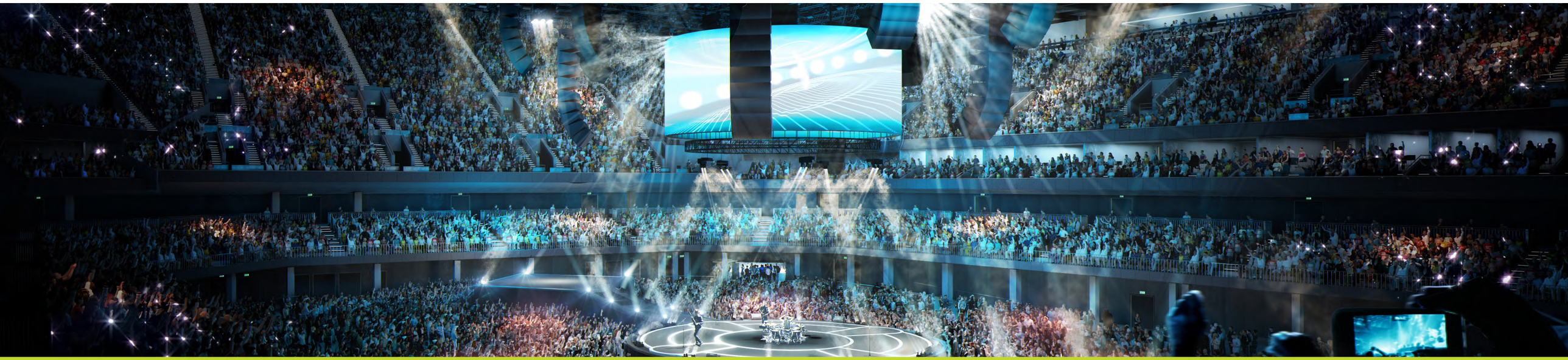
BUROHAPPOLD ENGINEERING

0042842 OVG MANCHESTER



SUSTAINABILITY STATEMENT

REVISION P07

02 MARCH 2020

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1 EXECUTIVE SUMMARY

"The Arena at Eastlands will promote sustainability and be at the forefront of energy efficiency and best practice low carbon design, aspiring to be the most sustainable UK venue and amongst the world's leading"

Zero Carbon 2038	Social Value	Fully Inclusive	Sustainable Travel
The Arena fully supports Manchester Zero Carbon 2038 strategy, with a deliverable route map to achieve this	During construction and after opening, the Arena supports the local economy and communities through new employment and skills opportunities	The Arena will be the best in class inclusive venue for both audience and performers, aspiring for Attitude is Everything Gold Status.	The Arena will benefit from excellent public transport links inherent in the Etihad Campus and will continue to support initiatives that make walking and cycling the preferred option.

Sustainable development is inherent within the regeneration proposals...

…transforming a brownfield site earmarked within the Eastlands Regeneration Framework into an iconic venue for Manchester to be proud of. A regeneration story that brings local economic and social value whilst playing its full part in delivering the Our Manchester 2025 vision and ambitious Manchester Zero Carbon 2038 commitments. The Arena aligns with and is fully supportive of the impressive sustainability initiatives already in place on the Etihad Campus, as underpinned by the Etihad Campus Strategic Sustainability Framework. Collectively, we aspire to be a pioneer for the whole of Manchester in pursuing its twin objective of realising locally-inclusive, globally-competitive economic growth, whilst simultaneously transforming to a net zero-carbon campus.

Key sustainability initiatives integrated into the Proposed Development are summarised on the next page, framed by the four key themes of the Etihad Campus Strategic Sustainability Framework:

1. Climate & nature positive
2. Vibrant & inclusive
3. Healthy & active
4. Open & connected

Going beyond planning compliance to redefine business as usual in a climate emergency

The venue significantly exceeds all council planning targets relating to sustainable development and sets a new benchmark for venues in the UK.

Venue	Stats	Energy
OVG Manchester	• Capacity: 23,500 • Planning decision 2020	• **34%** carbon emissions saving over Part L 2013, with potential for greater, pending final design (>Policy EN6: Min. 6%)) • PV area maximised on the roof • New cutting edge environmentally friendly fully recyclable Organic PV system proposed • BREEAM Excellent (>Policy DM1: BREEAM Very Good)
YTL Arena, Bristol	• Capacity: 17,080 • Planning decision 2020	• **32.9%** carbon emissions saving (Part L 2013) • 10,000 m^2 solar PV with battery storage • BREEAM Excellent
MSG Sphere, London	• Capacity, 21,500 • Planning decision: 2020	• **13.4%** carbon emissions saving (Part L 2013) • 36m2 PV (external lighting) • BREEAM Very Good

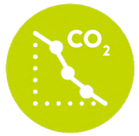
In addition, the Proposed Development has anticipated potential future policy relating to the Zero Carbon 2038 by actively:

- Going beyond Part L compliance to predict total energy consumption in operation and develop a route map to zero carbon by 2038;
- Undertaking an embodied carbon assessment to create a baseline for improvement during detailed design; and
- Proactively defining exemplar sustainable development in its widest sense to align with designing in a climate emergency.

1.1 OVG MANCHESTER - KEY SUSTAINABILITY HEADLINES

Climate & Nature Positive

Beacon of Manchester's rapid transition to a zero-carbon city, rich with wildlife and green infrastructure



Zero-Carbon 2038

Committed route map to be net zero carbon



Efficient building services systems

34% CO2 emissions reduction against Building Regulations Part L 2013 through intelligent energy efficient building services systems, with potential to be higher depending on final solutions identified (>6% for policy compliance)



Renewable technologies

PV area maximised on the roof, with exploration of a new cutting edge environmentally friendly fully recyclable Organic PV system



Low carbon technologies

Air Source Heat Pumps for heating and cooling



Ultra-efficient building envelope

U-Values better than Part L 2013 (over 40% for roof, walls and floor and nearly 30% for glazing).



District Heating

Future proofed for connection if network becomes available.



Post Occupancy Evaluation

3-Year commitment to monitor, review and improve on building performance and user comfort.



Sustainable catering

Sustainable and responsible food policy delivered in conjunction with our partners



Zero waste to landfill, no single use plastic

Operational targets to be set in operation in collaboration with supply chain



Reduced embodied carbon

Circular economy principles to reduce impact of construction materials, measured through a whole life carbon assessment



Ecological enhancements

Replacement of poor-quality site with improved ecology and environment onsite and adjacent



Sustainable drainage

Over 50% reduction in surface water run-off rates from existing through an innovative active system combining attenuation and rainwater harvesting.



Rainwater harvesting

100% rainwater for toilet flushing



Water efficiency

Over 40% less water use than a comparable building through water efficient sanitaryware and catering specifications

Vibrant & Inclusive

An arena for everyone, providing unrivalled education, training and employment opportunities for local residents



Local opportunities

Commitment to significant local employment, skills and opportunities



Local economy

Estimated additional :£36 million per year in direct annual local spending



Construction opportunities

Estimated 3,344 FTE construction jobs, including 100 apprenticeships, created during construction phase



Arena opportunities

Estimated 566 FTE jobs created over the first 20 years of operation



Everyone is welcome

Best in class inclusive venue –Attitude is Everything Gold Status, Sensory Room, 2 No. Changing Places toilets



Responsible neighbour

Establishing resident groups to ensure local views are always considered



Charitable giving

The arena and its partners intend to create a charitable programme to benefit the local community and disadvantaged groups

Healthy & Active

World-class destination for performance and leisure, inspiring healthy lifestyles and workplace



Safe & secure venue

World-leading robust strategy developed with GMP, Protect Advisers, and existing Campus operations team



Eat well

Healthy eating options & free drinking water provision



Healthy environment

Optimised comfort in temperature, indoor air quality, lighting and acoustics



Access to nature

'Green biodiversity ring' of planting around the arena and canal side public realm enhanced by wildflowers



Climate Resilience

Resilience to future increases in temperature



Active Travel

Plan to encourage walking and cycling

Open & Connected

Fully integrated into the fabric of the City, with excellent transport connections that support sustainable travel



Walking & cycling

Direct investment to enhance routes to/from the city centre, with connection to the Manchester Beelines network



Travel planning

Integrated event ticketing and communication to promote sustainable transport planning at point of ticket sale



Cycle storage

Investment in improved campus wide cycle facilities (240 extra covered spaces across the campus)



Travel information

Clear signposting and live travel information to the inherent excellent public transport links on and near the Campus



Controlled Parking Zones

Improved residents' environment through reducing congestion and parking controls



Community use

Working with our local partners to provide community activities and non-event day experiences

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2 INTRODUCTION

This Sustainability Statement has been prepared by Buro Happold on behalf of OVG Manchester Limited (the 'Applicant') in support of the planning application for a new 23,500 maximum capacity multi-use indoor arena ('OVG Manchester') located on the Etihad Campus, Manchester. This statement replaces the Environmental Standards Statement, instead providing a more ambitious non-technical summary of how the Proposed Development is addressing sustainability in its broadest sense. This Statement summarises the project commitments and is underpinned by the following technical documents to provide the detail and evidence base for realising the ambition of one of the greatest arenas in the UK.

Appended in support of the Sustainability Statement	Additional Planning Documents	Environmental Statement
1. Blue Green Infrastructure	• Planning Statement	• Construction Management
2. Crime Impact Statement	• Design and Access Statement (incl. Landscape and Public Realm Strategy and Signage Strategy)	• Air Quality and Dust
3. Ecology (incl. Preliminary Ecological Assessment)	• Broadband Connectivity Statement	• Ground Conditions
4. BREEAM Pre-Assessment	• Community Involvement Statement	• Lighting
5. Energy Statement	• Daylight / Sunlight Assessment	• Noise and Vibration
6. Local Benefits Proposal	• Economic Assessment	• Socio-economic Impacts
7. Social Value Toolkit	• Heritage Statement	• Townscape and Visual Impact
8. Tree Survey	• Operating Schedule / Event Management Strategy	• Traffic and Transport
9. Waste Management Strategy	• TV Reception Survey	• Water Quality, Drainage and Flood Risk
	• Ventilation, Extraction and Odour	• Wind Microclimate
		• Climate Change

3 POLICY CONTEXT

3.1 LOCAL

The **Guide to Development in Manchester (2007)** is effectively a hybrid document bringing together all the development principles that assist in creating a city which people choose to live, learn, work and relax. It does not create new planning policy but rather complements existing policies by providing additional guidance on compliance, including the framework for the Environmental Standards Statement required as part of the planning application.

The **Manchester Local Plan (2012)** provides the planning policy framework, with the Core Strategy at its heart. Covering a period of 15 years from 2012 to 2027, it sets out the long-term strategic policies for Manchester's future development. Sustainability cuts across the objectives set out within the Core Strategy.

Our Manchester 2016-25 resulted from a city-wide consultation in 2015 to define the vision for Manchester. Over one-third of responses focused on climate action, leading to the establishment of the Manchester Climate Change Board (MCCB). 2018 became a significant milestone for climate change action in Manchester. Science-based targets were proposed for Manchester and adopted by Manchester City Council on 14th November 2018, committing to be zero carbon by 2038. This was further reinforced by the Council declaring a Climate Emergency on 10th July 2019.

A **Draft Manchester Zero Carbon Framework (2019)** has been published, with the Final Framework and Action Plan scheduled for March 2020. Notably, Manchester City Football Club are signed up as one of the 10 MCCB Pioneers, setting an ambitious tone for the Etihad Campus. OVG fully supports this and will also sign-up to the action plan.

3.2 NATIONAL

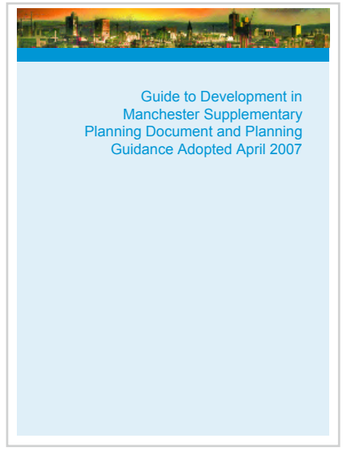
The presumption in favour of sustainable development is at the heart of the National Planning Policy Framework (updated Feb 2019), cascading through to local plans and the approval process for planning applications.

On 27th June 2019, the UK Government increased the ambition of the Climate Change Act 2008 to becoming net zero carbon by 2050. In addition, a 25 Year Plan to Improve the Environment was published to set the level of ambition.

3.3 GLOBAL

Climate Change is recognised as one of the biggest threats facing our planet. In 2015, the Paris Agreement was adopted by countries around the world, forming a global consensus on the need to limit the global temperature rise to well below 2 degrees Celsius through greenhouse gas mitigation measures. Annual UN Climate Change Conferences have taken place to develop the detailed action plan. Complementary to this in 2015, countries around the world adopted seventeen Sustainable Development Goals as a means to end poverty, protect the planet and ensure prosperity for all by 2030 through collective action.

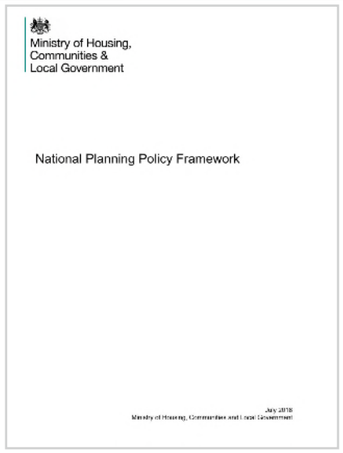


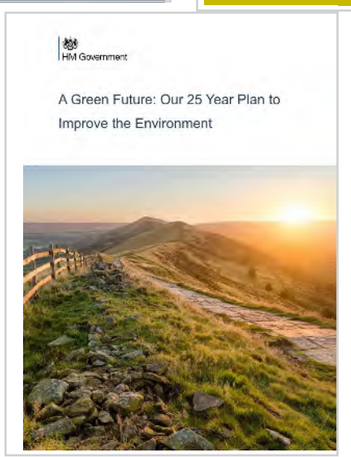














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4 SUSTAINABILITY STRATEGY OVERVIEW

4.1 ETIHAD CAMPUS STRATEGIC SUSTAINABILITY FRAMEWORK

The Etihad Stadium and City Football Academy have already been catalysts for the transformation of Eastlands. As the Campus embarks on the next key phase of its transformation to a world-class destination amidst increasing public awareness of the climate and biodiversity crisis, it recognises the opportunity for it to play its full part in exemplifying sustainable development.

The Etihad Campus aspires to be a pioneer for the whole of Manchester in pursuing its twin objective of realising locally-inclusive, globally-competitive economic growth, whilst simultaneously transforming to a net zero-carbon campus.

Four key themes underpin the delivery of this vision:

Climate & Nature Positive	Vibrant & Inclusive	Healthy & Active	Open & Connected
The Campus is a beacon of Manchester's rapid transition to a zero-carbon city, rich with wildlife and green infrastructure.	The Campus works for everyone and provides unrivalled education, training and employment opportunities for local residents.	The Campus is a world-class destination for sport, performance and leisure that inspires healthy lifestyles and workplaces.	The Campus is fully integrated into the fabric of the City, with excellent transport connections that support sustainable travel.

The Etihad Campus Strategic Sustainability Framework will provide an overarching vision for different partners and future plot developments to harmonise around in articulating and delivering the Campus sustainability ambitions. OVG and the new arena will play its part in delivering this vision.

4.2 OVG MANCHESTER SUSTAINABILITY VISION

As one of the first major developments within the Etihad Campus masterplan, the proposed OVG Manchester arena will align with the Campus vision and demonstrate how the ambitions can be translated into supporting sustainable and inclusive growth in line with the Our Manchester 2025 vision and emerging Zero Carbon 2038 framework.

4.3 SUSTAINABILITY APPROACH

Sustainability is inherent in the design and construction documentation to ensure it is a collective responsibility with targets owned by project team members best placed to influence and deliver these.

To deliver the aspiration of being one of the greenest arenas in the UK in the widest sense of sustainability, the Etihad Campus Strategic Sustainability Framework will be used to drive sustainability issues most pertinent to the design, construction and operation of the arena, namely energy, transport, waste and social value.

In line with current planning policy, a BREEAM pre-assessment has been undertaken to set out to confirm BREEAM Very Good with a route map to the higher rating of Excellent (See Appendix D). Certification will be sought to demonstrate industry best practice is captured.

The Etihad Campus sustainability themes align with the standard categories within the traditional Environmental Standards Statement (ESS) and is broadly complemented by BREEAM (Table 4.1). It can be seen that the Etihad Campus goes beyond just focusing on environmental sustainability to putting people at the heart of the development through incorporating social sustainability.

Table 4.1: Comparison of ESS, Etihad Campus and BREEAM sustainability themes

ESS Themes (Guide to Development in Manchester SPD, 2007)	Etihad Campus Sustainability Themes	BREEAM NC 2018 Categories
Energy efficiency and renewable energy	Climate & Nature Positive	Energy
Environmental design	Climate & Nature Positive	Materials
	Healthy & Active	Health & Wellbeing
	Open and Connected	Transport
Water management and weather resilience	Climate & Nature Positive	Water Pollution
Waste management	Climate & Nature Positive	Waste
Construction management	Climate & Nature Positive	Management
	Healthy & Active	Pollution
Biodiversity	Climate & Nature Positive	Land use & Ecology
Adaptation to climate change	Healthy & Active	Health & Wellbeing, Waste
Not covered	Vibrant and Inclusive	Management (Consultation)

The following chapters unpacks each of the Etihad Campus sustainability themes to demonstrate how the Proposed Development is playing its full part in delivering the net zero carbon 2038 vision. Each section comprises:

- Headlines outlining the key sustainability outcomes
- Details of sustainability commitments
- Summary of link documents for further technical details
- Summary of relevant local planning policies
- Contributions to the global UN Sustainable Development Goals

5 CLIMATE & NATURE POSITIVE

"Beacon of Manchester's rapid transition to a zero-carbon city, rich with wildlife and green infrastructure"

Headlines

Energy

- Route-map to net zero-carbon 2038
- 34% improvement on Part L through use of renewable energy and maximum efficiency throughout the building, bettering planning policy of min. 6%. There is further potential to increase this as PV technology develops
- PV area maximised on the roof
- Commitment to min. 3-Year Post Occupancy Evaluation
- Energy efficient plant and building management
- Circular economy principles to reduce embodied carbon

Materials & Waste

- Whole life carbon assessment
- Responsible and local sourcing of construction materials where possible
- Commitment to supply chain engagement to reduce excessive and non-recyclable packaging, including single use plastic
- Operational targets to be set for achieving zero single use plastic and zero waste to landfill
- In-use waste audits for continuous improvement

Water

- Over 40% less water use than a comparable building through water efficient sanitaryware and catering specifications
- 100% rainwater for toilet flushing
- Over 50% betterment on existing surface water run-off rates
- Combined active system for attenuation and rainwater harvesting to optimise efficiency
- Water efficient systems throughout the building

Biodiversity

- Replacement of existing poor-quality site with enhanced public areas and investment in improved environment and habitat on and off site
- Biodiversity 'green ring' of planting around the site
- Canal side public realm enhanced by wildflowers

ENERGY

Zero Carbon 2038 Definition

Manchester is committed to playing its full part in limiting the impacts of climate change by adopting science-based targets aligned with the Paris Agreement carbon budgets for limiting global temperature rise below 2 degrees Celsius. Analysis by the Tyndall Centre for Climate Change Research at the University of Manchester has identified the Manchester proportion of this budget and the emissions pathway to support the Paris Agreement. By 2038, Manchester is committed to be net zero carbon relating to total energy used in buildings and transport. A detailed plan for achieving this will be released in March 2020, with anticipated subsequent guidance on translating this into updated local planning policy.

Part L Compliance

Prior to revised planning policy on carbon reductions to deliver a net zero carbon Manchester by 2038, current policy based on Building Regulations Approved Document Part L 2013 have been used to demonstrate how the Proposed Development has actively reduced carbon emissions through design. Part L sets out the minimum energy efficiency standards and targets for regulated carbon emissions, i.e. those associated with the fixed building systems, which a design team can influence. Manchester City Council's planning policy requires a minimum 6% betterment of this carbon emissions target. An Energy Statement has been prepared to demonstrate how the Proposed Development has surpassed this, as summarised in Fig 4.1. Through best practice design following the 'Lean-clean-green' energy hierarchy, a saving of 34% is predicted, which betters the minimum 6% for planning and comparable arenas in the UK. There is further potential to increase this as PV technology develops prior to installation.

Future district heating connection

The Proposed Development is situated outside of any existing and planned district heating networks in Manchester. In the event that a heat network does become available in the future, space and building services provisions have been allowed for within the ground floor plant space to accommodate a district heating substation. This would replace the gas fired boilers to provide an alternative low carbon heat source for the hot water generation, presenting future opportunity to further reduce the carbon emissions of the building.

Low and Zero Carbon Technologies

A number of low and zero carbon technologies have been appraised within the Energy Statement as means of reducing the carbon emissions from the Proposed Development. This shows air source heat pumps and solar PV as the most feasible and have been incorporated into the proposals.

Additional technologies considered but discounted as not possible or viable were; biomass heating, solar hot water, wind and hydrogen fuel cell.

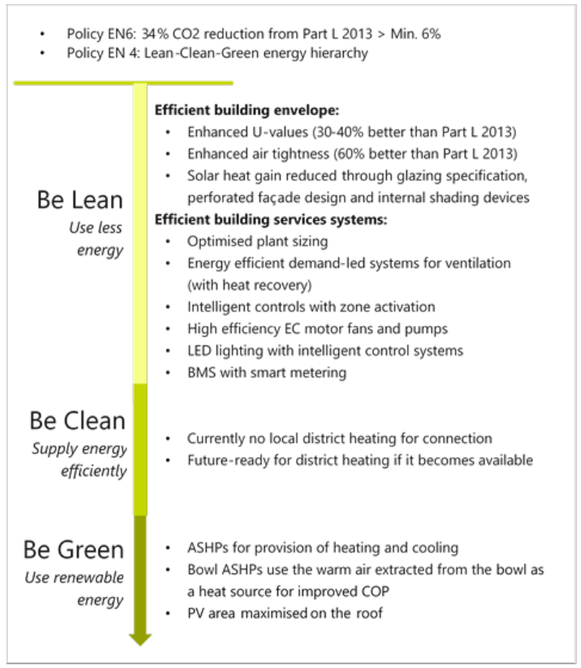


Figure 5.1: Part L compliance

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Figure 5.2: Example of sharing best practice sustainability with industry organisations

Total Operational Energy Prediction

The zero carbon 2038 commitment relates to total actual energy used by a building in operation. This includes:

1. **Regulated energy** relating to fixed building services systems (e.g. heating, cooling, ventilation, lighting) which the design team can influence through best practice design and the building operator can influence through sustainable building management procedures; and
2. **Unregulated energy** relating to other energy uses specific to a building's function (e.g. office equipment, specialist equipment associated with shows, catering) which are linked to future partners of the arena and building user behaviour.

Unregulated energy typically accounts for over half of the total energy used in a building, with this proportion increasing as building design becomes more energy efficient. As such, the Proposed Development is committed to undertaking a total operational energy prediction in line with the industry best practice guide, CIBSE TM54. With a better understanding of total energy use, an action plan can be put in place to focus on key leverage points for carbon reduction and inform a collaborative approach with future partners and building users to collectively deliver the zero carbon 2038 vision.

Post Occupancy Evaluation (POE)

Energy use in operation will be monitored through an extensive metering strategy and a minimum 3-year POE programme to identify opportunities for continuous improvement and engagement with both staff, tours operators and audiences. Where appropriate, collaboration will be sought with relevant industry organisations to knowledge share, for example Manchester Arts Sustainability Team, Julie's Bicycle and A Greener Festival. We are also supportive of the announcement by Massive Attack in November 2019 to work with the Tyndall Centre Manchester to create a zero-carbon plan for concerts and tours, focusing on band travel and production, audience transport and venue. If appropriate, we would welcome the opportunity to explore future collaboration and data sharing in support of this research.

Existing processes around POE and energy monitoring are already deployed on the Etihad Stadium and City Football Academy. Lessons learnt will be shared to ensure consistency in reporting across the Campus, ensuring an integrated approach to carbon reduction for maximum impact.

Towards Zero Carbon 2038

Designing an arena on a tight urban plot to be net zero carbon on day one is a challenge due to the energy intensive nature of the building function and spatial constraints for on-site renewables.

The Energy Statement sets out how the Proposed Development has actively sought to minimise energy requirements in the first instance through an energy efficient envelope (high performing insulation and detailing for good air tightness) and high efficiency building services systems. This ensures the building has an inherent low operational energy baseline.

To ensure the Proposed Development can continue to transition towards net zero carbon in operation by 2038, the building services systems have been designed to operate on predominantly electricity to minimise on-site fossil fuel combustion and benefit from long-term grid decarbonisation.

A plan will be put in place to transition away from the gas-fired boilers for hot water and stair core heating, and gas for the main kitchens when technology becomes more viable and carbon efficient to deliver the same outcome.

Future zero carbon retrofits and carbon offsetting will be explored as new technology and policy emerges to reach net zero carbon by 2038.

Figure 5.3 provides an illustrative route map to net zero carbon by 2038. Reference should be made to the Climate Change chapter within the EIA for details and preliminary carbon estimates associated with operational energy.

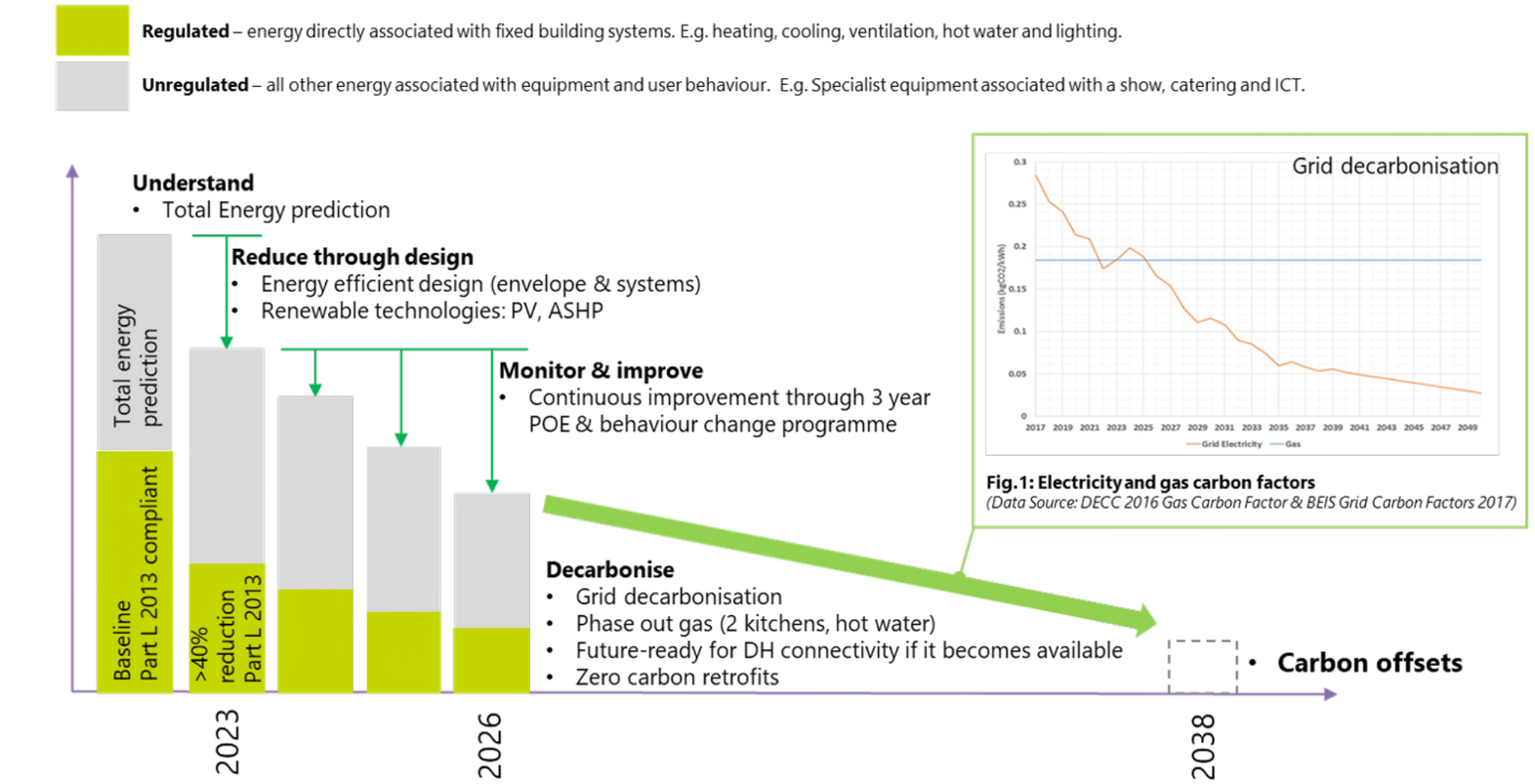


Figure 5.3: Transition to Net Zero Carbon

FURTHER INFORMATION

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• BREEAM Pre-assessment • Energy Statement	• Design and Access Statement • Environmental Statement • Climate Change Chapter	**Core Strategy (MCC, 2012):** • Policy EN4 LZC development • Policy EN5 CO2 reductions **Manchester Zero Carbon Framework 2020-2038**	7 AFFORDABLE AND CLEAN ENERGY 13 CLIMATE ACTION

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Figure 5.4: Example of potential behaviour change programmes implemented by a potential catering contractor at another arena

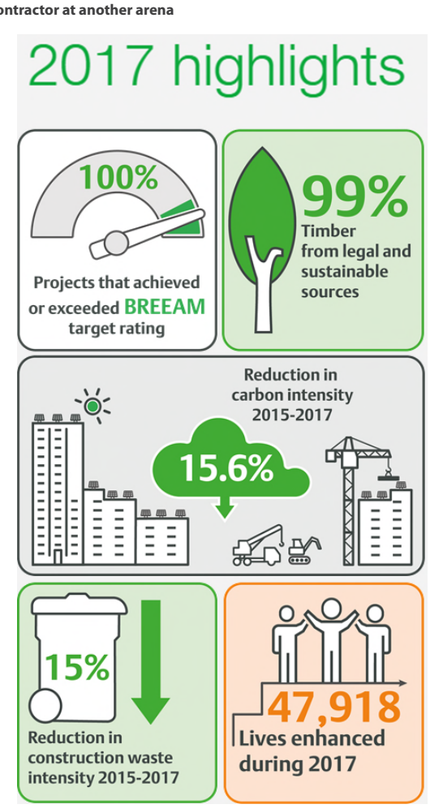


Figure 5.5: 2017 Site Sustainability highlights from our Preffered Contractor

CIRCULAR ECONOMY

With increasing recognition that a shift away from the current linear 'take-use-dispose' resource model is required to stay within the ecological footprint of the planet, an alternative circular economy model is emerging. The emphasis is shifted to re-use where possible to lessen the ecological burden of building on greenbelt land and new resource extraction for construction.

Unlocking the potential of a contaminated brownfield site earmarked for urban regeneration as a major leisure visitor destination aligns with the circular economy principles of re-use. It is also inherently sustainable, taking advantage of proximity to existing infrastructure and excellent accessibility by public transport. Furthermore, the Proposed Development has taken circular economy principles into consideration for the whole life cycle of the building, as summarised below. Reference should be made to the Design and Access Statement (Section 8: Sustainable Design and Construction for details).

	Impacts	Key Actions
Design	Embodied carbon, emissions associated with the production, transportation and installation of construction materials, typically accounts for over half of the whole life carbon of a building. With increase in building energy efficiency, this share will continue to increase. However, historically this is overlooked due to lack of consistent measuring and reporting mechanisms.	• Use less – material optimisation to minimise the use of new materials • Use less new – explore opportunities for increasing recycled content and materials to reduce the embodied carbon, e.g. cement replacement, recycled aggregates. • Responsible and locally sourced materials (BREEAM Mat 03)
Construction	As above, embodied carbon is associated with the delivery and installation of material. Significant construction waste can also arise from packaging, off-cuts and over-ordering.	• Require energy and waste to be monitored and reduced on site (BREEAM Man 03 and Wst 01, Construction Management Plan). As standard, our preferred contractor installs automatic meter readers connected to an online reporting system to identify and eliminate unnecessary energy use. • Energy and water efficient site accommodation and establishment of a temporary grid connection where possible to minimise the need for on-site generators, beneficial for both carbon reduction and local air quality. • Encourage modular and off-site construction to benefit from more material and energy efficient modern methods of construction • Supply chain engagement to harness knowledge and innovation around minimising embodied impacts and waste diversion from landfill, e.g. minimising or taking back packaging, product leasing models, donating timber offcuts to local community goods such as Emerge and Mens' Sheds • Green travel plan for site activities to minimise vehicle movements, with benefits to carbon reduction, local air quality and reduced traffic disturbance to neighbouring communities.
Operation	According to a report commissioned by the festival industry, Show Must Go On (Powerful Thinking, November 2015), operational waste typically accounts for 7% of a festival's footprint. Similarities in consumption (transient crowds, catering and merchandising) could be assumed to conclude similar impacts for an arena. In addition, there is increasing public awareness of the environmental impacts of single-use plastic.	• Source 100% of single-use packaging products from recyclable, renewable post-consumer content, compostable or credible certifications • Collaboration with local social enterprises that take and redistribute edible food that would otherwise be thrown away • Free drinking water refill points to reduce reliance on disposable plastic bottles • In-use waste audits, e.g. food waste tracking systems to avoid over-ordering, recycling rates • Commit waste contractors to monitoring and inspecting the final destination of sorted material
End-of-Life	Demolition results in significant waste, with contamination often hindering efficient resource recovery. Considering ease of deconstruction can support recovery, refurbishment and re-use elsewhere. Designing for future flexibility can help the Proposed Development stay relevant and mitigate the risk of redundancy before the end of its useful design life, minimising the replacement cycle which puts pressure on virgin resources.	• Adaptability of the event space is inherent in the brief to accommodate different types and scales of shows • Spatial and technical allowance for future servicing retrofits to maintain comfortable internal temperatures in the context of climate change • Simple multi-layer panelised façade for ease of replacement and deconstruction

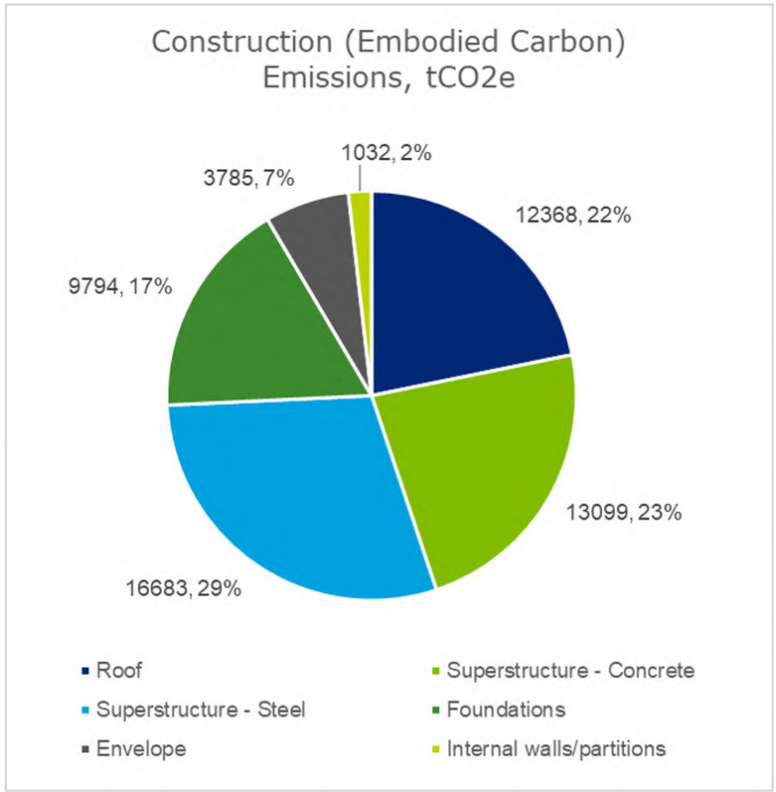


Figure 5.6: Embodied Carbon Summary

EMBODIED CARBON

A preliminary whole life carbon assessment has been undertaken as part of the Environmental Impact Assessment. Opportunities to reduce this will be actively explored during detailed design in collaboration with the construction supply chain through early contractor engagement.

EARTHWORKS

Extensive appraisal of the site levels took place at concept design to minimise excavation and need for removal of soil from site. However, site levels for accessibility and ground contamination have resulted in the need to remove up to 101,000m3 of soil from site.

Contaminated soil is classed as a hazardous waste with standard disposal routes sending this landfill. To mitigate against the environmental impacts of this, bioremediation trials are taking place to inform a soil remediation strategy. If successful, the contaminated excavation waste can be treated for re-use rather than sent to landfill.

FURTHER INFORMATION:

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• Waste Management Strategy	• Design and Access Statement (Section & Sustainable Construction) • Environmental Statement • Climate Change Chapter • Construction Management	**Core Strategy (MCC, 2120):** • **Policy DM1** Development Management • Policy EN19 W**aste**	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 13 CLIMATE ACTION

WATER

A changing climate will result in hotter, drier summers and more extreme weather events. Water conservation for drought tolerance and sustainable rainwater management for flood resilience during extreme storms has been factored in to the Propose Development.

Water Efficiency	**Sustainable Drainage**
• Over 40% improvement over notional BREEAM building (BREEAM Wat 01) through water efficient sanitaryware and catering specifications • 100% rainwater for WC flushing • Water efficient sanitaryware and catering equipment • Drought tolerant planting	• Over 50% betterment on existing run-off rates through use of attenuation tanks • Attenuation and rainwater harvesting tanks combined as an innovative active system for efficient construction and operation • Permeable paving incorporated into the Level 1 podium where practical to manage surface water at source where feasible • Drainage strategy includes 40% allowance for climate change

Nature-based infiltration drainage solutions have been considered in recognition of wider co-benefits that can be delivered through an integrated approach to sustainability. However, as outlined in the Drainage Strategy, these have been discounted due to spatial constraints and presence of contaminated ground.

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• Green and Blue Infrastructure	• Environmental Statement • Water Quality, Drainage and Flood Risk	**Core Strategy (MCC, 2012):** • Policy EN14 Flood Risk • Policy EN17 Water Quality • Policy EN8 Adaption to Climate Change	6 CLEAN WATER AND SANITATION 13 CLIMATE ACTION

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Figure 5.7: Canal side ecological enhancements

BIODIVERSITY

Pre-development

An ecological appraisal, including site survey, was undertaken in July 2019. Whilst the site was used as poor-quality occasional parking, the survey did identify areas of the site as unimproved neutral grassland, scrub encroachment and broadleaved trees. Despite being mainly gravel and hard standing, the site has naturally colonised over time and typical of a site with ongoing disturbance, there are areas of bare ground where parking and storage use continues. No protected species have been identified on the site.

Existing Etihad Campus

The Proposed Development sits within a wider landscape masterplan for the Etihad Campus, which aims to ensure each forthcoming plot development:

- Ties in to existing green corridors to maximise connectivity and value to both wildlife and pedestrians
- Lessons learnt from successful plant species and habitat establishment within the Campus inform future landscaping proposals
- Green-blue infrastructure and biodiversity initiatives which unlock wider social value and co-benefits are prioritised

Post Development

Whilst the building footprint and supporting hard-landscaping for access takes up the majority of the site, the Proposed Development has sought to creatively maximise soft planting into the proposals. A biodiversity green ring around the site has been incorporated through a series of green screens, planters and tree lines. Plant species have been carefully selected in conjunction with the ecologist. These provide links with existing green infrastructure, support local wildlife and help create a sense of wellbeing for users in the public realm and the general public passing by. In particular, wildflower planting, trees and green screens have been introduced to enhance the canal side edge, which significantly improves the attractiveness of this pedestrian route whilst creating new valuable canal side habitat. External lighting has been designed to not increase lighting on the canal, using directional luminaires, to support favourable conditions for local wildlife.

The feasibility of a green roof has been extensively considered, taking a multi-disciplinary approach to fully identify its co-benefits beyond biodiversity of sustainable drainage, air quality improvements and urban cooling. The provision of large spaces that are clear of columns to facilitate unobstructed sightlines within the arena result in long structural spans, which is not complementary to a heavy green roof build-up. A lighter (or shallower) green roof build-up is not expected to provide the required benefits and the cost of such a provision would override the benefits achievable. Green roofs have therefore been discounted from the project scheme on grounds of the increase in embodied carbon resulting from an enhanced structural solution needed to support a green roof.

Landscape and Habitat Management

It is also recognised that biodiversity is not simply delivered at the end of construction but is something that is nurtured over time to ensure wildlife can flourish. The Etihad Campus management team are already engaged in a number of habitat monitoring initiatives across the site, linked to trialling different sustainable land management practices to maximise both habitat creation and carbon storage. The Proposed Development will align with the Campus' existing successful land management policies and processes through contributing funds to the Campus landscape and habitat management plan. In addition, staff will be encouraged to volunteer time to support the ongoing Campus biodiversity outreach work with local schools and community groups.

FURTHER INFORMATION:

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• Ecological Assessment • Green and Blue Infrastructure • Tree Survey	• Design and Access Statement • Landscape & Public Realm Strategy	**Core Strategy (MCC, 2012):** • Policy EN9 Green Infrastructure • Policy EN8 Adaption to Climate Change	 

6 VIBRANT & INCLUSIVE

"An arena for everyone, providing unrivalled education, training and employment opportunities for local residents."

Headlines

Social Value

- Estimated 3,344 FTE construction jobs, including 100 apprenticeships, created during construction phase
- Estimated 566 FTE jobs created over the first 20 years of operation
- Estimated additional £36 million per year in direct annual local spending
- Over £1bn of economic and social value created

Inclusive Design

- Full inclusive facility for all user groups
- Targeting Attitude is Everything Gold Status
- Provision of Sensory Room
- 2 No. Changing Places toilets
- Provision of sight and hearing enhancements

SOCIAL VALUE

Regeneration offers tremendous opportunity for delivering social value to local communities. It is recognised that Manchester City Council are pioneers in maximising public benefit for local benefit through its Social Value Policy and Social Value Toolkit for Suppliers (2017). Whilst this toolkit is voluntary for non-public procurements, it will be adopted to drive best practice into the Proposed Development. Aspirations for maximising social value are summarised below.



The project is already in discussion with prospective contractors who have a demonstrable track record of unlocking a wide range of social value through the construction phase. Some examples of previous achievements on the adjacent Manchester City Football Academy which we would look to emulate for the Proposed Development include:

- Bespoke social value plan developed and delivered by the contractor's Education and Community Coordinator, drawing on their extensive existing network to truly reach out and integrate with local initiatives in both neighbouring communities and the wider city
- Employment drop-in centre on site for local members of the public to enquire about training and employment opportunities
- Mentoring, summer internship and Career Ready workshops provided to local schools, colleges and universities
- Supporting social mobility through collaborating with agencies and charities that focus on helping hard to reach groups and disadvantaged individuals back into employment and housing
- Corporate volunteering days with local charity and community groups, donating both labour and materials in kind
- Setting and delivering against local spend targets
- Use of the Social Value Portal to monitor and report on return on social investment, aligning with the National Themes Outcomes and Measures (TOMs) framework

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Figure 6.1: Wheelchair viewing spaces will be dispersed through the arena

INCLUSIVE DESIGN

The Proposed Development aspires to truly be an arena for everyone, exceeding minimum requirements to allow people to use the scheme safely, with dignity, comfort, convenience and confidence.

An Access Group comprising representatives from local disability groups will be set up as key stakeholders throughout the design and delivery process. In collaboration with Attitude is Everything, the disability-led charity improving access to live music for deaf and disabled people, the Proposed Development also aspires to achieve Attitude is Everything Gold Status accreditation.

Inclusive design best practice has already informed the planning application, with key proposals including:

- A sensory room, providing a specially designed environment for people with special needs who may find themselves overwhelmed and in need of a safe space to return to a state of calm
- Multi-faith rooms
- 2 No. changing places toilets, going beyond compliance requirements for standard accessible toilets
- A range of toilets catering for male, female, gender-neutral and wheelchair users
- Baby changing spaces
- Wheelchair user viewing spaces dispersed throughout the arena, with accompanying companion seating and close proximity via unimpeded routes to accessible WCs
- Concessions designed with accessible point of sales, appropriate counter heights and induction loops
- Accessible back of house and performance areas which enable deaf and disabled artists to operate freely
- Inclusive design best practice for internal finishes, fixtures, fittings and wayfinding.
- Sounds reinforcement and enhancement systems
- Inclusive emergency evacuation plans
- Assistant dog spending area
- Accessible parking bays and cycle parking spaces

After the venue opens, active management plans will be put in place to ensure clear operational policy mechanisms complement the physical accessible features to maintain a consistent high quality inclusive and accessible environment.

FURTHER INFORMATION

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• Social Value Toolkit • Local Benefits Proposal	• Design and Access Statement • Landscape and public realm strategy • Economic Assessment • Community Involvement Statement • Broadband Connectivity Statement • Environmental Impact Assessment • Socio-Economic Impacts	**Core Strategy (MCC, 2012):** • Policy EC1 Employment and Economic Growth • Policy EC7 Eastlands Strategic Employment Location	

7 HEALTHY & ACTIVE

"World-class destination for performance, sport and leisure, inspiring healthy lifestyles and workplace."

Headlines

- Healthy internal environmental quality aligned with BREEAM
- Comfortable wind microclimate
- Resilience to future increases in temperature
- No significant impact on local air quality
- Healthy eating options & free drinking water provision
- Robust safety & security strategy developed with GMP
- Targeting local employment and sustainable & healthy travel

HEALTHY LIFESTYLES IS ALSO SUPPORTED BY ACTIVE TRAVEL SUMMARISED UNDER 'OPEN & CONNECTED'. HEALTHY INTERIORS

Whether regular staff working back of house or transient audience attending an event, it is recognised that the internal environmental quality can have a significant impact on the health and wellbeing of people interacting with the building. Best practice design standards have been adopted from BREEAM to create a comfortable internal environment in terms of lighting, temperature, acoustics and air quality.

ACCESS TO NATURE

'Green biodiversity ring' of planting around the arena optimises the tight urban site for nature interaction. In particular, the canal-side public realm enhanced by wildflowers provides an ideal opportunity for comfort breaks amongst nature for all building users.

COMFORTABLE MICROCLIMATE

A wind microclimate assessment forms part of the Environmental Impact Assessment. A range of mitigation measures in the form of trees have been adopted to ensure safe and comfortable conditions for pedestrians within the public realm and at entranceways. Mitigation through green infrastructure also unlocks a number of co-benefits such as biodiversity, health & wellbeing benefits of interacting with nature

CLIMATE RESILIENCE – KEEPING COOL

The Proposed Development has been designed for future climate weather data to mitigate the risk of overheating within the arena in the short term and ensure it is adaptable in the long term by providing spatial and technical allowances for future retrofit. The cooling hierarchy has been applied to minimise future energy relating to increased cooling with rising temperatures.

Externally, soft landscaping and the building overhang will provide natural shading and urban cooling during heatwaves.

AIR QUALITY

Air quality has been assessed as part of the Environmental Impact Assessment, concluding low impact from potential sources and the following mitigation measures:

- **Construction** – Dust management best practice included within the Construction Environmental Management Plan
- **Building services** – Heating provided by Air Source Heat Pumps powered by grid electricity to minimise fossil fuel combustion on site. Low NOx gas-fired boilers are proposed for hot water.
- **Traffic** – a travel plan has been produced which outlines proposals to encourage sustainable travel choices to events. See 'Chapter 7 Open & connected'.

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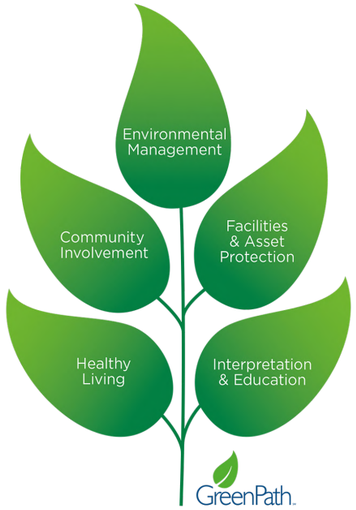




Figure 7.1: GreenPath and Healthy Living Policy from the Preferred Contractor

HEALTHY EATING

Discussions have commenced with potential catering contractors and there will be a focus on sustainable food sourcing and procurement. There will be a wide range of food offers including the provision of healthy food choices as part of the available concessions on offer. Free drinking water refill points are also proposed to encourage staff and visitors to stay hydrated.

The preferred catering contractor has a demonstrable track record for promoting healthy living through their established GreenPath sustainability strategy in place across similar venues around the world. Similar polices for healthy, locally sourced foods will be adopted for OVG Manchester.

SAFETY & SECURITY

The security design for the OVG Manchester Venue has been developed in consultation with Greater Manchester Police to deliver a security strategy to provide a safe and secure venue. The venue will be compliant with the revised National Planning Policy Framework (NPPF), Green Guide 2018 and CPNI Counter Terrorist and Design out Crime advice and recommendations and will also be at the forefront of all new developments such as "Martyn's Law" which will be incorporated into the licencing conditions. OVG have an in-house world leading security consultancy, Protect Advisers that has reviewed and provided input into these plans. The arena will also be embedded into the existing Etihad Campus, which has an established security operations team to provide site specific operational insight.

The principal objective is to demonstrate that all aspects of security have been given the highest consideration and that qualified security consultants have informed the design from the earliest stages resulting in appropriate, agreed and effective mitigation measures and strategies. The security strategy includes, but is not limited to, pedestrian and vehicle access control, hostile vehicle mitigation measures, surveillance, intruder detection, lighting, pedestrian and vehicle screening/validation, search as appropriate, and security control facilities that have been based around the agreed key threats and vulnerabilities as identified in the Threat and Risk Assessment.

FURTHER INFORMATION

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• Crime Impact Assessment • BREEAM Pre-assessment • Blue and Green Infrastructure	• Design and Access Statement • Landscaping and Public Realm Strategy • Daylight / Sunlight Assessment • Townscape & Visual Impact Assessment • Construction Environmental Management Plan • Environmental Impact Assessment • Air quality and Dust • Lighting • Noise and Vibration • Wind microclimate	**Core Strategy (MCC, 2012):** • Policy EN16 Air Quality • Policy EN7 Energy Infrastructure opportunities • Policy EN8 Adaptation to Climate Change • Policy DM1 Development Management GMCA Air Quality Action Plan	3 GOOD HEALTH AND WELL-BEING

8 OPEN & CONNECTED

"Fully integrated into the fabric of the City, with excellent transport connections that support sustainable travel"

Headlines

- Sustainable travel promoted with no net parking provided on site
- Connection to the Manchester Beelines network for enhanced walking and cycling routes from the city centre and into communities
- Integrated event communication to ensure sustainable travel options are promoted and encouraged at the point of ticket sale
- Inherent good public transport links, with enhanced services and shuttle buses during events
- Investment in a further 240 covered cycle parking spaces across the Etihad Campus to complement the existing 284
- Enhancement Controlled Parking Zones around the venue to prevent unauthorised parking impacting on local residents and congestion

SUSTAINABLE TRAVEL

The Proposed Development benefits from excellent public transport links inherent in the Etihad Campus and will continue to support initiatives that make public transport, walking and cycling the preferred options. Existing site connections are summarised in Figure 7 1.

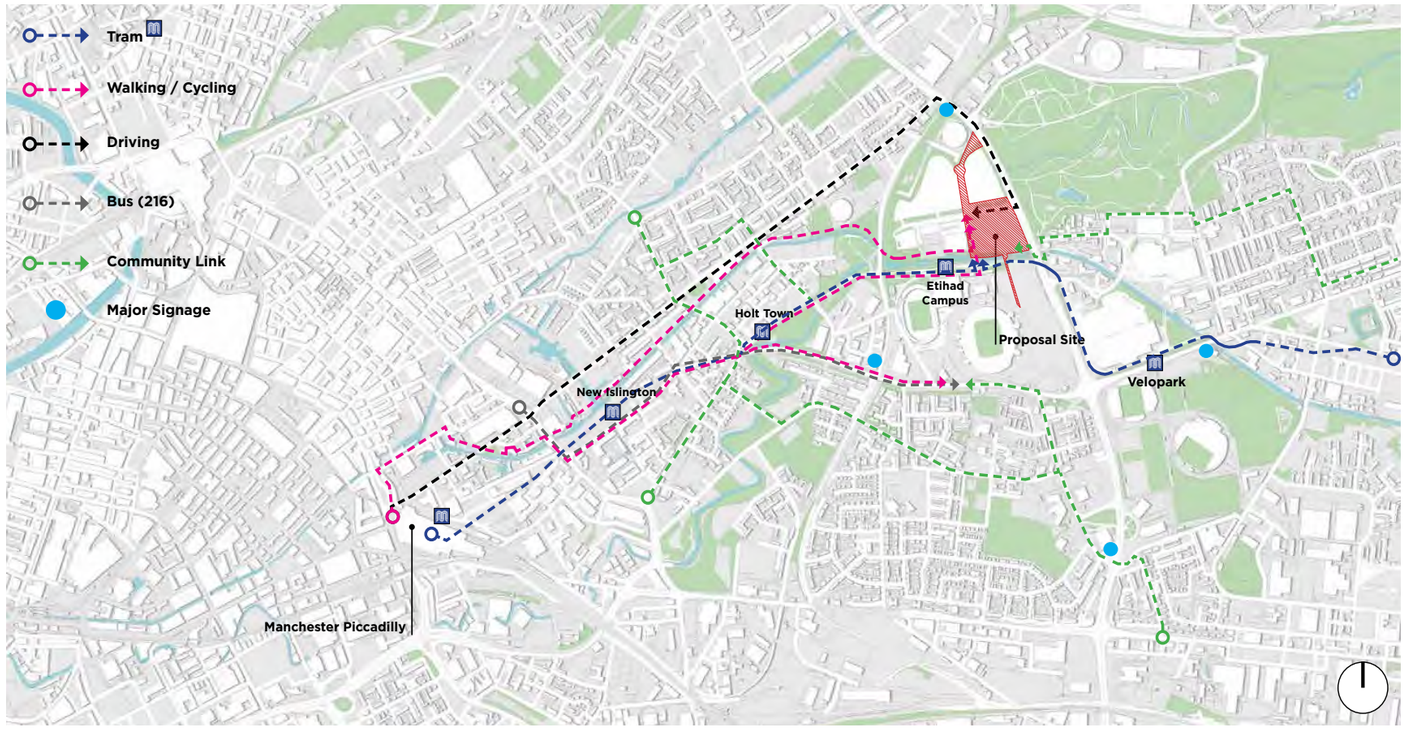


Figure 8.1: Existing Site Connections

A Transport Assessment & Travel Plan accompanies the planning application. A campus wide approach is being taken to promote active and sustainable modes of travel to both staff and event attendees. Active and sustainable modes of travel not only reduce travel related carbon emissions, co-benefits include improved air quality and active lifestyles.

Sustainable travel will be encouraged through a range of physical interventions and operational transport measure, as outlined in Table 8.1.

A Travel Plan Coordinator will be appointed to manage the Travel Plan, which will include overseeing its implementation and monitoring success.

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Figure 8.2: Indicative proposals for non-event day canal-side experience

Table 8.1: Sustainable Transport Interventions

Active Travel	Low Carbon Travel
• Extensive provision and promotion of safe pedestrian footways within and around the Site, connecting to the Metrolink station (less than a 5-minute walk) and Manchester Piccadilly is a 25-30 minute walk • Two National Cycle Network routes within the vicinity of the Site (Route 60 Alan Turing Way, Route 86 Ashton Canal) • Surrounding routes form part of the proposed Manchester Beelines network, a new plan to create a city-region-wide cycling and walking network • Improvements to walking and cycling routes between the Etihad Campus and city centre (Ashton New Road Route, City Link Route, Ashton Canal Towpath Route). To include improved signage, lighting, vegetation management, art work and stewarding for certain events to make routes more attractive and increase reinforce sense of personal safety. • 284 existing cycle parking spaces across the Etihad Campus, currently under-utilised, which will be promoted to arena users. • Commitment to install 240 covered cycle spaces to supplement the existing spaces across the Campus. In line with the Campus strategy, these cycle parking facilities are expected to be installed in locations where cycle routes enter the campus.	• Proximity to three main bus corridors with frequent and well-connected services • Served by the Metrolink Tram (blue line) which connects to Manchester Piccadilly and the City Centre to the west and Ashton-under-Lyne station to the east • Integrated event communication to ensure sustainable travel options are promoted and encouraged at the point of ticket purchase • Live travel information within the arena to make public transport visible and convenient • Public transport incentives for staff (both event and non-event) • Long term campus electrical vehicle charging strategy • No additional parking on site, increased protection for residents close to the site and sustainable travel promoted • Discussions with TFGM to run enhanced services around arena events (Metrolink and Bus) and shuttle-bus services between the Etihad Campus and City Centre. • Promotion of further park and ride opportunities

LOCAL RESIDENTS

The Proposed Development will align with the Etihad Campus' ethos of being a good neighbour by reducing overall transport impacts. Controlled Parking Zones currently operate on Etihad Campus event days and will be extended to provide a better service to local residents and to include all arena events to maintain accessibility and quality of life for local residents.

COMMUNITY USE

The arena will work with local partners to provide community activities outside of regular events. This could include:

- Considering the non-event day experience by opening the concourse food and beverage units on the south canal side to the landscaped podium space, providing amenities to visitors passing by the tow path and to local residents and businesses
- Adaptability of the event space is inherent in the brief, providing the possibility of portions of the building to be locked-off for reduced capacity requirements

FURTHER INFORMATION

Link Documents *(Appended)*	**Link Documents** *(Other Supporting Documents)*	**Key Planning Policy Reference**	**Contributions to the UN SDGs**
• Landscaping and Public Realm Strategy	• Travel Plan • Transport Assessment • Design and Access Statement • Environmental Impact Assessment • Traffic and Transport	**Core Strategy (MCC, 2012):** • Policy T1 Sustainable Transport • Policy T2 Accessible Areas of Opportunity and Need GM Transport Strategy 2040 (GMCA, 2019) Transport for Sustainable Communities (TfGM, 2013)	 

9 BENCHMARKING

“ The Arena at Eastlands will promote sustainability and be at the forefront of energy efficiency and best practice low carbon design, aspiring to be the most sustainable UK venue and amongst the world’s leading”

IS OVG MANCHESTER THE GREENEST ARENA IN THE UK?

It should be acknowledged that sustainability is contextual therefore impacts and mitigation measures are highly dependent on the local setting and climate. However, high level benchmarking has been undertaken to show how OVG Manchester is an exemplar sustainable venue which far exceeds current planning policy in response to the Climate Emergency:

Current planning policy	Current Manchester City Council planning policy exceeded, with a pro-active approach to addressing the emerging zero carbon 2038 framework (Table 8-1)
Current planning applications	Low carbon strategy better than comparable venues currently seeking planning permission in the UK (Table 8-2)
Greenest arenas around the world	Sustainable design and operational commitments align with best in class sustainable venues around the world (Table 8-3)

Table 9.1: Comparison with current Manchester City Council Environmental Sustainability Planning Policy with numerical targets

Policy	OVG Manchester	Could we do better?
EN 4 Reducing CO2 Emissions by enabling low and zero carbon development Apply the energy hierarchy **EN 6 CO2 reductions from low or zero carbon energy supplies** Min 15% improvement on Part L 2010 (equivalent to 6% improvement on Part L 2013)	**34% improvement** on Part L 2013 achieved through applying the energy hierarchy: **Lean** – Enhanced building envelope performance: Insulation over 40% better than Part L 2013; Glazing nearly 30% **Lean** – Efficient building services systems: demand-led systems with intelligent control and zoning, heat recovery, LED lighting, BMS and smart metering **Clean** – Future-ready for district-heating if this becomes available in the area **Green** – PV area maximised; ASHPs with heat recovery for heating/cooling PLUS: Route map to net zero carbon 2038	Insulation, glazing and building services systems are best available current viable technology. We will continue to review with the potential contractors to identify additional opportunities for carbon reduction. PV area on roof already maximised. Ongoing discussions with potential PV suppliers to ensure we are taking advantage of the latest viable lightweight technology PV performance.
EN 17 Water Quality Avoid adverse impact on water quality, minimise surface water run-off. Min. 50% betterment over the existing surface water run-off rate agreed with the LLFA.	50% betterment on the existing surface water run-off. Active rainwater management system to combine attenuation with rainwater harvesting to serve 100% water demand for toilet flushing. Significant improvement in water quality from existing untreated conditions. Porous paving on the podium will provide a level of filtration and the attenuation tank will provide further sediment settlement prior to discharge into the drainage network.	Limited space and contaminated ground means infiltration SUDS to manage all surface water at source is not viable for the site. Greater than 50% betterment would require increasing the size of the attenuation tank. Due to contaminated ground, the project ethos has been to minimise excavation to reduce the environmental and financial costs associated with removal, treatment and disposal of contaminated ground.

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Table 9.2 summarises current comparable venues recently submitted for planning as a benchmark for how others are responding to the climate emergency. In addition, the Golden 1 Center in the USA is shown for comparison as venue that is often seen as one of the most sustainable venues in the world, noting the favourable climate that support reliance on solar power.

Table 9.2: Best in Class Arena Case Studies - Environmental Sustainability Benchmarking

Arena Benchmark	Energy	Other Environmental Sustainability Features
OVG Manchester Capacity: Max. 23,500 Planning decision 2020	**34% regulated carbon emissions saving against Building Regulations Part L 2013** • High performance building fabric (Average U-values over 40% better than Part L 2013). • Efficient building services systems (demand-led, heat recovery, zone activation) • Building Management System with smart metering • LED lighting with intelligent control systems • Air source heat pumps for heating and cooling • PV area maximised on the roof • Future-ready for connection to a local district heating network should this become available • Operational energy assessment • Route map to net zero carbon by 2038	• Target of BREEAM Excellent under NC 2018 • Biodiversity enhancements • Working towards zero waste to landfill in operation • Over 40% less water use than a comparable building through water efficient sanitaryware and catering equipment. • Rainwater harvesting to provide 100% of water for toilet flushing • Proximity to good transport links • Enhancement of existing walking and cycling routes to the city centre
MSG Sphere, London, UK Capacity, 21,500 Planning decision: 2020	**13.4%** regulated carbon emissions saving against Building Regulations Part L 2013 • High performance building fabric • Efficient building services systems • District heating network for heating and cooling • 36 m2 solar PV for external lighting	• Target of BREEAM Very Good under NC 2014 • Biodiversity net gain • Rainwater harvesting for WC and urinal flushing • Proximity to good transport links
YTL Arena, Bristol, UK Capacity: 17,080 Planning decision 2020	**32.9%** regulated carbon emissions saving against Building Regulations Part L 2013 • High performance building fabric • Efficient building services systems • Future-ready for connection to a local district heating network should this become available • Air source heat pumps for heating, cooling and hot water • 10,000 m2 solar PV with battery storage • Operational energy assessment • Route map to zero carbon	• Target of BREEAM Excellent under NC 2018 • Biodiversity net gain • Rainwater harvesting • Zero waste to landfill in operation • Repurpose historic Brabazon Hangars into an arena, exhibition space and leisure/ entertainment destination
Golden 1 Center, Sacremento, USA Capacity: 18,000 Opened: 2016	**100%** solar powered • 1.2 MW solar array on the arena roof + 11 MW solar farm 40 miles away • Low energy Delta Breeze enhanced cooling system • High performance building fabric • Efficient building services systems	• LEED Platinum • Member of Green Sports Alliance • Ultra-low flow plumbing captures grey water for irrigating the open plaza outside the arena. Estimated 45% less water use than the California code 36% of construction materials from recycled sources (including material repurposed from the department store that was demolished to make way for the Golden 1 Center)

Table 9.3 provides additional benchmarking for context, showing a range of UK and USA venues of a similar scale that actively promote their sustainability policies and initiatives. This shows that our design and operational commitments align with the best in class.

Table 9.3: Additional Arena Case Studies - Environmental Sustainability Benchmarking

Arena Benchmark	Energy	Other Environmental Sustainability Features
P&J Live, Aberdeen Capacity, 15,000 Opened: 2019	• Energy centre which uses food and garden waste from around Aberdeen in an Anaerobic Digestion plant to generate hydrogen gas for powering the heating, cooling and power to the arena and onsite hotels	• BREEAM Excellent • Over 29,000 trees and shrubs planted on site • Network of over 7km of new footpaths serve the site, connecting it to surrounding areas • 98.8% of all materials have been re-used on site • Partnership with Dyce Academy to provide skills training, apprenticeships and employment opportunities
First Direct Arena, Leeds Capacity, 13,781 Opened: 2013	• EPC B • High performance façade and roof system for acoustic control and energy efficiency • LED lighting with intelligent lighting control, saving approximately 80% of energy compared to a conventional lighting solution	• BREEAM Very Good • Region of green roof • Rainwater harvesting for non-event toilet flushing • Sustainable urban drainage in the form of soakaway and infiltration incorporated in the new public plaza • High recycled content in construction material
Resorts World Arena, NEC, Birmingham Capacity, 16,500 Opened: 1980	• Energy efficient LED lighting with automatic sensors • Automatic start-stop escalators • Sustainability team comprising representation from several operational team staff, including catering, cleaning, facilities and events, to oversee sustainability initiatives	• Food waste taken to Trent Anaerobic Digestion Plant • Re-usable cups and refillable water bottles encouraged • 60% of food and beverage suppliers are small and medium enterprises, with 80% within a 30-mile radius of the NEC • 98% of disposable packaging spend is on sustainable products (recyclable, biodegradable or compostable)
Chase Center, San Francisco, USA Capacity, 18,000 Opened: 2019	• Light-coloured roof materials used to reflect rather than absorb solar heat to control solar heat gains and the local heat island effect. • LED lighting fixtures throughout • Heat pump chiller with heat recovery for efficient heat transfer in response to thermal comfort demands	• LEED Gold • Rainwater and grey water harvesting for non-potable applications (irrigation and flushing toilets) • 300 spaces provided for valet bicycle parking in collaboration with the San Francisco Bicycle Coalition • Signatories of the UN Sports for Climate Action Initiative • Anchor for Thrive City, which hosts new publicly accessible plazas and open space for community gathering and year-round health and wellness programming.
Fiserv Forum, Milwaukee, USA Capacity, 17,341 Opened: 2018	• Heat recovery technology and other efficient design practices reduce energy use by 12% • Intelligent building services to automate and optimise the internal environment for superior fan experience	• LEED Silver • Electric vehicle charging and carpool spaces • Low flow toilets to reduce water use by more than 30% • All food and drink containers are compostable, no plastic straws are distributed • All construction materials were selected to promote healthy indoor air quality, entire concrete and brick exterior regionally-sourced • Bird-friendly windows that minimise collision, designed in collaboration with Bird City Wisconsin
Amway Centre, Orlando, USA Capacity, 18,850 Opened: 2010	• Utilizing OUC chilled water to provide efficient air conditioning • Water savings of more than 1.3 million gallons through the use of low-flow fixtures and faucets • A reflective and insulated roof that reduces cooling costs • High-tech monitoring systems that shut off the lights when a room is empty • Both the roof of the building and the hardscape areas around the building have been designed to minimize daytime heat gain and subsequent night time release	• LEED Gold • Collecting rainwater from the roof and condensate water from the chiller equipment into a 5,000-gallon cistern to be used for site irrigation • Preferred parking for hybrids and other energy-efficient vehicles • Using more than 20 percent recycled materials and 30 percent regionally sourced materials in the building's construction, thereby saving transportation and production costs

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10 CONCLUSIONS

This Sustainability Statement seeks to demonstrate how the Proposed Development responds to the emerging Manchester City Council Zero Carbon 2038 framework and existing planning policies relating to sustainability. Furthermore, the Proposed Development aspires to be one of the most sustainable UK venue in the UK and amongst the world's leading venues.

The sustainability strategy has been structured around four sustainability themes taken from the wider Etihad Campus strategy:

1. Climate & Nature Positive
2. Vibrant & Inclusive
3. Healthy & Active
4. Open & Connected

This Statement has been produced in lieu of the current Environmental Sustainability Standards requirement to reflect the ambition of the Proposed Development to address sustainability in the widest sense and put people at the heart of both new development and climate action.

It can be seen that sustainability best practice commitments have been embedded into the Proposed Development. Furthermore, OVG Manchester Limited recognise that sustainability is not simply achieved at the end of construction but is an ongoing journey of evaluation, engagement and improvement. Through experience of operating similar venues around the world together with established sustainability practices across the Etihad Campus, there is precedented commitment to:

- Truly understand the impacts associated with operational energy, staff and audience travel and operational waste;
- Put processes in place, including stakeholder engagement, to inspire and facilitate collective action on reducing the negative impacts of live shows; and
- Be a good neighbour through ongoing community and city-wide engagement to maximise social value and deliver an arena for everyone.

Based on the above, it can be concluded that the Proposed Development aligns with both Manchester City Council's vision to be zero carbon by 2038 and a thriving sustainable city. Furthermore, its aspirations to be one of the greenest arenas in the world is delivered by the proposals contained within the planning application.



APPENDIX A GREEN AND BLUE INFRASTRUCTURE

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Deloitte.
Real Estate



OVG Manchester

Response to the Green and Blue Infrastructure Strategy for Manchester

February 2020

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1 Introduction

1.1 This 'Response to the Green and Blue Infrastructure Strategy for Manchester' ("the Statement") accompanies an application for Full Planning Permission and Consent to Display Advertisements submitted to Manchester City Council (MCC) in respect of a Site at the Etihad Campus ("the Site") for the construction a new indoor arena (the "Proposed Development"). The Applicant is OVG Manchester Limited (the "Applicant").

1.2 The Statement sets out how the Proposed Development responds to the vision and objectives set out in the Manchester Green and Blue Infrastructure Strategy 2015 (and in turn, Core Strategy Policies EN9 Green Infrastructure and EN15 Biodiversity and Geological Conservation). It should be read in conjunction with the Design and Access Statement (prepared by Populous) and Sustainability Statement (prepared by BuroHappold) submitted in support of the application.

A Green and Blue Infrastructure Strategy for Manchester

1.3 Manchester's Great Outdoors: a Green and Blue Infrastructure Strategy for Manchester 2015-25 was adopted by MCC in July 2015.

1.4 MCC recognises that green and blue infrastructure is an essential part of creating a successful, liveable city. Parks, river valleys, gardens, street trees, green roofs, canals and many other components all form part of a rich network that is integrated with the built environment in the world's most popular cities.

1.5 Section 3.1 of the Strategy sets out the vision for Manchester's green and blue infrastructure as follows:

"By 2025 high quality, well maintained green and blue spaces will be an integral part of all neighbourhoods. The City's communities will be living healthy, fulfilled lives, enjoying access to parks and green-spaces and safe green routes for walking, cycling and exercise throughout the City. Businesses will be investing in areas with a high environmental quality and attractive surroundings, enjoying access to a healthy, talented workforce. New funding models will be in place, ensuring progress achieved by 2025 can be sustained and provide the platform for ongoing investment in the years to follow."

1.6 Four objectives have been established to enable the vision to be achieved:

- Improve the quality and function of existing green and blue infrastructure, to maximise the benefits it delivers.
- Use appropriate green and blue infrastructure as a key component of new developments to help create successful neighbourhoods and support the city's growth.
- Improve connectivity and accessibility to green and blue infrastructure within the city and beyond.
- Improve and promote a wider understanding and awareness of the benefits that green and blue infrastructure provides to residents, the economy and the local environment.

1.7 Section 3.4 of the Strategy recognises that Manchester is a growing city, with plans for significant growth and development over the coming decade. High quality, green and open space that is appropriate to its location, well designed and well maintained will be an important and integral part of creating successful developments and supporting the city's growth.

1.8 The Strategy provides initial guidance on how developers can achieve this and recognises that different approaches will be required for different types of development and that different solutions, appropriate to the location, will be needed on each scheme. By considering green infrastructure from the beginning of the design process, developers will be able to understand the surrounding landscape, opportunities to enhance and link to it, and the types of green and open space that could be incorporated within and add value to the development itself.

The Application Site

1.9 The Proposed Development is situated on a brownfield site of approximately 4.46ha which is

currently used as an overspill car park and secured by a mesh fence.

1.10 In the Site's current situation, it comprises six main habitats. The middle of the Site is stone hardstanding, with very sparse low-growing plants of ephemeral/short perennial species scattered across the bare ground. The ephemeral/short perennial vegetation increases in cover slightly further out from the centre, containing a high proportion of introduced species such as white and ribbed melilot, common michaelmas-daisy and large-flowered evening primrose amongst the patches of bare ground.

Figure 1.1: Photograph of the Existing Site (Source: Deloitte Real Estate, December 2019)



1.11 Therefore whilst the Site does provide some ad-hoc green infrastructure, it does not currently contribute to the wider network of spaces which can be enjoyed and experienced by members of the public and the local community. It does not include any areas where people can meaningfully experience high-quality green and blue infrastructure and as such makes little to no contribution to the Vision of the Manchester's Great Outdoors: a Green and Blue Infrastructure Strategy for Manchester 2015-25

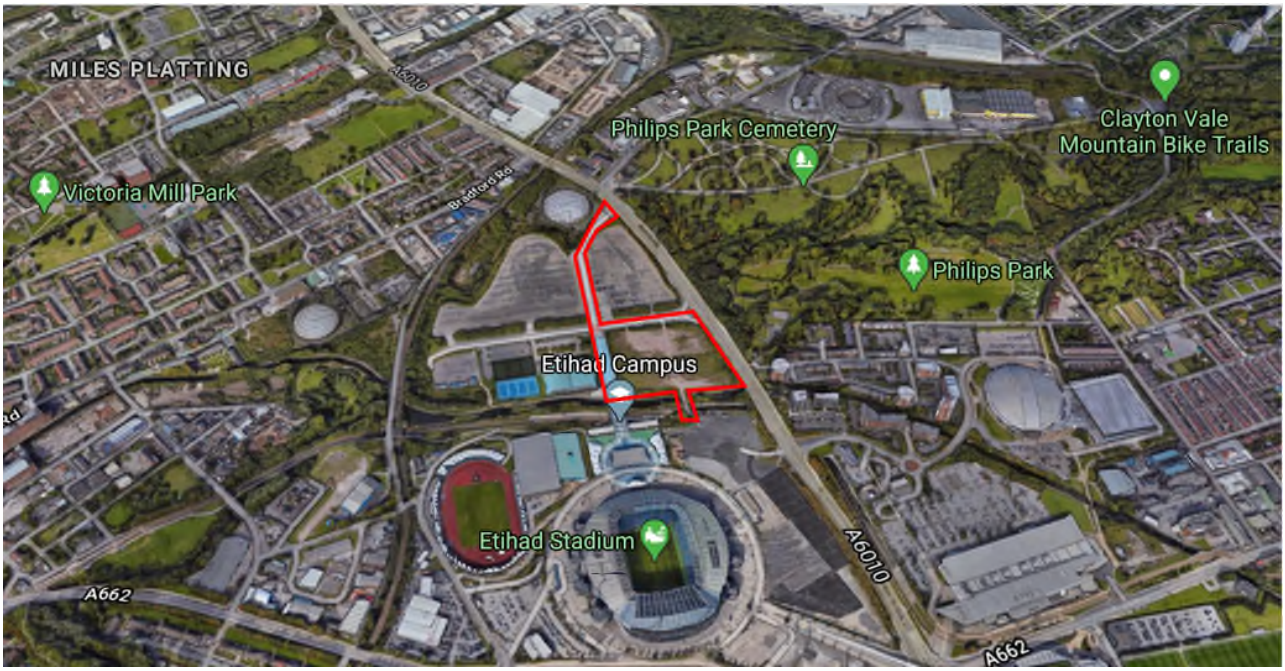
1.12 To the south of the Site is the Ashton Canal which benefits for a pedestrianised and well-lit towpath. The towpath provides onward linkages to the City Centre and Clayton and is often used when events or matches are held at the Etihad Stadium. However, despite the proximity of the Site to the Ashton Canal there is not a relationship between the two and the Site does not currently enhance the overall amenity of the towpath and Ashton Canal.

Figure 1.2: The Ashton Canal and towpath to the south of the Site (Source: Deloitte Real Estate, December 2019)



1.13 Within a wider context, the Site is located in close proximity to key pieces of green infrastructure including Philips Park (c. 30m from the Site) and Philips Park Cemetery and, slightly further afield, Victoria Mill Park and Clayton Vale.

Figure 1.3: Site's Wider Context (Source: Google Maps, 2020)



1.14 The Site forms part of the Etihad Campus and therefore will contribute to the wider Green and Blue Infrastructure vision for the Etihad Campus. The Etihad Campus aspires to be a pioneer for the whole of Manchester in pursuing its twin objective of realising locally-inclusive, globally-competitive economic growth, whilst simultaneously transforming to a zero-carbon campus. A key theme that underpins the delivery of this vision is for the campus to be a beacon of Manchester's rapid transition to a zero-carbon city, rich with wildlife and green infrastructure.

1.15 Therefore, the Proposed Development sits within a wider landscape masterplan for the Etihad

Campus, which aims to ensure that for each forthcoming plot development:

- The proposals are tied into existing green corridors to maximise connectivity and value to both wildlife and pedestrians.
- Lessons are learnt from successful plant species and habitat establishment within the Campus inform future landscaping proposals.
- Green-blue infrastructure and biodiversity initiatives which unlock wider social value and co-benefits are prioritised.

1.16 This vision and wider masterplan for the Campus has underpinned the public realm and landscaping design for the proposed arena, which aims to deliver a landmark design which will provide a sense of place where people spend time together. It introduces a well-designed place that enhances the local character and makes a positive contribution to the health, safety and wellbeing of the community by connecting with its history.

1.17 Moreover, one of the most important principles of the public realm is to connect to its surroundings, opening views towards the Ashton Canal and providing a safe relationship between the Etihad Campus and Philips Park. The podium level dialogs with the canal and bridges to make the development part of a cohesive wider scheme and the connection to Philips Park is enhanced by providing greenery towards the area and connecting flows of visitors to experience every part while linking with the city's blue and green infrastructure. Therefore, the proposed public realm acts as a junction between the Ashton Canal and Philips Park.

1.18 The link to the existing surroundings is also considered by the enhancement of biodiversity with the proposed vegetation which upgrades the quality of nearby green infrastructure, improving the act of its functions and creating connections with them.

2 Assessment of the Proposed Development

2.1 This section outlines the vision and objectives of the Manchester Green and Blue Infrastructure Strategy 2015 and details how the Proposed Development responds to these and, in turn, Core Strategy Policies EN9 'Green Infrastructure' and EN15 'Biodiversity and Geological Conservation'.

Green and Blue Infrastructure Objectives

2.2 As set out in Section 1, the Strategy establishes four objectives to enable the vision to be achieved. Table 2.1 considers the Proposed Development against these objectives.

Table 2.1: Proposed Response to Green and Blue Infrastructure Objectives

Objective:	Response:
1. Improve the quality and function of existing Green and Blue Infrastructure, to maximise the benefits it delivers.	As set out in Section 1, the Site does not currently contribute to Manchester's Green and Blue's Strategy. Therefore the Proposed Development provides the opportunity to greatly enhance the Site and utilise its position at a key node between the Ashton Canal and Philips Park. The Proposed Development will transform a brownfield site into a high quality visitor destination, which will include hard and soft landscaping and a green ring around the building comprising of a range of green and blue infrastructure enhancement measures. The landscaping and public realm proposals will link with the existing surroundings to enhance the Site's green infrastructure provision. The soft landscape strategy includes a range of enhancement measures including raised planters, tree planting, green screens and wildflower planting (with a focus on native species). The landscape proposals include the provision of a varied mix of native and non-native trees and planting, which will be attractive to invertebrates and higher trophic species. Species-rich native wildflower planting in areas of existing amenity grassland will improve biodiversity value for a range of fauna. Further information about the landscaping strategy can be found in the Design and Access Statement submitted with this planning application. In terms of function and use of the green and blue spaces around the Site, the proposed landscaping will act to make the Ashton Canal towpath a more attractive environment, increasing safety and subsequently increasing footfall, which will improve pedestrian and cyclist connectivity and will encourage the City's communities to use active modes of travel. The proposed green ring around the arena will also improve the pedestrian environment and link the green spaces from the Ashton Canal to Philips Park through the soft landscaping measures aforementioned. Access and egress points across the Site will also act to manage crowd flows and simultaneously increase awareness of the Site's surroundings.
2. Use appropriate green and blue infrastructure as a key component of new developments to help create successful neighbourhoods and support the City's growth.	As mentioned above, the proposals incorporate features to enhance biodiversity at the Site, which will improve the attractiveness of the environment and encourage access to the green and blue infrastructure networks by visitors to the Etihad Campus, as well as local residents and businesses. The regeneration of an underutilised brownfield site for an arena will act to further develop East Manchester as a 'destination' and will act as a catalyst for further investment within this area. In doing so the Proposed Development aligns to the vision of the Greater Manchester Strategy 2013 – 2020, maximising the sustainability potential of the Site and the Etihad Campus, through capturing new opportunities for growth in the visitor economy, creating jobs across the

Objective:	Response:
	City Region, as well as being a place at the forefront of action on climate change with clean air and a flourishing natural environment.
3. Improve connectivity and accessibility to green and blue infrastructure within the City and beyond.	The proposed green ring around the arena will act to ensure the Proposed Development assimilates sustainably into the existing landscape at the Etihad Campus. In particular, the provision of a soft border along the Ashton Canal edge, which is proposed to comprise of wildflower planting, tree planting and timber decking seating will seamlessly integrate the Proposed Development into the existing Site. It will also improve the attractiveness of a key pedestrian route to the Etihad Campus from Manchester City Centre; adding interest and vibrancy through activity. The incorporation of external seating overlooking the canal will also improve the safety of the route as a result of activity and natural surveillance. This will ultimately encourage people to walk to the Site. Improved connectivity to pedestrian and cycle routes will also be provided through the reallocation of junction space to Alan Turing Way, and the visual enhancement of the Ashton Canal corridor and towpath. The Applicant is also exploring the possibility of including a cycle wheeling ramp down the existing steps between Joe Mercer Way and the towpath to increase usability for cyclists. Through improving the immediate environment and public realm through the inclusion of the wildflower planting, green screens, raised planters and tree planting, the Proposed Development will encourage connectivity between the Ashton Canal and Philips Park and other green spaces at the Etihad Campus as the public realm is a more attractive environment for pedestrians and has greater permeability than the existing site, which is currently secured by mesh fencing. Furthermore the improved connectivity to Philips Park provides enhanced access to the River Medlock which runs through the Park and provides a rich habitat for a wide range of wildlife. Due to the increased footfall and activity that it creates, the Proposed Development will also act to improve awareness of and subsequently increase access to the Ashton Canal and Philips Park and other green spaces at the Etihad Campus.
4. Improve and promote a wider understanding and awareness of the benefits that green and blue infrastructure provides to residents, the economy and the local environment.	The improved environment will encourage people to use the existing pedestrian linkages from Manchester City Centre through improving the attractiveness and natural surveillance of this section of the Ashton Canal. The Proposed Development will offer opportunities to enhance the community outreach programme and there will be opportunities for local schools to get involved with planting activities within the new public realm areas.

Relevant Core Strategy Policies

EN9 Green Infrastructure

2.3 Core Strategy Policy EN9 sets out that new development will be expected to maintain existing green infrastructure in terms of its quantity, quality and multiple function. Where the opportunity arises and in accordance with current Green Infrastructure Strategies the Council will encourage developers to enhance the quality and quantity of green infrastructure, improve the performance of its functions and create and improve linkages to and between areas of green infrastructure.

2.4 As set out in Table 2.1, the Proposed Development has taken the opportunity to enhance the green infrastructure of the Site through the provision of high-quality landscaping which provides opportunity for biodiversity, the formation of habitats and also a place in which people can enjoy and relax in. In particular, it is envisioned that the Proposed Development will create an interface to Philips Park which is situated adjacent to the Site, across Alan Turing Way. Philips Park is an extensive area of green space – extending to over 13ha and with the provision of children's play areas, ponds, bowling greens, a BMX space and an extensive network of pathways.

2.5 The provision of amenity facilities within the Proposed Development (which will be open both on event days and non-event days) will contribute to creating a destination in which to dwell and relax in. The benefit of these amenities extends to providing further leisure opportunities to those who are visiting the park such as through the provision of a range of food and beverage facilities only minutes away and open throughout the year.

EN15 Biodiversity and Geological Conservation

2.6 Core Strategy Policy EN15 states the Council will seek to maintain or enhance sites of biodiversity and geological value throughout the City and that developers will be expected to identify and implement reasonable opportunities to enhance, restore or create new biodiversity, either on-site or adjacent to the site, contributing to linkages between valuable or potentially valuable habitat areas where appropriate.

2.7 The Ecology Report prepared by BuroHappold sets out a number of ways in which the Proposed Development contributes to biodiversity. In summary, the proposed landscaping on site will provide approximately:

- 1,208 sq.m. wildflower planting on the southern boundary, creating a native species-rich planting buffer to the Ashton Canal SBI.
- 681 sq.m. understorey and shrub planting beneath trees. These will include a mix of native and ornamental species and aim to provide a nectar and pollen source for foraging invertebrates.
- 1,916 sq.m. of green screens. These are pre-established screens that will be affixed to walls along the eastern, southern and western boundaries. These will provide instant green impact to the site and provide refuge sites for invertebrates.
- 67 trees including a mix of native and non-native species. The majority of trees will be broadleaved, with scots pine Pinus sylvestris and bullbay Magnolia grandiflora used as wind mitigation in required areas. Following consultation with GMEU, tree species on the southern boundary have been altered to be native species only, with the exception of bullbay as it is required for wind mitigation, to provide a more sensitive native species focussed buffer to the canal.
- Provide bat and bird habitat boxes along the canal edge opposite to the Site, away from the towpath. Bat boxes could also be incorporated under bridges in shaded areas away from artificial light and the tow path to minimise disturbance.

2.8 The wildflower buffer will be managed for wildlife. A mowing regime of a late summer cut, once the flowers have set-seed, is recommended to support the longevity of the planting mix. The arisings from the mowing should be removed from the Site to prevent nutrient enrichment of the soil which would encourage the establishment of non-target species such as nettles and docks. Whilst the wildflower area is establishing, management of the area should also include the removal of non-target species which might grow quicker and out-compete those planted.

2.9 The green screens and tree planting on the eastern boundary of the Site will replace the existing tree and scrub corridor that has established here. This will reconnect the Site with the established treeline planting already implemented on Etihad Campus to the north and south of the arena site.

3 Summary

3.1 As described in this Statement, the provision of an improved environment and green infrastructure onsite (and adjacent within the wider campus) have been integral to the Proposed Development and will contribute to the delivery of the campus vision to be a beacon of Manchester's rapid transition to a zero-carbon city, rich with wildlife and green infrastructure.

3.2 The Proposed Development will contribute to biodiversity and enhance wildlife habitats at the Site as part of the wider campus landscaping masterplan, with the aim for the green and blue infrastructure to link into established wildlife corridors. Opportunities to enhance and create new biodiversity within the Proposed Development, such as tree planting, raised planters and native wildflower planting, are designed into the scheme which will upgrade the quality of nearby green infrastructure, improving the act of its functions and creating connections with them.

3.3 The Proposed Development therefore accords with the vision and objectives of the Green and Blue Infrastructure Strategy for Manchester.

Deloitte.
Real Estate

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APPENDIX B CRIME IMPACT STATEMENT

APPENDIX C ECOLOGICAL ASSESSMENT

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BUROHAPPOLD ENGINEERING

OVG Manchester

Ecological Mitigation Report

0042841

27 February 2020

Revision 02

BRA-BHE-XX-XX-RP-YM-0001

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Revision	Description	Issued by	Date	Checked
00	Ecological Mitigation Report	JR	17/01/2020	PO
01	Updated landscape information	JR	14/02/2020	PO
02	Updated landscape information	JR	27/02/2020	PO

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date	**27/02/2020**
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date	**27/02/2020**

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Glossary

Term	Definition
CEMP	Construction Environment Management Plan
EA	Ecological Appraisal
GMEU	Greater Manchester Ecology Unit
MAGIC	Multi-Agency Geographical Information for the Countryside (government website)
MCC	Manchester City Council
PAA	Penny Anderson Associates – Subconsultant which carried out the Phase 1 habitat survey and EA report included within Appendix A.
SBI	Site of Biological Interest

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1 Introduction

1.1 Background

BuroHappold Engineering (BuroHappold) have been commissioned by OVG Manchester Limited to provide ecology consultant services to support a planning application for the construction of a new multi-use indoor arena in Manchester with supporting retail and leisure facilities, back-of-house and support functions, public realm, cycle parking, access and associated works; hereafter referred to as 'the proposed development'.

The proposed location for the arena is within the Etihad Campus Masterplan boundary, adjacent to Alan Turing Way (central OS Grid reference SJ8698 8286) and is hereafter referred to as 'the site' and shown in Figure 1-1. The site boundary totals an area of approximately 4.46ha, with the main arena development area being approximately 2.53ha.

Works to facilitate the proposed development would include complete clearance of vegetation within the main arena development area, along with clearance of additional smaller areas of vegetation for transport access improvements to the north and improved pedestrian connections from the north and south of the arena.

The results of an Ecological Appraisal (EA) of the main arena site (detailed in Appendix A) indicated that the proposed development would not result in a significant impact on ecological features outside of the site boundary, and so ecology was scoped out of the Environmental Statement. This report, therefore, is intended to provide detail on the mitigation designed into the proposed development to account for any site-level impacts that may be incurred by the proposed development during construction and/or operation. The report also outlines the enhancement measures for local biodiversity. This report provides a summary of the EA findings, and a complete habitat survey map of the site boundary, which changed following the completion of the EA report. Detailed survey information and relevant legislation and policy taken into account through the proposed development design are included in Appendix A.

A pre-application consultation meeting was held in January 2020 with Jennifer Atkinson from Manchester City Council (MCC) and David Dutton from the Greater Manchester Ecology Unit (GMEU). In the meeting, the proposed mitigation as detailed within this report was presented and agreed to be sufficient for the proposed development by the consultees present.

1.2 Site context

The site is situated east of Manchester City Centre and represents a brownfield site within the Etihad Campus which has been place-marked for development for a number of years. The site is currently used as required as over-flow parking. The site is situated 150m north of the Etihad Stadium and is bounded by the Sportcity Way to the north and the A6010 Alan Turing Way to the east. To the south is the Ashton Canal and associated towpath, and to the west is Joe Mercer Way, a raised pedestrian access boulevard to the stadium. Figure 1-1 illustrates the location of the site within the wider landscape.

The site is partially connected to the wider landscape via the Ashton Canal to the south, which supports a green corridor leading partially to the west but more substantially to the east. The wider Etihad Campus is adjacent to Philips Park, across Alan Turing Way to the east and scrubland associated with the former gas works to the north and west.



Figure 1-1 Proposed development site boundary and the wider landscape

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2 Site Survey

A desk study and Preliminary Ecological Appraisal of the site were undertaken in June 2019 (Appendix A). A further survey was undertaken of the wider Etihad Campus in July 2019. The results of both surveys have been combined to address the change in site redline boundary which was modified to include access routes to the north and south of the main arena development area. The combined habitat survey results are presented in Figure 2-1. Details of survey methodology and legislation relevant to the site are provided within the Ecological Appraisal report in Appendix A. The results of the surveys are summarised here.

2.1 Desk Study

A data search was commissioned from GMEU and was supplemented by data from the government website MAGIC in order to identify statutory and non-statutory designated sites, priority habitats and protected and/or notable species of flora and fauna within 2km of the site. Full results of the data search, including maps of the records returned, can be found in Appendix A. The most relevant results to the site with regards to the proposed development and mitigation proposed in this report are summarised below.

A single statutory designated site was returned within the search results. Clayton Vale Local Nature Reserve is located approximately 1km to the east of the site. It is considered to be of far enough distance, with significant barriers to ecological dispersal, to not require further assessment with regards to the proposed development. Three non-statutory designated Sites of Biological Interest (SBI) are within 1km of the site, with part of the Ashton Canal SBI immediately to the south of the site. The Ashton Canal is designated for its aquatic flora, including grass-wrack pondweed *Potamogeton zosteriformis*. The closest record of this plant within Ashton Canal is 1.8km south east of the site.

Protected and notable species records of note included a common pipistrelle *Pipistrellus pipistrellus* roost 65m along the Ashton Canal as well as multiple bat activity records using the canal as a foraging and commuting corridor, including one within 15m of the site.

One record for little ringed plover *Charadrius dubius* was also returned within the main arena development area. The nature of the record was unconfirmed within the data search results. However, at the meeting with David Dutton from GMEU, it was confirmed that the record concerned a confirmed breeding attempt by a solitary little ringed plover for a single season, and the species have not been recorded on site since.

2.2 Habitat survey

A Phase 1 habitat survey was undertaken of the main arena site on 21st June 2019 by Penny Anderson Associates (PAA) on behalf of BuroHappold. PAA were subsequently commissioned by City Football Group to undertake a further Phase 1 habitat survey of the wider Etihad Campus. The results of both of these surveys have been combined to illustrate the habitats within the final site boundary. The combined result of the habitat surveys is illustrated within Figure 2-1.

The key habitats identified on site are:

- Unimproved neutral grassland;
- Ephemeral/ short perennial vegetation;
- Broadleaved woodland;
- Scrub; and
- Hardstanding

The unimproved grassland covers the less used areas of the site with a relatively open sward. The grassland was considered to be species-rich and supported a number of species affiliated with calcareous substrates. Whilst 16 species listed on the GMEU selection criteria for grassland SBI (Greater Manchester Ecology Unit, 2016) were recorded on site, it is not considered that the grassland on site meets the other SBI criteria for grassland on brownfield sites. Most notably, the grassland is populated with young self-seeded trees including goat willow *Salix caprea* and silver birch *Betula pendula*, and scrub is encroaching on all edges of the site. Therefore, in the absence of development of this parcel of land, it is considered that the grassland would not persist without intervention and would eventually, naturally, become outcompeted by scrub and tree species.

The areas of broadleaved woodland on site refer to dense treeline stands on the boundaries of the site. This includes a mix of young to semi-mature planted small-leaved lime *Tilia cordata* and Italian alders *Alnus cordata* as well as self-established young silver birch and goat willow. Small pockets also persist to the north of the main development area as a fragmented southern boundary to the car parks on the Etihad Campus. These areas are more species diverse, with no dominant species, and include downy birch *B. pubescens*, hazel *Corylus avellana*, hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa* and ash *Fraxinus excelsior,* in addition to those listed previously.

As part of the survey of the habitats on site, surveyors also searched for the presence, or the potential for presence, of protected or notable species. No protected or notable species were identified on site. The potential for breeding birds to utilise the site was noted, with the trees and scrub providing suitable nesting habitat, although no nests were recorded during the survey. There are no structures on site and none of the trees were considered to have features suitable to support roosting bats. The isolated nature of the site, due to the presence of main roads and extensive hard standing immediately adjacent, lead to the conclusion that the presence of other protected or notable species on site would be unlikely and, therefore, no further surveys were undertaken.

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HABITAT SURVEY INFORMATION

Site boundary

Habitat type
- Norway Maple
- Scattered scrub
- Scattered broadleaved trees

Dry ditch
Fence
Wall

- Semi-natural broadleaved woodland
- Plantation broadleaved woodland
- Beech hedge with trees
- Unimproved neutral grassland
- Species-poor amenity grassland
- Species-rich amenity grassland
- Ephemeral/ short perennial
- Epemeral/ short perennial on bareground
- Introduced shrub
- Buildings
- Hardstanding

FINAL

Status of Drawing

BUROHAPPOLD ENGINEERING

Client	OVG Europe
Project	OVG Manchester
Drg Title	Phase 1 Habitat Survey Map
Scale @ A3	1:0
Drawn by	Jenny Ross
Checked by	Pernille Olsen
Date	17/01/2020
Job No.	0042841
Drg No.	BHE_DR_ENV_01
Rev	00

Figure 2-1 Combined Phase 1 habitat survey results

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3 Mitigation and enhancement measures

Whilst ecology was scoped out of the Environmental Statement, due to the consideration that the proposed development would not lead to significant effects on ecological features above the site level, a number of mitigation and enhancement measures have been designed into the proposed development to address non-significant effects on the ecology of the site. These measures are outlined below.

3.1 Ashton Canal SBI

Construction impacts

Whilst the Ashton Canal is outside of the site boundary and is not proposed to receive any surface water drainage from the site during construction or operation of the site, its proximity to the site puts it at risk of construction impacts.

In the absence of suitable mitigation, construction impacts on the canal could include airborne dust, surface water run off containing higher sediment loads and the potential for pollution events from machinery and/or material leaks on site.

The potential for these events and their impact on the Ashton Canal have been assessed within the Water and Air Quality Chapters as part of the Environmental Statement. Suggested mitigation measures are outlined in these reports and will be secured by a Construction Environment Management Plan (CEMP). Typical mitigation measures that are recommended to be employed at the site include:

- Dust management procedures such as damping down and tight control measures of waste materials;
- Shallow slope gradients of soil to prevent wash away in periods of heavy rainfall;
- Capture site run-off in perimeter cut-off ditches/ settlement lagoons and/or settlement tanks. Any dewatering of excavations should be pumped into a settlement tank or lagoon;
- Sediment should be removed from water before discharge into surface water network through the use of a baffle tank system or equivalent;
- Incorporate interceptors into the site drainage system at high risk areas such as car parks, unloading and refuelling areas; and
- Storage and refuelling areas should be within bunded areas not located within 10m of water bodies or drainage lines.

Additional construction impacts may also include light spill from construction lighting to facilitate night time works and/or security of the site compound. The CEMP will include details of how, should night-time lighting be required, lighting units will be positioned so as to prevent light spill on to the canal. This would include placing units on, or near to, the canal boundary and facing them away from the canal, directing light into the site compound where it is required.

Lighting impacts

The Ashton Canal is considered to offer important commuting and foraging routes for local wildlife, including bats. The desk study returned records for bats which included a roost record for common pipistrelle bats within 65m west of the site with an additional activity record of a common pipistrelle within 15m of the site on the canal.

Therefore, lighting for the site has been designed to minimise light spill on to the canal in an effort to maintain existing light levels through operation of the arena. Highly directional LED lighting has been used to ensure that the lighting is directed to areas required and does not spill on to the canal.

Initiatives implemented into the design include using recessed lights where possible, particularly under the overhangs designed into the building which will also help to minimise sky glow. Where lighting columns are required, and placed on the canal side of the development, they are directed into the site with units selected that have little to no back spill, preventing spill into the canal corridor. Seating areas on the canal edge are lit with recessed lighting, preventing upwards and backwards spill towards the canal.

Whilst lighting columns already exist on the canal tow path, these are outside of the site boundary and will be retained to maintain a safe lighting level for users of the tow path at night.

3.2 Habitat loss

During construction works to facilitate the proposed development, all habitats within the main arena development site will be lost. A small area of amenity grassland in the north of the site and a small section of the broadleaved parcel to the south of the car parking area will also be removed. Through the design process, the majority of the broadleaved woodland parcels to the south of the car park have been retained, with different scenarios of access in this area being tested and resulting in a greater retention than original plans.

Landscaping within the proposed development has sought to replace the green edge corridors of the boundaries of the site and protect and enhance the canal edge to the south of the development. Details of the landscaping can be found within the documents submitted as part of the planning application. An overarching landscaping plan is included within Appendix B.

In summary, the proposed landscaping on site will provide approximately:

- 1,208m^2 wildflower planting on the southern boundary, creating a native species-rich planting buffer to the Ashton Canal SBI;
- 681m^2 understorey and shrub planting beneath trees. These will include a mix of native and ornamental species and aim to provide a nectar and pollen source for foraging invertebrates;
- 1,916m^2 of green screens. These are pre-established screens that will be affixed to walls along the eastern, southern and western boundaries. These will provide instant green impact to the site and provide refuge sites for invertebrates; and
- 67 trees including a mix of native and non-native species. The majority of trees will be broadleaved, with scots pine *Pinus sylvestris* and bullbay *Magnolia grandiflora* used as wind mitigation in required areas. Following consultation with GMEU, tree species on the southern boundary have been altered to be native species only, with the exception of bullbay as it is required for wind mitigation, to provide a more sensitive native species focussed buffer to the canal.

The wildflower buffer will be managed for wildlife. A mowing regime of a late summer cut, once the flowers have set-seed, is recommended to support the longevity of the planting mix. The arisings from the mowing should be removed from the site to prevent nutrient enrichment of the soil which would encourage the establishment of non-target species such as nettles and docks. Whilst the wildflower area is establishing, management of the area should also include the removal of non-target species which might grow quicker and out-compete those planted.

The green screens and tree planting on the eastern boundary of the site will replace the existing tree and scrub corridor that has established here. This will reconnect the site with the established treeline planting already implemented on Etihad Campus to the north and south of the arena site.

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3.3 Breeding birds

Whilst breeding birds were not confirmed on site during the habitat survey, the trees and scrub provide suitable habitat which could support nesting birds. As all breeding birds, and their nests, are protected from disturbance and damage under the Wildlife and Countryside Act (1981, as amended), it is recommended that works to clear the vegetation on site avoid the bird nesting season (March-August, inclusive). Where this cannot be avoided, the vegetation should be checked by an experienced ecologist no more than 48 hours ahead of site clearance. Should an active nest be found, the vegetation containing the nest and a suitable buffer, as defined by the ecologist, would need to be retained on site until the chicks have fledged and the nest is confirmed by an ecologist to be no longer in use.

3.4 Supplementary mitigation measures

In addition to the mitigation outlined above, the following measures could also be implemented to support the landscaping and provide further enhancements for biodiversity as a result of the proposed development. These measures include:

- Apply sustainable horticultural practices to increase the sustainability of the formal landscaping by:
    - No, or low, use of residual pesticides;
    - No use of peat-based products;
    - Utilise rainwater harvesting in the irrigation system;
    - Design-in features to reduce water use and enable composting and integrated pest management;
    - Source and use UK-produced plants to reduce risk of introduction of imported pests and diseases and to reduce the carbon footprint;
    - Select plants that require less water and chemical inputs and are naturally suited to the local conditions; and
    - Widen the diversity of species planted to increase resilience to climate change and new pest/disease outbreaks.
- Provide bat and bird habitat boxes along the canal edge opposite to the site, away from the tow path. Bat boxes could also be incorporated under bridges in shaded areas away from artificial light and the tow path to minimise disturbance.

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Appendix A Ecological Appraisal Report – Penny Anderson Associates, 2019

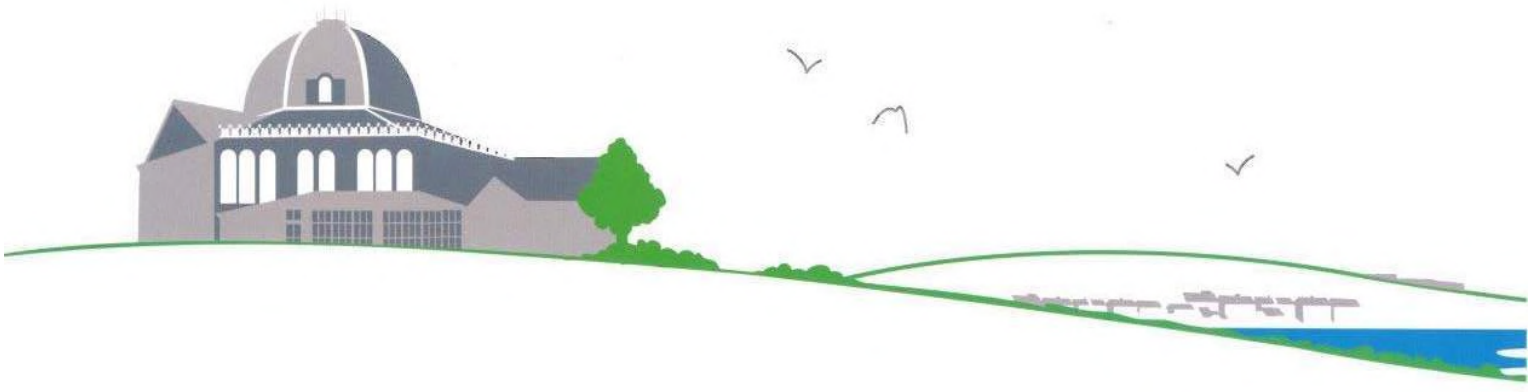
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Penny Anderson Associates Ltd
CONSULTANT ECOLOGISTS

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ECOLOGICAL APPRAISAL



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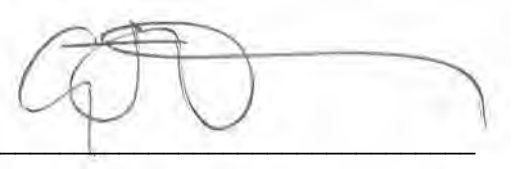
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July 2019

This project has been undertaken in accordance with PAA policies and procedures on quality assurance.

Signed: 

Penny Anderson Associates Ltd
CONSULTANT ECOLOGISTS

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SUMMARY

Penny Anderson Associates Ltd was commissioned by BuroHappold Engineering on behalf of OVG Manchester Limited to carry out an extended Phase 1 habitat survey at a site referred to as OVG Manchester, where there are proposals for development.

The extended Phase 1 habitat survey was carried out on 21st June 2019. Habitats were assessed based on the plant species present, with the results reported and presented on an annotated Phase 1 habitat survey map. The habitat map details the location and extent of all habitat types recorded within the site boundary.

An additional and important element of the extended Phase 1 habitat survey approach is to look for evidence of protected species being present and to assess the need for further species-specific surveys. A request was made to the Greater Manchester Ecology Unit for records of protected species, priority species and wildlife sites within 2km of the centre of the site to place the site within a wider ecological setting.

Data returned by Greater Manchester Ecology Unit did not identify protected species recorded within the site with the exception of a single record for little ringed plover, a Schedule 1 species, and one for northern lapwing, a Red listed species of conservation concern, just within or close to the site boundary.

No evidence of nesting birds was found during the survey. All breeding birds are protected by law and a recommendation is made that where possible initial works are carried out outside the bird nesting season (1st March to 30th September). If works are outside this period it is recommended that a suitably experienced ecologist check the site no more than 48 hours prior to works to ensure no active nests are present.

The former car park site comprises six ma e of the site is stone hardstanding, with very sparse low-growing plants of epheme cies scattered across the bare ground. The ephemeral/short perennial vegetatio slightly further out from the centre, containing a high proportion of introduced species such as white and ribbed melilot, common michaelmas-daisy and large-flowered evening primrose amongst the patches of bare ground.

This vegetation grades into the species-rich neutral grassland that has recently developed over the car park with increased grass and forb cover. The grassland has a rather open, skeletal structure with small areas of bare ground showing through. White melilot and michaelmas-daisy are still prominent in the sward along with a range of forbs and grasses, including the local Biodiversity Action Plan species, yellow-wort, which occurs rarely.

A number of upright concrete culverts are scattered across the grassland. Young saplings of a range of woody tree and scrub species have established on the grassland, scattered predominantly around the edges and in a conspicuous line across the middle of the site.

Goat willow and silver birch are the most common species with frequent butterfly-bush. More concentrated areas of the young trees/scrub have developed over the neutral grassland along the north, west and south-western edges of the site, with a small amount of Italian alder, which, being non-native suggests that an element of planting has occurred.

A small area of slightly more established semi-natural broadleaved woodland has developed at the south-east edge. Along the eastern boundary is a line of older, planted small-leaved lime trees with grassy ground flora. A dry, vegetated ditch runs along the north and west sides of the site, within the more wooded grassland areas.

There were no potential bat roost features observed in the trees during the survey, although the habitats on site and along the adjacent canal area would provide suitable foraging opportunity for bats.

Floating water-plantain, listed in Schedule 4 of the Conservation (Natural Habitats, etc.) Regulations 1994 and Schedule 8 of the WCA 1981, had been recorded in Ashton Canal. However, the survey found

that the canal was poor in aquatic vegetation. Additional surveys or special measures for other protected species are not considered necessary.

There are no designated wildlife sites within or immediately adjacent to the site and there are no Special Areas of Conservation or Sites of Special Scientific Interest within the 2km search area. A Local Nature Reserve, Clayton Vale, is located just less than 1km to the east of the site. There are three Sites of Biological Interest: Ashton Canal (West), Rochdale Canal Stott's Lane Ducie Street Basin and Bank Bridge Meadow within the search area. All wildlife sites and records of species returned were considered sufficiently distant and isolated from the site to not be impacted by development proposals.

National Planning Policy requires that opportunities for ecological enhancement are sought within all development proposals, moving towards the aim of 'biodiversity net gain'. A number of potential ecological enhancement measures that could be introduced as part of the re-development of the site are provided.

1. INTRODUCTION

1.1 Penny Anderson Associates Ltd (PAA) was commissioned by BuroHappold Engineering on behalf of OVG Manchester Limited to carry out an extended Phase 1 habitat survey at a site referred to as OVG Manchesteroff Alan Turing Way, Manchester (hereafter referred to as the 'site'). The survey was commissioned in relation to proposals for the re-development of the site.

1.2 The extended Phase 1 habitat survey also included a desk study for the site and the area within 2km of its centre. This examined all data records for protected sites, habitats and species held by Greater Manchester Ecology Unit (GMEU).

1.3 This report details the results of the desk study and the extended Phase 1 habitat survey.

Site Description

1.4 The site is approximately 2.35ha in extent. Alan Turing Way lies to the east and the Ashton Canal marks the southern boundary with the tramline to the south of the canal. A service road forms the northern boundary and to the west there is a walkway to the Etihad campus with the Manchester Tennis and Football Centre further west. The site is fenced and in most parts has a border of trees and scrub. The site predominantly consists of hardstanding with areas of neutral grassland and ephemeral/short perennial vegetation. There are no buildings or permanent structures.

Legislative Context

1.5 The text below provides a brief summary of the legislation in relation to the species or species group in England and Wales. The original Acts, Regulations and any amendments should be referred to for the precise wording.

1.6 A range of international and national legislation has been established in the UK to protect important nature conservation sites and priority species. At the international level, European Union (EU) Directives require individual member states to implement their conservation provisions nationally for the benefit of Europe as a whole. These Directives have been transposed into UK law by the Conservation of Habitats and Species Regulations 2017; further details can be obtained from the Joint Nature Conservation Committee (JNCC) web site at www.jncc.defra.gov.uk.

1.7 Other international conventions include: the Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979), which requires the maintenance of populations of wild flora and fauna, giving particular protection to endangered and vulnerable species; and the Bonn Convention on the Conservation of Migratory Species of Wild Animals (1979), which requires the protection of migratory species throughout their entire range. The above conventions are implemented in England and Wales via the Wildlife and Countryside Act (WCA) (1981) (as amended) and Countryside and Rights of Way (CRoW) Act 2000. This legislation also protects important habitats and sites such as Sites of Special Scientific Interest (SSSI).

1.8 At the national level, the UK Post-2010 Biodiversity Framework published in 2012 is the Government's response to the Convention on Biological Diversity (2010). It describes the UK's biological resources, commits a detailed plan for the protection of these resources within the UK's devolved framework across England, Wales, Scotland and Northern Ireland. The document identifies future priorities for nature conservation and adopts a more strategic approach, including ecosystem services and sustainability alongside biodiversity. Despite administrative changes following devolution, there is still an underlying objective of protecting and enhancing a range of priority species and habitats, often still based on the objectives and classifications of the original UK Biodiversity Action Plan. Biodiversity 2020 is England's

national biodiversity strategy. Building on the Natural Environment White Paper published in 2011, this provides a means of delivering the international and EU commitments to biodiversity. Under Biodiversity 2020, Priority Species and Habitats referred to are those of 'Principal Importance' for the conservation of biodiversity in England listed on Section 41 (England) of the Natural Environment and Rural Communities (NERC) Act 2006.

1.9 Finally, the National Planning Policy Framework (NPPF), updated 2019, provides guidance for local authorities on the content of the Local Plans and is a material consideration in determining planning applications. Briefly, with an overall focus on sustainable development, the NPPF states that developments should aim to engender positive outcomes for habitats and biodiversity, with a particular focus on the maintenance and creation of ecological networks. Furthermore, the NPPF also states that any planning proposals for which significant negative impacts on biodiversity cannot be avoided, mitigated or compensated for should be refused. The NPPF states that the planning system should contribute to and enhance the natural environment through a range of actions, including:

- protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils;
- recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services; and
- minimising impacts on biodiversity and providing net gains for biodiversity including establishing coherent ecological networks that are more resilient to current and future pressures.

1.10 To protect and enhance biodiversity and geodiversity, plans should:

- Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation; and
- promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.

Invasive Species

1.11 Certain non-native species that have been introduced into the UK are regarded as being a threat to native biodiversity. Legislative measures have, therefore, been put in place to prevent the spread of these invasive species in the wild.

1.12 Under section 14 of the WCA 1981 (as amended), it is illegal to introduce plants listed under Part II of Schedule 9 of the WCA into the wild or sell these species. Offences include causing the spread of viable plant material or neglecting to contain or appropriately manage non-native species.

1.13 Commonly introduced Schedule 9 species include non-native cotoneaster species, specifically, small-leaved cotoneaster (*Cotoneaster microphylla*) and wall cotoneaster (*C. horizontalis*), Himalayan balsam (*Impatiens glandulifera*) and Japanese knotweed (*Reynoutria japonica*).

Protected Species

1.14 Details of the protected species legislation relevant to this report can be found in Appendix 1.

2. METHODS

Desk Study

2.1 A request for details of protected species, priority species and wildlife sites within 2km of the centre of the site (SJ 86822 98867) was made to GMEU. The desk study consisted of a consultation exercise whereby statutory and non-statutory authorities were contacted to gather local and site-specific ecological information.

Phase 1 Habitat Survey

2.2 The Phase 1 habitat survey was undertaken by Ecologist Caroline Boffey on 21st June 2019. The surveyor has the appropriate practical experience in survey methods and the required knowledge, skills and experience as set out in Chartered Institute of Ecology and Environmental Management (CIEEM) competency guidelines (CIEEM 2013).

2.3 The Phase 1 habitat survey methodology was based on guidance set out in the *Handbook for Phase 1 Habitat Survey* (JNCC 2010). Habitats were assessed based on the plant species present, with the results reported and presented on an annotated Phase 1 habitat survey map (see Figure 1). This habitat map details the location and extent of all habitat types recorded within the site boundaries. Habitat types were recorded, along with an indication of the relative abundance of each plant species using the 'DAFOR' scale (where D = dominant; A = abundant; F = frequent; O = occasional; R = rare). Common names for species are given in the text and a full list with common and scientific names after Stace (2019) is presented in Appendix 2.

Protected Species Assessment

2.4 The habitat survey was 'extended' (Institute of Environmental Assessment 1995, CIEEM 2017) to include a general assessment of the suitability of the site to support any protected or notable species. Features with suitability for any individual species were noted, together with any incidental field signs.

2.5 During the survey any evidence of the trees being used by nesting birds (e.g. old nest material) was also looked for.

Limitations

2.6 It is important to note that the desk study results provide an indication of the species present in and around the site, but do not confirm current presence or absence of any particular species. Protected species are often under-recorded in county wildlife databases.

2.7 The survey was carried out by an experienced surveyor and access was available to the whole of the site. The day was warm and dry. It is, therefore, considered that there were no significant limitations to the survey.

3. RESULTS

Desk Study

3.1 The desk results returned by GMEU are presented as figures in Appendix 3.

Statutory Protected Sites

Special Areas of Conservation

3.2 Special Areas of Conservation (SAC) are protected sites with strict conservation protection, designated under Article 3 of the European Commission Habitats Directive.

3.3 There are no SAC in the 1km search zone for the site.

Sites of Special Scientific Interest

3.4 SSSI are statutory sites designated to support species of plants and animals that find it more difficult to survive in the wider environment. They represent a selection of this country's best wildlife and geological sites, and cover approximately 7% of the terrestrial area of the country (with over 4,000 sites in England).

3.5 There are no SSSI in the search zone for the site.

Local Nature Reserves

3.6 Local Nature Reserves (LNR) are a statutory designation made under Section 21 of the National Parks and Access to the Countryside Act 1949 by principal local authorities. LNR are sites that contain wildlife and/or geological features that are of special interest locally.

3.7 Manchester has seven LNR, one of which falls within the search area: Clayton Vale, located just under 1km to the east of the site. The LNR covers approximately 57ha consisting of unimproved grassland, woodland, ponds and the River Medlock. The vale has two ponds that are Grade C Sites of Biological Importance (SBI) containing common reed (*Phragmites australis*) and supporting a wide range of aquatic species. The site was originally heavily polluted by industrial waste during the industrial revolution and was purchased by the City Council in 1982 who undertook a major reclamation project, planting over 46ha of native trees.

Non-Statutory Protected Sites

Sites of Biological Interest

3.8 SBI are sites locally important for wildlife. SBI have no statutory legal protection, but do receive some protection through different policies and they must be taken into consideration by the planning authority when planning applications affect the site. SBI are assigned one of three grades:

- Grade A SBI are of county or regional importance (assumes a presumption against development);
- Grade B SBI are those of district importance; and
- Grade C SBI are those of local importance.

3.9 There are three SBI that fall within the search area (see Appendix 3, Map 1). A summary description is given in Table 1.

Table 1 Sites of Biological Importance Within the 2km Search Area

Site Name	Area (ha)	Grade	Description
Ashton Canal (West)	8.5ha	A	Ashton Canal is important for its submerged aquatic flora including grass-wrack pondweed (*Potamogeton compressus*) of local importance.
Rochdale Canal Stott's Lane Ducie Street Basin	8.1ha	A	Rochdale Canal supports regionally important aquatic species, including the submerged nationally important floating water plantain (*Luronium natans*).
Bank Bridge Meadow	1.4ha	C	Bank bridge meadow lies to the south of the River Medlock and consists of semi-improved and amenity grassland and deciduous trees.

Regionally Important Geological and Geomorphological Sites

3.10 Regionally Important Geological and Geomorphological Sites (RIGS) are locally designated sites of local, national and regional importance for geodiversity and protect important Earth Science and landscape features. They are conserved and protected from development and are a material consideration through the planning system.

3.11 There are no RIGS within the search zone for the site.

Protected and Notable Species

Section 41 Species

3.12 Some of the rarest and most threatened species are listed under Section 41 (S41) of NERC as Species of Principal Importance. The Government's Biodiversity 2020 strategy has an ambition to ensure that by 2020 there will be an overall improvement in the status of wildlife and no further extinctions of known threatened species. To achieve this, a range of actions have been identified to help in the recovery of S41 species. (see Appendix 3, Map 5)

Bats

3.13 Table 2 shows the number of each species of bat recorded in the search zone and the proximity to the site of the closest roost for each (see Appendix 3, Map 4).

Table 2 Bat Records from Greater Manchester Ecology Unit

Species		No. Roosts	No. Other Signs	Closest Roost	Closest Sign
Common pipistrelle	*Pipistrellus pipistrellus*	1	12	65m	15m
Soprano pipistrelle	*Pipistrellus pygmaeus*	-	3	n/a	75m
Pipistrelle species	*Pipistrellus* sp.	11	45	75m	45m
Brown long-eared	*Plecotus auritus*	1	-	190m	190m
Daubenton's bat	*Myotis daubentonii*	-	4	n/a	125m
Bat species		1	1	165m	165m

3.14 The majority of the records returned are for pipistrelle species. There are two native species: common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle (*Pipistrellus pygmaeus*).

The common pipistrelle is one of the UK's most common bat species found in a wide range of habitats including suburban and urban habitats. Soprano pipistrelle is also widely distributed across the UK. Where the distinction between the two species has not been made they are recorded as pipistrelle species (*Pipistrellus* sp.).

3.15 There is a single record for brown long-eared bat (*Plecotus auritus*), which is found throughout the UK and is widespread in the rest of Europe. Daubenton's bat (*Myotis daubentonii*) records are confined to the river Medlock corridor. This species characteristically fly and forage over water sometimes taking prey directly from the water surface (Bat Conservation Trust 2019).

Birds

Table 3 Bird Records (Including Schedule 1 Species)

Common Name	Scientific Name	Number Recorded	Amber	Red	Sch 1
Black redstart	*Phoenicurus ochruros*	1			x
Common bullfinch	*Pyrrhula pyrrhula*	8	x		
Common starling	*Sturnus vulgaris*	10		x	
Dunnock	*Prunella modularis*	5	x		
European herring gull	*Larus argentatus*	1		x	
House sparrow	*Passer domesticus*	8		x	
Kingfisher	*Alcedo atthis*	4	x		x
Linnet	*Linaria cannabina*	4		x	
Little ringed plover	*Charadrius dubius*	10			x
Northern lapwing	*Vanellus vanellus*	10		x	
Peregrine falcon	*Falco peregrinus*	6			x
Redpoll	*Carduelis flammea*	2	x		
Reed bunting	Emberiza schoeniclus	1	x		
Skylark	*Alauda arvensis*	1		x	
Song thrush	*Turdus philomelos*	6		x	
Spotted flycatcher	*Muscicapa striata*	1		x	

3.16 It should be noted that the number of species recorded within desk study data repositories does not necessarily indicate the population size. Less common species may be recorded more frequently because of their interest and rarity and more common species may be recorded less often.

3.17 The Red and Amber conservation status assessment is based on a number of criteria e.g. historical decline, trends in population and range, rarity, localised distribution and international importance (full details of this assessment are in Eaton *et al*. 2015). Table 3 includes those species recorded within the 2km search area that are listed as Red and Amber birds of conservation concern.

3.18 Species are Red listed because of a 50% decline in their population and Amber listed species are of medium conservation concern and have experienced a reduction of 25% in numbers. Schedule 1 species are protected under the WCA by the Environmental Protection Act 1990. It is an offence to intentionally disturb any of these species during the breeding season without a valid licence.

3.19 The number of European herring gull[1] has fallen over the past 25 years and over half of the UK breeding population is confined to fewer than ten sites. Common starling, house sparrow and song thrush are red listed because of their recent decline although they remain quite widespread in the UK. The skylark population has fallen drastically over the last 30 years thought caused by the use of herbicides and pesticides and a move to winter sown cereal crops that deters late season nesting attempts. Similarly, the northern lapwing has seen a sustained contraction in its numbers and range related to changes in farming practices and intensification. There is a record for a northern lapwing within or very close to the site (see Appendix 3, Map 5). The spotted flycatcher was once considered a common garden nesting species but has experienced a long-term decline since the 1970s. Evidence suggests this is due to poor annual survival rates of first year birds although conditions in their African wintering grounds may have also contributed to their decline. Linnet numbers have dropped substantially over the past few decades, with the UK population estimated to have declined by 57 per cent between 1970 and 2014 (BTO 2019, The Wildlife Trusts 2019: RSPB 2019)

3.20 The preferred habitat for dunnock is well-vegetated areas such as hedges, scrub and deciduous woodland and in urban areas they tend to be attracted to parks, gardens and scrub habitat. Common bullfinch is Amber listed and of medium conservation concern. It is widely distributed in the UK but populations have declined by 36% since 1967 thought to be related to the loss of habitat, agricultural intensification and reduced diversity in woodlands. The numbers of redpoll and reed bunting have also declined, once more thought related to changes in agricultural practices.

3.21 Schedule 1 species recorded are for peregrine falcon (six records), little ringed plover (ten records), black redstart (one record) and kingfisher (four records). The peregrine falcon faced extinction in the UK in the 1960s largely as a result of pesticides. However, they have made a rapid comeback and pairs now nest on high buildings in a number of city centres, including Manchester. High buildings are used by breeding peregrine falcons and breeding at the site is highly improbable, as the site has no built structures.

3.22 The little ringed plover is a summer visitor that first bred in the UK in 1938 and has since successfully colonised a large part of England and Wales. Expansion has been achieved through an exploitation of manmade habitats; especially gravel pits and new reservoirs. There is a record for little ringed plover within the Project Bradford site. It does not specify if this is a recorded sighting or a nesting site. Open brownfield habitats are favoured and breeding at the site is plausible.

3.23 There is a single record for black redstart to the west of the site. This species is a rare breeder, passage migrant and winter visitor with a small population concentrated in London, Liverpool, Sheffield and the West Midlands. There are also records of black redstart breeding in Manchester City Centre and Greater Manchester. The site is outside the Black Redstart Priority Area. This identifies an area in central Manchester where the Schedule 1 black redstart has been recorded. A Species Action Plan (Greater Manchester Biodiversity Project 2009) aims to maintain a breeding population in Greater Manchester.

3.24 Kingfisher nest in burrows in river banks and hunt fish from riverside perches. They are Amber listed as their numbers have declined, thought to be caused by habitat degradation through pollution and unsympathetic management of watercourses. Records are for the River Medlock and Rochdale Canal. Note that the records for Schedule 1 species are not to be placed in the

[1] *See Table 3 for scientific names of bird species*

public domain and the map showing record locations is not included in this report for that reason.

Eurasian Badger

3.25 Eurasian badger (*Meles meles*) and their setts are protected under the *Protection of Badgers Act 1992*. It is an offence to kill or injure a badger, or to damage, destroy or interfere with its sett or to allow a dog to enter a sett.

3.26 There are six records of badger signs (e.g. latrines, runs, foraging activity) within the search zone and 11 recorded setts. (Please note that information related to badger and their setts is confidential and the map provided by GMEU showing the location of the signs is not included in Appendix 3 for this reason).

Water Vole

3.27 The water vole (*Arvicola terrestris*) is protected and a Priority Species in the UK under the WCA, 1981.

3.28 There is a single record for water vole in Clayton Vale LNR.

Common Toad

3.29 The common toad (*Bufo bufo*) is protected and a Priority Species in the UK under the WCA 1981.

3.30 There is a single record of common toad in the search area, located in Clayton Vale LWS to the east of the site.

Slow-worm

3.31 The slow-worm (*Anguis fragilis*) is protected and a Priority Species in the UK under the WCA1981.

3.32 There are two records of slow-worm, the closest at a distance of approximately 1.8km.

Plant Species

3.33 Grass-wrack pondweed (*Potamogeton compressus*) is a threatened aquatic macrophyte species of the pondweed family. It is nationally scarce and declining both in Britain and throughout its range (Birkinshaw *et al*. 2013).

3.34 It has been recorded in the Ashton Canal approximately 1.8km to the south-east of the site (see Appendix, Map 5).

3.35 Floating water-plantain (*Luronium natans*) is listed in Schedule 4 of the Conservation (Natural Habitats, etc.) Regulations 1994; Schedule 8 of the WCA 1981, and on the IUCN Red List it is classified as 'Least Concern'.

3.36 There are two records, both on the Ashton Canal with one approximately 40m from the site.

Pond Mud Snail

3.37 The pond mud snail (*Omphiscola glabra*) is classified as Near Threatened by the IUCN, Vulnerable (RDB 2) in the UK Red Data Books and is a S41 Conservation Priority Species.

3.38 Decline in the population is due to the temporary habitats favoured by the pond mud snail being lost or degraded (Bratton 1991; Buglife 2019).

Schedule 9 Species

3.39 There were no records for non-native invasive Schedule 9 species.

Phase 1 Survey

Site Overview

3.40 The results of the Phase 1 survey are presented in Figure 1, showing the habitats and features within the site and including a buffer zone surrounding the site. Target notes (TN) describe features of interest. A selection of illustrative photographs is presented in Appendix 4.

3.41 The site is a former car park, bounded by metal fencing on three sides, with a concrete wall on the west side along the walkway to the Etihad campus. There is a dry ditch along the north and western edges. The site is accessed by a tarmac road over the canal bridge from the large car park area to the south (Plate1).

3.42 The central area of the site is stone hardstanding with very sparse, scattered ephemeral/short perennial plants (Plates 2 to 5). The ephemeral/short perennial vegetation cover increases further out from the centre of the site and grades into open, species-rich unimproved neutral grassland (Plate 6). Around the edge of the site broadleaved saplings/young trees and scrub has developed (Plates 6 and 7). There has probably been an element of tree planting as indicated by the presence of the non-native species, Italian alder. The tree saplings and willow/butterfly-bush scrub encroaches out into the main part of the site in places, with a distinct line of saplings across the centre of the site (Plate 8). A small area of slightly older semi-natural broadleaved woodland is present on the eastern boundary.

3.43 Along the eastern edge of the site is a line of immature/semi-mature small-leaved limes with grass-dominated vegetation underneath. This line extends outside the site fencing at the south-east corner (Plate 9).

3.44 A number of large concrete circular culverts lie across the site, often with tree saplings growing out of them (Plate 10). There was a small area with dark-coloured mats (Plate 11, TN1) potentially offering refugia for amphibians and reptiles. However, none were seen during the survey.

3.45 To the south, adjacent to the site is Ashton Canal, with semi-natural vegetation of unimproved neutral grassland along the concrete towpath verges and amongst the lock. The footpath extends around the south-east boundary of the site to join the pavement alongside the road, Alan Turing Way. There are two bridges across the canal (Plates 12 and 13, TN3) and areas of semi-natural broadleaved woodland on the southern canal banks (TN5). Concrete walls bound the edge of the canal area separating it from the adjacent tramline. The canal area is well used by the public as a footpath and recreational feature.

3.46 The surrounding land to the east and north of the site is tarmac road and pavement. There is a line of planted Norway maples in large wooden planters along part of the central reservation of the dual carriageway to the east (Plate 14).

Open, Neutral Grassland - Unimproved, with Young Trees/Scrub

3.47 The grassland is an open structure with areas of hardstanding visible, typical of vegetation that has recently developed over man-made substrates (Plates 9 and 15). Creeping bent grass and black medick are abundant, with locally abundant red fescue, frequent Yorkshire fog, common ragwort and the non-native species common michaelmas-daisy. Other non-native plants present include the legume, white melilot, which forms abundant patches across the grassland, occasional ribbed melilot and large-flowered evening primrose that occurs rarely. The garden escapees of lady's-mantle and columbine are present. There are locally abundant patches of the annual grass species squirrel-tail fescue, particularly as the vegetation grades into the ephemeral/short perennial vegetation habitat further into the site.

3.48 The grassland is species-rich, containing a range of grassland forbs including several species favouring calcareous substrates such as rough hawk's-beard, yellow-wort and wild carrot, red clover and patches of oxeye daisy and ribwort plantain are prominent in the sward, with occasional selfheal and perforate St. John's-wort and a number of other grassland species such as tufted vetch and bird's-foot trefoil occurring rarely.

3.49 The habitat contains a total of 16 species listed in the GMEU selection guidelines (Greater Manchester Ecology Unit 2016) as indicator species used in the consideration of sites for selection as Grade 2 Semi-natural Grassland SBI. Also of note is the presence of yellow-wort, a Greater Manchester Biodiversity Action Plan species (Plate 11, TN1).

3.50 The range and abundance of flowering plants present, combined with butterfly-bush scrub provide a nectar resource for invertebrates.

3.51 The site appears unmanaged, which has lead to the development of scattered tree saplings and scrub within the grassland, in particular in a line across the middle of the site (Plate 8). Goat willow and silver birch are the most common species, with frequent butterfly-bush. Other species present, to a lesser extent, include white and grey willow, white poplar and aspen.

3.52 Areas of more concentrated tree saplings/young trees and scrub have developed over the neutral grassland along the northern, western and south-west edges of the site (Plates 6, 7, 10 and 15) where in a few years, if left unmanaged, this will form areas of broadleaved woodland. Again, silver birch and goat willow are the most common species, with occasional to frequent butterfly-bush, occasional white willow and several other broadleaved tree species occurring less frequently. The non-native species Italian alder is present in the area of trees to the north, indicating that a degree of planting has taken place. Semi-natural tree saplings/scrub are more scattered around the south-east and eastern edges of the site.

Ephemeral/Short Perennial

3.53 The grassland area grades into ephemeral/short perennial vegetation further into the site, with an increase in the proportion of bare substrate visible. Creeping bent is the dominant species and squirrel-tail fescue abundant near to the grassland area. Apart from black medick, which is locally abundant, the non-native species of common michaelmas-daisy, white melilot and large-flowered evening primrose are the dominant flowering plants. Ribwort plantain and the annual pineappleweed are occasional in patches, other species occur rarely (Plates 6 and 10).

Hardstanding

3.54 The centre of the site is a large area of stone hardstanding of the former car park, with very sparse, scattered ephemeral/short perennial species (Plates 3 to 6).

3.55 A tarmac road accessing the site from the south has tarmac/stone pavements with unimproved neutral grassland on the wider area on the east and lines of ephemeral/short perennial vegetation along the road and bridge edges to the west (Plate 1).

3.56 Outside the site fencing, to the east, is tarmac pavement, a cycleway and the dual carriageway. To the north is tarmac pavement and a road. A concrete towpath follows the course of the canal and a short section of tarmac path runs alongside the south-east edge of the boundary fencing.

Broadleaved Woodland - Semi-natural

3.57 There is a small area of slightly older semi-natural broadleaved woodland on the eastern boundary, within the site (TN2). Silver birch and goat willow occur frequently, with occasional butterfly-bush, grey willow and aspen. Several other species of broadleaved tree occur rarely.

3.58 External to the site, along the southern edge of the canal are several small areas of semi-natural broadleaved woodland (TN5). Goat willow, other willow species, sycamore and silver

birch are the most frequent woody species with hawthorn and butterfly-bush being occasional. The ground flora is bramble-dominated in places with a patch of ivy and ferns along the canal edge.

Broadleaved Woodland - Plantation

3.59 Along the eastern edge of the site is a line of planted, evenly spaced small-leaved lime trees (Plates 9 and 16). The line of trees continues along the road verge outside the site boundary at the south-east corner of the site.

3.60 The ground vegetation underneath the limes is grass-dominated with abundant red fescue, Yorkshire fog, common couch and occasional tall false-oat-grass. Amongst the forbs, colt's-foot is abundant and dandelion, ribwort plantain and hairy tare frequent. Species diversity is moderately poor and other species are present only at occasional to rare frequency.

3.61 Running down the central reservation of the dual carriageway Alan Turing Way, adjacent to the site, there are regularly spaced large wooden containers with young planted Norway maple; some of the trees are looking unhealthy (Plate 14).

Dry Ditch

3.62 There is a dry ditch running along the north and western edges of the site amongst the denser areas of tree saplings/scrub. The vegetation present is not indicative of the ditch having being wet for extended periods of time and no animal signs were observed along the ditch.

Neutral Grassland - Unimproved

3.63 The other areas of unimproved neutral grassland present are all external to the site boundary, alongside the canal and a small area next to the footpath near the south-east corner. These areas of grassland are more established and managed. The fine-leaved grass red fescue and forbs ribwort plantain and selfheal are all abundant in the sward. Daisy, common ragwort and common michaelmas-daisy occur frequently to abundantly and yarrow and oxeye daisy are locally abundant. Species-richness is moderate. However, 12 of the species recorded are listed in the SBI grassland selection guidelines. A small plant of the Schedule 9 species, wall cotoneaster is present, possibly originated from planting within the local area.

Canal

3.64 The canal stretch adjacent to the site has little aquatic vegetation except a clump of arrowhead (Plate 15, TN4). The canal and towpath provide a recreational facility with walkers, runners, cyclists and narrow boats using the canal and lock.

3.65 The canal sides are concrete and straight-sided, offering no potential for water vole. The two bridges along the canal are intact and appear to offer negligible potential for roosting bats (Plates 12 and 13).

Evaluation

3.66 The desk study identified a single statutory wildlife site, Clayton Vale LNR and a number of protected species within the search area. All sites and records of species returned were considered sufficiently distant and isolated from the site to not be impacted by development proposals.

3.67 The desk study revealed that floating water-plantain had been recorded in Ashton Canal, close to the site. It was not, however, recorded in the stretch of canal adjacent to the site, which was poor in aquatic vegetation.

3.68 The trees within the site, apart from the planted small-leaved lime along the site boundary, were all young. No birds' nests were observed within any of the trees at the time of the survey. The desk study, however, showed a recorded sighting of northern lapwing within or very close to the site and a record for little ringed plover within the site boundary. This is a species that favours this type of brownfield site.

3.69 No potential bat roost features were observed in the trees on the site. The two bridges on the canal stretch adjacent to the site appeared intact, with little apparent opportunity for bats to roost. The desk study, however, recorded a pipistrelle bat roost at 65m from the site and a sighting at 15m away and the canal and areas of trees on site would offer suitable foraging sites for bats.

3.70 The extended Phase 1 habitat survey found the open, unimproved neutral grassland habitat that had developed on the man-made substrate of the former car park to be of nature conservation interest. Although the grassland habitat is typical of sites that have developed over hardstanding and contains a number of introduced species such as melilots and large-flowered evening primrose, it is species-rich and contains 16 species listed in the SBI selection guidelines as indicator species used in the consideration of sites for selection as Gr2 Semi-natural grassland SBI. Of particular note is the presence of yellow-wort, a Greater Manchester Biodiversity Action Plan species. The extent of flowering plants and scattered butterfly-bush within the grassland offer nectar sources for pollinating insects and other invertebrates.

3.71 No non-native invasive Schedule 9-listed plants were observed within the site boundary. There was, however, a small individual plant of wall cotoneaster in the grassland of the adjacent grassland alongside Ashton Canal.

4. RECOMMENDATIONS

Nesting Birds

4.1 No evidence of nesting birds was found. However, all breeding birds are protected by law and it is recommended that initial works are carried out outside the bird nesting season (1st March to 30th September). If winter clearance is not possible, then it is recommended that a suitably experienced ecologist check the site no more than 48 hours prior to works to ensure no active nests are present. If nesting birds are confirmed to be present then works should be postponed in that area until young have fledged and/or nesting had been completed. It may be necessary to cordon off the nest and monitor it until work is completed.

Other Protected Species

4.2 Additional surveys or special measures for other protected species are not considered necessary.

4.3 Artificial light associated with the site development, however, should be situated to avoid light spillage onto the adjacent Ashton Canal as the canal corridor offers suitable foraging habitats for bats and the trees present could provide roost habitats. Daubenton's bats in particular fly and forage over water and the desk study showed a Daubenton's bat record at just 125m from the site. The desk study also showed that common pipistrelle bats were recorded close by, with a roost at 65m and a sighting at 15m away.

Ecological Enhancement

4.4 National Planning policy requires that opportunities for ecological enhancement are sought within all development proposals, moving towards the aim of 'biodiversity net gain'. To achieve this, projects must be considered on an individual basis to ensure that new features, planting and management regimes are suitable for the conditions on site and thus likely to be successful in the longer term. Some potential options are presented for consideration in Table 4.

4.5 The proposed development footprint covers most of the site, however, the bank along part of the southern edge of the site appears from the plans to be outside the development area and retention of the trees/scrub present would create habitats for a range of animals. Management for this area could include selective thinning of the existing young trees/scrub, initially and at periods as the woodland establishes, to allow light to reach the ground layer. Patches of grassland could be retained and managed by annual mowing, after the flowers have set seed and removing the arisings from site.

4.6 The open structure of the species-rich unimproved neutral grassland and lack of a well-formed turf make it unsuitable for transplanting from areas under development. Enhancement of the strips of grassland habitat that remain after development could be obtained by annual mowing, after the flowers have set seed and removing the arisings from site. This will aim to reduce the spread and establishment of trees/scrub on the grassland habitat and also to maintain the low soil fertility of the substrate to enhance conditions for diverse, species-rich grassland to be maintained.

Table 4 Potential Enhancement Measures for Consideration

Enhancement	Description
Bird nest boxes	• Boxes designed for a range of different species are available and could be positioned within planted areas or on built structures depending on the target species. • Particular consideration should be given to providing nesting habitat for Red and Amber List species that may be found in urban and suburban areas such as swift, common house martin, house sparrow and starling.
Bat roost features	• Features incorporated within the structure of new buildings such as: o Self-contained bat bricks in walls o Smalls gaps to provide access to cavities behind surfaces such as fascia boards or hanging tiles o Access slot at apex of gable ends to allow bats to enter roof voids • These types of features would be best placed on the south-west, south or south-east facing elevations. • Self-contained bat boxes mounted on buildings or trees. • New roost features should be at a height of at least 3m and should have a clear flight path for bats to approach them. • (N.B. To qualify as enhancement new roost features would need to be over and above any requirement for replacement habitat that forms direct mitigation for impacts on an existing roost.)
Native species in landscape designs	• Planting schemes used in urban environments often include non-native species. These may be selected for their aesthetic appeal, pollution tolerance, evergreen foliage and low maintenance, and many nectar-bearing exotic species do support insects and provide foraging and nesting opportunities for birds. • However, native species, preferably of local provenance, tend to support greater biodiversity as they have evolved to the local conditions. It is recommended that, wherever practical, native trees and shrubs are selected for landscape designs.
Artificial lighting	• Artificial lighting can be disturbing to wildlife, particularly species such as bats that are nocturnal and adapted to forage in low-light conditions. Even if no roost is present on site, it would be good practice to adopt a sensitive lighting scheme to maximise biodiversity value post-development, with consideration given to the following points: o Directing lamps where they are needed to avoid unnecessary light spillage; o Use of narrow spectrum light sources with low ultra-violet, blue or white wavelength component to minimise insect attraction at lamps; o Avoiding illumination of features and habitats that are likely to have the greatest value to bats, such as tree canopies and ponds; and o Use of timers and/or motion sensors to limit periods of illumination to essential times only. • Further guidance on lighting specifications is provided in publications available from the Bat Conservation Trust website (www.bats.org.uk). This includes the impacts of different types of lighting (RCEP 2009), effects of artificial lighting on bat behaviour (Stone 2013) and guidelines for mitigation (Bat Conservation Trust 2014). • Specifically for this site, light spillage onto the adjacent Ashton Canal should be avoided, as the habitats present within the canal corridor offer suitable foraging opportunities for bats. Daubenton's bats in particular fly and forage over water. The wooded areas could also provide potential roosting sites.

Enhancement	Description
Green roofs	• Green roofs (living roofs) are intrinsically of greater benefit to biodiversity than more traditional roofing methods. • Green roofs can vary in their appearance and character. They can be designed to support low-growing mosses and sedums, wildflowers and grasses.
Off-site habitat enhancements	• The site area is relatively small. Outline details of the proposed redevelopment indicate limited available space for retention or enhancement of existing habitat of interest; it may be necessary to look outside the development boundary to other sites where biodiversity enhancements are more practically achieved.

5. REFERENCES

Bat Conservation Trust, 2019. https://www.bats.org.uk (accessed 10/06/2019).

Birkinshaw, N., Kemp, E. and Clarke, S., 2013. *The ecology of grass-wrack pondweed Potamogeton compressus.* Natural England Commissioned Reports, Number 130.

Bratton, J.H., 1991. British Red Data Books: 3. Invertebrates other than insects. JNCC. Peterborough.

BTO, 2019. https://www.bto.org British Trust for Ornithology (accessed 27/06/2019).

Buglife, 2019. https://www.buglife.org.uk/bugs-and-habitats/pond-mud-snail (accessed 27/06/2019).

CIEEM, 2013. *Competency Framework*. https://www.cieem.net/competency-framework.

CIEEM, 2017. *Guidelines for Preliminary Ecological Appraisal*, 2nd edition. Chartered Institute of Ecology and Environmental Management.

Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A. and Gregory, R.D., 2015. Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds*, **108**, 708–746.

Greater Manchester Biodiversity Project, 2009. *Black Redstart Species Action Plan*. GMEU.

Greater Manchester Ecology Unit, 2016. Greater Manchester Sites of Biological Importance Selection Guidelines, version 2.0. https://www.tameside.gov.uk/ecologyunit/sbi/guidelines.pdf (accessed 28/6/19)

Institute of Environmental Assessment, 1995. *Guidelines for Baseline Ecological Assessment*. E & F.N. Spon, an imprint of Chapman & Hall.

JNCC, 2010. *Handbook for Phase 1 Habitat Survey – a technique for environmental audit.* Joint Nature Conservation Committee (revised edition 2010).

RSPB, 2019. https://www.rspb.org.uk (accessed 27/06/2019).

Stace, C., 2019. *New Flora of the British Isles. Fourth Edition*. C&M Floristics.

The Wildlife Trusts, 2019. https://www.wildlifetrusts.org (accessed 27/06/2019).

6. ABBREVIATIONS

CIEEM	Chartered Institute of Ecology and Environmental Management
CRoW	Countryside and Rights of Way
EU	European Union
GMEU	Greater Manchester Ecology Unit
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserve(s)
NERC	Natural Environment and Rural Communities
NPPF	National Planning Policy Framework
PAA	Penny Anderson Associates Ltd
RIGS	Regionally Important Geological/geomorphological Site(s)
SAC	Special Area(s) of Conservation
SBI	Site(s) of Biological Importance
SSSI	Site(s) of Special Scientific Interest
TN	Target Note(s)
WCA	Wildlife and Countryside Act

FIGURE

386700 386800 386900 387000

399000 398900 398800

Apl	Acer platanoides	Norway maple
Tic	Tilia cordata	Small-leaved lime



Legend

- Site Boundary

Habitat

- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Neutral grassland - unimproved
- Open, neutral grassland - unimproved
- Open neutral grassland - unimproved with trees/scrub
- Standing water
- Ephemeral/short perennial
- Hardstanding
- Hardstanding with sparse ephemeral/short perennial
- Fence
- Dry ditch
- Wall
- Young tree/scrub
- Norway Maple
- Circular culverts
- Target Note

N

British National Grid
Projection: Transverse Mercator
False Easting: 400000.000000
False Northing: -100000.000000
Central Meridian: -2.000000
Scale Factor: 0.999601
Latitude Of Origin: 49.000000

ISO A3

0 5 10 20 30 40 Metres

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Project Name

Discipline: Ecology

Title:

Phase 1 Habitat Map

Scale: 1:1,000		Drawing No.: Figure 1	
Drawn By: MDM	Originator: CB	Date: 11/07/2019	
PAA Ref.: G:\BUHA10_Project_Bradford\Maps\		Revision: 1.0	

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APPENDICES

APPENDIX 1

Summary Species Legislation

SUMMARY OF THE LEGISLATION RELATING TO BADGERS AND THEIR SETTS

Badgers (*Meles meles*) are not an endangered species but have a long history of persecution and cruelty. As such, badgers and their setts are protected under the Protection of Badgers Act 1992 (as amended), which makes it illegal for any person to kill, injure or take a badger. It is also an offence to destroy, damage or obstruct a badger sett, or to disturb a badger whilst it is within a sett. There are also additional offences relating to possession of, buying and selling a dead badger, or anything derived from a badger, and causing a dog to enter a sett.

The Act defines a sett as 'any structure or place which displays signs of current use by a badger'. Setts are defined by English Nature (1995) as 'usually underground tunnel systems providing shelter for badgers, but may include other structures used by badgers such as hay bales, drainage culverts, or cellars'. 'Current use' is more difficult to define but is usually interpreted by the presence/absence of badger field signs over several observations of the sett (Natural England 2006).

Section 15 of the National Planning Policy Framework (NPPF 2018) states that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible. The NPPF also includes the requirement to contribute to the Government's commitment to halt the overall decline in biodiversity and to promote the reservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets. Reference is made to Circular 06/2005 *Biodiversity and Geological Conservation - Statutory Obligations and Their Impact within the Planning System* in respect of statutory obligations for biodiversity and geodiversity conservation.

Local authorities in England are required to consider the likelihood of any proposed development adversely affecting badgers' foraging territory, or links between them, or significantly increasing the likelihood of road or rail casualties amongst badger populations. The planning guidance for Wales, Technical Advice Note (Wales) 5, identifies the need to comply with the Protection of Badgers Act 1992.

English Nature, 1995. *Species Conservation Handbook*. English Nature, Peterborough.

Natural England, 2006. *Guidance on 'Current Use' in the definition of a badger sett*. Natural England, Peterborough.

Please note: the above text provides a brief summary of the legislation in relation to badgers for England and Wales and the original Act and amendments should be referred to for the precise wording.

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SUMMARY OF THE LEGISLATION RELATING TO BATS

All wild species of bat are protected under the Wildlife and Countryside Act (WCA) 1981, which has also been amended by later legislation, including the Countryside and Rights of Way (CRoW) Act 2000 and the Conservation of Habitats and Species Regulations 2017, and this legislation is applicable to England and Wales. Bats are listed on Schedule 5 of the WCA and are therefore subject to some the provisions of Section 9 which, with the amendments, make it an offence to:

- Intentionally or recklessly disturb a bat while it is occupying a structure or place which it uses for shelter or protection (S9:4b).
- Intentionally or recklessly obstruct access to any structure or place used for shelter or protection by a bat (S9:4c).

There are additional offences in relation to buying and selling (S9:5) any live or dead animal of this species or anything derived from them.

Bat species are also listed under Annexes IIa and IVa of the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora, also known as the 'Habitats Directive'. Inclusion on Annex IVa means they are consequently identified as European Protected Species (EPS) and protected under the Conservation of Habitats and Species Regulations 2017.

The Conservation of Habitats and Species Regulations 2017 state that a person commits an offence if they:

(a) deliberately capture, injure or kill any wild animal of a European protected species,

(b) deliberately disturb wild animals of any such species, in such a way as –

  (i) to impair their ability to survive, to breed or reproduce, or to rear their young, or

  (ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate, or

  (iii) to affect significantly the local distribution or abundance of the species to which they belong;

(c) deliberately take or destroy the eggs of such an animal, or

(d) damage or destroy a breeding site or resting place of such an animal.

Under these Regulations it is an offence to damage or destroy a breeding site or resting place whether the animal is in occupation or not, and protection extends to all life stages of the animal in question. There are additional offences relating to possession, control and sale of a live or dead bat or part of such an animal.

In addition, seven native British bat species, including the soprano pipistrelle (*Pipistrellus pygmaeus*) and the brown long-eared bat (*Plecotus auritus*), that are frequently found in buildings, are listed as a 'Priority Species' under the under the 2011 biodiversity strategy for England, *Biodiversity 2020: A strategy for England's wildlife and ecosystem services,* under the 2012 UK Post-2010 UK Biodiversity Framework. These Priority Species are also referred to as 'species of principal importance' for the conservation of biodiversity in England and Wales within Section 74 of the CRoW Act 2000, and Sections 41 (England) and 42 (Wales) of the Natural Environment and Rural Communities (NERC) Act 2006.

Section 15 of the National Planning Policy Framework (NPPF 2018) states that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible. The NPPF also includes the requirement to contribute to the Government's commitment to halt the overall decline in biodiversity and to promote the reservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets. Reference is made to Circular 06/2005 *Biodiversity and Geological Conservation - Statutory Obligations and Their Impact within the Planning System* in respect of statutory obligations for biodiversity and geodiversity conservation.

Local authorities in England are required to ensure that where significant harm resulting from development cannot be avoided (through locating on alternative sites with less harmful impacts),

adequately mitigated, or, as a last resort, compensated for, planning permission is refused. The commitment to preserving, restoring or enhancing biodiversity is further emphasised for England and Wales in Section 40 of the NERC Act 2006.

Please note: the above text provides a brief summary of the legislation in relation to bats in England and Wales and the original Acts, Regulations and any amendments should be referred to for the precise wording.

SUMMARY OF THE LEGISLATION RELATING TO BREEDING BIRDS

All wild species of breeding birds and their nests are protected under Part 1 of the Wildlife and Countryside Act (WCA) 1981, as amended by later legislation including the Countryside and Rights of Way (CRoW) Act 2000. This legislation applies in England and Wales.

Part 1 (Section 1:1) of the WCA states that:

> 'If any person intentionally,
>
> (a) kills, injures or takes any wild bird;
>
> (b) takes, damages or destroys the nest of any wild bird while that nest is in use or being built; or
>
> (c) takes or destroys an egg of any wild bird,
>
> he shall be guilty of an offence.'

Part 1 (Section 1:5) of the WCA (amended by the CRoW Act 2000) refers to specific birds listed on Schedule 1 of the WCA, and states that:

> 'If any person intentionally or recklessly,
>
> (a) disturbs any wild bird included in Schedule 1 while it is building a nest or is in, on or near a nest containing eggs or young; or
>
> (b) disturbs dependent young of such a bird,
>
> he shall be guilty of an offence and liable to a special penalty.'

Schedule 1 includes birds such as barn owl (*Tyto alba*), black redstart (*Phoenicurus ochruros*), wood lark (*Lullula arborea*) and Cetti's warbler (*Cettia cetti*). Please refer to the WCA for a complete list of Schedule 1 species.

Some provisions are made to allow the killing and taking of certain species under certain circumstances, as follows:

- Birds listed on Schedule 2 (Part 1) of the Act may be taken or killed outside of the 'close season' for each individual species (the 'close season' is defined by the Act). This includes various wild duck and geese species.
- Birds listed on Schedule 2 (Part 2) of the Act may be killed or taken by authorised persons at all times. This includes species such as carrion crow (*Corvus corone*), black-billed magpie (*Pica pica*), feral pigeon (*Columba livia*) and greater Canada goose (*Branta canadensis*). An 'authorised person' is defined as a person who has written authorisation to undertake the act from the relevant statutory authority. The written authority is in the form of a licence, either a general licence which covers a number of the more typical 'pest' species, or an individual licence for other individual species. In England these licences are issued by Natural England and in Wales by the Welsh Assembly Government.

Please note: the above text provides a brief summary of the legislation in relation to breeding birds in England and Wales and the original Act and any amendments should be referred to for the precise wording.

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SUMMARY OF LEGISLATION RELATING TO WATER VOLES

Water voles (*Arvicola amphibius*) are protected under the Wildlife and Countryside Act 1981, as amended, and this legislation is applicable to England and Wales. Water voles are listed on Schedule 5 of the Act and are, therefore, subject to some the provisions of Section 9 which, with the amendments, make it (in brief) an offence to:

- Intentionally kill, injure or take a water vole (S9:1);
- Intentionally or recklessly damage or destroy or a structure or place used for shelter or protection by a water vole (S9:4a);
- Intentionally or recklessly disturb a water vole while it is occupying such a place (S9:4b); or
- Intentionally or recklessly obstruct access to any structure or place a water vole uses for shelter or protection (S9:4c).

There are additional offences in relation to possessing, controlling (S9:2), and buying and selling (S9:5) any live or dead animal of this species or anything derived from them.

In addition, water voles are listed as a 'Priority Species' under the under the 2011 biodiversity strategy for England, *Biodiversity 2020: A strategy for England's wildlife and ecosystem services,* under the 2012 UK Post-2010 UK Biodiversity Framework. These Priority Species are also referred to as 'species of principal importance' for the conservation of biodiversity in England and Wales within Section 74 of the CRoW Act 2000, and Sections 41 (England) and 42 (Wales) of the Natural Environment and Rural Communities (NERC) Act 2006. Section 15 of the National Planning Policy Framework (NPPF 2018) states that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and provide net gains in biodiversity where possible. The NPPF also includes the requirement to contribute to the Government's commitment to halt the overall decline in biodiversity and to promote the reservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets. Reference is made to Circular 06/2005 *Biodiversity and Geological Conservation - Statutory Obligations and Their Impact within the Planning System* in respect of statutory obligations for biodiversity and geodiversity conservation.

Local authorities in England are required to ensure that where significant harm resulting from development cannot be avoided (through locating on alternative sites with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, planning permission is refused. The commitment to preserving, restoring or enhancing biodiversity is further emphasised for England and Wales in Section 40 of the NERC Act 2006.

Please note: the above text provides a brief summary of the legislation in relation to water voles for England and Wales and the original Acts, Regulations and any amendments should be referred to for the precise wording.

APPENDIX 2

Plant Species List

Appendix 2 Plant Species List

Common Name	Scientific Name	Open, Neutral Grassland - Unimproved, with Young Trees/Scrub	Ephemeral/ Short Perennial	Broadleaved Woodland - Semi-natural (TN2)	Broadleaved Woodland - Plantation	Neutral Grassland - Unimproved	Broadleaved Woodland - Semi-natural (TN5)	Standing Water - Canal
Woody Species								
Ash	*Fraxinus excelsior*	R					R-O	
Ash (sapling)	*Fraxinus excelsior* (sapling)	R	R		R			
Aspen	*Populus tremulous*	R		O				
Bramble	*Rubus fruticosus agg.*	R	R			O	O-F	
Broom	*Cytisus scoparius*			R	R	R		
Butterfly-bush	*Buddleja davidii*	LO-LF	R	O			LO	
Crack willow	*Salix euxina*						O	
Dog rose	*Rosa canina*	R						
Dogwood	*Cornus sanguinea*						LO	
Downy birch	*Betula pubescens* (seedling)	R				R		
Elder	*Sambucus nigra*						R	
Goat willow	*Salix caprea*	LA		F			F	
Goat willow (sapling)	*Salix caprea* (sapling)	R						
Goat willow (seedling)	*Salix caprea* (seedling)	R-O	R					
Grey willow	*Salix cinerea*			O		R	O	
Grey willow (seedling)	*Salix cinerea* (seedling)	R	R					
Hawthorn	*Crataegus monogyna*						O	
Hazel	*Corylus avellana*						R	
Hybrid black-poplar	*Populus x canadensis*	R		R				
Hybrid black-poplar (sapling)	*Populus x canadensis* (sapling)	R						
Italian alder	*Alnus cordata*	LO						
Norway maple	*Acer platanoides*				LD			
Norway maple (sapling)	*Acer platanoides* (sapling)				R			
Rose sp.	*Rosa sp.*						LO	
Silver birch	*Betula pendula*	LA		F			LF	
Silver birch (seedling)	*Betula pendula* (seedling)	O-LF						
Small-leaved lime	*Tilia cordata*				D			
Sycamore	*Acer pseudoplatanus*						O-F	
Sycamore (seedling)	*Acer pseudoplatanus* (seedling)		R					
White poplar	*Populus alba*			R				
White poplar (seedling)	*Populus alba* (seedling)	R-LO						
White willow	*Salix alba*	LO		R			R	
White willow (seedling)	*Salix alba* (seedling)	R						
Herbs, Grasses and Ferns								
Alsike clover	*Trifolium hybridum*	R						
Annual meadow-grass	*Poa annua*		O-LA					
Arrowhead	*Sagittaria sagittifolia*							R-LA
Bird's-foot trefoil	*Lotus corniculatus*	R			R			
Black medick	*Medicago lupulina*	A	O-LA			R		
Broad-leaved dock	*Rumex obtusifolius*	R	R		O	R		
Bush vetch	*Vicia sepium*	R			R			
Cat's ear	*Hypochaeris radicata*	R	R					
Cleavers	*Galium aparine*		R					
Cock's-foot	*Dactylis glomerata*	R						
Colt's-foot	*Tussilago farfara*	R-O			A			
Columbine	*Aquilegia vulgaris* (garden escape)	R						
Common couch	*Elytrigia repens*	R			F-A			
Common field-speedwell	*Veronica persica*	R						
Common knapweed	*Centaurea nigra*					R		
Common michaelmas-daisy	*Symphyotrichum x salignum*	F	LO-LF			F		
Common mouse-ear	*Cerastium fontanum*	R						
Common nettle	*Urtica dioica*				R			
Common ragwort	*Jacobaea vulgaris*	F	R		R	F		
Common vetch	*Vicia sativa*	R			O			
Crane's-bill species	*Geranium sp.*	R				R		
Creeping bent	*Agrostis stolonifera*	A	A			LF		
Creeping cinquefoil	*Potentilla reptans*	R			O			
Creeping thistle	*Cirsium arvense*	R			O			
Creeping-Jenny	*Lysimachia nummularia*					R		
Crested dog's-tail	*Cynosurus cristatus*	R						
Curled dock	*Rumex crispus*	R						
Cut-leaved crane's-bill	*Geranium dissectum*	R				R		
Daisy	*Bellis perennis*	R	R			F-A		
Dandelion	*Taraxacum officinale agg.*	O	R		F			
False oat-grass	*Arrhenatherum elatius*				O	O		
Fern species	*Dryopteris sp.*						LA	
Fern-grass	*Catapodium rigidum*	R-LF	R					
Field forget-me-not	*Myosotis arvensis*						LO	
Foxglove	*Digitalis purpurea*	R						
Great willowherb	*Epilobium hirsutum*	R			R	R		
Greater plantain	*Plantago major*	R-O	F-LA					
Hairy tare	*Ervilla hirsuta*	R						
Hairy tare	*Vicia hirsuta*				O-F			
Hard rush	*Juncus inflexus*	R	R					
Hedge mustard	*Sisymbrium officinale*	R	R					
Herb-Robert	*Geranium robertianum*	R				R		
Hop trefoil	*Trifolium campestre*	R-LA						
Horsetail species	*Equisetum arvensis*	R						
Ivy	*Hedera helix*						LD	
Knotgrass	*Polygonum aviculare*		R					
Lady's-mantle	*Alchemilla vulgaris* (garden escapee)	R						
Large-flowered evening primrose	*Oenothera glazioviana*	R	R-LF		R			
Lesser trefoil	*Trifolium dubium*	R				R		
Mayweed species	*Tripleurospermum sp.*	R						
Meadow buttercup	*Ranunculus acris*	R			R	R		
Meadow vetchling	*Lathyrus pratensis*	R			O			
Meadowsweet	*Filipendula ulmaria*					R		
Mouse-ear-hawkweed	*Pilosella officinarum*					R		
Mugwort	*Artemisia vulgaris*	R	R					
Nipplewort	*Lapsana communis*	R						
Oxeye daisy	*Leucanthemum vulgare*	O-LF			O	LA		

Common Name	Scientific Name	Open, Neutral Grassland - Unimproved, with Young Trees/Scrub	Ephemeral/ Short Perennial	Broadleaved Woodland - Semi-natural (TN2)	Broadleaved Woodland - Plantation	Neutral Grassland - Unimproved	Broadleaved Woodland - Semi-natural (TN5)	Standing Water - Canal
Pendulous sedge	*Carex pendula*	R						
Perennial rye-grass	*Lolium perenne*	R				R		
Perforate St. John's-wort	*Hypericum perforatum*	O				R		
Pineappleweed	*Matricaria discoidea*		LO					
Prickly sow-thistle	*Sonchus asper*	R						
Purple toadflax	*Linaria purpurea*	R						
Red clover	*Trifolium pratense*	F-LA	R					
Red fescue	*Festuca rubra*	LA	R- LF		A	A	F	
Ribbed melilot	*Melilotus officinalis*	O						
Ribwort plantain	*Plantago lanceolata*	O-LA	LO		F	A		
Rosebay willowherb	*Chamaenerion angustifolium*	R						
Rough hawk's-beard	*Crepis biennis*	R-LO	R					
Rough meadow-grass	*Poa trivialis*	R						
Selfheal	*Prunella vulgaris*	O	R-LO			A		
Smooth hawk's-beard	*Crepis capillaris*	R						
Smooth sow-thistle	*Sonchus oleraceus*		R					
Soft brome	*Bromus hordeaceus*	R						
Spear thistle	*Cirsium vulgare*	R	R			R		
Square stalked willowherb	*Epilobium tetragonum*	R	R					
Squirrel-tail fescue	*Vulpia bromoides*	O-LA	R-LA					
Thyme-leaved speedwell	*Veronica serpyllifolia*		R					
Traveller's joy	*Clematis vitalba*						R	
Tufted vetch	*Vicia cracca*	R			R	LF		
Wall cotoneaster	*Cotoneaster horizantalis*					R		
White clover	*Trifolium repens*	R						
White melilot	*Melilotus alba*	F-LA	O-LF					
Wild carrot	*Daucus carota*	R						
Yarrow	*Achillea millefolium*	R				LA		
Yellow bartsia	*Parentucellia viscosa*	R						
Yellow iris	*Iris pseudacorus*					R		
Yellow-wort	*Blackstonia perfoliata**	R						
Yorkshire fog	*Holcus lanatus*	F			A	O		
Mosses								
Pointed spear-moss	*Calliergonella cuspidata*	L-F						

KEY

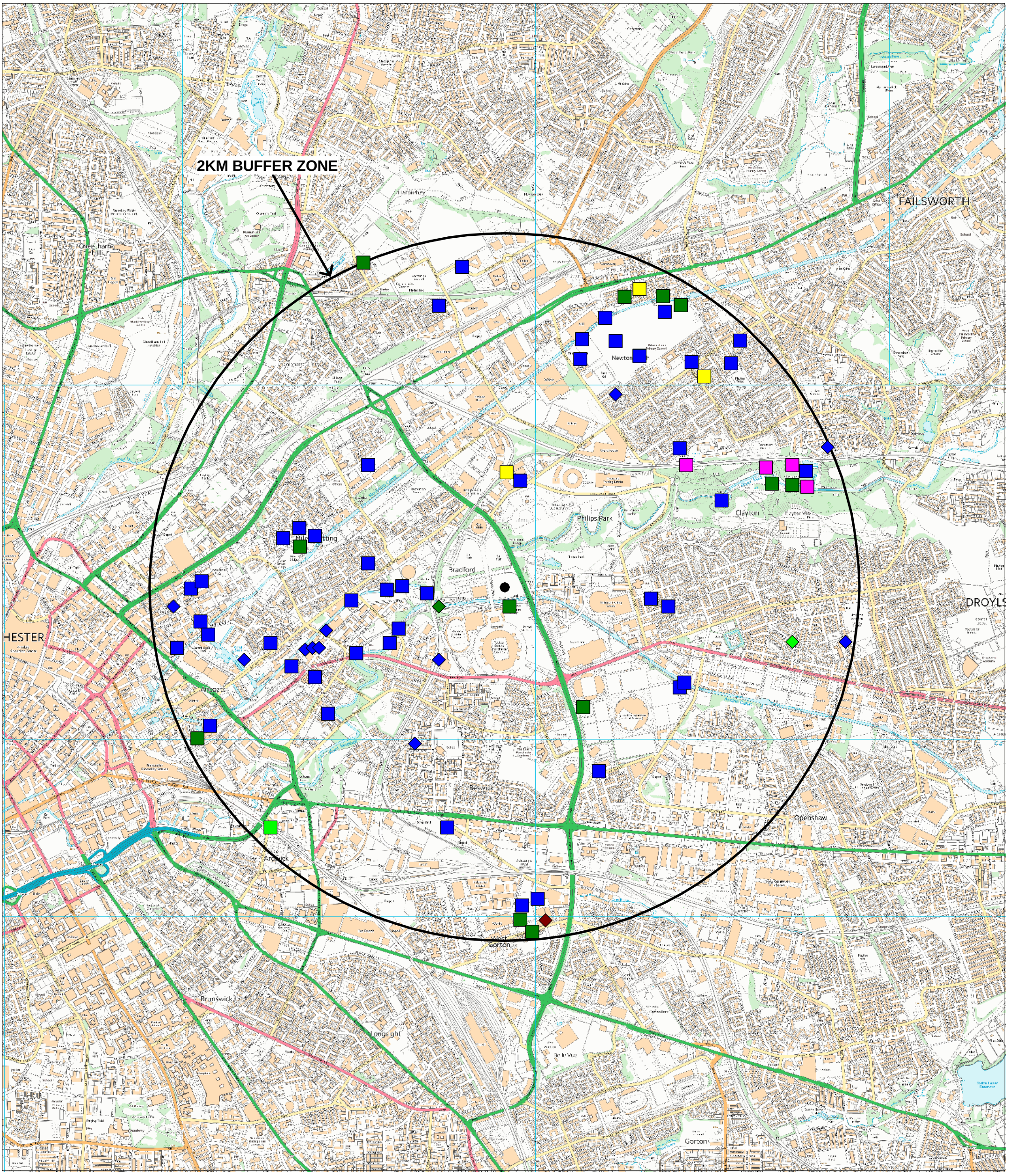
D - Dominant, A - Abundant, F - Frequent, O - Occasional, R - Rare, L - Locally

Species in blue are listed in the GMEU Sites of Biological Importance Selection Guidelines (for Grasslands)

* = BAP species

APPENDIX 3

Desk Study Results



KEY

BAT ROOSTS

- BAT SP
- BROWN LONG-EARED BAT
- COMMON PIPISTRELLE
- PIPISTRELLE SP

BATS OTHER SIGNS

- BAT SP
- COMMON PIPISTRELLE
- DAUBENTON'S BAT
- PIPISTRELLE SP
- SOPRANO PIPISTRELLE

GREATER MANCHESTER ECOLOGY UNIT
ECOLOGICAL SEARCH - SJ 86822 98860
SITE OFF ALAN TURING WAY - MAP 4

SCALE 1:20,000

BAT DATA COURTESY OF SOUTH LANCS BAT GROUP

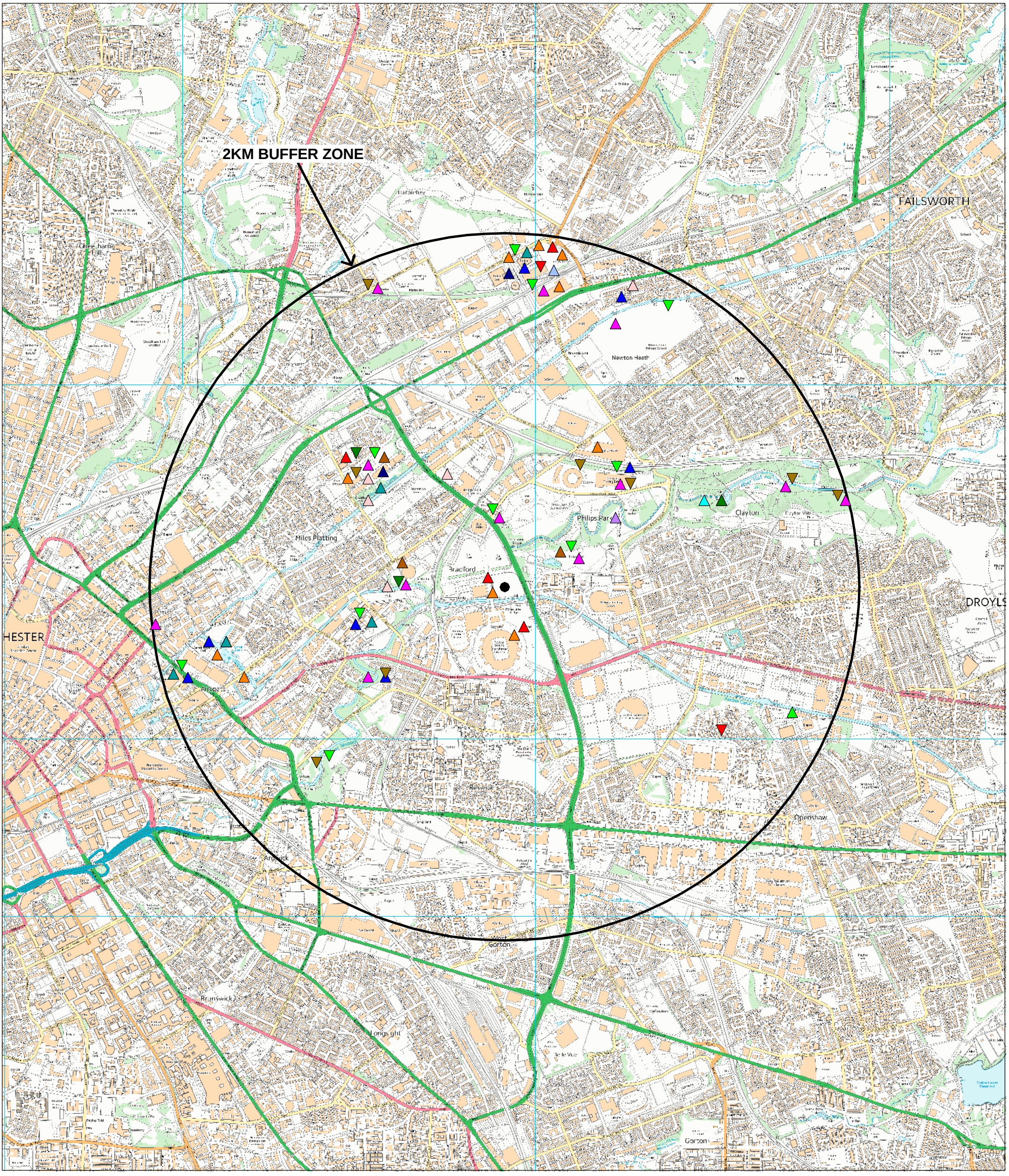
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Greater Manchester Ecology Unit

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Email: gmeu@tameside.gov.uk

Date Produced: 27/06/2019



KEY

SECTION 41 SPECIES

- BULLFINCH
- COMMON TOAD
- CURLEW
- DUNNOCK
- GRS-WRK PONDWEED
- HERRING GULL
- HOUSE SPARROW
- LAPWING
- LINNET
- MUD SNAIL
- REDPOLL
- REED BUNTING
- S41 MOTH
- SKYLARK
- SONG THRUSH
- SPOTTED FLYCATCHER
- STARLING

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SITE OFF ALAN TURING WAY - MAP 5

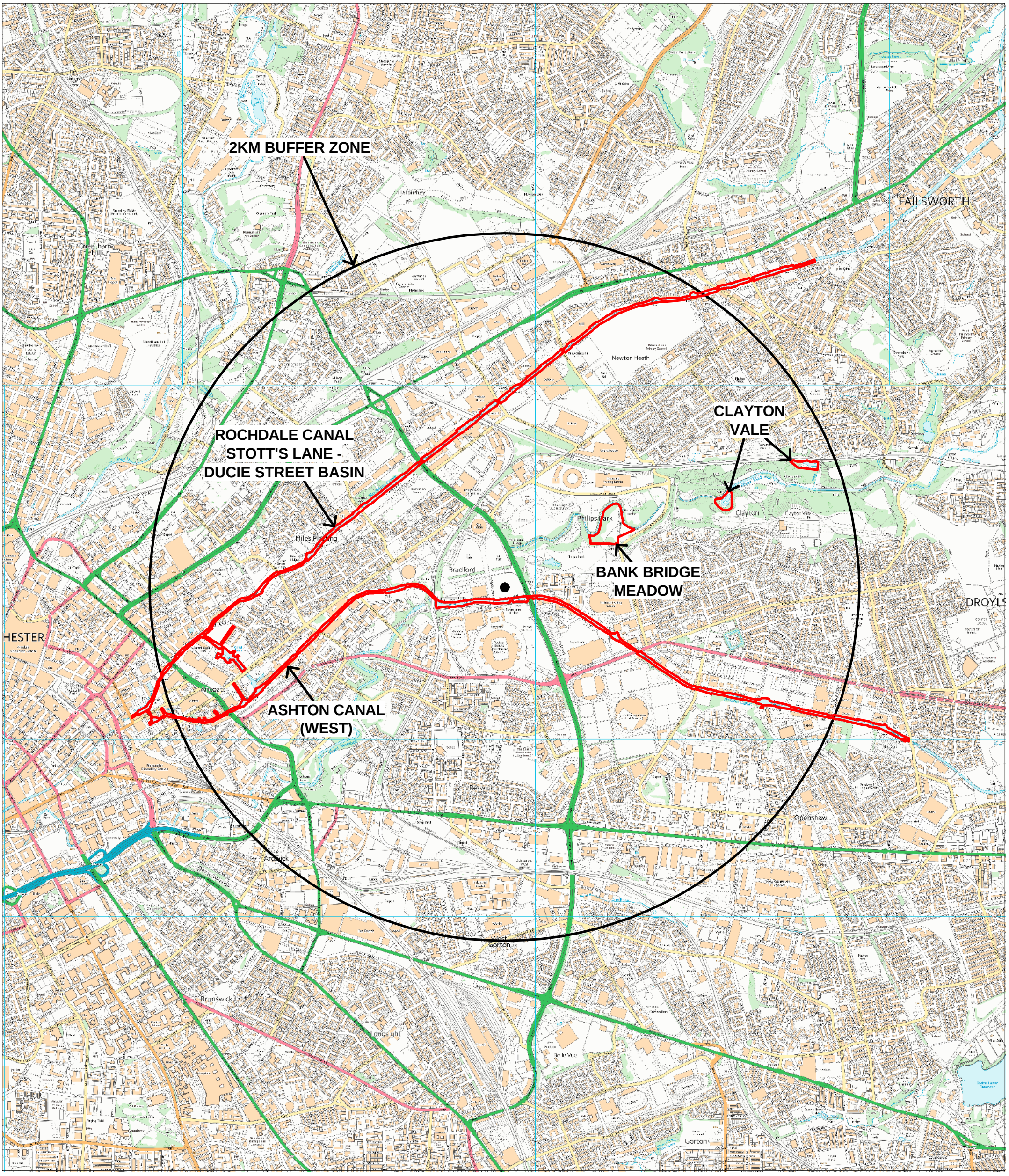
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KEY

SITE OF BIOLOGICAL IMPORTANCE

SBI BOUNDARY

GREATER MANCHESTER ECOLOGY UNIT
ECOLOGICAL SEARCH - SJ 86822 98860
SITE OFF ALAN TURING WAY - MAP 1

SCALE 1:20,000

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APPENDIX 4

Photographs



Photo 1 Tarmac road over canal bridge, accessing the site from the south



Photo 2 Site, looking west



Photo 3 Site, looking north-west



Photo 4 Site, looking north-east



Photo 5 Site, looking east



Photo 6 View looking north-west across open, unimproved neutral grassland towards ephemeral/short perennial vegetation, hard standing and neutral grassland with young trees/scrub in distance



Photo 7 Young trees/scrub within the unimproved neutral grassland along the southern edge of the site



Photo 8 Line of young trees/scrub across the middle of the site



Photo 9 Open, unimproved neutral grassland with scattered young trees/scrub & line of planted small-leaved lime trees in distance



Photo 10 Circular culvert within ephemeral/short perennial vegetation; young trees within the unimproved neutral grassland at north-east edge of site



Photo 11 Mats within the grassland offering potential refugia for amphibians/reptiles and yellow-wort plant



Photo 12 Bridge across the canal, looking west and unimproved neutral grassland verges



Photo 13 Bridge across the canal, looking east and unimproved neutral grassland verges



Photo 14 Norway maple planted in wooden containers along central reservation of the dual carriageway



Photo 15 Open, unimproved neutral grassland, with young trees/scrub along edge of site



Photo 16 Canal with small population of arrowhead plant, looking north towards edge of site and line of lime trees

Penny Anderson Associates Ltd

CONSULTANT ECOLOGISTS

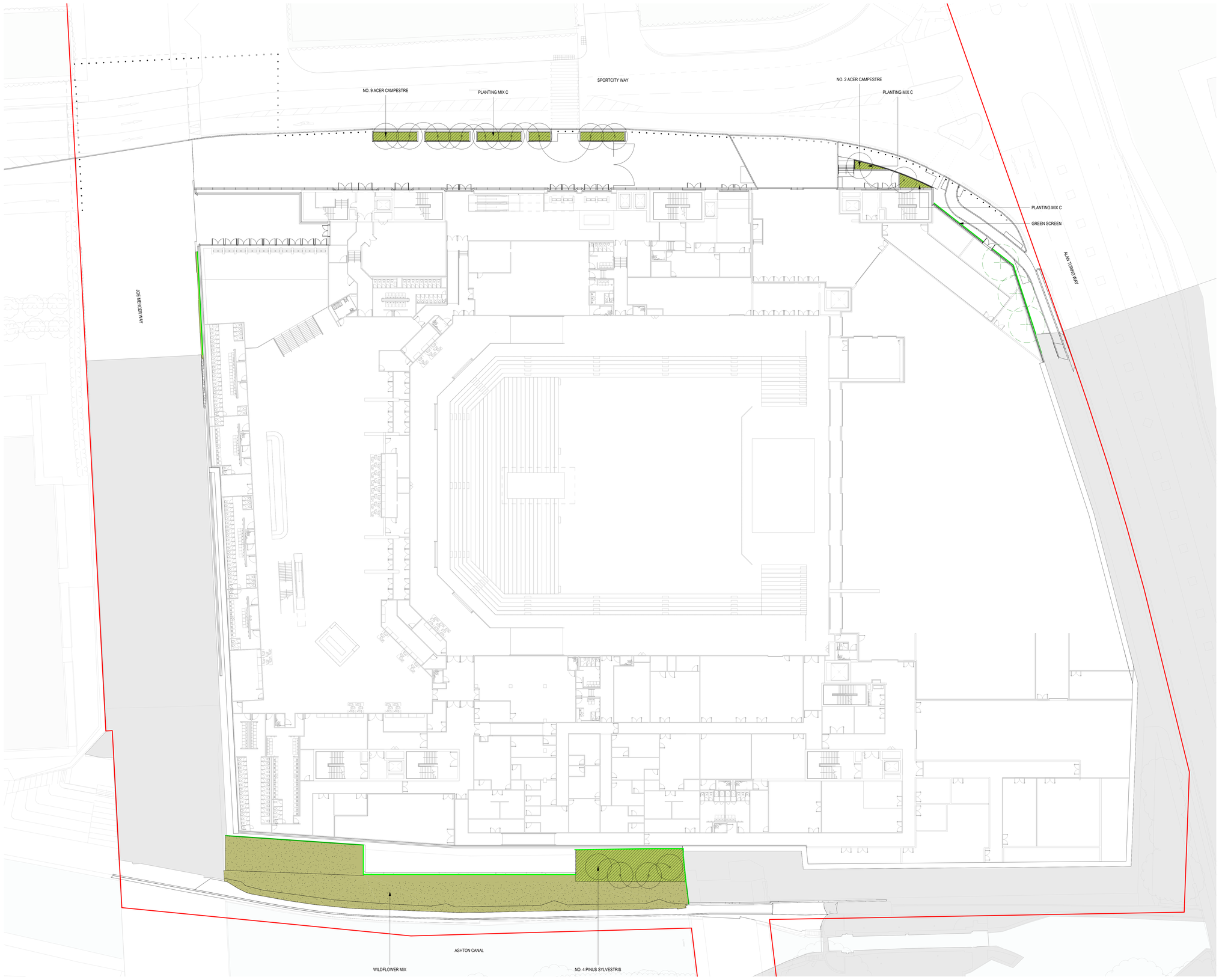


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Appendix B Overview Landscape Proposals – Populous 2020

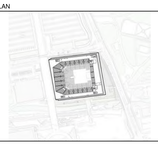
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REVISIONS

REV	DATE	DESCRIPTION
00	14.02.2020	PLANNING

KEY PLAN



KEY

- PLANNING APPLICATION BOUNDARY
- EXISTING TREES TO BE REMOVED
- EXISTING TREES TO BE RETAINED
- PROPOSED TREES
- PROPOSED SPECIMEN SHRUB
- PLANTING MIX A
- PLANTING MIX B
- PLANTING MIX C
- WILDFLOWER MIX
- GREEN SCREEN

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PROJECT NAME

OVG MANCHESTER

DRAWING TITLE

SOFT LANDSCAPE PLAN
GROUND FLOOR

STATUS	PROJECT No.
PLANNING	4933

DATE	SCALE	SIZE
14/02/2020	1 : 250	A0

DRAWN	CHECKED	APPROVED
ML	TJ	DS

PROJECT	ORIGIN	ZONE	LEVEL	TYPE	ROLE	DRAWING	REV
BRA-	POP-	ZZ-	GF-	DR-	L-	0655	00

SPORTCITY WAY

JOE MERCER WAY

WASTE MANAGEMENT

ALAN TURING WAY

ASHTON CANAL

FORGE LANE BRIDGE

GREEN SCREEN

GREEN SCREEN

GREEN SCREEN

GREEN SCREEN

GREEN SCREEN

COMPOUND AREA

PLANTING MIX C

NO. 3 PRUNUS LUSITANICA

NO. 18 TILIA CORDATA

NO. 2 MAGNOLIA GRANDIFLORA

PLANTING MIX A

NO. 4 PRUNUS LUSITANICA

NO. 3 PRUNUS LUSITANICA

NO. 2 PRUNUS LUSITANICA

NO. 2 PRUNUS LUSITANICA

PLANTING MIX A

PLANTING MIX A

PLANTING MIX A

PLANTING MIX A

PLANTING MIX A

PLANTING MIX A

PLANTING MIX A

NO. 2 SORBUS ARIA

NO. 2 SORBUS ARIA

NO. 16 BETULA PENDULA

NO. 4 SORBUS ARIA

GREEN SCREEN

NO. 7 PINUS SYLVESTRIS

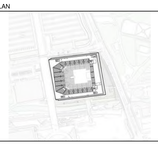
NO. 1 MAGNOLIA GRANDIFLORA

WILDFLOWER MIX

REVISIONS

REV	DATE	DESCRIPTION
00	14.02.2020	PLANNING

KEY PLAN



KEY

- PLANNING APPLICATION BOUNDARY
- EXISTING TREES TO BE REMOVED
- EXISTING TREES TO BE RETAINED
- PROPOSED TREES
- PROPOSED SPECIMEN SHRUB
- PLANTING MIX A
- PLANTING MIX B
- PLANTING MIX C
- WILDFLOWER MIX
- GREEN SCREEN

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LEVEL 01

STATUS	PROJECT No.
PLANNING	4933

DATE	SCALE	SIZE
14/02/2020	1 : 250	A0

DRAWN	CHECKED	APPROVED
ML	TJ	DS

PROJECT	ORIGIN	ZONE	LEVEL	TYPE	ROLE	DRAWING	REV
BRA-POP-	ZZ-	01-	DR-	L-		0656	00

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APPENDIX D BREEAM PRE-ASSESSMENT

BUROHAPPOLD ENGINEERING

OVG Manchester

BREEAM Pre-assessment Report

0042841

28 February 2020

Revision P02

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Revision	Description	Issued by	Date	Checked
00	DRAFT – Stage 3 - Issued for Comment	GC	22/11/19	-
P01	DRAFT - Issued for planning review	GC	20/01/20	AP
P02	FINAL – Issued for planning	GC	28/02/20	AP

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author	Georgina Chamberlain
date	**28.02.20**
approved	**Andrew Pottinger**
signature	
date	**28.02.20**

..

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2.3 BREEAM Minimum Standards 10

2.4 Conclusion and next steps 10

Appendix A Pre-assessment tracker

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1 Executive summary

This BREEAM Pre-assessment has been prepared by BuroHappold on behalf of OVG Manchester Limited (the 'Applicant') in support of a planning application for a new multi-use indoor arena ('OVG Manchester') located on the Etihad Campus, Manchester.

The contents of this report summarise the proposed approach to BREEAM for the new OVG Manchester arena.

The development is assessed under the current BREEAM scheme: *BREEAM New Construction 2018 – SD5078 2.0 – Assembly and Leisure (theatre/music/concert hall).*

The Proposed Development sits within the Manchester City Council area. Policy DM 1 Development Management within the Core Strategy (MCC, 2012) and the accompanying Guide to Development in Manchester SPD (MCC, 2007) requires all non-domestic developments to achieve a minimum BREEAM rating of Very Good. The Proposed Development aspires to go beyond this and presents a route map to BREEAM Excellent within this pre-assessment report.

As part of the planning proposals, a suite of credits equating to a score of **74.3%** is targeted, which provides a 4.3% safety margin above the 70% threshold for Excellent. In addition, there is a pool of potential credits that are possible for the project but subject to further design development or costs, which can be explored during detailed design as alternative routes to secure BREEAM Excellent.

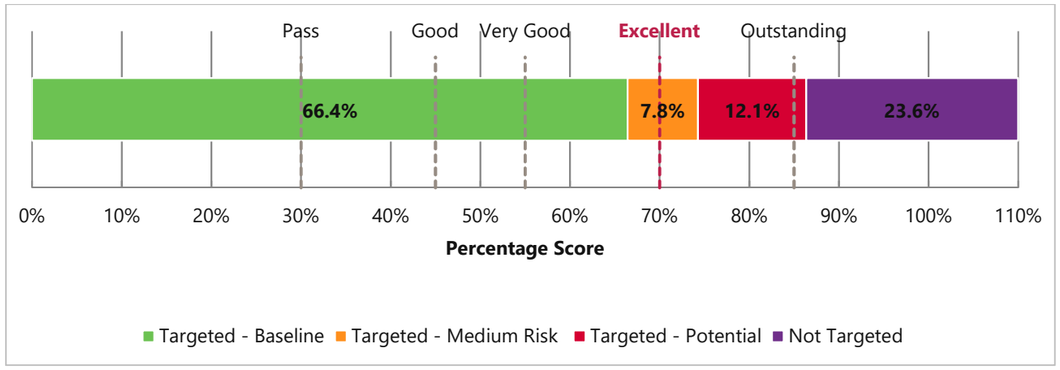


Figure 1.1: Summary of agreed BREEAM performance standard

This BREEAM assessment is complemented by the bespoke Etihad Campus Strategic Sustainability Framework which sets out a wider and more ambitious vision for sustainable development beyond BREEAM. The Proposed Development's response to this framework is captured within the Sustainability Statement.

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2 BREEAM pre-assessment report

2.1 Introduction to BREEAM

BREEAM (Building Research Establishment's Environmental Assessment Method) is the world's first sustainability rating scheme for the built environment and has contributed much to the strong focus in the UK on sustainability in building design, construction and use. BREEAM is now an international standard that is locally adapted, operated and applied.

As summarised in Table 2.1, ten categories of environmental impact are assessed, each covering a number of clearly defined issues. These issues seek to mitigate the impact of a new or refurbished building on the environment by setting performance-based criteria and benchmarks and a given number of credits is available for addressing each one.

Table 2.1: BREEAM environmental performance categories

	**Management** This category encourages the adoption of sustainable management practices in connection with design, construction, commissioning, handover and aftercare activities to ensure that robust sustainability objectives are set and followed through into the operation of the building.
	**Health & Wellbeing** This category encourages the increased comfort, health and safety of building occupants, visitors and others within the vicinity. Issues in this section aim to enhance the quality of life in buildings by recognising those that encourage a healthy and safe internal and external environment for occupants.
	**Energy** This category encourages the specification and design of energy efficient building solutions, systems and equipment that support the sustainable use and management of operational energy in the building.
	**Transport** This category encourages better access to sustainable means of transport for building users. Issues in this section focus on the accessibility of public transport and other alternative transport solutions (cyclist facilities, provision of amenities local to a building) that support reductions in car journeys and, therefore, congestion and CO2 emissions over the life of the building.
	**Water** This category encourages sustainable water use in the operation of the building and its site. Issues in this section focus on identifying means of reducing potable water consumption (internal and external) over the life time of the building and minimising losses through leakage.
	**Materials** This category encourages steps taken to reduce the impact of construction materials through design, construction, maintenance and repair. Issues in this section focus on the procurement of materials that are sourced in a responsible way and have a low embodied impact over their life including extraction, processing and manufacture and recycling.
	**Waste** This category encourages the sustainable management (and reuse where feasible) of construction, operational waste and waste through future maintenance and repairs associated with the building structure. It includes recognition of measures to reduce future waste as a result of the need to alter the building due to future changes to climate or change of use.
	**Land use and Ecology** This category encourages sustainable land use, habitat protection and creation, and improvement of long term biodiversity for the building's site and surrounding land. Issues in this section relate to the reuse of brownfield sites or those of low ecological value, mitigation and enhancement of ecology and long term biodiversity management.
	**Pollution** This category addresses the prevention and control of pollution and surface water run-off associated with the building's location and use. Issues in this section aim to reduce the buildings impact on surrounding communities and environments arising from light-pollution, noise, flooding and emissions to air, land and water.
	**Innovation** The innovation category provides opportunities for exemplary performance and innovation to be recognised that are not included within, or go beyond the requirements of the credit criteria. This includes exemplary performance credits, for where the building meets the exemplary performance levels of a particular issue. It also includes innovative products and processes for which an innovation credit can be claimed, where they have been approved by BRE Global Ltd.

Within each environmental performance category, there are a number of credits which developments are assessed against. Where evidence is provided demonstrating that the criteria of the credit have been met, the appropriate number of credits can be awarded. A weighting is applied to account for the varying importance of the different categories and then the category totals are added together to produce a single overall score on a scale of Pass, Good, Very Good, Excellent or Outstanding. The performance standard for each rating is summarised below in Table 2.2.

Table 2.2: BREEAM performance standards

BREEAM Rating	% Score
Outstanding	85 %
Excellent	70 %
Very Good	55 %
Good	45 %
Pass	30 %
Unclassified	< 30%

Certification is carried out at two stages as summarised below and in Figure 2.1:

- The **Design Stage assessment** and interim BREEAM rating confirms the proposed new building's performance at the design stage of the life cycle. Assessment and ideally certification will occur prior to the beginning of operations on-site. The BREEAM rating at this stage is labelled as 'interim' because it does not represent the building's final, new construction BREEAM performance; and
- The **Post Construction Stage assessment** and BREEAM rating confirms the final 'as built' performance of the building at the new construction stage of the life cycle. A final PCS assessment is completed and certified after practical completion of the building works.

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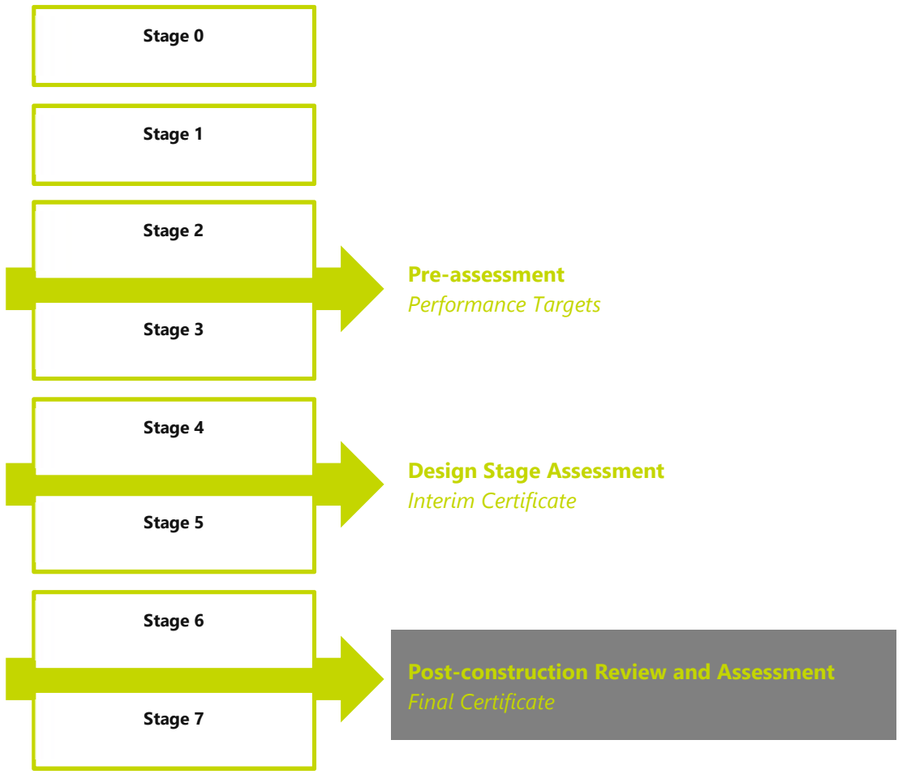


Figure 2.1: BREEAM assessment and certification stages

2.2 Pre-assessment overview

2.2.1 Project requirements

The Proposed Development sits within the Manchester City Council area. Policy DM 1 Development Management within the Core Strategy (MCC, 2012) and the accompanying Guide to Development in Manchester SPD (MCC, 2007) requires all non-domestic developments to achieve a minimum BREEAM rating of Very Good. The Proposed Development aspires to go beyond this and presents a route map to BREEAM Excellent within this pre-assessment report.

2.2.2 Assessment Scheme

The project has been registered under the current BREEAM scheme: *BREEAM New Construction 2018 – SD5078 2.0 – Assembly and Leisure (theatre/music/concert hall).*

2.2.3 Pre-assessment performance outcome

Based on an early RIBA Stage 2 pre-assessment workshop with the project team and subsequent BREEAM review workshops, a suite of credits equating to a score of **74.3%** is targeted and reflected within the planning proposals (See Fig 2-2). This provides 4.3% safety margin above the 70% threshold for Excellent. The targeted score includes a pool of medium risk credits which are achievable in principle but subject to final checks during detailed design. Should these prove not achievable, there is a pool of potential credits that are possible for the project but subject to further design development or costs, which can be explored during detailed design as alternative routes to secure BREEAM Excellent. See Appendix A for details of credits.

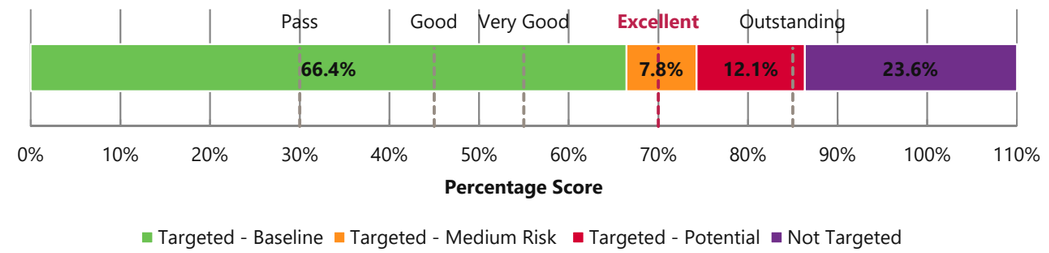


Figure 2.2: Summary of agreed BREEAM performance standard

Figure 2.3 further breaks down the score by BREEAM category, which show the Proposed Development performs well in terms of management for sustainability outcomes throughout the project, designing for good health and wellbeing of the end users and sustainable transport.

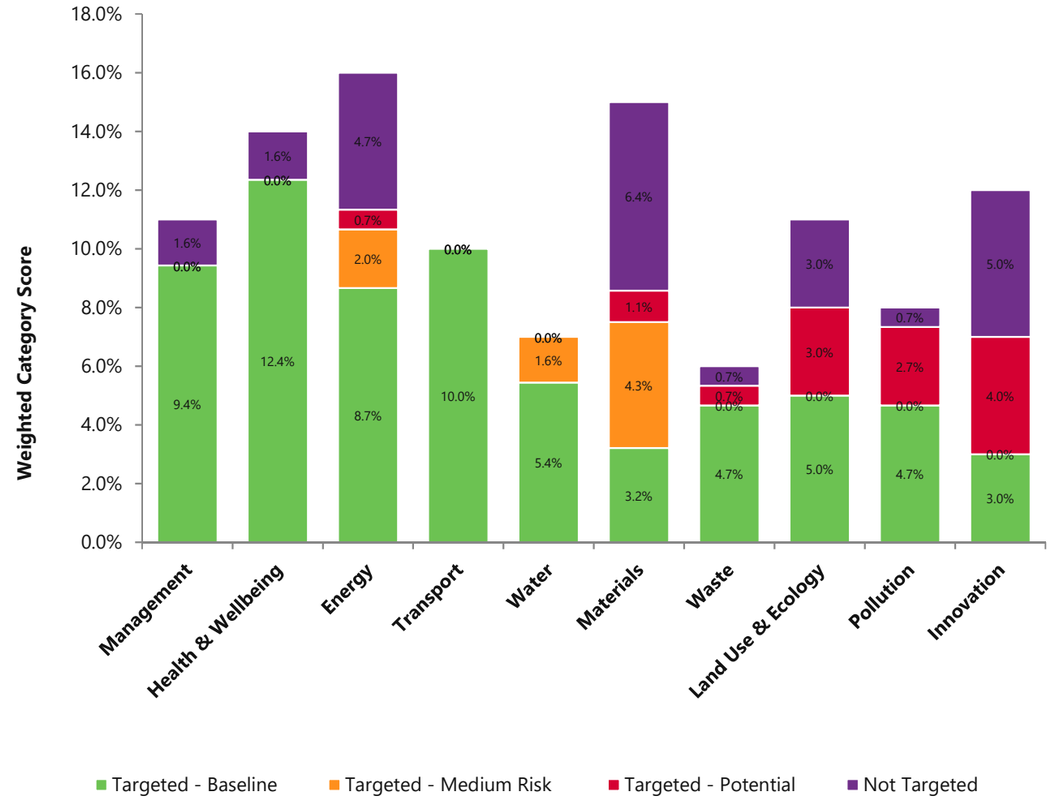


Figure 2.3: Summary of agreed BREEAM performance standard by assessment category

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2.2.4 RIBA Workstage Two actions

There are number of credits that require actions at certain stages of the design process. The BRE have stipulated the stages to coincide with industry recommendations of when considering the criteria can be of greatest influence and benefit to the design development. Targeted credits with actions required by the end of RIBA Stage 2 and 3 are summarised below to demonstrate the project is on track to securing these credits.

Table 2.3: Summary of progress made against RIBA Workstage Two dependant credits

Credit	Requirements	Lead	Response
Man 01 – Project brief and design	Collate information from project delivery stakeholder consultations (e.g. minutes, responsibility matrix, PEP) and demonstrate the impact on the design brief.	T&T	Client and project team meeting minutes provided. PEP in place.
	Collate information from third party stakeholder consultations with compliant content and demonstrating the impact on the design brief.	Deloitte / Laudation	Extensive consultation undertaken for planning. In addition, liaison with existing arenas for lessons learnt on operational issues has taken place.
	BREEAM target confirmed between team and client	BH BREEAM	BREEAM Stage 2 workshop took place on 28.06.19.
Hea 06 – Safety and security	Security Needs Assessment / Secured by Design	BH Security / GMP	BH provided initial Stage 2 advice. Greater Manchester Police have produced a Crime Impact Statement for planning.
Ene 04 – Low carbon design	Passive design analysis	-	Not targeted
	Low Zero Carbon feasibility study	MEE	Completed. ASHPs and PVs included within the Proposed Development.
Mat 03 – Responsible Sourcing	Sustainable procurement plan	BH BREEAM	Plan in place to inform design development and construction procurement.
Mat 06 – Material efficiency	Identifying opportunities and investigating measures for optimising the use of materials in consultation with the relevant parties.	BH BREEAM	Reviewed as part of the pre-assessment workshop.
Wst 05 – Adaptation to climate change	Climate adaptation strategy appraisal	BH BREEAM	Reviewed as part of the pre-assessment workshop.
Wst 06 – Functional adaptability	Functional adaptation strategy	BH BREEAM	Reviewed as part of the pre-assessment workshop.
LE 02 – Ecologist report and recommendations	Site visit/survey and ecology report with recommendations for protection, mitigation and enhancement	BH Ecology	Phase 1 Habitat Survey report undertaken.
Tra 01 Transport assessment and travel Plan	Develop a Transport Plan and Travel Plan	BH Transport	Transport Assessment and Draft Travel Plan produced for planning.

2.3 BREEAM Minimum Standards

In addition to meeting the 70% threshold for BREEAM Excellent, there are a number of minimum requirements that need to be satisfied. The project satisfies all minimum standards for BREEAM Excellent.

Table 1 Minimum standards for BREEAM 'Excellent' ratings

Credit Ref	BREEAM Issue title	Excellent	Typical standard to be achieved
Man 03	Responsible construction practices	1 credit	Score of at least 25 in the CCS scheme
Man 04	Commissioning and handover	Crit 10-11	Commissioning-test schedule and responsibilities and building user guide developed prior to handover
Man 05	Aftercare	1 credit	Commissioning implementation for 12 months
Ene 01	Reduction of CO_2 emissions	4 credits	Equivalent Performance ratio EPR>0.375 or prediction of operational energy
Ene 02	Energy monitoring	1 credit	Sub metering of major energy consuming systems
Wat 01	Water consumption	1 credit	12.5% improvement in water usage over baseline
Wat 02	Water monitoring	Criteria 1	Specification of water meter on mains supply
Mat 03	Responsible sourcing of materials	Criteria 1	All timber is 'legally harvested and traded timber'
Wst 03	Operational waste	1 credit	Dedicated space for recycling & segregating waste

2.4 Conclusion and next steps

This pre-assessment demonstrates the project is on track to achieve BREEAM Excellent, going beyond MCC planning policy which requires a minimum of BREEAM Very Good. Credit requirements will be reflected in the contract requirements for appointing a contractor and developed in detail post planning to enable a submission to the BRE for Design Stage Interim Certification prior to starting on site.

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Appendix A Pre-assessment tracker

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BREEAM UK New Construction 2018

BUROHAPPOLD ENGINEERING

Project name	OVG Manchester
Project Type	Assembly & Leisure (Fully Fitted)
BRE Registration Reference	BREEAM-0080-2298
Assessment stage	Pre-assessment
Date	28/02/2020
Tracker Revision	7 - Planning

BREEAM SCORE SUMMARY		
MINIMUM REQUIRED	55.0%	Very Good
TARGETED - BASELINE	66.4%	Very Good
TARGETED - MEDIUM RISK	74.3%	Excellent
TARGETED - POTENTIAL	86.4%	Outstanding

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
MANAGEMENT								
Man 01 Project Brief and Design	**Credit Aim:** Encouraging an integrated design process and considering BREEAM performance targets early to influence decision-making and c							
Project delivery planning	Stage 2	1	0.52%	1				T&T /Laudation
Stakeholder consultation (interested parties)	Stage 2 Stage 4	1	0.52%	1				Deloittes / Laudation
Prerequisite - BREEAM targets formally agreed	Stage 2	Achieved ?		Yes				CFG/OVG
BREEAM AP (Concept Design)		1	0.52%	1				BH BREEAM
BREEAM AP (Developed Design)		1	0.52%	1				BH BREEAM
Man 02 Life Cycle Cost and Service Life Planning	**Credit Aim:** Promoting the business case for sustainable buildings through the enhanced understanding of capital cost and improving design, costing.							
Elemental LCC	Stage 2	2	1.05%				2	T&T
Component level LCC options appraisal	Stage 4	1	0.52%				1	T&T
Capital cost reporting		1	0.52%	1				T&T
Man 03 Responsible Construction Practices	**Credit Aim:** Encouraging construction sites to be managed in an environmentally and socially considerate and responsible manner and monito reduction.							
Prerequisite - Legally harvested and traded timber		Achieved ?		Yes				Contractor
Environmental management		1	0.52%	1				Contractor
Prerequisite - BREEAM targets formally agreed		Achieved ?		Yes				Contractor
BREEAM AP (site)	Stage 5 Stage 6	1	0.52%	1				Contractor
Responsible construction management		2	1.05%	2				Contractor
Prerequisite - Monitoring of construction site impacts		Achieved ?		Yes				Contractor
Utility consumption (energy and water)		1	0.52%	1				Contractor
Transport of construction materials and waste		1	0.52%	1				Contractor
Exemplary - Responsible construction management		1	1.00%	1				Contractor
Man 04 Commissioning and Handover	**Credit Aim:** Encouraging a well-managed handover and commissioning process, which will ensure building services and fabric defects are iden occupants.							
Commissioning - testing schedule and responsibilities		1	0.52%	1				ME Engineers / Contractor
Commissioning - design and preparation	Stage 3/4	1	0.52%	1				OVG / Specialist Commissioning Manager
Testing and inspecting building fabric		1	0.52%	1				Contractor
Handover		1	0.52%	1				Contractor

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
Man 05 Aftercare	**Credit Aim:** Encouraging aftercare support during the first year of the building operation, to ensure the building operates in accordance with t							
Aftercare Support		1	0.52%	1				Contractor
Commissioning - implementation		1	0.52%	1				Contractor
Post-Occupancy Evaluation (POE)		1	0.52%	1				OVG
HEALTH & WELLBEING								
Hea 01 Visual comfort	**Credit Aim:** Providing occupants with the conditions that facilitate good visual comfort by designing out the potential for glare, achieving goo internal and external lighting systems to provide appropriate illuminance (lux) levels, thereby giving a more comfortable environment for occup							
Control of glare from sunlight		1	0.82%	1				Populous
Daylighting		1	0.82%				1	-
View Out		1	0.82%				1	Populous
Internal and external lighting levels, zoning and control		1	0.82%	1				ME Engineers
Exemplary - Daylighting		1	1.00%				1	-
Exemplary - Internal and external lighting levels, zoning and control		1	1.00%				1	-
Hea 02 Indoor air quality	**Credit Aim:** Facilitating good indoor air quality by considering indoor air pollution early in the design process so that a mitigation strategy can specifying finishes and products that have been tested in accordance with the appropriate standards and specifying an appropriate ventilation							
Prerequisite - Indoor air quality		Achieved ?		Yes				T&T / Indoor Air Quality Consultant
Ventilation		1	0.82%	1				ME Engineers
VOC emissions from construction products		2	1.65%	2				Populous
Post-construction indoor air quality measurement		1	0.82%	1				Contractor
Exemplary - Emissions from construction products		1	1.00%				1	-
Hea 03 Safe Containment in Laboratories	**N/A to BREEAM New Construction 2018**							
Hea 04 Thermal Comfort	**Credit Aim**: Thermal modelling informs the building design to provide a comfortable thermal environment that considers current climatic cond control over their environment through appropriate temperature control strategies and thermal zoning.							
Thermal modelling		1	0.82%	1				ME Engineers
Design for future thermal comfort		1	0.82%	1				ME Engineers
Thermal zoning and controls		1	0.82%	1				ME Engineers
Hea 05 Acoustic performance	**Credit Aim:** Enabling occupants to experience best practice acoustic performance levels appropriate to the functional activities in occupied spa							
Acoustic performance		3	2.47%	3				Vanguardia
Hea 06 Security	**Credit Aim:** Designing the building to consider and take into account security needs to ensure occupants safety and wellbeing.							
Security of site and building	Stage 2	1	0.82%	1				BH Security
Exemplary - Security of site and building		1	1.00%				1	TBC

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
Hea 07 Safe and healthy surroundings	**Credit Aim:** Providing external site areas that are safe for occupant use and enhancing the wellbeing of building users by giving access to an o							
Safe access		1	0.82%	1				Populous
Outside space		1	0.82%	1				Populous
ENERGY								
Ene 01 Reduction of energy and CO_2 emissions	**Credit Aim:** Encouraging the design of energy efficient buildings with energy performance above national building regulations and encouragir							
Energy performance		9	6.00%	3	1		5	ME Engineers
Prediction of operational energy consumption		4	2.67%	4				ME Engineers
Exemplary - Carbon negative		3					3	-
Exemplary - Post occupancy		2	2.00%	2				OVG
Ene 02 Energy monitoring	**Credit Aim:** Helping to identify and reduce high energy demands where possible by accurate measurement of the energy consumption of the							
Sub-metering of end-use categories		1	0.67%	1				ME Engineers
Sub-metering of high energy load and tenancy areas		1	0.67%	1				ME Engineers
Ene 03 External lighting	**Credit Aim:** Reducing the building's energy consumption through the specification of energy efficient external lighting.							
External lighting specification		1	0.67%			1		ME Engineers
Ene 04 Low Carbon Design	**Credit Aim:** Reducing the building's energy consumption through the adoption of passive design solutions, free cooling and low or zero carbc							
Passive design analysis	Stage 2	1	0.67%				1	ME Engineers
Free cooling analysis		1	0.67%				1	ME Engineers
Low and zero carbon technologies	Stage 2	1	0.67%	1				ME Engineers
Ene 05 Energy efficient cold storage		**Credit Aim:** Reducing the building's operational greenhouse gas emissions (CO_2-eq) through the design, installation and comr						
Refrigeration energy consumption		0	0.00%					-
Indirect greenhouse gas emissions		0	0.00%					-
Ene 06 Energy efficient transportation systems	**Credit Aim:** Reducing the building's energy consumption by specifying the optimum number and size of energy efficient transportation systen							
Energy consumption		1	0.67%	1				ME Engineers
Energy efficient features		2	1.33%	2				ME Engineers
Ene 07 Energy efficient laboratory systems	**N/A - No labs**							
Ene 08 Energy efficient equipment	**Credit Aim:** Demonstrating a meaningful reduction in the total unregulated energy demand of the building by using energy efficient equipme							
Energy efficient equipment		2	1.33%		2			CFG/OVG / ME Engineers

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
TRANSPORT								
Tra 01 Transport assessment and travel plan	**Credit Aim:** Recognising developments in proximity to good public transport networks, thereby helping to reduce transport-related pollution a							
Transport Assessment & Travel Plan	Stage 2	2	1.67%	2				BH Transport
Tra 02 Sustainable transport measures	**Credit Aim:** Recognising developments in close proximity of, and accessible to, local amenities which are likely to be frequently required and u							
Prerequisite - Achieve Tra 01		Achieved ?		Yes				BH Transport
Transport options implementation		10	8.33%	10				BH Transport / Populous / CFG/OVG
WATER								
Wat 01 Water Consumption	**Credit Aim:** Reducing the demand for potable water through the provision of efficient sanitary fittings, rainwater collection and water recycling							
Water consumption		5	3.89%	3	2			Populous / ME Engineers
Exemplary - Water consumption		1	1.00%			1		-
Wat 02 Water Monitoring	**Credit Aim:** Specification of water meters to allow for management and monitoring of water use in the building. This encourages reductions in causes.							
Water monitoring		1	0.78%	1				ME Engineers
Wat 03 Water Leak Detection	**Credit Aim:** Reducing the unintended water consumption due to leaks by installing leak detection systems and flow control devices.							
Leak detection system		1	0.78%	1				ME Engineers
Flow control devices		1	0.78%	1				ME Engineers
Wat 04 Water Efficient Equipment	**Credit Aim:** Reducing water consumption for non-domestic scale, non-sanitary water uses by specifying efficient systems and improving the d							
Water efficient equipment		1	0.78%	1				ME Engineers
MATERIALS								
Mat 01 Building Life Cycle Assessment (LCA)	**Credit Aim:** Reducing buildings' environmental life cycle impacts through conducting Life Cycle Assessment and integrating its outcomes in th							
Superstructure	Stage 2	6	6.43%		3		3	-
Substructure and hard landscaping options appraisal	Stage 2	1	1.07%				1	-
Exemplary - Core building services		1	1.00%				1	-
Exemplary - LCA and LCC alignment		1	1.00%				1	-
Exemplary - Third party verification		1	1.00%				1	-
Mat 02 Environment Product Declarations (EPD)	**Credit Aim:** To encourage availability of robust and comparable data on the impacts of construction products by rewarding the specification o							
Specification of products with a recognised environmental product declaration (EPD)		1	1.07%		1			Populous / BH Structures
Mat 03 Responsible sourcing of materials	**Credit Aim:** Recognising and encouraging responsible sourcing of construction products. This includes the source of products and the interme							
Prerequisite - Legally harvested and traded timber		Achieved ?		Yes				Contractor
Enabling sustainable procurement	Stage 2	1	1.07%	1				T&T
Measuring responsible sourcing		3	3.21%	1		1	1	Populous / ME Engineers / Contractor
Exemplary - Measuring responsible sourcing		1	1.07%				1	-

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
Mat 05 Designing for durability and resilience	**Credit Aim:** Increasing the lifespan of the building through designing for durability and protection from degradation and specifying appropria							
Protecting vulnerable parts of the building from damage		1	1.07%	1				Populous
Protecting exposed parts of the building from material degradation								Populous
Mat 06 Material Efficiency	**Credit Aim:** Encouraging the reduction of environmental impacts through optimising the use of materials during all stages of the project.							
Material Efficiency	Stages 1-6	1	1.07%				1	Design Team
WASTE								
Wst 01 Construction waste management	**Credit Aim:** Improving resource efficiency through developing a pre-demolition audit and a Resource Management Plan, maximising the recov landfill.							
Pre-demolition audit	Stage 2	0	0.00%					-
Construction resource efficiency		3	2.00%	2			1	Contractor
Diversion of resources from landfill		1	0.67%	1				Contractor
Exemplary - Construction resource efficiency and diversion from landfill		1	1.00%				1	-
Wst 02 Recycled and sustainably sourced aggregates	**Credit Aim:** Encouraging the use of recycled or secondary aggregate or aggregate types with lower environmental impact to reduce waste and							
Prerequisite - Pre-demolition audit		Achieved ?						-
Project sustainable aggregate points		1	0.67%			1		BH Structures
Exemplary - Project sustainable aggregate points		1	1.00%				1	-
Wst 03 Operational waste	**Credit Aim:** Encouraging the diversion of operational waste form landfill through the provision of space and facilities allowing the segregation							
Operational Waste		1	0.67%	1				Populous / BH Waste
Wst 04 Speculative finishes	**N/A - Commercial offices only**							
Wst 05 Adaptation to climate change	**Credit Aim:** To encourage the specification and fitting of floor and ceiling finishes selected by the building occupant and therefore avoid unne							
Resilience of structure, fabric, building services and renewables installation	Stage 2 Stage 4	1	0.67%	1				Populous / BH Structures / Civils
Exemplary - Responding to climate change		1	1.00%				1	-
Wst 06 Design for disassembly and adaptability	**Credit Aim:** To encourage the specification and fitting of floor and ceiling finishes selected by the building occupant and therefore avoid unne							
Design for disassembly and functional adaptability - recommendations	Stage 2	1	0.67%	1				Populous / BH Structures / ME Engineers
Design for disassembly and functional adaptability - implementation	Stage 4	1	0.67%	1				Populous / BH Structures / ME Engineers

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
LAND USE AND ECOLOGY								
LE 01 Site selection	**Credit Aim:** Recognising the reuse of previously developed and contaminated land where appropriate remediation has taken place.							
Previously occupied land		1	1.00%	1				Populous
Contaminated land		1	1.00%	1				BH Geotech
LE 02 Identifying and understanding the risks and opportunities for the project	**Credit Aim:** Identifying and understanding the ecological risks and opportunities associated with the site to inform the determination of the st							
Prerequisite - Assessment route selection		Achieved ?		Yes				BH Ecologist
Survey and evaluation	Stage 1	1	1.00%	1				BH Ecologist
Determining the ecological outcomes for the site		1	1.00%	1				BH Ecologist
Exemplary - Determining ecological outcomes for the site		1	1.00%			1		BH Ecologist / Project Team
LE 03 Managing negative impacts on ecology	**Credit Aim:** Recognition of steps taken to avoid impacts on existing site ecology as far as possible.							
Prerequisite – Identification and understanding the risks and opportunities for the site		Achieved ?		Yes				BH Ecologist
Planning, liaison, implementation and data	Stage 2	1	1.00%	1				BH Ecologist
Managing negative impacts of the project		2	2.00%				2	BH Ecologist
LE 04 Change and enhancement of ecological value	**Credit Aim:** Recognition of steps taken to enhance site ecology.							
Prerequisite - Identifying and understanding the risks and opportunities for the project		Achieved ?		Yes				BH Ecologist / Contractor
Liaison, implementation and data collation		1	1.00%			1		BH Ecologist / Populous
Enhancement of ecology		3	3.00%				1	BH Ecologist / Populous
Exemplary - Change in ecological value		1	1.00%				1	-
LE 05 Long term ecology management and maintenance	**Credit Aim:** Encouraging the long term maintenance and management of ecology on site to ensure both new and existing ecological features							
Prerequisite - Roles and responsibilities, implementation, statutory obligations		Achieved ?		Yes				BH Ecologist
Planning, liaison, data, monitoring and review management and maintenance		1	1.00%			1		BH Ecologist
Landscape and ecology management plan (or similar) development		1	1.00%			1		BH Ecologist

BREEAM Credits	RIBA Stage	Available Credits	% Score Value	Targeted - Baseline	Targeted - Medium Risk	Targeted - Potential	Not Targeted	Ownership
POLLUTION								
Pol 01 Impact of refrigerants	**Credit Aim:** Rewarding buildings that reduce the impact of refrigerant gas emissions.							
Prerequisite - Ammonia refrigerants		Achieved ?		Yes				**ME Engineers**
Impact of refrigerant		**2**	**1.33%**			1	1	**ME Engineers**
Refrigerant leak detection		**1**	**0.67%**	1				**ME Engineers**
Pol 02 Local air quality	**Credit Aim:** Recognising buildings which limit their impact on local air quality, by consideration of the combustion plant and fuel used on site.							
Local air quality		**2**	**1.33%**	2				**ME Engineers**
Pol 03 Flood and surface water management	**Credit Aim:** Rewarding buildings and their sites that limit on-site and off-site local flooding and hence the damage this can cause.							
Prerequisite - Appropriate consultant		Achieved ?		Yes				**BH Civils**
Flood Resilience		**2**	**1.33%**	2				**BH Civils**
Prerequisite - Surface water run-off		Achieved ?		Yes				**BH Civils**
Surface water run-off - Rate		**1**	**0.67%**	1				**BH Civils**
Surface water run-off - Volume		**1**	**0.67%**			1		**BH Civils**
Minimising watercourse pollution		**1**	**0.67%**			1		**BH Civils**
Pol 04 Reduction of night time light pollution	**Credit Aim:** Avoiding or reducing the impact of night time light pollution, through careful design and specification of light sources.							
Reduction of night time light pollution		**1**	**0.67%**			1		**ME Engineers / Vanguardia**
Pol 05 Reduction of noise pollution	**Credit Aim:** Avoiding or reducing the impact of external noise from the building.							
Reduction of noise pollution		**1**	**0.67%**	1				**BH / Vangardia**
INNOVATION								
Inn 01 Innovation		**Credit Aim:** To support innovation within the construction industry through the recognition of sustainability related benefits w						
Exemplary level of performance in existing BREEAM issues		**10**	**10.00%**	3		4	5	**See relevant issues above**
Approved Innovations								**Client / Assessor**

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APPENDIX E ENERGY STATEMENT

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OVG Manchester

Energy Statement
Revision 5

March 2nd 2020

OVG Manchester
Energy Statement

Issue and Revision Record

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1 EXECUTIVE SUMMARY

M-E Engineers have been engaged to develop an Energy Statement in support of the OVG Manchester arena.

This energy assessment for the proposed development of the new arena is written in response to the national, regional and local planning policies.

This document demonstrates how the building will comply with Part L of the UK Building regulations in line with the proposed Energy Strategy. Included in the measures outlined within this Energy Statement are the additional carbon-saving benefits of incorporating air source heat pumps to provide the heating and cooling for the building, and provision of a photovoltaic cell array to utilise the main roof for on-site generation of renewable energy.

A dynamic energy simulation has been undertaken to establish the energy consumption and carbon emissions of the proposed building. The building was broken down into Thermally Enclosed Spaces, and Non-Thermally Enclosed Spaces. Only the Thermally Enclosed spaces have been assessed in line with standard practice.

Thermally Enclosed Spaces: These are spaces within the building that are inside the thermal line, and which will be conditioned. These spaces will have a regulated energy consumption for Heating, Cooling, Hot Water, Lighting and Auxiliary Energy.

It is understood that the Manchester City Council (MCC) require the development to exceed Part L (2010) by a minimum of 15%. Enhancements made within Part L (2013) mean that, on average, Part L (2013) is circa 9% more stringent that Part L (2010). Therefore, to achieve the 15% beyond Part L (2010) required by MCC, this development must exceed Part L (2013) by a minimum of 6%.

By utilising the approaches and strategies set out in the body of this document, it has been demonstrated that the new development is expected to surpass Part L (2013) by 33.8%, therefore providing a pass beyond Part L (2010) equivalent to 42.8%, 27.8% beyond the MCC target. It should be noted that this is based on the Organic Photovoltaic (OPV) manufacturer achieving their expected 2023 efficiency increases ahead of the OPV installation. The OPV efficiencies currently achieved provide a pass beyond Part L (2013) of 31.1% (40.1% beyond Part L (2010); 25.1% beyond the MCC minimum target).

In addition to the basic MCC planning requirement noted above, MCC have declared a Climate Emergency and issued a framework to work towards achieving zero carbon emissions within the Greater Manchester (GM) area by 2038. The overall project Energy Strategy in general, and this Energy Statement in particular, demonstrate how this project shall provide carbon emission savings in excess of the minimum objectives of the national and local planning requirements. Through these additional measures, it shall be demonstrated how this project provides significant steps towards the future Zero Carbon 2038 target.

1.1 Calculation Methodology

This Energy Statement has been developed utilising the Energy Hierarchy: Reduce Energy Demand, Increase Efficiency and Generate Green Energy.

The inputs, outputs and overall results of these processes is described and discussed in greater detail within the main body of this report.

1.2 Reduce Demand

1.2.1 Passive & Active Energy Solutions

The following summarises the various energy efficiency measures used to reduce the building's inherent energy consumption and associated CO_2 emissions.

- The building envelope U-Values have been, where possible, improved upon the Part L limiting values when an area weighting is considered. The following U-Values are an average, calculated across all the Thermally Enclosed spaces.

Element	Part L2A U-value Limiting Standards (Area Weighted Average)	Average U-values Proposed for Thermally Enclosed Spaces Only
Roof	0.25 W/m²K	0.15 W/m²K
Walls	0.35 W/m²K	0.20 W/m²K
Floor	0.25 W/m²K	0.15 W/m²K
Glazing	2.20 W/m²K	1.60 W/m²K

- Glazing G-Value of 0.5.
- Improved building air tightness of 4.0m³/m²hr is proposed for thermally enclosed spaces.
- Low energy lighting.
- Automated lighting control systems.
- High efficiency boilers.
- Heat recovery on mechanical ventilation systems.
- High efficiency motors with variable speed drives for pumps and fans.
- Power factor correction on incoming electrical supplies.
- Building energy management system with monitoring and energy targeting software.

1.3 Increase Efficiency

Building services plant throughout the design have been selected such that the minimum efficiency demands are exceeded as far as practicably possible.

1.3.1 District Heating

Currently, there is no local district heating system which can be utilised by the proposed development.

1.4 Generate Green Energy

The following table describes the various renewable technologies which have been assessed for inclusion into the development to further reduce CO_2 emissions.

Technology	Comments	Calculated CO_2 Saving ($kgCO_2$/year)
Heat Pumps	Air Source Heat Pumps (ASHPs) were found to be feasible for this building and have been proposed for the provision of space heating and cooling.	- 233.23 Tonnes of CO_2 per Year
Photovoltaic Array	Photovoltaics (PVs) have been found to be technically viable for this project and a design has been generated in co-ordination with a manufacturer of thin-film Organic Photovoltaic (OPV) cells. One highly significant benefit to OPV technology is that, unlike standard PVs, no rare or toxic materials are required for their manufacture and they are recyclable at the end of their life. This means that OPV technology has a considerably lower environmental impact over the entirety of its life than standard PV technology. The OPV array proposed for the project is expected to generate 687kW_{peak} of electrical energy based on technological improvements the manufacturer expects to have achieved prior to installation at OVG Manchester. Based on contemporary technology, 522kW_{peak} electrical energy would be generated by this same array. This electrical energy would be utilised to offset a portion of the day-to-day electrical base load meaning that the building will require less electrical energy from the National Grid.	- 265.03 Tonnes of CO_2 per Year
Biomass Heating	Due to logistical difficulties arising from the layout of the site, biomass has not been considered to be viable.	-
Solar Hot Water	Solar hot water has been found to be feasible for this project, however it would compete for roof space with the PV installation reducing the carbon savings provided by the PV system. Therefore solar hot water has not been considered within this Energy Statement. Given the location of the Hot Water plant at Level 04, Solar Hot Water could potentially be integrated into the PV array and easily connected into the building hot water system should technologies become available that mean this provides greater carbon savings than PV systems alone.	-

Wind	As well as the difficulty in preventing an impact to the view of the site from the wider area, wind turbines have been discounted on the basis of the impact to wildlife and interference with telecommunications on site.	-
Hydrogen Fuel Cell	Not Considered to be currently commercially Viable.	-

1.5 Summary of Carbon Emissions

	Carbon Dioxide Emissions (Tonnes of CO_2 per annum)		
	Regulated	**Unregulated**	**% Improvement**
Baseline: Part L (2013) of the Building Regulations Compliant Development	1,738.61	912.52	0.0%
Reduction after energy demand reduction	1,648.50	912.52	5.2%
Reduction after Air Source Heat Pumps	1,415.27	912.52	18.6%
Reduction after OPV Array (Expected 2023 Efficiencies)	1,150.24	912.52	33.8%

At the time of writing of this report, the calculated reductions are expected to achieve 33.8% improvements over the Part L (2013) baseline by utilising ASHPs and an OPV array. The OPV array assumes the manufacturer's expected OPV technological improvements are achieved prior to installation.

Stated regulated and unregulated carbon emissions are based on the Part L (2013) National Calculation Methodology standards. This equates to approximately 40.1% better than Part L (2010), 25.1% better than the MCC minimum planning requirement.

As noted in section 1.4, the OPV manufacturer expects technological advancements to provide increased OPV efficiencies to have been achieved prior to installation which would allow for Part L (2013) to be surpassed by 33.8%. This equates to a pass beyond Part L (2010) of 42.8%, 27.8% beyond the minimum MCC requirements. Based on the manufacturer's current, marginally lower, efficiencies the OPV array would provide a pass beyond Part L (2013) of 31.1%. This equates to a pass beyond Part L (2010) of 40.1%, 25.1% beyond the minimum MCC requirements.

As discussed, an OPV array has been included within the design of OVG Manchester. Based on a standard mono / polycrystalline PV solution it has been estimated that carbon emission savings of up to 46.2% beyond Part L (2013) may be achieved. Whilst this would provide an increased level of savings in terms of carbon emissions from the building, the decision to utilise an OPV solution has been made based on the following key points:

- The manufacturing and disposal processes of standard PVs lead to the production of chemicals such as Silicon Tetrachloride, Hydrochloric Acid and Cadmium Telluride amongst others. Each of these substances are highly toxic and damaging to both health and the environment. The proposed OPV solution does not include any toxic or rare materials, and can be recycled by a "clean-burning" incinerator, leaving behind only the precious metals which can be recycled and processed into new OPV modules.

- The embodied carbon from the manufacturing of standard PVs, including the mining of rare materials, are deemed to pose a significant environmental impact. Whilst OPVs also have a level of embodied carbon (as is true for everything), the fact that no rare materials are required to be mined indicates that the embodied carbon of an OPV module would be lower than that of a standard PV module.
- Standard PV modules are heavier than the thin-film OPV modules proposed within this design. This coupled with the requirement to include ballast to hold standard PVs in place on the roof means that a standard PV solution would increase the roof loading circa 55-fold. This would in turn require additional structural support and increase the roof build up to enable a standard PV system to be installed, all of which would further increase the project embodied carbon resulting from a standard PV array.

2 INTRODUCTION

2.1 General Information

This Energy Statement is intended to outline the process employed to develop the Energy Strategy for the proposed new arena, and the status of the overall performance as it currently stands.

The outcomes of the calculations of the Energy Strategy are presented within this document. These should serve to provide key information to support the planning application for the new development and demonstrate not only compliance, but exceedance, of the MCC targets.

2.2 Development Description

This Energy Statement is intended to support the full planning permission for a new multi-use indoor arena, together with supporting retail, leisure facilities, back-of-house and support functions, public realm, cycle parking, access and associated works (the 'Proposed Development').

3 POLICY CONTEXT

3.1 National Planning Policy Framework

The Energy Statement has been structured with the relevant policies of the National Planning Policy Framework (NPPF) in mind. This policy outlines how developments should be planned to reduce carbon emissions and protect the environment.

3.2 Manchester City Council – Core Strategy Development Plan

Adopted on the 11th July 2012, the Core Strategy Development Plan includes the following relevant policies:

Policy EN 4 – Reducing CO_2 Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO_2 emissions, and rising fossil fuel prices, through the following actions:

- All developments must follow the principle of the Energy Hierarchy, being designed:
    - to reduce the need for energy through design features that provide passive heating, natural lighting and cooling
    - to reduce the need for energy through energy efficient features such as improved insulation and glazing
    - to meet residual energy requirements through the use of low or zero carbon energy generating technologies
- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings. Where appropriate new development and retrofit projects will be required to connect to and / or make contributions to low or zero carbon energy schemes and / or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.
- The use of building materials with low embodied carbon in new development and refurbishment schemes.

Policy EN 5 – Strategic Areas for Low and Zero Carbon Decentralised Energy Infrastructure.

Within Manchester it is considered that the following strategic areas will have a major role to play in achieving an increase in the level of decentralised, low and zero carbon energy supplies available:

- The Regional Centre, which also includes the Oxford Road Corridor and Eastlands
- District Centres and associated major development sites
- Airport Strategic Site
- Strategic housing location
- Strategic employment locations

Within these areas of new development, regeneration and retrofit projects will be expected to take place in the context of more detailed proposals for decentralised low and zero carbon energy infrastructure in the form of energy proposal plans. The Council will work with all relevant stakeholders, which may include developers, landowners, residents, community groups, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward such plans.

Where investment or development is being undertaken into or adjacent to a public building / asset or district heating network, full consideration shall be given to the potential role that these can have in providing an anchor load within a decentralised energy network or in creating opportunities for CO_2 reduction funded by contributions.

Policy EN 6 – Target Framework for CO_2 Reductions from Low or Zero Carbon Energy Supplies

Applications for residential developments of 10 or more units and all other developments over 1,000m^2 will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2 (of the Core Strategy Development Plan), unless this can be shown not to be viable. This should be demonstrated through an Energy Statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO_2 emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an Energy Statement.

The target framework relates to three broad development locations and their potential for low and zero carbon decentralised energy. The areas are defined as follows:

- Target 1 - Network Development Areas: Locations where the proximity of new and existing buildings together with the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 - Electricity Intense Areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes.
- Target 3 - Micro-generation Areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

Non-domestic CO_2 emissions reduction targets:

Target	% Minimum Requirement
Target 1: Network Development area	15% Increase on Part L (2010)
Target 2: Electricity Intense Buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45kg CO_2/m^2)	+10% increase on part L (2010)
Target 3: Micro-generation Area	+15% increase on part L (2010)

MCC Core Strategy Development Plan Document, 11/07/12 - Table 12.2 – Non-domestic CO_2 emissions reduction targets

Where the CO_2 emissions reduction required under any future revision to Part L of the building regulations becomes greater than the '% Minimum requirement', the reduction required under building regulations would apply.

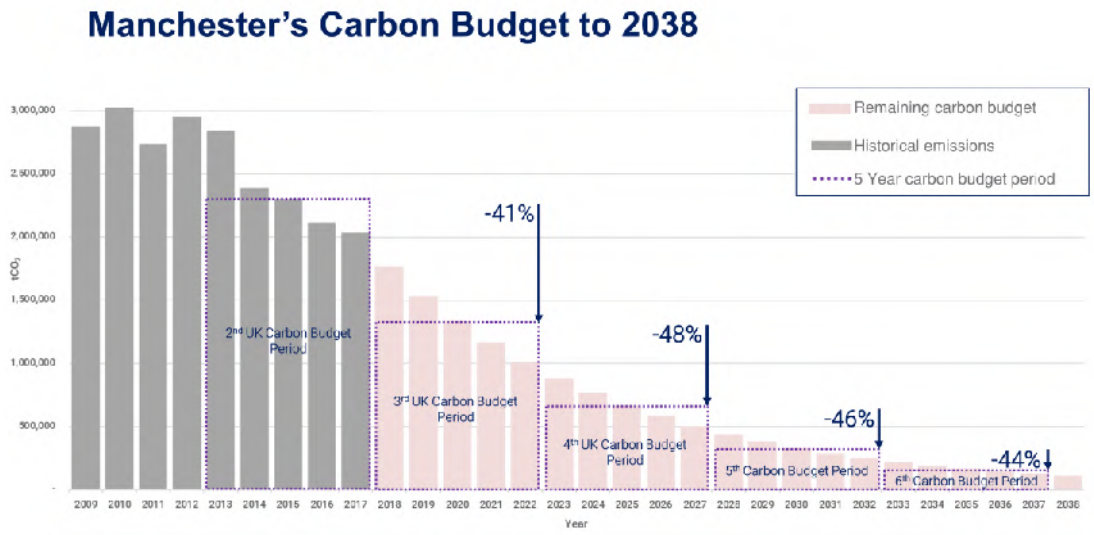
Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the '% Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.

The Energy Statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO_2 mitigation, subject to the Energy Statement incorporating evidence such as modelling to demonstrate compliance.

3.3 Manchester Zero Carbon Framework 2020-2038

The MCC is dedicated to reducing the carbon emissions generated within the GM area and they have generated a framework document to set out key milestones to achieve “zero carbon” by 2038.

Although this framework does not provide specific guidance or targets to achieve in order to meet the 2038 objective, it does provide an overview of the intended carbon reductions throughout the GM area during each of the Carbon Budget periods (as defined by the UK Climate Change Act, 2008), indicated within the following graphic:



Total budget (2018-2100) tCO_2	Immediate term (2018-2022) tCO_2	Medium term (2023-2027) tCO_2	Long term (2028-2037) tCO_2
15,187,610	6,928,620	3,593,560	3,046,920

*Budget periods align with the nationally legislated Carbon Budget periods under the UK Climate Change Act (2008). The 5 yearly Paris aligned Carbon Budgets require a significantly more ambitious level of reduction relative to the legislated Committee on Climate Change budget reductions. The Committee on Climate Change are currently considering revising their approach to budgets and whether to adopt a (net) zero carbon approach. Reduction % estimates represent the average (mean) emissions of each 5 year Carbon Budget period compared against previous 5 year Carbon Budget period average.

Source: Manchester’s Carbon Budget to 2038, Draft Manchester Zero Carbon Framework 2020-2038

The carbon budgets, projected totals and associated required savings relate to total carbon emissions from a combination of sources, e.g. heat generation, power generation, road traffic, public transport etc. Consequently there are a number of contributors across numerous sectors that must work together in order to achieve the carbon reductions detailed above. This project has placed a high priority on achieving significant carbon savings, as detailed by the following sections of this report.

The summary contained within Section 10 of this Energy Statement provides an overview of the current projected carbon emissions from this project against each of the Carbon Budgets.

3.4 Applicable Targets to OVG Manchester

Based on the relevant policy surrounding carbon emissions reduction, it is believed that OVG Manchester should be considered to be required to, as a minimum, meet the targets under Target 1: Network Development Area. As there are no local district heating networks currently in operation or in development in the immediate area of the site, the minimum saving beyond Part L (2010) is 15%.

As previously discussed and agreed with the local Building Control Officer, the latest version of Part L (being 2013 with amendments from 2016) states the below:

> - The notional building used to determine carbon dioxide targets is the same size and shape as the actual building, constructed to a concurrent specification. The Part L 2013 specifications have been strengthened to deliver 9 per cent carbon dioxide savings across the new non-domestic building mix relative to Part L 2010.

This statement means that a Building Emission Rate (BER) of 6% beyond Part L (2013) is the equivalent of a BER of 15% (6% + 9%) beyond Part L (2010).

It is therefore intended that as a basic target, OVG Manchester shall surpass Part L (2013) by a minimum of 6%.

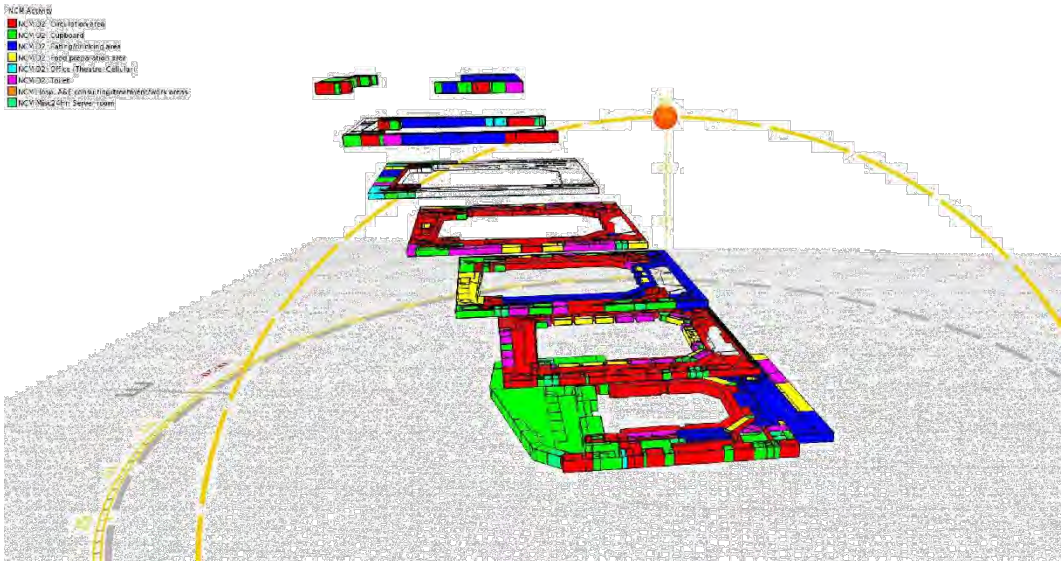
4 DYNAMIC ENERGY MODELLING

4.1 Model

OVG Manchester has been modelled to establish baseline regulated emissions using the IES VE software suite.

Thermally Enclosed Spaces are spaces within the building that are inside the thermal line, and which will be conditioned. These spaces will have an associated regulated energy consumption in regards to:

- Heating
- Cooling
- Auxiliary Power
- Lighting
- Hot Water



All the areas have been assessed as per their proposed treatment, and where spaces will be treated by a fixed building service as defined within Part L of the UK Building Regulations, these spaces were included as thermally enclosed.

4.2 Model Pre-Simulation Methodology

Once the spaces were defined within the building, the U-Values were applied to the various construction elements as per the target thermal performances of the building fabric.

The building was geo-located on the site, in order to run a Sun Cast solar shading calculation for incorporation into the simulation.

4.3 National Calculation Methodology

National Calculation Methodology (NCM) profiles have been applied to the appropriate zones of the model as required.

5 MINIMISE ENERGY DEMAND

As part of the energy hierarchy, the first part of the Energy Strategy focuses on potential options of minimising the energy demand of the building.

5.1 General

A significant focus of OVG Manchester is to provide a world-class music venue which maximises the user experience and minimises the impact on the environment. To this end, the design process has focused on specifying and providing good, sustainable building services solutions which provide reduced energy demands and comfortable conditions for the staff and occupants.

The building will be initially designed to achieve the following 'good practice' objectives.

- The adoption of passive measures, such as external shading have been incorporated in the shape and form of the building, wherever possible to limit the base CO_2 emissions in line with the demand reduction principle.
- It is proposed to install mechanical and electrical engineering systems that will assist in achieving the lowest possible annual energy input thereby reducing the level of CO_2 emissions.

5.2 Good Practice Measures

The key focus of the detailed design will be to minimise energy usage first, and then to find the most efficient and economical systems to serve the required purpose. Spaces shall be evaluated to anticipate seasonal internal temperatures based on the load profile of the spaces prior to making decisions on level of conditioning.

5.3 Sustainable Objectives

5.3.1 General

During the detailed design development, close attention will be paid to coordinating and integrating the structure and the occupied areas to:

a) Minimise direct solar gain.

b) Optimising daylight factors where possible and appropriate. Daylighting calculations have been undertaken with high levels of daylighting. Further assessments on measures that can be taken to control natural light levels will look to develop a solution where daylight autonomy is maximised.

c) Optimise utilisation of plant and systems. The Energy Strategy has been developed taking into account a reasonable diversity for plant and systems that are expected, meaning that the amount of plant that will be needed can be reduced.

d) Optimise control and flexibility of the installations. Through the proposed de-centralised ventilation plant, an increased level of control and flexibility in spaces will be achievable, in conjunction with an integral BMS, weather compensator, time switches and energy management system.

e) Incorporate appropriate energy recovery systems. Heat Recovery is a core part of the Energy Strategy within the building. All occupied spaces that are heated and cooled will incorporate energy recovery to minimise the energy consumption.

In addition, the environmental services proposals will be designed using the latest techniques for 'active and passive' energy recovery and conservation, to enable the most advantageous, cost effective 'energy targets' possible to be achieved.

The following sections describe the good practice elements to be reviewed and incorporated where suitable with the renewable elements identified and covered in detail in a later section of this report.

5.3.2 Passive Energy Solutions

Among the passive design aspects of OVG Manchester, the thermal performance will be improved beyond the limitation of the building regulations, to minimise heat losses in winter and heat gains in summer.

The table below indicates the U-Values that are being proposed for OVG Manchester.

Element	Part L2A U-Value Limiting Standards (Area Weighted Average)	Average U-Values Proposed for Thermally Enclosed Spaces Only
Roof	0.25W/m^{2}K	0.15W/m^{2}K
Walls	0.35W/m^{2}K	0.20 W/m^{2}K
Floor	0.25W/m^{2}K	0.15 W/m^{2}K
Glazing	2.2W/m^{2}K	1.6 W/m^{2}K

The limit for the design air permeability is 10m^3/m^{2}hr at 50 Pa in accordance with current Building Regulations, however, for this development, improved air tightness is to be achieved for the new construction elements as follows for the thermally enclosed spaces.

4.0m^3/m^{2}hr at 50Pa for the Thermally Enclosed Spaces

5.3.3 Zoning

It is anticipated that the engineering services installation will be suitably zoned, both at a macro level for the whole site and micro level for the individual areas.

Heating, ventilation, water services and electrical zoning shall be configured to promote the maximum flexibility in order to enable remodelling and re-planning to be undertaken at a future date.

To control and monitor energy consumption it is envisaged that provision for sub-metering of all major services to each zone will be required and that this shall be interfaced with the Building Management Systems.

5.3.4 Variable Speed Drives

The use of frequency inverter variable speed drives is proposed for all major pump sets and ventilation fans. For primary heating distribution systems the variable speed circulation pumps are to be used in association with two-port control valves.

The use of variable speed drives will also remove the use of belt drive pumps.

5.3.5 Plant Sizing

All the central plant including air handling units and boilers will be selected so that they correctly reflect the required loadings for the building. Over sizing of fans will be avoided, unless they are provided with inverter drives for variable duty operation or to assist in the testing and commissioning process of the plant and system.

5.3.6 Heating Systems

The current heating strategy for the building is for the heating provision to be delivered via air source heat pumps. This strategy allows for a decentralised approach, where zones of the building can operate independently of one another, without the need for a central heating plant to be activated.

This approach also reduces the need for large hot water distribution, saving on energy associated with heating system auxiliary equipment.

Utilising air source heat pumps for the heating provision is part of the building's use of low and zero carbon technologies, and for the purposes of demonstrating the improvement over conventional boiler plant, the initial assessment for this part of the Energy Strategy has looked at utilising a conventional centralised boiler approach. This is discussed further within the following sections of this report.

5.3.7 Solar Control

Though there are low levels of glazing that have been incorporated into the design as part of the architectural language of the building, for areas that contain glazing, in order to manage the potential of excessive solar gains within conditioned spaces, glazing with a solar heat gain coefficient (G-Value) of 0.5 will be used.

Additionally, and as part of the wider visual comfort strategy, internal shading devices will be employed to further reduce the levels of direct solar gains into the conditioned spaces where it is appropriate and practical to do so. This will have a positive impact both on the occupant comfort conditions, and in saving energy.

The arena design proposes a perforated façade on the outside of the building which provides shading to the building structure. This will reduce the amount of solar gain through conduction and assist in the reduction of heat gain due to direct solar radiation that is conducted through the building envelope and structure.

5.3.8 Lighting Installation

The lighting installation throughout OVG Manchester shall maximise the use of low energy lamps and high efficiency electronic ballast technology wherever possible, and linked to daylight and PIR sensors for dimming and switching.

In addition long life lamps will be incorporated into all aspects of the installation, utilising LED technology whenever the task permits.

The complete lighting installation shall be controlled via separate automatic PLC based control systems. The system generally operates on a pre-set time based programme to minimise the operating hours of all luminaires. The systems provide fully interactive control terminals, which enable the operator to override or amend the programme should the required operational needs of the separate areas change.

5.3.9 Ventilation Systems

The Hall ventilation will be provided via a series of AHUs, equipped with heating and cooling coils as per the descriptions in the relevant sections of this report. The AHUs will also include provision of heat recovery through the use of run-around coils, as well as the appropriate filtration for the outside air supply into the Hall.

The ventilation to ancillary areas around the Hall will be provided via a series of AHUs and MVHRs, equipped with heat recovery through the use of plate heat exchangers, as well as the appropriate filtration for the outside air supply.

5.3.10 Building Management

OVG Manchester shall be provided with a Building energy Management System (BMS) to fully control, monitor and record the various Mechanical, Electrical and Public Health systems.

The BMS includes stand-alone intelligent outstations and / or local controllers, linked via the main LAN to an operator terminal. The BMS shall not only control the Mechanical, Electrical and Public Health systems but also fully monitor the energy usage by the installation of local energy monitors. This shall be linked to software so that the building manager can record energy usage and identify where improvement to energy consumption can be made.

6 ANNUAL ENERGY CONSUMPTION AND CO_2 EMISSIONS

This section describes the computational modelling process used to establish the baseline CO_2 emissions from which any improvements are measured and then to calculate the resulting CO_2 emissions once the 'Be Lean' enhancements are implemented.

6.1 Design Standards used in the Energy Model

The table below sets out the design criteria used for the Buildings Energy Model to establish the 'baseline' emissions.

System Description	Proposed
Boiler Seasonal Efficiency (Baseline option)	0.95
Heating VRF COP (LZC option)	3.5
Cooling VRF COP	4.0
Cooling Plant System Seasonal Energy Efficiency Ratio (SSEER)	3.5
Ventilation Plant (Specific Fan Power)	1.7
Heat Recovery Efficiency	70%
Building Air Permeability @ 50 Pa	4.0

6.2 Cooling System Description

The cooling strategy for the building has been combined with the heating system strategy, through the use of heat pumps (VRF / V) systems. This decentralised approach will allow the cooling systems to more accurately match the cooling demand profile of the building, and meet more closely the diversity through the building zones, and reduce the amount of energy required for comfort cooling when compared against a standard centralised cooling system.

6.3 Fuel Loads and CO_2 Emissions

Conversion factors for calculating carbon dioxide emissions are shown in the table below, these are the factors used in calculating compliance with Part L of the UK Building Regulations (2013).

	CO_2 Emissions (kg/kWh)
Natural Gas	0.216
Grid Supplied Electricity	0.519

6.4 Calculated Energy Emissions:

Treated Floor Area (m^2)	Carbon Emissions ($kgCO_2/m^2.year$)				Reduction
	TER	TER Annual CO_2 Emissions (tonnes)	BER	BER Annual CO_2 Emissions (Tonnes)	
53,006.4	32.8	1,738.6	31.1	1,648.5	**5.2%**

The table above indicates that by adhering to the first step in the energy hierarchy and reducing the energy demand within the building by improving specification of the building fabric, improving the building air permeability and utilising building services with performance criteria better than the limiting values, the design surpasses Part L (2013) by 5.2%. This provides a pass equivalent to 14.2% beyond Part L (2010). This step alone does not succeed in achieving the MCC minimum planning requirement of exceeding Part L (2010) by 15%.

7 FEASIBILITY ASSESSMENT DISTRICT HEATING

7.1 District Heating

There are currently three operational District Heating Networks in the Regional Centre. These are the Manchester Oxford Road Corridor, Manchester Civic Quarter, and Media City District Heating Networks.

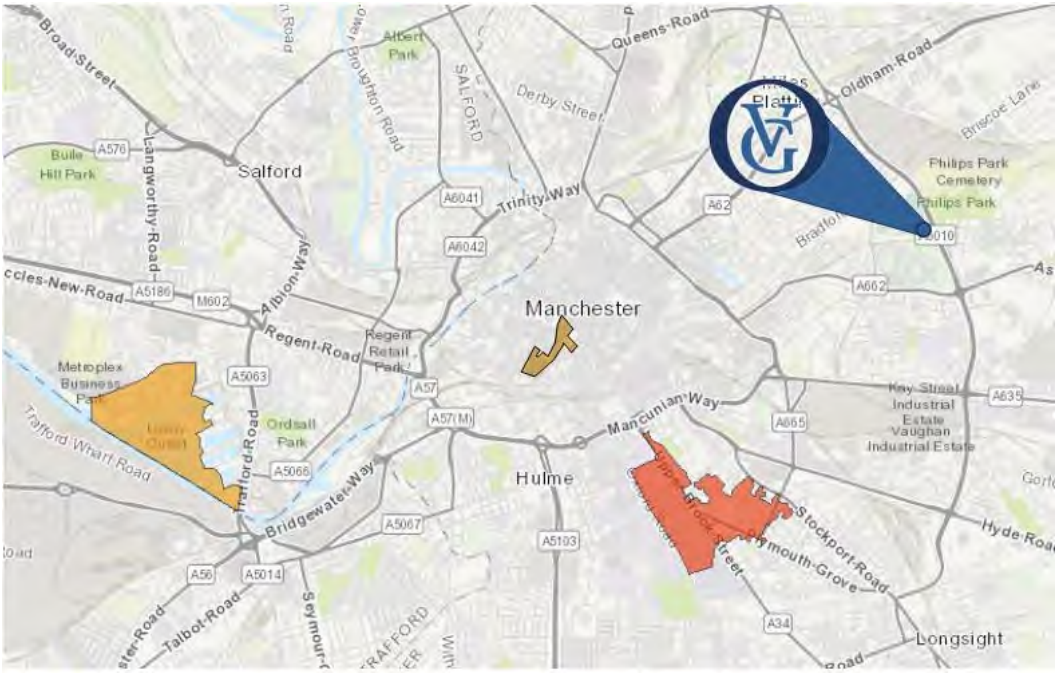


Figure 1 – UK District Heating Development Map developed by the Department for Business, Energy & Industrial Strategy identifies two District Heating Systems operating in Media City and Oxford Road Corridor. (Source https://chptools.decc.gov.uk/developmentmap)

The OVG Manchester development is situated outside of these District Heating Networks, and is also sited beyond any planned extension that are underway. As such, a district heating network connection is not currently being provided for the OVG Manchester development located at the Etihad Campus.

In the event that a heating network becomes available in the future, space and MEP provisions have been allowed for within the ground floor gas meter room to accommodate a district heating substation. The district heating allowed for complies with Tables 1.1 & 1.2 within Appendix A of the *District Heating Manual for London issued by the Mayor of London* which is considered to be a reasonable guide for the substation requirements.

As the district heating would replace the requirement for gas fired boilers and provide an alternate heat source for the domestic hot water generation and space heating, it is anticipated that the gas meter and booster set currently designed to serve the building could either be reduced to provide gas only for catering, or removed entirely allowing the catering operations to utilise electrical means rather than gas. Dependent upon the decarbonisation of the electrical grid, this may present an opportunity to further reduce the carbon emissions of the building.

7.2 Proposed Future District Heating Plant

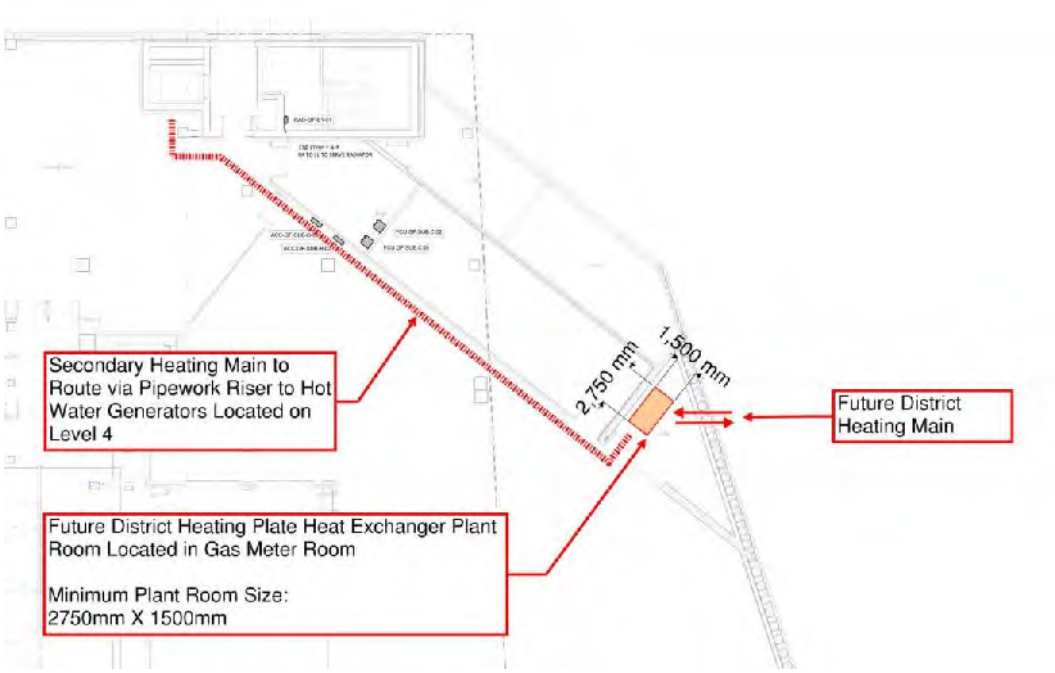


Figure 2 – Future Plant Space for District Heating connection in compliance with the District Heating Manual for London

Item:	Heat Exchange Substation Details:
Output (kW)	1,000
Number of heat exchangers	2
Length (mm)	2,750
Width (mm)	1,500
Height (mm)	2,500
Approximate dry weight (kg)	1,725

Item:	Specification Requirements:
Room Illumination	Minimum light level: 150 lux
Electrical Connection	III 380V to earth / 32 A
Water Supply	DN 25
Water Discharge	Provide wastewater discharge line in the plant room and sump to collect condensation from heat exchangers.
Concrete Bases	Provide concrete bases for heat exchangers and pumps (if present)
Ventilation	Mechanical and continuous, with a minimum of three air changes per hour

8 ASSESSMENT OF SUITABLE RENEWABLE ENERGY TECHNOLOGIES – FEASIBLE TECHNOLOGIES

This section analyses potential onsite renewable energy generation and considers their technical feasibility.

8.1 Renewable Energy Systems

The following technologies are considered as possible renewable energy sources:

- Ground / Air Source Heat Pump
- Photovoltaic Panels
- Solar Thermal, Hot water Generation
- Biomass Boilers
- Wind
- Hydrogen Fuel Cell

8.2 Heat Pumps

An Air Source Heat Pump (ASHP), or Ground Source Heat Pump (GSHP) is a system which transfers heat from outside to inside a building, or vice versa. Under the principles of vapour compression refrigeration, an ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another. They can be used as a space heater or cooler and are sometimes called "reverse-cycle air conditioners".

The main components of a heat pump

- A heat exchanger coil, which extracts heat from ambient air or the ground
- An indoor heat exchanger coil, which transfers the heat into hot air ducts, an indoor heating system such as water-filled radiators or underfloor circuits and / or a domestic hot water tank.

A Heat Pump for generating a low carbon source of heat for the space heating of the building is thought to be feasible, and was therefore considered in certain circumstances.

An initial assessment undertaken at RIBA Stage 2 for this project indicated that the use of heat pumps (In the form of Variable Refrigerant Volume / Flow, or Variable Refrigerant Temperature systems) were viable, and offered both the opportunity for higher heating efficiencies, as well as the ability to decentralise a significant portion of the heating requirement for the building, and thus provide additional energy savings from an increased ability to more closely track the diversity throughout the building in its operation.

Due to the nature of the building design, appropriate space was able to be allocated for all relevant equipment, where considerations surrounding adequate ventilation, visual concerns and acoustic requirements were addressed.

Heating Provision by:	Efficiency:	Kg CO_2 / kWh heat:
Conventional Boilers:	Up to 95% Efficient.	**0.22 kg CO_2**
Heat Pumps (Air Source)	COP of 3.5, equivalent to 350%	**0.15 kg CO_2**

The table above shows how the proposed heat pumps for the building can reduce the amount of associated carbon emissions for the same amount of heat when compared to the gas boiler utilised in the baseline calculations.

The building was then modelled using the heat pumps with the following saving over the baseline calculation and resulting in further savings over the initial reductions achieved through implementation of energy efficiency measures.

Treated Floor Area (m^2)	Carbon Emissions ($kgCO_2/m^2$.year)				Total Reduction
	TER	TER Annual CO_2 Emissions (tonnes)	BER	BER Annual CO_2 Emissions (Tonnes)	
53,006.4	32.8	1,738.6	31.1	1,648.5	**5.2%**
Utilise Heat Pumps for Space Heating:				-233.2	-
53,006.4	32.8	1,738.6	26.7	1,415.3	**18.6%**

Implementation of heat pumps over conventional boilers for OVG Manchester therefore represent a further saving of 233,200$kgCO_2$/year, and should achieve an 18.6% saving over part L (2013) Target Emissions Rate.

It should be noted that when compared to Part L (2010), this equates to a pass of approximately 27.6% beyond Part L (2010).

8.3 Photovoltaic Panels

Organic Photovoltaic (OPV) Panels have been investigated in detail during the design of this building and the intention is that these shall be installed and operational in time for the building opening. A solution has been designed which utilises a series of flat panel OPV modules. OPV modules are a lightweight PV solution which do not require any toxic or rare materials during production and are therefore recyclable, have a lower environmental impact and reduced embodied carbon in comparison to standard PV systems.

A design has been generated in conjunction with an OPV manufacturer which enables a 6,247m^2_{active} OPV array to be installed on the main roof of the building. This array, based on expected efficiency figures by 2023, is projected to generate a peak load of 687kW of electrical energy which can be utilised by the day-to-day running of the building. By renewably generating this electricity on-site, the demand from the National Grid is reduced, thereby removing the potential need to burn fossil fuels, in turn reducing the carbon footprint of the building.

Treated Floor Area (m^2)	Carbon Emissions ($kgCO_2/m^2$.year)				Total Reduction
	TER	TER Annual CO_2 Emissions (tonnes)	BER	BER Annual CO_2 Emissions (Tonnes)	
53,006.4	32.8	1,738.61	31.1	1,648.50	**5.2%**
Utilise Heat Pumps for Space Heating:				-233.23	-
53,006.4	32.8	1,738.61	26.7	1,415.27	**18.6%**
Utilise 2023 OPVs to partially offset baseload:				-265.03	-
53,006.4	32.8	1,738.61	21.7	1,150.24	**33.8%**

The table above indicates that that a further 265,030kgCO_2/year may be saved by inclusion of an OPV array offsetting electrical demand from the National Grid. This would result in a saving beyond the requirements of Part L (2013) of 33.8%. This has been calculated based on the enhanced efficiencies the manufacturer expects to have achieved by 2023.

It should be noted that this provides a saving of 42.8% beyond Part L (2010), thereby surpassing the MCC planning requirement of 15% beyond Part L (2010) by 27.8%.

As noted, the carbon savings above are based on expected technological improvements providing increased efficiency figures, provided by the OPV manufacturer. These increased efficiencies are projected to be indicative of the OPV modules installed as part of this project.

The current efficiencies experienced by the OPV modules are slightly lower than the expected 2023 figures. Therefore, based on the current efficiency rates, carbon emission savings would slightly lower for an equivalent OPV array installed in the immediate future, using the current efficiencies.

The following table provides the indicative reductions for an OPV array utilising the 2020 efficiency rates:

Treated Floor Area (m^2)	Carbon Emissions ($kgCO_2/m^2$.year)				Total Reduction
	TER	TER Annual CO_2 Emissions (tonnes)	BER	BER Annual CO_2 Emissions (Tonnes)	
53,006.4	32.8	1,738.61	31.1	1,648.50	**5.2%**
Utilise Heat Pumps for Space Heating:				-233.23	-
53,006.4	32.8	1,738.61	26.7	1,415.27	**18.6%**
Utilise 2020 OPVs to partially offset baseload:				-217.33	-
53,006.4	32.8	1,738.61	22.6	1,197.94	**31.1%**

Based on the 2020 efficiencies, this OPV array could save a further 217,330kgCO_2/year over the savings provided by ASHPs. This would provide indicative carbon savings of 31.1% beyond Part L (2013), 40.1% beyond Part L (2010), and equating to 25.1% beyond the minimum MCC planning requirements.

As discussed within Section 1.5 of this report, a standard PV array has been calculated to provide potential savings of 46.2% beyond Part L (2013). However, due to the toxic materials and carbon emissions generated throughout the manufacturing and disposal processes of standard PVs, this approach has been deemed to have a greater negative impact overall than the OPV solution incorporated into the design.

9 OTHER LOW AND ZERO CARBON TECHNOLOGIES NOT CURRENTLY FEASIBLE

Other technologies that were assessed during the feasibility study and found not to be feasible are noted in this section of the Energy Statement.

9.1 Solar Thermal, Hot Water Generation

The use of solar heating for hot water generation would require the installation of solar panels at roof level. Ideally the panels should be aligned in a southerly direction with a tilt of between 30° and 40°.

Solar thermal panels will also require to be mounted in areas that are unshaded. The potential, therefore, of incorporating solar thermal is limited as it would compete for roof space with the OPV system being proposed.

There is also limited benefit in using solar heating for this building, as the hot water requirement for a venue of this sort does not have a consistent base load high enough to warrant a solar thermal system to be installed.

9.2 Biomass Boilers

Biomass technology could be installed as part of the central heating provision. The most economical option and the best for reducing CO_2 emission levels would normally be to install Biomass Boilers to act as the lead boiler to cater for the base hot water heating load with the remaining gas fuelled boilers sized to meet the total heating load and to form a standby facility.

The Bio-energy boiler system will require the installation of additional components for the storage of the wood chips or pellets used as fuel, along with the necessary transportation components to link between the storage hoppers and the boiler.

Wood chips or pellets would need to be stored in external or internal hoppers. The amount of wood chips or pellets stored will affect the choice of the silo or bunker storage types. Storage systems require sufficient space for large delivery vehicles to ‘shoot’ the wood fuel directly into the storage facility.

The wood chips or pellets are transferred from the storage facility by screw or similar transportation system linking between the wood hoppers and the boiler house.

The waste combustion products from the boilers (in the form of ash) can either be removed manually or automatically by the use of screw feed units direct to a collection skip. This plant ash is an inert ash and can be used as fertiliser assuming that the wood is obtained from clean sources (i.e. non industrial and not contaminated with plastics). The use of automatic removal of the plant ash will reduce maintenance costs but increase the initial capital installation costs.

Wood burning boilers have comparable combustion efficiencies as basic gas fired systems. The fluing requirements for modern wood fired boilers are comparable with those of gas fired systems and the emissions are similar to that of gas fired units. Where the heat output to water is above 300kW (400kW input) there is a requirement under the clean air regulations when using waste wood to install continuous flue monitoring of the waste gas products. These systems are relatively expensive to install and maintain.

Biomass Boilers can also operate on a modulating basis to vary the heat output. Boilers can operate at as low as 30% of their maximum load, however require additional plant room area than the standard models.

The installation of a Biomass Boiler with pellet storage as the main heating boiler is not considered a viable option for OVG Manchester. Biomass boilers require large areas of floor space for fuel storage and transmission, which need to be maintained in a dry storage area. With space being at a high premium in the proposed building, it is not anticipated that biomass fuel storage will be a provision that is easy to make.

Biomass is therefore discounted as a feasible and viable option for the arena.

9.3 Wind Power

To evaluate the suitability for wind power generation it is necessary to undertake a full survey and analysis of the site to ascertain the likely wind speeds available to support the viability of wind generation.

The British Wind Energy Association (BWEA) wind database suggests that wind speed at the site would be around 4-6m/s at 25m. This could support a small wind turbine, however, annual load generation will be relatively low.

Installation of wind turbines would have a negative effect on the architectural character of the building. This issue aside, wind turbines can have a detrimental effect on telecommunications in the vicinity of their location. Given the extent of telecommunication that would be installed within the building (Wi-Fi, Mobile phone operators, TV broadcasting, etc.), the size of possible turbines would be limited.

Another limiting factor in the installation of wind turbines would be the location of the site in an urban area. Wind patterns in urban areas can be very turbulent, and are not the best conditions to yield a good output from small scale wind turbines.

In addition, planning requirements from the local authority regarding potential noise from the wind generators would have to be considered. It is likely that during the day sound levels would not be noticeable but at night with lower background levels this could be invasive to the buildings particularly to the residential developments in relatively close proximity to the site.

Other important considerations, would be the potential effect on wild birds and particularly on the bat corridor located adjacent to the site.

It would therefore be reasonable to conclude that based on the above information, even without a technical review of the installation costs, the requirements for maintenance and the installation restraints are unlikely to support the installation of electrical wind generation for this development.

9.4 Hydrogen Fuel Cells

Hydrogen fuel cells have been considered for use within the building but have been discounted due to the current lack of a commercially viable source of hydrogen. Many current installations are known to be running on natural gas until the hydrogen becomes available.

There is currently no commercially available fuel cell technology in the European market.

10 SUMMARY

10.1 Energy Statement Summary

The first stage of the energy hierarchy applied energy efficiency measures to the building which resulted in a reduction of carbon emissions over Part L (2013) of the building regulations of 5.2% (14.2% beyond Part L (2010)). This step alone does not achieve the Manchester City Council target of 15% beyond Part L (2010) (6% beyond Part L (2013)).

The next stage of the hierarchy applied the results of investigations into the possibility of connecting to district heating networks close to the site. As there are no current plans known to develop a district heating network in the vicinity of the site, this did not yield any positive results.

A Low and Zero Carbon feasibility study concluded that heat pumps for the provision of space heating and cooling was a viable option, and their incorporation into the building is calculated to further reduce the carbon emissions to 18.6% over the Part L (2013) limits. This results in carbon emission reductions of 27.6% beyond Part L (2010), surpassing the Manchester City Council target by 12.6%.

Further to the inclusion of heat pumps, photovoltaics were investigated to offset a portion of the building's electrical base load to further progress the project carbon emissions towards the Zero Carbon 2038 Manchester City Council target. It was identified that an Organic Photovoltaic array of 6,247m^2_{active} could be installed to the main roof. This would provide a source of renewable energy for the building whilst having limited impact on the environment. Based on projected efficiency increases from technological advancements, it is anticipated that this array could generate 687kW_{peak} of electrical energy, offsetting 265,030$kgCO_2$/year. Should the expected efficiency improvements not be achieved by the manufacturer, based on efficiencies currently realised by the Organic Photovoltaic modules, this array would generate circa 522kW_{peak} of electrical energy. This would provide carbon savings of 217,330$kgCO_2$/year.

The calculated reductions from inclusion of Air Source Heat Pumps and Organic Photovoltaics (with their expected 2023 efficiencies) show that the Energy Strategy adopted by OVG Manchester would surpass the Part L (2013) requirements by 33.8%, totalling carbon savings of 588,370$kgCO_2$/year. In terms of the Manchester City Council minimum planning requirements, this design equates to savings of 42.8% beyond the requirements of Part L (2010), 27.8% beyond the Manchester City Council target. Should the Organic Photovoltaic efficiencies not improve to the expected levels, OVG Manchester would achieve carbon savings in excess of 540,670$kgCO_2$/year based upon the currently achieved efficiencies. This would provide a betterment beyond Part L (2013) of 31.1%, 40.1% beyond Part L (2010) and 25.1% beyond the Manchester City Council minimum requirement.

10.2 Zero Carbon 2038 Summary

Further to basic compliance with the UK Building Regulations and Manchester City Council planning requirements, this project has sought opportunities to further reduce carbon emissions with the intent of heading towards the Manchester City Council target of achieving Zero Carbon by 2038.

The following table shows the expected regulated carbon emissions, in Tonnes of CO_2, for each of the stages discussed within this Energy Statement. The tonnages have been related to each Carbon Budget to demonstrate what percentage of each Carbon Budget would be absorbed by OVG Manchester.

	Budget Tonnes of CO_2	TER		BER		+ ASHP		+ PVs (2020)		+ PVs (2023)	
		Tonnes of CO_2	%	Tonnes of CO_2	%	Tonnes of CO_2	%	Tonnes of CO_2	%	Tonnes of CO_2	%
2018 - 2100	15,187,610	133,873	0.88%	126,934	0.84%	108,976	0.72%	92,242	0.61%	88,568	0.58%
2018 - 2023	6,928,620	1,739	0.03%	1,648	0.02%	1,415	0.02%	1,198	0.02%	1,150	0.02%
2023 - 2028	3,593,560	8,693	0.24%	8,242	0.23%	7,076	0.20%	5,990	0.17%	5,751	0.16%
2028 - 2037	3,046,920	15,647	0.51%	14,836	0.49%	12,737	0.42%	10,782	0.35%	10,352	0.34%

OVG Manchester's contribution to the Carbon Budgets detailed within the Zero Carbon 2038 Framework (Figures adjusted to allow for 2023 opening date)

This indicates that as a percentage of the Manchester Carbon Budget, OVG Manchester would utilise only 0.58% of the overall Carbon Budget up to the year 2100.

It is important to note that this figure is based upon the currently agreed carbon intensity of the National Grid electricity of 0.519kgCO_2/kWh. As the National Grid shifts away from dependence on fossil fuels and moves towards more renewable energy sources, such as solar, wind and tidal generation, the carbon emissions from the project will also fall further as a direct result, meaning that OVG Manchester would absorb even less of each Carbon Budget.

In addition to the carbon savings that decarbonisation of the National Grid will offer, OVG Manchester will seek to remove natural gas from the building (currently used predominantly to generate domestic hot water and major catering operations) as viable technologies become available, or the carbon intensity of electricity falls to a level below that of natural gas. Further to this, provision has been made within the building to allow for a connection to a District Heating network, should one become available in the area at a future date.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

19024 - Project Bradford - Baseline

As designed

Date: Fri Sep 27 09:57:16 2019

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	32.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	32.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	31.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	77000000:Surf[2]
Floor	0.25	0.15	0.15	68000000:Surf[0]
Roof	0.25	0.15	0.15	68000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	60000000:Surf[1]
Personnel doors	2.2	1.8	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	4

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Heat Pump

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	4.5	0	1.7	0.75
Standard value	0.91*	2.55	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

2- Store

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	3.5	0	1.7	0.75
Standard value	0.91*	2.55	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- Auditorium

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	3.4	0	1.6	0.7
Standard value	0.91*	2.7	N/A	1.6^	0.45
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Artist 1	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Artist 1	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 1	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 10	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 10	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 11	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 11	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 12	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 12	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 12	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 2	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 2	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 2	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 2	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 3	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 4	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 4	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 5	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 5	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 6	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 6	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 7	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 7	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 8	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 8	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 8	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 9	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 9	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Artist 9	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Atrium	-	-	-	-	-	-	-	0.4	-	-	N/A
00 BEF	-	-	-	-	-	-	-	0.4	-	-	N/A
00 BEF	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Crew Catering	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Crew WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Decibel Club	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Founders Club	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Founders Club	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Founders Club	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Games Room	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Green Room	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Green Room	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Green Room	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Green Room	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Laundry	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Local Crew	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 MER	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Production	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Promoter	-	-	-	-	-	-	-	0.4	-	-	N/A
00 SCR	-	-	-	-	-	-	-	0.4	-	-	N/A
00 SCR	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Security	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Security Control	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Shower - Groom	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Shower - Groom	-	-	-	-	-	-	-	0.4	-	-	N/A
00 Staff Entry - Staff Accreditaion	-	-	-	-	-	-	-	0.4	-	-	N/A
00 UPS	-	-	-	-	-	-	-	0.4	-	-	N/A
00 UPS	-	-	-	-	-	-	-	0.4	-	-	N/A
00 UPS	-	-	-	-	-	-	-	0.4	-	-	N/A
00 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
00 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Adult Change	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Atrium Foyer	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Atrium Foyer	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Box Office	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Box Office	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Canal Side	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Concession	-	-	-	-	-	-	-	0.4	-	-	N/A
01 East Foyer	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Merchandise	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Merchandise	-	-	-	-	-	-	-	0.4	-	-	N/A
01 North Foyer	-	-	-	-	-	-	-	0.4	-	-	N/A
01 Potential Retail Space	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 UPS	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Breifing Room	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Canteen	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Corner Club Lounge	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Loge Club	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Loge Club	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Loge Club	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Manager	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Pava Rack	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Pava Rack	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Pava Rack	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Reception	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 1	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 10	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 11	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 12	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 13	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 14	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02 Suite 15	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 16	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 17	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 18	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 19	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 2	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 20	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 21	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 22	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 23	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 24	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 3	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 4	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 5	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 6	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 7	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 8	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Suite 9	-	-	-	-	-	-	-	0.4	-	-	N/A
02 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
02 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Adult Change	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Experiance - Night Market East	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Experiance - Night Market North	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Experiance - Night Market South	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Experiance Atrium Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
03 Merchandise Shell Unit	-	-	-	-	-	-	-	0.4	-	-	N/A
03 PAR	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Accessbile WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Accessible WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Bar	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Comms	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Event Control	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Female WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Lobby	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Male WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 MER	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Mobile Operations	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Office	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Terrace Bar North	-	-	-	-	-	-	-	0.4	-	-	N/A
04 Terrace Bar South	-	-	-	-	-	-	-	0.4	-	-	N/A
04 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
04 WC	-	-	-	-	-	-	-	0.4	-	-	N/A
Hospitality Circulation	-	-	-	-	-	-	-	0.4	-	-	N/A
02 Loge Club	-	-	-	-	-	-	-	0.4	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00 Artist 1	90	-	-	84
00 Artist 1	90	-	-	15
00 Artist 1	90	-	-	14
00 Artist 10	90	-	-	50
00 Artist 10	90	-	-	15
00 Artist 11	90	-	-	51
00 Artist 11	90	-	-	14
00 Artist 12	90	-	-	15
00 Artist 12	90	-	-	74
00 Artist 12	90	-	-	15
00 Artist 2	90	-	-	14
00 Artist 2	90	-	-	15
00 Artist 2	90	-	-	51
00 Artist 2	90	-	-	15
00 Artist 3	90	-	-	42
00 Artist 4	90	-	-	51
00 Artist 4	90	-	-	15
00 Artist 5	90	-	-	52
00 Artist 5	90	-	-	15
00 Artist 6	90	-	-	15
00 Artist 6	90	-	-	47
00 Artist 7	90	-	-	47
00 Artist 7	90	-	-	15
00 Artist 8	90	-	-	15
00 Artist 8	90	-	-	51
00 Artist 8	90	-	-	14
00 Artist 9	90	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Artist 9	90	-	-	14
00 Artist 9	90	-	-	44
00 Atrium	-	90	-	6469
00 BEF	90	-	-	94
00 BEF	90	-	-	70
00 Bulk Store	90	-	-	202
00 Bulk Store	90	-	-	247
00 Circulation	-	90	-	50
00 Circulation	-	90	-	62
00 Circulation	-	90	-	164
00 Circulation	-	90	-	102
00 Circulation	-	90	-	121
00 Circulation	-	90	-	132
00 Circulation	-	90	-	124
00 Circulation	-	90	-	490
00 Circulation	-	90	-	202
00 Circulation	-	90	-	115
00 Circulation	-	90	-	241
00 Circulation	-	90	-	62
00 Circulation	-	90	-	115
00 Circulation	-	90	-	148
00 Circulation	-	90	-	166
00 Circulation	-	90	-	153
00 Circulation	-	90	-	322
00 Circulation	-	90	-	304
00 Circulation	-	90	-	626
00 Circulation	-	90	-	268
00 Circulation	-	90	-	328
00 Clean	90	-	-	57
00 Commissary Kitchen	-	90	-	4609
00 Concession	90	-	-	88
00 Concession	90	-	-	68
00 Concession	90	-	-	220
00 Concession	90	-	-	136
00 Concession	90	-	-	87
00 Concession	90	-	-	68
00 Crew Catering	-	90	-	557
00 Crew Kitchen	-	90	-	844
00 Crew WC	-	80	-	184
00 Decibel Club	-	90	-	976
00 Female WC	-	80	-	412
00 Female WC	-	80	-	448
00 Female WC	-	80	-	717

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Founders Club	-	90	-	103
00 Founders Club	-	90	-	692
00 Founders Club	-	90	-	88
00 Games Room	90	-	-	874
00 Green Room	-	90	-	99
00 Green Room	-	90	-	53
00 Green Room	-	90	-	118
00 Green Room	-	90	-	365
00 Laundry	90	-	-	505
00 Lobby	-	90	-	146
00 Lobby	-	90	-	139
00 Lobby	-	90	-	39
00 Lobby	-	90	-	138
00 Lobby	-	90	-	146
00 Lobby	-	90	-	1622
00 Local Crew	90	-	-	465
00 Male WC	-	80	-	429
00 Male WC	-	80	-	234
00 Medical	90	-	-	40
00 MER	90	-	-	150
00 Office	90	-	-	285
00 Production	90	-	-	719
00 Promoter	90	-	-	942
00 SCR	90	-	-	99
00 SCR	90	-	-	94
00 Security	90	-	-	349
00 Security Control	90	-	-	993
00 Shower - Groom	-	90	-	121
00 Shower - Groom	-	90	-	134
00 Staff Entry - Staff Accreditaion	-	90	15	443
00 Stair	-	90	-	267
00 Stair	-	90	-	282
00 Stair	-	90	-	261
00 Stair	-	90	-	267
00 Stair	-	90	-	149
00 Stair	-	90	-	251
00 Stair	-	90	-	278
00 Stair	-	90	-	37
00 Stair	-	90	-	279
00 Store	90	-	-	45
00 Store	90	-	-	43
00 Store	90	-	-	66
00 Store	90	-	-	30

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Store	90	-	-	77
00 Store	90	-	-	90
00 Store	90	-	-	136
00 Store	90	-	-	184
00 Store	90	-	-	47
00 Store	90	-	-	51
00 UPS	90	-	-	134
00 UPS	90	-	-	149
00 UPS	90	-	-	63
00 VIP Cloak	90	-	-	36
00 Wardrobe	90	-	-	50
00 WC	-	80	-	127
00 WC	-	80	-	129
00 WC	-	80	-	36
00 WC	-	80	-	46
00 WC	-	80	-	43
01 Accessible WC	-	80	-	54
01 Accessible WC	-	80	-	51
01 Accessible WC	-	80	-	62
01 Accessible WC	-	80	-	53
01 Adult Change	-	90	-	37
01 Atrium Foyer	-	90	-	4284
01 Atrium Foyer	-	90	-	729
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	119
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bin Store	90	-	-	19
01 Bin Store	90	-	-	34
01 Box Office	90	-	-	248
01 Box Office	90	-	-	191
01 Canal Side	-	90	-	2927
01 Circulation	-	90	-	27
01 Circulation	-	90	-	25
01 Circulation	-	90	-	14
01 Circulation	-	90	-	38
01 Circulation	-	90	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Circulation	-	90	-	26
01 Circulation	-	90	-	27
01 Circulation	-	90	-	76
01 Circulation	-	90	-	29
01 Circulation	-	90	-	23
01 Circulation	-	90	-	27
01 Comms	90	-	-	45
01 Comms	90	-	-	49
01 Comms	90	-	-	48
01 Comms	90	-	-	46
01 Concession	90	-	-	48
01 Concession	90	-	-	80
01 Concession	90	-	-	44
01 Concession	90	-	-	77
01 Concession	90	-	-	72
01 East Foyer	-	90	-	4817
01 Female WC	-	80	-	349
01 Female WC	-	80	-	412
01 Female WC	-	80	-	259
01 Female WC	-	80	-	296
01 Female WC	-	80	-	377
01 First Aid	90	-	-	27
01 Keg Room	90	-	-	25
01 Keg Room	90	-	-	25
01 Lobby	-	90	-	101
01 Lobby	-	90	-	663
01 Lobby	-	90	-	95
01 Lobby	-	90	-	296
01 Lobby	-	90	-	101
01 Lobby	-	90	-	141
01 Male WC	-	80	-	257
01 Male WC	-	80	-	313
01 Male WC	-	80	-	262
01 Male WC	-	80	-	258
01 Merchandise	90	-	-	422
01 Merchandise	90	-	-	413
01 North Foyer	-	90	-	3537
01 Potential Retail Space	90	-	-	1451
01 Stair	-	90	-	233
01 Stair	-	90	-	231
01 Stair	-	90	-	196
01 Stair	-	90	-	48
01 Stair	-	90	-	234

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Stair	-	90	-	461
01 Stair	-	90	-	205
01 Stair	-	90	-	218
01 Stair	-	90	-	94
01 Stair	-	90	-	101
01 Stair	-	90	-	218
01 Stair	-	90	-	217
01 Store	90	-	-	30
01 Store	90	-	-	37
01 Store	90	-	-	37
01 Store	90	-	-	31
01 Store	90	-	-	21
01 Store	90	-	-	13
01 Store	90	-	-	35
01 Store	90	-	-	33
01 UPS	90	-	-	43
02 Bar	-	90	-	82
02 Bar	-	90	-	105
02 Bar	-	90	-	105
02 Breifing Room	90	-	-	583
02 Canteen	-	90	-	202
02 Circulation	-	90	-	59
02 Circulation	-	90	-	148
02 Circulation	-	90	-	124
02 Circulation	-	90	-	62
02 Circulation	-	90	-	550
02 Circulation	-	90	-	161
02 Circulation	-	90	-	65
02 Circulation	-	90	-	51
02 Circulation	-	90	-	166
02 Circulation	-	90	-	233
02 Circulation	-	90	-	18
02 Circulation	-	90	-	100
02 Clean	90	-	-	17
02 Comms	90	-	-	45
02 Comms	90	-	-	57
02 Comms	90	-	-	56
02 Comms	90	-	-	54
02 Corner Club Lounge	-	90	-	6032
02 Female WC	-	80	-	126
02 Female WC	-	80	-	202
02 Female WC	-	80	-	220
02 Female WC	-	80	-	125

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Female WC	-	80	-	131
02 Female WC	-	80	-	57
02 Kitchen	-	90	-	491
02 Kitchen	-	90	-	768
02 Kitchen	-	90	-	404
02 Kitchen	-	90	-	382
02 Kitchen	-	90	-	726
02 Kitchen	-	90	-	501
02 Kitchen Store	90	-	-	77
02 Lobby	-	90	-	1302
02 Lobby	-	90	-	1489
02 Lobby	-	90	-	101
02 Lobby	-	90	-	101
02 Lobby	-	90	-	95
02 Lobby	-	90	-	94
02 Locker Female	90	-	-	129
02 Locker Male	90	-	-	129
02 Loge Club	-	90	-	380
02 Loge Club	-	90	-	387
02 Loge Club	-	90	-	386
02 Male WC	-	80	-	166
02 Male WC	-	80	-	59
02 Male WC	-	80	-	124
02 Male WC	-	80	-	184
02 Male WC	-	80	-	127
02 Male WC	-	80	-	148
02 Manager	90	-	-	292
02 Pava Rack	90	-	-	69
02 Pava Rack	90	-	-	42
02 Pava Rack	90	-	-	46
02 Reception	-	90	15	108
02 Stair	-	90	-	205
02 Stair	-	90	-	813
02 Stair	-	90	-	233
02 Stair	-	90	-	120
02 Stair	-	90	-	218
02 Stair	-	90	-	234
02 Stair	-	90	-	196
02 Stair	-	90	-	218
02 Stair	-	90	-	231
02 Stairs	-	90	-	217
02 Store	90	-	-	24
02 Store	90	-	-	71

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Store	90	-	-	18
02 Store	90	-	-	56
02 Store	90	-	-	27
02 Store	90	-	-	72
02 Suite 1	-	90	-	106
02 Suite 10	-	90	-	106
02 Suite 11	-	90	-	106
02 Suite 12	-	90	-	107
02 Suite 13	-	90	-	107
02 Suite 14	-	90	-	107
02 Suite 15	-	90	-	107
02 Suite 16	-	90	-	107
02 Suite 17	-	90	-	180
02 Suite 18	-	90	-	180
02 Suite 19	-	90	-	180
02 Suite 2	-	90	-	106
02 Suite 20	-	90	-	180
02 Suite 21	-	90	-	107
02 Suite 22	-	90	-	107
02 Suite 23	-	90	-	107
02 Suite 24	-	90	-	107
02 Suite 3	-	90	-	106
02 Suite 4	-	90	-	106
02 Suite 5	-	90	-	177
02 Suite 6	-	90	-	177
02 Suite 7	-	90	-	177
02 Suite 8	-	90	-	177
02 Suite 9	-	90	-	106
02 Support Kitchen	-	90	-	1329
02 Uniform	90	-	-	13
02 Uniform	90	-	-	32
02 Uniform	90	-	-	31
02 Uniform	90	-	-	13
02 WC	-	80	-	114
02 WC	-	80	-	168
02 WC	-	80	-	120
02 WC	-	80	-	161
03 Accessible WC	-	80	-	58
03 Accessible WC	-	80	-	74
03 Accessible WC	-	80	-	55
03 Accessible WC	-	80	-	80
03 Adult Change	-	90	-	87
03 Bar	-	90	-	457

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
03 Bar	-	90	-	133
03 Bar	-	90	-	380
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bin Store	90	-	-	88
03 Bin Store - Circulation	90	-	-	113
03 Circulation	-	90	-	93
03 Clean	90	-	-	32
03 Clean	90	-	-	65
03 Comms	90	-	-	76
03 Comms	90	-	-	79
03 Comms	90	-	-	78
03 Comms	90	-	-	74
03 Experiance - Night Market East	-	90	-	4947
03 Experiance - Night Market North	-	90	-	3761
03 Experiance - Night Market South	-	90	-	3529
03 Experiance Atrium Bar	-	90	-	5824
03 Female WC	-	80	-	504
03 Female WC	-	80	-	787
03 Female WC	-	80	-	349
03 Female WC	-	80	-	505
03 Female WC	-	80	-	647
03 Female WC	-	80	-	17
03 Female WC	-	80	-	527
03 Female WC	-	80	-	415
03 First Aid	90	-	-	51
03 Keg Room	90	-	-	76
03 Lobby	-	90	-	156
03 Lobby	-	90	-	164
03 Lobby	-	90	-	165
03 Lobby	-	90	-	157
03 Male WC	-	80	-	542
03 Male WC	-	80	-	381
03 Male WC	-	80	-	594
03 Male WC	-	80	-	464
03 Male WC	-	80	-	403
03 Merchandise Shell Unit	90	-	-	863
03 PAR	90	-	-	36
03 Stair	-	90	-	270
03 Stair	-	90	-	259
03 Stair	-	90	-	194

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
03 Stair	-	90	-	298
03 Stair	-	90	-	302
03 Stair	-	90	-	287
03 Stair	-	90	-	287
03 Stair	-	90	-	298
03 Stair	-	90	-	34
03 Stair	-	90	-	279
03 Store	90	-	-	93
03 Store	90	-	-	130
03 Store	90	-	-	143
03 Store	90	-	-	84
04 Accessbile WC	-	80	-	46
04 Accessible WC	-	80	-	45
04 Accessible WC	-	80	-	46
04 Archive	90	-	-	47
04 Bar	-	90	-	243
04 Bar	-	90	-	199
04 Circulation	-	90	-	192
04 Circulation	-	90	-	246
04 Circulation	-	90	-	90
04 Circulation	-	90	-	78
04 Circulation	-	90	-	126
04 Circulation	-	90	-	37
04 Circulation	-	90	-	101
04 Circulation	-	90	-	91
04 Circulation	-	90	-	99
04 Circulation	-	90	-	165
04 Circulation	-	90	-	86
04 Circulation	-	90	-	865
04 Circulation	-	90	-	158
04 Circulation	-	90	-	241
04 Comms	90	-	-	80
04 Comms	90	-	-	76
04 Comms	90	-	-	74
04 Comms	90	-	-	72
04 Event Control	90	-	-	647
04 Event Floor	-	70	-	27714
04 Female WC	-	80	-	206
04 Female WC	-	80	-	247
04 Lobby	-	90	-	176
04 Lobby	-	90	-	143
04 Lobby	-	90	-	151
04 Lobby	-	90	-	144

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
04 Male WC	-	80	-	198
04 Male WC	-	80	-	247
04 MER	90	-	-	232
04 Mobile Operations	90	-	-	436
04 Office	90	-	-	331
04 Office	90	-	-	322
04 Office	90	-	-	234
04 Office	90	-	-	230
04 Office	90	-	-	164
04 Office	90	-	-	146
04 Office	90	-	-	146
04 Office	90	-	-	797
04 Office	90	-	-	226
04 Office	90	-	-	327
04 Stair	-	90	-	284
04 Stair	-	90	-	272
04 Stair	-	90	-	272
04 Stair	-	90	-	287
04 Stair	-	90	-	179
04 Store	90	-	-	108
04 Store	90	-	-	90
04 Store	90	-	-	379
04 Terrace Bar North	-	90	-	1436
04 Terrace Bar South	-	90	-	1165
04 WC	-	80	-	167
04 WC	-	80	-	168
04 WC	-	80	-	206
05 Stair	-	90	-	311
05 Stair	-	90	-	285
05 Stair	-	90	-	670
Hospitality Circulation	-	90	-	1203
00 Event Floor	-	70	-	31391
03 Event Floor	-	70	-	14946
05 Event Floor	-	70	-	3501
02 Loge Club	-	90	-	376
01 Event Floor	-	70	-	9661
02 Event Floor	-	70	-	7649

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Artist 10	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 3	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Atrium	N/A	N/A
00 BEF	N/A	N/A
00 BEF	N/A	N/A
00 Bulk Store	N/A	N/A
00 Bulk Store	N/A	N/A
00 Clean	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Crew Catering	N/A	N/A
00 Crew WC	N/A	N/A
00 Decibel Club	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Games Room	N/A	N/A
00 Green Room	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Laundry	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	NO (-57.4%)	NO
00 Local Crew	N/A	N/A
00 Male WC	N/A	N/A
00 Male WC	N/A	N/A
00 Medical	N/A	N/A
00 MER	N/A	N/A
00 Office	N/A	N/A
00 Production	N/A	N/A
00 Promoter	N/A	N/A
00 SCR	N/A	N/A
00 SCR	N/A	N/A
00 Security	N/A	N/A
00 Security Control	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Staff Entry - Staff Accreditaion	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 VIP Cloak	N/A	N/A
00 Wardrobe	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Adult Change	N/A	N/A
01 Atrium Foyer	YES (+15.6%)	NO
01 Atrium Foyer	NO (-83.9%)	NO
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bin Store	N/A	N/A
01 Bin Store	N/A	N/A
01 Box Office	N/A	N/A
01 Box Office	N/A	N/A
01 Canal Side	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 East Foyer	NO (-55.6%)	NO
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 First Aid	N/A	N/A
01 Keg Room	N/A	N/A
01 Keg Room	N/A	N/A
01 Lobby	N/A	N/A
01 Lobby	NO (-13.6%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-16.5%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-42.1%)	NO
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Merchandise	N/A	N/A
01 Merchandise	N/A	N/A
01 North Foyer	NO (-36.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Potential Retail Space	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 UPS	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Breifing Room	N/A	N/A
02 Canteen	N/A	N/A
02 Clean	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Corner Club Lounge	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Kitchen Store	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Locker Female	N/A	N/A
02 Locker Male	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Manager	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Reception	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Suite 1	N/A	N/A
02 Suite 10	N/A	N/A
02 Suite 11	N/A	N/A
02 Suite 12	N/A	N/A
02 Suite 13	N/A	N/A
02 Suite 14	N/A	N/A
02 Suite 15	N/A	N/A
02 Suite 16	N/A	N/A
02 Suite 17	N/A	N/A
02 Suite 18	N/A	N/A
02 Suite 19	N/A	N/A
02 Suite 2	N/A	N/A
02 Suite 20	N/A	N/A
02 Suite 21	N/A	N/A
02 Suite 22	N/A	N/A
02 Suite 23	N/A	N/A
02 Suite 24	N/A	N/A
02 Suite 3	N/A	N/A
02 Suite 4	N/A	N/A
02 Suite 5	N/A	N/A
02 Suite 6	N/A	N/A
02 Suite 7	N/A	N/A
02 Suite 8	N/A	N/A
02 Suite 9	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Adult Change	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bin Store	N/A	N/A
03 Bin Store - Circulation	N/A	N/A
03 Clean	N/A	N/A
03 Clean	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Experiance - Night Market East	N/A	N/A
03 Experiance - Night Market North	N/A	N/A
03 Experiance - Night Market South	N/A	N/A
03 Experiance Atrium Bar	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 First Aid	N/A	N/A
03 Keg Room	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Merchandise Shell Unit	N/A	N/A
03 PAR	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
04 Accessbile WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Archive	N/A	N/A
04 Bar	N/A	N/A
04 Bar	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
04 Event Control	N/A	N/A
04 Event Floor	N/A	N/A
04 Female WC	N/A	N/A
04 Female WC	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Male WC	N/A	N/A
04 Male WC	N/A	N/A
04 MER	N/A	N/A
04 Mobile Operations	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Terrace Bar North	N/A	N/A
04 Terrace Bar South	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A
Hospitality Circulation	N/A	N/A
00 Event Floor	N/A	N/A
03 Event Floor	N/A	N/A
05 Event Floor	N/A	N/A
02 Loge Club	N/A	N/A
01 Event Floor	N/A	N/A
02 Event Floor	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	53006.4	53006.4
External area [m²]	71195.3	66724.8
Weather	MAN	MAN
Infiltration [m³/hm²@ 50Pa]	4	3
Average conductance [W/K]	18403.3	19438.3
Average U-value [W/m²K]	0.26	0.29
Alpha value* [%]	6.15	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
98	**D2 General Assembly and Leisure, Night Clubs, and Theatres**
	Others: Passenger terminals
	Others: Emergency services
2	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	9.85	11.94
Cooling	3.79	4.02
Auxiliary	21.16	19.13
Lighting	16.24	21.01
Hot water	37.63	36.52
Equipment*	33.17	33.17
TOTAL**	**88.67**	**92.62**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	76.15	91.85
Primary energy* [kWh/m²]	181.22	191.3
Total emissions [kg/m²]	31.1	32.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Constant volume system (variable fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	86.5	3	29.3	0.3	24.7	0.82	2.6	0.92	4.5
	Notional	86.8	7.8	28	0.6	18.1	0.86	3.79	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	6.9	85.5	2.3	6.8	24.1	0.83	3.51	0.92	4.5
	Notional	17.4	94.8	5.6	7	24.7	0.86	3.79	----	----
[ST] Constant volume system (fixed fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	29.1	16.1	9.7	2	21.2	0.83	2.22	0.92	4.5
	Notional	63.3	40.4	20.4	3	15.3	0.86	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	77000000:Surf[2]
Floor	0.2	0.02	RM000138:Surf[112]
Roof	0.15	0.02	RM000063:Surf[154]
Windows, roof windows, and rooflights	1.5	1.6	60000000:Surf[1]
Personnel doors	1.5	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

19024 - Project Bradford - Be Green

As designed

Date: Fri Sep 27 11:34:33 2019

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	27.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	27.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	26.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	77000000:Surf[2]
Floor	0.25	0.15	0.15	68000000:Surf[0]
Roof	0.25	0.15	0.2	RM000002:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	60000000:Surf[1]
Personnel doors	2.2	1.8	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	4

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Heat Pump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.61	4.5	0	0	0.75
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- Tech rooms

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.61	3.5	0	0	0.85
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

3- Store

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.61	3.5	0	1.7	0.75
Standard value	2.5*	3.2	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- Auditorium

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.61	2.5	0	1.6	0.7
Standard value	2.5*	3.2	N/A	1.6^	0.45
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	**System type in Non-domestic Building Services Compliance Guide**
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 10	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 10	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 11	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 11	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 3	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 4	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 4	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 5	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 5	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 6	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 6	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 7	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 7	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Atrium	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Crew Catering	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Crew WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Decibel Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Games Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Laundry	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Local Crew	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Production	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Promoter	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Security	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Security Control	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Shower - Groom	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Shower - Groom	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Staff Entry - Staff Accreditaion	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Adult Change	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Atrium Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Atrium Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Box Office	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Box Office	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Canal Side	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 East Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Merchandise	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Merchandise	-	-	-	1.7	-	-	-	-	-	-	N/A
01 North Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Potential Retail Space	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Breifing Room	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Canteen	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Corner Club Lounge	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Manager	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Reception	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 1	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 10	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 11	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 12	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 13	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 14	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 15	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 16	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 17	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 18	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 19	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 2	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 20	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 21	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 22	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 23	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 24	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 3	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 4	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 5	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 6	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 7	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 8	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 9	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Adult Change	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market East	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market North	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market South	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance Atrium Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Merchandise Shell Unit	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessbile WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Event Control	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
04 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Terrace Bar North	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Terrace Bar South	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
Hospitality Circulation	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00 Artist 1	90	-	-	84
00 Artist 1	90	-	-	15
00 Artist 1	90	-	-	14
00 Artist 10	90	-	-	50
00 Artist 10	90	-	-	15
00 Artist 11	90	-	-	51
00 Artist 11	90	-	-	14
00 Artist 12	90	-	-	15
00 Artist 12	90	-	-	74
00 Artist 12	90	-	-	15
00 Artist 2	90	-	-	14
00 Artist 2	90	-	-	15
00 Artist 2	90	-	-	51
00 Artist 2	90	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Artist 3	90	-	-	42
00 Artist 4	90	-	-	51
00 Artist 4	90	-	-	15
00 Artist 5	90	-	-	52
00 Artist 5	90	-	-	15
00 Artist 6	90	-	-	15
00 Artist 6	90	-	-	47
00 Artist 7	90	-	-	47
00 Artist 7	90	-	-	15
00 Artist 8	90	-	-	15
00 Artist 8	90	-	-	51
00 Artist 8	90	-	-	14
00 Artist 9	90	-	-	15
00 Artist 9	90	-	-	14
00 Artist 9	90	-	-	44
00 Atrium	-	85	-	6850
00 BEF	90	-	-	94
00 BEF	90	-	-	70
00 Bulk Store	80	-	-	227
00 Bulk Store	80	-	-	277
00 Circulation	-	85	-	53
00 Circulation	-	85	-	66
00 Circulation	-	85	-	174
00 Circulation	-	85	-	108
00 Circulation	-	85	-	129
00 Circulation	-	85	-	140
00 Circulation	-	85	-	131
00 Circulation	-	85	-	519
00 Circulation	-	85	-	214
00 Circulation	-	85	-	121
00 Circulation	-	85	-	255
00 Circulation	-	85	-	66
00 Circulation	-	85	-	121
00 Circulation	-	85	-	157
00 Circulation	-	85	-	176
00 Circulation	-	85	-	162
00 Circulation	-	85	-	341
00 Circulation	-	85	-	322
00 Circulation	-	85	-	663
00 Circulation	-	85	-	283
00 Circulation	-	85	-	347
00 Clean	80	-	-	64
00 Commissary Kitchen	-	90	-	4609

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Concession	90	-	-	88
00 Concession	90	-	-	68
00 Concession	90	-	-	220
00 Concession	90	-	-	136
00 Concession	90	-	-	87
00 Concession	90	-	-	68
00 Crew Catering	-	90	-	557
00 Crew Kitchen	-	90	-	844
00 Crew WC	-	80	-	184
00 Decibel Club	-	90	-	976
00 Female WC	-	80	-	412
00 Female WC	-	80	-	448
00 Female WC	-	80	-	717
00 Founders Club	-	90	-	103
00 Founders Club	-	90	-	692
00 Founders Club	-	90	-	88
00 Games Room	90	-	-	874
00 Green Room	-	90	-	99
00 Green Room	-	90	-	53
00 Green Room	-	90	-	118
00 Green Room	-	90	-	365
00 Laundry	90	-	-	505
00 Lobby	-	85	-	155
00 Lobby	-	85	-	147
00 Lobby	-	85	-	41
00 Lobby	-	85	-	146
00 Lobby	-	85	-	154
00 Lobby	-	85	-	1718
00 Local Crew	90	-	-	465
00 Male WC	-	80	-	429
00 Male WC	-	80	-	234
00 Medical	80	-	-	45
00 MER	90	-	-	150
00 Office	90	-	-	285
00 Production	90	-	-	719
00 Promoter	90	-	-	942
00 SCR	90	-	-	99
00 SCR	90	-	-	94
00 Security	90	-	-	349
00 Security Control	90	-	-	993
00 Shower - Groom	-	80	-	136
00 Shower - Groom	-	80	-	151
00 Staff Entry - Staff Accreditaion	-	90	15	443

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Stair	-	85	-	283
00 Stair	-	85	-	299
00 Stair	-	85	-	276
00 Stair	-	85	-	283
00 Stair	-	85	-	158
00 Stair	-	85	-	266
00 Stair	-	85	-	295
00 Stair	-	85	-	40
00 Stair	-	85	-	296
00 Store	80	-	-	51
00 Store	80	-	-	48
00 Store	80	-	-	75
00 Store	80	-	-	34
00 Store	80	-	-	87
00 Store	80	-	-	102
00 Store	80	-	-	153
00 Store	80	-	-	207
00 Store	80	-	-	53
00 Store	80	-	-	58
00 UPS	85	-	-	141
00 UPS	85	-	-	158
00 UPS	85	-	-	67
00 VIP Cloak	80	-	-	41
00 Wardrobe	80	-	-	56
00 WC	-	80	-	127
00 WC	-	80	-	129
00 WC	-	80	-	36
00 WC	-	80	-	46
00 WC	-	80	-	43
01 Accessible WC	-	80	-	54
01 Accessible WC	-	80	-	51
01 Accessible WC	-	80	-	62
01 Accessible WC	-	80	-	53
01 Adult Change	-	80	-	41
01 Atrium Foyer	-	85	-	4536
01 Atrium Foyer	-	85	-	772
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	119
01 Bar	-	90	-	94

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bin Store	80	-	-	22
01 Bin Store	80	-	-	38
01 Box Office	90	-	-	248
01 Box Office	90	-	-	191
01 Canal Side	-	85	-	3099
01 Circulation	-	85	-	29
01 Circulation	-	85	-	26
01 Circulation	-	85	-	15
01 Circulation	-	85	-	40
01 Circulation	-	85	-	15
01 Circulation	-	85	-	28
01 Circulation	-	85	-	28
01 Circulation	-	85	-	81
01 Circulation	-	85	-	30
01 Circulation	-	85	-	24
01 Circulation	-	85	-	29
01 Comms	85	-	-	48
01 Comms	85	-	-	52
01 Comms	85	-	-	51
01 Comms	85	-	-	49
01 Concession	90	-	-	48
01 Concession	90	-	-	80
01 Concession	90	-	-	44
01 Concession	90	-	-	77
01 Concession	90	-	-	72
01 East Foyer	-	85	-	5100
01 Female WC	-	80	-	349
01 Female WC	-	80	-	412
01 Female WC	-	80	-	259
01 Female WC	-	80	-	296
01 Female WC	-	80	-	377
01 First Aid	80	-	-	31
01 Keg Room	80	-	-	28
01 Keg Room	80	-	-	28
01 Lobby	-	85	-	107
01 Lobby	-	85	-	702
01 Lobby	-	85	-	101
01 Lobby	-	85	-	313
01 Lobby	-	85	-	107
01 Lobby	-	85	-	149

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Male WC	-	80	-	257
01 Male WC	-	80	-	313
01 Male WC	-	80	-	262
01 Male WC	-	80	-	258
01 Merchandise	90	-	-	422
01 Merchandise	90	-	-	413
01 North Foyer	-	85	-	3745
01 Potential Retail Space	90	-	-	1451
01 Stair	-	85	-	247
01 Stair	-	85	-	244
01 Stair	-	85	-	207
01 Stair	-	85	-	51
01 Stair	-	85	-	248
01 Stair	-	85	-	488
01 Stair	-	85	-	217
01 Stair	-	85	-	230
01 Stair	-	85	-	100
01 Stair	-	85	-	107
01 Stair	-	85	-	230
01 Stair	-	85	-	229
01 Store	80	-	-	34
01 Store	80	-	-	42
01 Store	80	-	-	41
01 Store	80	-	-	35
01 Store	80	-	-	24
01 Store	80	-	-	15
01 Store	80	-	-	40
01 Store	80	-	-	38
01 UPS	85	-	-	46
02 Bar	-	90	-	82
02 Bar	-	90	-	105
02 Bar	-	90	-	105
02 Breifing Room	90	-	-	583
02 Canteen	-	90	-	202
02 Circulation	-	85	-	62
02 Circulation	-	85	-	156
02 Circulation	-	85	-	131
02 Circulation	-	85	-	66
02 Circulation	-	85	-	583
02 Circulation	-	85	-	170
02 Circulation	-	85	-	69
02 Circulation	-	85	-	54
02 Circulation	-	85	-	175

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Circulation	-	85	-	246
02 Circulation	-	85	-	19
02 Circulation	-	85	-	106
02 Clean	80	-	-	19
02 Comms	85	-	-	48
02 Comms	85	-	-	61
02 Comms	85	-	-	59
02 Comms	85	-	-	57
02 Corner Club Lounge	-	90	-	6032
02 Female WC	-	80	-	126
02 Female WC	-	80	-	202
02 Female WC	-	80	-	220
02 Female WC	-	80	-	125
02 Female WC	-	80	-	131
02 Female WC	-	80	-	57
02 Kitchen	-	90	-	491
02 Kitchen	-	90	-	768
02 Kitchen	-	90	-	404
02 Kitchen	-	90	-	382
02 Kitchen	-	90	-	726
02 Kitchen	-	90	-	501
02 Kitchen Store	80	-	-	87
02 Lobby	-	85	-	1379
02 Lobby	-	85	-	1577
02 Lobby	-	85	-	107
02 Lobby	-	85	-	107
02 Lobby	-	85	-	101
02 Lobby	-	85	-	100
02 Locker Female	80	-	-	145
02 Locker Male	80	-	-	145
02 Loge Club	-	90	-	380
02 Loge Club	-	90	-	387
02 Loge Club	-	90	-	386
02 Male WC	-	80	-	166
02 Male WC	-	80	-	59
02 Male WC	-	80	-	124
02 Male WC	-	80	-	184
02 Male WC	-	80	-	127
02 Male WC	-	80	-	148
02 Manager	90	-	-	292
02 Pava Rack	90	-	-	69
02 Pava Rack	90	-	-	42
02 Pava Rack	90	-	-	46

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Reception	-	90	15	108
02 Stair	-	85	-	217
02 Stair	-	85	-	861
02 Stair	-	85	-	247
02 Stair	-	85	-	128
02 Stair	-	85	-	230
02 Stair	-	85	-	248
02 Stair	-	85	-	207
02 Stair	-	85	-	230
02 Stair	-	85	-	244
02 Stairs	-	85	-	229
02 Store	80	-	-	26
02 Store	80	-	-	80
02 Store	80	-	-	21
02 Store	80	-	-	63
02 Store	80	-	-	30
02 Store	80	-	-	81
02 Suite 1	-	90	-	106
02 Suite 10	-	90	-	106
02 Suite 11	-	90	-	106
02 Suite 12	-	90	-	107
02 Suite 13	-	90	-	107
02 Suite 14	-	90	-	107
02 Suite 15	-	90	-	107
02 Suite 16	-	90	-	107
02 Suite 17	-	90	-	180
02 Suite 18	-	90	-	180
02 Suite 19	-	90	-	180
02 Suite 2	-	90	-	106
02 Suite 20	-	90	-	180
02 Suite 21	-	90	-	107
02 Suite 22	-	90	-	107
02 Suite 23	-	90	-	107
02 Suite 24	-	90	-	107
02 Suite 3	-	90	-	106
02 Suite 4	-	90	-	106
02 Suite 5	-	90	-	177
02 Suite 6	-	90	-	177
02 Suite 7	-	90	-	177
02 Suite 8	-	90	-	177
02 Suite 9	-	90	-	106
02 Support Kitchen	-	90	-	1329
02 Uniform	80	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Uniform	80	-	-	36
02 Uniform	80	-	-	35
02 Uniform	80	-	-	15
02 WC	-	80	-	114
02 WC	-	80	-	168
02 WC	-	80	-	120
02 WC	-	80	-	161
03 Accessible WC	-	80	-	58
03 Accessible WC	-	80	-	74
03 Accessible WC	-	80	-	55
03 Accessible WC	-	80	-	80
03 Adult Change	-	80	-	98
03 Bar	-	90	-	457
03 Bar	-	90	-	133
03 Bar	-	90	-	380
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bin Store	80	-	-	99
03 Bin Store - Circulation	80	-	-	127
03 Circulation	-	85	-	98
03 Clean	80	-	-	36
03 Clean	80	-	-	73
03 Comms	85	-	-	81
03 Comms	85	-	-	84
03 Comms	85	-	-	83
03 Comms	85	-	-	79
03 Experiance - Night Market East	-	85	-	5238
03 Experiance - Night Market North	-	85	-	3983
03 Experiance - Night Market South	-	85	-	3737
03 Experiance Atrium Bar	-	85	-	6167
03 Female WC	-	80	-	504
03 Female WC	-	80	-	787
03 Female WC	-	80	-	349
03 Female WC	-	80	-	505
03 Female WC	-	80	-	647
03 Female WC	-	80	-	17
03 Female WC	-	80	-	527
03 Female WC	-	80	-	415
03 First Aid	80	-	-	58
03 Keg Room	80	-	-	85
03 Lobby	-	85	-	166

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
03 Lobby	-	85	-	174
03 Lobby	-	85	-	174
03 Lobby	-	85	-	166
03 Male WC	-	80	-	542
03 Male WC	-	80	-	381
03 Male WC	-	80	-	594
03 Male WC	-	80	-	464
03 Male WC	-	80	-	403
03 Merchandise Shell Unit	90	-	-	863
03 PAR	90	-	-	36
03 Stair	-	85	-	286
03 Stair	-	85	-	274
03 Stair	-	85	-	206
03 Stair	-	85	-	316
03 Stair	-	85	-	320
03 Stair	-	85	-	304
03 Stair	-	85	-	304
03 Stair	-	85	-	316
03 Stair	-	85	-	36
03 Stair	-	85	-	296
03 Store	80	-	-	105
03 Store	80	-	-	147
03 Store	80	-	-	161
03 Store	80	-	-	94
04 Accessbile WC	-	80	-	46
04 Accessible WC	-	80	-	45
04 Accessible WC	-	80	-	46
04 Archive	80	-	-	53
04 Bar	-	90	-	243
04 Bar	-	90	-	199
04 Circulation	-	85	-	204
04 Circulation	-	85	-	261
04 Circulation	-	85	-	95
04 Circulation	-	85	-	83
04 Circulation	-	85	-	134
04 Circulation	-	85	-	39
04 Circulation	-	85	-	107
04 Circulation	-	85	-	97
04 Circulation	-	85	-	105
04 Circulation	-	85	-	175
04 Circulation	-	85	-	91
04 Circulation	-	85	-	915
04 Circulation	-	85	-	167

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
04 Circulation	-	85	-	255
04 Comms	85	-	-	85
04 Comms	85	-	-	80
04 Comms	85	-	-	78
04 Comms	85	-	-	77
04 Event Control	90	-	-	647
04 Event Floor	-	70	-	27714
04 Female WC	-	80	-	206
04 Female WC	-	80	-	247
04 Lobby	-	85	-	187
04 Lobby	-	85	-	152
04 Lobby	-	85	-	159
04 Lobby	-	85	-	152
04 Male WC	-	80	-	198
04 Male WC	-	80	-	247
04 MER	90	-	-	232
04 Mobile Operations	90	-	-	436
04 Office	90	-	-	331
04 Office	90	-	-	322
04 Office	90	-	-	234
04 Office	90	-	-	230
04 Office	90	-	-	164
04 Office	90	-	-	146
04 Office	90	-	-	146
04 Office	90	-	-	797
04 Office	90	-	-	226
04 Office	90	-	-	327
04 Stair	-	85	-	300
04 Stair	-	85	-	288
04 Stair	-	85	-	288
04 Stair	-	85	-	304
04 Stair	-	85	-	189
04 Store	80	-	-	122
04 Store	80	-	-	101
04 Store	80	-	-	426
04 Terrace Bar North	-	90	-	1436
04 Terrace Bar South	-	90	-	1165
04 WC	-	80	-	167
04 WC	-	80	-	168
04 WC	-	80	-	206
05 Stair	-	85	-	330
05 Stair	-	85	-	302
05 Stair	-	85	-	709

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Hospitality Circulation	-	85	-	1273
00 Event Floor	-	70	-	31391
03 Event Floor	-	70	-	14946
05 Event Floor	-	70	-	3501
02 Loge Club	-	90	-	376
01 Event Floor	-	70	-	9661
02 Event Floor	-	70	-	7649

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 3	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Atrium	N/A	N/A
00 BEF	N/A	N/A
00 BEF	N/A	N/A
00 Bulk Store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Bulk Store	N/A	N/A
00 Clean	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Crew Catering	N/A	N/A
00 Crew WC	N/A	N/A
00 Decibel Club	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Games Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Laundry	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	NO (-57.4%)	NO
00 Local Crew	N/A	N/A
00 Male WC	N/A	N/A
00 Male WC	N/A	N/A
00 Medical	N/A	N/A
00 MER	N/A	N/A
00 Office	N/A	N/A
00 Production	N/A	N/A
00 Promoter	N/A	N/A
00 SCR	N/A	N/A
00 SCR	N/A	N/A
00 Security	N/A	N/A
00 Security Control	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Staff Entry - Staff Accreditaion	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 VIP Cloak	N/A	N/A
00 Wardrobe	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Adult Change	N/A	N/A
01 Atrium Foyer	YES (+15.6%)	NO
01 Atrium Foyer	NO (-83.9%)	NO
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bin Store	N/A	N/A
01 Bin Store	N/A	N/A
01 Box Office	N/A	N/A
01 Box Office	N/A	N/A
01 Canal Side	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 East Foyer	NO (-55.6%)	NO
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 First Aid	N/A	N/A
01 Keg Room	N/A	N/A
01 Keg Room	N/A	N/A
01 Lobby	N/A	N/A
01 Lobby	NO (-13.6%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-16.5%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-42.1%)	NO
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Merchandise	N/A	N/A
01 Merchandise	N/A	N/A
01 North Foyer	NO (-36.8%)	NO
01 Potential Retail Space	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 UPS	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Breifing Room	N/A	N/A
02 Canteen	N/A	N/A
02 Clean	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Corner Club Lounge	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Kitchen Store	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Locker Female	N/A	N/A
02 Locker Male	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Manager	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Reception	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Suite 1	N/A	N/A
02 Suite 10	N/A	N/A
02 Suite 11	N/A	N/A
02 Suite 12	N/A	N/A
02 Suite 13	N/A	N/A
02 Suite 14	N/A	N/A
02 Suite 15	N/A	N/A
02 Suite 16	N/A	N/A
02 Suite 17	N/A	N/A
02 Suite 18	N/A	N/A
02 Suite 19	N/A	N/A
02 Suite 2	N/A	N/A
02 Suite 20	N/A	N/A
02 Suite 21	N/A	N/A
02 Suite 22	N/A	N/A
02 Suite 23	N/A	N/A
02 Suite 24	N/A	N/A
02 Suite 3	N/A	N/A
02 Suite 4	N/A	N/A
02 Suite 5	N/A	N/A
02 Suite 6	N/A	N/A
02 Suite 7	N/A	N/A
02 Suite 8	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Suite 9	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Adult Change	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bin Store	N/A	N/A
03 Bin Store - Circulation	N/A	N/A
03 Clean	N/A	N/A
03 Clean	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Experiance - Night Market East	N/A	N/A
03 Experiance - Night Market North	N/A	N/A
03 Experiance - Night Market South	N/A	N/A
03 Experiance Atrium Bar	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 First Aid	N/A	N/A
03 Keg Room	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Merchandise Shell Unit	N/A	N/A
03 PAR	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
04 Accessbile WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Archive	N/A	N/A
04 Bar	N/A	N/A
04 Bar	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Event Control	N/A	N/A
04 Event Floor	N/A	N/A
04 Female WC	N/A	N/A
04 Female WC	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Male WC	N/A	N/A
04 Male WC	N/A	N/A
04 MER	N/A	N/A
04 Mobile Operations	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Terrace Bar North	N/A	N/A
04 Terrace Bar South	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Hospitality Circulation	N/A	N/A
00 Event Floor	N/A	N/A
03 Event Floor	N/A	N/A
05 Event Floor	N/A	N/A
02 Loge Club	N/A	N/A
01 Event Floor	N/A	N/A
02 Event Floor	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	53006.4	53006.4
External area [m^2]	71195.3	66724.8
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	4	3
Average conductance [W/K]	19354.3	19438.3
Average U-value [W/m^2K]	0.27	0.29
Alpha value* [%]	6.42	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
98	**D2 General Assembly and Leisure, Night Clubs, and Theatres**
	Others: Passenger terminals
	Others: Emergency services
2	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	2.66	4.02
Cooling	2.9	4.02
Auxiliary	14.5	9.27
Lighting	16.72	21.01
Hot water	37.63	36.52
Equipment*	33.17	33.17
TOTAL**	**74.41**	**74.84**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	77.24	91.85
Primary energy* [kWh/m^2]	163.96	171.31
Total emissions [kg/m^2]	26.7	27.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Constant volume system (variable fresh air rate), [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	91.2	2.9	7.9	0.2	24.8	3.22	3.47	3.61	6
	Notional	86.8	7.8	9.4	0.6	18.1	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1228.9	0	76.1	0	3.54	4.48	3.61	6
	Notional	0	1194.6	0	87.6	0	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8	35.8	0.6	2.2	11.9	3.54	4.48	3.61	6
	Notional	18.1	48.8	2	3.6	6.3	2.56	3.79	----	----
[ST] Constant volume system (fixed fresh air rate), [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	34.1	15.4	2.9	1.4	21.6	3.26	2.96	3.61	6
	Notional	63.3	40.4	6.9	3	15.3	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	77000000:Surf[2]
Floor	0.2	0.02	RM000138:Surf[112]
Roof	0.15	0.02	RM000063:Surf[154]
Windows, roof windows, and rooflights	1.5	1.6	60000000:Surf[1]
Personnel doors	1.5	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

19024 - Project Bradford - 2023 PVs

As designed

Date: Tue Feb 18 14:46:09 2020

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	27.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	27.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	21.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	77000000:Surf[2]
Floor	0.25	0.15	0.15	68000000:Surf[0]
Roof	0.25	0.15	0.2	RM000002:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	60000000:Surf[1]
Personnel doors	2.2	1.8	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	4

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Heat Pump

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	4.5	0	0	0.75
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Tech rooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	3.5	0	0	0.85
Standard value	2.5*	0.7	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- Store

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	3.5	0	0	0.75
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

4- Radiators - background Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.93	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

5- Auditorium

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	2.5	0	1.6	0.7
Standard value	1	3.2	N/A	1.6^	0.45
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 10	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 10	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 11	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 11	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 3	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 4	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 4	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 5	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 5	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 6	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 6	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 7	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 7	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Atrium	-	-	-	1.7	-	-	-	-	-	-	N/A
00 BEF	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 BEF	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Crew Catering	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Crew WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Decibel Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Games Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Laundry	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Local Crew	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 MER	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Production	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Promoter	-	-	-	1.7	-	-	-	-	-	-	N/A
00 SCR	-	-	-	1.7	-	-	-	-	-	-	N/A
00 SCR	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Security	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Security Control	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Shower - Groom	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Shower - Groom	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Staff Entry - Staff Accreditaion	-	-	-	1.7	-	-	-	-	-	-	N/A
00 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A
00 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Adult Change	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Atrium Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Atrium Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Box Office	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Box Office	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Canal Side	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 East Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Merchandise	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Merchandise	-	-	-	1.7	-	-	-	-	-	-	N/A
01 North Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Potential Retail Space	-	-	-	1.7	-	-	-	-	-	-	N/A
01 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Breifing Room	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Canteen	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Corner Club Lounge	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Manager	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Pava Rack	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Pava Rack	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Pava Rack	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Reception	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 1	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 10	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 11	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 12	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 13	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 14	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 15	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 16	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 17	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 18	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 19	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 2	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 20	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 21	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 22	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 23	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 24	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 3	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 4	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 5	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 6	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 7	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 8	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 9	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Adult Change	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market East	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market North	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market South	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance Atrium Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Merchandise Shell Unit	-	-	-	1.7	-	-	-	-	-	-	N/A
03 PAR	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessbile WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Event Control	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 MER	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Mobile Operations	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Terrace Bar North	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Terrace Bar South	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
Hospitality Circulation	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00 Artist 1	90	-	-	84
00 Artist 1	90	-	-	15
00 Artist 1	90	-	-	14
00 Artist 10	90	-	-	50
00 Artist 10	90	-	-	15
00 Artist 11	90	-	-	51
00 Artist 11	90	-	-	14
00 Artist 12	90	-	-	15
00 Artist 12	90	-	-	74
00 Artist 12	90	-	-	15
00 Artist 2	90	-	-	14
00 Artist 2	90	-	-	15
00 Artist 2	90	-	-	51
00 Artist 2	90	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Artist 3	90	-	-	42
00 Artist 4	90	-	-	51
00 Artist 4	90	-	-	15
00 Artist 5	90	-	-	52
00 Artist 5	90	-	-	15
00 Artist 6	90	-	-	15
00 Artist 6	90	-	-	47
00 Artist 7	90	-	-	47
00 Artist 7	90	-	-	15
00 Artist 8	90	-	-	15
00 Artist 8	90	-	-	51
00 Artist 8	90	-	-	14
00 Artist 9	90	-	-	15
00 Artist 9	90	-	-	14
00 Artist 9	90	-	-	44
00 Atrium	-	85	-	6850
00 BEF	90	-	-	94
00 BEF	90	-	-	70
00 Bulk Store	80	-	-	227
00 Bulk Store	80	-	-	277
00 Circulation	-	85	-	53
00 Circulation	-	85	-	66
00 Circulation	-	85	-	174
00 Circulation	-	85	-	108
00 Circulation	-	85	-	129
00 Circulation	-	85	-	140
00 Circulation	-	85	-	131
00 Circulation	-	85	-	519
00 Circulation	-	85	-	214
00 Circulation	-	85	-	121
00 Circulation	-	85	-	255
00 Circulation	-	85	-	66
00 Circulation	-	85	-	121
00 Circulation	-	85	-	157
00 Circulation	-	85	-	176
00 Circulation	-	85	-	162
00 Circulation	-	85	-	341
00 Circulation	-	85	-	322
00 Circulation	-	85	-	663
00 Circulation	-	85	-	283
00 Circulation	-	85	-	347
00 Clean	80	-	-	64
00 Commissary Kitchen	-	90	-	4609

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Concession	90	-	-	88
00 Concession	90	-	-	68
00 Concession	90	-	-	220
00 Concession	90	-	-	136
00 Concession	90	-	-	87
00 Concession	90	-	-	68
00 Crew Catering	-	90	-	557
00 Crew Kitchen	-	90	-	844
00 Crew WC	-	80	-	184
00 Decibel Club	-	90	-	976
00 Female WC	-	80	-	412
00 Female WC	-	80	-	448
00 Female WC	-	80	-	717
00 Founders Club	-	90	-	103
00 Founders Club	-	90	-	692
00 Founders Club	-	90	-	88
00 Games Room	90	-	-	874
00 Green Room	-	90	-	99
00 Green Room	-	90	-	53
00 Green Room	-	90	-	118
00 Green Room	-	90	-	365
00 Laundry	90	-	-	505
00 Lobby	-	85	-	155
00 Lobby	-	85	-	147
00 Lobby	-	85	-	41
00 Lobby	-	85	-	146
00 Lobby	-	85	-	154
00 Lobby	-	85	-	1718
00 Local Crew	90	-	-	465
00 Male WC	-	80	-	429
00 Male WC	-	80	-	234
00 Medical	80	-	-	45
00 MER	90	-	-	150
00 Office	90	-	-	285
00 Production	90	-	-	719
00 Promoter	90	-	-	942
00 SCR	90	-	-	99
00 SCR	90	-	-	94
00 Security	90	-	-	349
00 Security Control	90	-	-	993
00 Shower - Groom	-	80	-	136
00 Shower - Groom	-	80	-	151
00 Staff Entry - Staff Accreditaion	-	90	15	443

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Fire Fighting Core 04	-	85	-	283
00 Fire Fighting Core 02	-	85	-	299
00 Staircase 02	-	85	-	276
00 Fire Fighting Core 03	-	85	-	283
00 Stair	-	85	-	158
00 Staircase 03	-	85	-	266
00 Fire Fighting Core 01	-	85	-	295
00 Stair	-	85	-	40
00 Staircase 01	-	85	-	296
00 Store	80	-	-	51
00 Store	80	-	-	48
00 Store	80	-	-	75
00 Store	80	-	-	34
00 Store	80	-	-	87
00 Store	80	-	-	102
00 Store	80	-	-	153
00 Store	80	-	-	207
00 Store	80	-	-	53
00 Store	80	-	-	58
00 UPS	85	-	-	141
00 UPS	85	-	-	158
00 UPS	85	-	-	67
00 VIP Cloak	80	-	-	41
00 Wardrobe	80	-	-	56
00 WC	-	80	-	127
00 WC	-	80	-	129
00 WC	-	80	-	36
00 WC	-	80	-	46
00 WC	-	80	-	43
01 Accessible WC	-	80	-	54
01 Accessible WC	-	80	-	51
01 Accessible WC	-	80	-	62
01 Accessible WC	-	80	-	53
01 Adult Change	-	80	-	41
01 Atrium Foyer	-	85	-	4536
01 Atrium Foyer	-	85	-	772
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	119
01 Bar	-	90	-	94

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bin Store	80	-	-	22
01 Bin Store	80	-	-	38
01 Box Office	90	-	-	248
01 Box Office	90	-	-	191
01 Canal Side	-	85	-	3099
01 Circulation	-	85	-	29
01 Circulation	-	85	-	26
01 Circulation	-	85	-	15
01 Circulation	-	85	-	40
01 Circulation	-	85	-	15
01 Circulation	-	85	-	28
01 Circulation	-	85	-	28
01 Circulation	-	85	-	81
01 Circulation	-	85	-	30
01 Circulation	-	85	-	24
01 Circulation	-	85	-	29
01 Comms	85	-	-	48
01 Comms	85	-	-	52
01 Comms	85	-	-	51
01 Comms	85	-	-	49
01 Concession	90	-	-	48
01 Concession	90	-	-	80
01 Concession	90	-	-	44
01 Concession	90	-	-	77
01 Concession	90	-	-	72
01 East Foyer	-	85	-	5100
01 Female WC	-	80	-	349
01 Female WC	-	80	-	412
01 Female WC	-	80	-	259
01 Female WC	-	80	-	296
01 Female WC	-	80	-	377
01 First Aid	80	-	-	31
01 Keg Room	80	-	-	28
01 Keg Room	80	-	-	28
01 Lobby	-	85	-	107
01 Lobby	-	85	-	702
01 Lobby	-	85	-	101
01 Lobby	-	85	-	313
01 Lobby	-	85	-	107
01 Lobby	-	85	-	149

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Male WC	-	80	-	257
01 Male WC	-	80	-	313
01 Male WC	-	80	-	262
01 Male WC	-	80	-	258
01 Merchandise	90	-	-	422
01 Merchandise	90	-	-	413
01 North Foyer	-	85	-	3745
01 Potential Retail Space	90	-	-	1451
L01 Staircase 01	-	85	-	247
L01 Fire Fighting Core 01	-	85	-	244
01 Stair	-	85	-	207
01 Stair	-	85	-	51
L01 Fire Fighting Core 02	-	85	-	248
01 Stair	-	85	-	488
L01 Staircase 03	-	85	-	217
L01 Fire Fighting Core 04	-	85	-	230
01 Stair	-	85	-	100
01 Stair	-	85	-	107
L01 Fire Fighting Core 03	-	85	-	230
L01 Staircase 02	-	85	-	229
01 Store	80	-	-	34
01 Store	80	-	-	42
01 Store	80	-	-	41
01 Store	80	-	-	35
01 Store	80	-	-	24
01 Store	80	-	-	15
01 Store	80	-	-	40
01 Store	80	-	-	38
01 UPS	85	-	-	46
02 Bar	-	90	-	82
02 Bar	-	90	-	105
02 Bar	-	90	-	105
02 Breifing Room	90	-	-	583
02 Canteen	-	90	-	202
02 Circulation	-	85	-	62
02 Circulation	-	85	-	156
02 Circulation	-	85	-	131
02 Circulation	-	85	-	66
02 Circulation	-	85	-	583
02 Circulation	-	85	-	170
02 Circulation	-	85	-	69
02 Circulation	-	85	-	54
02 Circulation	-	85	-	175

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Circulation	-	85	-	246
02 Circulation	-	85	-	19
02 Circulation	-	85	-	106
02 Clean	80	-	-	19
02 Comms	85	-	-	48
02 Comms	85	-	-	61
02 Comms	85	-	-	59
02 Comms	85	-	-	57
02 Corner Club Lounge	-	90	-	6032
02 Female WC	-	80	-	126
02 Female WC	-	80	-	202
02 Female WC	-	80	-	220
02 Female WC	-	80	-	125
02 Female WC	-	80	-	131
02 Female WC	-	80	-	57
02 Kitchen	-	90	-	491
02 Kitchen	-	90	-	768
02 Kitchen	-	90	-	404
02 Kitchen	-	90	-	382
02 Kitchen	-	90	-	726
02 Kitchen	-	90	-	501
02 Kitchen Store	80	-	-	87
02 Lobby	-	85	-	1379
02 Lobby	-	85	-	1577
02 Lobby	-	85	-	107
02 Lobby	-	85	-	107
02 Lobby	-	85	-	101
02 Lobby	-	85	-	100
02 Locker Female	80	-	-	145
02 Locker Male	80	-	-	145
02 Loge Club	-	90	-	380
02 Loge Club	-	90	-	387
02 Loge Club	-	90	-	386
02 Male WC	-	80	-	166
02 Male WC	-	80	-	59
02 Male WC	-	80	-	124
02 Male WC	-	80	-	184
02 Male WC	-	80	-	127
02 Male WC	-	80	-	148
02 Manager	90	-	-	292
02 Pava Rack	90	-	-	69
02 Pava Rack	90	-	-	42
02 Pava Rack	90	-	-	46

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Reception	-	90	15	108
L02 Staircase 03	-	85	-	217
02 Stair	-	85	-	861
L02 Staircase 01	-	85	-	247
02 Stair	-	85	-	128
L02 Fire Fighting Core 03	-	85	-	230
L02 Fire Fighting Core 02	-	85	-	248
02 Stair	-	85	-	207
L02 Fire Fighting Core 04	-	85	-	230
L02 Fire Fighting Core 01	-	85	-	244
L02 Staircase 02	-	85	-	229
02 Store	80	-	-	26
02 Store	80	-	-	80
02 Store	80	-	-	21
02 Store	80	-	-	63
02 Store	80	-	-	30
02 Store	80	-	-	81
02 Suite 1	-	90	-	106
02 Suite 10	-	90	-	106
02 Suite 11	-	90	-	106
02 Suite 12	-	90	-	107
02 Suite 13	-	90	-	107
02 Suite 14	-	90	-	107
02 Suite 15	-	90	-	107
02 Suite 16	-	90	-	107
02 Suite 17	-	90	-	180
02 Suite 18	-	90	-	180
02 Suite 19	-	90	-	180
02 Suite 2	-	90	-	106
02 Suite 20	-	90	-	180
02 Suite 21	-	90	-	107
02 Suite 22	-	90	-	107
02 Suite 23	-	90	-	107
02 Suite 24	-	90	-	107
02 Suite 3	-	90	-	106
02 Suite 4	-	90	-	106
02 Suite 5	-	90	-	177
02 Suite 6	-	90	-	177
02 Suite 7	-	90	-	177
02 Suite 8	-	90	-	177
02 Suite 9	-	90	-	106
02 Support Kitchen	-	90	-	1329
02 Uniform	80	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Uniform	80	-	-	36
02 Uniform	80	-	-	35
02 Uniform	80	-	-	15
02 WC	-	80	-	114
02 WC	-	80	-	168
02 WC	-	80	-	120
02 WC	-	80	-	161
03 Accessible WC	-	80	-	58
03 Accessible WC	-	80	-	74
03 Accessible WC	-	80	-	55
03 Accessible WC	-	80	-	80
03 Adult Change	-	80	-	98
03 Bar	-	90	-	457
03 Bar	-	90	-	133
03 Bar	-	90	-	380
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bin Store	80	-	-	99
03 Bin Store - Circulation	80	-	-	127
03 Circulation	-	85	-	98
03 Clean	80	-	-	36
03 Clean	80	-	-	73
03 Comms	85	-	-	81
03 Comms	85	-	-	84
03 Comms	85	-	-	83
03 Comms	85	-	-	79
03 Experiance - Night Market East	-	85	-	5238
03 Experiance - Night Market North	-	85	-	3983
03 Experiance - Night Market South	-	85	-	3737
03 Experiance Atrium Bar	-	85	-	6167
03 Female WC	-	80	-	504
03 Female WC	-	80	-	787
03 Female WC	-	80	-	349
03 Female WC	-	80	-	505
03 Female WC	-	80	-	647
03 Female WC	-	80	-	17
03 Female WC	-	80	-	527
03 Female WC	-	80	-	415
03 First Aid	80	-	-	58
03 Keg Room	80	-	-	85
03 Lobby	-	85	-	166

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
03 Lobby	-	85	-	174
03 Lobby	-	85	-	174
03 Lobby	-	85	-	166
03 Male WC	-	80	-	542
03 Male WC	-	80	-	381
03 Male WC	-	80	-	594
03 Male WC	-	80	-	464
03 Male WC	-	80	-	403
03 Merchandise Shell Unit	90	-	-	863
03 PAR	90	-	-	36
L03 Staircase 03	-	85	-	286
03 Stair	-	85	-	274
03 Stair	-	85	-	206
L03 Staircase 01	-	85	-	316
L03 Fire Fighting Core 02	-	85	-	320
L03 Fire Fighting Core 03	-	85	-	304
L03 Fire Fighting Core 04	-	85	-	304
L03 Fire Fighting Core 01	-	85	-	316
03 Stair	-	85	-	36
L03 Staircase 03	-	85	-	296
03 Store	80	-	-	105
03 Store	80	-	-	147
03 Store	80	-	-	161
03 Store	80	-	-	94
04 Accessbile WC	-	80	-	46
04 Accessible WC	-	80	-	45
04 Accessible WC	-	80	-	46
04 Archive	80	-	-	53
04 Bar	-	90	-	243
04 Bar	-	90	-	199
04 Circulation	-	85	-	204
04 Circulation	-	85	-	261
04 Circulation	-	85	-	95
04 Circulation	-	85	-	83
04 Circulation	-	85	-	134
04 Circulation	-	85	-	39
04 Circulation	-	85	-	107
04 Circulation	-	85	-	97
04 Circulation	-	85	-	105
04 Circulation	-	85	-	175
04 Circulation	-	85	-	91
04 Circulation	-	85	-	915
04 Circulation	-	85	-	167

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
04 Circulation	-	85	-	255
04 Comms	85	-	-	85
04 Comms	85	-	-	80
04 Comms	85	-	-	78
04 Comms	85	-	-	77
04 Event Control	90	-	-	647
04 Event Floor	-	70	-	27714
04 Female WC	-	80	-	206
04 Female WC	-	80	-	247
04 Lobby	-	85	-	187
04 Lobby	-	85	-	152
04 Lobby	-	85	-	159
04 Lobby	-	85	-	152
04 Male WC	-	80	-	198
04 Male WC	-	80	-	247
04 MER	90	-	-	232
04 Mobile Operations	90	-	-	436
04 Office	90	-	-	331
04 Office	90	-	-	322
04 Office	90	-	-	234
04 Office	90	-	-	230
04 Office	90	-	-	164
04 Office	90	-	-	146
04 Office	90	-	-	146
04 Office	90	-	-	797
04 Office	90	-	-	226
04 Office	90	-	-	327
L04 Fire Fighting Core 01	-	85	-	300
L04 Fire Fighting Core 04	-	85	-	288
L04 Fire Fighting Core 03	-	85	-	288
L04 Fire Fighting Core 02	-	85	-	304
04 Stair	-	85	-	189
04 Store	80	-	-	122
04 Store	80	-	-	101
04 Store	80	-	-	426
04 Terrace Bar North	-	90	-	1436
04 Terrace Bar South	-	90	-	1165
04 WC	-	80	-	167
04 WC	-	80	-	168
04 WC	-	80	-	206
05 Stair	-	85	-	330
05 Stair	-	85	-	302
05 Stair	-	85	-	709

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Hospitality Circulation	-	85	-	1273
00 Event Floor	-	70	-	31391
03 Event Floor	-	70	-	14946
05 Event Floor	-	70	-	3501
02 Loge Club	-	90	-	376
01 Event Floor	-	70	-	9661
02 Event Floor	-	70	-	7649

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 3	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Atrium	N/A	N/A
00 BEF	N/A	N/A
00 BEF	N/A	N/A
00 Bulk Store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Bulk Store	N/A	N/A
00 Clean	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Crew Catering	N/A	N/A
00 Crew WC	N/A	N/A
00 Decibel Club	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Games Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Laundry	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	NO (-57.4%)	NO
00 Local Crew	N/A	N/A
00 Male WC	N/A	N/A
00 Male WC	N/A	N/A
00 Medical	N/A	N/A
00 MER	N/A	N/A
00 Office	N/A	N/A
00 Production	N/A	N/A
00 Promoter	N/A	N/A
00 SCR	N/A	N/A
00 SCR	N/A	N/A
00 Security	N/A	N/A
00 Security Control	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Staff Entry - Staff Accreditaion	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 VIP Cloak	N/A	N/A
00 Wardrobe	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Adult Change	N/A	N/A
01 Atrium Foyer	YES (+15.6%)	NO
01 Atrium Foyer	NO (-83.9%)	NO
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bin Store	N/A	N/A
01 Bin Store	N/A	N/A
01 Box Office	N/A	N/A
01 Box Office	N/A	N/A
01 Canal Side	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 East Foyer	NO (-55.6%)	NO
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 First Aid	N/A	N/A
01 Keg Room	N/A	N/A
01 Keg Room	N/A	N/A
01 Lobby	N/A	N/A
01 Lobby	NO (-13.6%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-16.5%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-42.1%)	NO
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Merchandise	N/A	N/A
01 Merchandise	N/A	N/A
01 North Foyer	NO (-36.8%)	NO
01 Potential Retail Space	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 UPS	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Breifing Room	N/A	N/A
02 Canteen	N/A	N/A
02 Clean	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Corner Club Lounge	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Kitchen Store	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Locker Female	N/A	N/A
02 Locker Male	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Manager	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Reception	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Suite 1	N/A	N/A
02 Suite 10	N/A	N/A
02 Suite 11	N/A	N/A
02 Suite 12	N/A	N/A
02 Suite 13	N/A	N/A
02 Suite 14	N/A	N/A
02 Suite 15	N/A	N/A
02 Suite 16	N/A	N/A
02 Suite 17	N/A	N/A
02 Suite 18	N/A	N/A
02 Suite 19	N/A	N/A
02 Suite 2	N/A	N/A
02 Suite 20	N/A	N/A
02 Suite 21	N/A	N/A
02 Suite 22	N/A	N/A
02 Suite 23	N/A	N/A
02 Suite 24	N/A	N/A
02 Suite 3	N/A	N/A
02 Suite 4	N/A	N/A
02 Suite 5	N/A	N/A
02 Suite 6	N/A	N/A
02 Suite 7	N/A	N/A
02 Suite 8	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Suite 9	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Adult Change	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bin Store	N/A	N/A
03 Bin Store - Circulation	N/A	N/A
03 Clean	N/A	N/A
03 Clean	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Experiance - Night Market East	N/A	N/A
03 Experiance - Night Market North	N/A	N/A
03 Experiance - Night Market South	N/A	N/A
03 Experiance Atrium Bar	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 First Aid	N/A	N/A
03 Keg Room	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Merchandise Shell Unit	N/A	N/A
03 PAR	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
04 Accessbile WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Archive	N/A	N/A
04 Bar	N/A	N/A
04 Bar	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Event Control	N/A	N/A
04 Event Floor	N/A	N/A
04 Female WC	N/A	N/A
04 Female WC	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Male WC	N/A	N/A
04 Male WC	N/A	N/A
04 MER	N/A	N/A
04 Mobile Operations	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Terrace Bar North	N/A	N/A
04 Terrace Bar South	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Hospitality Circulation	N/A	N/A
00 Event Floor	N/A	N/A
03 Event Floor	N/A	N/A
05 Event Floor	N/A	N/A
02 Loge Club	N/A	N/A
01 Event Floor	N/A	N/A
02 Event Floor	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	53006.4	53006.4
External area [m²]	71195.3	66724.8
Weather	MAN	MAN
Infiltration [m³/hm²@ 50Pa]	4	3
Average conductance [W/K]	19354.3	19438.3
Average U-value [W/m²K]	0.27	0.29
Alpha value* [%]	6.42	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
98	**D2 General Assembly and Leisure, Night Clubs, and Theatres**
	Others: Passenger terminals
	Others: Emergency services
2	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.62	9.14
Cooling	3.62	3.9
Auxiliary	13.58	8.52
Lighting	16.72	21.01
Hot water	37.35	36.39
Equipment*	33.17	33.17
TOTAL**	**75.9**	**78.97**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	9.35	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	90.38	103.85
Primary energy* [kWh/m²]	160.92	172.87
Total emissions [kg/m²]	21.7	27.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Constant volume system (variable fresh air rate), [HS] Heat pump (gas/oil): air source, [HFT] Natural Gas, [CFT] Electrici										
	Actual	100.4	3.3	8.7	0.4	24.8	3.22	2.09	3.61	3.61
	Notional	87.2	7.7	18.3	0.6	18	1.33	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	67.2	0	22.5	0	4.2	0.83	0	0.93	0
	Notional	111.4	0	35.9	0	2	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1222.8	0	75.7	13.6	3.54	4.48	3.61	6
	Notional	0	1188.3	0	87.1	7.2	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8.1	35.2	0.6	3.6	11.9	3.54	2.7	3.61	3.61
	Notional	18	47.3	2	3.5	6.3	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	147.5	14.7	11.6	0.9	0	3.54	4.48	3.61	6
	Notional	181.1	30.5	19.7	2.2	0	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	77000000:Surf[2]
Floor	0.2	0.02	RM000138:Surf[112]
Roof	0.15	0.02	RM000063:Surf[154]
Windows, roof windows, and rooflights	1.5	1.6	60000000:Surf[1]
Personnel doors	1.5	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

19024 - Project Bradford - 2020 PVs

As designed

Date: Tue Feb 18 13:19:41 2020

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	27.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	27.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	22.6
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	77000000:Surf[2]
Floor	0.25	0.15	0.15	68000000:Surf[0]
Roof	0.25	0.15	0.2	RM000002:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	60000000:Surf[1]
Personnel doors	2.2	1.8	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	4

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Heat Pump

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	4.5	0	0	0.75
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Tech rooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	3.5	0	0	0.85
Standard value	2.5*	0.7	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- Store

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	3.5	0	0	0.75
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

4- Radiators - background Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.93	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

5- Auditorium

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.61	2.5	0	1.6	0.7
Standard value	1	3.2	N/A	1.6^	0.45
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 1	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 10	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 10	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 11	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 11	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 12	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 2	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 3	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 4	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 4	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 5	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 5	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 6	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 6	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 7	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 7	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 8	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Artist 9	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Atrium	-	-	-	1.7	-	-	-	-	-	-	N/A
00 BEF	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 BEF	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Crew Catering	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Crew WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Decibel Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Founders Club	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Games Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Green Room	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Laundry	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Local Crew	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 MER	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Production	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Promoter	-	-	-	1.7	-	-	-	-	-	-	N/A
00 SCR	-	-	-	1.7	-	-	-	-	-	-	N/A
00 SCR	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Security	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Security Control	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Shower - Groom	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Shower - Groom	-	-	-	1.7	-	-	-	-	-	-	N/A
00 Staff Entry - Staff Accreditaion	-	-	-	1.7	-	-	-	-	-	-	N/A
00 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A
00 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
00 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Adult Change	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Atrium Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Atrium Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Box Office	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Box Office	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Canal Side	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Concession	-	-	-	1.7	-	-	-	-	-	-	N/A
01 East Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Merchandise	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Merchandise	-	-	-	1.7	-	-	-	-	-	-	N/A
01 North Foyer	-	-	-	1.7	-	-	-	-	-	-	N/A
01 Potential Retail Space	-	-	-	1.7	-	-	-	-	-	-	N/A
01 UPS	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Breifing Room	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Canteen	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Corner Club Lounge	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Manager	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Pava Rack	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Pava Rack	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Pava Rack	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Reception	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 1	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 10	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 11	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 12	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 13	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 14	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 15	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 16	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 17	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 18	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 19	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 2	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 20	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 21	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 22	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 23	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 24	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 3	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 4	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 5	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 6	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 7	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 8	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Suite 9	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
02 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Adult Change	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market East	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market North	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance - Night Market South	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Experiance Atrium Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
03 Merchandise Shell Unit	-	-	-	1.7	-	-	-	-	-	-	N/A
03 PAR	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessbile WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Accessible WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Bar	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Comms	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Event Control	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Female WC	-	-	-	1.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Lobby	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Male WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 MER	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Mobile Operations	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Office	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Terrace Bar North	-	-	-	1.7	-	-	-	-	-	-	N/A
04 Terrace Bar South	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
04 WC	-	-	-	1.7	-	-	-	-	-	-	N/A
Hospitality Circulation	-	-	-	1.7	-	-	-	-	-	-	N/A
02 Loge Club	-	-	-	1.7	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00 Artist 1	90	-	-	84
00 Artist 1	90	-	-	15
00 Artist 1	90	-	-	14
00 Artist 10	90	-	-	50
00 Artist 10	90	-	-	15
00 Artist 11	90	-	-	51
00 Artist 11	90	-	-	14
00 Artist 12	90	-	-	15
00 Artist 12	90	-	-	74
00 Artist 12	90	-	-	15
00 Artist 2	90	-	-	14
00 Artist 2	90	-	-	15
00 Artist 2	90	-	-	51
00 Artist 2	90	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Artist 3	90	-	-	42
00 Artist 4	90	-	-	51
00 Artist 4	90	-	-	15
00 Artist 5	90	-	-	52
00 Artist 5	90	-	-	15
00 Artist 6	90	-	-	15
00 Artist 6	90	-	-	47
00 Artist 7	90	-	-	47
00 Artist 7	90	-	-	15
00 Artist 8	90	-	-	15
00 Artist 8	90	-	-	51
00 Artist 8	90	-	-	14
00 Artist 9	90	-	-	15
00 Artist 9	90	-	-	14
00 Artist 9	90	-	-	44
00 Atrium	-	85	-	6850
00 BEF	90	-	-	94
00 BEF	90	-	-	70
00 Bulk Store	80	-	-	227
00 Bulk Store	80	-	-	277
00 Circulation	-	85	-	53
00 Circulation	-	85	-	66
00 Circulation	-	85	-	174
00 Circulation	-	85	-	108
00 Circulation	-	85	-	129
00 Circulation	-	85	-	140
00 Circulation	-	85	-	131
00 Circulation	-	85	-	519
00 Circulation	-	85	-	214
00 Circulation	-	85	-	121
00 Circulation	-	85	-	255
00 Circulation	-	85	-	66
00 Circulation	-	85	-	121
00 Circulation	-	85	-	157
00 Circulation	-	85	-	176
00 Circulation	-	85	-	162
00 Circulation	-	85	-	341
00 Circulation	-	85	-	322
00 Circulation	-	85	-	663
00 Circulation	-	85	-	283
00 Circulation	-	85	-	347
00 Clean	80	-	-	64
00 Commissary Kitchen	-	90	-	4609

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Concession	90	-	-	88
00 Concession	90	-	-	68
00 Concession	90	-	-	220
00 Concession	90	-	-	136
00 Concession	90	-	-	87
00 Concession	90	-	-	68
00 Crew Catering	-	90	-	557
00 Crew Kitchen	-	90	-	844
00 Crew WC	-	80	-	184
00 Decibel Club	-	90	-	976
00 Female WC	-	80	-	412
00 Female WC	-	80	-	448
00 Female WC	-	80	-	717
00 Founders Club	-	90	-	103
00 Founders Club	-	90	-	692
00 Founders Club	-	90	-	88
00 Games Room	90	-	-	874
00 Green Room	-	90	-	99
00 Green Room	-	90	-	53
00 Green Room	-	90	-	118
00 Green Room	-	90	-	365
00 Laundry	90	-	-	505
00 Lobby	-	85	-	155
00 Lobby	-	85	-	147
00 Lobby	-	85	-	41
00 Lobby	-	85	-	146
00 Lobby	-	85	-	154
00 Lobby	-	85	-	1718
00 Local Crew	90	-	-	465
00 Male WC	-	80	-	429
00 Male WC	-	80	-	234
00 Medical	80	-	-	45
00 MER	90	-	-	150
00 Office	90	-	-	285
00 Production	90	-	-	719
00 Promoter	90	-	-	942
00 SCR	90	-	-	99
00 SCR	90	-	-	94
00 Security	90	-	-	349
00 Security Control	90	-	-	993
00 Shower - Groom	-	80	-	136
00 Shower - Groom	-	80	-	151
00 Staff Entry - Staff Accreditaion	-	90	15	443

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Fire Fighting Core 04	-	85	-	283
00 Fire Fighting Core 02	-	85	-	299
00 Staircase 02	-	85	-	276
00 Fire Fighting Core 03	-	85	-	283
00 Stair	-	85	-	158
00 Staircase 03	-	85	-	266
00 Fire Fighting Core 01	-	85	-	295
00 Stair	-	85	-	40
00 Staircase 01	-	85	-	296
00 Store	80	-	-	51
00 Store	80	-	-	48
00 Store	80	-	-	75
00 Store	80	-	-	34
00 Store	80	-	-	87
00 Store	80	-	-	102
00 Store	80	-	-	153
00 Store	80	-	-	207
00 Store	80	-	-	53
00 Store	80	-	-	58
00 UPS	85	-	-	141
00 UPS	85	-	-	158
00 UPS	85	-	-	67
00 VIP Cloak	80	-	-	41
00 Wardrobe	80	-	-	56
00 WC	-	80	-	127
00 WC	-	80	-	129
00 WC	-	80	-	36
00 WC	-	80	-	46
00 WC	-	80	-	43
01 Accessible WC	-	80	-	54
01 Accessible WC	-	80	-	51
01 Accessible WC	-	80	-	62
01 Accessible WC	-	80	-	53
01 Adult Change	-	80	-	41
01 Atrium Foyer	-	85	-	4536
01 Atrium Foyer	-	85	-	772
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	119
01 Bar	-	90	-	94

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bar	-	90	-	94
01 Bin Store	80	-	-	22
01 Bin Store	80	-	-	38
01 Box Office	90	-	-	248
01 Box Office	90	-	-	191
01 Canal Side	-	85	-	3099
01 Circulation	-	85	-	29
01 Circulation	-	85	-	26
01 Circulation	-	85	-	15
01 Circulation	-	85	-	40
01 Circulation	-	85	-	15
01 Circulation	-	85	-	28
01 Circulation	-	85	-	28
01 Circulation	-	85	-	81
01 Circulation	-	85	-	30
01 Circulation	-	85	-	24
01 Circulation	-	85	-	29
01 Comms	85	-	-	48
01 Comms	85	-	-	52
01 Comms	85	-	-	51
01 Comms	85	-	-	49
01 Concession	90	-	-	48
01 Concession	90	-	-	80
01 Concession	90	-	-	44
01 Concession	90	-	-	77
01 Concession	90	-	-	72
01 East Foyer	-	85	-	5100
01 Female WC	-	80	-	349
01 Female WC	-	80	-	412
01 Female WC	-	80	-	259
01 Female WC	-	80	-	296
01 Female WC	-	80	-	377
01 First Aid	80	-	-	31
01 Keg Room	80	-	-	28
01 Keg Room	80	-	-	28
01 Lobby	-	85	-	107
01 Lobby	-	85	-	702
01 Lobby	-	85	-	101
01 Lobby	-	85	-	313
01 Lobby	-	85	-	107
01 Lobby	-	85	-	149

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Male WC	-	80	-	257
01 Male WC	-	80	-	313
01 Male WC	-	80	-	262
01 Male WC	-	80	-	258
01 Merchandise	90	-	-	422
01 Merchandise	90	-	-	413
01 North Foyer	-	85	-	3745
01 Potential Retail Space	90	-	-	1451
L01 Staircase 01	-	85	-	247
L01 Fire Fighting Core 01	-	85	-	244
01 Stair	-	85	-	207
01 Stair	-	85	-	51
L01 Fire Fighting Core 02	-	85	-	248
01 Stair	-	85	-	488
L01 Staircase 03	-	85	-	217
L01 Fire Fighting Core 04	-	85	-	230
01 Stair	-	85	-	100
01 Stair	-	85	-	107
L01 Fire Fighting Core 03	-	85	-	230
L01 Staircase 02	-	85	-	229
01 Store	80	-	-	34
01 Store	80	-	-	42
01 Store	80	-	-	41
01 Store	80	-	-	35
01 Store	80	-	-	24
01 Store	80	-	-	15
01 Store	80	-	-	40
01 Store	80	-	-	38
01 UPS	85	-	-	46
02 Bar	-	90	-	82
02 Bar	-	90	-	105
02 Bar	-	90	-	105
02 Breifing Room	90	-	-	583
02 Canteen	-	90	-	202
02 Circulation	-	85	-	62
02 Circulation	-	85	-	156
02 Circulation	-	85	-	131
02 Circulation	-	85	-	66
02 Circulation	-	85	-	583
02 Circulation	-	85	-	170
02 Circulation	-	85	-	69
02 Circulation	-	85	-	54
02 Circulation	-	85	-	175

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Circulation	-	85	-	246
02 Circulation	-	85	-	19
02 Circulation	-	85	-	106
02 Clean	80	-	-	19
02 Comms	85	-	-	48
02 Comms	85	-	-	61
02 Comms	85	-	-	59
02 Comms	85	-	-	57
02 Corner Club Lounge	-	90	-	6032
02 Female WC	-	80	-	126
02 Female WC	-	80	-	202
02 Female WC	-	80	-	220
02 Female WC	-	80	-	125
02 Female WC	-	80	-	131
02 Female WC	-	80	-	57
02 Kitchen	-	90	-	491
02 Kitchen	-	90	-	768
02 Kitchen	-	90	-	404
02 Kitchen	-	90	-	382
02 Kitchen	-	90	-	726
02 Kitchen	-	90	-	501
02 Kitchen Store	80	-	-	87
02 Lobby	-	85	-	1379
02 Lobby	-	85	-	1577
02 Lobby	-	85	-	107
02 Lobby	-	85	-	107
02 Lobby	-	85	-	101
02 Lobby	-	85	-	100
02 Locker Female	80	-	-	145
02 Locker Male	80	-	-	145
02 Loge Club	-	90	-	380
02 Loge Club	-	90	-	387
02 Loge Club	-	90	-	386
02 Male WC	-	80	-	166
02 Male WC	-	80	-	59
02 Male WC	-	80	-	124
02 Male WC	-	80	-	184
02 Male WC	-	80	-	127
02 Male WC	-	80	-	148
02 Manager	90	-	-	292
02 Pava Rack	90	-	-	69
02 Pava Rack	90	-	-	42
02 Pava Rack	90	-	-	46

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Reception	-	90	15	108
L02 Staircase 03	-	85	-	217
02 Stair	-	85	-	861
L02 Staircase 01	-	85	-	247
02 Stair	-	85	-	128
L02 Fire Fighting Core 03	-	85	-	230
L02 Fire Fighting Core 02	-	85	-	248
02 Stair	-	85	-	207
L02 Fire Fighting Core 04	-	85	-	230
L02 Fire Fighting Core 01	-	85	-	244
L02 Staircase 02	-	85	-	229
02 Store	80	-	-	26
02 Store	80	-	-	80
02 Store	80	-	-	21
02 Store	80	-	-	63
02 Store	80	-	-	30
02 Store	80	-	-	81
02 Suite 1	-	90	-	106
02 Suite 10	-	90	-	106
02 Suite 11	-	90	-	106
02 Suite 12	-	90	-	107
02 Suite 13	-	90	-	107
02 Suite 14	-	90	-	107
02 Suite 15	-	90	-	107
02 Suite 16	-	90	-	107
02 Suite 17	-	90	-	180
02 Suite 18	-	90	-	180
02 Suite 19	-	90	-	180
02 Suite 2	-	90	-	106
02 Suite 20	-	90	-	180
02 Suite 21	-	90	-	107
02 Suite 22	-	90	-	107
02 Suite 23	-	90	-	107
02 Suite 24	-	90	-	107
02 Suite 3	-	90	-	106
02 Suite 4	-	90	-	106
02 Suite 5	-	90	-	177
02 Suite 6	-	90	-	177
02 Suite 7	-	90	-	177
02 Suite 8	-	90	-	177
02 Suite 9	-	90	-	106
02 Support Kitchen	-	90	-	1329
02 Uniform	80	-	-	15

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02 Uniform	80	-	-	36
02 Uniform	80	-	-	35
02 Uniform	80	-	-	15
02 WC	-	80	-	114
02 WC	-	80	-	168
02 WC	-	80	-	120
02 WC	-	80	-	161
03 Accessible WC	-	80	-	58
03 Accessible WC	-	80	-	74
03 Accessible WC	-	80	-	55
03 Accessible WC	-	80	-	80
03 Adult Change	-	80	-	98
03 Bar	-	90	-	457
03 Bar	-	90	-	133
03 Bar	-	90	-	380
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bar	-	90	-	133
03 Bin Store	80	-	-	99
03 Bin Store - Circulation	80	-	-	127
03 Circulation	-	85	-	98
03 Clean	80	-	-	36
03 Clean	80	-	-	73
03 Comms	85	-	-	81
03 Comms	85	-	-	84
03 Comms	85	-	-	83
03 Comms	85	-	-	79
03 Experiance - Night Market East	-	85	-	5238
03 Experiance - Night Market North	-	85	-	3983
03 Experiance - Night Market South	-	85	-	3737
03 Experiance Atrium Bar	-	85	-	6167
03 Female WC	-	80	-	504
03 Female WC	-	80	-	787
03 Female WC	-	80	-	349
03 Female WC	-	80	-	505
03 Female WC	-	80	-	647
03 Female WC	-	80	-	17
03 Female WC	-	80	-	527
03 Female WC	-	80	-	415
03 First Aid	80	-	-	58
03 Keg Room	80	-	-	85
03 Lobby	-	85	-	166

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
03 Lobby	-	85	-	174
03 Lobby	-	85	-	174
03 Lobby	-	85	-	166
03 Male WC	-	80	-	542
03 Male WC	-	80	-	381
03 Male WC	-	80	-	594
03 Male WC	-	80	-	464
03 Male WC	-	80	-	403
03 Merchandise Shell Unit	90	-	-	863
03 PAR	90	-	-	36
L03 Staircase 03	-	85	-	286
03 Stair	-	85	-	274
03 Stair	-	85	-	206
L03 Staircase 01	-	85	-	316
L03 Fire Fighting Core 02	-	85	-	320
L03 Fire Fighting Core 03	-	85	-	304
L03 Fire Fighting Core 04	-	85	-	304
L03 Fire Fighting Core 01	-	85	-	316
03 Stair	-	85	-	36
L03 Staircase 03	-	85	-	296
03 Store	80	-	-	105
03 Store	80	-	-	147
03 Store	80	-	-	161
03 Store	80	-	-	94
04 Accessbile WC	-	80	-	46
04 Accessible WC	-	80	-	45
04 Accessible WC	-	80	-	46
04 Archive	80	-	-	53
04 Bar	-	90	-	243
04 Bar	-	90	-	199
04 Circulation	-	85	-	204
04 Circulation	-	85	-	261
04 Circulation	-	85	-	95
04 Circulation	-	85	-	83
04 Circulation	-	85	-	134
04 Circulation	-	85	-	39
04 Circulation	-	85	-	107
04 Circulation	-	85	-	97
04 Circulation	-	85	-	105
04 Circulation	-	85	-	175
04 Circulation	-	85	-	91
04 Circulation	-	85	-	915
04 Circulation	-	85	-	167

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
04 Circulation	-	85	-	255
04 Comms	85	-	-	85
04 Comms	85	-	-	80
04 Comms	85	-	-	78
04 Comms	85	-	-	77
04 Event Control	90	-	-	647
04 Event Floor	-	70	-	27714
04 Female WC	-	80	-	206
04 Female WC	-	80	-	247
04 Lobby	-	85	-	187
04 Lobby	-	85	-	152
04 Lobby	-	85	-	159
04 Lobby	-	85	-	152
04 Male WC	-	80	-	198
04 Male WC	-	80	-	247
04 MER	90	-	-	232
04 Mobile Operations	90	-	-	436
04 Office	90	-	-	331
04 Office	90	-	-	322
04 Office	90	-	-	234
04 Office	90	-	-	230
04 Office	90	-	-	164
04 Office	90	-	-	146
04 Office	90	-	-	146
04 Office	90	-	-	797
04 Office	90	-	-	226
04 Office	90	-	-	327
L04 Fire Fighting Core 01	-	85	-	300
L04 Fire Fighting Core 04	-	85	-	288
L04 Fire Fighting Core 03	-	85	-	288
L04 Fire Fighting Core 02	-	85	-	304
04 Stair	-	85	-	189
04 Store	80	-	-	122
04 Store	80	-	-	101
04 Store	80	-	-	426
04 Terrace Bar North	-	90	-	1436
04 Terrace Bar South	-	90	-	1165
04 WC	-	80	-	167
04 WC	-	80	-	168
04 WC	-	80	-	206
05 Stair	-	85	-	330
05 Stair	-	85	-	302
05 Stair	-	85	-	709

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Hospitality Circulation	-	85	-	1273
00 Event Floor	-	70	-	31391
03 Event Floor	-	70	-	14946
05 Event Floor	-	70	-	3501
02 Loge Club	-	90	-	376
01 Event Floor	-	70	-	9661
02 Event Floor	-	70	-	7649

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 1	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 10	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 11	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 12	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 2	N/A	N/A
00 Artist 3	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 4	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 5	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 6	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 7	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 8	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Artist 9	N/A	N/A
00 Atrium	N/A	N/A
00 BEF	N/A	N/A
00 BEF	N/A	N/A
00 Bulk Store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Bulk Store	N/A	N/A
00 Clean	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Concession	N/A	N/A
00 Crew Catering	N/A	N/A
00 Crew WC	N/A	N/A
00 Decibel Club	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Female WC	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Founders Club	N/A	N/A
00 Games Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Green Room	N/A	N/A
00 Laundry	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	N/A	N/A
00 Lobby	NO (-57.4%)	NO
00 Local Crew	N/A	N/A
00 Male WC	N/A	N/A
00 Male WC	N/A	N/A
00 Medical	N/A	N/A
00 MER	N/A	N/A
00 Office	N/A	N/A
00 Production	N/A	N/A
00 Promoter	N/A	N/A
00 SCR	N/A	N/A
00 SCR	N/A	N/A
00 Security	N/A	N/A
00 Security Control	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Shower - Groom	N/A	N/A
00 Staff Entry - Staff Accreditaion	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 Store	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 UPS	N/A	N/A
00 VIP Cloak	N/A	N/A
00 Wardrobe	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
00 WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Accessible WC	N/A	N/A
01 Adult Change	N/A	N/A
01 Atrium Foyer	YES (+15.6%)	NO
01 Atrium Foyer	NO (-83.9%)	NO
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bar	N/A	N/A
01 Bin Store	N/A	N/A
01 Bin Store	N/A	N/A
01 Box Office	N/A	N/A
01 Box Office	N/A	N/A
01 Canal Side	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Comms	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 Concession	N/A	N/A
01 East Foyer	NO (-55.6%)	NO
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 Female WC	N/A	N/A
01 First Aid	N/A	N/A
01 Keg Room	N/A	N/A
01 Keg Room	N/A	N/A
01 Lobby	N/A	N/A
01 Lobby	NO (-13.6%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-16.5%)	NO
01 Lobby	N/A	N/A
01 Lobby	NO (-42.1%)	NO
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Male WC	N/A	N/A
01 Merchandise	N/A	N/A
01 Merchandise	N/A	N/A
01 North Foyer	NO (-36.8%)	NO
01 Potential Retail Space	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 Store	N/A	N/A
01 UPS	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Bar	N/A	N/A
02 Breifing Room	N/A	N/A
02 Canteen	N/A	N/A
02 Clean	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Comms	N/A	N/A
02 Corner Club Lounge	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Female WC	N/A	N/A
02 Kitchen Store	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Lobby	N/A	N/A
02 Locker Female	N/A	N/A
02 Locker Male	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Loge Club	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Male WC	N/A	N/A
02 Manager	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Pava Rack	N/A	N/A
02 Reception	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Store	N/A	N/A
02 Suite 1	N/A	N/A
02 Suite 10	N/A	N/A
02 Suite 11	N/A	N/A
02 Suite 12	N/A	N/A
02 Suite 13	N/A	N/A
02 Suite 14	N/A	N/A
02 Suite 15	N/A	N/A
02 Suite 16	N/A	N/A
02 Suite 17	N/A	N/A
02 Suite 18	N/A	N/A
02 Suite 19	N/A	N/A
02 Suite 2	N/A	N/A
02 Suite 20	N/A	N/A
02 Suite 21	N/A	N/A
02 Suite 22	N/A	N/A
02 Suite 23	N/A	N/A
02 Suite 24	N/A	N/A
02 Suite 3	N/A	N/A
02 Suite 4	N/A	N/A
02 Suite 5	N/A	N/A
02 Suite 6	N/A	N/A
02 Suite 7	N/A	N/A
02 Suite 8	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Suite 9	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 Uniform	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
02 WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Accessible WC	N/A	N/A
03 Adult Change	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bar	N/A	N/A
03 Bin Store	N/A	N/A
03 Bin Store - Circulation	N/A	N/A
03 Clean	N/A	N/A
03 Clean	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Comms	N/A	N/A
03 Experiance - Night Market East	N/A	N/A
03 Experiance - Night Market North	N/A	N/A
03 Experiance - Night Market South	N/A	N/A
03 Experiance Atrium Bar	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 Female WC	N/A	N/A
03 First Aid	N/A	N/A
03 Keg Room	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Lobby	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Male WC	N/A	N/A
03 Merchandise Shell Unit	N/A	N/A
03 PAR	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
03 Store	N/A	N/A
04 Accessbile WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Accessible WC	N/A	N/A
04 Archive	N/A	N/A
04 Bar	N/A	N/A
04 Bar	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Comms	N/A	N/A
04 Event Control	N/A	N/A
04 Event Floor	N/A	N/A
04 Female WC	N/A	N/A
04 Female WC	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Lobby	N/A	N/A
04 Male WC	N/A	N/A
04 Male WC	N/A	N/A
04 MER	N/A	N/A
04 Mobile Operations	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Office	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Store	N/A	N/A
04 Terrace Bar North	N/A	N/A
04 Terrace Bar South	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A
04 WC	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Hospitality Circulation	N/A	N/A
00 Event Floor	N/A	N/A
03 Event Floor	N/A	N/A
05 Event Floor	N/A	N/A
02 Loge Club	N/A	N/A
01 Event Floor	N/A	N/A
02 Event Floor	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	53006.4	53006.4
External area [m²]	71195.3	66724.8
Weather	MAN	MAN
Infiltration [m³/hm²@ 50Pa]	4	3
Average conductance [W/K]	19354.3	19438.3
Average U-value [W/m²K]	0.27	0.29
Alpha value* [%]	6.42	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
98	**D2 General Assembly and Leisure, Night Clubs, and Theatres**
	Others: Passenger terminals
	Others: Emergency services
2	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.62	9.14
Cooling	3.62	3.9
Auxiliary	13.58	8.52
Lighting	16.72	21.01
Hot water	37.35	36.39
Equipment*	33.17	33.17
TOTAL**	**75.9**	**78.97**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	7.65	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	90.38	103.85
Primary energy* [kWh/m²]	160.92	172.87
Total emissions [kg/m²]	22.6	27.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Constant volume system (variable fresh air rate), [HS] Heat pump (gas/oil): air source, [HFT] Natural Gas, [CFT] Electrici										
	Actual	100.4	3.3	8.7	0.4	24.8	3.22	2.09	3.61	3.61
	Notional	87.2	7.7	18.3	0.6	18	1.33	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	67.2	0	22.5	0	4.2	0.83	0	0.93	0
	Notional	111.4	0	35.9	0	2	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1222.8	0	75.7	13.6	3.54	4.48	3.61	6
	Notional	0	1188.3	0	87.1	7.2	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	8.1	35.2	0.6	3.6	11.9	3.54	2.7	3.61	3.61
	Notional	18	47.3	2	3.5	6.3	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	147.5	14.7	11.6	0.9	0	3.54	4.48	3.61	6
	Notional	181.1	30.5	19.7	2.2	0	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	77000000:Surf[2]
Floor	0.2	0.02	RM000138:Surf[112]
Roof	0.15	0.02	RM000063:Surf[154]
Windows, roof windows, and rooflights	1.5	1.6	60000000:Surf[1]
Personnel doors	1.5	1.8	RM000064:Surf[0]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

APPENDIX F LOCAL BENEFITS PROPOSAL

OVG Manchester:
Local Benefits Proposal

OVG Manchester Ltd in support of our application for planning permission for our new arena scheme in Manchester would like to emphasis our commitment to establishing ourselves as an employer of local labour in the Manchester area.

As a business we are fully supportive of Manchester City Council's (MCC) Core Strategy Policies listed below and we will support and encourage the value they add to ensuring the prosperity of the region and the benefit these will have to our arena operation:

- EC 1 - Employment and Economic Growth in Manchester: specifically: "Demonstrating that employment - generating development has fully considered opportunities to provide jobs for local people, through construction or use".
- EC 7 (Eastlands Strategic Employment Location): specifically: "Ensure opportunities to employ residents from the local community are established with key partners".

We are already working with MCC's representatives (Mike Cunliffe and/or Westley Robinson) to develop a Local Employment Agreement which will contain a commitment to work with the Work and Skills Team and Local Ward Councillors to ensure that employment opportunities resulting from this development are made available to Manchester residents through the existing recruitment offer and allow hard to reach groups equal opportunity to be successful in applying.

We will also work with our contractor and partners in the arena to ensure they also support these initiatives and work with us on these programmes.

OVG has made it clear to the council and to local residents that we consider it a vital element of this commitment that the benefits and opportunities a new, world class arena will bring are targeted to the local East Manchester area as well as the wider region.

What type of job opportunities would the arena create?

A new arena on the Etihad Campus would provide over 1,000 jobs, with a wide range of job roles:

- Customer service
- Event
- management
- Technical
- engineers
- Facilities
- management
- Stewarding
- Hospitality
- Catering
- Cleaning
- Management
- Marketing
- Sales
- Operations

The arena would also generate a significant number of indirect jobs – anticipated to be around 1,400 – through the supply chain and other multipliers, for example, at local restaurants, bars and shops, and on accommodation and transport.

Opening up opportunities for local people

We want the arena to be rooted in the local community and agree that it needs to provide genuine benefits for local people. We are committed to making a positive contribution to the local community by providing employment, skills and training opportunities, and supporting community and social activities.

We are committed to ensuring as many jobs as possible go to local people (and will prioritise hiring people who live within walking distance) and that all arena employees will be paid at least the Manchester Living Wage (significantly more than the statutory minimum).

Inspiring young people

Having world-class acts and performances on the doorstep provides an outstanding opportunity to introduce young people to performing arts, music and dance.
We will use our resources and networks to bring the world of live entertainment to the young people of Eastlands, through school visits, tours and outreach activities. In our other locations, we have arranged for tour buses to visit local schools, showcasing the diverse range of job opportunities available in live entertainment. Jobs such as tour manager, stage and lighting designer, costume designer, sound engineer and others are rarely seen in standard careers guidance programmes, but are varied, interesting and highly skilled jobs.

We and our partners will work closely with local schools and develop a school leaver programme to ensure that we provide a pathway for local school leavers to find employment

Direct job opportunities and training
We and our partners will work with the Council and local Ward Councillors to identify any skills gaps that are needed to fill employment opportunities and will provide courses and opportunities to be employment ready.

We can start working now to ensure that as many as possible of the 1,000+ operational jobs at the arena can go to local people. We are already in discussions with Manchester City Council, but will continue to work with them, as well as key education and work bodies, to define an employment and skills strategy, which will include:

• Apprenticeships
• Local jobs fairs
• Specific skills training in partnership with local education providers
• Measures to encourage people getting back into work

We and our partners will commit to employ and train an agreed number of local apprenticeships at the arena.

The three-year to four-year construction period for the arena is expected to support around 3,350 construction jobs. Our preferred contractor has demonstrated their track record and commitment to targeting local employment and skills training, as well as confirming their buy-in to local work and skills initiatives.

Greater Manchester has a well-developed system for supporting apprenticeships and strong Further Education Colleges able to support off-the-job training. Over the four years, 100 apprentices would benefit from the construction activity.

What could a new arena deliver for the communities of East Manchester?

- Potential for over **1,000** direct operational jobs
- Become the proud home for a pioneering venue that pushes the boundaries of the live entertainment experience in the UK Community and educational use of arena spaces
- Arena staff support for educational and stakeholder organisations' events in the city
- Provide a significant boost to **Manchester's visitor economy**, which currently supports over 41,000 jobs
- Access and priority for a wide range of job opportunities – including skills training and local jobs fairs
- Improvements to walking and cycling routes into the city centre, helping to create a healthier, greener city

- Charitable activity to support and invest in local causes
- Opportunities to provide employment and training places for Manchester residents

We look forward to working with the council to agree our Local Employment Agreement as soon as possible.

Yours faithfully

Steve Collins
For and on behalf of OVG International

APPENDIX G SOCIAL VALUE TOOLKIT

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Deloitte.
Real Estate



OVG Manchester

Social Value Toolkit

March 2020

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1 Introduction

1.1 This Social Value Toolkit ("the Statement") accompanies an application for Full Planning Permission and Consent to Display Advertisements submitted to Manchester City Council (MCC) in respect of a Site at the Etihad Campus ("the Site") for the construction a new indoor arena (the "Proposed Development"). The Applicant is OVG Manchester Limited (the "Applicant").

1.2 It should be read in conjunction with the Sustainability Statement (prepared by BuroHappold) and Local Benefits Proposal (prepared by the Applicant) submitted in support of the application.

Manchester's Social Value Objectives

1.3 The Statement sets out how the Proposed Development responds to what MCC is seeking to achieve for Manchester's residents and neighbourhoods through Social Value, drawing on the following six social value objectives set out within MCC's 'Social Value Toolkit for Suppliers 2017':

- Promote employment and economic sustainability – tackle unemployment and facilitate the development of residents' skills.
- Raise the living standards of local residents – working towards living wage, maximise employee access to entitlements such as childcare and encourage suppliers to source labour from within Greater Manchester.
- Promote participation and citizen engagement - encourage resident participation and promote active citizenship.
- Build the capacity and sustainability of the voluntary and community sector– practical support for local voluntary and community groups.
- Promote equity and fairness – target effort towards those in the greatest need or facing the greatest disadvantage and tackle deprivation across the borough.
- Promote environmental sustainability – reduce wastage, limit energy consumption and procure materials from sustainable sources.

The Etihad Campus

1.4 As the Etihad Campus embarks on the next key phase of its transformation to a world-class destination amidst increasing public awareness of the climate and biodiversity crisis, it recognises the opportunity for it to play its full part in exemplifying sustainable development. To guide this, The Campus Strategic Sustainability Framework has been produced by Hillbreak.

1.5 This strategic vision document outlines the over-arching direction for the development and stewardship of The Campus, and the key principles for embedding sustainability into every aspect of it. It is the lead framework document for The Campus, acting as an umbrella for all other strategies and proposals.

1.6 A key theme underpinning the vision for the Etihad Campus is "Vibrant and Inclusive - the Campus works for everyone and provides unrivalled education, training and employment opportunities for local residents."

OVG Manchester

1.7 OVG and its partners are committed to delivering social value to local communities.

1.8 It is recognised that MCC are pioneers in maximising public benefit for local benefit through its Social Value Policy and Social Value Toolkit for Suppliers (2017). Whilst this toolkit is voluntary for non-public procurements, OVG have adopted to drive best practice into the Proposed Development.

2 Approach to Social Value – Construction Phase

2.1 Social value has formed a key part of conversations with prospective contractors. OVG's identified preferred contractor has a demonstrable track record of unlocking a wide range of social value through the construction phase.

Approach to Social Value

2.2 The preferred contractor's approach will include:

- A bespoke social value plan developed and delivered by the contractor's Education and Community Coordinator, drawing on their extensive existing network to truly reach out and integrate with local initiatives in both neighbouring communities and the wider city.
- Employment drop-in centre on site for local members of the public to enquire about training and employment opportunities.
- Mentoring, summer internship and Career Ready workshops provided to local schools, colleges and universities.
- Supporting social mobility through collaborating with agencies and charities that focus on helping hard to reach groups and disadvantaged individuals back into employment and housing.
- Corporate volunteering days with local charity and community groups, donating both labour and materials in kind.
- Setting and delivering against local spend targets.
- Use of the Social Value Portal to monitor and report on return on social investment, aligning with the National Themes Outcomes and Measures (TOMs) framework.

2.3 The estimated return on social investment based on the above bullets is **£19,893,784.02**.

2.4 The Contractor's social value plans are bespoke to each project and will be further developed with OVG and its partners to ensure that maximum added value is being delivered on the project. The Contractor believes that collaboration is paramount and establish Social Value partnership groups with representatives from local organisations who they believe are critical in ensuring projects are not only successful, but leave lasting legacies for the communities in which they work.

2.5 The Contractor is also part of the Considerate Constructors Scheme.

Social Value Targets

2.6 The preferred contractor has reviewed what was achieved in regards to social value at the adjacent Manchester City Football Academy, and they are committed to emulating and improving on these for the Proposed Development.

2.7 Table 2.1 sets out the Contractor's proposed targets for the construction phase.

Table 2.1: Proposed Construction Phase Social Value Targets

What was achieved at MCFC City Football Academy:	Proposed targets for OVG Manchester
89 Local residents who worked on the project were previously unemployed	**100** Employment opportunities by working with: MCC's Work and Skills Team, Unite (for the training academy), DWP and Talent Match.
50 Apprentices worked on the project	**100** Apprentices and trainees through the preferred contractor, our Supply Chain and Manchester GTA.
13,385 Training hours	**400** Training weeks through a proposed training academy with Unite.

What was achieved at MCFC City Football Academy:	Proposed targets for OVG Manchester
109 People gained qualifications whilst working on the project	**2,800** Apprenticeship and trainee weeks will be collated through the biometric system, M-Site.
2395 Students involved in educational events	**50** Education activities by linking up with: St Barnabas, St Brigid's and Ashbury Meadow Primary Schools, The East Manchester Academy, Connell Sixth Form College and the Manchester College.
33 Work experience placements	**50** Work experience placements through the preferred contractor and Supply Chain for students, long-term unemployed, ex-offenders, NEETS, veterans and those experiencing homelessness.
£53k Worth of labour and materials to local projects	**50** Community activities with **£100k** worth of materials and labour for community projects such as: Justlife, Victoria House, Oasis Centre, Revive, Walking with the Wounded, Crossley House Youth Centre.
58 Site visits by students and community groups	**70** Site visits for students and community groups.
1050 Members of the workforce from the local area with 2100 from Greater Manchester.	**Local Labour:** Tier 1: Manchester – 25% Tier 2: Greater Manchester– 60% Tier 3: North West – 75%
80% of the project's value was spent with local businesses	**Local Supply Chain:** Tier 1: Manchester – 20% Tier 2: Greater Manchester – 55% Tier 3: North West – 75%

3 Approach to Social Value – Operational Phase

3.1 OVG and its partners are committed to delivering social value to local communities, and want those who live and work in the area to benefit from having a state-of-the-art venue nearby.

Employment and Economic Sustainability / Raising the Living Standards of Local Residents

3.2 Once completed, the Proposed Development will generate long term employment opportunities within the operational uses, including concert and event spaces, as well as food and beverage uses.

3.3 It is estimated that the Proposed Development will support approximately 47 full time equivalent positions and 1,038 part time event-based jobs each year. This equates to 566 full time equivalent (FTE) jobs based on a ratio of two part time jobs per FTE. This estimation is based on the first twenty years of the operational phase.

3.4 The Proposed Development will create flexible employment opportunities for residents within the City, particularly residents within the Wards close to the Proposed Development across a wide range of roles including:

- Customer service
- Event management
- Technical engineers
- Facilities management
- Stewarding
- Hospitality
- Catering
- Cleaning
- Management
- Marketing
- Sales
- Operations

3.5 OVG is committed to ensuring as many jobs as possible go to local people (and will prioritise hiring people who live within walking distance) and that all arena employees will be paid at least the Manchester Living Wage (significantly more than the statutory minimum).

3.6 OVG has also committed to providing a range of employment, skills and training initiatives to maximise the accessibility of employment opportunities to local residents within the City.

Promote participation and citizen engagement

3.7 Local people have been involved in shaping the new arena from the very beginning. The consultation strategy was developed to provide meaningful opportunities for local people to engage with the Applicant and shape the development proposals, as well as what they mean to the local area.

3.8 OVG plans to maintain communication with the local community throughout the build and operational phases of the project. There will be open days, access to tickets and a direct phone and email address for anyone to contact the arena directly.

3.9 Through experience of operating similar venues around the world together with established practices across the Etihad Campus, there is a precedented commitment to:

- Put processes in place, including stakeholder engagement, to inspire and facilitate collective action on reducing the negative impacts of live shows; and

- Be a good neighbour through ongoing community and city-wide engagement to maximise social value and deliver an arena for everyone.

3.10 The Applicant is also in the process of forming an All Access Group with members of the local community to ensure that they continue to work with key stakeholders to deliver a great and inclusive facility.

Build the capacity and sustainability of the voluntary and community sector

3.11 The proposed arena will be a key part of the local community. In addition to providing employment, skills and training, it will also support community and social events. The arena will be able to host meetings, annual general meetings and fund raising events as part of a regular programme of engagement.

3.12 The proposed landscaping and new public realm will help to create a sense of place, pride and safety in the community and create new links to existing neighbourhoods. The public realm and amenity spaces will provide a number of opportunities for passive recreation and will incorporate a seating areas around the Arena.

3.13 OVG and its partners also envisage launching a charitable trust or community programme, with a share of revenue of the arena donated by a combination of the venue, partners and performers to be used to support a local charity/cause.

Promote equity and fairness

3.14 Having world-class acts and performances on the doorstep provides an outstanding opportunity to introduce young people to performing arts, music and dance. OVG is committed to using their resources and networks to bring the world of live entertainment to the young people of Eastlands, through school visits, tours and outreach activities. At OVG's other venue locations, they have arranged for tour buses to visit local schools, showcasing the diverse range of job opportunities available in live entertainment. Jobs such as tour manager, stage and lighting designer, costume designer, sound engineer and others are rarely seen in standard careers guidance programmes, but are varied, interesting and highly skilled jobs. OVG and their partners will therefore work closely with local schools and develop a school leaver programme to provide a pathway for local school leavers to find employment.

3.15 The arena staff will also be involved in working with other stakeholders and organisations in the City to maximise employment and training opportunities. This will include attending jobs fairs at various educational institutions and careers guidance days at local schools. In addition, staff will be actively involved in city business groups and networks.

Promote environmental sustainability

3.16 The Etihad Campus aspires to be a pioneer for the whole of Manchester in pursuing its twin objective of realising locally-inclusive, globally-competitive economic growth, whilst simultaneously transforming to a zero-carbon campus. OVG's aspirations reflect those of the wider campus, with the target of delivering the most sustainable arena in the UK.

3.17 In light of this, sustainable development has been integral to the design of the Proposed Development. The Proposed Development will promote sustainability and be at the forefront of energy efficiency and best practice low carbon design, delivering the most sustainable UK arena and one of the most sustainable arenas in the world.

4 Summary

4.1 As described in this Statement, OVG and its partners are committed to delivering social value to local communities, and want those who live and work in the area to benefit from having a state-of-the-art venue nearby.

4.2 Table 4.1 summarises how the Proposed Development responds to MCC's six Social Value Objectives.

Table 4.1: Assessment of the Proposed Development against Social Value Objectives

Social Value Objective	Applicant's Commitment
Promote Employment and Economic Sustainability	OVG and their partners commit to work with MCC and local Ward Councillors to identify any skills gaps that are needed to fill employment opportunities and provide courses and opportunities to be employment ready.
	Construction Phase: • Creation of 3,344 FTE over 3 years within the local economy. • 100 employment opportunities by working with MCC's Work and Skills Team, Unite (for the training academy), DWP and Talent Match. • 100 Apprentices and trainees (including through the Supply Chain and Manchester GTA). • 400 Training weeks through the proposed training academy with Unite. • 2,800 Apprenticeship and trainee weeks. • 50 Education activities by linking up with nearby educational institutions. • 50 Work experience placements for students, long-term unemployed, ex-offenders, NEETS, veterans and those experiencing homelessness.
	Operational Phase: • 586 FTE jobs over the first 20 years. • OVG has also committed to providing a range of employment, skills and training initiatives to maximise the accessibility of employment opportunities to local residents within the City.
	Support the local economy through expenditure in the local supply chain
	Support the local supply chain with expenditure within the Manchester area including attracting approximately 1 million visitors a year will generate approximately £36 million in additional local spending per annum.
	Attract inward investment into Manchester. • A significant proportion of visitor economy benefits will be accrued to city centre businesses where the majority of the hotels, serviced accommodation, food and beverage and retail businesses are based. • Improvements to regeneration objectives and several domains of deprivation including income and employment. • The provision of a new 20,000 plus capacity Arena will significantly increase the City's ability to host large events.
	Support MCC's vision for East Manchester to broaden the activities in the area and ensure development opportunities secure the wider regeneration of the area.
	The preferred contractor is part of the Considerate Constructors Scheme
Raise the living standards of local residents	OVG commit to ensuring as many jobs as possible go to local people during construction and operational phases, and will prioritise hiring people who live within walking distance.
	All arena employees will be paid at least the Manchester Living Wage (significantly more than the statutory minimum).

Social Value Objective	Applicant's Commitment
	OVG and their partners will work closely with local schools and develop a school leaver programme to provide a pathway for local school leavers to find employment.
Promote equity and fairness	Use the resources and networks of OVG and its partners to bring the world of live entertainment to the young people of Eastlands, through school visits, tours and outreach activities.
	Work with other stakeholders and organisations in the City to maximise employment and training opportunities, including attending jobs fairs at various educational institutions and careers guidance days at local schools.
Promote participation and citizen engagement	Be a good neighbour through ongoing community and city-wide engagement to maximise social value and deliver an arena for everyone.
	Formation of an All Access Group with members of the local community to ensure that they continue to work with key stakeholders to deliver a great and inclusive facility.
	Maintain communication with the local community throughout the construction and operational phases of the project through open days, access to tickets and a direct phone and email address to contact the arena directly.
	Put processes in place, including stakeholder engagement, to inspire and facilitate collective action on reducing the negative impacts of live shows.
Build capacity and sustainability of the Voluntary and Community Sector	OVG and its partners also envisage launching a charitable trust or community programme, with a share of revenue of the arena donated by a combination of the venue, partners and performers to be used to support a local charity/cause.
	The arena will be able to host meetings, annual general meetings and fundraising events as part of a regular programme of engagement.
Promote environmental sustainability	Promote sustainability and be at the forefront of energy efficiency and best practice low carbon design, aspiring to be the most sustainable UK venue and amongst the world's leading venues.
	Fully support Manchester Zero Carbon 2038 strategy, with a deliverable route map to achieve this.
	Over 40% CO_2 emissions reduction against Building Regulations Part L 2013 through intelligent energy efficient building services systems.
	Target zero waste to landfill and no single use plastic.
	Use of renewable technologies.
	Over 50% reduction in surface water run-off rates from existing through an innovative active system combining attenuation and rainwater harvesting.
	Over 40% less water use than a comparable building through water efficient sanitaryware and catering specifications.
	Replacement of a poor-quality site with improved ecology and environment onsite and adjacent.

4.3 The Proposed Development therefore delivers a positive benefit for Manchester's residents and neighbourhoods through Social Value.

Deloitte.
Real Estate

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APPENDIX H TREE SURVEY

ARBTECH

BS5837:2012
Trees in relation to design, demolition and construction – Recommendations

Arboricultural Method Statement

OVG Manchester Limited

Etihad Campus,

Manchester,

M11 3FF.

24 February 2020

Author: Alan Thompson FdSc. (Arb.), M.Arbor.A.

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Introduction

Arbtech Consulting Limited (Arbtech) received written instruction on 5th September 2019 from OVG Manchester Limited to attend Etihad Campus, Manchester, M11 3FF (site) to undertake an arboricultural survey a to BS5837:2012 guidance to assess trees, hedges and major shrub groups growing on and within influencing distance of the site and to produce a Schedule of trees and Tree Constraints Plan, Arboricultural Impact Assessment , Arboricultural Method Statement and Tree Protection Plan.

Executive Summary

This report describes the extent and effect of the proposed development at the site on individual trees and groups of trees within and adjacent to the site.



Trees within the site were surveyed; using a methodology guided by British Standard 5837:2012 'Trees in relation to design, demolition and construction – Recommendations' ("BS5837").

Subsequently, this report has been produced, balancing the layout of the proposed development against the competing needs of trees. This report comprises all of the requisite elements of an arboricultural implications assessment, method statement and supporting plans.

Checklist for Submission to Local Planning Authority

Tree survey	☒
Tree constraints plan	☒
Arboricultural impact assessment	☒
Arboricultural method statement	☒
Tree protection plan	☒

This report and its appendices follow precisely the strategy for arboricultural appraisal intended to provide local planning authorities with evidence that trees have been properly considered throughout the development process.

It is the conclusion of this report that the overall quality and longevity of the amenity contribution provided for by the trees and groups of trees within and adjacent to the site will not be adversely affected as a result of the local planning authority consenting to the proposed development. It is considered that any issues raised in this report, or beyond the scope of it can be dealt with by planning conditions.

General Information

Client: OVG Manchester Limited

Site: Etihad Campus, Manchester, M11 3FF.

Brief proposal description: Construction of events area with associated landscaping.

Table 1: Documents referred to.

Document	Reference No.
Topographical survey drawing	BRA-POP-ZZ-ZZ-DR-L-0650
Proposed layout drawing	19D065 A
Landscape master plan drawing	N/A
LPA pre-app comments	N/A
British Standard 5837:2012	“BS5837”
Arboricultural Impact Assessment	Arbtech AIA 01
Tree Protection Plan	Arbtech TPP 01

Tree Survey

Survey: An arboricultural survey to BS5837 of all trees within impacting distance of the site was undertaken by Alan Thompson of Arbtech Consulting on 19th September 2020.

A total of 22 individual trees and 9 groups of shrubs/trees were surveyed. Details for each of the trees surveyed are provided in the Schedule of Trees (see Appendix 1)

Table 2: Documents upon which this tree survey has been based

Document	Originator	Reference Number	Title
Topographical Survey	Survey Operations	19D065 A	Measured Survey

Limitations: The survey was made at ground level using visual observation only. Detailed examinations, such as climbing inspections and decay detection equipment were not employed, though may form part of the survey's management recommendations. Measurements were taken using specialist tapes, laser and GPS devices. Where this was not possible, measurements are estimated.

Scope: Pre-development tree surveys make arboricultural management recommendations based exclusively upon the individual tree or group of trees condition relative to their present context (*i.e. not in relation to the proposed development*).

Legal Status: No statutory protection check has been performed. BS5837 does not draw any distinction between trees subject to statutory protection, such as a Tree Preservation Order ("TPO"), and those trees without. This is principally because a detailed planning consent overrides any TPO protection. Consequently, we do not seek to offer any comparison between or infer any difference in the quality or importance of TPO trees and other trees.

* For more information on the surveyed trees please see Arbtech Consulting Ltd, Tree Survey Schedule (Appendix 1), Tree Survey Report and Tree Constraints Plan.

Arboricultural Impact Assessment

Table 3: Documents upon which this assessment has been based

Document	Originator	Reference Number	Title
Topographical Survey	Survey Operations	19D065 A	Measured Survey
Site Plan	Populus Architects	BRA-POP-ZZ-ZZ-DR-L-0650	Proposed Site Plan

There are a number of issues that may need to be addressed in an arboricultural impact assessment between the trees and the proposed development, these are as follows:

- The effect and extent of the proposed development within the root protection areas (RPAs) of retained trees;
- The potential conflicts of the proposed development with canopies of retained trees; and
- The likelihood of any future remedial works to retained trees beyond which would have been scheduled as a part of usual management.

Table 4: Impacts upon the RPAs of retained trees

Tree Number	Species	Structure	Incursion
T17	Small leaved lime	Hard surfacing replacement	RPA
T18	Small leaved lime	Hard surfacing replacement	RPA

These impacts can be seen on the Arboricultural Impact Assessment drawing number Arbtech AIA 01.

Trees to be removed

The proposal requires the removal of 16No. trees and 6No. groups of shrubs/small trees.

A breakdown of all tree removals and pruning works can be seen in Table 8: Summary of Tree Works

Table 5: Number of individual trees to be removed.

U	A	B	C
0	0	14	2

Table 6: Number of groups to be removed.

U	A	B	C
0	0	0	6

Canopy cover is ecologically important, and the loss of these trees will be mitigated with tree planting within the proposed landscaping development.

Arboricultural Method Statement

The purpose of this method statement is to demonstrate how any aspect of the development that has potential to result in loss or damage to a tree may be implemented and provide an adequate level of protection for those trees that are to be retained during the proposed works.

Details of key site personnel, including site / project manager will be submitted to the Council's Tree Officer prior to the commencement of site works.

This method statement is to be approved and agreed to in writing by all key personnel prior to the commencement of site works.

No site personnel are to be present and no demolition, site clearance, building work or delivery of materials is to occur until the protective measures are in accordance with this method statement and the Tree Protection Plan drawing number Arbtech TPP 01.

Protective measures should be in accordance with this method statement and the Tree Protection Plan; drawing number Arbtech TPP 01 will remain unaltered and in situ, unless otherwise specified, for the entire duration of the construction.

Table 7: Documents upon which this assessment has been based

Document	Originator	Reference Number	Title
Topographical Survey	Survey Operations	19D065 A	Measured Survey
Site Plan	Populus Architects	BRA-POP-ZZ-ZZ-DR-L-0650	Proposed Site Plan

Tree Works

For reasons of public safety, all tree works referred to herein must be carried out prior to any site personnel commencing works or any building materials being delivered.

Table 8: Summary of Tree Works

No.	Species	Works	Category
T1	Sycamore	Fell to ground level; remove stump	C1
T2 – T9	Small leaved lime	Fell to ground level; remove stump	B2
T10	Small leaved lime	Fell to ground level; remove stump	C1
T11 – T16	Small leaved lime	Fell to ground level; remove stump	B2
G1	Various	Fell to ground level; remove stumps	C2
G2	Various	Fell to ground level; remove stumps	C2
G3	Various	Fell to ground level; remove stumps	C2
G4	Various	Fell to ground level; remove stumps	C2
G5	Various	Fell to ground level; remove stumps	C2
G6	Various	Fell to ground level; remove stumps	C2

Notes

All tree work is to be undertaken in accordance with British Standard BS 3998:2010, Recommendations for tree work. All arising's are to be removed and the site is to be left as found. Care is to be taken of the ground around retained trees to make sure that it does not become compacted as a result of tree surgery operations. No equipment or vehicles such as timber Lorries, tractors, excavators or cranes shall be parked or driven beneath the crowns of any retained trees, to prevent subsequent compaction and root death.

Tree removal

A tree should be felled in one piece only when there is no significant risk of damage to people, property or protected species (see Annex A).
Where restrictions (e.g. lack of space, buildings, other features, land ownership or use, or other trees which are to be retained) cannot be overcome, trees should be dismantled in sections.

This also applies where a tall stump is being retained but where branches are to be removed/pruned.
Extensively decayed trees can be unpredictable when they are being felled, and special precautions should therefore be taken, such as the use of a winch to guide the direction of fall.

Stump removal – stump grinding

Stump grinding should be to a minimum of 300mm deep or to extend through the base of the stump leaving the major roots disconnected if the intention is to reduce the potential for the spread of Honey fungus.
The grinding residue should be treated as arising's and removed from site.
NOTE Mechanical destruction of a stump by stump grinding is less disruptive to the site than digging out.
The hole left by stump removal, should be filled with soil or other material. The filling should be appropriate for future site usage, and for any surface treatment that is to be installed.
Where future plant growth is desired, the backfill material should be firmed in 150 mm layers by treading, avoiding excessive compaction and destruction of the soil structure.

Stump removal - digging

Stump removal by digging out should include disposal/utilisation of woody material (see Clause **13**).
NOTE Whether done by hand or machine, digging out can cause severe disturbance of the site.
Where possible, when winching out a stump, a ground or other type of anchor should be used rather than a tree to be retained. If there is no alternative to using such a tree as an anchor, appropriate protective measures should be adopted.

After stump removal

The hole left by stump removal, whether by digging out or grinding, should be filled with soil or other material. The filling should be appropriate for future site usage and for any surface treatment that is to be installed.
Where future plant growth is desired, the back fill material should be firmed in 150mm layers by treading, avoiding excessive compaction and destruction of the soil structure.

Protected Species

Conservation Status of British Bats

The general consensus in Britain and Europe is that virtually all bat species are declining and vulnerable. Our understanding of population status is poor as there is very little historical data for most bat species. Certain species, such as the horseshoe bats, are better understood and have well documented contractions in range and population size.

Given this general picture of decline in UK Government within the UK Biodiversity Action Plan has designated five species of bats as priority species (greater and lesser horseshoe bats, barbastelle, Bechstein's and pipistrelle). These plans provide an action pathway whereby the maintenance and restoration of the former populations levels are investigated.

Legal Status of British Bats

Given the above position all British bats as well as their breeding sites and resting places enjoy national and international protection.

All bat species in the UK are fully protected under the Wildlife and Countryside Act 1981 (as amended) through inclusion in Schedule 5. All bats are also listed on Annex IV (and some on Annex II) of the EC Habitats Directive giving further, European protection. Taken together the act and Conservation of Habitats and Species Regulations 2012 (as amended)* make it an offence to; intentionally or deliberately kill, injure or capture (take) bats;

- Deliberately disturb bats (whether in a roost or not);
- Damage, destroy or obstruct access to bat roosts;
- Possess or transport a bat or any part of a bat, unless acquired legally;
- Sell, barter or exchange bats, or parts of bats

The legislation although not strictly affording protection to foraging grounds does protect roost sites. Bat roosts are protected at all times of the year whether or not bats are present. Any disturbance of a roost due to development must be licenced.

**the regulations that delivered by the UK's commitments to the Habitats Directive.*

Breeding birds

All nesting birds are protected under the Wildlife and Countryside Act (as amended) 1981, which makes it an offence to intentionally kill, injure or take any wild bird or take, damage or destroy its nest whilst in use or being built, or take or destroy its eggs. Furthermore a number of birds enjoy further protection under that Act and are listed on Schedule 1 of the Act. These further protected birds are also protected from disturbance and it may be necessary to operate “no-go” buffer zones around such nests – typically out to 100m.

Planning policy guidance on the treatment of species identified as priorities under the biodiversity action programme suggests that local authorities should take measures to protect the habitats of these species from further decline through policies in local development documents and should ensure that they are protected from the adverse effects of development, where appropriate, by using planning conditions or obligations. The conservation of these species should be promoted through the incorporation of beneficial biodiversity designs within developments.

Site Management

The site manager will be responsible for briefing and inducting all personnel who will be working on any stage of this development and especially those who will be working within or adjacent to the canopies or RPAs of retained trees; and will make them aware of, and provide a copy of this method statement and tree protection plan drawing number Arbtech TPP 01; this is to include but not exclusively of the movement and or operation of plant, excavations, unloading deliveries, mixing and or pouring of cement and concrete.

The site manager will be responsible for the day to day running and protection of all retained trees and for liaising with the project arborist about any tree related matters and prior to any works that may or will affect the RPAs or canopies of retained trees; this is to include but not exclusively the movement and or operation of plant, excavations, unloading deliveries, mixing, pouring and storage of all caustic materials that may cause harm to retained trees.

Any incidents of damage to retained trees or of tree protection measures will be documented by the site manager who will then report these incidents to the project arboriculturist immediately and make sure that works within this area cease until the project arborist has had an opportunity to inspect the damage and where appropriate, agree a mitigation plan with the local planning authority tree officer.

The site manager may designate another person to take charge of briefing and inducting process of new site personnel or visitors in his absence.

If the site manager is replaced or is absent from site for more than three consecutive working days the project arborist will be informed and a pre start meeting will be held with the new or acting site manager.

It is the responsibility of the site manager to ensure that the planning conditions attached to the planning consent are adhered to at all times and that a monitoring regime and supervision of any works within or adjacent to the RPAs are adopted.

If at any time pruning works are required other than those previously approved, permission must be sought from the LPA tree officer and once permission is granted they are to be carried out by a suitably qualified person in accordance with BS3998:2010 Tree work – Recommendations.

Prohibition

- Mechanical digging or scraping is not permitted within a defined root protection area or within areas cordoned off by protective barrier fencing.
- No access will be permitted within the protected areas;
- No materials, equipment or debris will be stored within any of the fenced areas, or against the fencing;
- Fires are not permitted within 10m of any vegetation.
- Leaning objects against or attaching of objects to a tree is not permitted.
- Machinery, plant and vehicles are not permitted to be washed down within 10m of vegetation.
- Chemicals and materials are not to be transported, stored, used or mixed within a root protection area or within areas cordoned off by protective barrier fencing.
- Cement silos, mixing site to be situated within a bunded area to prevent pillage/leaking of chemicals harmful to trees. These areas are to be sited well clear of protected trees.
- Refuelling of plant or machinery is prohibited within 10m of the construction exclusion zones.
- It is essential that allowance should be made for the slope of the ground so that damaging materials such as concrete washings, mortar or diesel oil cannot run towards trees.
- Where machinery is to be used within 5m of retained tree canopies a banks man will be required at all times whilst setting up, moving or operating within this distance of retained trees canopies.
- Storage of all caustic material and chemicals are to be situated well clear of protected areas and preferably on lower ground if slopes are present, or to be situated within a bonded area to prevent any spills or leaks entering the ground.

Sequencing of works

A logical sequence of events is to be observed and shall be phased as follows.

Table 9: Sequence of Events

Stage	Event
Stage 1	Pre-commencement site meeting
Stage 2	Carry out tree works as specified within the summary of tree works
Stage 3	Installation of protective measures in accordance with the approved tree protection plan/s
Stage 4	Site set up
Stage 5	Undertake and complete construction works
Stage 6	Undertake external landscaping works outside of the construction exclusion zones
Stage 7	Removal of all machinery and materials form site
Stage 8	Dismantle and removal of protective measures
Stage 9	Undertake external landscaping works within the construction exclusion zones
Stage 10	Sign off from project arboriculturist

Protective Measures

Protective measures are to be installed immediately following the completion of the tree works, and are to be sited and aligned in accordance with the tree protection plan (Arbtech TPP 01) prior to the commencement of any works or the introduction of any machinery or material to site.

Upon installation of the protective measures around the retained trees the project arboriculturist will visit the site to inspect and document the position and specifications of the protective measures.

In the event that the protective measures and their positions do not comply with this arboricultural method statement document number Arbtech AMS 01 (24-02-20) and tree protection plan drawing number Arbtech TPP 01, the project arboriculturist shall inform the client and fencing contractor so adjustments can be made.

When the protective measures comply with document number Arbtech AMS 01 (24-02-20) and tree protection plan drawing number Arbtech TPP 01, the project arboriculturist will sign off the protective measures in writing to the client and will send a copy to the fencing contractor, site agent and local authority tree officer.

If the protective measures become damaged or there is any accident or emergencies involving trees, these areas are to be cordoned off immediately with high visibility plastic mesh fencing. The site agent is to photograph and document the damage and inform the project arboriculturist immediately after the incident and all work within in this area is to cease until the project arboriculturist has made a visit to the site. Any and all damaged sections of protective measures shall be replaced within 48 hours of the initial incident.

The protected area is sacrosanct and will not be invaded by the storage of materials, mixing of concrete or other products, accessed by machinery, equipment or pedestrians or in any other way disturbed by construction activity.

The protective measures will remain in place until the completion of stage 8 (see Sequencing of Works), thereafter they will be carefully dismantled only with the agreement of the project arboriculturist and or the local authority tree officer.

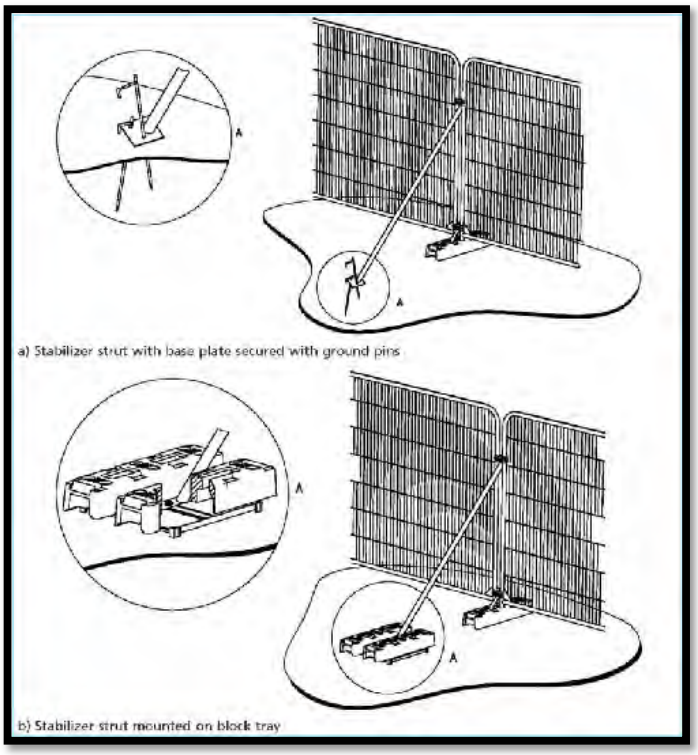
The existing site boundary measures are to be retained for the duration of the development. If for any reason the existing boundary measures are not to be used protective barrier fencing is to be installed along the line of the boundaries and is only to be removed upon the written permission of the project arboriculturist or LPA tree officer upon the completion of the development or immediately prior to the installation of the permanent boundary measures.

No equipment, vehicles or plant shall operate beyond the tree protection fencing. Booms, hoists and rigs should be kept as far away from the canopies of retained trees at all times. Where it is necessary to operate within 5m of a tree canopy, it will be done with the utmost caution and under the control of a banks man. Damage to trees will be considered a breach of this tree protection plan, which in turn could be a breach of planning permission.

Protective Barrier Fencing

Protective barrier fencing should be appropriate for the intensity and proximity of the development to protect trees where development activity is in close proximity.

Specification: To comprise of 2m tall welded mesh panels on rubber or concrete feet. Panels are to be joined together using a minimum of two anti-tamper couplers, installed so that they can only be removed from inside the fence. The panels should be supported on the inner side by stabiliser struts, which should be attached to a base plate and secured with ground pins.



Signage denoting the words "*tree protection area*" at 5.0m intervals should be fixed to the protective barrier fencing (See Appendix 2).

Protective fencing is to be removed only with the written permission of the arboricultural consultant and approval of the local planning authority (LPA)

Demolition

Prior to the demolition of the existing site features, all tree works are to have been completed, tree protection measures are to be in place as per Arbtech Consulting Ltd. tree protection plan document number Arbtech TPP 01 and have been signed off and a copy of the demolition method statement has been submitted and approved by the project arboriculturist and LPA tree officer, to ensure that there is no conflict with this method statement.

Any demolition work within or immediately adjacent to RPAs or canopies of retained trees is to be undertaken under the direct on-site supervision of an arboriculturist.

Hard Surfacing within the RPAs of trees T17 & T18

Where it is required for hard surfacing is to be removed and or re-surfaced within the RPAs of retained trees it is to be undertaken under direct on-site arboricultural supervision, during the landscaping phase of the development.

The wearing course will be broken up using a hand held pneumatic breaker, hand tools and wheel barrows to break up and remove the surfacing. Where is necessary to remove the sub base this is to be undertaken using a fork to loosen the material and moved using shovels and wheel barrows.

In some situations and at the discretion of the arborist it may be possibly to use an excavator using a hydraulic breaker and a suitably sized toothless grading bucket. If an excavator is to be used it must be situated outside of the RPAs, on top of the hard surfacing working away from the RPAs or from ground boarding.

Whichever system is used there is to be **NO** disturbance of the soil beneath. If roots are found they are to be covered over with damp hessian and a layer of either sharp sand, wood chip or top soil will be applied as soon as practicably possible to prevent desiccation.

Construction

Prior to the construction of the proposal, a copy of the construction method statement should have been submitted and approved by the project arboriculturist and LPA tree officer, to ensure that there is no conflict with this method statement.

All excavations and construction work within or immediately adjacent to RPAs or canopies of retained trees is to be undertaken under the direct on-site supervision of an arboriculturist.

Services

Detailed drawings of proposed underground services are not available at this time; hence it is not possible to identify any specific potential impacts associated with the scheme at this stage.

Existing services within the site should be retained where ever possible. Where existing services within RPAs require upgrading, the upmost care must be taken to minimise disturbance, and where feasible trenchless techniques are to be employed, and only where necessary should open excavations be considered.

Where new services are to be introduced into the site they should be located outside of RPAs, where they will not interfere with tree roots. If any excavations are required within the RPAs all trenches are to be excavated by hand and radially to the tree trunks under direct on-site arboricultural supervision and are to be carried out under NJUG guidelines.

Final positions of any proposed services should be verified and approved by the arboricultural consultant and local authority tree officer before implementation.

New Underground services

Trenching for installation of underground services and drainage routes could sever any roots that may be present and as such adversely affects the health of the tree. For this reason particular care should be taken in routing and methods of installation of all underground services. All underground services and drainage routes should be located so that no excavations are required within RPAs.
Where it has been impossible to keep underground services from passing through RPAs or within close proximity to trees, these sections are to be installed in one of three ways in accordance with the guidance set out in National Joint Utilities Group guidelines (NJUG 4), under on site arboricultural supervision.

Trenchless Techniques

There are three main types of trenchless techniques, these include, guided and unguided boring and pipe replacement by lining or bursting. These allow for the installation, maintenance or renewal of underground services, without the disturbance of soil in which roots are likely to be growing. Starting and receiving pits for the boring machinery are to be located outside of the RPAs of any retained trees, with the bore depth being maintained at a minimum depth of 600mm below the existing ground level. Techniques involving external lubrication of the equipment shall use no material other than water as other lubricants could contaminate the soil (e.g. oil, bentonite, etc.).

Manual Excavation

Excavation within RPAs will be undertaken by hand under direct on-site arboricultural supervision of the required depth of the foundation; Or to a minimum of 600mm deep of any excavation, whether for proposed foundations, hard surfacing or underground services. The total depth of the manual excavation will be determined by the arboriculturist whilst on site.

The soil is to be loosened with the aid of a fork or pick axe and then cleared with the aid of an Air-spade, Air-vac and or shovel. Any roots found will be cleanly severed by the arboricultural consultant with either a hand saw or secateurs.

Any roots found with a diameter of less than 25mm shall be cleanly severed by the arboricultural consultant. Any roots of 25mm and above shall be excavated around without damaging them; the arboricultural consultant shall decide if it's feasible or necessary to retain the root, if not it shall be severed.

The edge of the excavation closest to the trees will be covered with damp hessian to prevent soil collapse or contamination by concrete.

Soil beneath the depth may be sheet piled, regular piled or excavated deeper. Machinery may be used for this providing that it is situated outside of the RPA or has appropriate ground protection in place to move around on and work upon.

Broken Trench – Hand Dug

This technique combines both trenchless techniques and manual excavation where excavation is unavoidable. Excavations should be limited to where there is clear access around and below the roots. All trenches shall be excavated by hand with the same precautions taken as for manual excavation. Open section of trench should only be large enough to allow access for linking to the next section.

Landscaping

Any tree planting should take into consideration the available space for tree growth and development in order to ensure the trees are physically suited to the site at maturity. A specification for and notation relating to the precise alignment of replacement trees will be contained in the landscape proposals.

Landscaping around retained trees may only be carried out once all tree protection measures have been removed (planting, turfing, fencing etc.).

All excavations within the Root Protection Areas shall be undertaken by hand and without reducing current ground levels unless it is agreed in writing with the LPA. At no time is the use of a rotavator permitted within the RPAs of retained tree.

Any tree roots discovered will be left in-situ and shall not be cut or otherwise damaged. Where possible, the soil structure within the Root Protection area shall be preserved.

No works will be carried out within the RPAs of any trees if the soil moisture is of such a level that soil compaction may be likely. Should the soil become compacted or has poor structure which would hinder the development of the existing trees and plants or any new plantings the arboriculturist should be consulted about soil decompaction techniques.

Monitoring and Supervision

Where trees have been identified within this method statement and tree protection plan drawing number Arbtech TPP 01 for retention, there should be an auditable system of arboricultural monitoring. This is to extend to arboricultural supervision whenever demolition or construction activity is to take place within or adjacent to any canopy or RPA.

The development's tree protection measures are to be monitored and all demolition and construction works to be undertaken within or adjacent to the RPAs of retained trees are to be supervised by project arboriculturist, who should be retained to record and report observations to the council at appropriate intervals.

Pre-commencement site meeting

Prior to the commencement of any works or machinery and materials arriving on site a pre-commencement site meeting involving the project arborist, land owner or agent, site manager, contractors and engineer (as appropriate) and the relevant LPA officers will be held to ensure that all aspects of the arboricultural method statement and tree protection are understood and for all parties to swap contact details (see Appendix 3).

Monitoring and supervision schedule

The initial monitoring visit will be to check that the tree protective measures are in the correct location and as specified within the approved method statement; if so to sign off their installation.

There after monitoring visits are to take place at regular intervals, to ensure that tree protection measures are in place and are functioning as designed or whenever necessary to undertake works to be carried out under arboricultural supervision. The frequency of the monitoring visits is to be determined with the LPA tree officer at the pre-commencement site meeting.

A record of all arboricultural monitoring and supervision visits will be kept and any faults will be logged, this will then be copied to the site agent, developer and local planning authority in a digital format.

If during the course of the development it is necessary for areas to be re-designed so that they would require changes to the approved arboricultural method statement or tree protection plan and so affecting retained trees the project arborist and LPA tree officer will be invited to attend a site meeting with all relevant parties. Prior to any changes being implemented these must have been approved in writing by the LPA tree officer.

Supervision

The arboricultural consultant will be required to attend site to directly supervise all demolition and construction works that are to be undertaken within or adjacent to the RPAs of all retained trees and will be advised a minimum of 72 hours prior to the commencement of any works that require his attendance, these will include:

1. Pre-commencement site meeting.
2. Location of protective measures.
3. Removal of existing hard surfacing within the RPAs of tree nos.T17 & T18.
4. Any excavations within or adjacent to RPAs, including foundations, hard surfacing or underground services.
5. Removal of protective measures and sign off.

Completion meeting

Once all construction works have been completed all materials and machinery has been removed from site the project arborist shall be informed and will invite the LPA tree officer to meet on site to discuss the process and discuss any final remedial works that may be required and to sign the development off so that the protective measures may be removed.

Appendix 1: Tree Survey Schedule

BS5837:2012 Tree Survey

Client: OVG Manchester
Project: Etihad Campus, Manchester, M11 3FF.
Survey Date: 19/09/2019
Surveyor: Alan Thompson

Artbech Consulting Ltd.

Unit 3, Well House Barns
Chester Road
Chester
Cheshire
CH4 0DH
Phone: 01244 66 11 70

Tree and Tag No / Species	Hght (m)	Stems No	Stems Ø (mm)	Crown Spread (m)	Crown Clear (m)	Age	RP A (m²) R (m)	Phys Condition	Structural Condition	Preliminary Recommendations / Survey Comment	Cat ERC
G1										Estimated Measurements	
A Group	2.5	1	30	N	1.5	0.2	Y	A: 0.4	Good	C: Good	C.2
- -				E	1.5	0.2		R: 0.35		S: Good	>40 yrs
				S	1.5	0.2				B: Good	
				W	1.5	0.2				Group is comprised of natural regeneration of young trees and shrubs. Species are predominantly silver birch and goat willow interspersed with buddleia. Measurements given are estimated averages for the group.	
G2										Estimated Measurements	
A Group	2.5	1	20	N	0.5	0.2	Y	A: 0.2	Good	C: Good	C.2
- -				E	0.5	0.2		R: 0.25		S: Good	>40 yrs
				S	0.5	0.2				B: Good	
				W	0.5	0.2				Fragmented grouproup is comprised of natural regeneration of young trees and shrubs. Species are predominantly silver birch and goat willow interspersed with buddleia. Measurements given are estimated averages for the group.	
G3										Estimated Measurements	
A Group	2.5	1	30	N	1.5	0.2	Y	A: 0.4	Good	C: Good	C.2
- -				E	1.5	0.2		R: 0.35		S: Good	>40 yrs
				S	1.5	0.2				B: Good	
				W	1.5	0.2				Group is comprised of natural regeneration of young trees and shrubs. Species are predominantly silver birch and goat willow interspersed with buddleia. Measurements given are estimated averages for the group.	
G4										Estimated Measurements	
A Group	2.5	1	30	N	1.5	0.2	Y	A: 0.4	Good	C: Good	C.2
- -				E	1.5	0.2		R: 0.35		S: Good	>40 yrs
				S	1.5	0.2				B: Good	
				W	1.5	0.2				Group is comprised of natural regeneration of young trees and shrubs. Species are predominantly silver birch and goat willow interspersed with alder and crack willow. Measurements given are estimated averages for the group.	

Age Classifications: N Newly planted; Y Young; SM Semi-mature; EM Early Mature; M Mature; OM Over Mature

Condition: C Crown; S Stem; B Basal area

Stems: Ø Diameter; (Eq) Equivalent stem diameter using BS5837:2012 definition

Tree and Tag No Species	Hght (m)	Stems No	Stems Ø (mm)	Crown Spread (m)	Crown Clear (m)	Age	RP A (m²) R (m)	Phys Condition	Structural Condition	Preliminary Recommendations Survey Comment	Cat ERC
G5										Estimated Measurements	
A Group - -	2.5	1	30	N 1.5 E 1.5 S 1.5 W 1.5	0.2 0.2 0.2 0.2	Y	A: 0.4 R: 0.35	Good	C: Good S: Good B: Good	Group is comprised of natural regeneration of young trees and shrubs. Species are predominantly silver birch and goat willow interspersed with buddleia. Measurements given are estimated averages for the group.	C.2 >40 yrs
G6										Estimated Measurements	
A Group - -	2.5	1	30	N 1.5 E 1.5 S 1.5 W 1.5	0.2 0.2 0.2 0.2	Y	A: 0.4 R: 0.35	Good	C: Good S: Good B: Good	Group is comprised of natural regeneration of young trees and shrubs. Species are predominantly silver birch and goat willow interspersed with buddleia. Measurements given are estimated averages for the group.	C.2 >40 yrs
G7										Estimated Measurements	
A Group - -	7	1	230	N 3 E 3 S 3 W 3	1.5 1.5 1.5 1.5	Y	A: 23.9 R: 2.75	Good	C: Good S: Good B: Good	Linear boundary screening group is comprised of approximately 25 early mature trees. Species are predominantly silver birch interspersed with lime and hazel. Measurements given are estimated averages for the group.	B.2 >40 yrs
G8										Estimated Measurements	
A Group - -	7	1	240	N 3 E 3 S 3 W 3	1.5 1.5 1.5 1.5	Y	A: 26.1 R: 2.88	Good	C: Good S: Good B: Good	Linear boundary screening group is comprised of approximately 25 early mature trees. Species are predominantly silver birch interspersed with lime, ash, wild cherry and hazel. Measurements given are estimated averages for the group.	B.2 >40 yrs
G9										Estimated Measurements	
A Group - -	7	1	250	N 3 E 3 S 3 W 3	1.5 1.5 1.5 1.5	Y	A: 28.3 R: 3	Good	C: Good S: Good B: Good	Linear boundary screening group is comprised of approximately 25 early mature trees. Species are predominantly alder interspersed with occasional oak. Measurements given are estimated averages for the group.	B.2 >40 yrs

Age Classifications: N Newly planted; Y Young; SM Semi-mature; EM Early Mature; M Mature; OM Over Mature

Condition: C Crown; S Stem; B Basal area

Stems: Ø Diameter; (Eq) Equivalent stem diameter using BS5837:2012 definition

Tree and Tag No Species	Hght (m)	Stems No	Stems Ø (mm)	Crown Spread (m)	Crown Clear (m)	Age	RP A (m²) R (m)	Phys Condition	Structural Condition	Preliminary Recommendations Survey Comment	Cat ERC
T1											
Sycamore *Acer pseudoplatanus*	5	10	126 (Eq)	N 2 E 2 S 2 W 2	2 2 2 2	Y	A: 7.2 R: 1.51	Good	C: Good S: Good B: Good	Tree of limited amenity value.	C.1 >40 yrs
T2											
Small-Leafed Lime *Tilia cordata*	7	1	250	N 3.5 E 3.5 S 3.5 W 3.5	1 3 1 1	Y	A: 28.3 R: 3	Good	C: Good S: Good B: Good	Tree forms part of a linear boundary screening group.	B.2 >40 yrs
T3											
Small-Leafed Lime *Tilia cordata*	7	0		N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 0 R: 0	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	B.2 >40 yrs
T4											
Small-Leafed Lime *Tilia cordata*	7	1	240	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 26.1 R: 2.88	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	B.2 >40 yrs
T5											
Small-Leafed Lime *Tilia cordata*	7	1	240	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 26.1 R: 2.88	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	B.2 >40 yrs
T6											
Small-Leafed Lime *Tilia cordata*	6.5	8	198 (Eq)	N 4.5 E 4.5 S 4.5 W 4.5	0.5 3 0.5 0.5	Y	A: 17.7 R: 2.37	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	B.2 >40 yrs

Age Classifications: N Newly planted; Y Young; SM Semi-mature; EM Early Mature; M Mature; OM Over Mature

Condition: C Crown; S Stem; B Basal area

Stems: Ø Diameter; (Eq) Equivalent stem diameter using BS5837:2012 definition

Tree and Tag No Species	Hght (m)	Stems No	Ø (mm)	Crown Spread (m)	Clear (m)	Age	RP A (m²) R (m)	Phys Condition	Structural Condition	Preliminary Recommendations Survey Comment	Cat ERC
T7											
Small-Leafed Lime *Tilia cordata*	6.5	9	210 (Eq)	N 4.5 E 4.5 S 4.5 W 4.5	0.5 0.5 0.5 0.5	Y	A: 20 R: 2.52	Good	C: Good S: Good B: Good		**B.2** >40 yrs
T8											
Small-Leafed Lime *Tilia cordata*	7	1	260	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 30.6 R: 3.12	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.2** >40 yrs
T9											
Small-Leafed Lime *Tilia cordata*	6.5	1	260	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 30.6 R: 3.12	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.2** >40 yrs
T10											
Goat Willow *Salix caprea*	6	6	122 (Eq)	N 3.5 E 3.5 S 3.5 W 3.5	0.5 0.5 0.5 0.5	SM	A: 6.8 R: 1.47	Good	C: Good S: Good B: Good	Tree forms part of a linear boundary screening group. Tree of limited amenity value.	**C.1** >40 yrs
T11											
Small-Leafed Lime *Tilia cordata*	6.5	1	230	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 23.9 R: 2.75	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.2** >40 yrs
T12											
Small-Leafed Lime *Tilia cordata*	6	0		N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 0 R: 0	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.2** >40 yrs

Age Classifications: N Newly planted; Y Young; SM Semi-mature; EM Early Mature; M Mature; OM Over Mature

Condition: C Crown; S Stem; B Basal area

Stems: Ø Diameter; (Eq) Equivalent stem diameter using BS5837:2012 definition

Tree and Tag No Species	Hght (m)	Stems No	Stems Ø (mm)	Crown Spread (m)	Crown Clear (m)	Age	RP A (m²) R (m)	Phys Condition	Structural Condition	Preliminary Recommendations Survey Comment	Cat ERC
T13											
Small-Leafed Lime *Tilia cordata*	5.5	6	171 (Eq)	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 13.3 R: 2.05	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.2** >40 yrs
T14											
Small-Leafed Lime *Tilia cordata*	6	6	220 (Eq)	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 22 R: 2.64	Good	C: Good S: Good B: Good		**B.2** >40 yrs
T15											
Small-Leafed Lime *Tilia cordata*	7	10	190 (Eq)	N 4.5 E 4.5 S 4.5 W 4.5	0.5 3 0.5 0.5	Y	A: 16.3 R: 2.27	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.1** >40 yrs
T16											
Small-Leafed Lime *Tilia cordata*	6	1	260	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 30.6 R: 3.12	Good	C: Good S: Good B: Good	Early mature tree. Tree forms part of a linear boundary screening group.	**B.2** >40 yrs
T17											
Small-Leafed Lime *Tilia cordata*	7	1	230	N 4 E 4 S 4 W 4	1.5 1.5 1.5 1.5	Y	A: 23.9 R: 2.75	Good	C: Good S: Good B: Good	Off site tree. Early mature tree forms part of linear boundary screening group.	**B.2** >40 yrs
T18											
Small-Leafed Lime *Tilia cordata*	6.5	1	230	N 4 E 4 S 4 W 4	1 3 1 1	Y	A: 23.9 R: 2.75	Good	C: Good S: Good B: Good		**B.2** >40 yrs

Age Classifications: N Newly planted; Y Young; SM Semi-mature; EM Early Mature; M Mature; OM Over Mature

Condition: C Crown; S Stem; B Basal area

Stems: Ø Diameter; (Eq) Equivalent stem diameter using BS5837:2012 definition

Tree and Tag No Species	Hght (m)	Stems No	Stems Ø (mm)	Crown Spread (m)		Crown Clear (m)	Age	RP A (m²) R (m)	Phys Condition	Structural Condition	Preliminary Recommendations Survey Comment	Cat ERC
T19												
Small-Leafed Lime *Tilia cordata*	5	1	210	N E S W	3.5 3.5 3.5 3.5	1 3 1 1	Y	A: 20 R: 2.52	Good	C: Good S: Good B: Good		**B.2** >40 yrs
T20												
Small-Leafed Lime *Tilia cordata*	5	1	200	N E S W	3.5 3.5 3.5 3.5	1 3 1 1	Y	A: 18.1 R: 2.4	Good	C: Good S: Good B: Good		**B.2** >40 yrs
T21												
Small-Leafed Lime *Tilia cordata*	6.5	1	250	N E S W	4 4 4 4	1 3 1 1	Y	A: 28.3 R: 3	Good	C: Good S: Good B: Good		**B.2** >40 yrs
T22												
Small-Leafed Lime *Tilia cordata*	5	1	200	N E S W	4 4 4 4	1 3 1 1	Y	A: 18.1 R: 2.4	Good	C: Good S: Good B: Good		**B.2** >40 yrs

Age Classifications:	N	Newly planted	EM	Early Mature	**Condition:**	C	Crown	**Stems:** Ø Diameter
	Y	Young	M	Mature		S	Stem	(Eq) Equivalent stem diameter using BS5837:2012 definition
	SM	Semi-mature	OM	Over Mature		B	Basal area	

Appendix 2: Tree Protection Notice

(To be printed at A3 or larger)

Tree Protection Area

KEEP OUT

Do **not** move this fence

(TOWN & COUNTRY PLANNING ACT 1990)
TREES ENCLOSED BY THIS FENCE ARE PROTECTED BY PLANNING CONDITIONS AND/OR ARE THE SUBJECT OF A TREE PRESERVATION ORDER.
CONTRAVENTION OF A TREE PRESERVATION ORDER MAY LEAD TO CRIMINAL PROSECUTION

ANY INCURSION INTO THE PROTECTED AREA MUST BE WITH THE WRITTEN PERMISSION OF THE LOCAL PLANNING AUTHORITY

ARBTECH

Arbtech Consulting Limited.
Unit 3, Well House Barn, Chester Road, Chester, CH4 0DH
www.arbtech.co.uk - 01244 661170

Appendix 3: Contact Details

Name	Position	Company	Contact
	Client	OVG Manchester Limited	
	Tree Officer		
Alan Thompson	Arboricultural Consultant	Arbtech Consulting Ltd.	01244 661170 07703 676216 at@arbtech.co.uk https://arbtech.co.uk
	Site Manager		
	Main contractor		

Document Production Record

Document number	Editor	Signature	Position	Issue number	Date
Arbtech AMS 01	Alan Thompson		Arboricultural Consultant	1	28/02/2020

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Tree Categories

Trees are categorised in accordance with the cascade chart in Table 1 of the British Standard BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'

Category 'U' – Trees in such condition that they cannot realistically be retained as living trees in context of the current land use for longer than 10 years.
Category 'A' – Trees of high quality with an estimated remaining life expectancy of at least 40 years.
Category 'B' Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.
Category 'C' – Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm.

Root Protection Area

In order to avoid damage to the roots or rooting environment of retained trees, the Root Protection Areas (RPAs) should be plotted around each of the category A, B and C trees. This is a minimum area in m^2 which should be left undisturbed around each retained tree.

The RPA is calculated using the British Standard BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations.

The calculated RPA is capped to 707m^2, which is the equivalent to a circle with a radius of 15m. Where there appears to be restrictions to root growth the root protection area is reshaped to more accurately reflect the likely distribution of the roots.

Arboricultural Impacts

Impacts	Nos. of trees
Trees to be removed	16
Groups / Hedges to be removed (Partial removal of groups)	6 (0)
Trees with proposed incursions into RPAs	2
Groups / Hedges with proposed incursions into RPAs	0
Trees that will require pruning	0
Groups / Hedges that will require pruning	0
Trees to be transplanted	0
Groups / Hedges to be transplanted	0

No.	Species	Proposed structure	Incursion
T17	Small leaved lime	Hard surfacing replacement	RPA
T18	Small leaved lime	Hard surfacing replacement	RPA

Tree Work Schedule

No.	Species	Works	Category
T1	Sycamore	Fell to ground level; remove stump.	C
T2 - T9	Small leaved lime	Fell to ground level; remove stump.	B
T10	Small leaved lime	Fell to ground level; remove stump.	C
T11 - T15	Small leaved lime	Fell to ground level; remove stump.	B
G1	Various	Fell to ground level; remove stump.	C
G2	Various	Fell to ground level; remove stump.	C
G3	Various	Fell to ground level; remove stump.	C
G4	Various	Fell to ground level; remove stump.	C
G5	Various	Fell to ground level; remove stump.	C
G6	Various	Fell to ground level; remove stump.	C

All tree work is to be undertaken in accordance with British Standard BS 3998:2010 Tree work - Recommendations.
All arising's are to be removed and the site is to be left as found.
Care is to be taken of the ground around retained trees to make sure that it does not become compacted as a result of tree surgery operations. No equipment or vehicles such as timber lorries, tractors, excavators or cranes shall be parked or driven beneath the crowns of any retained trees, to prevent subsequent compaction and root death.

No. of individual trees to be removed

U	A	B	C
0	0	14	2

No. of groups / hedges to be removed

U	A	B	C
0 (0)	0 (0)	0 (0)	6 (0)

( ) = Partial removal of a groups

Arboricultural Method Statement

All tree work is to be undertaken in accordance with British Standard BS3988. Please refer to Arbtech Consulting Ltd. Tree Schedule, Arboricultural Method Statement and Tree Protection Plan, for full details of all surveyed trees and how all aspects of the development maybe implemented without detriment to retained trees.

Note: No unauthorised excavations are to be carried out within the RPAs of any retained trees. Any level changes must form part of a construction method statement & must protect the rooting environments of all retained trees.

Issue: Proposed hard surfacing replacement is partially situated within the RPAs of trees T17 & T18.
Solution: Proposed surfacing is to be designed in conjunction with an arboriculturist so that it can be constructed entirely above the existing soil level.

Indicative only

ARBTECH
Unit 3, Well House Barns, Chester, CH4 0DH
https://arbtech.co.uk, 01244 661170

Project:
Etihad Campus,
Manchester,
M11 3FF.

Client:
OVG Manchester Limited

Drawing:
Arboricultural Impact Assessment

Based on:
BRA-POP-ZZ-ZZ-DR-L0650

Drawing No:
Arbtech AIA 01

Rev:

Date:
Feb 2020

Scale:
1:200 @ A0

Drawn:
AST

Key:

Tree Nos.:	T1	Tree Canopies:		Trunks:	
RPAs:		Category 'B' trees:		Category 'B' groups:	
Category 'C' trees:		Category 'C' groups:		Trees to be removed:	T1
Incursion - Hard surfacing:					

All dimensions should be checked on site. No dimensions are to be scaled from this drawing.
Please notify us of any discrepancies found. Arbtech Consulting Ltd. cannot be held responsible for inaccuracies in the base drawing in which the data is based.
This drawing is to be used for the purposes of the layout or design only, and relates only to the protection of trees and hedges.
This drawing is not to be read as a definitive part of the engineering or construction designs or method statement. An architect or structural engineer should be contacted over any matters of construction, detailing or specification and for any standards or regulatory requirements relating to proposed structures, hard surfacing or underground services.
This drawing was produced in colour - a monochrome copy should not be relied upon.

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Protective Fencing

To be erected prior to the commencement of all works on site, and retained in place throughout construction.
Specification: To comprise of 2m tall welded mesh panels on rubber or concrete feet. Panels are to be joined together using a minimum of two anti-tamper couplers, installed so that they can only be removed from inside the fence. The panels should be supported on the inner side by stabilizer struts, which should should be attached to a base plate and secured with ground pins.
All weather notices should be erected at regular intervals on the weld mesh panels with words such as "Construction exclusion zone - Keep out".

Tree Protection Area

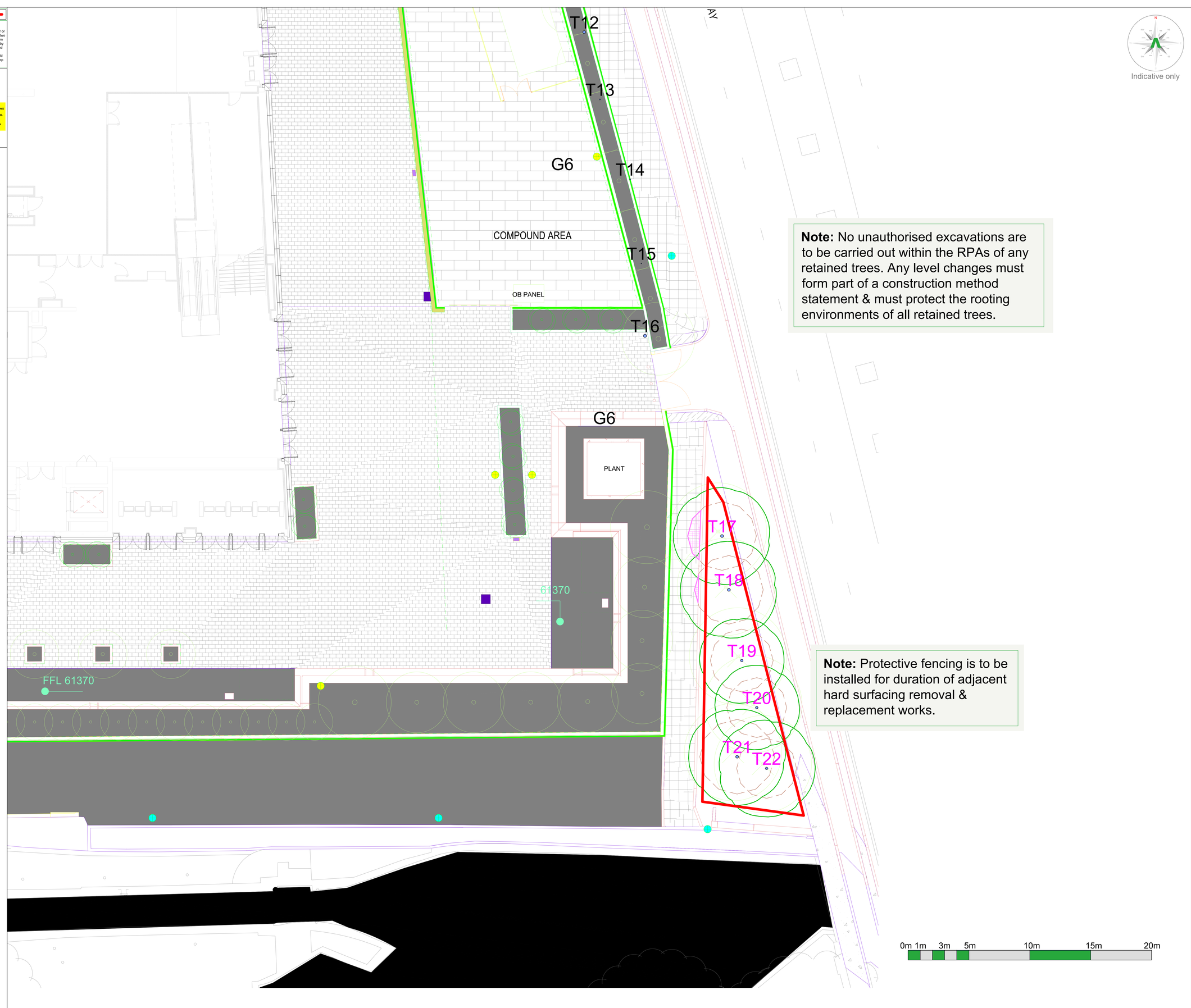
KEEP OUT

Do **not** move this fence

(TOWN & COUNTRY PLANNING ACT 1990)
TREES ENCLOSED BY THIS FENCE ARE PROTECTED BY PLANNING CONDITIONS AND/OR ARE THE SUBJECT OF A TREE PRESERVATION ORDER. CONTRAVENTION OF A TREE PRESERVATION ORDER MAY LEAD TO CRIMINAL PROSECUTION

ANY INCURSION INTO THE PROTECTED AREA MUST BE WITH THE WRITTEN PERMISSION OF THE LOCAL PLANNING AUTHORITY

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https://arbtech.co.uk, 01244 661170



Note: No unauthorised excavations are to be carried out within the RPAs of any retained trees. Any level changes must form part of a construction method statement & must protect the rooting environments of all retained trees.

Note: Protective fencing is to be installed for duration of adjacent hard surfacing removal & replacement works.

Indicative only

Tree Categories

Trees are categorised in accordance with the cascade chart in Table 1 of the British Standard BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'

Category 'U' - Trees in such condition that they cannot realistically be retained as living trees in context of the current land use for longer than 10 years.
Category 'A' - Trees of high quality with an estimated remaining life expectancy of at least 40 years.
Category 'B' - Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.
Category 'C' - Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm.

Root Protection Area

In order to avoid damage to the roots or rooting environment of retained trees, the Root Protection Areas (RPAs) should be plotted around each of the category A, B and C trees. This is a minimum area in m^2 which should be left undisturbed around each retained tree.

The RPA is calculated using the British Standard BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations.

The calculated RPA is capped to 707m^2, which is the equivalent to a circle with a radius of 15m. Where there appears to be restrictions to root growth the root protection area is reshaped to more accurately reflect the likely distribution of the roots.

Arboricultural Impacts Addressed

No.	Species	Proposed structure	Incursion
T17	Small leaved lime	Hard surfacing replacement	RPA
T18	Small leaved lime	Hard surfacing replacement	RPA

Tree Work Schedule

No.	Species	Works	Category
T1	Sycamore	Fell to ground level; remove stump.	C_1
T2 - T9	Small leaved lime	Fell to ground level; remove stump.	B_1
T10	Small leaved lime	Fell to ground level; remove stump.	C_1
T11 - T16	Small leaved lime	Fell to ground level; remove stump.	B_1
G1	Various	Fell to ground level; remove stump.	C_1
G2	Various	Fell to ground level; remove stump.	C_1
G3	Various	Fell to ground level; remove stump.	C_1
G4	Various	Fell to ground level; remove stump.	C_1
G5	Various	Fell to ground level; remove stump.	C_1
G6	Various	Fell to ground level; remove stump.	C_1

All tree work is to be undertaken in accordance with British Standard BS 3998:2010 Tree work - Recommendations.
All arising's are to be removed and the site is to be left as found.
Care is to be taken of the ground around retained trees to make sure that it does not become compacted as a result of tree surgery operations. No equipment or vehicles such as timber lorries, tractors, excavators or cranes shall be parked or driven beneath the crowns of any retained trees, to prevent subsequent compaction and root death.

Arboricultural Supervision

The arboricultural consultant will be required to attend site to directly supervise all demolition and construction works that have to be undertaken within the root protection areas. This will include:
1. Pre-commencement site meeting.
2. Location of protective measures.
3. Removal of existing hard surfacing within the RPAs of tree nos.T17 & T18.
4. Any excavations within or adjacent to RPAs, including foundations, hard surfacing or underground services.
5. Removal of protective measures and sign off.

Arboricultural Method Statement

Please refer to Arbtech Consulting Ltd. Tree Schedule and Arboricultural Method Statement, for full details on all surveyed trees and how all aspects of the the development maybe implemented without detriment to retained trees.

ARBTECH
Unit 3, Well House Barns, Chester, CH4 0DH
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Project:
Etihad Campus,
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OVG Manchester Limited

Drawing:
Tree Protection Plan

Based on:
BRA-POP-ZZ-ZZ-DR-L0650

Drawing No:	Rev:
Arbtech TPP 01	

Date:	Scale:	Drawn:
Feb 2020	1:100 @ A0	AST

Key:

Tree Nos.:	T1	Tree Canopies:		Trunks:	
RPAs:		Category 'B' trees:		Category 'B' groups:	
Category 'C' trees:		Category 'C' groups:		Location of removed tree:	T1
Protective fencing:		Hard surfacing removal:			

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APPENDIX I WASTE MANAGEMENT STRATEGY

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BUROHAPPOLD ENGINEERING

OVG Manchester

Operational Waste Management Strategy

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14 February 2020

Revision P03

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Glossary

Term	Definition
AD	Anaerobic Digestion
CFG	City Football Group
C&I	Commercial and Industrial
Defra	Department for Environment, Food and Rural Affairs
DMR	Dry Mixed Recyclables
FM	Facilities Management
GA	General Admission
IVC	In-Vessel Composting
MBT	Mechanical Biological Treatment
MCC	Manchester City Council
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
OWMS	Operational Waste Management Strategy
RDF	Refuse-Derived Fuel
WEEE	Waste Electrical and Electronic Equipment

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1 Introduction

1.1 Preamble

OVG Manchester Limited (the applicant) are seeking full planning permission for a new multi-use indoor arena, together with supporting retail and leisure facilities, back-of-house and support functions, public realm, cycle parking, access and associated works (the proposed development). The site is located within the administrative area of Manchester City Council (MCC).

The site sits to the north side of the Etihad Stadium and within the eastern edge of the Etihad Campus Masterplan boundary, as is shown in blue in Figure 1.1.

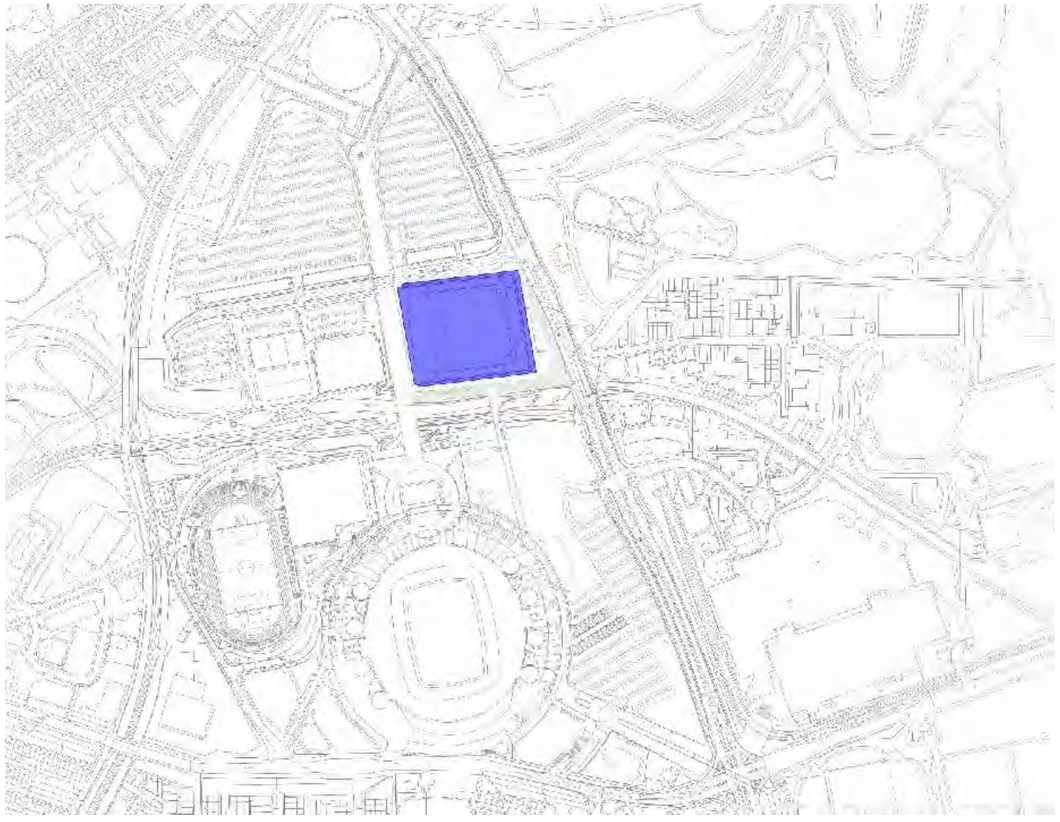


Figure 1.1 Site location

The red line boundary for the site is shown in Figure 1.2.

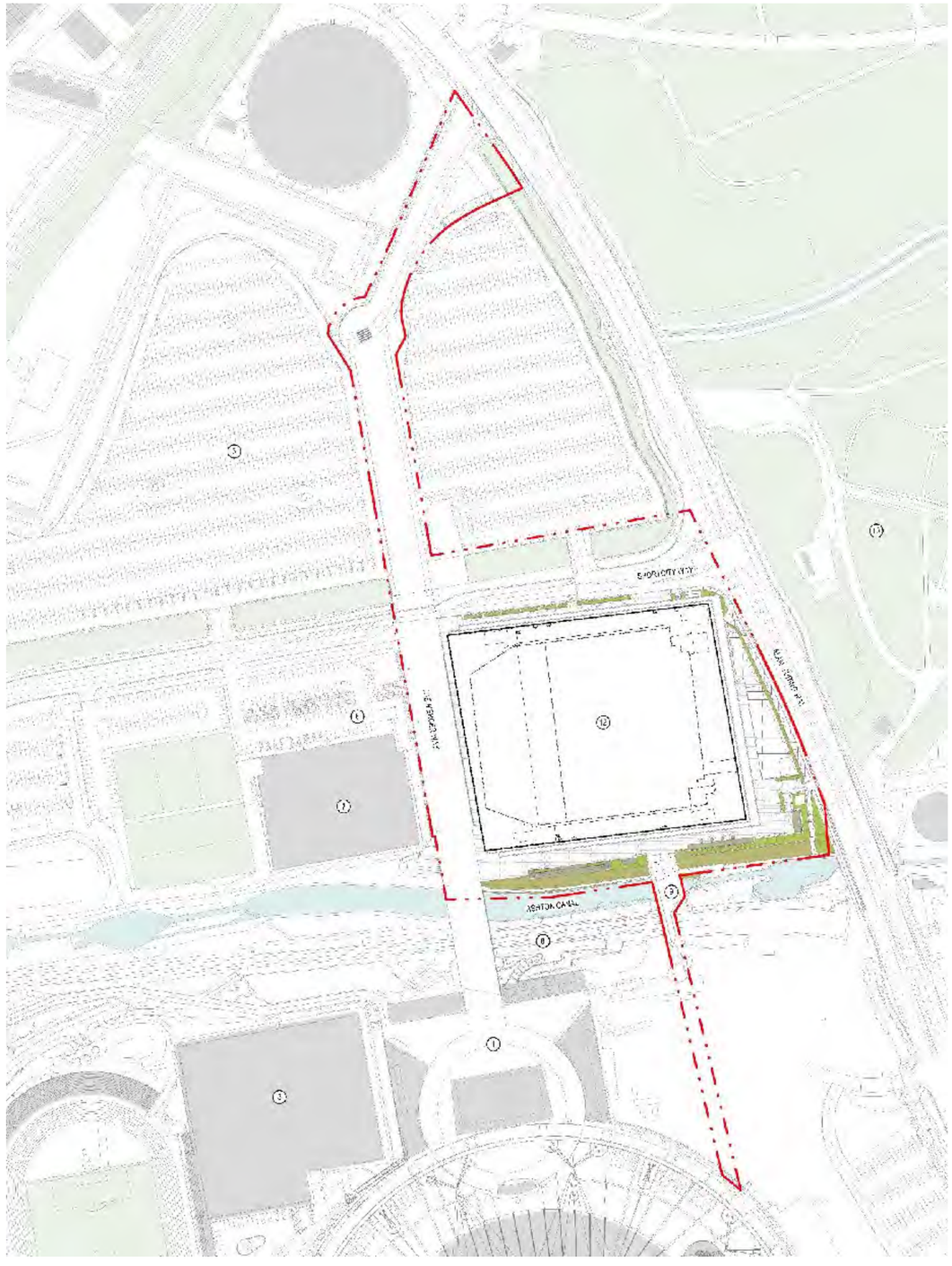


Figure 1.2 Site red line boundary

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This Operational Waste Management Strategy (OWMS) has been prepared by BuroHappold Engineering on behalf of the applicant to accompany a full planning application for the proposed development.

The applicant and the design team have been fully involved in the process of developing this OWMS and acknowledge that the future management of solid waste is an important element to consider when buildings are designed. Planning for future operational waste management will help the venue to operate efficiently, sustainably and safely, all while minimising impacts on building performance, the users of the site and the application site environment.

In line with this, the key objectives of this document are as follows:

- To provide a suite of measures for integrating the principles of the waste hierarchy and circular economy into the proposed development's design and operations;
- To provide an estimate of the anticipated waste generation for the proposed development during operation;
- To provide guidance on the future management of waste to ensure that adequate spatial provision is made in the design for the clean and efficient storage and collection of waste;
- To allow waste and recycling to be easily collected, stored and managed by the Facilities Management (FM) team in a sustainable, efficient and discreet manner; and
- To ensure that national and local policies, as well as all of the applicant's waste management aims and aspirations, are met. Relevant national, regional and local policies are detailed in full in Appendix A.

It should be emphasised that developing the waste strategy is an iterative process. In line with this, there is a clear commitment to keep the OWMS under review to ensure that new methods, attitudes and models in waste management are considered and implemented once the venue is operational.

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2 The Waste Hierarchy and Circular Economy

2.1 Introduction

The applicant aspires for the proposed development to set a new typology in sustainable venue operation, with a focus on achieving the climate change commitments set out in the Manchester Zero Carbon Framework 2020-2038 (see Appendix A).

In line with this aspiration, the applicant will promote the principles of the waste hierarchy (see Figure 2.1) and a circular economy across all aspects of its operations. The waste management strategy will first look to prevent and reduce waste generation, before re-using, recycling or recovering value from discarded material. Only after these options have been deemed unfeasible should the safe treatment and final disposal of waste be considered.



Figure 2.1 The waste hierarchy

The development's waste management strategy will facilitate staff and guests in making sustainable choices and will look to move beyond the traditional linear approach of 'make, use, dispose'. Instead, a circular economy model will be promoted, with the aim of keeping resources in use for as long as possible, so that the maximum value possible can be extracted from them. In line with this ambition, attention will be paid to all stages of product packaging design and use, with the necessary provision made in the design and strategy to enable the effective segregation and recycling of materials.

The key principles of a circular economy model are illustrated schematically in Figure 2.2.

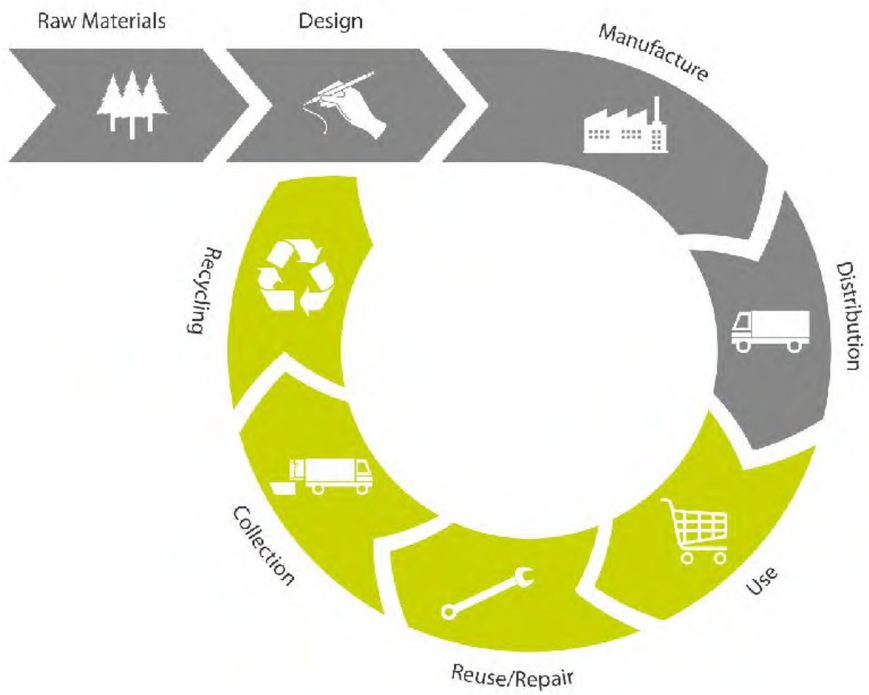


Figure 2.2 Principles of a circular economy

2.2 Reduce

The preferred waste management approach is to, first and foremost, minimise the amount of waste produced and to avoid producing waste to begin with. It is recommended that the following initiatives are implemented during the development's operational phase to help achieve this ambition:

- Educating staff and guests on how they can reduce, reuse and recycle effectively, as well as regular monitoring of waste management performance;
- Incorporating drinking water fountains across the venue in suitable locations as a means of reducing waste from plastic bottles;
- Dispensing condiments from bulk containers instead of single-serve packets can reduce plastic waste generation, as can advising staff to only provide utensils, straws and lids when asked. If any utensils are used, these should preferably be biodegradable or compostable, individually dispensed and unwrapped;
- Using a stock inventory system to monitor and provide control over the use of supplies, helping the applicant to avoid over-ordering and producing unnecessary waste. This should be complemented by a supply chain audit to identify opportunities for removing waste at source, streamlining materials and removing avoidable single-use plastics;
- Procuring products from suppliers that allow for the backhauling of packaging waste or the re-use of packaging crates;

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- Reducing food waste through tracking food sales/consumption to avoid over-ordering. It is recommended that, where possible, surplus food is recovered and donated to local charities;
- Reviewing and developing supplier guidance on how goods are packaged (e.g. using no packaging, edible materials, less packaging or packaging that is made up of a proportion of recycled materials). The applicant will aim to source 100% of any single-use packaging products it procures from recyclable or compostable materials or from credible certifications; and
- There is potential to develop a campus-wide product procurement strategy. Sharing suppliers and delivering in bulk will help to minimise packaging waste.

2.3 Re-use

Where preventing waste generation is not possible, efforts should then be made to re-use items as many times as possible. One potential initiative is to sell reusable cups to guests, with a discounted drink incentive used to encourage lower waste generation.

2.4 Recycle

Where possible, waste that can no longer be re-used or that is no longer needed should be recycled. The applicant should focus efforts on improving the quality of recyclate, committing contractors to monitoring and inspecting the final destination of sorted material to ensure that it is segregated and then recycled. The following measures should be implemented to help improve the quality of recyclate:

- Training staff to ensure that those working at the venue are fully aware of how the waste management and disposal system works;
- Engaging and educating guests to encourage proper disposal of waste and to reduce the potential for contamination;
- Providing clear signage with recycling and disposal guidance;
- Using colour-coded packaging and bags to make it easier to distinguish which bin should be used to dispose of particular items. This will be defined at later stages, once there is a clearer definition on the type of materials likely to be produced on-site; and
- Ensuring that packaging materials of any procured goods are 'streamlined' to reduce the contamination of recycling streams.

In summary, the applicant should ensure that their product procurement strategy puts an emphasis on sourcing materials that can be recirculated back into the value chain. Products that generate unnecessary waste should be avoided, along with materials where a reusable, recyclable or compostable alternative could have been used instead.

2.5 Duty of Care

In line with the Environmental Protection (Duty of Care) Regulations 1990, the applicant has a duty of care to ensure that their waste is managed properly. All waste materials will therefore be stored safely and securely and, when collected, will be taken by a registered waste carrier to an appropriate permitted facility, with all relevant documentation completed.

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3 Waste Movement and Collection

3.1 Introduction

The following section describes the proposed strategy to segregate, store, move and collect all waste generated within the venue.

3.2 Integration with Etihad Campus Masterplan

The applicant is keen to explore opportunities to integrate with the rest of the Etihad Campus and, where possible, to make use of existing infrastructure in order to maximise operational efficiencies. In addition, while the applicant is open to having waste compactors collected from the ground floor service yard, they are reluctant for bins to be collected from this area, as the yard will also be used for artist drop-off.

A portion of the venue's waste will therefore be moved to the existing Etihad Campus waste compound for collection, via a designated bin compound on the L01 podium. The location of the Etihad Campus waste compound is shown in red in Figure 3.1.

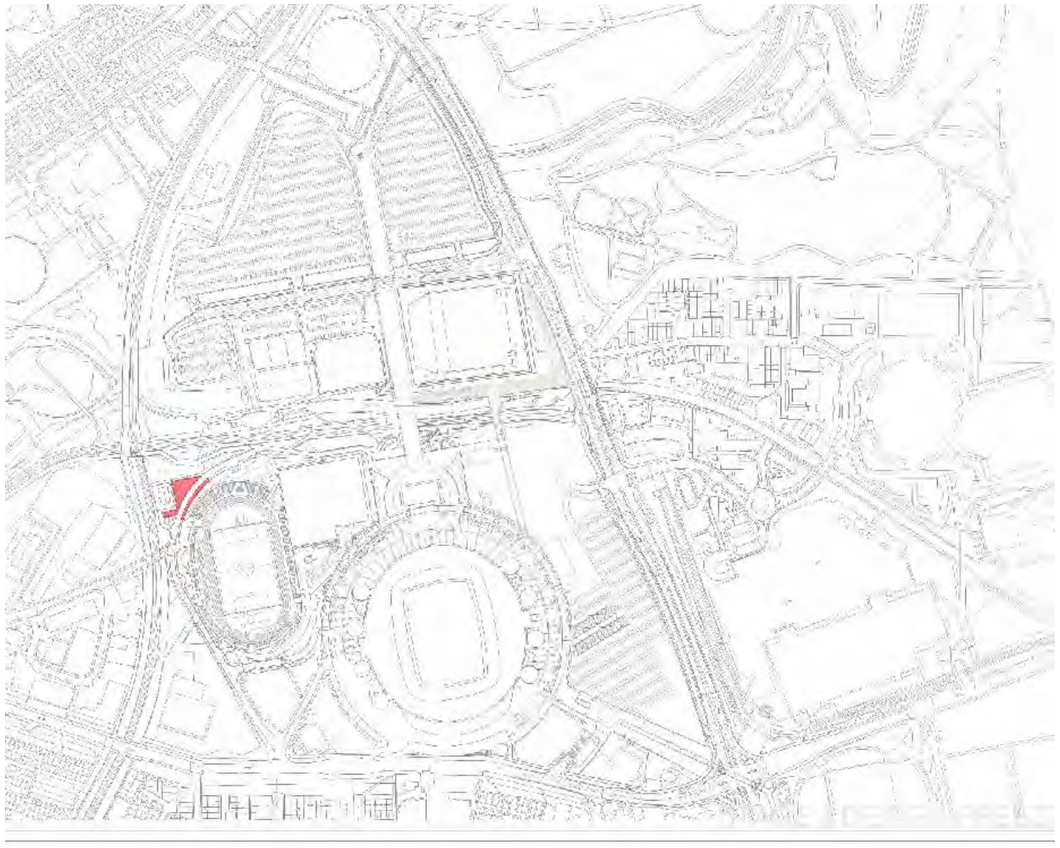


Figure 3.1 Location of existing Etihad Campus waste compound

To ensure that the waste management strategy offers sufficient resilience, provision has been made for a portion of the venue's waste to be compacted on-site and collected from the ground floor service yard. Based on benchmarking work done on existing music-focused arenas, it is anticipated that residual waste will make up the majority of the venue's waste. At this stage, it is therefore proposed that this waste stream is compacted on-site. Meanwhile, high quality dry mixed recyclables (DMR) (primarily consisting of plastic bottles/cups, cardboard packaging and paper), organics and glass will be moved to the Etihad Campus waste compound for collection, via the bin compound on the L01 podium. Further details on the collection strategy are outlined in Section 3.4.

While the proposal at this stage is for residual waste to be compacted on-site, it should be noted that there is flexibility to adapt the strategy, if required. For example, if DMR were to comprise a higher proportion of the venue's waste than initially expected, then there is potential to use one or both of the compactors in the ground floor service yard for this stream, rather than residual waste.

3.3 Waste Segregation and Movement

Waste generated within the venue will be segregated at source into a number of streams. This section outlines the segregation and movement strategy for the following areas:

- Public realm areas;
- Secure ticket check;
- General admission areas;
- Hospitality areas;
- The arena bowl; and
- Other areas.

As a minimum, each area will segregate residual waste and DMR, although glass and organic waste will also be segregated in some areas.

Public Realm Areas

Litter bins will be provided throughout the public realm podium areas, with residual waste and DMR segregated. The exact specification of litter bins will be confirmed at later stages. To help reduce the risk of littering and improve recycling capture rates, it is recommended that messages on bins are simplified, for example, through using images of recyclable and non-recyclable items. Litter bins should also be easily visible and be placed at frequent intervals to avoid excessive walking distances.

The site FM team will regularly service the litter bins and undertake litter picks to ensure that waste does not become an environmental or visual nuisance. When the bins are nearly full, they will use mobile waste containers to transfer DMR bags to the L01 bin compound and residual bags to the ground floor compactors, as is illustrated in Figure 3.2.

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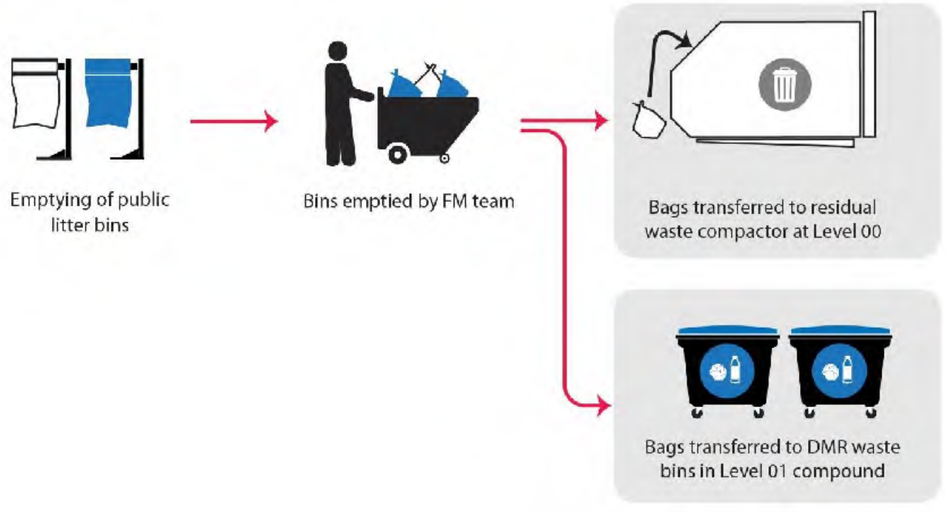


Figure 3.2 Illustration of waste strategy in public realm areas

Secure Ticket Check

Guests are also likely to dispose of waste when entering the venue. A two-stream system of litter bins will therefore be provided at the secure ticket check, with residual waste and DMR segregated.

Bins at the secure ticket check will be emptied and removed during quieter periods, when the majority of guests are in the arena bowl. The FM team will collect bagged waste from the bins and then use mobile waste containers to move waste manually to the compactors at ground floor (residual waste) or the bin compound at L01 (DMR).

General Admission Areas

General admission (GA) concourses give access to the arena bowl and also provide facilities for guests, including toilets, food concessions, bars and merchandising outlets.

Most food preparation on-site will take place in the main commissary kitchen at ground floor level. As such, it is expected that the quantities of organic waste generated in the GA concourses will be minimal. A separate organic waste collection is therefore not deemed necessary in these areas. Instead, two streams will be segregated: residual waste and DMR.

Two-stream litter bins will be provided throughout the concourses. When these areas are less congested, the venue's FM team will empty the litter bins and transfer bagged waste using mobile waste containers to 660 litre bins in intermediate waste stores, as is shown in Figure 3.3. The intermediate stores provide a space for temporary waste storage during an event and will help to reduce the risk of litter bins overflowing.

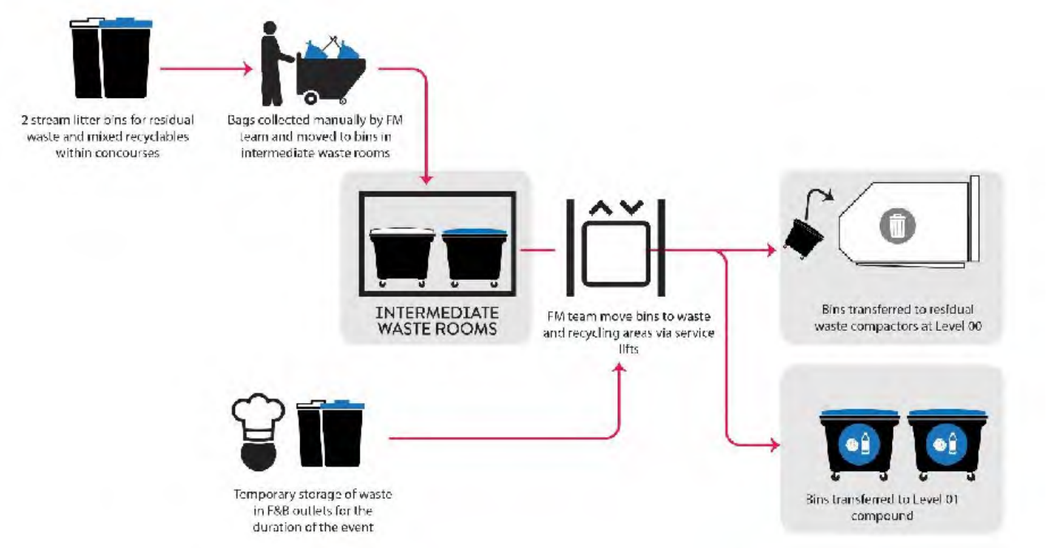


Figure 3.3 Illustration of waste strategy for GA concourses

Waste generated within the GA bars and concession units themselves will be stored within these units for the duration of an event, with residual waste and DMR segregated at source.

The FM team will move the 660 litre bins from the intermediate stores and bagged waste from the bar and concession units to the ground floor compactors (residual waste) or to the L01 bin compound (DMR). Bins will mainly be transferred to ground floor or L01 using the service lift in the north-east corner, although the service lift in the south-east corner can also be used if needed. Figure 3.4 shows the location of these lifts and illustrates the main routes that will be used for waste movement at ground floor level and on L01. Each service lift is capable of holding five 660 litre bins and a member of staff. It should also be noted that the northern service lift is located in close proximity to the ground floor compactor area and L01 bin compound which will help to reduce staff travel distances and minimise the time required for venue clean-down.

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Figure 3.4 Illustration of main waste movement routes (ground floor and L01)

The movement of bins from the intermediate stores to ground floor and L01 will be staggered so as to avoid bottlenecks in these areas. In addition, the compactors in the ground floor service yard will each be fitted with a bin hoist to improve the efficiency of waste management operations. Once bins have been emptied/collected, the FM team will return them to the appropriate intermediate waste room.

Hospitality Areas

It is anticipated that a plated (washable) premium service will be offered in the venue's hospitality areas. The use of reusable cutlery, crockery and glasses is an effective means of preventing and reducing waste generation. While this is the case, it is still expected that some wastes will be generated in these areas, namely glass from bottled beverages, organics (from plate waste) and some DMR (as it is likely that plastic glasses will be offered for use in hospitality areas that are open to the bowl).

These areas will be kept clean by hospitality staff, with waste 'backhauled' to the kitchens/bars on each level, where residual waste, DMR, organics and glass will be segregated. Hospitality staff will be provided with adequate training to ensure that they are aware of the procedure for separating waste streams. It is also recommended that a food waste tracking system is used in the kitchens to monitor the main sources of organic waste and to use this data as the basis for effective waste reduction interventions.

Waste from these areas will be moved at the end of an event once all guests have left the venue, with residual waste transferred to the ground floor compactors, while DMR, organics and glass are transferred to the L01 bin compound. The waste segregation and movement strategy for the hospitality areas is illustrated schematically in Figure 3.5.

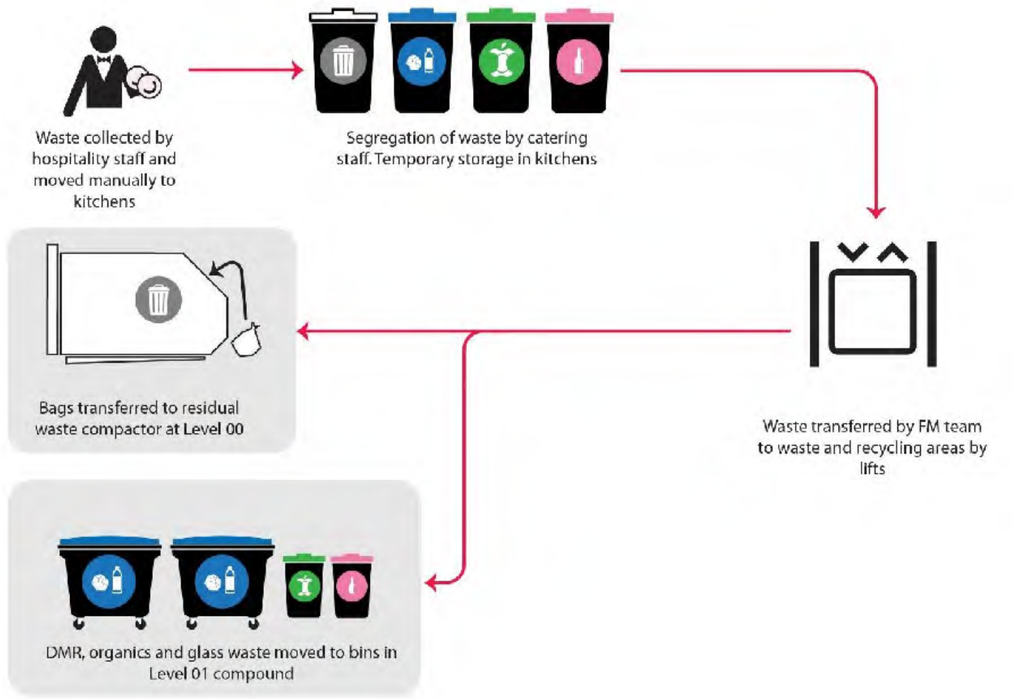


Figure 3.5 Illustration of waste strategy for hospitality areas

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Arena Bowl

Any waste left in the arena bowl will be moved directly to the compactors at ground floor (residual) and the L01 bin compound (DMR) once guests have left the venue. It is recommended that the FM team carry out a positive pick in order to collect mixed recyclables. While collecting waste by hand is labour-intensive, it is one of the most effective methods for recovering recyclable materials. The residual waste that remains will be bagged and moved manually to the compactors in the ground floor service yard, as illustrated in Figure 3.6.

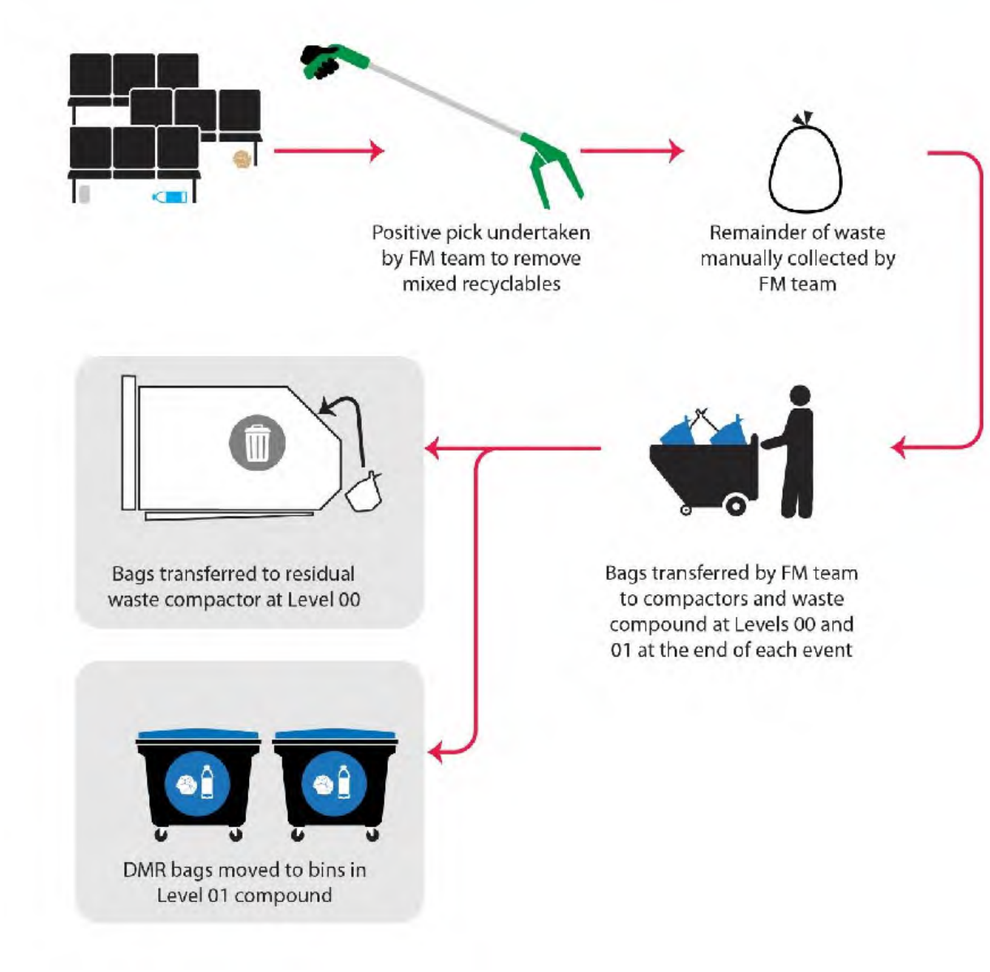


Figure 3.6 Illustration of waste strategy for the arena bowl

Other Areas

The ground floor commissary kitchen will be the main area in which food preparation is undertaken. It is therefore proposed that organic waste is segregated in this area, in addition to residual waste and DMR. When full, residual bins will be emptied into the compactors, while DMR and organics bins will be transferred to the L01 bin compound.

It is anticipated that relatively small quantities of waste will be generated in the offices, artist and crew areas. Waste from these areas will therefore be stored locally on event days in small bins and will be segregated into the following two streams: residual waste and DMR. When convenient, bags will be collected and moved to the compactors at ground floor (residual) or the L01 bin compound (DMR) by the venue's FM team.

3.4 Waste Collection

As outlined in Section 3.2, a portion of the venue's waste will be compacted on-site and collected from the ground floor service yard, with the remainder moved to the Etihad Campus waste compound for collection. At this stage, it is anticipated that residual waste will be compacted on-site, with DMR, organics and glass collected from the off-site compound. The collection strategy for the venue is summarised in Figure 3.7.

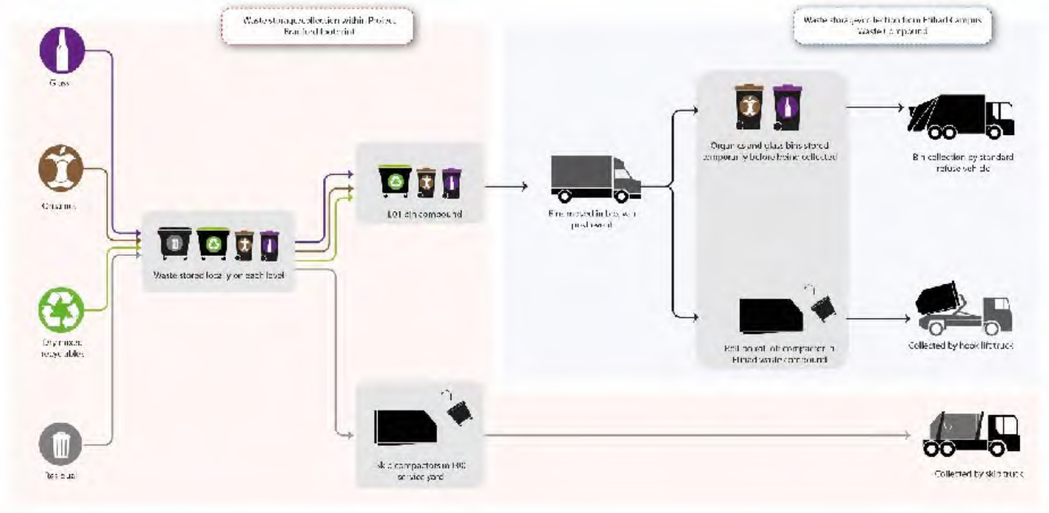


Figure 3.7 Illustration of waste collection strategy for the venue

Space has been provided in the ground floor service yard for two skip compactors, each with an approximate capacity of 11m^3 and the following approximate dimensions (including bin hoist): 2.19m (H) x 1.89m (W) x 5.73m (L). Further details on the compactors are set out in Section 4.4.

The compactors will be collected by a private contractor, with collection vehicles accessing and exiting the service yard via Sportcity Way to the north. Access to the service yard will be controlled and secure, with vehicles stopped at a point external to the building to allow them to be identified and checked before entering.

A skip-lift truck will be used to collect each of the compactors, an example of which is shown in Figure 3.8.

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Figure 3.8 Example of skip-lift swing-arm truck

A minimum head clearance of 5.0m has been provided above and in front of the compactors to enable the compactor lift. The positioning and orientation of the compactors has been carefully assessed to mitigate any health and safety risks to staff and to ensure that the trucks do not obstruct the main servicing circulation route when making collections. The compactors will be collected at separate times to minimise the risk of any vehicle clashes. To help further mitigate this risk, a banksman will also be present to supervise all waste collections.

Swept path analysis has been undertaken to demonstrate how the compactors will be collected from the ground floor service yard, as is shown in Appendix C. For the purposes of this analysis, a skip-lift truck with the following dimensions has been tested: 3.66m (H) x 2.48m (W) x 7.10m (L).

As outlined in Section 3.2, DMR, organics and glass will be moved to a 'recycling zone' in the L01 bin compound, before being transferred to the Etihad Campus waste compound for consolidation and collection. To maximise the efficiency of operations, it is recommended that a 3.5t box van is used for transferring bins (see example in Figure 3.9). This vehicle must be fitted with a tail-lift and should have the following approximate dimensions: 6.51m (L) x 2.20m (W) x 3.10m (H). A vehicle of this size will be able to transport a minimum of four 660 litre bins or ten 240 litre bins at a time.



Figure 3.9 Example of 3.5t box van

Swept path analysis has been undertaken to demonstrate how bins will be collected from the L01 bin compound, as is shown in Appendix C. The box vans will follow the route shown in Figure 3.10 when transferring waste to the Etihad Campus waste compound. In order to avoid any adverse impact on users of the campus, waste will be moved in the early hours, when levels of pedestrian activity are at their lowest.

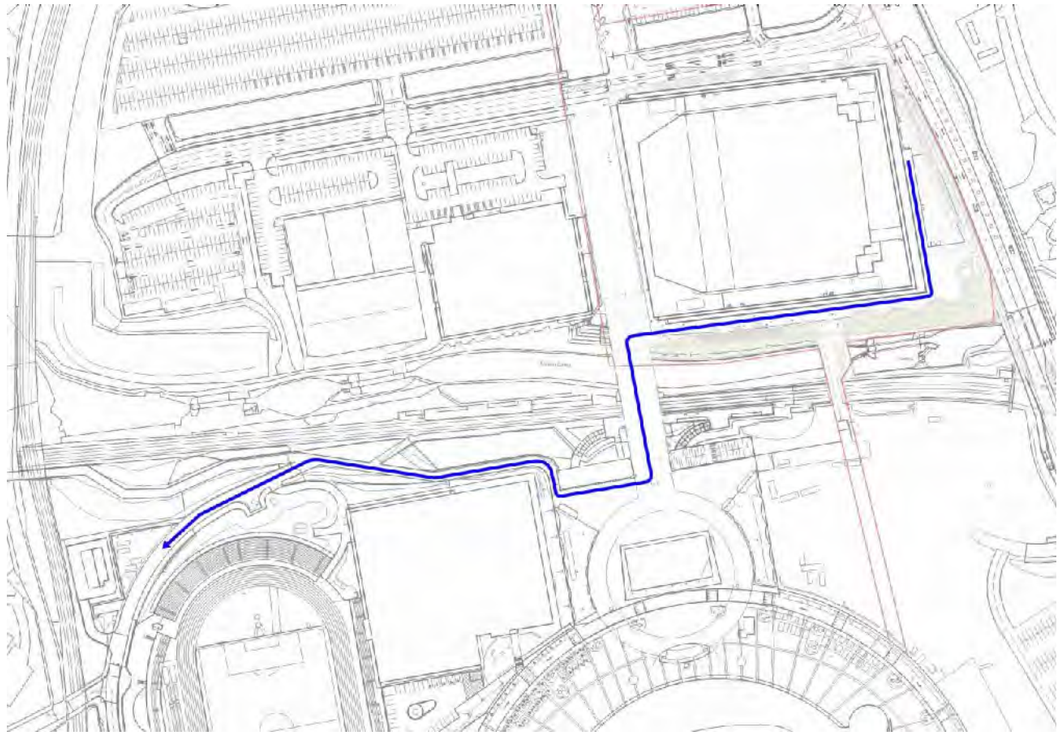


Figure 3.10 Indicative route used to transfer waste from L01 bin compound to Etihad Campus waste compound

Organics and glass waste will not be compacted and will instead be collected from the Etihad Campus waste compound by a rear-end loader refuse vehicle. It is therefore recommended that these bins are transferred across to the Etihad Campus waste compound first, to allow maximum time for them to be collected and returned to the venue before pedestrians once again begin circulating the campus.

In contrast, mixed recyclables will be compacted at the Etihad Campus waste compound, meaning that the DMR bins can be emptied on arrival and returned to the venue immediately. To minimise the number of waste vehicle trips, it is proposed that this waste stream is stored in a large portable roll-on roll-off compactor and collected by a hook-lift truck.

3.5 Waste Treatment/Disposal

As outlined in Section 2.1, the applicant will look to apply the principles of the waste hierarchy to all aspects of their operations, prioritising waste prevention, reduction, re-use, recycling and energy recovery over landfill disposal.

In line with this, DMR will be directed to a materials recovery facility (MRF) for sorting and onward transfer to recycling processing facilities. There are a number of MRFs in the region serving the commercial and industrial (C&I) sectors, one example being the Fresh Start MRF just outside the M60 ring road.

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It is proposed that organic wastes are sent for treatment at either an anaerobic digestion (AD) plant or an appropriate composting facility. AD is the process by which organic waste is broken down in the absence of oxygen in sealed tanks to produce biogas and bio-fertiliser. Meanwhile, composting can take several forms, with in-vessel composting (IVC) systems most prevalent in urban areas. These systems involve aerobically breaking down organic waste in a contained environment.

The Greater Manchester Joint Waste Development Plan Document (see Appendix A) states that there will be sufficient recycling capacity and sufficient organic waste treatment capacity for managing waste generated by the region's C&I sectors, at least until 2028.

In terms of residual waste, the applicant's first priority will be to minimise the amount of this material that is generated. Any residual waste that is produced should be diverted to energy recovery facilities, either directly or after being pre-treated at a mechanical biological treatment (MBT) facility. This strategy aligns with the applicant's aspiration to consign as little waste as possible to landfill.

MBT plants use mechanical and biological processes to convert residual material into refuse-derived fuel (RDF). The thermal treatment of this fuel can then be used to generate energy. Much of the RDF output from Manchester's MBT facilities can be sent to the Viridor energy recovery facility in Runcorn, which serves Liverpool, Cheshire and Greater Manchester, and can treat approximately 850,000 tonnes of RDF per year.

The applicant should undertake regular auditing and inspection of waste treatment facilities to ensure that they are maximising recycling rates and landfill diversion rates.

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4 Waste Generation and Storage Requirements

4.1 Introduction

In order to determine the spatial requirements for waste storage, outline waste quantities have been estimated. These have been based on the seating manifest for the venue, along with a number of additional assumptions informed by benchmarking work on other music-focused arena developments. These assumptions are outlined in Section 4.2.

It should be noted that the current proposed seating manifest may be subject to minor changes in future design stages. However, any alterations are unlikely to result in significant changes to operational waste generation quantities.

4.2 Key Working Assumptions

Venue-Wide

- To estimate the total quantity of waste generated by the venue, a venue-wide waste generation rate has been used. This has been based on waste generation data for a range of other music-focused arena developments. It has been assumed that 0.31kg of waste will be generated per guest per event. On the basis of the data that has been analysed, this generation rate is deemed to be conservative and represent a reasonable worst case;
- Based on the frozen seating manifest, the maximum potential capacity of the venue has been estimated at 23,275. This maximum capacity will occur during a 'Concert Terraces Centre Stage Standing' event. While this is likely to represent an absolute worst case in terms of waste generation, it should be emphasised that this type of event is only likely to occur on a very rare basis. While sufficient storage space will be provided across the venue for the waste generated during this type of event, the intermediate waste stores on each level are intended to accommodate a more 'typical' event scenario. On the rare occasions that the capacity of the venue reaches 23,275, a number of strategies will be implemented to manage the uplift in waste generation and ensure that waste does not cause a significant detrimental impact (see Section 4.4);
- The composition split for the venue has been based on existing operations at a range of existing music-focused arenas. The assumed composition split (by mass) is as follows: 50% residual waste; 30% dry mixed recyclables; 10% organics; and 10% glass; and
- A 60% high quality recycling capture rate has been applied, as, based on past project experience, it is expected that some guests will incorrectly dispose of recyclables in the residual waste stream.

General Admission Areas

Outline bin numbers for the GA intermediate storage areas have been based on the following assumptions, which have been informed by benchmarking work done on a range of other music-focused arena developments:

- Waste generated within the GA concessions and bars will be stored locally within the units themselves for the duration of an event;
- Waste from the GA concourses and litter bins will be cleared by the venue's FM team and stored temporarily in intermediate waste rooms on each level;
- A separate specific generation rate for GA guests has been used to help estimate the amount of waste generated in the GA concourses. It has been assumed that 0.23kg of waste will be generated per GA guest per event, based on operations at a range of existing music-focused arenas;
- The amount of waste generated in the GA concourses has in large part been based on a 'Concert Terraces End Stage Full Standing 220' event. This type of event will occur on a regular basis and will have a capacity of 20,455 – the maximum capacity for events that occur on a rare, occasional, regular or very regular basis;
- The amount of waste generated in the L01 concourses has been estimated based on a 'Concert Terraces End Stage Seated 220 Degree' event. This type of event will occur on a very regular basis. While the total capacity for this type of event will be lower than a 'Concert Terraces End Stage Full Standing 220' event, the number of guests and amount of waste generated in the L01 concourse is likely to be higher;
- In the concourse areas, it has been assumed that residual waste and DMR will be segregated, with an assumed composition split (by mass) of 62.5% residual to 37.5% DMR. A 60% recycling capture rate applied;
- It has been assumed that both waste streams will be stored in the intermediate waste rooms in 660 litre Eurobins, each with an assumed maximum fill weight of 80kg;
- The total mass of waste for each concourse has been estimated by multiplying the GA guest generation rate by the number of guests using each concourse; and
- It has been assumed that 70% of this waste will be accessible to the FM team during an event, with the remaining 30% left by guests in the arena bowl (to be cleared post-event).

Hospitality Areas

- Waste from the hospitality areas will be 'backhauled' by hospitality staff to the bars/satellite kitchens on each level, where space for waste storage will be provided;
- It is anticipated that less packaging waste will be generated in the hospitality areas compared to in the GA concourses due to the plated (washable) service and use of washable glassware; and
- While some residual waste and dry mixed recyclables will be generated, it is expected that the majority of waste will arise from organics (from plate waste) and glass. All four waste streams will be segregated in the kitchens and stored in bins.

Other Areas

- It has been assumed that the remainder of the venue's waste will be generated in other areas, namely the arena bowl, main commissary kitchen, crew and artist facilities, offices, etc; and
- It has been assumed that waste generated in the arena bowl will accumulate on the floor during an event (to be cleared once guests have left the venue).

L01 Bin Compound

- The main purpose of the bin compound on the L01 podium will be to temporarily hold DMR, organics and glass bins before they are transferred to the Etihad Campus waste compound; and
- At this stage, it has been assumed that DMR will be stored in 660 litre Eurobins (with a maximum fill weight of 80kg) while organics and glass will be stored in 240 litre Eurobins (with a maximum fill weight of 50kg).

4.3 Waste Generation

Venue-Wide

Based on the assumptions set out in Section 4.2, it is expected that approximately 7,300kg of waste will be generated during a 'Concert Terraces Centre Stage Standing' event, as is illustrated in Table 4.1. This represents an absolute worst case in terms of waste generation during an event.

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Table 4.1 Estimated waste generation per 'Concert Terraces Centre Stage Standing' event

Land use	Maximum capacity	Estimated waste generation (kg/event)				
		Residual*	Recyclables	Organics	Glass	Total
Venue-wide	23,275	4,502	1,307	726	726	7,262

*assuming 60% recycling capture rate

General Admission Areas

In the concourse areas, it is proposed that two primary waste streams will be segregated: residual waste and DMR. Table 4.2 details the expected waste generation for each concourse area for a 'Concert Terraces End Stage Full Standing 220' event. This type of event represents a more 'typical' scenario and has been used to help estimate the number of bins required in the intermediate waste stores.

Table 4.2 Estimated waste generation per 'Concert Terraces End Stage Full Standing 220' event (general concourse guests only)

Level	No. of GA guests using concourses*	Estimated waste generated by GA guests (kg/event)		
		Residual**	Mixed recyclables	Total
GF HALL	7,746	1,353	393	1,745
L01 DECK	2,836	495	144	639
L02 CLUB	0	0	0	0
L03 LOFT	7,743	1,352	393	1,745
L04 ATTIC	0	0	0	0
Total	**18,325**	**3,200**	**929**	**4,129**

*these numbers do not include those seated in the hospitality areas, as these areas will not be served by the GA intermediate waste stores. Waste from the hospitality areas will instead be backhauled to the bars/kitchens, where space for waste storage will be provided.
**assuming 60% recycling capture rate

Waste quantities have also been estimated for a 'Concert Terraces End Stage Seated 220 Degree' event, as the number of guests using the L01 concourse will be higher during this type of event, as is shown in Table 4.3.

Table 4.3 Estimated waste generation per 'Concert Terraces End Stage Seated 220 Degree' event (general concourse guests only)

Level	No. of GA guests using concourses*	Estimated waste generated by GA guests (kg/event)		
		Residual**	Mixed recyclables	Total
GF HALL	3,474	607	176	783
L01 DECK	4,916	858	249	1,108
L02 CLUB	0	0	0	0
L03 LOFT	7,743	1,352	393	1,745
L04 ATTIC	0	0	0	0
Total	**16,133**	**2,817**	**818**	**3,635**

*these numbers do not include those seated in the hospitality areas, as these areas will not be served by the GA intermediate waste stores. Waste from the hospitality areas will instead be backhauled to the bars/kitchens, where space for waste storage will be provided.
**assuming 60% recycling capture rate

As specified in Section 4.2, it is anticipated that approximately 70% of GA waste will be accessible to the FM team for collection during an event, with the remaining waste from guests using these areas left in the arena bowl, and therefore inaccessible during event mode. The total estimated quantity of waste which could potentially be stored in each of the GA intermediate stores is shown in Table 4.4. The numbers for ground floor and L03 have been based on a 'Concert Terraces End Stage Full Standing 220' event, while the numbers for L01 have been based on a 'Concert Terraces End Stage Seated 220 Degree' event.

Table 4.4 Estimated quantity of waste to be stored in GA intermediate waste rooms

Level	Estimated waste generated by GA guests (kg/event)	Waste which can be stored in intermediate rooms (kg/event)		
		Residual	Mixed recyclables	Total
GF HALL	1,745	947	275	1,221
L01 DECK	1,108	601	174	775
L02 CLUB	0	0	0	0
L03 LOFT	1,745	947	275	1,221
L04 ATTIC	0	0	0	0

4.4 Waste Storage

General Admission Areas

Intermediate waste stores will be provided in close proximity to the GA concourses. These stores will help to reduce the risk of litter bins overflowing and will improve the efficiency of waste management operations.

If the stores were to hold waste for the duration of a 'typical' high-capacity event, then they would need to accommodate the bin numbers shown in Table 4.5. The numbers for ground floor and L03 have been based on a 'Concert Terraces End Stage Full Standing 220' event, while the numbers for L01 have been based on a 'Concert Terraces End Stage Seated 220 Degree' event.

Table 4.5 Expected intermediate waste storage requirement (concourses)

Level	Waste which can be stored in intermediate rooms (kg/event)	No. of 660 litre Eurobins required		
		Residual	Mixed recyclables	Total
GF HALL	1,221	12	4	16
L01 DECK	775	8	2	10
L02 CLUB	0	0	0	0
L03 LOFT	1,221	12	4	16
L04 ATTIC	0	0	0	0

The intermediate stores will be designed to hold waste for the duration of an event. However, where spatial constraints preclude this, a number of options are available for preventing the build-up of waste. For example, the FM team could move waste from the stores to the ground floor compactors and L01 bin compound during the course of an event. An indicative layout for one of the potential storage spaces on L03, with waste containers drawn in situ, is shown in Figure 4.1.

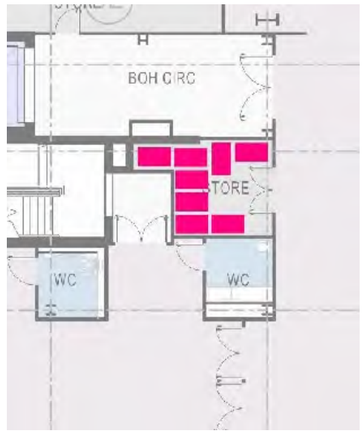


Figure 4.1 Indicative layout of potential L03 intermediate waste store

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All waste rooms will have adequate ventilation and lighting. Drainage need not be provided; however, rooms will be fitted out to be easily cleaned and maintained. Rubber buffers or stainless steel plating should also be incorporated in all waste rooms and service lifts to avoid damaging the walls.

L01 Bin Compound

The L01 bin compound will be used to temporarily hold DMR, organics and glass bins before they are transferred to the Etihad Campus waste compound. The compound has been sized to provide sufficient space to store all DMR, organics and glass bins for the venue.

Based on the assumptions set out in Section 4.2 and the waste generation values for a worst-case event (see Table 4.1), it is recommended that the L01 bin compound provides adequate space to accommodate the bin numbers shown in Table 4.6.

Table 4.6 Estimated number of Eurobins required in the L01 bin compound

	DMR 660 litre Eurobins	**Organics** 240 litre Eurobins	**Glass** 240 litre Eurobins
Total estimated waste generation (kg/event)	1,307	726	726
Total number of Eurobins required in L01 bin compound	17	15	15

Space will also be provided in the L01 bin compound for the following:

- An area for temporarily holding bins before they are moved across to the Etihad Campus waste compound;
- An area for temporarily holding empty bins that have been returned from the Etihad Campus waste compound. To maximise the efficiency of operations, full bins ready for dispatch should be separated from empty bins returned; and
- A bin wash-down area with appropriate drainage provision. Drainage should be by means of a trapped gully connected to the foul sewer.

An indicative layout of the L01 bin compound with the containers drawn in situ is shown in Figure 4.2.

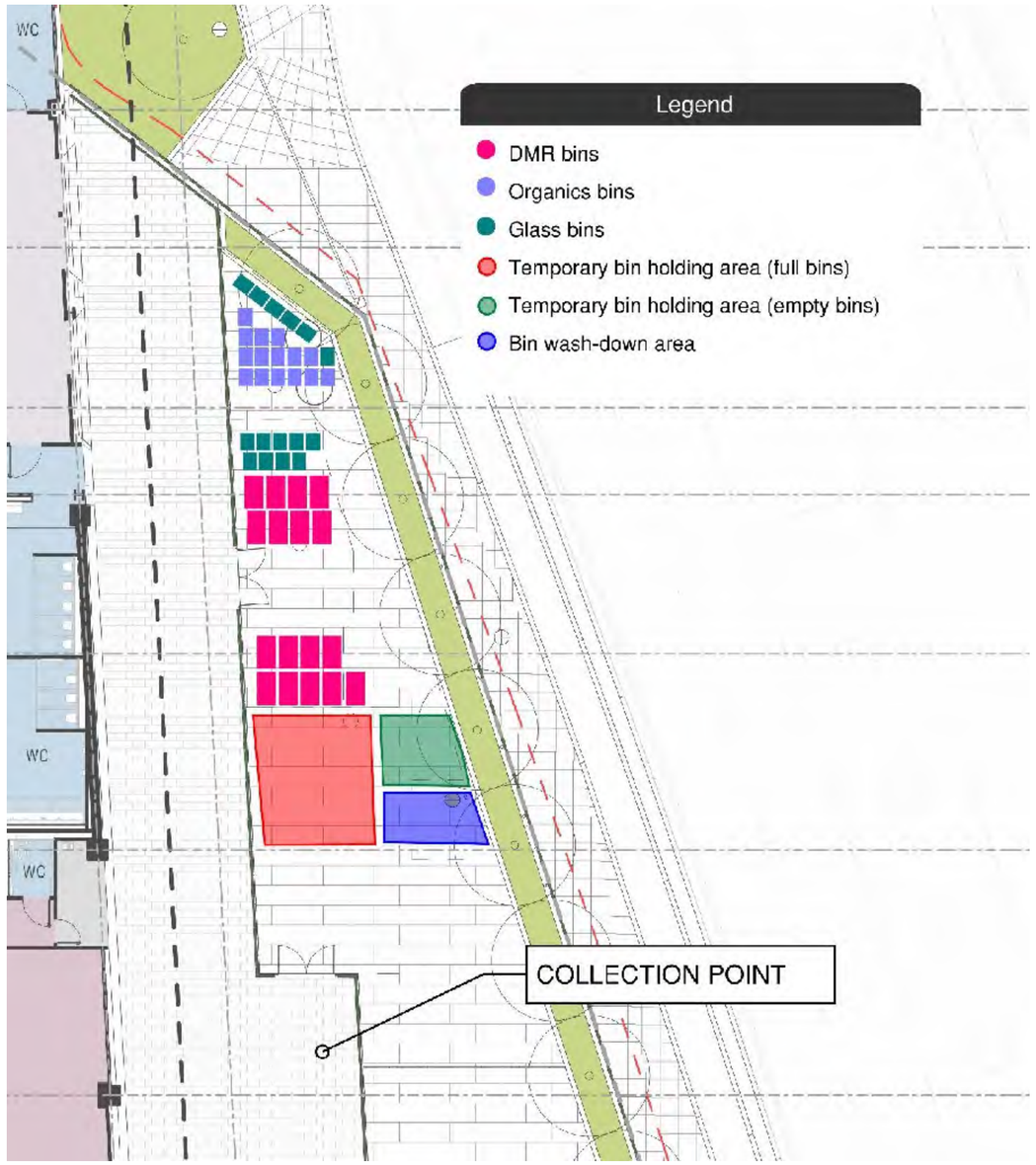


Figure 4.2 Indicative layout of L01 bin compound

The L01 bin compound will be secured and adequately lit to prevent unauthorised access. It is recommended that the walls of the compound are formed of non-combustible material that is robust, so as to prevent vermin entering.

Ground Floor Service Yard

At this stage, it is proposed that all of the venue's residual waste is compacted on-site and collected from the ground floor service yard. However, as outlined in Section 3.2, it should be emphasised that there is flexibility to adapt the strategy, if required.

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As with the L01 bin compound, the ground floor service yard must be properly equipped and maintained, with adequate pedestrian buffer zones, markings and signage, supervision and security.

The compactor store in the ground floor service yard includes space for the following:

- A dedicated secure cabinet for the storage of any hazardous wastes. All areas for hazardous waste storage are to be properly marked, with safe and secure containers used. Safe working methods are to be adopted by any operatives handling hazardous wastes;
- 2 no. portable skip compactors (with an approximate capacity of 11m^3 and payload of up to 3,000kg). The typical dimensions for this piece of equipment are as follows: 2.19m (H) x 1.89m (W) x 3.93m (L) (5.73m long with bin hoist). These compactors have an operating height clearance of 5.0m. The bin hoists will need to be folded up and over the compactors at collection times to avoid clashing with the collection vehicles. The applicant will ensure that a compactor and bin hoist model is selected that allows for this; and
- Space for the storage of a small quantity of Waste Electrical and Electronic Equipment (WEEE) wastes that will be generated.

It is anticipated that at least one of the compactors will need to be collected between each event, as is shown in Table 4.7, with the second compactor providing capacity for any additional residual waste. It should be noted, however, that there is flexibility to adapt the compactor collection frequency depending on the events that are scheduled for each week.

Table 4.7 Residual compactor requirements

	Residual
Estimated waste generation (kg/event)*	4,502
Maximum compactor payload (kg)	3,000
Compactor fill level	150%
Number of compactors required in ground floor service yard	2

*assuming 60% recycling capture rate

An indicative plan of the compactor store in the ground floor service yard, with the compactors drawn in situ, is shown in Figure 4.3. In order to mitigate health and safety risks and facilitate vehicle movements in the service yard, one of the compactors has been positioned at an angle. The column layout and roller shutter will be adjusted in future design stages to accommodate this. To mitigate the risk of any vehicle clashes, the compactors will be collected at separate times. In addition, a banksman will be present to supervise all waste collections.

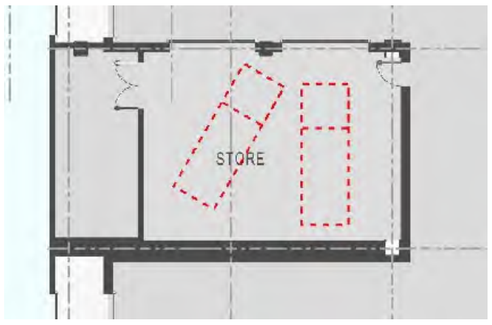


Figure 4.3 Indicative layout of compactor store in ground floor service yard

Etihad Campus Waste Compound

DMR, organics and glass bins will be transferred from the L01 bin compound to the Etihad Campus waste compound in the early hours, when levels of pedestrian activity are at their lowest. At this stage, it has been assumed that waste generated from the proposed development will be stored separately from waste generated by the rest of the Etihad Campus, as a further study of campus waste quantities will need to be undertaken if waste storage equipment is to be shared between different elements of the masterplan.

On this basis, the applicant and City Football Group (CFG) will ensure that adequate space is set aside for the proposed development's waste operations on top of what is currently provided in the compound to serve other parts of the masterplan. Space will therefore be provided in the Etihad Campus waste compound for the following:

- 1 no. portable roll-on roll-off compactor for DMR. At this stage, it is recommended that a compactor with an approximate capacity of 24m^3 is used. The approximate dimensions of this compactor (with bin hoist) are as follows: 2.56m (H) x 2.55m (W) x 8.92m (L). Sufficient manoeuvring space will also be provided so that the compactor can be collected by a hook-lift truck;
- Space for holding 30 no. 240 litre bins. Sufficient manoeuvring space will also be provided so that the bins can be collected by a rear-end loader dustcart; and
- A bin wash-down area with appropriate drainage provision.

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5 Conclusions

This OWMS has described how operational waste generated from the proposed OVG Manchester development will be managed in compliance with relevant national, regional and local waste management policy requirements (see Appendix A).

The waste management strategy has been formulated with the guiding vision of helping the venue to operate efficiently, sustainably and safely, all while minimising impacts on building performance, the users of the site, and the application site environment. In line with Manchester's Local Development Framework Core Strategy Development Plan Document (MCC, 2012), the strategy will promote the principles of the waste hierarchy and a circular economy. The emphasis will first and foremost be on minimising the amount of waste that is generated. Product procurement will play a key role in achieving this, with particular consideration given to how goods are packaged (e.g. using no packaging, edible materials, less packaging or packaging that is made up of a proportion of recycled materials).

In line with the requirements set out in the National Planning Policy for Waste (Ministry of Housing, Communities and Local Government, 2014), the waste management strategy will then look to maximise recycling and re-use, with waste segregated at source into a number of streams. As a minimum, residual waste and mixed recyclables will be separated, although some areas will also segregate glass and organic waste.

The venue will be at its busiest during a 'Concert Terraces Centre Stage Standing' event and it is at this type of event that most waste will be generated. In total, it is estimated that approximately 7,300kg of waste will be produced when the venue reaches maximum capacity.

Adequate provision has been made in the venue's ground floor compactor store and L01 bin compound for the on-site storage of all operational waste. The provision of intermediate waste storage rooms in various locations across the venue will provide further resilience and also improve the efficiency of waste management operations. These rooms will be located in close proximity to those areas that generate the most significant quantities of waste (i.e. the GA concourses), and will enable waste to be held locally until the guest circulation areas are less congested. Bins will be moved down to the ground floor compactors and L01 bin compound during the course of an event when the concourse areas are less congested.

At this stage, it is proposed that residual waste will be compacted on-site and collected from the ground floor service yard, while DMR, glass and organics will be moved to the Etihad Campus waste compound for collection, via the bin compound on the L01 podium. However, it should be emphasised that there is flexibility to adapt which waste streams are collected from the service yard at ground floor level, for example, if DMR were to comprise a higher proportion of the venue's waste stream than initially expected.

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Appendix A Waste Management Policy and Guidance

A.1 Introduction

This appendix provides an overview of the most relevant national, regional and local policies and guidance relating to the management of waste in the proposed development.

A.2 National Context

Government Review of Waste Policy in England (Department for Environment, Food and Rural Affairs, 2011)

This document aligns with the EU Waste Framework Directive (2008/98/EC) and sets out requirements for the collection, transport, recovery and disposal of waste. It prioritises efforts to manage waste in line with the waste hierarchy, with a focus on waste prevention and reuse, supporting greater resource efficiency.

Waste Management Plan for England (Department for Environment, Food and Rural Affairs, 2013)

This legislative document sets out a planning framework to help local authorities develop strategies that identify sites and areas suitable for new or enhanced waste management infrastructure/facilities. In addition, the document provides advice for local authorities to better apply the waste hierarchy in their own jurisdiction.

At its core, the plan describes how the government intends to work towards a more efficient and sustainable approach to waste and resource use/management. It provides an analysis of the waste management situation in England and how it will aim to achieve the objectives of the EU Waste Framework Directive (2008/98/EC).

National Planning Policy for Waste (Department for Environment, Food and Rural Affairs, 2014)

The National Planning Policy for Waste document states that non-waste planning applications should consider the impact on existing and planned waste infrastructure and that suitable provision should be made for managing waste within new developments. Additionally, it stresses the need to ensure that the handling of waste arising from construction and operation of non-waste developments maximises re-use/recovery opportunities, and minimises off-site disposal.

National Planning Practice Guidance: Waste (Ministry of Housing, Communities and Local Government, 2015)

The National Planning Practice Guidance (NPPG) for waste provides further information to the National Planning Policy Framework (NPPF) to support local authorities in implementing waste planning policy. For example, it sets out the role of waste planning in meeting the obligations of the European Union Waste Framework Directive (2008/98/EC) and implementing the waste hierarchy, and gives guidance on how to develop and identify waste requirements in Local Plans. It also provides details on determining planning applications, the regulatory regimes controlling waste management planning, and the requirement for inspections and monitoring to be carried out by local authorities to ensure compliance with the Waste Framework Directive.

Our Waste, Our Resources: A Strategy for England (Department for Environment, Food and Rural Affairs, 2018)

This strategy sets out plans to double resource productivity and eliminate avoidable wastes of all kinds by 2050. It includes details of how waste will be minimised and managed to reduce damage to the environment. The strategy gives a policy direction in line with the Department for Environment, Food and Rural Affairs (Defra) (2018) 25 Year Environment Plan, with a particular focus on moving away from a traditional linear economic model towards a more sustainable and efficient circular model.

Relevant targets from this document include the following:

- To work towards achieving a 65% recycling rate for municipal solid waste (MSW) by 2035;
- To work towards sending 10% or less of MSW to landfill by 2035; and
- To eliminate all avoidable waste by 2050.

National Planning Policy Framework (Ministry of Housing, Communities and Local Government, 2019)

The NPPF notes that the purpose of the planning system is to contribute to the achievement of sustainable development. The document identifies three dimensions to sustainable development: economic, social and environmental. As part of its environmental role, the planning system should help to use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

The 2012 NPPF did not contain specific waste policies, since national waste planning policy was published as part of the National Waste Management Plan for England. Similarly, the revised NPPF should be read in conjunction with the government's separate planning policy for waste. Where waste is mentioned, there is little difference between the 2012 and revised versions of the Framework. Both documents note that efforts must be made to minimise waste generation and to facilitate the sustainable use of recycled materials.

A.3 Local Context

Manchester's Local Development Framework Core Strategy Development Plan Document (MCC, 2012)

This document outlines MCC's development vision for Manchester in 2027 and sets out the planning policies which will be used to help deliver on that vision.

The following policies are of most relevance to operational waste management within the proposed development:

- Policy EN17 Water Quality – this policy stipulates that any development close to a watercourse should ensure that waste or litter cannot enter the watercourse from the site.
- Policy EN19 Waste – this policy states that all developers will be required to demonstrate to the council how their proposals will promote the principles of the waste hierarchy and help achieve a closed-loop waste management system.

Greater Manchester Joint Waste Development Plan Document (Association of Greater Manchester Authorities, 2012)

This document sets out a strategy to help ensure that adequate provision is made for waste management facilities in Greater Manchester up to 2027.

The plan not only looks to ensure that sufficient capacity is provided for waste management in the region; it also aims to promote the movement of waste up the waste hierarchy. In line with this, developments' waste management strategies should first look to minimise waste at source, before targeting reuse, recycling, recovery and, as a last resort, safe disposal.

Waste Storage and Collection Guidance for New Developments (MCC, 2017)

This guidance sets out minimum standards for planners, architects, developers and property managers to assist in planning and designing systems for the storage and collection of refuse, and for recycling facilities in domestic and commercial properties.

Planning applications for all new developments should include a waste management strategy which includes the following:

- Estimated volumes and types of waste produced by the development;
- Details of internal and external stores for waste and recycling;
- Location of the proposed collection point and details of the route the collection vehicle will take;
- Details of how waste will be transferred between stores and to the collection location; and
- Details on the number and capacity of bins proposed and the collection frequency.

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These details should also be provided in a waste Proforma, submitted to MCC. This has been provided in Appendix B.

Draft Manchester Zero Carbon Framework 2020-2038 (Manchester Climate Change Board and Agency, 2019)

The purpose of this document is to help ensure that all residents, businesses, the public sector and all other sectors within Greater Manchester take urgent and sustained action on climate change. In terms of waste and resources, the document touches on the importance of reducing material consumption and waste generation, with a particular focus on eradicating food waste. The framework targets a shift to a new circular economy model, one in which materials are kept in circulation so that the maximum value possible can be extracted from them.

A.4 Other Relevant Guidance

Building Regulations Approved Document H6 Drainage and Waste Disposal and British Standards 5906:2005

These documents set out a number of requirements and guidelines for solid waste storage within buildings. The following requirements and guidelines are of particular relevance to this proposed development:

- Adequate provision shall be made for the storage of solid waste;
- Adequate means of access shall be provided for people in the building to the place of storage and from the place of storage to a collection point;
- A minimum clear space of 150mm should be provided between and around all bins in waste storage rooms;
- Adequate space must be provided for the easy and efficient movement of bins over smooth, continuous surfaces;
- Waste storage areas should be secure to prevent access by vermin unless the waste is to be stored in secure containers with close fitting lids; and
- Adequate lighting, drainage and ventilation should be provided in these areas.

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Appendix B Waste Management Strategy Proforma

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Appendix E Proforma for Planning Applications

MANCHESTER CITY COUNCIL

Planning Application – Waste Management Strategy

Planning Application Number:
Date Submitted:

Estimated volumes/ m^2 required by the development

Low Rise Domestic

Waste Types	Capacity Required (litres)	Number of bins required per household	Confirm what is to be provided
General refuse	140 / 240	1 x wheeled bin	N/A
Pulpable Recycling	140 / 240	1 x wheeled bin	N/A
Mixed Recycling	140 / 240	1 x wheeled bin	N/A
Garden Waste	140 / 240	1 x wheeled bin	N/A
Food Waste	23	1 x 23 litre caddy	N/A

High Rise Apartment Developments

	Yes/No - how much space has been provided?
$0.43m^2$ has been provided per apartment for the container space. Space to manoeuvre and access containers individually has also been provided so that each container can be accessed and removed for collection individually.	N/A

Commercial Developments

Please state number of bins you propose, showing calculations where appropriate.

General Waste - 2 no. 11m^3 skip compactors Pulpable Recycling - N/A Mixed Recycling -17 no. 660L Eurobins for mixed recycling; 15 no. 240L Eurobins for glass Food Waste - 15 no. 240L Eurobins for organics Industrial Waste - N/A

Details on calculations and assumptions are contained in the OWMS report.

Has / will a contract be obtained with a licenced waste carrier?	☒

Mixed Use Developments

Are the stores for residential and commercial separate from each other?	☐	N/A

Internal Stores (Residential and Commercial)

Please provide details of internal stores / segregation of waste and recycling.

Waste will be segregated at source into a number of streams. As a minimum, each area will segregate residual waste and dry mixed recyclables (DMR). Waste from the general admission (GA) concourses will initially be moved to intermediate waste stores to help reduce the risk of concourse litter bins overflowing. Waste generated within the GA bars and concession units themselves will be stored within these units for the duration of an event. Waste from the hospitality areas will be 'backhauled' to the kitchens/bars on each level, where residual waste, DMR, organics and glass will be segregated.

Storage Areas for Waste Containers (Residential and Commercial)

Please provide details of container stores, attaching plans if appropriate.

Residual waste will be moved to the compactor store in the ground floor service yard, while DMR, organics and glass will be moved the the 'recycling zone' in the L01 bin compound. Indicative layouts of these areas are included in the OWMS report.

DMR, organics and glass bins will be transferred to the Etihad Campus waste compound for consolidation and collection post-event. This will be done in the early hours to minimise the risk of clashes with pedestrians circulating the campus.

Ensure all bins in the store are accessible	☒
Ensure recycling facilities are as easy to access as general refuse	☒

Please confirm details of waste store ventilation and hygiene / cleaning proposals

Ventilation -	internal waste rooms will be mechanically ventilated. External waste stores will be naturally ventilated.
Hygiene -	intermediate waste rooms will be fitted out to be easily cleaned and maintained. Bin wash down facilities will be provided in the L01 bin compound. Drainage will be by means of a trapped gully connected to the foul sewer.

Please provide details of who will be responsible for placing the bins at the collection point and returning them to the store / property promptly e.g. resident / management company

The venue's facilities management (FM)/cleaning team will be responsible for moving waste from the point where it is generated to the point where it is collected.

Please ensure that you have attached: Plans are included in the OWMS report

Detailed plans of waste stores	☒
Location plans showing stores	☒
Location plans showing the proposed collection point and the route the collection vehicle will take	☒

Please ensure that you have completed this form in accordance with our GD04 Waste Storage and Collection Guidance for New Developments

Appendix C Waste Collection Vehicles Swept Path Analysis

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CONSTRUCTION.

N/A

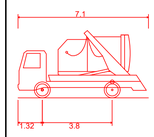
MAINTENANCE/CLEANING/OPERATION.

N/A

DECOMMISSIONING/DEMOLITION.

N/A

Notes



Swing Arm Skip Compactor Truck

Overall Length	7.100m
Overall Width	2.480m
Overall Body Height	3.664m
Min Body Ground Clearance	0.410m
Track Width	2.480m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	7.000m

COLUMN LAYOUT TO BE ADJUSTED TO AVOID CLASHING WITH SWEPT PATH.

Rev	Description	Date	Drn	Ch'd
P01	INITIAL ISSUE	17.01.2020	SBH	NJH

INFORMATION

Status of drawing

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Architect *POPULOUS*

Project **OVG MANCHESTER**

Drg Title VEHICLE TRACKING ANALYSIS
SERVICE YARD
COMPACTOR COLLECTION

Scales@A1	1:100	Job No.	0042841
Drawn by	SBH	Date	JAN 2020
Checked by	NJH	Rev	P01

Drawing No. BRA-BHE-XX-XX-SK-C-0018

Steve Hicks P:\0042841 Project Bradford\RS9 Civils - Infrastructure\Sheet\Sketches\BRA-BHE-XX-XX-SK-C-0018.dwg

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DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

N/A

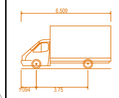
MAINTENANCE/CLEANING/OPERATION.

N/A

DECOMMISSIONING/DEMOLITION.

N/A

Notes



3.5t box van (tall)

Overall Length	6.509m
Overall Width	2.200m
Overall Body Height	3.100m
Min Body Ground Clearance	0.214m
Max Track Width	1.959m
Lock to lock time	4.00s
Kerb to Kerb Turning Radius	6.280m

BIN COMPOUND BOUNDARY TO BE ADJUSTED TO AVOID CLASHING WITH SWEPT PATH.

3.5t box van

Rev	Description	Date	Drn	Ch'd
P01	INITIAL ISSUE	17.01.2020	SBH	NJH

INFORMATION

Status of drawing

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Architect *POPULOUS*

Project **OVG MANCHESTER**

Drg Title VEHICLE TRACKING ANALYSIS
L01 PODIUM
REFUSE COLLECTION

Scales@A1	1:250	Job No.	0042841
Drawn by	SBH	Date	JAN 2020
Checked by	NJH	Rev	P01

Drawing No. BRA-BHE-XX-XX-SK-C-0019

Steve Hicks P:\0042841 Project Bradford\09 Civils - Infrastructure\Sheet\Sketches\BRA-BHE-XX-XX-SK-C-0019.dwg

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BUROHAPPOLD ENGINEERING

0042841 OVG MANCHESTER
SUSTAINABILITY STATEMENT
REVISION P07

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