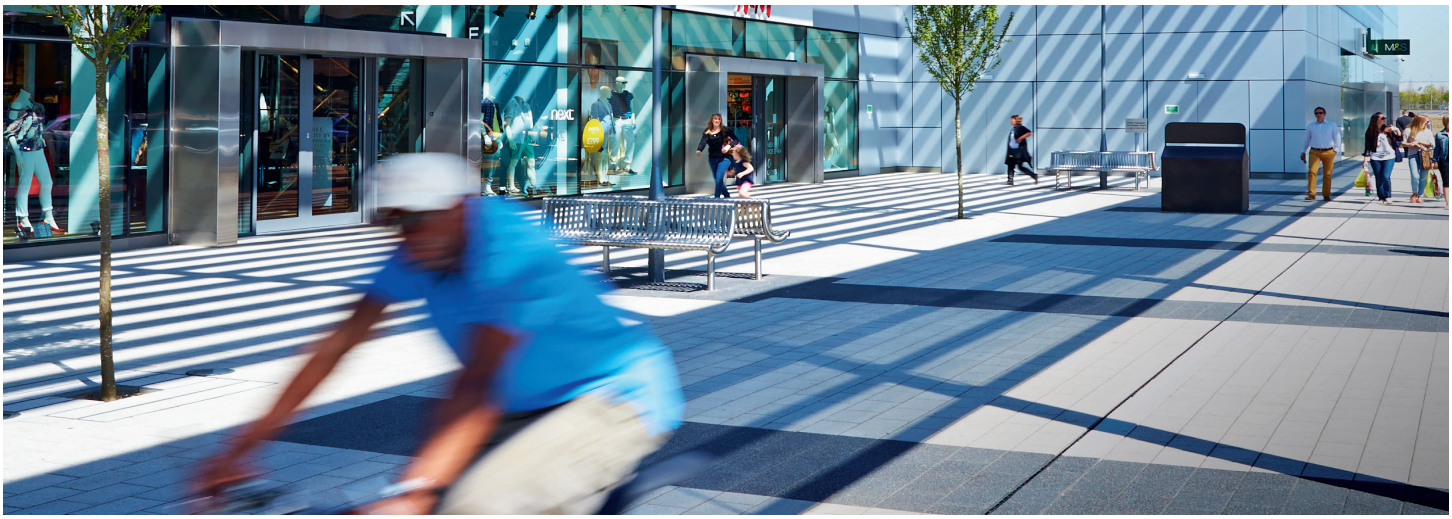
Development and Project Management

Development Sustainability Principles

THE CROWN ESTATE



Version 2.1, November 2016

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1 Introduction

1.1 Overview

This Development Sustainability Principles (DSP) document sets out a series of sustainability key performance indicators (KPIs) against which development works within The Crown Estate's Central London and Regional Portfolios must report. Where appropriate, minimum and aspirational target levels of performance are also outlined. This process is intended to challenge project teams and asset managers to design, construct, refurbish and operate buildings that achieve consistently high standards across all aspects of sustainability.

Project teams are required to review the contents of this document and to set relevant target levels of performance. Project teams are then expected to track their performance and to report this information back to The Crown Estate.

1.2 Applicability

Applicability of individual KPIs to specific projects is determined primarily as a function of project scale. Developments are categorised as either 'minor', 'moderate' or 'major', based on scope, scale and total contract value. Detail on how to determine which of these categories a project fits into is provided in Appendix A, for both Central London and Regional developments. The applicability of KPIs to minor, moderate and/or major projects is outlined in Section 4. Minor and moderate projects are encouraged to go over and above minimum requirements for their categorisation (i.e. to apply major project KPIs) wherever commercially viable and where it has been agreed with The Crown Estate Development Manager/Asset Manager and Sustainability Manager. Critically, the approach to applying the DSP to each development must be approved by The Crown Estate.

1.3 Timing

This document applies to all project Work Stages as defined within The Crown Estate Plan of Work (2014). To achieve real improvements in sustainability performance it is essential that the DSP is considered by the Design Team from Work Stage 1 and that the outcomes of this review are used to inform strategic decisions.

1.4 Document history

This document is Version 2.1 of the DSP and represents a minor revision to Version 2, launched in July 2015. Amongst other updates, Version 2.1 introduces greater clarity on the varying applicability of sustainability KPIs across 'minor', 'moderate' and 'major' project typologies. Additionally, further guidance is provided relating to BREEAM credits that have been 'pre-approved' for Central London developments by the BRE on the basis that The Crown Estate has a comprehensive portfolio-wide apporoach to particular issues (e.g. ecology, flood risk and transport). Version 2.1 also introduces: a small number of new KPIs; updates to existing KPIs; and, an overhaul of The Crown Estate's approach to operational cost analysis (previously 'life cycle costing') and post occupancy evaluation.

Key changes introduced with Version 2 included greater clarity on the level of reporting required at each project stage and improved guidance within the reporting proformas. Version 2 also included a number of new KPIs and, where appropriate, more stringent target levels of performance against established KPIs. Version 1 of the DSP was launched in September 2013.

The DSP will continue to be reviewed regularly and updated as required to ensure it continues to drive improvements for a more sustainable built environment.

2 Context

2.1 Vision

We are a modern, progressive business. To sustain our business we must keep acting today to ensure we remain resilient and successful tomorrow. Our ethos of conscious commercialism puts this priority at the heart of what we do. It's about being astute and enterprising in how we create value today while always considering the long-term effects of what we do and how we do it.

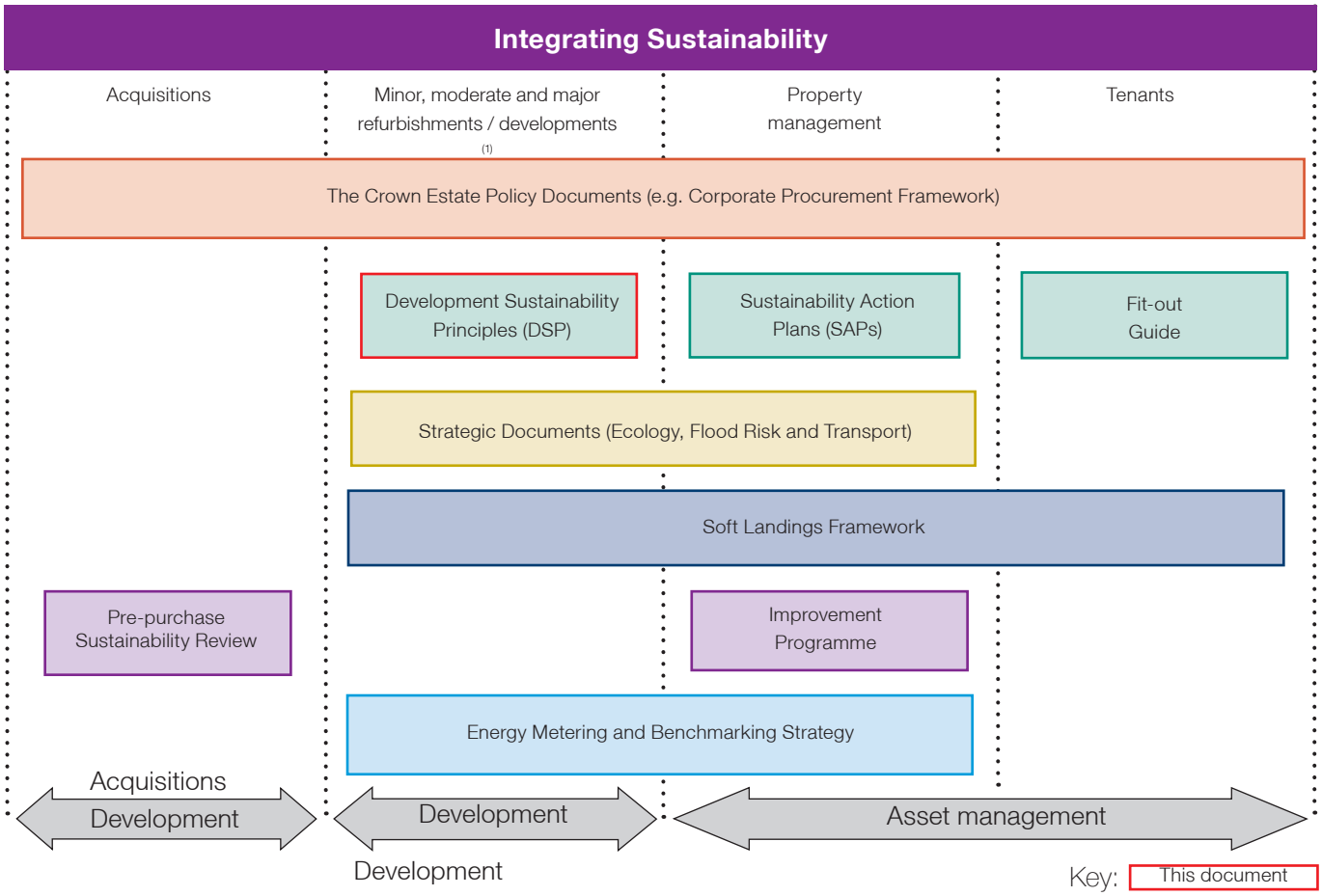
Innovation is key to our approach – new challenges and opportunities demand a bold and ambitious response. We have therefore developed a set of three Aspirations to make our business resilient to material future trends.

- Climate-proof business - By 2030 we are managing every one of our climate challenges effectively and taking a leadership role by responding early to key issues.
- Healthy places - By 2030 we are measurably enhancing the local environment around every one of our major assets, enabling people and natural ecosystems to thrive together.
- Super-efficiency - By 2030 we are buying, using and recycling resources in a way that enables us to generate profit without producing waste, forming innovative partnerships to create a circular economy.

Further details of The Crown Estate, including our values, and our approach to integrating sustainability can be found on our website: www.thecrownestate.co.uk.

2.2 Integrating Sustainability within the Central London and Regional Portfolios

To support The Crown Estate's vision to integrate sustainability within the Central London and Regional Portfolios, a range of policies, programmes and guidance documents have been developed for use across our business activities:

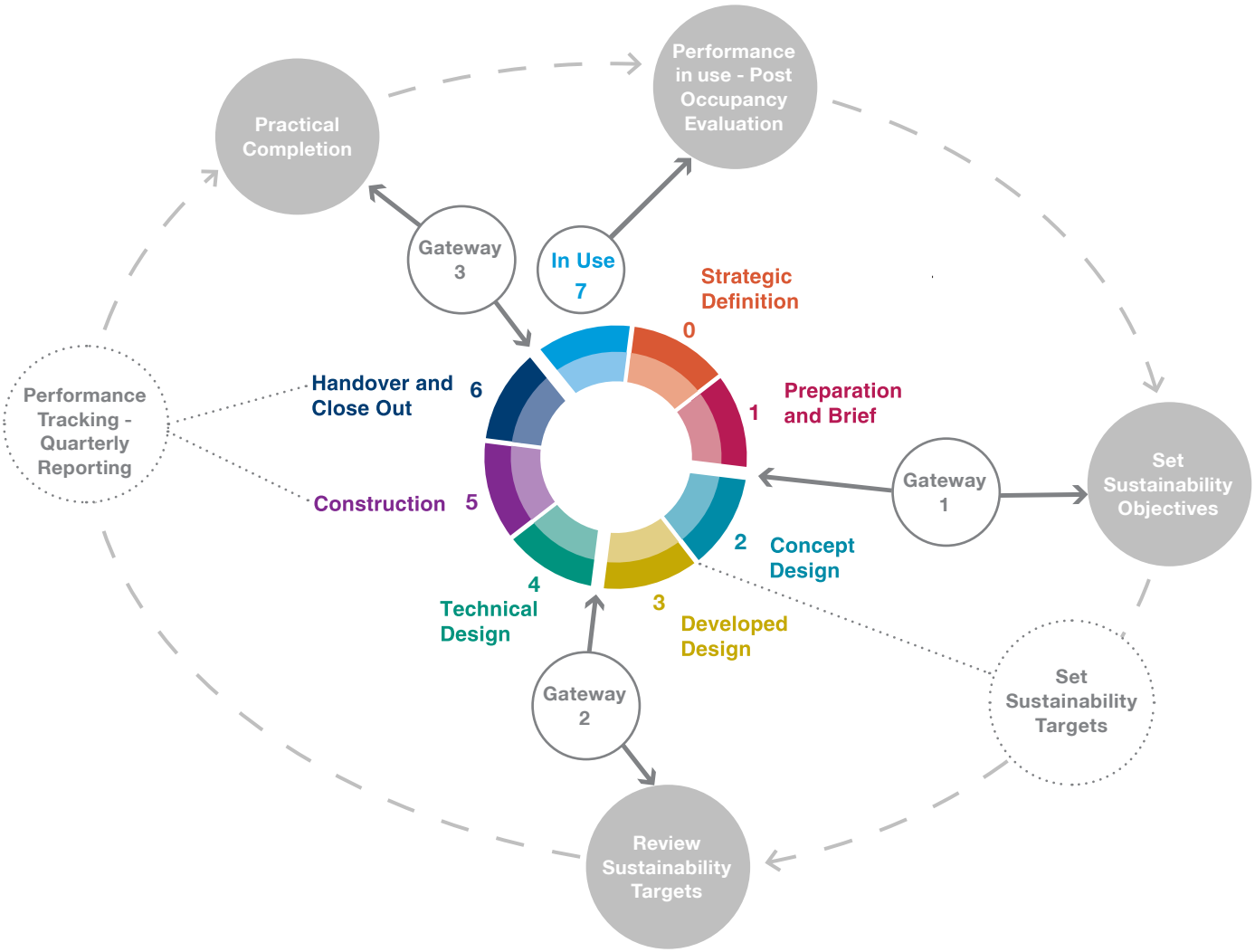


(1) Definitions of minor, moderate and major refurbishments / developments are provided in Appendix A.

3 Process, Roles & Responsibilities

3.1 Implementation

The DSP process follows the Work Stages set out in The Crown Estate Plan of Work (2014). These Work Stages (e.g. Strategic Definition, Preparation and Brief) and key activites and milestones of the DSP process are summarised in the diagram below.



Further information on the specific requirements of the overall process is provided on the next page (shown against each of the Work Stages).

3.2 Reporting

Critical to the success of the DSP is regular reporting. For major projects, project teams are required to report on performance to The Crown Estate Development Manager and Sustainability Manager through an appointed Sustainability Coordinator and using the reporting proformas provided - at each Gateway during Workstages 0-3 and quarterly during Work Stages 5-6. Quarterly reporting through Gateway 3 proformas should be completed and submitted within three weeks of the end of each financial quarter. For minor and moderate projects, project teams are required to track performance and report information back to The Crown Estate's Sustainability Manager through a nominated individual. Reporting should be against agreed project-specific KPIs and in line with the project-specific Main Contractor's Employer's Requirements on Sustainability.

3.3 Data verification and assurance

Regular audits of reported data will be conducted to support data verification and assurance. Project teams are therefore required to collect and store evidence of reported performance (e.g. source data and calculations) for the duration of the project and liability period.

3 Process, Roles & Responsibilities

The table below outlines required roles, responsibilities and deliverables. Particularly important is the allocation of responsibility for agreeing target performance levels to the Development Manager, Project Manager and Design Team (at Stages 1 and 2). Suggested roles and responsibilities for individual sustainability KPIs are presented in Appendix D. For major projects, guidance outlined in this section should be applied in its entirety; for minor and moderate projects, given the short timescales a less onerous process will be applied.

Work Stage		Actions
 Strategic definition	Issue briefing information to design team	Issue of: Development Sustainability Principles; Energy Metering and Benchmarking Strategy; London Ecology Masterplan/Regional Portfolio Landscaping Handbook;
 Preparation & brief	Hold workshop & set high-level objectives	Hold workshop(s) to review sustainability opportunities and constraints, and identify any additional appointments
		Agree high-level objectives with The Crown Estate Sustainability Manager - update Gateway 1 proforma
		Gateway 1 – Submit
 Concept design	Develop detailed sustainability proposals & targets	Hold workshop(s) to develop targets - complete Gateway 2 proforma. Workshop(s) to cover contents of Gateway 2 proforma and review of ecology and embodied carbon reduction opportunities.
		Agree targets with The Crown Estate Sustainability Manager
 Developed design	Confirm sustainability proposals & targets	Review targets (including consideration of costs, programme and technical feasibility) - update Gateway 2 proforma
		Gateway 2 – Submit
 Technical design	Track progress against targets & specify contractor requirements	Hold workshop(s) to review performance against targets - complete Gateway 3 proforma. Workshop(s) to cover
		Prepare and include the project-specific Gateway 2 Proforma and Main Contractor's Employer's Requirements on
 Construction	Brief contractor on sustainability performance & reporting requirements	Contractor briefing on targets and reporting procedures as outlined in the project-specific Main Contractor's Employer's
		Quarterly reporting - update Gateway 3 proforma
 Handover & close out	Validation of 'as built' sustainability performance	Review performance against targets - update Gateway 3 proforma
		Quarterly reporting - update Gateway 3 proforma
		Gateway 3 – Submit
 In-use	Post occupancy evaluation	Lessons learned workshop and report - production of case study
		Determine and optimise occupant satisfaction levels and
		DSP Process

The approach for minor and moderate projects should be developed and agreed with The Crown Estate Sustainability Manager and Sustainability Coordinator (project specific).

● Lead ● Support role

	The Crown Estate Development Manager	External Development Manger/Project Manager	Design Team	Sustainability Coordinator	Contractor	The Crown Estate Sustainability Manager	The Crown Estate Asset Manager
	Responsibilities						
London Phase 1 Habitat Survey; London Landscape Monitoring and Maintenance Strategy; Corporate Procurement Framework; Central London Transport Strategy	●			●		●	●
- complete Gateway 1 proforma. Workshop(s) to cover contents of Gateway 1 proforma.	●	●	●	●		●	●
	●	●	●	●		●	●
completed Gateway 1 Proforma							
	●	●	●	●		●	●
	●	●	●	●		●	●
	●	●	●	●		●	
completed Gateway 2 Proforma							
contents of Gateway 3 proforma and r eview of ecology opportunities.	●	●	●	●		●	●
Sustainability within tender. Review tender responses for demonstration of clear understanding/consideration of DSP targets.	●	●	●	●		●	
Requirements on Sustainability.	●	●		●	●	●	
	●	●		●	●	●	
	●	●	●	●	●	●	
	●	●	●	●	●	●	
completed Gateway 3 Proforma							
	●	●	●	●	●	●	●
resource use (energy & water) in years 1, 2 and 3.	●	●	●	●	●	●	●
Completion							

4 Sustainability Requirements, KPIs & Targets

4.1 Materials

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
Low volatile organic compound (VOC) content	All		Select materials that have a low VOC content, where appropriate (1)	
	Moderate and major		Target and achieve VOC emissions levels (products) credit from relevant sustainability rating scheme (2)	
Circular economy	Major		Select materials in line with principles of circular economy, where appropriate (3)	
Durability and resilience of assets	Major		Consider and enhance asset durability and resilience, where appropriate (4)	
Recycled (5) and recyclable materials	All		Select materials that are recycled and/or recyclable, where appropriate	
Recycled (5) content (% by weight)				
Blockwork	Major		50%	90%
Plasterboard			80%	90%
Chipboard			70%	90%
Concrete paving slabs/blocks and reconstituted stone paving blocks			20%	90%
Embodied Carbon, $kgCO_2/m^2$ GIA (6)	Major		- Embodied carbon minimisation workshop (Work Stage 2) (7) - Project target to be agreed with The Crown Estate (Work Stage 3)	

(1) For guidance on how to apply/determine 'low VOC' emissions levels/criteria to/for individual products, refer to guidance within BREEAM (non-domestic) (e.g. Hea 02), BREEAM Refurbishment (domestic) (e.g. Hea 03), Home Quality Mark (09 Indoor Pollutants) and WELL (04 VOC reduction).

(2) The 'relevant sustainability ratings scheme' will be whichever BREEAM, Home Quality Mark and/or WELL Certification scheme that the project is targetting. Scheme-specific VOC emission levels (product) credits are as follows: Hea 02 'Volatile organic compound (VOC) emission levels (products)' (BREEAM UK New Construction 2014 (non-domestic)/BREEAM UK Refurbishment and Fit-out 2014 (non-domestic)); Hea 03 (BREEAM Refurbishment Domestic Buildings 2014); 09 Indoor Pollutants, Criteria 01 (Home Quality Mark); 04 VOC reduction (WELL).

(3) Circular economy principles for materials include designing out waste, recycled content, take-back schemes, re-use, recycling, upcycling, product leasing arrangements, design for disassembly etc.

(4) For guidance, refer to BREEAM (non-domestic) credit Mat 05 and Home Quality Mark credit 21 Durability of Construction Products.

(5) For definition of 'recycled content' see www.greenspec.co.uk/building-design/recycled-content.

(6) The methodology for calculating embodied carbon follows closely that used for BREEAM New Construction (2014) and BREEAM Non-Domestic Refurbishment and Fit-out (2014) Credit Mat 01. Further guidance on how and when to calculate embodied carbon is provided in Appendix B.

(7) Guidance on how to conduct and record the outcomes of this workshop is provided in Appendix B.

4.1 Materials - continued

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
The Crown Estate Corporate Procurement Framework [1]	All		100% compliance	
Responsibly sourced (% by weight)				
Timber [2]	All		100% of timber to be from certified source, e.g. FSC or equivalent [3]	
Blockwork	Major		100% BES 6001 Good [4]	100% BES 6001 Very Good [4]
Structural steel			100% ISO 14001, ISO 18001, OHAS 9001 [4]	
Reinforcing steel			100% BES 6001 Good [4]	100% BES 6001 Very Good or CARES Sustainable Steel Certification [4]
Glass			100% ISO 14001, ISO 18001, OHAS 9001 [4]	100% BES 6001 Very Good [4]
Plasterboard			100% ISO 14001, ISO 18001, OHAS 9001 [4]	100% BES 6001 Very Good [4]
Concrete			100% BES 6001 Good [4]	100% BES 6001 Very Good [4]

(1) To be formally issued to project teams by The Crown Estate during Work Stage 0.
(2) This applies to all timber used within the project (i.e. site timber used in the construction process and timber materials installed within the building elements).
(3) Timber to be procured in line with UK Government's Central Point of Expertise on Timber (CPET) 5th Edition report www.cpet.org.uk/.
(4) Or acceptable equivalent, as approved by The Crown Estate.

4 Sustainability Requirements, KPIs & Targets

4.2 Water

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
Water efficient appliances	All		Install water efficient appliances, where applicable	
Reduction in mains water use (%) (1) (2)	Major offices / retail		40%	50%
Mains water use (2) (3) (l/m^2/year)	Major offices / retail		Targets to be agreed on a project specific basis	
Mains water use (4) (l/p/day)	Major residential		≤ 105 l/p/day	≤ 80 l/p/day
Construction				
On site water use (m^3) (5)	All		Measurement/reporting of on site water consumption	
On site water use (m^3/£100,000 construction spend) (5)	Moderate and major		Targets to be agreed on a project specific basis	

These operational KPIs will be evaluated as part of the Post-Occupancy Evaluation of resource use (see Section 4.11).

Strategic Document

All Central London projects should in the first instance refer to the Central London Flood Risk Assessment.

(1) Compliance to be demonstrated using the BREEAM New Construction (2014) and BREEAM Non-Domestic Refurbishment and Fit-out (2014) Water Use Calculator (Wat 01). Note that the minimum requirement of 40% reduction (3 Credits) is normally achievable through demand reduction alone.

(2) Indicator not applicable to shell only developments (e.g. retail units).

(3) This metric should be calculated by converting the emerging l/person/day figure from Wat 01 to l/m^2/year. This metric should also cover total anticipated consumption from all water using activities, i.e. including irrigation for general landscaping. For the purposes of these calculations, the following assumptions should be made: occupancy rate - 1 person / $9m^2$; days of operation - 5 days/week and 253 days/year.

(4) Compliance to be demonstrated using the The Water Efficiency Calculator for New Dwellings (The Building Regulations Part G 2015 edition with 2016 amendments) - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504207/BR_PDF_AD_G_2015_with_2016_amendments.pdf.

(5) Includes water consumed during construction and demolition activities.

4.3 Waste

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
Provision of space for segregation and storage of operational recyclable waste on or near site (1) (2)	All offices / retail		100% compliance	
Provision of appropriate internal and/or external recycling segregation and storage facilities (3)	All residential		100% compliance	
Design/Construction				
Pre-demolition or pre-strip out waste audit	Moderate and major		Undertake a pre-demolition or pre-strip out audit and identify opportunities to minimise waste generation and inform extent of work proposed	
Weight of non-hazardous construction waste generated (tonnes/100m^2 GIA) (4)	Moderate and major offices / retail		≤ 6.5t	≤ 3.2t
	Moderate and major residential		≤ 25t	≤ 15t
Non-Hazardous construction (4), demolition (5) and excavation waste by weight diverted from landfill (%) (6)	Moderate and major new build		90% construction, 95% demolition	100% construction 100% demolition 95% excavation
	Moderate and major refurbishment		90% construction, 97% demolition	100% construction 100% demolition
Construction				
Waste arisings (tonnes)	All		Measurement/reporting of waste arisings	
Waste disposal routes (tonnes)	Moderate and major		Measurement/reporting of waste disposal routes (e.g. landfill, incineration, incineration with energy recovery, materials recovery facility, recycling)	

(1) Refurbishment projects where the minimum level of provision is not already in place shall undertake a study to determine the feasibility of improving the provision to meet this standard.

(2) Specification of dedicated storage space to comply with requirements outlined in BREEAM New Construction (2014) Wst 03 Operational Waste. Where these requirements cannot be satisfied, an alternative waste management approach/strategy must be agreed with The Crown Estate Sustainability Manager.

(3) Specification of dedicated storage space to comply with requirements outlined in the Recyclable Waste credit of the Home Quality Mark (Criteria 1-3). Where these requirements cannot be satisfied, an alternative waste management approach/strategy must be agreed with The Crown Estate Sustainability Manager.

(4) Includes fit-out related wastes.

(5) Includes site clearance related wastes.

(6) Detailed definitions and calculation methodology as per BREEAM New Construction (2014) and BREEAM Non-Domestic Refurbishment and Fit-out (2014) Wst 01.

4 Sustainability Requirements, KPIs & Targets

4.4 Ecology

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
London Ecology Masterplan / Regional Portfolio Landscape Handbook	Moderate		Identify opportunities to include new areas of green infrastructure in line with Ecology Masterplan / Landscape Handbook	
	Major		100% compliance	
Area of green space (% of development footprint) (1)	Major C. London		7%	12%
Change in ecological value (area-weighted change in species richness) (2)	Major offices / retail		>0	>6
Implementation of recommedations identified by ecologist (3)	Major residential		All general recommendations	30% additional recommendations

The Crown Estate's Ecology and Landscape Specialists

Teams are required to consult on the project's proposed ecology/landscape features with The Crown Estate's Landscape/Ecology Specialists (Arup/TFT) at Work Stage 2 and 4. It is suggested that consultation with landscape/ecology specialists at Work Stage 2 takes place as part of a workshop with key members of the project team.

Central London Portfolio Strategic Documents

The Crown Estate has developed a series of documents as part of its estate-wide approach to ecology and green infrastructure. These are:

- Phase 1 Habitat Survey: An estate-wide Phase 1 Habitat survey is undertaken every two years. This establishes the baseline ecological value across the estate and removes the need for individual Phase 1 Habitat Surveys to be undertaken.
- London Ecology Masterplan: This document sets out the objectives, requirements and guidance for design of green infrastructure across developments and managed assets.
- Monitoring and Maintenance Strategy: This document sets out the monitoring and maintenance requirements and processes to be applied for all green infrastructure across the Estate.

Together these three documents can and should be used to secure certain ecology-related BREEAM credits for all of The Crown Estate's Central London developments. For further information, including the specific schemes and credits requirements, please refer to the BREEAM Interface Guidance Note.

Regional Portfolio Strategic Documents

The Regional Portfolio Landscape Handbook provides guidance on horticulture management practices and integration of ecological features to enhance biodiversity across the regional developments.

(1) Green space is defined as any soft landscape intervention included as part of the development footprint. This may include large scale installations such as green roofs and green walls; small features such as window boxes and pocket habitats or; individual features such as street trees and planters.
(2) Detailed definitions and calculation methodology as per BREEAM New Construction (2014) Credits LE 03/04.
(3) 'General' and 'additional' recommendations to be determined with reference to BREEAM Domestic Refurbishment (2014) Man 05 credit and the BREEAM Interface Guidance Note. For schemes applying the Home Quality Mark, 'general' and 'additional' recommendations will be described as 'high priority' and 'desirable' recommendations respectively, and determined with reference to the Home Quality Mark. (2015) Ecology credit.

4.5 Transport

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
Central London Transport Strategy	Minor and moderate C. London		Incorporate principles of Central London Transport Strategy, as appropriate	
	Major C. London		100% compliance	
Review of wayfinding opportunities	All Regional		Review wayfinding opportunities and integrate into existing Travel Plan, where available	
Independent travel survey of existing tenants and customers	Major Regional		100% compliance	
Site-specific travel plan			100% compliance	
Provision and access to safe and secure cycle parking (staff and visitors) (1)			100% compliance	

Strategic Document

All Central London projects should in the first instance refer to the Central London Transport Strategy.

(1) Facilities must be 'Compliant cycle storage spaces' as defined by BREEAM New Construction (2014) and Non-Domestic Refurbishment and Fit-out (2014) (Credit Tra 03).

4 Sustainability Requirements, KPIs & Targets

4.6 Community

KPI	Applies to	Applies from	Minimum	Aspiration
Design				
Project-specific Community Consultation Plan aligned with portfolio-level Consultation Strategy [1]	Major		100% compliance	
Design/Construction				
Engagement with schools & colleges (% providing positive feedback) [2]	Major		100%	
Construction				
% Main Contractor staff paid at or above Living Wage [3] [4]	All		Report Main Contractor Staff paid at or above Living Wage (%)	
	Major C. London		100%	
Number of site staff employed from the local area [5] [6] [7]	All projects above £20m contract value		1 employee per £2m of contract value	2 employees per £2m of contract value
Number of traineeships [6] [8]			1 per £10m of contract value	
Number of apprenticeships [6] [9]			1 per £20m of contract value	

(1) Develop and execute a Community Consultation Plan that is aligned with the portfolio-level Consultation Strategy and signed off by The Crown Estate Development Manager and Sustainability Manager. The plan should be finalised by Gateway 1.

(2) For London projects, the approach to this KPI to be agreed in consultation with The Crown Estate Sustainability Manager and Head of Employment Generation.

(3) For London portfolio projects this is the 'London Living Wage' and for Regional portfolio projects this is the 'UK Living Wage'. See Living Wage Foundation - http://www.livingwage.org.uk/ for more information.

(4) 'Main Contractor staff' are direct employees of the Main Contractor.

(5) 'Site staff' includes all onsite staff working on the project (i.e. staff that have received a site induction).

(6) The approach to local employment, traineeships and apprenticeships to be agreed in consultation with The Crown Estate Sustainability Manager and Head of Employment Generation.

(7) Local Labour Engagement: Requirement for a contractor to provide an individual the equivalent of not less than 13 weeks employment from a local area (i.e. in relation to the Central London portfolio, to Greater London boroughs, and otherwise, for the regional portfolio as agreed with The Crown Estate), with an emphasis on long term sustainable employment for an individual who has become involved in the project via The Crown Estate referral partners. The Crown Estate model screens for suitability and ensures that the relevant training is in place to perform the work outlined. The contractor should identify and allow for costs (salary and training costs) during the period of employment.

(8) Requirement for a contractor to provide the equivalent of not less than standard industry training (not less than 3, nor more than 13, weeks formal training per individual) for an individual who has become involved in the project, and where possible by virtue of the 'new local labour engagement' requirement. The contractor should identify and allow for costs (salary and training costs) during the period of training. The intention for this is for the traineeship route to take the individual on a structured training programme specific to the trade craft undertaking, and the training relevant to the skill set, but not necessarily an apprenticeship.

(9) Requirement for a contractor to initiate where possible, or otherwise engage, an apprenticeship in relation to: the project only; a trade which is associated with a material phase of the site activity for an approved trade; and, a recognised course / college. The contractor should identify and allow for costs (salary and training costs) during the period of the apprenticeship. An apprenticeship is as defined by the S106 and local council. All proposals are to be approved and rigorously monitored by The Crown Estate.

4.7 Energy/Carbon

KPI	Applies to	Applies from	Minimum	Aspiration
Design/Operation				
EPC	Minor and Moderate Regional		D	B
	Moderate C. London		C	B
	Major new build		B	A
	Major refurb		C	B
Operating carbon emissions ($kgCO_2/m^2/yr$) (1)	All C. London		Report design estimate for operating carbon	
	Moderate and major Regional			
	Major office new build		$50kgCO_2/m^2/yr$	$25kgCO_2/m^2/yr$
	Major office refurb		$75kgCO_2/m^2/yr$	$50kgCO_2/m^2/yr$
	Major residential new build		$40kgCO_2/m^2/yr$	$15kgCO_2/m^2/yr$
	Major residential refurb		$50kgCO_2/m^2/yr$	$25kgCO_2/m^2/yr$
Operating carbon Emissions - landlord-provided energy (% reduction on benchmark) (2)(3)	Major retail		25%	50%
Energy Metering Strategy	Moderate and Major C. London		100% compliance (4)	
Construction				
On site energy use (kWh) (5)	All		Measurement/reporting of on site energy consumption	
On site energy use (kWh/£100,000 construction spend (5)	Moderate and major		Targets to be agreed on a project specific basis	

These operational KPIs will be evaluated as part of the Post-Occupancy Evaluation of resource use (see Section 4.11).

(1) The methodology, assumptions and timings for calculating operating carbon emissions are set out in Appendix C.

(2) Where energy for retail units is not provided via landlord supplies / systems, this indicator can be scoped out as not applicable. Where energy for retail units is provided via landlord supplies / systems (and therefore that consumption forms part of The Crown Estate's 'direct' carbon footprint), project teams shall provide a target carbon intensity for the retail unit. Where only heating and cooling are provided from the landlord, the intensity shall relate to these services only and this shall be stated in the commentary. Where possible the project team shall seek to minimise the retail carbon intensity through measures under base build control. These include the generation efficiency of heating and cooling (and electricity if appropriate), and the performance of the building fabric.

(3) Target emissions shall be based on retail energy consumption benchmarks in CIBSE Guide F unless more specific information is available. The Real Estate Environmental Benchmark (REEB) may be consulted for additional contextual information.

(4) It is feasible that compliance with the soft landings framework may result in non-compliance with the energy metering strategy. For example, the soft landings process may suggest moving away from overly complex metering in an attempt to ensure the building is easy to operate. In these instances, and only if agreed with The Crown Estate's Development Manager and Sustainability Manager, such deviations from the energy metering strategy will be permissible.

(5) Includes electricity and fuel consumed during construction and demolition activities.

4 Sustainability Requirements, KPIs & Targets

4.8 Sustainability Ratings

KPI	Applies to	Applies from	Minimum	Aspiration
Design/Construction				
Certification scheme feasibility assessment	All moderate and major		Assessment of feasibility of an appropriate certification scheme	
BREEAM New Construction	Major office new build/ refurb		Excellent	Outstanding
	Major retail new build/ refurb		Very good	Excellent
BREEAM Domestic Refurbishment	Major residential refurb		Excellent	Outstanding
Construction				
Considerate Constructor's Scheme	Moderate and Major		Participation	

Residential (new build)

Following the Government's decision to phase out the Code for Sustainable Homes, it is no longer possible to register new projects for this green building rating scheme. As a result, new projects with a residential component will need to consider an alternative scheme (e.g. Home Quality Mark) and rating level, and agree this with The Crown Estate Development Manager and Sustainability Manager.

Applicability

Whether or not BREEAM should be applied to a scheme will depend to some extent on the scale of the development. For example, it may not be appropriate to go for these schemes on very small projects. Moreover, it may not be appropriate to apply BREEAM to all elements of a mixed-use project (i.e. including offices, retail and residential). Precisely how BREEAM is applied to individual projects should be agreed with The Crown Estate Sustainability Manager before the end of Work Stage 1.

Strategic Documents

Project teams should refer to the relevant strategic documents as outlined within Appendix L of the Development Manual. Moreover, teams should take into consideration the portfolio-specific strategic documents including ecology (Central London and Regional), flood risk (Central London) and transport (Central London). In addition, each project must be in accordance with the Project-Specific KPIs and Project-Specific Main Contractor's Employer's Requirements on Sustainability.

4.9 Operating Cost Analysis

KPI	Applies to	Applies from	Minimum	Aspiration
Annual total operating cost (service charge estimate) (£/m²/yr)	Major		Targets to be agreed on a project specific basis	

Requirement

Project quantity surveyor and managing agent shall collaborate to produce an estimated annual total operating cost (service charge) for the building. This collaboration accords with the principles of a soft landing and may be integrated into the project's overall approach to soft landings.

The estimate shall include:
1. All aspects of day-to-day operation and maintenance (security, cleaning, maintenance, consumables, etc).
2. Annualised cost for the major maintenance and lifecycle replacement of the building fabric and landlord's plant.

This should include all foreseeable maintenance / replacement costs [within a 25 year period] (e.g. replacement of plant such as boilers, chillers, lifts; major fabric maintenance such as stone cleaning, renewal of facade seals & gaskets, flat roof replacements).

Note that this requirement falls short of a full lifecycle cost analysis, which would generally consider a 60 year life.

Purpose

The purpose of the Operating Cost Analysis is two-fold:
1. To give The Crown Estate's Asset Managers an early indication of the likely service charge, so that this can be factored into the commercial strategy.
2. To ensure that optimisation of operating cost, both short and long-term is a factor in the development of the design, so that the buildings produced by The Crown Estate's development supply chain are cost-effective to operate in the context of their particular markets.

Timing

The aim is to influence the design to optimise asset operating cost. In order to have the maximum influence, the initial assessment must be carried out at Work Stage 2, with a view to identifying the major contributors to operating cost and identifying strategies to optimise.

Appointments

Operating cost assessment needs to be specifically reflected in QS scopes of service. This needs to include not only the requirement to carry out the assessment, but needs to reflect the timing constraints and requirement to update the assessment periodically.

4 Sustainability Requirements, KPIs & Targets

4.10 Soft Landings

The following soft landings requirements will apply to a select number of projects. Adoption will be agreed at Work Stage 0 and on a project by project basis through discussion with The Crown Estate Sustainability Manager.

KPI	Applies to	Applies from	Minimum	Aspiration
Development of a Soft Landings Plan	All		Confirmation that Project Soft Landings Plan has been produced and is up to date	
Appointment of Soft Landing Champion (name) [1]			Confirmation that role of Soft Landings Champion has been scoped and person appointed	

Central London Portfolio

For minor and moderate projects, the Soft Landings Plan should be produced with reference to the Soft Landings Manual for Minor to Moderate Scale Projects in Central London, whilst major projects should refer to the Soft Landings Manual. These documents are included in The Crown Estate Plan of Work and include recommended actions and deliverables at all Work Stages.

Regional Portfolio

For minor, moderate and major projects the Soft Landings Plan should be produced with reference to the Regional Soft Landings Manual.

(1) Role typically fulfilled by Project Manager. Support provided to Project Manager by Arup (Central London) and TFT (Regional).

4.11 Post-occupancy Evaluation

Post-occupancy performance evaluations are required for all projects to help minimise any performance gap related issues between the design and operation of buildings. The table below sets out the process requirements, roles and responsibilities and target levels of performance for each element (resource use and occupant satisfaction).

KPI	Applies to	Applies when	Requirements & responsibility	Minimum	Aspirational
Energy and water use	Major	Within 12 months of practical completion	Appointed and managed by Managing Agent [1]	Initial validation of the performance of the BMS and Energy Metering systems.	
		End of Year 1		Measure and record performance levels (energy & water); identify actions	
		End of Year 2		≤40% above design target	≤25% above design target
		End of Year 3		≤25% above design target	≤10% above design target
Occupant satisfaction;	Major office	Within 12 months of practical completion	Appointed and managed by Managing Agent [2]	Structured interview of tenants in occupation to identify any issues relating to building performance.	
		End of Year 1		Measure and record satisfaction levels	
		End of Year 2		50th percentile	75th percentile
		End of Year 3		Equal or better than 'End of Year 2' percentile score	

Defects Liability Period

The opportunity to identify any base build defects with the base build contractor is limited to the defects liability period that typically lasts for 12 months after practical completion (PC). It is therefore recommended that Systems Analytics is installed shortly after PC in order to complete an initial validation of the performance of the BMS and Energy Metering systems. In parallel, a structured interview should be carried out by the Managing Agent with tenants in occupation to identify any issues relating to building performance. Any defects identified can then be fed into the snagging system.

Resource Use (End of Year 1 Onwards)

All projects will set design targets for operational energy and water consumption at Gateway 2. Post-occupancy reviews of resource use will provide comparisons between a full year's operational resource consumption (energy and water) and design targets (refer to Section 4.2, 4.7 and Appendix C). Operational data, including number of occupants, hours of use and any tenancy voids will be taken into account in the comparison, and the design targets updated accordingly. If the review highlights a significant discrepancy between design and operational performance, then recommendations shall be made for further diagnosis and/or remedial work to resolve the issues and bring consumption in line with targets.

Occupant Satisfaction (End of Year 1 Onwards)

The appointed consultant shall undertake an occupant satisfaction survey using the BUS [3] methodology. A report will be presented to The Crown Estate Development and Asset Managers with diagnosis of outcomes and recommendations for remedial action where appropriate.

(1) Resource use PoE studies will be undertaken by a third-party assessor, in collaboration with Managing Agents and Design teams.

(2) Occupant satisfaction PoE studies will be carried out by a third-party assessor.

(3) BUS (Buildings in Use Surveys) was developed by the Usable Buildings Trust and is owned by Arup. It is available to other firms for use under licence. www.busmethodology.org.uk

Appendix A
Minor, moderate and major developments / refurbishments

This appendix sets out the applicability of DSP KPIs, according to whether developments and refurbishments are 'minor', 'moderate' or 'major' in scale.

Central London -

Development works undertaken within the Central London portfolio are categorised under the following typologies:

'Minor' Works	• External decoration and repair to the building fabric • Service charge recoverable landlord works
'Moderate' Refurbishments/ Developments	• Residential (including changing residential use) of up to 10 units • Refurbishment works – comprising subdivision or reorientation within existing units, or non-service charge landlord works with a floor area less than 1,000m^2 (NIA)
'Major' Refurbishments/ Developments	• Major refurbishments or new developments with an overall floor area greater than 1,000m^2 (NIA) or greater than 10 residential units • Capital expenditure (construction spend) in excess of £5 million

Regional -

Development works undertaken within the Regional portfolio are categorised under the following typologies:

'Minor' Works	• Minor works to the building fabric • Public realm works including car parking improvement
'Moderate' Refurbishments/ Developments	• Small scale new build - i.e. individual new retail/A3 units or a number of new pods within an existing retail park, with a floor area of no more than 1,000m^2 • Refurbishment works – comprising subdivision or reorientation within existing units, or landlord works within covered shopping centres, creating additional floor area of no more than 1,000m^2
'Major' Refurbishments/ Developments	• New developments with a floor area greater than 1,000m^2 • Capital expenditure (construction spend) in excess of £3 million
Funding - Any existing development projects where The Crown Estate are, or are due to, provide funding to an external developer will not be subject to these requirements with sustainability provision having been established and agreed at purchase.	

Appendix B
Embodied carbon calculation

B1 Embodied carbon calculation methodology

The aim of this methodology is to allow all of The Crown Estate projects to estimate on a consistent basis the total embodied carbon emissions resulting from the construction of buildings. Embodied carbon is a relatively narrow measure of environmental impact of construction materials, although it is considered a good proxy for overall impact. It also has the advantage of producing a single transparent metric and therefore facilitates comparisons between projects.

In order to simplify the method and avoid additional work, the method follows that required for BREEAM 2014 Mat 01. However, in order to give as true a picture as possible of the total embodied impact, additional elements are required to be assessed, as shown in the following table.

		Building type		
		Office	Retail	Residential
Element (BREEAM)	External walls	√	√	√
	Windows	√	√	√
	Roof	√	√	√
	Upper floor slab	√	√	√
	Internal walls			√
	Floor finishes / coverings	√	√	√
Element (Additional)	Sub-structure	√	√	√
	Ground Floor	√	√	√
	Structural frame	√	√	√

In the Green Guide to Specification, values for carbon intensity ($kgCO_2e/m^2$) are provided for a range of specifications for each of the above elements, based on a 60 year life. At its simplest, the total embodied carbon is simply the sum of the total area of each specification for each element, multiplied by its carbon intensity. However, the specifications available in the Green Guide are limited in some areas, particularly with concrete slabs for example. Designers have three options to obtain more representative ratings:

1. Obtain a bespoke rating from the BRE (via project BREEAM assessor). This may additionally benefit the Mat 01 score, but is more complex because of the range of factors considered.
2. Obtain a specific carbon intensity from the manufacturer if appropriate. Assurance will be required that this is consistent with the BRE methodology.
3. Calculate a specific carbon intensity based on other appropriate published data.

Appendix B
Embodied carbon calculation

B2 Embodied Carbon Reporting Form

A spreadsheet has been created to assist in the documentation of embodied carbon. This is issued to all projects during Work Stage 0.

How to use the reporting tool:

1. All building uses are to be assessed separately, using multiple versions of the form.
2. Complete the 'Project Data' tab, as this will inform results.
3. Complete the 'Green Guide to Specification' tab with outputs from the project's Mat 01 calculator. A Mat 01 calculator will need to be completed for all building uses, regardless of the scope of any BREEAM assessment. Where a refurbished element is used, include the relevant information from the Green Guide Calculator.
4. Complete the 'Additional Elements' tab from the bill of quantities (or other applicable source), referencing sources of carbon data used. For Design Stage, recommendations for data sources are noted in the form.
5. All 'Elements' present on the project must be reported in this form.
6. Submit completed form.

B3 Timing of embodied carbon assessments (including high level review and workshop during Work Stage 1)

High level review and workshop during Work Stage 2 -
Embodied carbon and opportunities to reduce the footprint of the development should be discussed at a high-level during Work Stage 2. It is recommended that this discussion takes place as part of a workshop with key members of the project team and that the outcomes are recorded in the Gateway 1 Proforma. Examples of embodied carbon interventions that require early consideration include:

- retaining key elements of any existing structures, e.g. facade;
- designing for materials optimisation, e.g. optimise structural utilisation, minimise finishes, balance cut & fill;
- investigate the use of using innovative structural components, e.g. timber frame; and,
- incorporating the principles of 'Designing out Waste'.

Detailed assessments using the Embodied Carbon Reporting Form -
A completed Embodied Carbon Reporting Form should be submitted at the end of Work Stage 3 (Gateway 2) and Work Stage 6 (Gateway 3). Early in design, clearly the level of detail available will be limited, and approximations in terms of constructions, quantities and specifications are acceptable. The aim is to establish approximately where the project sits in comparison to other projects, and to identify the main focus areas for improvement.

Appendix C
Operational carbon calculation

C1 Calculation of operational carbon emissions

Generating a realistic and consistent estimate of operating carbon emissions at design stage is challenging due to the wide range of factors that influence the outcome.

The predicted operational carbon calculation does however provide:
- a benchmark for actual operational carbon emissions; and,
- a tool for predicting trends in carbon emissions from the overall estate.

It is recognised both building operation and building design will affect operational carbon emissions from the development.

In order to produce a design stage estimate of operating carbon emissions, design teams should follow the method set out by the Chartered Institute of Building Services Engineers[1]. This sets out a standard method and identifies a series of specific input assumptions required. The method breaks overall energy consumption down into a series of end-use categories. Provision of estimates against each end-use category will be required as output from the development team to allow post-occupancy evaluation of resource use to be carried out.

Three benchmark figures shall be calculated for each development: low, medium and high. These shall represent the anticipated range of performance outcomes for the development. Where specific operational information is not available, these calculations shall be based on a set of operational assumptions. For the purposes of maintaining consistency between the operational carbon calculations across the estate the assumptions set out in the table overleaf should be used.

C2 Timing of operational carbon assessments

Operational carbon calculations should initially be completed at the end of Concept (Work Stage 1). Calculations should then be updated every Work Stage henceforth.

(1) TM54 "Evaluating Operational Energy Performance of Buildings at the Design Stage" (August 2013)

Appendix C
Operational carbon calculation

Operating Carbon Calculation - Common Assumptions

THE CROWN ESTATE

All Consultants shall use the method set down in CIBSE TM54 for the purposes of producing estimates of operating carbon emissions at design stage. In the absence of project specific information, the following common assumptions shall be used to ensure consistency between projects.

Office Areas		Low Estimate	Median Estimate	High Estimate
Occupancy Rate				
Data (Peak)	m^2/person	13	9	8
Hourly Profile		NCM - 2 (1)	NCM	NCM + 3 (1)
Data Source		BCO 2009	NCM	BCO 2009
Small Power				
Data (Peak)	W/m^2	10	11.7	18
Hourly Profile		NCM - 2 (1)	NCM	NCM + 3 (1)
Data Source		ECON 19	NCM	ECON 19
Out-of-hours consumption	% of peak	5%	8%	15%
Lighting				
Out-of-hours consumption	% of peak	5%	8%	15%
Operating Hours				
Data (Peak)		8am-6pm, 5 days/week	7am-7pm, 5 days/week	6am-9pm, 6 days/week
Data Source			NCM	
Catering				
Assumption		Assume no catering in office areas unless there is project-specific information available		
Server Rooms				
Data (Peak)	W/m^2	250	500	1000
Data Source			NCM (Heavy)	
Floor Area (% Office NIA)		1%	1%	1.5%
Weather File				
Data Source		CIBSE TRY		

Retail		Low Estimate	Median Estimate	High Estimate
Total Demand				
		X W/m^2 (2)	Y W/m^2 (2)	Z W/m^2 (2)
Data Source		CIBSE Guide F		

Residential		Low Estimate	Median Estimate	High Estimate
Total Demand				
Calculation Basis		Estimate based on output of SAP calculation, to include SAP assumptions on catering (SAP 2009 L3) and small power (SAP 2009 L2) demand.		

Notes:

1 NCM Profiles to be adjusted in line with proposed operating hours, e.g. 'NCM - 2' is NCM minus 2 hours.

2 Benchmark assumptions to be calculated for the project based on the anticipated mix of retail typologies, using benchmark data from CIBSE Guide F.

Operating Carbon - Estimated Consumption Outputs

the below is an example pro-forma for the presentation of the output of a TM54 energy use estimate. This may be adjusted as appropriate to match the particular project

Energy Consumption Benchmark		Fuel	Low Estimate	Median Estimate	High Estimate	Actual
Heating						
Space Heating	kWh/m²/yr	E/G?				
Hot Water Generation	kWh/m²/yr	E/G?				
Cooling						
Chiller Load	kWh/m²/yr	E/G?				
cooling towers / dry air coolers	kWh/m²/yr	E/G?				
Auxilliary						
Fans	kWh/m²/yr	E/G?				
Pumps	kWh/m²/yr	E/G?				
Terminal Units	kWh/m²/yr	E/G?				
Lighting						
Landlord Lighting	kWh/m²/yr	E/G?				
Tenant Lighting	kWh/m²/yr	E/G?				
ICT						
Server Rooms	kWh/m²/yr	E/G?				
Small Power	kWh/m²/yr	E/G?				
Lifts						
Lifts	kWh/m²/yr	E/G?				
TOTAL DEMAND						
Electricity						
Gas						

On-site Generation			Low Estimate	Median Estimate	High Estimate	
Photovoltaics						
Other...						

Carbon Emissions			Low Estimate	Median Estimate	High Estimate	
Carbon Intensity						
Gross Emissions						

Appendix D
Illustrative roles and responsibilities matrix

The table below provides an example illustration of how roles and responsibilities for performing and reporting against KPI targets could be delegated within the project team. Naturally, any Scopes of Works take precedent.

Responsibilities		
General	Reporting of data / data validation (per project)	
	Collation / reporting of DSP data (all projects)	
Meeting target KPI performance level/tracking performance	Materials	- Low volatile organic compound (VOC) content - Recycled content and recyclable materials - Embodied carbon/ responsible sourcing
		- The Crown Estate Corporate Procurement Framework
	Water	- Mains water use
		- On site construction water use
	Waste	- Provision of waste facilities
		- On site waste arisings
	Ecology	- Compliance with London Ecology Masterplan/Regional Portfolio Landscape Handbook - Area of green space (m^2) - Change in ecological value / implementation of recommedations identified by ecologist
	Transport	- Compliance with London Transport Strategy - Review of wayfinding opportunities - Independent travel survey of existing tenants and customers - Site-specific travel plans - Provision and access to safe and secure cycle parking (staff and visitors)
	Community	- Community consultation
		- Living wage - Engagement with schools / colleges - Local employment / traineeships / apprenticeships
	Carbon	- EPCs - Operating carbon emissions
		- On site construction energy use
	Sustainability rating	- BREEAM rating
		- Considerate constructors scheme
	Operating cost	- Annual total operating cost (service charge estimate)
Soft landings		- Development of a Soft Landings Plan
		- Appointment of Soft Landing Champion (name)
Post Occupancy Evaluation		- User Satisfaction Survey (within 12 months and then years 1, 2, 3) - Energy/water performance review (within 12 months and then years 1, 2, 3)
		- Lessons learned feedback workshop and summary document

● Lead role ● Support role

Work Stage	Development Team														
	The Crown Estate Development Manager	External Development Manager (If applicable)	Project Manager	Architect	Structural Engineer	MEP Engineer	Sustainability Co-ordinator	Quantity Surveyor	Contractor	Managing Agent	The Crown Estate Asset Manager	The Crown Estate Sustainability Manager	The Crown Estate Head of Employment Generation	Landscape/Ecology Specialists (Arup / TFT)	Strategic Sustainability Advisor (Arup)
1-6			●	●	●	●	●	●	●						●
1-6												●			●
2-6			●	●	●		●	●	●						
2-6	●	●	●	●	●	●	●	●	●						
2-6			●	●		●	●		●						
5			●				●		●						
2-6			●	●	●		●	●	●						
2-6			●	●	●		●	●	●						
2-6			●	●			●		●					●	
2-6			●	●			●								
2-6	●	●	●				●					●	●		
2-6			●				●	●	●				●		
2-6			●	●		●	●		●	●					
5			●				●		●						
1-6	●	●	●	●	●	●	●	●	●			●			
5			●				●		●						
2-6			●	●	●	●	●	●	●	●	●				
2-6	●	●	●	●		●	●				●	●			●
2-7	●	●	●	●		●	●		●		●	●			●
7			●	●	●	●	●			●	●				●
7	●	●	●	●	●	●	●	●	●		●	●			

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