, have a lot more EPD availability than other materials. As

such, it is expected that the majority of these products procured will have EPDs available.

d. All other building materials, including fit-out materials and products, should maximise the number of EPDs obtained.

e. The total value of the materials with EPDs will then be quantified as a percentage cost of the project – for commercial buildings, this will feed into the Life Cycle Analysis.

f. Useful links: http://www.greenbooklive.com/search/scheme.jsp?id=260

https://www.environdec.com/Epd-Search/?search_type=simple&Category=7764

g. If sample EPDs are required please get in touch with the sustainability team.

3.3. Embodied carbon

BREEAM 2014, 2018 — **Recommended**

a. Below is a table of the current CWG commercial project intensity targets (the figures are in kg $CO2_e/m^2$ of GIA at year 0):

Building	Carbon intensity baseline
Wood Wharf D1/D2	445
Wood Wharf D3/D4	554
Wood Wharf C2	538
Wood Wharf B3	535

b. Future commercial building baselines will be expected to fall within the range of these figures and improve them wherever possible.

c. The calculations will be done by a third party sustainability consultant and the design consultants will be expected to follow the recommendations of the report wherever possible.

4.0 Sustainable procurement

All Projects — **Compulsory**

The following products must be specified according to the following certifications at a minimum (in order of preference). These should be included in the architectural specifications:

Material	Certification Scope	Certification
Timber & Wood Based Products Virgin Timber, Wood panel and wood based composite products such as Oriented Strand Board, plywood, HPL, chipboard / particle, glulam, LVL, etc.	**Key Process:** Entire product lifecycle captured through Chain of Custody	Reused timber
		Forest Stewardship Council (FSC) – NO ALTERNATIVES WILL BE ACCEPTED
Primary Structural Steel & Reinforcement (Rebar)	**Key Process:** Metal product manufacture, e.g.	Reused metals

Material	Certification Scope	Certification
Steel, any other metals used within the primary structure, steel reinforcement	steel section production	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing
		CARES Sustainable Construction Steel (SCS) Scheme
		Eco-reinforcement Responsible Sourcing Standard
Concrete & Cement Products Ready-mixed concrete, precast concrete products, concrete blocks, cement, Cement bonded particle board	**Key Process:** Ready-mixed concrete plant, Concrete product manufacture **Supply Chain Process:** Cement production, Aggregate extraction and production	Reused concrete
		BRE Global, BES 6001 - Framework Standard for Responsible Sourcing (Good)
Glass	**Key Process:** Glass production **Supply Chain Process:** Sand extraction Soda ash production or extraction	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing
		EMS – Certified Environmental Management System, key processes and supply chain
		EMS – Certified Environmental Management System, key processes only
Plasterboard	**Key Process:** Plasterboard or plaster manufacture **Supply Chain Process:** Gypsum extraction synthetic gypsum (from flue gas desulphurisation) by default (recycled content)	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing (Good)
Insulation Foam Insulation Wool, Stone wool, glass & cellular glass	**Key Process:** Insulation / product manufacture **Supply Chain Process:** Main polymer production, e.g. Polystyrene, MDI, Phenolic resin or equivalent Any quarried or mined mineral over 20% of input Wool scouring	BRE Global, BES 6001 - Framework Standard for Responsible Sourcing
		EMS – Certified Environmental Management System, key processes and supply chain

All other materials should have, as a minimum, a certified Environmental Management System in place for key processes (eg: ISO 14001).

5.0 Reuse of Materials, Material Recovery and Recycled Content

All Assessments — **Recommended**

Reuse any existing material on-site if possible.

Designs should always consider ease of disassembly and focus on the end-of-life of a material. A design must optimise product recovery and material recyclability when the material is recovered to minimise the future need for primary material feedstock.

BREEAM (ALL) **Recommended**

Prioritise materials with higher levels of recycled and reused content wherever possible. Recycled content is defined as the portion of materials used in a product that have been diverted from the solid waste stream. Whilst there is no certification in place for this, details of recycled content can be found on product datasheets or upon request to the supplier.

As a minimum, the following targets of recycled or reused content in products and materials must be met based on % of material value[1] :

	Baseline	Good practice	Best practice*
Commercial retail	11-32%	21-44%	45%
Commercial offices	10-22%	12-30%	35%

*these are the figures that we will expect consultants to comply with.

Below are indicative figures of recycled content in specific materials based on industry standards – materials procured should align as closely to these as possible. Should the figures below not be feasible, please submit the alternative to the CWG Sustainability Team:

Material	Type	Recycled content benchmark	Notes / examples of compliant products*
Cement[2]	Pulverised Fly Ash (PFA)	30%	To be discussed with the structural engineer to discuss potential constraints. This is of particular relevance to concrete used in basements but should be investigated for use above grade.
	Ground Granulated Blast Furnace Slag (GGBS)	70%	
Aggregates[3]	Sub-bases, fill, external works	80%	Subject to approval from structural engineers. Please note that the structural concrete aggregate replacement is only for light-weight structures.
	Structural concrete	30%	
	Aggregate-containing products (eg: pavers and blocks)	80%	
Steel	Reinforcement	95%[4]	Sourcing reinforcement steel produced by means of Electric Arc Furnace (EAF) helps to achieve this as EAF uses around 95% scrap metal for the final product[5], a much higher percentage than steel from Basic Oxygen Furnace. All steel with the Eco-Reinforcement certification are produced using

[1] http://www.sustainabilityexchange.ac.uk/files/wrap_benchmarks_for_target_setting.pdf
[2] https://www.hanson.co.uk/en/ready-mixed-concrete/sustainable-concrete/benefits
[3] Draft London Plan Policy S.10 Aggregates
[4] https://precast.org/2010/05/the-green-side-of-precast-concrete/
[5] http://www.eco-reinforcement.org/requirements-of-eco-reinforcement/

Material	Type	Recycled content benchmark	Notes / examples of compliant products*
			EAF and as such comply with the benchmark.
	Structural steelwork	60%[6]	Subject to approval from structural engineers.
	Non-structural	80%	
Glass		35%[7]	St Gobain glass: 35%-41%[8] AGC glass: 30%[9]
Aluminium		50-80%	Alcoa Ecodura: 50%[10] Wausau windows and curtainwalling systems: 70-83%[11] Kawneer curtain walling: 75%[12]
Insulation	Glass wool[13]	80%	Knauf mineral wool: 80%[14] Isover Climcover Roll Alu2: 86%[15] Isover glass mineral wool: 80%[16]
	Rockwool	20-30%[17]	Rockfon: 40%[18] Thermafiber mineral wool: 70%[19] Rockwool: 56%[20] Isover stonewool: 30%[21]
	Cellulose	82-85%[22]	Excel Industries - Warmcell 300: 76%[23] Thermofloc: 91.6%[24] Isocell: 90%[25]
	XPS	20%	Kingspan GreenGuard XPS: 20%[26] Owens Corning Foamular XPS: 20% [27]
Plasterboard		90%	British Gypsum Gyproc plasterboard: 90.03%[28]

[6] WRAP
[7] https://www...kgbc.org/wp-content/uploads/2018/10/-ow-to-guide_Buildng-glass-into-CE.pdf
[8] https://uk.saint-gobain-building-glass.com/en-gb/glass-return-scheme
[9] http://www.agc-glass.eu/sites/default/files/2018-05/chapter06-Earn%20LEED%20points%20with%20AGC%20glass%20.pdf.pdf
[10] https://www.alcoa.com/global/en/what-we-do/cast-products/
[11] http://www.wausauwindow.com/index.cfm?pid=68&pageTitle=Recycled-Aluminum
[12] https://www.kawneer.com/kawneer/europe_kingdom/pdf/kawneer_curtain_wall_epd.pdf
[13] http://www.greenspec.co.uk/building-design/insulation-mineral/
[14] https://www.knaufinsulation.co.uk/why-knauf-insulation/sustainability
[15] https://www.isover.co...k/products/climcover-roll-alu2
[16] BREEAM Mat 04 Responsible Sourcing Statement for Isover's Structural Insulation Applications
[17] https://www.encon.co.uk/sites/default/files/rockwool%20sustainability%20brochure.pdf
[18] https://cor01rockfon.co...k/sys-assets/commerce/en-gb/tiles/documents/product-sustainability-declaration/uk-product-sustainability-declaration-rockfon-color-all-wall-ceiling_e_04_20188.pdf?t=20181213160709
[19] https://www.thermafiber.com/wp-content/uploads/2013/11/Recycled-Content-Data-Sheet.pdf
[20] http://www.wrap.org.uk/sites/files/wrap/Rules_of_Thumb1.pdf
[21] https://www.isover-technical-insulation.com/stone-wool
[22] https://www.energy.gov/energysaver/weatherize/insulation/insulation-materials
[23] http://www.wrap.org.uk/sites/files/wrap/Rules_of_Thumb1.pdf
[24] https://www.thermofloc.com/palmCMSv3/_data/manager/files/EPD_EPD-PSG-20150321-IBAI-EN_English.pdf
[25] http://www.oai-epd.at/wp-content/uploads/2014/11/EPD-_SOCELL_GaB_20140825-Eng_sn.pdf
[26] GreenGuard XPS Insulation Board – Contribution to LEED credits
[27] https://www2.owenscorning.com/literature/pdfs/XPSFoam_LEED.pdf

Material	Type	Recycled content benchmark	Notes / examples of compliant products*
			Knauf: 95%[29]
Chipboard		30-70%	Kingspan RMG system chipboard component: 30%[30] Egger chipboard: 30%[31] Kronospan chipboard: 70%[32]

*Please note that the products highlighted are for reference only and do not indicate any preference for supplier or material.

6.0 Local Sourcing

All assessments — **Recommended**

Local sourcing, meaning materials or products which have been extracted, harvested or recovered, as well as manufactured, up to 500 miles of the project site[33], shall be prioritised.

Concrete has a particularly high potential for local sourcing and should be maximised wherever possible. The average delivery distance for all concrete in the UK in 2016 was 45km and the average delivery distance for its raw materials was 57km. This only applies to in-situ concrete and not pre-cast.

As this is a UK-wide average, concrete procured for CWG projects should adhere or exceed these figures wherever possible.

7.0 Health and Wellbeing

BREEAM 2011, 2014, 2018, WELL Assessment — **Recommended**

VOCs are gases emitted from certain solids or liquids which can have short and/or long-term adverse health effects.

Avoid the use of materials containing high VOC content in paints & coatings, sealants & adhesives, flooring, ceiling systems, thermal & acoustic insulation and furniture & furnishings. For a full list, please refer to Appendix D – VOC limits.

Useful links: http://www.mindfulmaterials.com/

https://level.ecomedes.com/

https://spot.ul.com/

Logos to look out for that indicate low VOC content (this is not an exhaustive list):

[29] https://www.british-gypsum.com/about-us/sustainability-faqs
[30] Knauf UK Sustainability Scorecard 2017 Dataset
[31] LEED Data - Green Building Leadership - Kingspan Access Floors
[32] https://www.egger.com/shop/en_GB/about-us/environment/recycling
[33] https://www.pbpaywood.com/kronospan-o2-superfine-eo-board.htm
[34] LEED v4

WELL Assessment

The chemicals listed below should be avoided altogether (including in packaging), unless required for fire performance or lack of alternatives. In the case of the latter, please send the material to the CWG Sustainability Team for review.

a) Mercury – less than 100ppm in new furniture, furnishing and electrical components. Illuminated exit signs, thermostats, switches and electrical relays must be mercury free,
b) Lead
c) Hexavalent Chromium – less than 100ppm in all new furniture, furnishing and electrical components
d) Antimony – less than 100ppm
e) Phtalates – less than 100ppm in flooring, wall coverings, window blinds & shades, shower curtains, furniture & upholstery and plumbing pipes & moisture barriers. Electrical components (fire alarms, meters, sensors, thermostats and load break switches) must contain phthalates at less than 100ppm.
f) Isocyanate-Based Polyurethane from interior finishes
g) Perfluorinated compounds (PFCs) – less than 100ppm in components that constitute at least 5% by weight of a furniture or furnishing.
h) Polyvinyl Chloride (PVC) – less than 100ppm in flooring, wall coverings, window blinds & shades, shower curtains, furniture & upholstery and plumbing pipes & moisture barriers Chlorinated Polyethylene and Chlorosulfonated Polyethylene.
i) Artificial turf with pure polyethylene fibres
j) Petrochemical Pesticides and Herbicides
k) Avoid outdoor structures made from high or low density polyethylene (HDPE or LDPE). These should not contain wood-plastic composites, multiple commingled recycled consumer plastics, fiberglass (for non-structural applications) polystyrene or polyvinyl chloride (PVC).

For all installed interior finishes and finish materials, furnishings, in-built furniture, products that restrict the use of hazardous ingredients and promote material transparency are encouraged. The following schemes are compliant:

a) Declare Labels
b) Health Product Declarations
c) Global GreenTag Standard v4.0
d) Green Screen
e) Cradle to Cradle

If sample certificates are required please get in touch with the sustainability team.

8.0 Appendices

- Appendix A – Banned and Restricted products
- Appendix B – Material Justification Form
- Appendix C – Example EPD
- Appendix D - VOC Limits

8.1. Appendix A - Banned and Restricted Products

Name	Where it can be found	Reason for the ban	Notes
Banned			
High Alumina Cement (HAC) in structural elements or Calcium Aluminate Cement	Structural Concrete as HAC and non-structural uses as CAC	**Structural safety** BS EN 206:2013+A1:2016 BS 8500-1:2015+A2:2019	
Non BS compliant aggregates in concrete	Concrete	**Structural safety** BS EN 206:2013+A1:2016 BS 8500-1:2015+A2:2020	
Calcium Chloride admixtures in reinforced concrete	Concrete	**Structural safety** BS EN 206:2013+A1:2016 BS 8500-1:2015+A2:2019	
asbestos and any material containing asbestos	Electrical insulation and building insulation in old buildings. Textured coatings Contaminated vermiculite insulation	**Asbestos Regulations, 2006**	
Chlorofluorocarbons (CFCs) and any material containing CFCs or using CFCs in its manufacture	M&E principally but risk to encounter CFCs is close to zero in new manufactured system	**EC Regulation 1005/2009** on Ozone Depleting Substances (ODS), **Ozone-Depleting Substances Regulations 2015**	
Hydrochlorofluro-carbons HCFCs	Fridge, cooling system, heat pump. In some insulation or foams but very unlikely in new manufactured system	**EC Regulation 1005/2009** on Ozone Depleting Substances (ODS), **Ozone-Depleting Substances Regulations 2015**	
Halons/ Bromofluorocarbons	Insulation, furniture foam and upholstery, electronics, wire and cable jacketing	**EC Regulation 2037/2000**	

Name	Where it can be found	Reason for the ban	Notes
Banned			
Polychlorinated Biphenyls (PCBs), Polychlorinated Terphenyls (PCTs)	window replacement, flourescent light ballasts, Bleaching fibres for paper or textiles, or the manufacture of chlorinated phenols, particularly when reaction temperature is not well controlled	**Regulation (EC) No 850/2004** on persistent organic pollutants, **Directive 96/59/EC** Stockholm Convention on Persistent Organic Pollutants	Safe PCB Abatement Activities : -Characterization and sampling. -Protective measures for workers. -Safe storage and disposal. -Record keeping.
Azoic Dyes	Carpets, upholstery	AZO Dyes - **Directive 2002/61/EC** – only regulates certain arylamines superseded by **REACH Regulation**	
Pentabromodiphenyloctabromodiphenyl and decabromodiphenyl ethers	carpet, polyurethane foam	**DIRECTIVE 2003/11/EC** Use been restricted since 2004	
Polychlorinated Biphenyls (PCBs), Polychlorinated Terphenyls (PCTs)	Bleaching fibres for paper or textiles, or the manufacture of chlorinated phenols, particularly when reaction temperature is not well controlled	**Regulation (EC) No 850/2004** on persistent organic pollutants, **Directive 96/59/EC** Stockholm Convention on Persistent Organic Pollutants	
Non FSC certified woods with full chain of custody	Doors, furniture, worktop, pipe insulation	**Environmental concerns** Deforestation, habitat destruction **Social concerns** Conflicts and migration	Not prohibited legally byt CWG requirement.
Mercury	Exit signs, Thermostats, Switches, Electric Relays, HVAC, lamps, compact fluorescent lightbulbs (CFL) illuminated exit signs.	**Human Toxicity** Impairs neurological development	Traces in portland cement allowed. Furniture and furnishing <100 ppm
limits on levels of VOC	Coatings	**VOC in paints, varnishes and Vehicle Refinishing products Regulations 2005**	Partially addressed under the restricted list

Name	Where it can be found	Reason for the ban	Notes
Banned			
Lead and lead compounds	roofing and flashing, pipe solder, flexible PVC, paint, alloys, artificial turf with pure polyethylene fibres, electrical components Drinking Water Inspectorate (DWI) approved list or BS EN16057:2012	**Human toxicity:** Can be absorbed by inhaling, causes symptoms like headaches, tiredness, irritability, anaemia or stomach pains. Neurotoxin that accumulates both in soft tissues and the bones. Continued uncontrolled exposure can cause more serious problems like kidney, nerve and brain damage, and even possibly cancer. **The Control of Lead at Work regulations 2002**	Traces in Portland cement and Fly Ash allowed, to be less than 100ppm. Interior paints <90 ppm Artificial turf <300 mg/Kg
Arsenic and arsenic compound	outdoor structures and preservation of wood, wood structures (CCA (Chromated copper arsenate) treated timber), insecticides	**Human Toxicity:** Human toxicity disrupts ATP which leads to organ failure. Cause cancers of the skin, bladder, and lung as well as neurological and cardiovascular illness Since June 2004 use of CCA-treated timber in the UK has been restricted. Following EU Directive amendment **76/769/EEC** arsenic compounds may not be used 'in the preservation of wood.	
Phthalates DEHP, DBP, BBP, DINP, DIDP or DNOP (often found in polyvinyl chloride (PVC))	Electrical components: Fire alarms, meters, sensors, thermostats and load break switches. Other: Flooring, including resilient and hard surface flooring and carpet, Wall coverings, window blinds and shades, shower curtains, furniture and upholstery, Plumbing pipes and moisture barriers	**Human toxicity** Male and female fertility impairment, asthma, thyroid. Adverse effects on the lungs, liver and kidneys. **Environment:** Phthalates may also pose risks for aquatic and terrestrial ecosystems particularly in the vicinity of phthalate processing industries. Some phthalates are bioaccumulative and have been detected in aquatic organisms. **ROHS / REACH Regulation and Phthalates Directive 2005/84/EC**	Electrical components: <1000 ppm other <100 ppm permitted

Name	Where it can be found	Reason for the ban	Notes
Banned			
Cadmium and cadmium compound	Furniture, furnishings and electrical components, batteries, alloys, coatings (electroplating), solar cells, plastic stabilizers, and industrial paints.	**Human toxicity** cadmium and its compounds as being carcinogenic in humans. Causees respiratory problems (e.g. tracheo-bronchitis, pneumonitis, and pulmonary edema), bones become soft, lose bone mineral density; renal failure **ROHS / REACH Regulation**	Except galvanised metal and photovoltaic panels.Traces in Portland cement and Fly Ash allowed. However limit to <100 ppm
PBB (Polybrominated biphenyls) and PBDE (polybrominated diphenyl ethers)	Flame retardant chemicals, which are used to increase fire-resistance of materials	**Human Toxicity:** Associated with potential neurobehavioral, carcinogenic and immune effects. Some of these chemicals can bioaccumulate in fat and result in food chain contamination, including human milk. **ROHS / REACH Regulation**	
Hexavalent Chromium (Cr VI)	Electrical components: Fire alarms, meters, sensors, thermostats and load break switches.	**Human toxicity** All hexavalent chromium compounds are considered carcinogenic to workers. Eye damage, irritate the nose, throat, and lungs, Prolonged skin contact can result in dermatitis and skin ulcers. **ROHS / REACH Regulation**	<100 ppm permitted
Pentachlorophenol or timber treated with Pentachlorophenol	Timber treatment, textile, leather, carpet	**96/211/EC: Commission Decision of 26 February 1996 concerning the prohibition of pentachlorophenol (PCP)**	organochlorine compound used as a pesticide and a disinfectant. It prevents fungal growth and decay by bacteria
Pentabromodiphenyloctabromodiphenyl and decabromodiphenyl ethers (Brominated flame retardant)	carpet, polyurethane foam	**DIRECTIVE 2003/11/EC** Use been restricted since 2004	

Name	Where it can be found	Reason for the ban	Notes
Banned			
HBCDD (Hexabromocyclodo-decane)	Brominated flame retardant Also present in polycarbonate, Epoxy resin and Polyolefins	**Human toxicity** potential reproductive, developmental and neurological disruptor. **Ecological toxicity** highly toxic to aquatic organisms **Classed as a Substance of Very High Concern on the REACH list.** UN voted worldwide ban on the production and use of the flame retardant HBCD in May 2013. HBCD has been listed on the Stockholm Convention	

Name	Where it can be found	Reason for the ban	Notes
Restricted			
woodwool slabs in permanent formwork to concrete or in structural elements	Permanent formwork	**Engineering and structural safety**	
Polyvinyl Chloride - DEHP, DBP, BBP, DINP, DIDP or DNOP (often found in polyvinyl chloride [PVC])	Pipework, Flooring, including resilient and hard surface flooring and carpet backing, electrical cables, unplasticised PVC for construction, commercial signage products, plasticisers and vinyl records, Wall coverings, window blinds and shades, shower curtains, furniture and upholstery moisture barriers.	**Environmental concerns** Very polluting manufacturing process and disposal (e.g. release of dioxins)	
Chlorinated Polyethylene and Chlorosulfonated Polyethlene	roof membranes electrical connectors sheet membrane for pond liners Geo-membranes wire and cable jacketing	**Environmental concerns** Very polluting manufacturing process. (e.g. release of dioxins, hydrogen chloride) It is also a high embodied carbon manufacturing process	

Name	Where it can be found	Reason for the ban	Notes
Restricted			
Man-made mineral fibre (MMF) or naturally occurring fibres	Insulation, carpet	**Human toxicity** Fibre with a thickness of 3 microns or less and between 5 and 200 microns in length, unless appropriately sealed to prevent migration have a potential to cause cancer	materials containing fibres which have a diameter of three (3) microns or less and a length of two hundred (200) microns or less
Polyurethane (PUR) and Isocyanate-based PUR	Insulation, spray polyurethane foam (SPF), injection moulding, paints, binder in mineral insulation , PUR insulation	**Environmental concerns** Very polluting manufacturing process. (e.g. release of dioxins, hydrogen chloride) It is also a high embodied carbon manufacturing process Release of iscocyanates during manufacturing process and dioxins when burnt **Human toxicity:** respiratory sensitivity, irritation to eyes, nose, skin, allergies,.	
Polyisocyanurate foam (PIR)	Insulation, spray insulation, injection moulding	**Environmental concerns** Very polluting manufacturing process. (e.g. release of dioxins, hydrogen chloride) It is also a high embodied carbon manufacturing process **Human toxicity** Release of iscocyanates during manufacturing process and dioxins when burnt	
VOCs (Volatile Organic Compounds) Internal wall/ceiling coatings with VOC content <3g/l Internal wood/metal coatings with VOC content <80g/l Specialist coatings7 with VOC content <200g/l	Internal paint, intumescent coatings,	**Human toxicity** Respiratory issues (e.g. asthma), allergic reaction, headaches **Environmental concerns** Contribute to atmospheric pollution	

Name	Where it can be found	Reason for the ban	Notes
Restricted			
Formaldehyde	Manufactured timber products, mineral insulation (e.g. ROCKWOOL), adhesives, urea-formaldehyde foam (UFFI) in old buildings, composite wood products, laminating adhesives, resins, thermal insulation	**Human toxicity** classed as carcinogenic to humans (Group 1) according to IARC2 It is linked to nasopharyngeal cancer in humans.	Naturally occurring formaldehydes found in timber is acceptable. Others <100 ppm
Antimony	Furnishings and furniture (including textiles, finishes and dyes), electric components	**Human toxicity:** causes heart and lung problems, vomiting and abdominal pain, stomach ulcer, eye irritation, lung cancer.	<100 ppm permitted
Perfluorinated compounds (PFCs)	furniture or furnishings	**Human toxicity:** Firtility issues, ADHD, cholestrol, thyroid, birth defect, cancer,	< 100 ppm in components that constitute at least 5% by weight
halogenated flame retardants	Window, waterproofing membrane, door and window frames and siding, flooring, ceiling tiles, wall coverings, piping, electrical cables, conduits, junction boxes, sount and thermal insulation, upholstered furniture and furnishings, textile and fabrics.	**Human toxicity:** endocrine and thyroid disruption, impacts to the immune system, reproductive toxicity, cancer, and adverse effects on fetal and child development and neurologic function	< 100 ppm in components that constitute at least 20% by cost
wood-plastic composites, multiple commingled recycled consumer plastics, fiberglass, Polystyrene	Plastic Lumbar	**Environmental Concern:** takes a long time to decompose (500 years). Impact on global warming and marine pollution. **Human toxicity:** Polystyrene contains the toxic substances Styrene and Benzene, suspected carcinogens and neurotoxins that are hazardous to humans	plastic lumbar to be made from high or low density polyethylene (HDPE or LDPE)

Name	Where it can be found	Reason for the ban	Notes
Restricted			
petrochemical herbicides and pesticides	Pesticides for outdoor use	**Human toxicity** respiratory tract irritation, sore throat and/or cough allergic sensitisation, eye and skin irritation nausea, vomiting, diarrhoea, headache, loss of consciousness, extreme weakness, seizures and/or death. Long term exposure linked ot parkinson's, asthama, depression and anxiety, cancer and ADHD.	Hazard Tier ranking of 3 (least hazardous) based on the Pesticide Research Institute's PestSmart tool or "Least Restricted" based on the Pesticide Product Evaluator tool, except in cases of emergency.
Solvents containing 1,1,1 trichloroethaneor bromochloromethane (CBM) or carbon tetrachloride	glues, aerosol sprays, metal degreasing agents, paints, glues and cleaning products.	**Environmental Concern:** leaching in to water bodies and food. **Human toxin:** cancer, birth defects, breathing problems, impacts nervous system and liver.	
Tributyltin (TBT)	stabiliser in vinyl flooring, biocides in carpet	**Human toxicity** may interfere with breathing and cause headache, weakness, tremors and incoordination **Ecological toxicity** Extremely toxic to crustacean, bioaccumulation in oyster, salmon etc.	
ABS (Acrylonitrile butadiene styrene)	Pipework, synthetic rubber flooring	**Environmental concerns** Very polluting manufacturing process and disposal (e.g. release of dioxins)	
Expanded polystyrene	Insulation, packaging, food container	**Environmental concern** Although recyclable, currently not widely recycled **Fire Safety**	
Products containing chemicals rated in the material safety datasheet	Broad range of products from concrete release agent to sealant and plasterboard. Any product with a MSDS	**Human toxicity** Ingredients are carcinogenic, mutagenic, reproductive disruptor	

Name	Where it can be found	Reason for the ban	Notes
Restricted			
(MSDS) as: R39-43; R45; R46, R48; R50; R57; R58; R60 – R64. ; R67 Products containing the following hazard statement according to GHS : H300, H304, H310, H317, , H330, H334, H336, H340, H350, H351, H360-362, H400, H410, H420, H370, EUH201, EUH203, EUH204, EUH207		**Ecological toxicity** Very toxic to aquatic organism or long-term impact on the environment	
Anti-microbial (type of biocide)	carpet, bathroom sealant, grout	**Human toxicity**	
Chloroprene (Neoprene)	Geo-membranes weather stripping expansion joint filler water seals other gaskets and adhesives	**Environmental concerns** Very polluting manufacturing process. (e.g. release of dioxins, hydrogen chloride) It is also a high embodied carbon manufacturing process	

8.2. Appendix B - Material Justification Form

This form is to be used with reference to the CWG materials brief.			
Where design team or sub-contractor have design responsibility and propose to use a material on the Grey List, this justification form should be completed and approved by a member of the CWG Sustainability team.The designer must look into suitable alternatives where available and provide justification for use of a material in teh restricted list.			
Project Name		**Works Package:**	
Contractor Name (if applicable)		**Package Number:**	
Approval Sought by:			
Name		**Position**	
Justification for Use of Material on the Restricted list			
Include justification by comparing alternative materials/systems in terms of quality, function, environmental benefit, cost (direct and indirect), programme implication and any other relevant information.			
Approval Status (APPROVED, QUERY, NOT APPROVED)			
	Approver Name:		
	Position:		

8.3.Appendix D – VOC limits

BREEAM Emission limit				WELL Emission Limits		
Formaldehyde	Total VOC	Category 1A and 1B carcinogens	BREEAM Testing requirement	Formaldehyde	Total VOC	UK/ EU Equivalencies
Interior paints and coatings*						
≤0.06 mg/m^3	≤1.0 mg/m^3	≤0.001 mg/m^3	- EN 16402 - ISO16000-9 - EN16515 - CDPH Standard Method v1.1	10 µg/m^3 at 28 days to be met for eco-INSTITUT-Label		• Indoor Advantage Gold • A or A+ class rating under the French legislation on VOC emissions • eco-INSTITUT-Label (2015 version) • MAS Certified Green' • Indoor Air Comfort Gold
Interior adhesives and sealants (including flooring adhesives)						
≤0.06 mg/m^3	≤1.0 mg/m^3	≤0.001 mg/m^3	- EN 13999 (Parts 1-4) - ISO 16000-9 - EN 16516 - CDPH Standard Method v1.1	10 µg/m^3 at 28 days to be met for eco-INSTITUT-Label		- Floorscore (for adhesives only) - Indoor Advantage Gold - eco-INSTITUT-Label (2015 version) - MAS Certified Green' - Indoor Air Comfort Gold • A or A+ class rating under the French legislation on VOC emissions
Wood-based products (including wood flooring)						
≤ 0.06 mg/m^3 (Non-MDF) ≤ 0.08 mg/ m^3(MDF)	≤1.0 mg/m^3	≤0.001 mg/m^3	- ISO 16000-9 - EN 16516 - CDPH Standard Method v1.1 - EN 717-1 (formaldehyde emissions only)			
Flooring materials (including floor levelling compounds and resin flooring)						
≤ 0.06 mg/m^3	≤1.0 mg/m^3	≤0.001 mg/m^3	- ISO 10580 - ISO 16000-9 - EN 16516 - CDPH Standard Method v1.1	0.01 mg/m^3 at 28 days to be met for eco-INSTITUT-Label GUT - 3 days after loading: 0.01mg/m^3. 28 days after loading: 4 µg/m^3	GUT – 3 days after loading : 250 µg/m^3, 28 days after loading: 100 µg/m^3	- Floorscore - A or A+ class rating under the French legislation on VOC emissions - eco-INSTITUT-Label (2015 version) - GUT. - MAS Certified Green'

						- Indoor Air Comfort Gold - Global Green Tag - M1 certification - GreenGuard Gold
Ceiling, wall, and acoustic and thermal insulation materials						
≤ 0.06 mg/m^3	≤1.0 mg/m^3	≤0.001 mg/m^3	- ISO 16000-9 - EN 16516 - CDPH Standard Method v1.1	10 µg/m^3 at 28 days to be met for eco-INSTITUT-Label Insulation: 10 µg/m^3	Insulation: ≤ 0.3 mg/m^3 Exemplary level emission criteria from the BREEAM International New Construction 2016 scheme	- A or A+ class rating under the French legislation on VOC emissions - eco-INSTITUT-Label (2015 version) - MAS Certified Green' - Insulation materials may be tested using: ISO 16000-9, CEN/TS 16516 or CDPH Standard Method v1.1. - Indoor Air Comfort Gold
Furniture and furnishings (only for WELL Standard)						
- AFRDI Green Tick Furniture - GreenGuard Gold Indoor Advantage Gold - the Finnish M1 label for non-upholstered furniture, provided the furniture is also separately tested for 4-phenylcyclohexane and total aldehydes and held to the same limits specified in ANSI/BIFMA e3-2011 section 7.6.1 and 7.6.2 - the Blue Angel label for upholstered furniture, provided the furniture is also separately tested for 4-phenylcyclohexane and total aldehydes and held to the same limits specified in ANSI/BIFMA e3-2011 section 7.6.1 and 7.6.2 - Field and Laboratory Emission Cell (FLEC) emissions testing is approved as an emissions testing methodology only for furniture and furnishings that are made up of a uniform material and have flat testing surfaces on which the FLEC emissions testing methodology may be applied. Additional tests performed in accordance with ISO 16000 methodology must be performed for total aldehydes and 4-Phenylcyclohexane and must meet the thresholds specified in the WELL Building Standard - MAS Certified Green' - VOC ETL class 2 and 3, VOC+ ETL Environmental and Formaldehyde-Free						

* Paints used in wet areas should protect against mould growth.

Notes:

Products or materials applied or installed within one year prior to the WELL Performance Verification are considered to be newly installed. Only products that are installed or applied in parts of the building where their emissions are likely to affect indoor air quality and inside the weather proofing membrane need to be assessed.

The following materials are considered as inherently non-emitting: stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, natural wool, and unfinished or untreated solid wood flooring. NOTE: if any of these items have finishes, sealants or adhesives applied, they will require VOC testing either as a whole or in parts, i.e. at least the coating/finish/adhesive requires VOC testing.

Paints, coatings, adhesives and sealants applied off-site are excluded for WELL. HOWEVER these are included in BREEAM, therefore all off-site manufactured elements will have to adhere to VOC limits for the whole product.

Fire coatings are excluded from the scope for WELL and BREEAM for all materials including insulation.
Salvaged and reused architectural millwork more than one year old at the time of occupancy is considered compliant, provided it meets the requirements for any new site-applied paints, coatings, adhesives, and sealants.
Furniture and furnishings generally include all stand-alone and built-in furniture items purchased for the project.
Salvaged and reused architectural millwork more than one year old at the time of occupancy is considered compliant, provided it meets the requirements for any new site-applied paints, coatings, adhesives, and sealants.

Appendix VIII Health and Wellbeing Strategy

CANARY WHARF
CONTRACTORS

CANARY WHARF CONTRACTORS
HEALTH AND WELLBEING STRATEGY

1. Introduction

At the Canary Wharf Estate we have delivered exemplar buildings over the last three decades and wellbeing of Estate users has always been of the utmost importance to us as a business. While our genes, social and economic circumstances and quality of relationships and purpose of our work impact and shape our overall wellbeing. A number of studies show our built environment can shape our habits, help balance our sleep cycle and drive us towards healthy or unhealthy choices. This has placed an increased emphasis on health and wellbeing within the built environment.

The links between wellbeing and productivity should be obvious when one considers the main costs and drivers of a company's success: its staff.

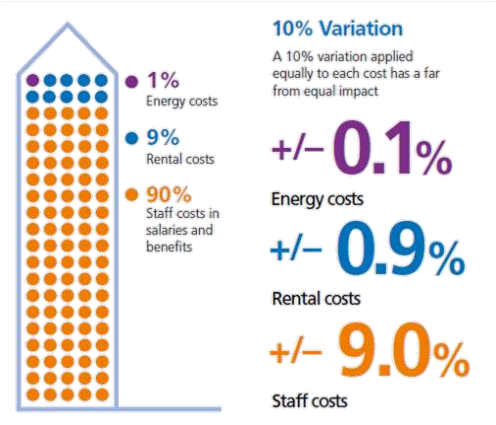


Figure 1: Building costs over a lifetime

A small increase in staff wellbeing, and thus in productivity, can have significant effects on the company's finances as Shown in figure 1. Physical workplace is one of the top three factors affecting performance and job satisfaction. Personnel costs significantly outweigh the costs for design, construction and maintenance; improving the workplace thus offers a significant return on investment. Healthy buildings are known to reduce absenteeism, increase staff retention, reduce medical costs and complaints.

This brief has been developed to address specific design interventions that design, construction, operations and fit-out teams will have to take into consideration to deliver healthy spaces for our employees, tenants, clients and customers over the lifetime of the building.

2. CWC Wellbeing Framework

There are a number of standards in the market that benchmark and measure wellbeing and productivity in the built environment. This includes:

- The British Council for Offices (BCO) *Wellness Matters* study[1] - The BCO standard focuses on a roadmap to health and wellbeing for offices in UK.
- International WELL Building Institute's (IWBI's) WELL Building Standard™[2] - a performance-based system for measuring, certifying, and monitoring wellbeing in built environment. This is modelled after LEED certification.

[1] E. Garrod, J. Pack, W. Poole-Wilson, P. Cushman, S. DeMarteis, D. Clements-Croome, British Council for Offices (2018) *Wellness Matters: Health and wellbeing in offices and what to do about it.* http://www.bco.org.uk/HealthWellbeing/WellnessMatters.aspx

- Fitwel® standard[3] - Another wellbeing standard which aligns with Public Health and GRESB.

A number of green building certification also looks into health and wellbeing requirements including

- BREEAM®[4]
- LEED™ v4 BD+C[5].

However, to ensure the benefits of these specifications reach all our users and make the estate a truly healthy place to visit, work and live, we will have to develop a bespoke CWC Wellbeing Framework. This will address our specific challenges and unique opportunities that the estate offers. This will also help us tailor the benefits of each assessment to our needs and embed this into our design and management briefs rather than standalone assessments.

Some key health and wellbeing risk factors that can be influenced by design are presented below:

- **Lower back pain (lumbago):** is the top disability affecting over 40% of adults for at least 1 day over a 12-month period in the UK[6]. The costs of care for LBP exceed £500 million/year and lost production as a result of LBP costs at least £3500 million/year[6].
- **Physical Inactivity**: Approximately 20 million adults in the UK are physically inactive, and physical inactivity and **low physical activity** are thought to be the fourth most important risk factor in the UK for **premature death** from any cause, including coronary heart disease[7].
- **Air Pollution**: Each year, **inhaling particulates** causes around **29,000 deaths** in the UK, which, on recent evidence, may rise to around 40,000 deaths when also considering nitrogen dioxide exposure[8].
- **Mental Health**: UK-wide stress survey by the Mental Health Foundation has found that almost **three quarters of adults** (74%) have at some point over the past year felt so **stressed** they felt **overwhelmed or unable to cope.**

The CWC Wellbeing Framework Structure

1.1. Themes

CWC Framework has scoped the key priorities for us and our occupiers. The wellbeing features have been captured under seven key themes, as shown in Figure 2 below:

[2] IWBI. WELL Building Standard™ https://v2.wellcertified.com/landing
[3] Fitwel https://fitwel.org/
[4] BREEAM https://www.breeam.com/
[5] LEED https://new.usgbc.org/leed
[6] NICE. https://www.nice.org.uk/guidance/cg88/documents/low-back-pain-final-scope2
[7] British Heart Foundation (BHF). Physical Inactivity and Sedentary Behaviour Report 2017. https://www.bhf.org.uk/informationsupport/publications/statistics/physical-inactivity-report-2017
[8] The Royal College of Physicians (RCP) and the Royal College of Paediatrics and Child Health (RCPCH) February 2016 *Every Breath We Take The Lifelong Impact Of Air Pollution. Report of a working party.*

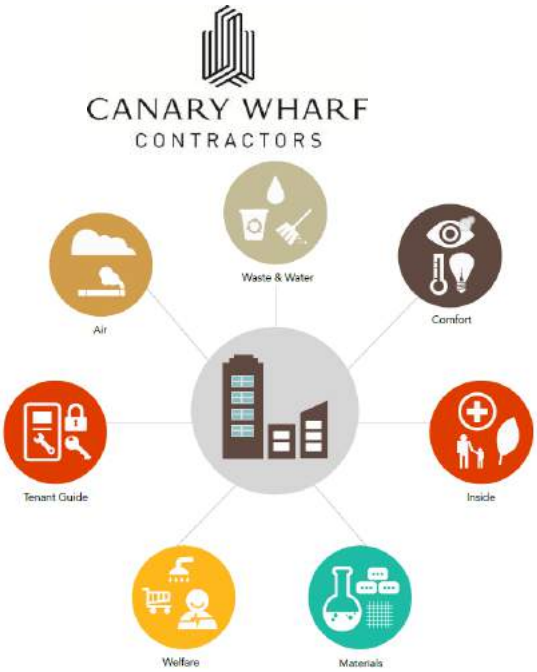


Figure 2: Framework Health and Wellbeing Themes

- **Air** - avoid adverse air quality and airborne contaminants and maximise indoor air quality.
- **Water and waste** - address chemicals or contaminants of concern in water and facilitate on-site hygiene thought correct waste storage and disposal.
- **Comfort** - to design environmental conditions to maximise indoor comfort; this section considers acoustic, visual, facilities and thermal comfort and the relevant survey metrics to evaluate this is constantly achieved.
- **Inside** - to provide specific facilities indoors which are wellbeing oriented, including aesthetics and biophilia.
- **Materials** - to encourage procurement of materials, where feasible, which are not toxic and can be easily maintained.
- **Welfare** - to provide mental-health oriented design features and policies for CWC direct staff based on nourishment, community and mind.
- **Tenant fit-out guide** - to provide recommendation on compliant wellbeing fit-out issues for tenants to incorporate within their own design.

1.1. Process

The Framework will be provided to our project teams at RIBA Stage 1, Client and Project Briefing, by CWC. The format of our Framework is an Excel tool and the process to be stepped through by the project team is shown in Figure 3 below:

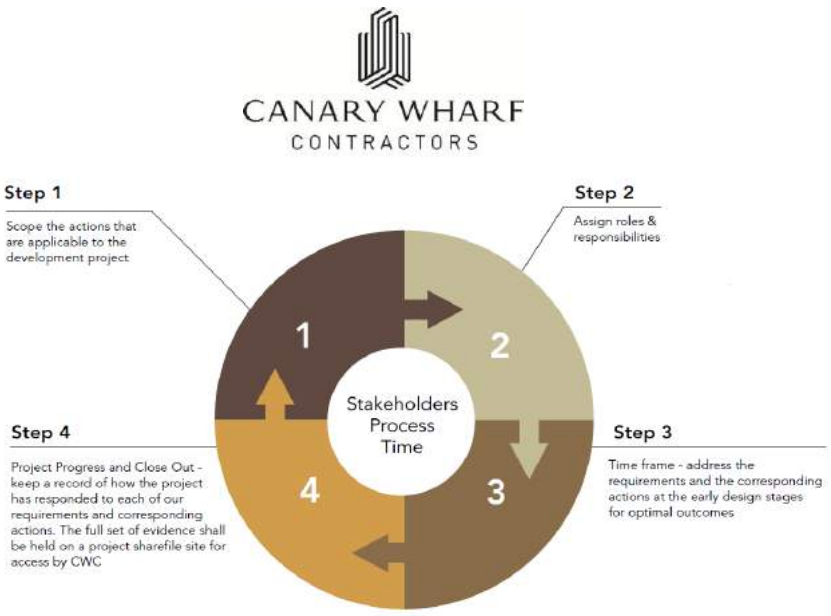


Figure 3: The CWC Health and Wellbeing Framework Process

Step 1 Scoping: (RIBA Stage 1-4)

The Framework includes specific actions applicable to different buildings types which can be scoped out depending of the building type as shown in Figure 4. Our building types have been classified as follows:

- **Commercial Buildings**: this includes office, retail and leisure buildings.
- **Residential Buildings**: our residential developments.
- **All building types**: actions that are applicable to all building types.

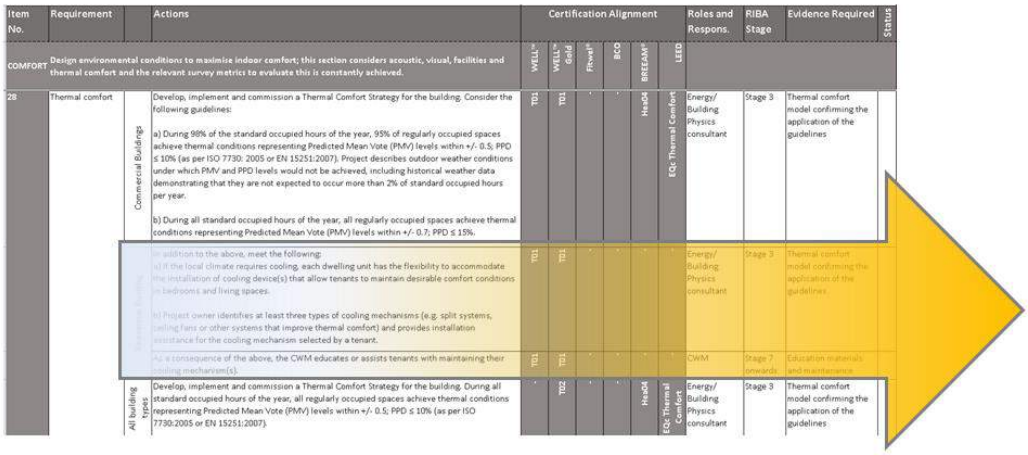


Figure 4: Scoping according to building classification

Any fit-out projects pursuing certification under the WELL Building Standard™ should scope in all the requirements and actions that are aligned with WELL™ Gold, as identified under the 'certification alignment' section of the Framework, as shown in Figure 5 below.

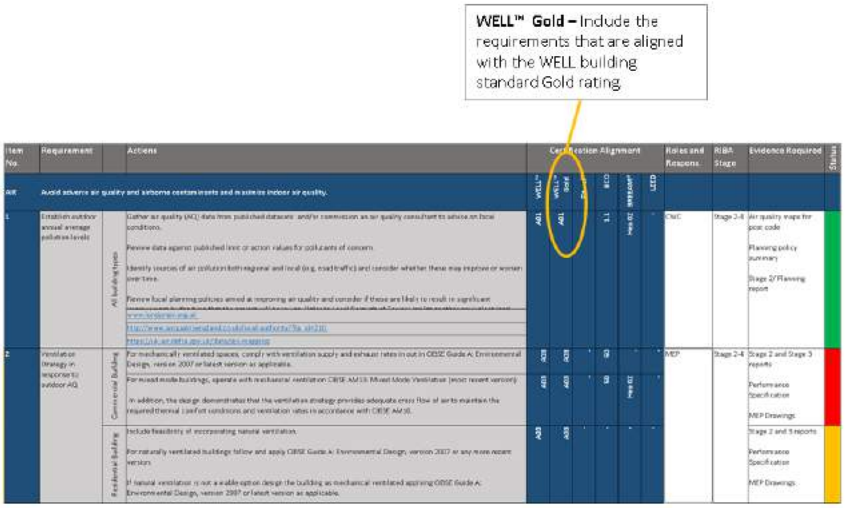


Figure 5: Scoping Requirements and Actions aligned with WELL™ Gold Certification

Step 2 Roles & Responsibilities:

The Framework will be embedded in all projects by the design team to the fullest extent, where technically and financially feasible. There are a number of key stakeholders who will have specific responsibilities to embed this framework, this may vary from project to project. The key responsibility within CWC to lead on this framework will lie with the Sustainability team and the in house WELL AP.

The stakeholders involved in CWC Framework for design and operations are as follows:

- Client (CWC)
- Client management team (CWM)
- CWG HR
- CWC fit-out team
- Tenant
- PAD Team
- Architect
- Mechanical and electrical engineer (MEP)
- Structural engineer
- Lighting designer
- Acoustician
- Air quality consultant
- Third party air test consultant / Specialist testing agent accredited ISO/IES 17025
- Commissioning specialist
- Interior designer.

For any further information contact the sustainability team:

Sustainability Team
Canary Wharf Contractors
Sustainabilityqueries@cwcontractors.com
+44 (0)20 7418 2000

Step 3 Establishing Time Frames:

For optimal outcomes and cost efficiency, health and wellbeing must be considered from the outset of our projects. CWC Framework identifies the RIBA work stage that is

considered to be most appropriate for the initial consideration of our health and wellbeing requirements.

For clarity the time scale used equates to the following:

- RIBA Stage 0 -1: Business case, client and project brief preparation
- RIBA Stage 2 - 4: Project design stages covering concept, developed and technical design
- RIBA Stage 5: Construction
- RIBA Stage 6: Building handover
- RIBA Stage 7: In use

Step 4 Project Progress and Close Out:

The CWC WELL AP shall use the project specific Health and Wellbeing Framework to monitor progress against the delivery of each action. For the 'status' column, a RAG system will be used (Red = no action to date, Amber = Action in progress, Green = action completed). The CWC WELL AP shall keep a record of how they have responded to each of our requirements and corresponding actions. This will be noted in the project specific Framework under 'Evidence Required'.

To assist with this process, we have provided examples of evidence including but not limited to:

- Professional narratives presented in RIBA Stage reports
- Modelling outputs
- Technical Assessment reports
- Strategy documents
- Certificates e.g. Health Product Declarations
- Material data sheets
- Survey outputs
- Drawings and plans

These are indicative only and shall be updated for each development project. The full set of evidence shall be held on a project SharePoint for access by CWC.

Figure below illustrates the structure and key elements of our CWC Wellbeing Framework:

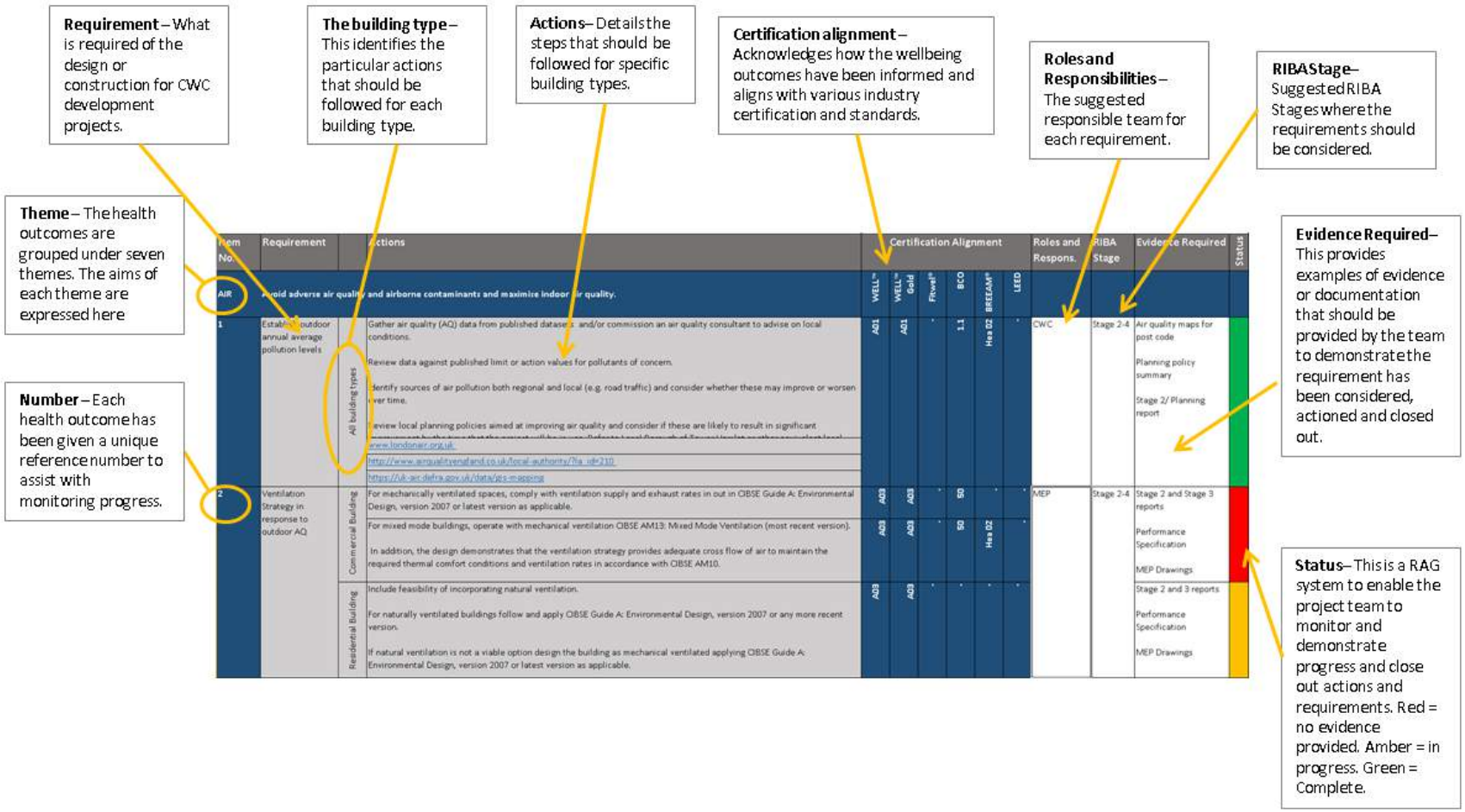


Figure 4: Structure of the CWC Health and Wellbeing Framework

Appendix IX Sustainable Design and Construction Strategy

CANARY WHARF
CONTRACTORS

CANARY WHARF CONTRACTORS
SUSTAINABLE DESIGN AND CONSTRUCTION STRATEGY

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."
– Buckminster Fuller

CANARY WHARF
CONTRACTORS

1. INTRODUCTION

As an integrated property developer, Canary Wharf Group (CWG) is in a unique position to understand how a good design can help to create the cities of the future where people can thrive and prosper in a healthy environment.

CWG has now completed 30 years at the wharf and now we focus on what the future would look like. Between now and 2030 we are delivering several new developments including Wood Wharf New District, Newfoundland, Bank street projects, South Bank and North Quay. We are also expanding our portfolio outside the wharf both within the UK and internationally. An expanding portfolio and population demands long-term thinking. Therefore, we must set targets that are long term and focus on collaboration, innovation and resilience.

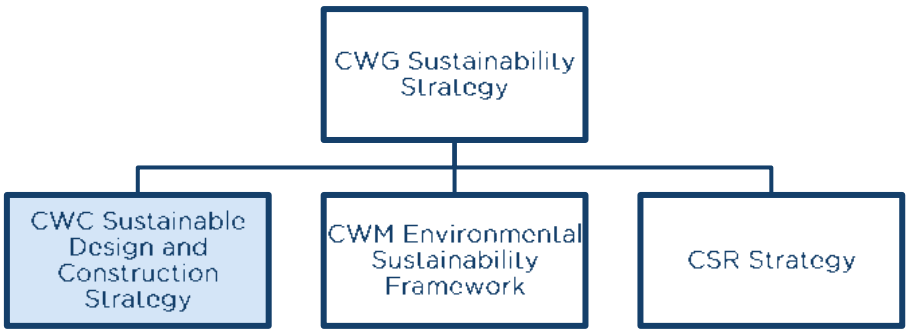
To achieve the above, we have developed this strategy that reflects our journey, purpose and vision. This strategy defines our short term and long-term targets across all our design and construction and fit-out projects.

1.1. Purpose

This document outlines the sustainability strategy and targets for all development works for Canary Wharf Contractors (CWC). The targets set in this document are applicable to all new construction, fit-out and refurbishment projects. This includes all office, retail, residential and infrastructure projects. The strategy currently does not cover temporary arts and events, community and Corporate Social Responsibility (CSR) and the Canary Wharf Management (CWM) works as they will be addressed in separate strategies.

1.2. Alignment

This design and construction strategy aligns with the wider CWG Sustainability Strategy and contributes to the United Nations (UN) Sustainable Development Goals (SGDs). The info graphic



below shows where this document sits within the group sustainability documents.

In 2015, the UN launched 17 goals to set a challenge for humanity to decouple economic growth from climate change, poverty and inequality. The World Green Building Council (WGBC) outlines how our building designs can contribute to the SDGs in the image below.

Below are all SDGs that would be specifically applicable to CWC projects:

- **Goal 3: Good Health & Wellbeing** – Ensure healthy lives and promote wellbeing for all at all ages
- **Goal 5: Gender Equality** – Achieve gender equality and empower all women and girls.
- **Goal 6: Clean Water & Sanitisation** – Ensure access to water and sanitation for all
- **Goal 7: Affordable & Clean Energy** – Ensure access to affordable, reliable, sustainable and modern energy for all.
- **Goal 8: Decent Work & Economic Growth** – Promote inclusive and sustainable economic growth, employment and decent work for all.
- **Goal 9: Industry, Innovation & infrastructure** – build resilient infrastructure, promote sustainable industrialisation and foster innovation
- **Goal 11: Sustainable Cities & Communities** – Make cities inclusive, safe, resilient and sustainable
- **Goal 12: Responsible Consumption & Production** – Ensure sustainable consumption and production patterns
- **Goal 13: Climate Action** – Take urgent action to combat climate change and its impacts
- **Goal 14: Life Below Water** - Conserve and sustainably use the oceans, seas and marine resources
- **Goal 15: Life on Land** - Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss
- **Goal 17: Partnerships for The Goals** - Revitalise the global partnership for sustainable development

1.3. Stakeholders and key responsibilities

CWC works with several consultants, wider design team, trade contractors and our supply chain. All teams are critical to the delivery of projects and to ensure this is done in the most sustainable way possible.

Some of the key stakeholders and their responsibilities are detailed below.

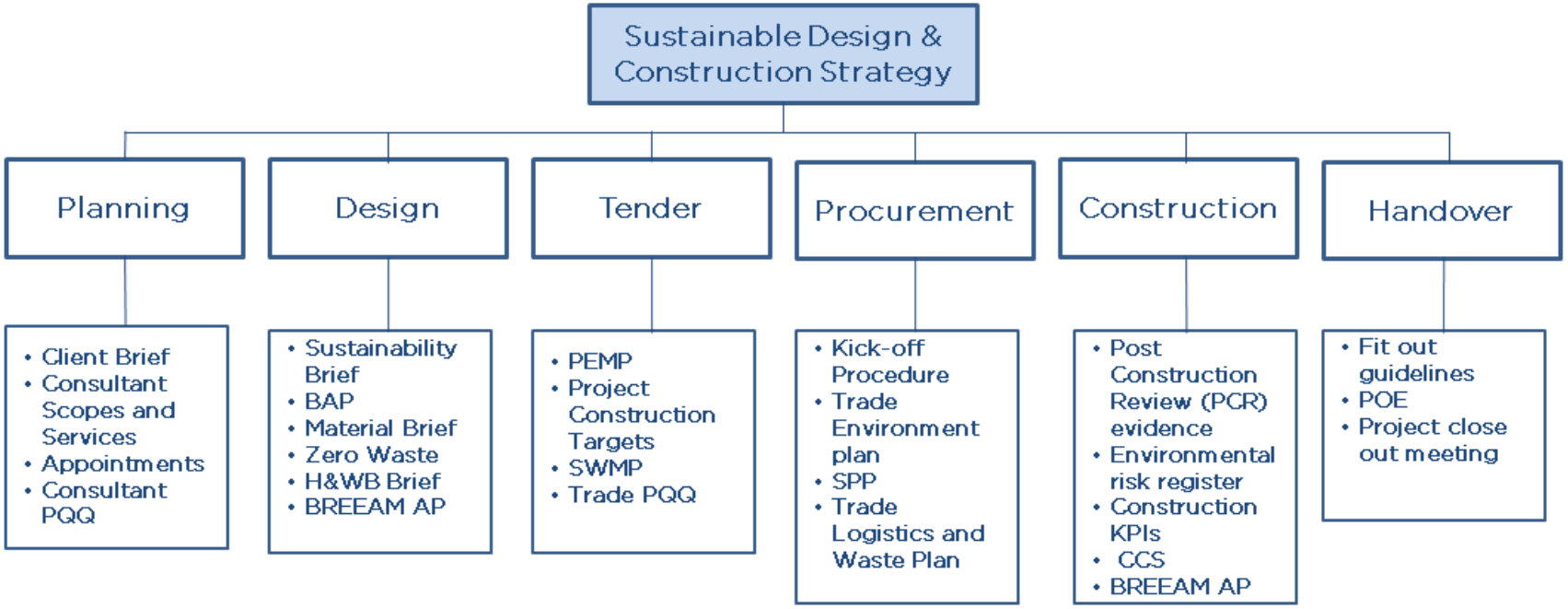
Stakeholder	Responsibilities
CWC Sustainability team (Design and Construction)	• Manage the Sustainability and Environmental targets for all Projects. • Set project specific targets through design briefs and construction KPI documents. • Engage key stakeholders throughout the design and construction process. • Track progress at end of each work stage. • Hold workshop after project handover to reflect on performance and lessons learnt.
CWC Internal Design team (PAD, M&E, procurement & Legal, Contractor)	• Attend key workshops and review targets set against cost, project programme and feasibility. • Collaborate to agree targets and ensure compliance. • Ensure delivery of the agreed targets.
External Stakeholders (Architects, Mechanical, Electrical, Public Health team, Landscape consultants, trade contractors, Assessors, other specialist consultants)	• Organise workshops and ensure design meets and exceeds targets as agreed. Teams to explore opportunities to innovate where feasible. • Review performance and where required flag up any changes to design that would impact the final performance. • Ensure delivery of the agreed targets and planning and regulation requirements.
Supply Chain (All businesses supplying goods and services to CWC)	• Review key targets and benchmarks set for suppliers in the strategy and ensure compliance • Fill in the Pre-Qualification Questionnaires (PQQ) • Align with CWC procurement policies and wider sustainability and environment targets. • Monitor their supply chain • Continually improve sustainability within their organisation • Provide evidence to sustainability team as required. • Fill in materials justification form as required by the CWC sustainable and healthy materials brief and ISO20400.

2. SUSTAINABLE DESIGN AND CONSTRUCTION IN CWCL

This Sustainable Design and Construction Strategy document has been developed to ensure our vision and strategic sustainability goals for CWC are implemented in all our projects. The document sets out key sustainability targets which all projects delivered by CWC must achieve. The targets set within this document act as a delivery mechanism to ensure that we not only continue to meet our Sustainability goals but also maximise opportunities to innovate and

improve our design and construction processes. This document does not include site specific environmental KPI's and this will be covered in site specific KPI document.

This strategy will be reviewed with project teams at the inception stage of every new project. Project specific briefs will be produced for projects to set targets and monitoring mechanisms at design stage and Construction KPI document will be developed to monitor site targets. CWC has established policies, procedures and guidelines that assist in the delivery of our projects. The figure below outlines how this document will be ntegrated in the process.



2.1. Implementation

To ensure compliance with our sustainable design and construction targets and minimise risk to certification, the brief is broken down by RIBA stages. Key responsibilities and expected outcome has been outlined. This will be monitored at the end of each work Stage.

RIBA Work Stage	Responsibility	Actions	Outcomes
Stage 0-1 Strategic definition, Preparation and Brief	CWC Sustainability Design Manager and PAD* Team	• Early engagement with team to understand sustainability targets and aspirations. • Identify relevant early sustainability issues and opportunities.	• Identify target score. • List out sustainability issues and opportunities.
Stage 2 Concept Design	CWC Sustainability Design Manager and PAD Team	• Develop a project specific Sustainability brief. • Align with local planning requirements. • Provide BREEAM AP/ WELL AP advice. • Identify early innovation opportunities. • Negotiate planning sustainability requirements	• List of early Sustainability Assessment (SA) credits to be achieved. • Checklist of requirements to be circulated to team. • Produce planning documents • Key consultant appointment
Gateway 1 - Formal handover to CWC from PAD			
Stage 3 Developed Design	CWC Sustainability Design Manager, Consultants, Project DM* and Project Director	• Incorporate sustainability brief requirements in early design • Target and carry out relevant early design credit requirements. • Ensure energy, ecology, water and waste strategy align with the sustainability brief	• Finalise SA strategy and close out Stage 0-2 credits • Appointment of other relevant consultants
Stage 4 Technical Design	CWC Sustainability Design Manager, Consultants, Project DM* and Project Director	• Develop all design sustainability targets. • Identify opportunities to optimise in material use through specification and procurement. • Finalise clause(s) for tenant contract obligation	• Collate design stage evidence. • Finalise procurement targets. • Submit design stage assessments.
	CWC Construction Sustainability Manager, Consultants, Project DM* and Project Director	• Ensure all sustainability requirements are in the tender pack	• Set site environment and SA targets. • Tender and procurement inputs
Gateway 2 - Handover from Design Sustainability team to Site Sustainability team			
Stage 5 – Construction	CWC Construction Sustainability Manager,	• Develop shell and core metering strategy which also allows for future tenant metering. • Monitor site environmental	• Inputs in tender pack. • Finalise SA construction

	Consultants, Project DM* and Project Director	impacts and coordinate CCS visits and scores • Hold workshops for suppliers and product manufacturers. • Kick off meeting for construction stage to ensure all targets at design stage are understood. • Ensure Site sustainability and biodiversity champion are nominated.	strategy. • Early site credits achieved. • Supply chain engagement
Stage 6 – Handover and close out	CWC Construction Sustainability Manager/ Consultants	• Hold a close out workshop • Training for FM team	• Achieve final certificate • Project close out workshop
Gateway 3 - Formal handover to CWM			
Stage 7 – In Use	Management Sustainability Manager/ Consultants	• Operational targets to be set • Training for FM team • Post Occupancy Evaluation (POE) targets to be set. • Soft Landings Champion to be appointed.	• POE to be carried out after 1 year of occupancy. • POE to be carried out year 2 and 3. • Where applicable, undertake seasonal commissioning

* PAD – Planning, Architecture and Development
DM – Design Manager
SA – Sustainability Assessments – this includes BREEAM, Code, WELL or any equivalent assessments.

2.2. Monitoring and Reporting

All sustainability targets as agreed will be monitored at the end of relevant work stages to ensure compliance. An implementation tracker will be produced for individual projects and used to track progress. All targets will be reviewed by the CWC Sustainability team and progress report will be issued to the design and construction team. At Stage 7 (post-handover) a POE workshop will be held to ensure the design environment/ sustainability considerations will be briefed to the management team. The performance of the building will be monitored annually for a minimum of 3 years.

3. Sustainability Targets

All buildings designed and constructed by CWC as a minimum will meet the following ratings for SA methodologies. The target rating for projects must be set at RIBA Stage 0-1 and must be reviewed and communicated to all team members. The projects in CWC have been split into the 3 categories to set specific targets for each individual team involved in various project sages. The 3 categories are:

Estate

This will cover all public realm and any other infrastructure, including but not limited to the site walkways, parking, basements, parks and gardens, amenities area and other public realm areas. For typical CWC projects, targets will be set in work stage 1.

Building Design (Residential, office, retail and fit-out)

This will cover design and specification for all domestic and non-domestic buildings. Some of the requirements go beyond planning and SA requirements to ensure consideration is given to all sustainability features. For typical CWC projects targets will be set in work stage 1-2.

Construction

This will cover all construction activities including site offices, construction activities, supply chain engagement and handover. For typical CWC projects targets will be set in work stage 4-5. See appendix A for construction evidence tracking process.

The operational targets will be set in our POE document and will sit with and be delivered through CWM facility managers.

SDG	Sl.no	Priorities	2019-2020 Target	Residential	Offices	Retail	Fit-out	Estate	Construction	Long Term Target
	1	Certifications	All offices and communities assessment to achieve BREEAM Outstanding.		●			●		Benchmark all buildings on estate against various performance indicators.
			All other major commercial (above 500 sqm) buildings to achieve BREEAM 'Excellent' or 'Very good' for smaller developments. OR as required by planning			●				
			All residential to achieve minimum Code Level 4 or equivalent	●						
			Support compliance with Green Lease clause				●			
			Considerate Constructor Scheme (CCS) minimum 40 on all projects						●	
	2	Energy and Carbon	Zero Carbon – with 35% improvement over Part L achieved on site.	●	●	●				Zero Carbon through onsite and offsite measures
			Energy metering and sub-metering to be provided as per best practice requirements	●	●	●	●	●	●	
			All buildings to achieve a minimum of EPC rating B for office buildings.	●		●				Achieve a minimum of EPC rating A for offices.
			Outstanding offices to achieve EPC rating A.		●					
			Office buildings to achieve a 15% reduction in energy demand through passive design measures.		●					Office buildings to achieve 20% reduction in energy demand through passive design measures only.
			All office and retail buildings to carry out climate change risk assessment and produce climate change resilience report.		●	●				To implement roadmap and climate change resilience strategy to certify Canary Wharf as a climate resilient district.
			Pilot climate change risk assessment and resilience report to be carried out for residential project.	●						
			Set up a pilot project to test and develop a performance-based energy protocol.		●					All future buildings energy consumption prediction to be based on performance-based energy protocol.

SDG	Sl.no	Priorities	2019-2020 Target	Residential	Offices	Retail	Fit-out	Estate	Construction	Long Term Target
	3	Water	Water metering and sub-metering for all relevant areas	●	●	●		●	●	Develop a water strategy for CWC
			Office building design to achieve 55% water reduction water consumption		●					Office building design to achieve 65% water reduction water consumption
			Resident a to meet 105L/person/ day as a minimum	●						Resident al to meet 80L/person/ day
			At least 25% of water demand of buildings to be met by recycled water.	●	●	●				At least 50% of water demand of buildings to be met by recycled water
	4	Materials	Undertake Life Cycle Analysis (LCA) on a minimum of three buildings and continue to build the CWC embodied carbon database.		●					CWC internal and external embodied carbon benchmarking methodology to be developed and implemented across projects.
			Align CWCL Sustainable Procurement Plan with ISO20400 principles	●	●	●		●	●	Engage and train 100% of our supply chain to align with our procurement policy.
			All new office projects to procure materials in accordance with the CWC Material Brief.		●	●				All CWC projects including resident al, commercial, temporary works, fit out and refurbishment projects to procure materials in accordance with the CWC Material Brief
	5	Waste	Develop roadmap and strategy to achieve Zero Waste to Landfill	●	●	●				Achieve Zero Waste to Landfill in all projects.
			Identify and map out partners for reuse network	●	●	●		●		
			Develop a circular economy strategy for projects in line with new London Plan	●	●	●				Implement Circular Economy principles across all projects.

SDG	Sl.no	Priorities	2019-2020 Target	Residential	Offices	Retail	Fit-out	Estate	Construction	Long Term Target
	6	Health and Well-being	Develop a wellbeing framework for CWC.	●	●	●	●	●		Ensure all office projects are compliant with CWC wellbeing framework
			Develop strategy for CWC wellbeing initiatives on site offices						●	-
	7	Biodiversity	Develop and implement 10-year BAP for the Estate	●	●	●	●	●	●	Achieve net gains target for the estate.
	8	Operational Considerations	Develop a POE procedure and roadmap for CWC		●					Carry our POE for all existing portfolio
			Develop Sustainable design fit-out guide				●			All fit-out and refurbishment to be compliant with the sustainable fit-out guide.
			Project specific workshops during project handover to share lessons learnt. Works shops at end of year 1 and 3 to review building performance against design principles.	●	● ●	●	●	●	●	Benchmark all CWC buildings for operational performance.
	9	Training and partnerships	Map out training programme with various partners and deliver: • 12 CPDs • 20% of staff to be trained in design and construction sustainability • 1 Executive sustainability programme Engage 3 suppliers in sustainability training							Provide training to at least 50 % of all Design and Construction teams. 25% of supply-chain engage in training.

SDG	Sl.no	Priorities	2019-2020 Target	Residential	Offices	Retail	Fit-out	Estate	Construction	Long Term Target
			Monitor local employment, skills and training targets for all projects.							
			Input into CWC risk register and monitor performance							

4. Appendix A

Key steps to be followed by the sustainability team at RIBA Stage 4-5 to achieve sustainability targets set for each project. The wider environmental targets for site activities will be detailed in Construction KPI document. The sustainability team will facilitate the delivery of these targets. However, the package mangers and environmental representatives identified by the Project Directors will have a key responsibility to ensure project targets are met. This will have to be communicated to the team by the respective project director.

Principles	
What?	There is a need to monitor sustainability deliverables throughout the construction process
Why?	To close the gap between design intent and post-construction environment performance
How?	A spreadsheet that details specific requirements to be produced for all projects starting PCR assessment. This will be monitored by the sustainability team throughout the construction process.

Key Interventions		
Post-Design	Construction	Pre-operations
Targets defined, and construction tracker produced using design stage information	Post-construction evidence to be tracked and collated.	Post-construction evidence submitted, and handover completed.

Process Details			
	Task	Lead	Output
Step 1	CWC Sustainability (Design) Manager to provide soft handover with all design stage evidence and design tracker to the CWC Sustainability (Construction) Manager. This will include: • Project location on J drive or Sharepoint • All evidence and tracker	CWC Sustainability (Design)	First draft tracker

	• All completed proformas and calculator tools • Team project directory Issue initial draft of tracker to team.		
Step 2	CWC Sustainability (Construction) Manager to set up kick-off meeting with the assessor and site team to understand the PCR deliverables and update tracker accordingly with targets and key risk items. This will also kick-start the site BREEAM AP process.	CWC Sustainability (Construction)	Engage with site team
Step 3	CWC Sustainability Manager (Both) to update the tracker as per initial discussions to issue second draft of the tracker to the team.	CWC Sustainability (both)	Second draft tracker
Step 4	CWC Sustainability (Construction) Manager to identify PM and environmental reps as agreed with project director to carry out kick-off meetings with trade contractors Provide training to PM and environmental reps to ensure they have good understanding of deliverables/ targets and evidential requirements so they can support the process.	CWC Sustainability (Construction)	Allocate responsibility on site
Step 5	PM and environmental reps will carry out kick-off meetings with respective trades as a part of their engagement with the supply chain. These meetings will cover the following: • Outline package specific deliverables to trades • Highlight evidence required from each trade contractor • Complete the kick-off meeting minutes and issue to sustainability team. • Flag up any non-compliance or risk to the sustainability team in a timely manner	PM and Environmental rep	Kick-off meetings minutes.
Step 6	CWC Sustainability (Construction) Manager to monitor team deliverables using the tracker on a monthly basis and issue updates collated by the team and assessor to the wider team. All PC evidence will be reviewed and issued to the SA consultant in timely manner. The PC BREEAM AP evidence to be collected.	CWC Sustainability (Construction)	PC Evidence and monthly progress report

Step 7	Final PCR evidence to be issued to assessor and ensure any planning conditions or timescales for assessments are met accordingly. Issue final certificate from the BRE when the assessment is complete.	CWC Sustainability (Construction)	Certification
Step 8	After achieving the final PCR certificate, the CWCL sustainability team will conduct workshop for the project team key members to discuss any feedback flagged by the assessment body. This will also cover lessons learnt and any good practice to be shared with future projects.	CWC Sustainability (both)	Training and learning.