Deloitte.
Real Estate



OVG Manchester

Environmental Statement – Volume 2

March 2020

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1 Introduction

1.1 This Environmental Statement ('ES') accompanies an application for Full Planning Permission for a new indoor arena. The Applicant is OVG Manchester Limited.

1.2 The Site is approximately 4.46 ha. and is located to the north of the Etihad Stadium within the Etihad Campus in East Manchester. The Site is located within the Ward of Ancoats and Beswick in Manchester.

1.3 A planning history search was undertaken using MCC's public access system. There have been no recent applications of interest on the Site. However, in April 2010 Planning Permission was granted for *"remediation works including the removal of underground structures, processing and treatment of excavated material and site works including installation of water attenuation tanks, archaeological works, new boundary fencing and demolition of the existing visitors centre"* (Ref: 092380/FO/2010/N2).

1.4 Prior to this Planning Permission was granted in 2007 on part of the Site for the construction of a temporary Olympic Standard BMX track, ramp and associated parking for the use of British Cycling as a training facility ahead of the Beijing Olympics.

1.5 A subsequent time extension was granted, with the temporary BMX track, ramp and associated parking being permitted until 31 December 2010. It is unknown when the Site was cleared of these facilities, but they became defunct for Olympic training purposes when the purpose built BMX Complex opened in July 2011.

1.6 There are no existing buildings on the Site, which is currently used as an over-spill surface level car park for those attending events associated with the Etihad Stadium. The Site is estimated to have capacity for 500 car parking spaces and is secured with a tall mesh fence on all sides. The perimeter of the Site is also populated with informal, dense shrubbery and self-seeded unclassified trees.

1.7 The Site's topography is generally flat, albeit the Site slopes gently down from south to north, but drops steeply at the southern edge down to the Ashton Canal.

1.8 The Site is shown on the location plan at Figure 1.1.

1.9 The formal description of development contained within the planning application form is as follows:

"Development of a multi-use arena (Class D2) with a partially illuminated external facade together with supporting retail uses (Classes A1, A3 and A4), associated highways, access, servicing, landscaping, public realm and other associated works."

1.10 The development will comprise:

- Construction of a world-class arena with a capacity of 20,000 (extendable to 23,500 for certain events/formats), and the inherent flexibility in event modes to capitalise on market opportunities and attract a wide range of major new events and formats to Manchester;
- A supporting retail and leisure offer, including bars, retail concessions, pop-up retail spaces, hospitality spaces and lounges, together with a wide range of back of house and support facilities which will provide a truly exceptional event day experience for all customers;
- High quality artist and backstage spaces and facilities including dressing rooms, a green room, games room and other management support spaces;

- A comprehensive transport and movement strategy and associated operational management regime for facilitating the safe and efficient movement of people to and from the arena in all event scenarios;
- An exemplar sustainability strategy which redefines existing planning policy and will deliver the most sustainable venue in the UK; and,
- High quality public realm proposals and pedestrian connections.

1.11 Accompanying the application for Planning Permission is an application for Consent to Display Advertisements. This covers signage proposals for three LED screens fully integrated into the architectural design of the building and designed to sit flush into the venue façade. When activated these will display variable messaging and content, and when not activated the black LED displays blend back into the façade. In addition, the signage proposals will provide six internally and externally illuminated Totem Signs to provide wayfinding

1.12 The proposals, as outlined in detail at Chapter 4 of the ES, are hereafter referred to as the 'Proposed Development'.

1.13 This ES sets out the findings of an Environmental Impact Assessment ('EIA') carried out in respect of the development of the Site.

Requirements for EIA

1.14 The EIA process is the mechanism by which development proposals are appraised in terms of their likely environmental effects, in addition to engineering and technical considerations.

1.15 The purpose of the EIA is to establish the nature of the Proposed Development and the environment in which it is likely to take place, during both construction and operational phases, so as to identify the likely significant effects on the environment. The assessment compares the existing situation at the start of the work (baseline) with the situation during demolition (as relevant) and construction, and when the Proposed Development is operational.

1.16 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the "EIA Regulations") require that any Proposed Development falling within the description of a 'Schedule 2 development' (as defined within the meaning of the EIA Regulations), will be subject to an EIA where such development is likely to have 'significant' effects on the environment by virtue of such factors as its nature, size or location (EIA Regulation Schedule 3).

1.17 The Proposed Development is considered to fall under the category of 'urban development projects' (EIA Regulations Schedule 2, 10, (b)) where:

- The development includes more than 1 hectare of urban development which is not a dwellinghouse development; or
- The development includes more than 150 dwellings; or
- The overall area of the development exceeds 5 hectares.

1.18 A formal EIA Scoping request was submitted to Manchester City Council (MCC) on 26 November 2019, requesting confirmation as to the proposed scope of the EIA required in respect of the Proposed Development. An EIA Scoping Opinion was received from MCC on 15 January 2020. MCC broadly agreed with the proposed content of the ES; however, MCC also requested Climate Change to be scoped into the ES as a standalone chapter. Climate Change has therefore been assessed and the results are set out in Chapter 15 Climate Change. The EIA Scoping exercise is discussed further in Chapter 2.

1.19 In accordance with the EIA Regulations, this ES sets out the following information:

- A description of the development, including in particular:

  (a) a description of the location of the development;

  (b) a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases;

(c) a description of the main characteristics of the operational phase of the development; and,

(d) an estimate, by type and quantity, of expected residues and emissions during the construction and operation phases.

- A description of the reasonable alternatives studied, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.
- A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.
- A description of the factors specified in regulation 4(2) likely to be significantly affected by the development.
- A description of the likely significant effects of the development on the environment resulting from, inter alia:

  (a)the construction and existence of the development, including, where relevant, demolition works;

  (b)the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;

  (c)the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;

  (d)the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);

  (e)the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;

  (f)the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change; and,

  (g)the technologies and the substances used.
- A description of the likely significant effects on the factors specified in regulation 4(2) that covers the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.
- A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.
- A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis).
- A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned.
- A non-technical summary of the information.
- A reference list detailing the sources used for the descriptions and assessments included.

Project Team

1.20 Deloitte Real Estate has significant experience and expertise in managing the EIA process and hold the IEMA EIA Quality Mark. Deloitte Real Estate has managed the EIA process and the production of the ES for the Proposed Development. Deloitte Real Estate has received technical input from a range of suitably qualified and experienced technical consultees.

1.21 Details of the EIA Technical Team and qualifications are set out in Table 1.1.

Table 1.1: Project Team and Qualifications

Organisation	Expertise / Role	Qualifications
Deloitte Real Estate	Town Planning, EIA Coordination	MRTPI, IEMA Practitioner, IEMA Quality Mark
Buro Happold	Air Quality	Member of the Institute of Environmental Sciences (IES) (MIEnvSc), Institute of Air Quality Management (IAQM), and Chartered Scientist
	Ground Conditions	BSc hons in Geology, C.WEM, C.ENG
	Noise and Vibration	BSc (Hons), PGDip, and is a full member of the Institute of Acoustics
	Socio-Economics	BA Geography, MSc Spatial Planning
	Traffic and Transport	HNC in Civil Engineering and is a Member of the Chartered Institute of Highways and Transportation (MCIHT)
	Water Resources, Drainage and Flood Risk	BSc (Hons) Environmental Science, MEng in Civil Engineering, BEng in Civil Engineering, Mst in Construction Engineering, IEng.
	Wind Microclimate	PhD in Mechanical Engineering
	Climate Change	Chartered Engineer, Member of the Institution of Civil Engineers, Member of the Institution of Structural Engineers, Affiliate Member of the Institute of Environmental Management and Assessment, BREEAM Advisory Professional
ME Engineers	Lighting	MSc Hons, Interim CEng
Planit-i.e.	Townscape and Visual Impact	Planit-IE is a registered practice of the Landscape Institute

Although we have read ME Engineers, Plant-i.e, and Buro Happold's reports ('the Consultant Reports') for consistency and provide our observations based on our knowledge and experience, we accept no liability or responsibility for the Consultant's Reports and will not be responsible for the technical content of Chapters 6 to 15.

Organisation of the Environmental Statement

1.22 This ES comprises 17 chapters and is supported by figures (located at the back of each chapter within Volume 2) and technical appendices (within a separate Volume 3). A Non-Technical Summary ('NTS') is provided as Volume 1.

1.23 Figures have been referenced using the chapter number as a prefix followed by the number of the figure within a given chapter. Appendices have been referenced in the same way but due to their size they are contained separately in Volume 3.

1.24 Table 1.2 sets out the structure of the ES:

Table 1.2: Structure of the ES

Chapter	Topic	Author
1.	Introduction	Deloitte Real Estate
2.	EIA Methodology	Deloitte Real Estate
3.	Consideration of Alternatives and Design Evolution	Deloitte Real Estate
4.	Site, Surroundings and Description of Proposals	Deloitte Real Estate
5.	Construction Management and Phasing	Turner & Townsend
6.	Air Quality and Dust	Buro Happold
7.	Ground Conditions	Buro Happold
8.	Lighting	ME Engineers
9.	Townscape and Visual Impact	Plant-i.e.
10.	Noise and Vibration	Buro Happold
11.	Socio-Economic	Buro Happold
12.	Traffic and Transport	Buro Happold
13.	Water Quality, Drainage and Flood Risk	Buro Happold
14.	Wind Microclimate	Buro Happold
15.	Climate Change	Buro Happold
16.	Summary of Residual Effects	Deloitte Real Estate
17.	Type 1 Cumulative Assessment	Deloitte Real Estate

Other Documents

1.25 A number of other documents have been submitted to MCC as part of the planning application. These include outlined in Table 1.3.

Table 1.3: List of Application Documents

Document	Prepared by
Application Form and Certificates	Deloitte Real Estate
Site Location Plan	Populous
Full suite of existing and proposed plans, including landscaping plans and Accommodation Schedule	Populous

Document	Prepared by
Design and Access Statement (including Landscaping and Public Realm Strategy and Signage Strategy)	Populous
Market Assessment: Volume 1: OVG Manchester, due diligence report Volume 1: UK Arena and Manchester Market Overview Volume 2: UK Large Arena Market and Growth Scenarios 2018-2040	PwC ekosgen
Economic Impact of Two Arenas in Manchester	ekosgen
Sequential Test Assessment	Deloitte Real Estate
Planning Statement	Deloitte Real Estate
Statement of Community Involvement	Counter Context
Sustainability Statement *including the following technical appendices:* • Response to Green and Blue Infrastructure Strategy • Strategy for Manchester BREAAM Pre Assessment • Crime Impact Statement • Ecological Mitigation Report • Energy Statement • Local Benefits Proposal • Social Value Toolkit • Tree Survey • Operational Waste Management Strategy	Buro Happold Deloitte Real Estate Buro Happold GMP Buro Happold ME Engineers OVG Deloitte Real Estate Arbtech Buro Happold
Broadband Connectivity Statement	ME Engineers
Daylight/Sunlight Assessment	Buro Happold
Heritage Statement	Deloitte Real Estate
Operating Schedule and Event Management Strategy	Laudation
Topographical Survey	Populous
TV Reception Survey	ME Engineers
Ventilation, Extraction and Odour	ME Engineers

Environmental Statement Availability

1.26 The ES is available for public viewing on Manchester City Council's Public Access website at the following address: http://pa.manchester.gov.uk/online-applications/ once the application has been submitted and validated.

1.27 The ES may be purchased in volumes, the costs for which are set out below:

- Volume 1: Non-Technical Summary - £15
- Volume 2: ES Main Text and Figures - £150

- Volume 3: ES Appendices - £150
- Full Copy (Volumes 1, 2, and 3) of the ES on a CD - £15

1.28 For copies of any of the above, please contact the Manchester Planning Team at Deloitte Real Estate:

OVG Manchester Project Team - Planning and EIA
Deloitte Real Estate
2 Hardman Street
Manchester
M3 3HF

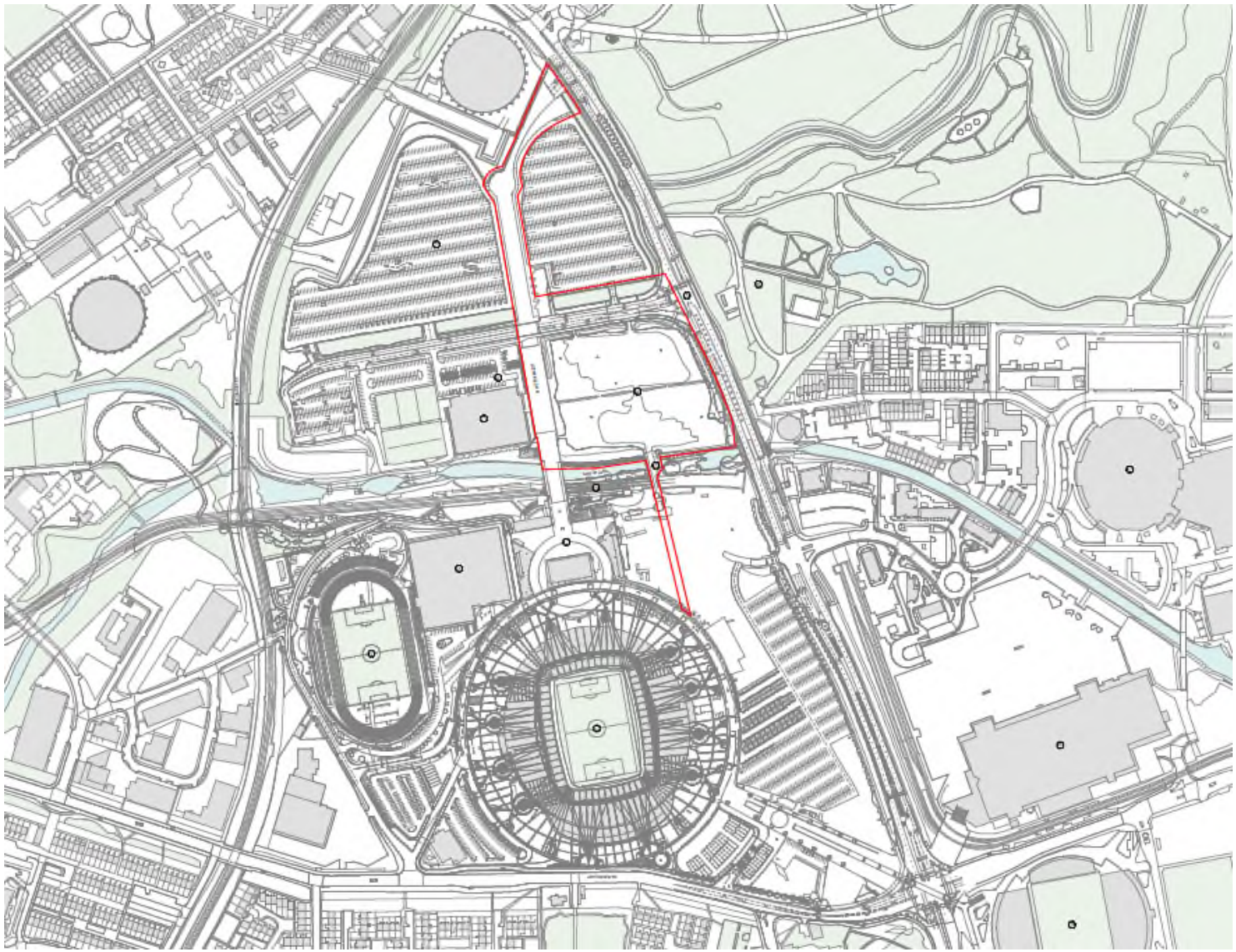


Figure:	**1.1**			
Title:	**Site Location Plan**			
Project:	**OVG Manchester**			
Date:	**March 2020**	**Scale:**	**NTS**	

2 EIA Methodology

2.1 This Chapter sets out the methodology used to prepare each Chapter of the ES and describes its structure and content. In particular, it sets out the process of identifying and assessing the likely significant effects of the Proposed Development on the environment as defined in Chapter 1 and described in detail in Chapter 4.

2.2 It is accompanied by five technical appendices:

- Appendix 2.1 EIA Screening and Scoping Request
- Appendix 2.2 EIA Screening and Scoping Opinion
- Appendix 2.3 EIA Scoping Opinion Summary of Comments and Responses
- Appendix 2.4 Committed Developments
- Appendix 2.5 Salford Archaeology and GMAAS Emails

Legislation and Guidance

2.3 The ES has been prepared to comply with EIA Regulations, which implement European Council Directive No. 85/337/EEC as amended by Directive 2014/52/EU and entered into force on 17 May 2017.

2.4 Reference has also been made to currently available good practice guidance in EIA including:

- The European Commission's numerous EIA guidance documents available here: http://ec.europa.eu/environment/eia/eia-support.htm
- National Planning Practice Guidance – Department for Communities and Local Government (March 2014 and continuously updated as a 'live' resource)
- Reference has been made to the Institute of Environmental Management and Assessment (IEMA) publications, including:
  - IEMA ES Review Criteria
  - IEMA Guidelines for Environmental Impact Assessment (2004)
  - IEMA Special Report into the State of Environmental Impact Assessment Practice in the UK (2011)
  - IEMA Shaping Quality Development (2015)
  - IEMA Delivering Quality Development (2016)
  - IEMA Delivering a Proportionate EIA (2017)

2.5 The ES has also had regard to the National Planning Policy Framework 2019 (NPPF). The NPPF sets out the Government's economic, environmental and social planning policies for England, articulating the Government's aspiration for sustainable development. The NPPF has been considered where it is relevant to EIA.

2.6 It is considered that there is no relevant regional planning policy and guidance of relevance to this ES.

2.7 As relevant to the ES technical chapter's scope, methodology and assessment of effects, key local planning policy and guidance documents have been considered. These include:

- Manchester City Council Core Strategy (2012)
- Saved Unitary Development Plan Policies (1995)

2.8 Any additional planning policy or guidance documents considered relevant have been identified within the relevant technical chapters.

EIA Screening and Scoping

2.9 An EIA Screening and Scoping Opinion request was submitted to Manchester City Council on 26 November 2019, requesting confirmation as to the proposed scope of the EIA required in respect of the Proposed Development. A copy of the report is provided at Appendix 2.1. An EIA Scoping Opinion was issued by MCC on 15 January 2020; a copy of the EIA Scoping Opinion is provided at Appendix 2.2. A detailed series of responses to the EIA Scoping Opinion is found within Appendix 2.3, which also summarises discussions with MCC in response to the EIA Scoping Opinion. Together, these reports form the basis on which the EIA has been prepared, as agreed with the Local Planning Authority.

2.10 The EIA is based on the scope of assessment agreed through the EIA Scoping process. Compliance with the scope is detailed with the 'Assessment Methodology and Significance Criteria' section of each Technical Chapter.

Consultation

2.11 The EIA Screening and Scoping exercise involved consultation with the technical stakeholders identified in Table 2.1.

2.12 The Proposed Development has been the subject of a wider pre-application consultation process, which is described in the Statement of Consultation.

Table 2.1: EIA Screening and Scoping - Technical Consultees

EIA Consultation
Manchester City Council Planning Authority
Manchester City Council Environmental Health
Manchester City Council Flood Risk Management
Manchester City Council Highway Services
Manchester City Council Arborist
Manchester City Council Work & Skills Team
Coal Authority
Greater Manchester Ecology Unit
Environment Agency
Cadent Gas
Greater Manchester Archaeological Advisory Service
Design for Security at Greater Manchester Police
Historic England

EIA Consultation
Natural England
Transport for Greater Manchester
United Utilities
Canal & Rivers Trust
Aerodrome Safeguarding at Manchester Airport

Non-Significant Effects

2.13 It is considered that the following disciplines will not give rise to likely significant effects on the environment and therefore do not require inclusion in the ES; this has been confirmed through the EIA Screening and Scoping Opinion. An explanation for each discipline is provided in the EIA Scoping Report in Appendix 2.1. The disciplines are:

- Agricultural Circumstances
- Archaeology
- Aviation
- Built Heritage
- Daylight and Sunlight
- Ecology
- Television, FM Radio and DAB Radio Reception
- Human Health (*but considered as part of individual technical chapters and Chapter 17 Type 1 Cumulative Effects)*

Approach to Technical Studies

2.14 Various technical studies were commenced at an early stage in the development process. The findings of the baseline environmental studies have played an important role in the design of the Proposed Development by defining the environmental sensitivities, constraints and opportunities associated with the Site.

2.15 Design team reviews, attended by members of the project team, were held throughout the pre-application process. These reviews provided a valuable forum for the exchange of information and ensured that the design team was fully aware of the environmental constraints and opportunities and of the interactions between disciplines. Meetings were also held with MCC as the Local Planning Authority, as well as pre-application discussions with technical consultees, as highlighted at Table 2.1.

2.16 The technical studies have been undertaken in accordance with current best practice. Specific guidance used is referenced within each of the respective assessment chapters.

2.17 The majority of assessments involved consultations with statutory and non-statutory bodies, desk-based research, site inspections and surveys, impact prediction and mitigation.

2.18 The assessment and conclusions of the ES are based on the description of the Proposed Development provided in Chapter 4.

Structure of Technical Chapters

2.19 Each technical chapter of the ES (Chapters 6 to 15) has been set out broadly in line with Table 2.2; any variation from this structure is explained within the chapter.

Table 2.2: Structure of ES Technical Chapters

Technical Chapter Structure	
Introduction	Each of the technical chapters begins with an introduction providing context to the EIA completed.
Policy Context	This section includes a summary of legislation and of national and local policies relevant to the environmental discipline and explains its purpose in the context of the Proposed Development and the ES.
Assessment Methodology & Significance Criteria	This section describes the method or approach employed in the assessment of impacts, the criteria against which the significance of effects has been evaluated, the sources of information used and any technical difficulties encountered. Relevant legislation is also identified.
Baseline Conditions	This section describes and evaluates the baseline environmental conditions i.e. the current situation and anticipated changes over time assuming the Site remains unchanged. This is a critical part of the EIA process as it provides a measure against which potential environmental effects can be assessed.
Identification and Evaluation of Key Impacts	This section identifies the likely significant effects on the environment resulting from the Proposed Development. A description of the likely effects of the Proposed Development and an assessment of their predicted significance is provided. The assessment of effect significance has been undertaken using appropriate national and international quality standards. Where no such standards exist, the judgments that underpin the attribution of significance are described. The guidelines, methods and techniques used in the process of determining significance of effects are contained within each of the technical chapters presented.
Mitigation Measures	One of the main aims of the EIA process is to develop suitable mitigation measures to avoid, reduce or compensate for any significant adverse effects of a project. This section of each technical chapter describes the measures which would be implemented to mitigate potential adverse effects. Where possible, enhancement measures have also been proposed.
Cumulative Effects	This section considers the cumulative effects of the Proposed Development identified within the vicinity of the Site. Any likely significant effects on the environment arising in this respect are set out in this section. There are two distinct types of cumulative effects: Type 1 - Cumulative effects are the interactions between effects of the Proposed Development on a single receptor. These are addressed in Chapter 16. Type 2 - Cumulative effects are those that arise from incremental changes caused by other consented or reasonably foreseeable activities ('committed developments') together with the Proposed Development.
Residual Effects	The residual effects, i.e. the remaining effects of the Proposed Development assuming implementation of the proposed mitigation measures, have been estimated and presented. The methods used to make these estimates are described and proposed methods of treatment for any residual effects have been identified and quantified where possible.
Reference List	A reference list is provided wihtin each chapter as relevant.
Summary	Each technical chapter concludes with a brief summary outlining the potential residual effects of the Proposed Development.

2.20 Chapter 5 provides information to allow the construction phase of the Proposed Development to be assessed by the disciplines set out in Chapters 6-15.

Assessment and Evaluation of Likely Significant Effects

2.21 The assessment of effect significance has been undertaken using appropriate national and international quality standards. Where no such standards exist, the judgments that underpin the attribution of significance are described. The guidelines, methods and techniques used in the process of determining significance of effects are contained within each of the technical chapters presented.

Magnitude

2.22 The methodology for determining the scale, or magnitude, of effect is set out in Table 2.3.

Table 2.3: Methodology for Assessing Magnitude

Magnitude of Impact	Criteria for Assessing Efect
Major	Total loss or major/substantial alteration to key elements/features of the baseline conditions such that the post development character/composition/attributes will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of the baseline will be materially changed.
Minor	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character / composition / attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

Sensitivity

2.23 The sensitivity of a receptor is based upon the relative importance of the receptor using the scale in Table 2.4.

Table 2.4: Methodology for Assessing Sensitivity

Sensitivity	Example of Receptor
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of international or national importance.
Medium	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance.

Significance

2.24 The significance of an environmental effect is determined by the interaction of magnitude and sensitivity, whereby the impacts can be positive or negative. Table 2.5 below shows how magnitude and sensitivity interact to derive effect significance.

Table 2.5: Methodology for Assessing Significance

Magnitude	Sensitivity		
	High	Moderate	Low
Major	Major Adverse/Beneficial	Major - Moderate Adverse/Beneficial	Moderate - Minor Adverse/Beneficial

Magnitude	Sensitivity		
	High	Moderate	Low
Moderate	Major - Moderate Adverse/Beneficial	Moderate – Minor Adverse/Beneficial	Minor Adverse/Beneficial
Minor	Moderate – Minor Adverse/Beneficial	Minor Adverse/Beneficial	Minor - Negligible
Negligible	Negligible	Negligible	Negligible

2.25 The above magnitude and significance criteria have been provided as a guide for technical specialists to assess impact significance. Where discipline specific methodology has been applied that differs from the generic criteria above, this has been clearly explained within the given chapter under the heading of 'Assessment Methodology and Significance Criteria'.

2.26 For the purposes of this ES, an effect will be considered to be 'significant' if it is classed as either 'moderate' or 'major', unless otherwise specified within the technical chapter.

Baseline Conditions

2.27 Each technical chapter includes a section which describes and evaluates the baseline environmental conditions (i.e. the current situation and anticipated changes over time assuming the Site remains unchanged). Baseline data has been obtained from a variety of sources, including published documents, maps, historical information and site survey data. Given the complex nature of the Site and surroundings, each technical chapter (Chapters 6 to 15) includes a clear description of what is assumed as the baseline against which the assessment is being made.

2.28 The baseline includes nearby schemes under construction.

2.29 The method used to obtain baseline information, where relevant and possible, has been clearly identified within each technical chapter and agreed in advance with statutory consultees.

Mitigation

2.30 Any adverse environmental effects have been considered for mitigation at the design stage and, where practicable, specific measures have been put forward. Measures have been considered based on the following hierarchy of mitigation:

- Avoidance.
- Reduction.
- Compensation.
- Remediation.
- Enhancement.

2.31 Where the effectiveness of the mitigation proposed has been considered uncertain, or where it depends upon assumptions of operating procedures, data and/or professional judgement has been introduced to support these assumptions.

2.32 Mitigation recommended during the construction phase would be set out in the detailed Construction Environmental Management Plan (CEMP) to be agreed with MCC prior to the commencement of work and implemented throughout the duration of the works. Outline mitigation measures to be included are set out in Chapter 5: Construction Management Methodology and Programme and the Construction Management Plan at Appendix 5.1.

2.33 Mitigation to be implemented during the operational phase would be secured through planning conditions and obligations.

Residual Effects

2.34 The likely significant effects on the environment, assuming the successful implementation of mitigation measures proposed, have been estimated within each chapter. These are termed 'residual effects'.

Cumulative Effects

2.35 The ES considers the potential for likely significant effects on the environment resulting from consented or reasonably foreseeable activities or developments in the area, which could lead to potentially significant cumulative effects in conjunction with the Proposed Development ('Committed Developments').

2.36 These include:

- Approved but uncompleted projects;
- Plans or projects for which an application has been made and which are under consideration by the consenting authorities; and,
- Certain projects which are reasonably foreseeable, i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative effects.

2.37 A search of Manchester City Council's planning applications database and knowledge of the area has identified a number of schemes for which cumulative effects are considered likely. A full list, as of 30 January 2020, is contained at Appendix 2.4.

2.38 Technical Chapters 6-14 have assessed the potential for likely significant effects on the environment as a result of the above committed developments, together with the Proposed Development.

2.39 Chapter 15 Climate Change has not included an assessment of the Proposed Development with other committed developments. This is in line with IEMA (2017) guidance, which notes that any development will result in Greenhouse Gas emissions and the cumulative concentration in the atmosphere will contribute to climate change. The receptor and cumulative effects from nearby committed developments are therefore at the global rather than local scale.

2.40 In addition, Chapter 17 assesses the Type 1 Cumulative effects, also known as inter-project effects.

Assumptions and Limitations

2.41 The principal assumptions that have been made and any limitations that have been identified in preparing the ES are set out in each technical chapter. General assumptions include the following:

- All of the principal land uses adjoining the Site remain. Where redevelopment proposals have been granted Planning Permission, the effect of those proposals are considered as part of the Cumulative Impacts;
- Unless otherwise stated, baseline conditions have been established in 2019 from a variety of sources, including historical data, but due to the dynamic nature of certain aspects of the environment, conditions will change during the Proposed Development;
- Information received from third parties is complete and up to date;
- The various stages of the Proposed Development will satisfy minimum environmental standards, consistent with contemporary legislation, practice and knowledge;
- Assessments are based upon, and conclude, the "worst case" effects that would arise from the application as defined by the description of development set out in Chapter 4, Site Surroundings and Description of the proposals;
- Construction methods and phasing will follow the timetable and methods set out in Chapter 5, Construction Management Methodology and Programme.

- Conditions will be attached to the Planning Permission that will control disturbance during the construction and operation of the Proposed Development;
- Necessary off-site services infrastructure for the Proposed Development will be provided by statutory undertakers; and,
- The Proposed Development is operational all year round and is expected to hold circa 120 events in the opening year, with the potential for increased number of events in future years.

Objectivity

2.42 The technical studies undertaken within the ES have been progressed in a transparent, impartial and unbiased way with equal weight attached, as appropriate, to beneficial and adverse effects. Where possible, this has been based upon quantitative and accepted criteria together with the use of value judgements and expert interpretations.

3 Consideration of Alternatives and Design Evolution

3.1 Regulation 18(3) and Paragraph 2 of Schedule 4 of the EIA Regulations requires the Applicant to provide an outline of the reasonable alternatives studied by the Applicant and an indication of the main reasons for the choice made, including a comparison of the environmental effects.

3.2 The form of the Proposed Development has been influenced by a range of factors, including location, surrounding land use and input from MCC, Statutory and Non-Statutory Consultees and other stakeholders.

3.3 This chapter reviews the principal land use and siting options explored and the reasoning for the selection of the current design for the Proposed Development, which forms the subject of assessment within the ES.

3.4 This chapter considers the following four options in the context of the existing Development Brief:

- The 'do nothing' alternative where the Proposed Development is not progressed;
- Alternative uses for the Site;
- Alternative locations for the Proposed Development; and,
- Alternative design/layout for the Proposed Development in the context of the design evolution.

The 'do nothing' alternative

3.5 The 'do nothing' scenario refers to the option of leaving the Site in its current state, therefore an overspill car park occasionally used for events at the Etihad Arena.

3.6 The area has been identified as a key regeneration priority for the Council, with the New East Manchester Corporation Ltd being formed in 1999 to guide the regeneration of the area ahead of the Commonwealth Games in 2002. Subsequently a number of regeneration initiatives have looked to build upon the success of the Commonwealth Games, first as the City of Manchester Arena and then as the home-ground of Manchester City Football Club.

3.7 Since 2002, the Etihad Stadium has been the beacon of regeneration for East Manchester. The pace of economic growth within Manchester over the last ten years along with the ongoing investment from the City Council, the Abu Dhabi United Group and other partners, such as Sport England, has strengthened the focus of the Etihad Stadium and its environs as a focus for new investment and job growth in East Manchester.

3.8 This has included the delivery of the City Football Academy, which transformed 75 acres of reclaimed former industrial land into the world's leading training ground and one of the world's best elite performance facilities. Together with the expanded Etihad Campus' existing array of sports and community facilities, the project has delivered jobs and training opportunities for local residents and a new community hub incorporating sports and education facilities, in addition to the Manchester Institute of Health and Performance (MIHP), which is a world-class centre for scientific research, analysis and treatment.

3.9 Central to the long term vision for the Etihad Campus and the wider area has been the ambition to establish it as a place to drive forward the development of a globally competitive sport, leisure and recreation offer. Over the last 15 years the loss of the opportunity for Manchester to host the first Regional Casino, aligned with the deep economic recession of 2008 and 2009, thwarted any opportunity for the Etihad Campus to fulfil that long term ambition to host a globally competitive leisure and recreation offer.

3.10 In MCC's Manchester Core Strategy 2012 it is set out that East Manchester remains a major economic driver and centre of employment for the City and the conurbations ad has a number of key advantages including good vehicle access, good public transport linkages and the availability of large flexible sites. Notably it notes land around the Etihad Stadium to the north should be a focus for development and that developments *which "support the overall vision for this major regeneration initiative on sites within the general environs of Eastlands will be appropriate, provided they do not prejudice other policies within the plan."*

3.11 The Council's ambitions to develop the Site is further stated in the Eastlands Regeneration Framework ('ERF') where the Site as being situated in the 'Etihad Campus', to the north of the Etihad Stadium and is considered to be a key regeneration priority.

3.12 The Eastlands Regeneration Framework (ERF) was originally endorsed in 2011 which shaped and guided investment and development in East Manchester. It was updated in 2017 and 2019 and a further draft for consultation of the document was published in. For clarification, the ERF sets out environmental, social, design and economic objectives which are relevant to the attainment of the regeneration of the East Manchester area which is supported by existing planning policy. It is not a planning policy document and it is not a site allocations document. As such this document has the status of a "Local Development Document" but not a "Development Plan Document" and should not be considered or viewed as planning policy, and does not set out a series of tests to be passed.

3.13 The role of the ERF is to seek to guide the content of planning applications so that they have in mind the objectives for East Manchester. Throughout the various iterations of the ERF, and through the thirty-year journey of transformation of East Manchester, the Etihad Campus has consistently been a major economic driver in its own right within a city region and national context. Successive Regeneration Frameworks have identified the Etihad Campus as a place to drive forward the development of a globally competitive sport, leisure and recreation offer. Over the last ten years' significant new investment has been made to deliver new facilities that benefit the community with new local leisure and educational developments being part of an integrated approach to the transformation of the area.

3.14 The 2019 draft ERF was presented to the Council's Executive Committee in March 2019 for consultation. Following consultation, in July 2019 the Executive Committee resolved to delegate authority to the Strategic Director – Growth & Development, in consultation with the Leader of the Council and the Executive Member for Housing & Regeneration, to approve once certain matters have been addressed, including the requirement for the draft ERF to reference the recently announced Carbon Reduction targets. At the time of writing, the revised version to address these issues has not been published.

3.15 In its current state the Site does not realise its economic or social potential as an infrequently used overspill car park. This use as an overspill car park is also contrary to the Council's commitment to increasing and promoting the use of sustainably transport and to improve air quality emissions around key roads through reducing vehicle movements. In this way, the redevelopment of the Site could lead to a more efficient, employment generating use on previously development land.

3.16 The Site has therefore been identified for regeneration priority by the Council for a significant number of years, and is considered appropriate for development which utilises the Site's locational benefits and contributes to the success of Eastlands.

Alternative uses

3.17 In planning policy terms, the Site is already identified in Manchester's Unitary Development Plan (1995) – Sub Area 7 – Sportcity Saved Policy EM11 as: *"a major focus for regeneration activity on previously developed land. It is located in a strategic position at the heart of East Manchester with excellent infrastructure and proposed infrastructure links to the City Centre, adjacent areas and the national motorway network." It goes on to state that: "the area fronting the Alan Turing Way is suitable for a mix of uses including a hotel, leisure and other commercial uses*."

3.18 Manchester's Core Strategy (2012) builds on this by identifying the Etihad Campus as a location "*suitable for a major sports and leisure visitor destination with complementary commercial, retail*

and hotels." It outlines the requirements of new development at the Eastlands Strategic Employment Location: to broaden the activities in the area to ensure development opportunities secure the wider regeneration of the surrounding area and deliver maximum benefits for the community.

3.19 Policy EC7 identifies two sites as a focus for development, one of which is the land around the stadium including the "Collar Site" which "*provides an opportunity for a leisure, recreation and entertainment visitor attraction of national significance*". A landmark design will be key to delivering such a prestigious development which, together with the existing developments within Eastlands, will not only provide a sense of place but will also ensure integration with the surrounding community. Developments that are predominantly tourism / leisure based, including hotels and food and drink will be appropriate together with ancillary retail required to support the principal usesDevelopments that are predominantly tourism / leisure based, including hotels and food and drink will be appropriate together with ancillary retail required to support the principal uses. This Policy therefore sets the principle of further leisure development within Eastlands.

3.20 Further to the adopted Core Strategy, the 2017 ERF specifically identified the Site as being in an area where development should encourage activity all-year round through uses such as retail and hotels, and uses which may also serve the evening economy. In the 2019 update to the ERF the Site was again identified for regeneration, in particular for a leisure use with a new indoor arena and a multi-plex cinema. It is considered that a large-scale leisure use would bring many benefits to the local area including employment and local expenditure, and the redevelopment of a longstanding regeneration site. In addition, the location of the Site in proximity to the Etihad Arena and other sporting uses, as well as the previous Gas Works and Mining Operations in the area make an arena, a less sensitive use, an ideal use. During the construction phase the proposed leisure use will have an environmental impact, as would any type development. However, it is considered that the overall benefits from the operational use mitigates any short-term construction impacts.

3.21 The proposed leisure use, and more specifically the proposed arena use is therefore considered appropriate for the Site and is supported in local planning policy and within MCC regeneration guidance. On this basis no alternative uses are considered further as part of this ES.

Consideration of alternative locations

3.22 The planning application is accompanied by an extensive sequential assessment, which details why the Site is considered the only viable option within the appropriate 'area of search' to accommodate the Proposed Development.

3.23 Paragraph 85 of the NPPF directs these types of uses to city/town centre locations first to seek to protect the vitality and viability of centres, then edge of centre locations, and only if suitable sites are not available (or expected to become available within a reasonable period) should out of centre sites be considered. When considering out of centre proposals, preference should be given to accessible sites which are well connected to the centre.

3.24 In policy terms, an arena is classified as a 'main town centre use'. As Tthe Etihad Campus as a location is, in planning policy terms, an out-of-centre location (notwithstanding its location within the Regional Centre), a sequential test has been undertaken in accordance with NPPF Paragraph 86 to identify and evaluate the suitability and availability of sites for an arena, within or on the edge of Manchester City Centre and other Greater Manchester Town Centres (the appropriate area of search.

3.25 OVG (an international arena operator) has identified Manchester as their preferred location for their first arena in the UK – reflecting the wider market interest from international entertainment operators and investors in Manchester. The decision to locate in Manchester has been underpinned by detailed analysis as set out in Section 10 of the Planning Statement and also within the 'UK Large Arena Market and Growth Scenarios 2018-2040' document prepared by Ekosgen and 'The Economic Impact of Two Arenas in Manchester' prepared by Ekosgen.

3.26 OVG's aspiration is to deliver the best arena in Europe. To achieve this, the location of the arena is key. OVG's requirements are for a site which has:

- access to major public transport;
- international connectivity;
- the capability of being sufficiently high profile (for example, it is associated with other world class institutions);
- adds to the overall economic functioning and vibrancy of the City as determined through contribution to the delivery of Regional/City Economic and Planning Priorities; and,
- the ability to deliver an additional visitor experience.

3.27 Following the initial identification of 73 potential sites (the "long list"), when assessed against OVG's broad site suitability and availability criteria, 61 of these were discounted as unsuitable or unavailable to accommodate an arena. An example of the reasons for discounting sites include the site being too small to accommodate the minimum site area required (2 ha.) or being unavailable due to alternative proposals progressing on site.

3.28 The remaining 12 sites (the "short list") were considered against the detailed site criteria including the appropriateness of each site to accommodate a large arena, accessibility and connectivity, market assessment and viability, availability and contribution to the delivery of economic and planning priorities. The three sites tested which are more central than the Etihad Campus in policy terms (Piccadilly Trading Estate, Pomona Island and Stockport Mayoral Development Corporation) can all be discounted based on these detailed site criteria.

3.29 The remaining nine sites are all in out-of-centre locations (and include the Etihad Campus). NPPF paragraph 87 states that when considering out of centre proposals, preference should be given to accessible sites which are well connected to the town centre. Therefore, the assessment of these shortlisted out-of-centre sites was to determine whether the Etihad Campus is the best location against the defined criteria relative to the other nine non-sequentially preferable sites

3.30 The analysis confirms the Etihad Campus as the optimum location as it satisfies the most criteria when assessed in detail:

- Appropriateness of site to accommodate an arena – the Etihad Campus is an appropriate size and shape to accommodate an arena of the scale proposed. The Campus also contains existing complementary uses and major events already take place in this location. No other site considered has the same cluster of activities nearby.
- Accessibility and connectivity – the Etihad Campus is an accessible site which is well connected to the centre by non-car modes. It has good existing pedestrian linkages to the city centre and contains a Metrolink stop which provides a direct link to Manchester Piccadilly Station, which provides an onward rail connection to Manchester Airport. On match days, up to 40% of visitors (or approximately 20,000) arrive by non-car modes, underpinning the opportunity afforded by this location for sustainable transport. Whilst some of the other sites tested also have good accessibility, none can demonstrate an existing capability to provide accessibility by non-car modes for the scale of visitors proposed.
- Market assessment and viability – there would be no usual or complex constraints to the development of an arena on site. The Etihad Stadium and Campus is a world renowned sports and leisure destination offering brand association for an arena use. The development of an arena at the Etihad Campus is complementary to this cluster of existing uses and will deliver a globally competitive environment and add value to the destination that the Etihad Campus has established over the last ten years. No other site considered has the same potential brand association or complementary cluster of uses.
- Availability within a reasonable timeframe – the Etihad Campus is capable of delivering an arena within the required timescales. Most of the other sites considered would either require assembly or are unavailable due to alternative proposals being progressed.
- Contribution to the delivery of Regional/City economic and planning priorities – the Draft 2019 ERF highlights that the Etihad Campus has the capacity to respond to and host significant new opportunities for a globally competitive leisure and recreation offer,

which if secured, would deliver key benefits to residents through investment and jobs. It will also support MCC's vision for East Manchester (as outlined in the Core Strategy) to broaden the activities in the area to ensure development opportunities secure the wider regeneration of the surrounding area and deliver maximum benefits for the community. For almost all the other sites considered, planning policy does not support leisure uses of this scale.

3.31 The sequential analysis concludes that the Etihad Campus is suitable, available and viable for the proposed arena development and is an accessible site which is well connected to the centre by non-car modes. Furthermore, an arena in this location would enhance the existing leisure offer at the Etihad, exploiting the latent economic capacity of the Campus and further promoting this destination as a world class sporting and leisure destination.

Alternative design/layout

3.32 The optimum function of the arena is paramount to its success, and the function has therefore been a key factor in developing the form of the Proposed Development. In addition to the specific use as an arena, the design has developed from the technical requirements to deliver the client's brief for a world-class indoor arena with a typical capacity of 20,000 visitors but with the potential to accommodate 23,500 visitors for certain events and arena configurations.

3.33 First consideration is given to the Site's context due to the differing topographies and the need for level access into the Proposed Development as well as servicing access. This, alongside the required space for crowd modelling, has determined the positioning of the Proposed Development within the Site.

3.34 Externally, the form of the arena has been designed to step in and out, which responds to the size of the internal spaces and creates partial canopies for pedestrians to shelter under whilst also adding prominence to the main entrance. The result is a 'stacked box' appearance.

3.35 The layout and orientation of the Proposed Development has been considered in terms of microclimate impacts, including the existing wind environment, to provide a form that ensures a suitable environment for users of nearby public realm and amenity spaces.

3.36 At the outset a traditional bowl design was considered, creating a curved design. Upon further analysis it was established that in order to reach the minimum requirements of the venue of the desired capacity the circulation spaces would become overly complex as well as an inefficient design that failed to utilise the changes in topography.

3.37 In addition to the 'bowl' design, a more uniform and linear form was considered; the simple linear form was considered to create a strong identity and was lifted above the remaining pedestrian routes around the lower concourse level to give a contrast in scale between figure and form. The large flat facade surfaces are intended to be a viable display area for potential sponsors, brand activation and event activation. The linearity of the design acts as an ideal canvas for such activation. However, internally this simple linear form would lead to volumes that were not fit for intended purpose. In addition, due to technical requirements the arena must not have windows at the location of the event space which has also resulted in the layout of the Proposed Development being arranged to ensure the active frontages overlook the pedestrianised areas such as the adjacent canal.

3.38 The linear design was developed further, stepping the design out to create the stacked box design. This stepping out responds to some of the pragmatic needs of the building, also creating partial canopies over external pedestrian spaces where event goers would be queuing. This will give prominence to the main entrance of the building adjacent to Joe Mercer Way, the central boulevard linking the Etihad Campus and the car parks.

3.39 The building form was therefore pushed to respond functionally to the interior spaces. In turn, the form steps in or out responding to where space is required inside the building therefore creating a stacked box aesthetic.

3.40 The stacked box form has a strong relationship with the interiors of the building, providing shelter, a unique identity and allows for dynamic facade activation. The horizontal layering of the

stacked form contrasts strongly with the solid form of the plinth that grounds the building to the site.

3.41 Internally, consideration has been given to the operational requirements associated with an arena and has partially dictated the stacked-box appearance. The design brief included a venue that could be used for both event and non-event activities, which had required a unique internal configuration.

3.42 The venue will have the capability to successfully hold a varied array of different event types. Flexibility and scalability have been built into the design of the arena to allow for a multitude of different modes to ensure the venue can regularly host events, putting Manchester in the world stage for entertainment and leisure.

3.43 The Proposed Development seeks to redefine the arena design approach, through providing attractive spaces around the auditorium to create a venue which can be used for event and non-event activities. These uses include food and beverage offers, bars, retail concessions, pop-up retail spaces and lounges.

3.44 There is therefore limited scope in which to provide an alternative design which meets the technical brief required for a state-of-the art arena.

3.45 Further details on the design evolution of the Proposed Development can be found within Section 3 of the Design and Access Statement prepared by Populous.

Chosen Design

3.46 The Proposed Development realises the potential of the Site and is in compliance with national and local planning policy and guidance whilst also meeting the requirements of the client's brief.

3.47 The Proposed Development will benefit from the public transport links that are necessary to the success of the arena and has been designed in consideration of environmental effects including townscape and visual impact, wind, noise and air quality.

3.48 Overall the Proposed Development will create an enhancement from the Site in its current state and will deliver wider social and economic benefits.

4 Site, Surroundings and Description of the Proposals

4.1 The Site is approximately 4.46 ha. and is located to the north of the Etihad Stadium within the Etihad Campus in East Manchester; an area which has seen significant positive physical, economic, social and environmental transformation of the past three decades. The Site is located within the Ward of Ancoats and Beswick in Manchester.

4.2 Joe Mercer Way is located immediately to the west of the Site and is an elevated pedestrian boulevard route to the Etihad Stadium, separating the Site from the adjacent Manchester Tennis and Football Centre located further to the west.

4.3 To the north of the Site is a large car park for the Etihad Stadium and a link road (Sportcity Way) providing access to Alan Turing Way. The Site also extends to the north to incorporate a further access to Alan Turing Way.

4.4 To the north of this there are two residential properties at the entrance to Philips Park Cemetery, but the area is generally characterised by a number of light industrial uses and Philips Park Fire Station is also located here. The raised railway line acts to separate the residential neighbourhood in Miles Platting from these industrial uses and the Site also.

4.5 To the southern edge of the Site is the Ashton Canal, which comprises of towpath and cycle path routes into Manchester City Centre, elsewhere in East Manchester and further afield.

4.6 A planning history search was undertaken using Manchester City Council's (MCC) public access system. There have been no recent applications of interest on the Site. However, in April 2010 Planning Permission was granted for "remediation works including the removal of underground structures, processing and treatment of excavated material and site works including installation of water attenuation tanks, archaeological works, new boundary fencing and demolition of the existing visitors centre" (Ref: 092380/FO/2010/N2).

4.7 Prior to this Planning Permission was granted in 2007 on part of the Site for the construction of a temporary Olympic Standard BMX track, ramp and associated parking for the use of British Cycling as a training facility ahead of the Beijing Olympics.

4.8 A subsequent time extension was granted, with the temporary BMX track, ramp and associated parking being permitted until 31 December 2010. It is unknown when the Site was cleared of these facilities but they would have become defunct for Olympic Training purposes when the purpose built BMX Complex opened in July 2011.

4.9 There are no existing buildings on the Site, which is currently used as an over-spill surface level car park for those attending events associated with the Etihad Stadium. The Site is estimated to have capacity for 500 car parking spaces and is secured with a tall mesh fence on all sides. The perimeter of the Site is also populated with informal, dense shrubbery and self-seeded unclassified trees.

4.10 The Site's topography is generally flat, albeit the Site slopes gently down from south to north, but drops steeply at the southern edge down to the Ashton Canal.

Site Specific Environmental Designations

Air Quality

4.11 The Site is situated in the Greater Manchester Combined Authority Air Quality Management Area (AQMA).

Landscape and Ecology

4.12 The Site is not within, nor does it contain, any ecological designations including Sites of Specific Scientific Interest (SSSI), Sites of Biological Importance (SBI) or Special Protection Areas (SPA). However, the Ashton Canal to the south of the Site boundary is a non-statutory designated SBI, protected under national and local planning policy. An Ecological Statement prepared by Penny Anderson further sets out the ecological considerations for the Site and the Proposed Development.

Flood Risk and Drainage

4.13 The Site is located within Flood Zone 1 and therefore has a low probability of flooding. It is situated within the Manchester, Salford and Trafford Critical Drainage Area (CDA), as designated in 2011.

4.14 Located adjacent to the Ashton Canal, the Site is located within a Canal Breach Hazard Zone B as identified in the Manchester, Salford, Trafford and Environment Agency Joint Strategic Flood Risk Assessment statement (March 2010). The zones demarcate areas that could potentially be affected by flooding in the event of overtopping or breach of canal embankments.

Heritage and Archaeology

4.15 The Site is not within a Conservation Area and there are no Listed Buildings on the Site. However, there are elevent designated heritage assets within the area of analysis as defined in the Heritate Statement prepared by Deloitte Real Estate. The impact of the Proposed Development on the significance of these identified heritage assets are discussed further within the Heritage Statement.

4.16 As set out in the Scoping Report at Appendix 2.1 and corrospondance with Salford Arcaheology and GMAAS at Appendix 2.5, there have been extensive archaeological works in the area including at the Site. It has been concluded that there are no buried archaeological remains at the Site.

Accessibility

4.17 The Site is located approximately 1.5 km walk from the edge of Manchester City Centre, as defined by Great Ancoats Street (circa 15 minutes' walk), with Manchester Piccadilly Station approximately 25 - 30 minutes' walk from the Site (or an 8 minute journet time via Metrolink services), providing intercity and cross-country services as well as regional and local services across Northern England.

4.18 There is an extensive provision of high quality and well-lit pedestrian footways within and around the Site and associated pedestrian crossings. As a result, people frequently walk to and from the Etihad Stadium to Manchester City Centre after match days or concerts.

4.19 There are a number of alternative walking routes to the City Centre available. The most direct route, known as the 'City Link' is via the A662 Pollard Street/Merrell Street/Ashton New Road, was initially developed for the 2002 Commonwealth Games. This route is signed between the Etihad Campus and the City Centre, is lit with footways on either side, and includes controlled crossings at junctions with major roads (of which there are only two - Carruthers Street and Every Street). A branch of this route connects from Every Street to the centre of the Etihad Campus via a traffic-free route.

4.20 An alternative traffic-free walking route between the City Centre and the Etihad Campus is available via the Ashton Canal towpath. This route is slightly longer, but still only takes a few minutes longer. This route passes beneath Great Ancoats Street alongside the canal.

4.21 The Site is also well connected via bicycle with National Cycle Route 60 running adjacent to the Site along Alan Turing Way. National and Regional Route 86 also runs east-west through the Site. It connects from Ducie Street within the City Centre along the Ashton Canal towpath through the Etihad Campus and then through Philips Park. The Etihad Campus currently provides 272 cycle parking spaces.

4.22 The Site and Etihad Campus are also well served by public transport routes. The Etihad Campus Metrolink stop is located approximately 200m walk (less than 5 minutes) to the Site via the Joe Mercer Way footbridge.

4.23 The Metrolink stop is on the Ashton-under-Lyne to Eccles/MediaCityUK Metrolink line, which currently provides a six-minute frequency (i.e. 10 trams per hour) in both directions. These services call at key City Centre stops including Piccadilly (8 minutes from the Site), Piccadilly Gardens, St Peter's Square and Deansgate Castlefield. Interchange onto all other Metrolink lines is possible at these City Centre stops.

4.24 TfGM currently operate an 'enhanced service' on the Metrolink to serve football matches and other major events at the Etihad Campus. Multiple bus stops are also located within five minutes' walk to the Site.

Description of the Proposed Development

4.25 The Proposed Development comprises of a new indoor arena (Use Class D2) with a capacity of 20,000, extendable to 23,500 for certain events/formats, comprising of 68,608 sq. m. GEA of floorspace, including supporting retail uses (Use Classes A1, A3 and A4).

4.26 The proposed floorspace figures and associated use classes are set out in detail in Table 4.1.

Table 4.1: Proposed Development floorspace

Level	Name	Use Class	M² (GEA)
Level 00			
Level 00	L00 GF	D2	17,309
Level 00	L00 GF Base Atrium	A1, A3 and A4	3,964
Level 0M	Level 0M	D2	1,497
Level 01			
Level 01	L01	D2	4,848
Level 01	L01 Atrium	A1, A3 and A4	2,331
Level 01	L01 Canal Popup	A3	41
Level 01	L01 Canal side	A3 and A4	1,233
Level 01	L01 Backstage	A1, A3 and A4	1,235
Level 02			
Level 02	L02 Tier	D2	352
Level 02	L02	D2	2,436
Level 02	L02 Atrium	A3 and A4	3,593
Level 02	L02 North	A3 and A4	1,749
Level 02	L02 South	A3 and A4	1,839
Level 03			
Level 03	L03 Tier	D2	861
Level 03	L03	D2	10,743
Level 04			
Level 04	L04	D2	2,888
Level 04	L04 North	A3 and A4	798
Level 04	L04 South	A3 and A4	668
Level 05			
Level 05	Upper Tier	D2	4,899
Roof	L05	D2	5,323
Total: 68,608 m²			

The Arena Bowl

4.27 The Proposed Development will have the capability to successfully hold a varied array of different event types. Flexibility and scalability have been built into the design of the arena to allow for a multitude of different modes to ensure the venue can regularly host events, putting Manchester in the world stage for entertainment and leisure.

4.28 Within these parameters mentioned above, the layout would be flexible to accommodate a range of events of different nature and scale, which could include music, sport, performances, awards and other live entertainment. Events could be held during the day and evening, throughout the year.

4.29 Importantly, the configuration of the Proposed Development is flexible to accommodate a range of different sports events including (but not limited to) ice hockey, basketball, boxing, eSports, tennis, handball and UFC.

4.30 Further accommodated entertainment acts include family spectaculars such as Disney on Ice or Walking with Dinosaurs. The large event floor can also be used as a dining area for award shows.

Supporting Uses

4.31 The Proposed Development seeks to redefine the arena design approach, through providing attractive spaces around the auditorium to create a venue which can be used for event and non-event activities. This supports activity levels at the arena and improves the wider amenity offer of the Etihad Campus, including on match days.

4.32 To address the brief to create a 'best in class' venue, the design incorporates 'destination spaces' which provide high-quality entertainment facilities and build on the gradient of expectation leading to the auditorium event.

4.33 These 'destination spaces' are set out across five floors, with access to the concourse spaces from both Ground Floor and First Floor levels, making best use of the Site topography. The atrium floor is connected to the upper levels by stairs, escalators and lifts in the main cores, and is a triple height space from Ground Floor through to Level 2. Further food and beverage facilities are available on Level 3 for spectators on the upper tier.

4.34 Hospitality facilities are accommodated on Level 2, which includes the 'Atrium Lounge' and a number of private suites. The hospitality accommodation is sub-divided into a series of spaces, including individual suites and slightly larger lounges that are open to the concourse spaces below on Level 1 and Ground Floor. A corridor circulation lounge route with bars, small seating areas and spectator support facilities connects all three sides of the hospitality level.

4.35 Spectator accommodation at Level 4 comprises two slim lounge spaces on the north and south sides that are open to the main auditorium with views down to the stage and event floor. Guests in these lounges do not have access to the back of the tier, but are accommodated at tables and drinks rails at the front of the lounge to watch performances.

4.36 Through the provision of a range of facilities including food and beverage offers, bars, retail concessions, pop-up retail spaces and lounges, fans are encouraged to arrive earlier and enjoy the range of facilities available at the venue. This increases dwell time and creates a vibrant atmosphere, which is an important factor in boosting quality of experience, revenue and managing crowd flows.

4.37 Further ancillary spaces and functions to support the effective operation of the arena are also proposed for artists, security, venue operation, and logistics including: offices and meeting rooms; communications rooms; plant and storage; bin storage; kitchens, canteens and catering support; event control rooms; a multi-faith room; and staff changing facilities and lockers. WCs are included on all floors and are provided in accordance with venue capacity and accessibility standards requirements.

4.38 A key element of the Proposed Development is also the provision of high quality artist and backstage space and facilities including artists' dressing rooms, a green room, games room and other management support spaces for performers and competitors.

Scale and Massing

4.39 The nature of the Proposed Development requires the development of a large-scale building to ensure that the capacity and facilities required for the best arena in Europe can be accommodated. The venue's functional requirements to meet the client's brief, limits the opportunities to experiment with different scales and massing for the Proposed Development.

4.40 With this in mind, the Design Team have worked hard to create a recognisable landmark and iconic Manchester building, with acknowledgement for its surroundings, whilst ensuring the Proposed Development creates an event experience that visitors will enjoy.

4.41 The existing Site has provided the optimum environment to work with the Site topography and the design of the building responds intelligently to this through providing access points into the concourse area at different levels across the Site.

4.42 The concept proposes two principal elements, a grounded lower masonry plinth and an upper lightweight stepped box. The lower plinth connects to Sportcity Way and Alan Turing Way and forms a series of terraces along Joe Mercer Way and the Ashton Canal. This acts to provide 'in-built' crowd management and enhanced safety and security through the distribution of crowds across the Site and the separation of pedestrians from vehicles.

4.43 Similarly, the scale and massing of the venue responds directly to the Site and surrounding local context by making sure it does not exceed the height of the existing surrounding buildings, whilst ensuring efficient and effective use of a previously developed site in a strategically important location.

4.44 The form of the building is simplistic, yet iconic, with a distinctive form allowing for a simple diagram of the building to be used to give the venue a strong place making identity.

4.45 The horizontal layering of the stacked boxes create visual interest whilst following the function of the building, with different space requirements at each level.

4.46 Furthermore, through working with the existing Site topography and designing the building into the ground all servicing is accommodated below street level and is therefore fully enclosed. As such, the unique identity and form of the building is not compromised on any elevation and the height minimised to just 40m, significantly below the 70m tall Etihad Stadium which is adjacent.

4.47 The compact design also means that the arena will be lower in height than the 02 London, which is circa 50m tall.

Façade Design and Materiality

4.48 The design delivers a high quality façade treatment which includes LED screens and architectural lighting to the upper box and box soffits, integrated seamlessly into the structure of the Proposed Development and flexible to the level and spread of illumination and the activation and type of images shown.

4.49 The materials proposed further add to the architectural quality of the Proposed Development and reflect Manchester's rich heritage. They have been chosen to contrast with the solid plinth and enable the form of an iconic, yet simple, acoustically effective development. There is no desire to provide glazing to the façade of the building or allow daylight into the internal spaces since the acoustic value of the Proposed Development can only be maximised through the creation of an immersive experience.

4.50 The design also allows for dynamic facade activation to the upper box and the building soffits, with the flat surface on each façade being viable as display areas for sponsors, brand activation and event activation.

4.51 The seamless integration of the architectural lighting and LED façade material ensures that the they form part of the structure of the building during daylight hours and are not discernible as LED panels, creating a calm and simple, yet iconic contemporary design.

4.52 When approaching the building, the façade is revealed in more detail, and the pattern of the perforation, the integration of the architectural lighting and LED screens is complemented by a carefully designed panellised grid. This grid has been arranged to emphasise the verticality of the façade against the length of each elevation, heightening the dramatic overhangs of the stepped boxes.

4.53 The black perforated panelling is to have a higher gloss level, so that the façade reflects the surrounding environment and skyscape, bringing a further level of animation to the appearance of the building in daylight.

4.54 To enhance this architectural illusion, the base concrete panelling is capped by a reflective soffit installed to the base of the lowest of the boxes. This acts to animate event arrival ambiance and boost illumination as guests approach the entrances.

4.55 The controlled palette of high quality materials proposed and interesting shape of the Proposed Development unify the buildings elevations and ensure that it is both architecturally beautiful when illuminated and when not.

4.56 Light coloured, textured and smooth concrete panelling is proposed to frame the main entrances to the base of the building to contrast with the dark granite paving to the venue approaches. Green screens are proposed to the vertical concrete plinth facing Joe Mercer Way and to the landscaped site perimeter wall to Alan Turing Way to the east, softening the building into the Site.

4.57 In delivering the intention for the arena to become a beacon of Manchester's rapid transition to a zero-carbon city, the Proposed Development has been designed with acknowledgement for the principles of the circular economy to reduce embodied carbon.

4.58 Whilst it is acknowledged that functional requirements of the building has driven the choice of standard carbon-intense materials, steps will be taken to reduce the impact within this remit. The key actions taken include material optimisation to minimise the use of new materials, exploring opportunities to use recycled materials to reduce embodied carbon. In addition, the construction materials have also been responsibly and locally sourced where possible. There is also a commitment to the installation of PV panels on the roof of the arena, the exact detail of which will be determined in the light of the latest technology and following consultation with the planners.

4.59 Further information about proposed materials is contained in the Design and Access Statement submitted in support of the planning application.

Public Realm

4.60 This Site currently comprises underutilised brownfield land, occupying a prominent site along the Ashton Canal. The Proposed Development presents the opportunity to improve the frontage along the Canal in particular.

4.61 The landscape proposals for the Site have been key in shaping the character and quality of the development as a whole and form part of a wider strategy for the Etihad Campus, which will enhance the local environment, improving the quality of and access to existing green and blue spaces, including the Ashton Canal towpath and Philips Park. As such, the proposals have been developed in consultation with various stakeholders, including the Canal and River Trust.

4.62 The public realm of the Proposed Development aims to provide a landmark design which will create a sense of place where people spend time together.

4.63 The experience for those visiting the Proposed Development and using the public realm relies on the smooth access and egress from the venue. To this end, the team has undertaken extensive crowd modelling studies to ensure that people flow easily and safely into and out of the venue. These crowd flow requirements are a key driver for the design of an efficient and safe development and public realm environment.

4.64 The public realm has therefore taken into account the key routes through and around the Site, with the primary pedestrian access coming from Joe Mercer Way.

4.65 The design also incorporates landscaping along the Ashton Canal, which includes wildflower planting and the incorporation of a green screen along the boundary of the podium level to seamlessly integrate the Proposed Development into the existing site and to enhance biodiversity value.

4.66 The landscaping proposals will 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, which will ultimately encourage people to walk to the Site. Overall this will act to make walking to the Etihad Campus a favourable option.

4.67 As part of this place making strategy, a large hydraulic 'up and over' bi-fold shutter, backed by a long double-sided bar is proposed to the south façade of the building. This will allow the venue

to open to the landscape in finer weather, enhancing the quality of the public realm environment and activating the south of the building near to the Ashton Canal.

4.68 Two-stream litter bins will also be provided throughout the public realm podium areas at frequent intervals, with residual waste and dry mixed recycling (DMR) segregated. They will be concentrated more densely at key waste generation hotspots (e.g. places where people are likely to congregate). To help reduce the risk of littering and improve recycling capture rates, messages on bins will be simplified, for example, through using images of recyclable and non-recyclable items.

4.69 The site 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 Level 1 bin compound and residual bags to the ground floor compactors.

4.70 Green infrastructure is proposed wherever possible around the Proposed Development to compliment the Site's biodiversity value. The proposed green ring around the arena will act to ensure the Proposed Development assimilates sustainably into the existing landscape at the Etihad Campus, connecting the green spaces along the Ashton Canal with Philips Park. The public realm spaces will be managed and maintained regularly to ensure the environment remains attractive and safe.

4.71 These elements of green infrastructure will be managed and maintained as it is 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.

4.72 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 to these existing 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.

4.73 Together with an attractive asset for the outdoor experience, the proposed vegetation supports local wildlife and brings a soft feeling to the public realm and seating areas. The vegetation also forms an important aspect of the scheme to provide comfortable zones sheltered from winds and to direct crowd flows.

4.74 A quantitative study has been prepared by BuroHappold and assesses the likely Wind Microclimate impacts of the Proposed Development upon the Site and surrounding area. This is explained in greater detail in Chapter 14 of the Environmental Statement, with the emphasis of the analysis being on the impact of wind on the comfort and safety of pedestrians.

4.75 This assessment identified there are no areas where the safety criteria has been exceeded within the Proposed Development and nearby perimeter areas, once landscape and mitigation measures have been implemented.

4.76 Tree and shrub planting, external seating areas, decking and paving have all also been designed carefully to direct crowd flows, but also create a strong sense of place and an environment which is suitable for both event days and non-event days.

4.77 The Proposed Development has been designed to ensure the retention of as many trees as possible on the Site. The Applicant is also proposing to plant a further 67 trees at a replacement, in place of the 16 trees and 6 groups of shrubs and small trees which are required to be removed.

4.78 In the interest of safety, the eastern boundary of the Site along Alan Turing Way and the adjacent compound will be secured by green screens, to separate the podium from traffic. All boundaries to the Site have been softened as much as possible by the introduction of planting, barrier free access and buffer zones, while keeping a visual connection with the existing surroundings.

5 Construction Management – Programme and Methodology

Introduction

5.1 This chapter has been prepared to outline the approach to managing the risk and impact associated with the works to construct the Proposed Development. It provides an overview of anticipated site and construction activities, including:-

- Site access and logistics.
- Site establishment.
- Construction operations.
- Control and management of construction activities.
- Waste management.
- Impact of associated highways improvement works (S.278) and the measures implemented to mitigate their impact on local businesses and residents.

5.2 It is supported by a technical appendix as follows:

- Appendix 5.1 Construction Management Plan (CMP).

5.3 Assessments of suitable contractors for the project will be undertaken to establish capability/ suitability, ability to work within confined sites and management procedures to be implemented to ensure successful project delivery. In executing the works, the appointed Contractor will implement the appropriate Risk Assessments and Method Statements (RAMS) to ensure the works are executed in a safe and suitable manner and in accordance with the CDM 2015 regulations whilst fulfilling obligations as Principal Designer and Principal Contractor.

5.4 Whilst defining the obligations and limitations placed on the Contractor when executing the works, this will form the basis for the Construction Phase Health & Safety Plan (CPHSP). The CPHSP will identify key project specific risks associated with the execution of the works and measures implemented place to reduce or mitigate these risks.

5.5 A further detailed CMP would be prepared by the appointed Contractor in due course and updated as appropriate to reflect comments received. This document would form a primary mechanism for maintaining the communicative relationship with Manchester City Council and other third parties in understanding the nature of the Proposed Development and the associated construction activities. Where comments or third party approvals affect the CMP, the plan will reviewed and updated as appropriate.

5.6 The CMP would be periodically updated as required advising of any proposed changes / improvements to the construction methodology.

5.7 Key Performance Indicators (KPI's) will be used to benchmark the Contractor's performance against the requirements of this plan.

Overview of the Works

5.8 The primary construction activities related to the Proposed Development can be summarised as follows: -

- Highways alterations (including S278 works).

- Site clearance, removal and disposal of existing vegetation and scrub.
- Service diversions and removal/ capping of redundant services.
- Site levelling and preparation.
- Earthworks (including formation of retaining walls and piled foundations etc.).
- Construction of the Proposed Development.
- Public Realm and associated landscaping works.

Highways Alterations

5.9 Section 278 alterations will be limited to works required to facilitate the Proposed Development.

5.10 Works will be undertaken at the 'Gate 1' access point from the North carpark to allow left-in and left-out vehicle movements from Alan Turing Way to manage and improve access / egress. This area will also be remodelled to form a new servicing slip road into the North carpark.

5.11 At Sportcity Way, the pavement will be widened adjacent to the proposed building and rising bollards installed adjacent to the Joe Mercer Way crossing to create new Operations options for event days.

Ground Works

5.12 To maximise the use of the Site and contain the massing of the Proposed Development, a reduced level dig approach is proposed to be adopted. This utilises the levels on Sports City Way for vehicular access into the proposed loading bay areas to the East of the Site. Due to the proximity of the Proposed Development to adjacent highways, a sheet piled / contiguous piled solution is proposed to the Site boundary where adjacent structures and roadways are vulnerable to the reduced level works. This perimeter piling would be incorporated into the overall substructure design as permanent works.

5.13 As set out in the Coal Mining Report (Appendix 7.2) further probing on the site as part of an enabling works package is required to establish the possibility of an additional coal mining shaft. If a positive identification is made then it will need to be grouted and capped, and the foundations of the structure above will need to bridge over it. Evidence of these surveys and works will be provided from the Contractor to show that this risk has been adequately mitigated.

Substructure

5.14 The substructure is proposed to be a piled solution, consisting of piles, pads and ground beams. Due to the proximity of adjacent properties, Continuous Flight Auger (CFA) piling is proposed to be used for the foundations of the Proposed Development. Pile sizes and depths will be determined by the Contractor. The Contractor's preferred build methodology and design will dictate the quantity of waste from these activities, therefore this cannot be quantified at this stage. The quantity of material will be calculated by the Contractor and addressed as part of the Contractors' Site Waste Management Plan. Below ground retaining structures will be constructed adjacent to the canal towpath to retain the banked earth. Reinforcement of the crib wall to Joe Mercer Way will be undertaken as required.

Superstructure

5.15 The superstructure comprises of a combination of steel and concrete frame with a ground bearing ground floor slab and insitu concrete upper floors. Vertical restraint to the Proposed Development would be provided through a combination of vertical cores, bracing and shear walls.

Building Façade

5.16 Due to the adjacent site topographies, the need to provide a robust construction solution and ensure longevity of the façade, the proposed elevational treatment is split as follows: -

Lower Accessible Levels – Levels 00 & 01

5.17 The vertical concrete panel system would provide a robust and durable solution to all pedestrian accessible areas, thereby reducing future building maintenance and replacement of exposed building components.

Upper levels – Levels 02 and above

5.18 Composite type cladding panel with bracketry spacer zone for the installation of an outer cloaking panel. Façade lighting is proposed within designated areas of the spacer zone. Due to the stepped nature of the façade, construction and maintenance of the façade is proposed to be undertaken using a combination of Mobile Elevating Work Platforms (MEWP) and scaffolding.

5.19 The façade of the Proposed Development has been designed to be constructed, accessed and maintained from within the Site.

5.20 The general arrangement of the Proposed Development has taken into account the adjacent site topography, creating access points on levels 00 and 01.

Health and Safety

5.21 Health and Safety in connection with the Proposed Development is of paramount importance to ensure safe working conditions for site operatives. Activities pertaining to the works will be reviewed and assessed at every stage of the construction process ensuring the appropriate RAMS are in place and adhered to at all times.

5.22 The Contractor will undertaker the Principal Designer and Principal Contactor roles for the duration of the works. A Principal Designer role will be retained by the Employer to assist in compliance with duties under CDM 2015.

5.23 Work will be undertaken in accordance with Health and Safety at Work Act 1974 and other legislative requirements including (but not limited to) the Manual Handling Operations Regulations 1992 and the working at Height Regulations 2005. Designer's risk assessments will be provided to the Contractor to provide a greater understanding of any design considerations or assumptions in the preparation of the RAMS.

5.24 Trained first aid personnel will be available and clearly identifiable on site at all times. The Contractor will develop a site fire plan, identifying evacuation procedures and muster points. Trained fire marshals will be clearly identifiable.

Construction Activities

Site Access

5.25 Vehicles accessing the Site from outside the city centre will utilise the motorway network to access the M60 Manchester circular. Appropriate delivery routes will be established to limit the duration of vehicles occupy the network. Diverse routes will be managed by the Contractor to distribute vehicle movements across the network. Where possible, deliveries will be scheduled outside of peak traffic flow times to minimise the impact on the surrounding areas

5.26 Deliveries to Site made from the M60 Manchester circular will utilise the M60 as far as reasonably practical to reduce the impact on traffic within the city centre. Where this is not practical, the use of main A road routes will be prioritised.

5.27 For deliveries to/ removal from Site, the Contractor undertakes a transit assessment identifying:

- Delivery/ removal.
- Vehicle size and load.
- Route from source to completion.
- Timings associated with the vehicle movements, with an infrastructure network assessment.

Deliveries and Removals

5.28 Primary access to the Site for larger deliveries will be made via Sportcity Way to the North of the Site, or via the access point further north of the Etihad Stadium car parking. Loading or unloading of plant and materials will not be permitted outside of the Etihad Campus.

5.29 Smaller / regular deliveries to the Site will be made from the Site compound to the south of Ashton Canal, accessed via Gibbon Street. Access to the Site from the Site compound is via Forge Lane Bridge. The Site compound will encompass a material holding area for unloading and interim holding of materials prior to delivery to the Site.

5.30 Where practical, off-site construction and 'just in time' deliveries will be promoted. Deliveries and waste removal will be managed by the Contractor. No off-site stacking of deliveries will be permitted.

5.31 Materials and components will be locally sourced where practical to minimise transportation distances.

Contractor Parking

5.32 The Contractor provides and maintains a Construction Travel Plan for all Contractor and Subcontractor employees for the duration of the works promoting public transport reduce the vehicular movement associated with the works and promote the projects suitability approach to construction.

5.33 Contractor parking will be managed within the Site compound and the North car park. Where the North car park is unavailable on event days, the Contractor will manage and monitor parking, ensuring the workforce use dedicated localised parking areas (not on-street parking) to minimise the impact on surrounding areas.

Plant and Equipment

5.34 MEWP and mobile cranes will be utilised for the construction of the Proposed Development with crawler cranes for the movement and positioning of primary structure. Where practical, construction techniques and the associated plant and equipment will be selected to minimise acoustic intrusions on surrounding areas.

5.35 The Contractor will develop a detailed schedule of plant and equipment to confirm these assumptions in due course.

Construction Sequencing

5.36 To improve the accessibility of the Site and reduce the impact of the construction works on the surrounding areas and infrastructure, it is proposed that the S278 works associated with highway's alterations will be undertaken as a 'first task' in the construction process.

5.37 Piling to the perimeter of the Site is proposed to be undertaken to ensure stability of adjacent structures and facilitate the reduced level dig. The implementation of a single or split level piling solution is still to be established, and will be dependent on the Contractor's preferred method of construction.

5.38 Where reasonably practical, material will be retained and reused on site.

Operating Hours

5.39 Site operating hours will adhere with Manchester City Council's (MCC) 'Environmental Protection Information for Developers': -

- Monday – Friday 07:30 – 18:00hrs
- Saturday 08:30 – 14:00hrs
- Sunday/ Bank Holidays No works permitted

5.40 To reduce the impact on the existing transport and public transport infrastructure of operatives attending site, arrival of the workforce on site 30 minutes prior to the permitted operating hours for setting up will be encouraged.

5.41 No works will commence outside of the above permitted times without prior agreement by Manchester City Council.

Programme

Key Dates

5.42 The current master programme is a development based programme with the following key dates:

- Planning Submission Q1 2020.
- Contractor Appointment (Stage 1) Q1 2020.
- RIBA Workstage 4 Q2 2020.
- Contract Award (Stage 2) Q2 2020.
- Site Mobilisation Q3 2020.
- Completion Q3 2023.

5.43 The works will be undertaken in a single phase, with an enabling works contract to prepare the Site to include:

- Site clearance.
- Service diversions.
- Section 278 highway works.
- Perimeter piling.
- Site levelling to formation level.

5.44 A detailed programme of construction activities and sequencing will be provided by the Contractor as part of the detailed CMP, to be secured through a planning condition.

Site Setup and Operations

5.45 The following site setup and operational requirements apply to the Proposed Development and will be developed in further detail by the Contractor.

Site Establishment

5.46 The Site compound will be located on the Etihad Campus to the south side of the Ashton Canal. Access to the Site from the Site compound will be via Forge Lane Bridge. Construction activities will be contained within the Site and Etihad Campus where possible.

5.47 Highway improvement works will be undertaken outside of the core construction site boundary.

5.48 The following will be provided for the works as temporary facilities:

- Project offices.
- Meeting and conference facilities.
- Induction and training centre.
- Canteen and rest area.

- Toilets and washroom facilities.

5.49 Material storage and waste segregation will be managed by the Contractor to prevent cross contamination of materials whilst promoting recycling and reducing landfill. All flammables waste streams and those with potential environmentally adverse impacts will be appropriately contained and managed by the Contractor.

5.50 Fuel and oil will be stored in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001 with refuelling and transfer of fuel oils undertaken in designated areas by trained personnel, equipped with the appropriate spill kits and emergency action plans.

5.51 Lighting associated with the Site and site establishment will be designed to minimise light spillage to limit the impact on adjacent properties, highways and canals.

Site and Boundary Fencing

5.52 The Site is secured to the north, east and south by 2.4m high palisade fencing. This will be retained and adjusted to suit construction activities during of the works. To the west, access to the Site is restricted by site topography and the elevated Joe Mercer Way. Additional fencing will installed along Joe Mercer Way to secure the Site.

5.53 Solid faced site hoarding will be used to the perimeter of the Site and sealed to the ground to further reduce dust arising and further prevent materials and debris leaving the Site and potentially entering water bodies.

5.54 Site hoardings will be utilised to inform others of the Proposed Development and coloured as appropriate.

5.55 Areas outside of the core working site area in relation to the S278 works and drop off areas will be appropriately secured to protect against public injury and potential theft of plant and materials.

Access Routes and Points

5.56 The method of delivery for plant and materials, and removal of waste from the Site will be defined by the Contractor using key access roads into the Site and surrounding areas.

5.57 Turnstiles to secure the Site from unauthorised access will be in place at all pedestrian access points. Banksman will be present at all vehicular access points.

5.58 Details of the proposed site access arrangements are identified on the Site Logistics Plan within Appendix A of the Outline CMP at Appendix 5.1.

Housekeeping

5.59 The Contractor will maintain a high level of site cleanliness to:

- Reduce potential Health and Safety issues arising from poor working conditions.
- Improve working conditions and operational productivity.
- Reduce waste material on site.
- Remove the potential for waste material inadvertently leaving site (wind conditions etc.).

5.60 In maintaining the cleanliness of the Site, the Contractor will also ensure:

- The appropriate behaviour of the works force (including subcontractors) is appropriate both on- and off-site.
- Waste is removed from the Site at regular intervals to prevent local wildlife being attracted onto site and the potential for fire hazards on site.
- Cleanliness of adjacent roads affected by the works are maintained (wheel washing, road sweepers etc.).

- No fires are permitted on site.

Wheel Wash Facilities and Road Sweeping

5.61 To reduce the quantity of earth on adjacent highways, the Contractor will provide wheel wash facilities at exits from the Site. These will be accompanied by tyre inspection points to remove any large / solid material from vehicles.

5.62 In addition, a road sweeping regime will be implemented and tailored to suit on site activities and associated vehicular movement off site to maintain cleanliness of the adjacent highways.

Lighting of the Site

5.63 To minimise light spill from the Site and reduce the impact of the localised townscape and ecology, directional lighting will be used to illuminate the Site. Localised task lighting will be provided as required by the Contractor to execute the Proposed Development.

Energy

5.64 In line with the UK National Energy Efficiency Action Plan, the Contractor will implement, where possible, greener sources and more energy efficient plant to assist in cutting carbon dioxide emissions by:

- Monitoring and reducing energy consumption during construction.
- Maximising plant and equipment fuel / energy usage efficiency.
- Maximising renewable energy sources.
- Reducing workforce travel and promoting sustainable modes of transport.
- Utilising localised supply chains to reduce transportation.

Materials

5.65 In the selection of material, consideration will be given to the embodied carbon footprint, its recyclability and recycled values / content. The Contractor will employ procurement procedures, ensuring the environmental impact of materials are considered in their selection.

5.66 The use of local supply chains will be promoted to reduce the transportation impact of materials to and from site, whilst investing capital into the local economy and supply chains.

5.67 All timber used on site will be FSC compliant and obtained from sustainable sources.

Waste

5.68 Prior to commencing the works, the Contractor will establish a Construction Waste Management Plan (CWMP) in accordance with the Site Waste Management Plans Regulation 2008.

5.69 The CWMP will identify:

- The various waste streams generated by the construction of the Proposed Development.
- Methods of waste segregation.
- Estimated quantity of each waste type.
- The waste management action for re-using, recycling, recovery and disposal for each waste type.

5.70 The Contractor will:

- Review the CWMP.
- Record quantities and types of waste produced.

- Record the types and quantities of waste that have been:
  - Reused (on or off site).
  - Recycled (on or off site).
  - Sent of other forms of recovery (on or off site).
  - Sent to landfill.
  - Otherwise disposed of.
- Update the plan to reflect the progress of the project

5.71 Where practical, off-site modular construction will be promoted to reduce waste material going off site.

Construction Methodology

5.72 At this stage of design development, the structure of the Proposed Development can be summarised as follows:

- Pile substructure with pile caps and ground beams.
- Ground bearing insitu concrete slab to ground floor.
- Insitu concrete columns and beams to ground floor areas.
- Steel frame to first floor and above.
- Insitu concrete floors over profiled metal decking first floor and above.
- Concrete cores to provide vertical stability.

5.73 Following site preparation completed as part of the enabling works, the outline construction programme and methodology can be summarised as follows:

Table 5.1: Indicative Construction Programme

Date	Construction Stage	
Wk 0-74	Substructure	Installation of CFA piles, pile caps and ground beams to support the primary structural frame. Installation of retaining walls, below ground structures and structural waterproofing. Temporary ground profiling to facilitate the works. Installation and connection of foul and surface water drainage systems.
Wk 37-97	Superstructure (up to and including Level 02)	Installation of structural concrete/ steel frame complete with Insitu composite floors and vertical cores. Installation by mobile cranes for precast concrete and steelwork solutions.
Wk 79-114	Superstructure & Bowl Arena (above Level 02)	Floor by floor sequential installation of the superstructure and raking tiers forming the bowl, complete with Insitu composite floors and vertical cores.
Wk 84-108	Roofs	Insitu composite roofs with single ply type membrane over and parapet upstands.
Wk 99-134	Bowl Roof	Installation of roof trusses from within the site/ Sports City Way using crawler cranes, installation of acoustic treatment and roof finishes.

Date	Construction Stage	
Wk 110-145	Building Facade	Installation of building façade and façade activation measures via MEWP access.
Wk 85-149	Fit out	Installation of partitions, ceilings and finishes etc.
Wk 85-149	M&E Installations	Installation of base build and specialist M&E equipment
Wk 150-170	Testing & Commissioning	Testing and commissioning of the M&E installations, including witnessing by the Local Authority.
Wk 135-170	External Works	Installation of hard/ soft landscaping and planting

5.74 The above is an indicative construction timeline and construction methodology. A detailed programme of construction activities and sequencing will be provided by the Contractor.

Control Measures

Personnel Protection

5.75 In maintaining a safe site, the Contractor will implement a Health & Safety regime for all site operatives and site visitors to ensure a standardised ethos to safety through the implementation of appropriate PPE. The Principal Contractor will review operation specific Risk Assessments and Method Statements (RAMS), ensuring process specific measures are implemented as appropriate.

Protection of Environmental Features

5.76 Due to the Brownfield nature of the Site and previous remedial measures, environmental features to be retained are limited. All trees within the Site retained as part of the proposals will be protected during the works to BS: 5837(2012).

5.77 The integration and interaction of the towpath with further enhance the local areas. Site activities with the potential to pollute watercourses will be undertaken away from such features. Spill kits will be available at all times.

5.78 The Contractor will undertake regular inspections of the measures in place, and adjust these are required by the works.

Noise and Vibration

5.79 Noise and vibration of site activities will be kept to a minimum as far as reasonably practical for the duration of the works and particularly during the first operating hour of the Site. Where the Contractor is required to operate the Site outside of these times, this will only be permitted following consultation and agreement with Manchester City Council's Environmental Health Officer. The Contractor will prepare a specific Management Plan for the control and monitoring of noise and vibration relating to the works, identify noise generating plant and equipment used on site (including type, size and quantity).

5.80 The Contractor makes the necessary Section 61 Control of Pollution Act 1974 applications to the local authority at least 28 days prior to the works, obtaining the relevant consents prior to undertaking the works. Works will be executed in accordance said consents.

5.81 In addition to any restrictions, limitation and or obligations imposed by the Section 61 consent, the Contractor complies with the requirements of the statutory code of practise BS: 5228.

5.82 The Contractor provides draft and final copies of the applicable consents to the Employer's Project Manager for acceptance.

Air Quality

5.83 Prior to the commencement of the works, the Contractor undertakes an air quality assessment and management plan identifying the management and monitoring of dust, smoke and other airborne pollutants.

5.84 Following completion of the air quality assessment, the Contractor makes all necessary applications pertaining to the works, seeking consent from the relevant Pollution Control Authority (Local Authority and/or Environment Agency) in accordance with the Environmental Protection Act 1990 and Pollution Prevention Control Act 1999.

5.85 Measures undertaken by the Contractor shall include but not limited to:

Site Deliveries

5.86 Selection of appropriate vehicles sizes relative to the delivery load will be managed by the Contractor to minimise vehicle pollutants. Where possible these will be co-ordinated with deliveries to nearby sites to minimise vehicles mileage to and from distribution centres.

5.87 Vehicles carrying loose material to and from site will be sheeted to prevent spillage and reduce dusty emissions during transit.

5.88 Implementation of these measures is the responsibility of the Contractor. The Contractor records and reports activities in relation to these measures and any subsequent corrective measures employed, ensuring records are available at all times.

Construction Vehicles

5.89 All vehicles regularly used on will comply with the relevant emissions standards/ legislation and will be serviced in accordance with the manufacturer's recommendations. Vehicles also using public highways will comply with all MOT requirements. The Contractor shall provide all MOT and service documentation for Local Authority inspection upon request and a running log of: -

- Any complaints relating to emissions alleged to be as a result of construction activities, received from either a resident or local business
- The date and vehicle identification number of any construction vehicle observed to be carrying material that has the potential to release dust and does not have the appropriate sheeting measures in place; and
- The date and location of any cleaning of paved areas and roads

5.90 The Contractor ensures no construction plant or vehicle engines are left running when not in use except when the Employer's Project Manager considers there is a valid operational reasoning or justification. The Contractor is encouraged to use low pollutant vehicles or 'green' vehicles in the execution of the works.

5.91 All construction vehicles tracking the site will adhere to the site speed limit and route controls.

Dust Suppression

5.92 The Contractor employs dust suppression systems as appropriate during the works to reduce the quantity of airborne pollutants, providing suitable water bowsers and/or sprays for the task. To limit the generation of dust on and off site, the Contractor will employ appropriate dampening and wheel wash measures for all vehicles trafficking site. Unloading of loose material (spoil) will adhere to the control drop height to control dust release. Smaller hand held tools will be fitted with localised dust collectors or dust suppression systems.

5.93 To reduce any windblown dust arising from stacked materials, the Contractor ensures stacked materials are profiled to minimise wind and rain impact and subsequent erosion. Earth mounds will be kept sufficiently damp to further limit wind impact. Where appropriate, seeding of earth mounds will be encouraged. Where possible, stacked materials with the potential to create dust emissions will be located away from site boundaries.

Hard Standings

5.94 The use of existing hard standings will be promoted to reduce site churn and airborne dust during site operations. Extensions of existing hardstanding will promoted in favour of new hardstanding. Hardstanding will be incorporated within the permanent works where practical.

Water Quality and Drainage

5.95 In executing the works, the Contractor will adopt good construction management practices to reduce the risk of accidental discharge and contamination of rivers, streams, ponds and ground water. These practises will be incorporated into the CMP and include:

- The extent and status of all ground water to the land below the works and any temporary works and land use for the removal of material from site and;
- Comply with the 'Policy and Practice for the Protection of Groundwater Environment Agency TSO 1998'.
- Control of sediment and loads to surface water systems.
- The Pollution Control and contingency plan to identify the requirements for pollution control and emergency procedures for the works.
- Measures for minimising water consumption during the construction process.
- Details of the construction phase drainage strategy during the works (using permanent drainage systems where possible).

5.96 Within their proposals, the Contractor details the use of settlement tanks to remove surface water sediments (incl. sediment from dewatering of excavations) and pollutants from surface water prior to discharge into watercourses.

Aquifer – River Medlock

5.97 Due to the proximity of the site to the River Medlock, stockpiling of any contaminated soils is to be avoided with materials removed from site as soon as reasonable practical. Where stockpiling is require, the Contractor ensures stockpiles are placed on impermeable surfaces and appropriate measures implemented to prevent leaching.

Ashton Canal

5.98 The Contractor instigates control measures to prevent the contamination of the canal by the Works, ensuring the implementation of good construction practises. The Contractor controls surface water runoff, ensuring safe discharge using appropriate drainage systems and undertakes periodic sampling of the canal waters during the Works.

Flood Risk

5.99 The Contractor ensures all Construction workers are made aware of the risks associated with excessive surface water and overland flows resulting in standing water. Site cut levels are to be at least 0.5m above the groundwater level. Where this proves impractical, groundwater measures such as dewatering are implemented to protect construction workers, plant and materials.

Unexploded Ordinance

5.100 The Employer has completed a desktop study for the potential for UxO on the site. The site has been deemed as moderate risk for the presence of UxO. The potential and procedures for discovery of UxO will be identified to all operatives during the Contractor's 'toolbox talks'. An ongoing watching brief will be undertaken by the Contractor and his competent Explosive Ordnance Disposal Engineer.

Vapour/ Ground Gases

5.101 Prior to execution of the Works, the Contractor assess the potential and extent of any ground gasses associated with the Works. Within his designs, the Contractor ensures appropriate gas protection measures are implemented to protect the building and its occupants, and are addressed in connection with undertaking the Works to ensure safety of all site operatives. The control measures implemented for entering and working within confined spaces will be clearly identified within all RAMS

Archaeology and Cultural Heritage

5.102 Due to the previous industrial usage of the Site and the Site remediation works, no designated sites of archaeological sensitivity have been identified in connection with the Site.

Contaminated Land

5.103 Contaminated soils on site have been identified. Removal/ remediation of contaminated soils will be undertaken in accordance with the Environmental Protection Act 1990. The Contractor will avoid stockpiling and contaminated soils to prevent leaching and surface water runoff contaminating localised water courses. Where stockpiling is required, the Contractor will limited it where reasonably possible and located away from water courses as far as reasonably practical

Pollution Control and Contingency Plan

5.104 A Pollution Control and Contingency Plan (PCCP) will be developed by the Contractor to reflect construction activities and will be included within the detailed CMP.

5.105 Measures will be developed by the Contractor to minimise and control site runoff to prevent contamination. These measures will take account of the Environment Pollution Prevention Guidelines:

- PPG1 General guide to the prevention of pollution
- PPG5 Works and maintenance in or near water
- PPG6 Working at construction and demolition site
- PPG18 Managing fire-water and major spillages
- PPG21 Pollution incident response planning
- PPG22 Dealing with spillages on highways

Definition of a Pollutant

5.106 Pollutants are substances that pollute the environment which renders the air, soil, water, or other natural resource harmful or unsuitable for a specific purpose. Environmental incidents occur when an activity or event causes or has the potential to cause harm to people or damage to property and or the environment.

Pollution Prevention

5.107 Works will be undertaken in close proximity to the Ashton Canal and existing drainage networks. Works may also affect the existing ground water table.

5.108 Potential pollutants as a result of the works and prevention measures include:

Concrete and Cementitious Materials

5.109 Concrete and cementitious based materials are alkaline and are potential pollutants. To reduce the risk of any runoff entering watercourse, mixing will be undertaken a minimum of 10 meters away from and watercourses. Wash from concrete and cement works is not discharged into a watercourse. A designated concrete washout area will be provided for the washing out of concrete delivery lorries, pumps and lines with a suitable storage vessel for controlled disposal.

5.110 Where mixing or pumping is within 10m of a water course, an appropriate method to prevent discharge into watercourses will be developed by the Contractor. Prior to piling works, the Contractor will establish any redundant mining works have been sealed to prevent the pumped concrete from the CFA piling contaminating any watercourses.

Oils and fuels

5.111 All oil and fuel will be stored in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001, ensuring safe storage of material and controlled access at all times and:

- Storage areas are not located within 10 meters of a watercourse or highway gully
- Mobile bowsers are bunded and comply with the requirements of Control of Pollution (Oil Storage) (England) Regulations 2001
- Storage drums are contained within bunded areas with a minimum of 25% of the total volume of the volume contained within the bund or, 110% of the largest container, whichever is the greater.
- Refuelling of plant and equipment is undertaken by trained operatives
- Plant is regularly checked for leaks and is regularly maintained.
- Drip trays are placed below any standing plant and equipment.
- Static combustion engine plant (e.g. compressors etc.) are fully integrally bunded or placed on drip trays.
- Spill kits are provided within close proximity to oil and fuel storage areas, ensuring operatives are trained in their use.

5.112 The use of non-toxic biodegradable fluids and oils is encouraged and must be used in all sensitive locations or areas of increased pollution risk.

Plant Maintenance

5.113 Maintenance of any plant will be undertaken at least 10 meters from any watercourse or drain. Spill kits must be available and on hand during all maintenance operations with drip trays to contain any leakage of oil or fuels.

5.114 Any plant or equipment considered a pollutant risk will be repaired or removed from site.

Ground Material and Control of Sedimentation

5.115 Disturbance and handling of soils (particularly in wet weather) can lead to the transfer of particles by running water into watercourses. Potential sedimentation of watercourse as a result of these works include Ashton Canal and highway gullies. The Contractor will employer soils management ensuring:

- Activities likely to give rise to sedimentation of watercourses are located away from water courses.
- Silt fencing is in place to suspend particles from running water
- Settlement tanks or silt tanks are utilised to suspend particles prior to its release into any watercourse

Excavated Spoil

5.116 Excavated spoil will be removed from site as works progress. Where practical materials will be reused on site. Removed materials will treated off site or disposed of as appropriate. Vehicle movements associated with the material of spoil from site will be in accordance with Chapter 12 of this ES.

Construction Waste Materials

5.117 Waste materials will controlled in line CWMP and secured to prevent cross contamination of waste streams or pollution of any water courses. Any liquid waste will be secured in a suitably lined container within a bunded area.

Trade Effluent

5.118 Trade effluent (toilets etc.) will be connected to a foul water drainage system for the duration of the works. Where temporary chemical recirculating toilets are used, their use will be limited as far as reasonably practical and appropriately secured/ weighted to prevent spills. Emptying and refilling will be undertaken by a licensed contractor.

Notification Procedures

5.119 Procedures for the notification and reporting of spillages, pollutants or environmental incidents will be clearly set out within the Contractor's CMP and reinforced through site inductions and toolbox talks.

5.120 The procedure will include details of the recording and reporting process of incidents and details of those notified.

5.121 Contact details for key on site personnel and emergency response persons responsible for environmental protection will be displayed in key locations around the Site and include details of:

- Contractor's Project Manger
- Construction Site Manger
- Contractor's Environmental Manager
- Employer's Project Manager
- Community Liaison Officer
- Emergency Services
- Environment Agency

5.122 The Contractor will promote a system good working practices, actively encouraging suggestions from operatives to improve operational procedures to reduce the risk of environmental incidents, and anonymous reporting of works not being undertaken in accordance with the CMP.

Communications

Project Communications

5.123 To ensure the Health and Safety, Operational and Environmental requirements of the project are communicated effectively and efficiently, this CMP will be distributed to all members of the project team (incl. sub-contractors). Control and mitigation measures associated with key activities or potentially environmentally sensitive operations will be agreed and regularly reviewed between the Contractor and Employer. The Contractor will ensure copies of the following are available on site for review at all times:

- this CMP and/or Contractor's CMP
- the project, Employer and any company environmental policies
- the list of key contacts associated with the works

5.124 During the construction phase of the works, regular internal meetings will occur to identify:

- Progress over the period.

- Works planned over the next period.
- Inductions and training undertaken over the period.
- Health and safety issues incurred (incl. near misses etc.)
- Records on inspections and audits, with a schedule of non-conformances issued.
- Feedback from Community liaisons, copes of any complaints received and mitigation measures implemented.
- Visits and inspections by third parties, including statutory bodies and H&S monitoring officers.
- Records and compliance with the environmental performance and objectives.

5.125 Internal and external communication methods will be defined by the Contractor, maintaining dialogue through the Community Liaison Officer as appropriate. External communications will be coordinated with the Employer's Project Manager to ensure effective and appropriate communications.

Community Liaisons

5.126 Community liaisons will be undertaken by the CLO during the construction process, providing the community with regular updates on the works.

5.127 The CLO's responsibilities include:

- Gathering and sharing information pertaining to the works.
- Fostering an environment, encouraging and supporting community involvement and engagement.
- Presentations to community organisations.
- Hosting or attending community meetings, allowing attendees to express concerns and raise issues.
- Lead community interaction, ensure compliance with the project's social responsibility objectives (employment, work experience schemes etc.).
- Building a 'community spirit' around a project.

Compliance

5.128 Successful implementation of this CMP relies on regular review and updates in response to evolving site conditions. The Contractor will define appropriate measures and procedures to review activities against the CMP and legal/ statutory requirements and any measures implemented in response to CCIs.

Recording

5.129 The Contractor maintains a register of compliance issuing Non-Conformance Reports (NCR's) identifying actions or works not undertaken in accordance with the CMP, method statements or legislative requirements and obligations. The NCR will be accompanied with the appropriate Corrective Action Report (CAR) detailing:

- Action owner(s).
- Corrective measures required.
- Monitoring/ inspection and signoff procedures to be implemented.

- Timescales for close out.
- 3rd party approvals upon completion of the corrective measures.

5.130 As part of the CAR process, a lessons learnt workshop will be conducted to prevent reoccurrence of the event.

Monitoring

5.131 Environmental monitoring of the works will be undertaken during the construction phase to evaluate the environmental impact of the works. This information will be assessed in conjunction with the CMP and improvements/ revisions to the CMP made where appropriate.

5.132 A programme of environmental monitoring will established by the Construction Environmental Manager to suit the construction programme and works on site. Monitoring will be undertaken and assessed against the legal/ legislative requirements, consents and project targets/ requirements.

Review Process

5.133 Records of waste management and environmental aspects pertaining to the works will be mainlined in accordance with the CMP or respective organisational requirements (which is ever is the greater). Records are to be maintained in both digital and hard copies to protect against damage, deterioration or loss and made available to the Employer's Project Manager upon request. Disposal will be upon express consent of the Employer's Project Manager.

Complaints, Compliments and Inquires

Procedures

5.134 A complaints, compliments and inquires procedure (CCI) will be implemented to ensure members of the public wishing to complain, provide feedback or make inquiries can do so. Contact details will be published for use by members of the public with the public actively encouraged to engage as part of the Community Liaison. Liaisons with local councillors, Town/ Parish Councils and the local authority (incl. environmental health) will be undertaken to address any concerns or issues raised directly to councillors by the general public.

5.135 Any CCI's received will be recorded and reported to the Employer's Project Manager and include:

- Parties affected/ reporting
- Timing
- Location
- On site activities being undertaken

5.136 All complete with details of any reactive measures implemented where appropriate.

Reporting

5.137 Any CCIs raised will be reported at internal progress meetings to ensure appropriate measures are being implemented, improving the impact on the community during the construction phase.

5.138 The LA Environmental Health Team may be the first to be contact for residents affected by the works. Ongoing dialogue with the will be undertaken with the Environmental Health Team to ensure responses to any complaints can be provided swiftly.

5.139 Due to the nature of the proposals and proximity of adjacent residents, the works may be subject to a Section 61 application under the Control of Pollution Act 1974 prior to commencing the works. The Contractor will agree any mitigation measures in connection with this application with the Local Authority, obtaining the required permits/ licenses prior to commencing the works.

Feedback

5.140 To validate the CCI process, feedback on any CCIs raised will be provided as part of the community liaison process. Feedback sessions will identify:

- Details of the CCI.
- Assessment undertaken.
- Mitigation measures implemented.

5.141 Any additional beneficiary measures and options will be discussed with the community to further improve the impact of the community during the construction phase.

6 Air Quality and Dust

Introduction

6.1 This chapter of the ES assesses the likely environmental effects of the Proposed Development with regards to air quality. The chapter describes the methods used to assess the baseline conditions currently existing at the Site and surrounding area; the likely effects of the Proposed Development; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been adopted.

6.2 The chapter takes into account relevant legislation, policy and key technical guidance, in line with industry best practice. A comprehensive review of air quality data from Greater Manchester Combined Authority (GMCA) has also been undertaken and, where relevant, considered as part of the baseline sections of the report.

6.3 The Chapter assesses the likely impacts and subsequent effects of the Proposed Development on local air quality through the identification and assessment of direct and indirect emission sources. Likely changes to air quality in the area as a result of the Proposed Development are considered in relation to national air quality objectives and EU limit values. Where required, the assessment considers mitigation measures to reduce the effect of the Proposed Development on local air quality.

6.4 The Chapter author is a Chartered Scientist (CSci), member of the Institute of Environmental Science and Institute of Air Quality Management and holds an Environmental Science MSc with over seven years' experience in air quality consultancy, including writing numerous ES chapters for projects throughout the UK.

6.5 This chapter is supplemented by a number of appendices, including;

- Appendix 6.1 Construction Assessment Methodology
- Appendix 6.2 Traffic Data
- Appendix 6.3 Receptor Locations
- Appendix 6.4 Construction Traffic Modelling
- Appendix 6.5 Model Verification
- Appendix 6.6 Operational Modelling Results (2023)
- Appendix 6.7 Operational Modelling Results (2026)

Limitations and Assumptions

6.6 The baseline year is 2018 for air quality; this the most up-to-date available data for a full calendar year, which is required as air quality concentrations are measured on an annual average basis.

Road traffic modelling

6.7 There are a number of components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

6.8 An important stage in the process is model verification, which involves comparing the model output with measured concentrations. This can only be done for the road traffic model. Because

the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2018) concentrations.

6.9 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

6.10 The arena is operational all year round and is expected to hold circa 120 events in the opening year (2023), with the potential for up to 180 events by 2026. The circa 120 event flows are incorporated into the annual average daily trip flows supplied by BuroHappold traffic consultant in the 2023 Do Something scenario and 180 event flows are incorporated into the 226 Do Something scenario.

Combustion plant modelling

6.11 The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which in reality are variable as the plant will operate at different loads at different times.

6.12 There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs.

Legislative and Policy Context

6.13 Part IV of the Environment Act 1995 places a duty on the Secretary of State for the Environment to develop, implement and maintain an Air Quality Strategy (AQS) with the aim of reducing atmospheric emissions and improving air quality. The latest AQS for England, Scotland, Wales and Northern Ireland was published in 2007, and provides the framework for ensuring the air quality limit values are complied with based on a combination of international, national and local measures to reduce emissions and improve air quality. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundaries against a series of objectives, and appraise development and transport plans against these assessments.

6.14 In areas where air quality objectives are not likely to be met by the relevant target date, local authorities are required to declare an Air Quality Management Area (AQMA) and develop an air quality action plan in pursuit of the air quality objectives. The national air quality objectives relevant to this assessment are detailed in Table 6.1.

Table 6.1 NO_2 and PM_{10} National Air Quality Objectives included in the Air Quality (England) Regulations 2000

Pollutant	Objective	Date to be achieved and maintained thereafter
Nitrogen dioxide (NO_2)	200µg/m^3 measured as a 1-hour mean, not to be exceeded more than 18 times a year	31st December 2005
	40µg/m^3 measured as an annual mean	
Particulate Matter (PM_{10})	50µg/m^3 measured as a 24-hour mean, not to be exceeded more than 35 times a year	31st December 2004
Particulate Matter ($PM_{2.5}$)	25µg/m^3 measured as an annual mean	2020

National Planning Policy

6.15 The National Planning Policy Framework (NPPF) (February 2019) sets the planning policy for England, and underlines the importance of local authorities contributing towards improving and protecting the environment. The NPPF states that the purpose of the planning system is to contribute to the achievement of sustainable development.

6.16 With particular regard to air quality management, Section 9 of the NPPF notes that the environmental impact of transport and traffic should be identified and assessed, whilst mitigating adverse effects to bring about net environmental gains. The guidance states that the planning system should actively manage patterns of growth, offering a choice of transport modes to reduce air pollution:

'Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.'

6.17 Further to this, Section 15 of the NPPF notes that planning policies should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of AQMAs and Clean Air Zones (CAZ), and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Additionally, the NPPF states that planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local air quality action plan.

6.18 National Planning Practice Guidance (NPPG) (November 2019) provides guiding principles on how the planning process can take account of the impact of new development on air quality. Guidance outlines when air quality considerations could be relevant to the development management process. The NPPG states:

6.19 '*Whether air quality is relevant to a planning decision will depend on the Proposed Development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the Proposed Development would be particularly sensitive to poor air quality in its vicinity.*

6.20 Where air quality is a relevant consideration the local planning authority may need to establish:

- *The 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *Whether the Proposed Development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *Whether occupiers or users of the development could experience poor living conditions or health due to poor air quality.'*

6.21 The guidance also outlines the specific issues that may need to be considered when assessing air quality impacts. Relevant considerations include when a development would:

- '*Lead to changes (including any potential reductions) in vehicle-related emissions in the immediate vicinity of the Proposed Development or further afield. This could be through the provision of electric vehicle charging infrastructure; altering the level of traffic congestion; significantly changing traffic volumes, vehicle speeds or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; could add to turnover in a large car park; or involve construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; biomass boilers or biomass-fuelled Combined Heat and*

Power plant; centralised boilers or plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area; or extraction systems (including chimneys) which require approval or permits under pollution control legislation;

- *Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality*;
- *Give rise to potentially unacceptable impacts (such as dust) during construction for nearby sensitive locations;*
- *Have a potential adverse effect on biodiversity, especially where it would affect sites designated for their biodiversity value*.*'*

6.22 Guidance also provides detail on how air quality impacts can be mitigated, stating that mitigation should be spatially specific, dependent on the Proposed Development, and proportionate to the likely impact. The following examples of mitigation are given:

- '*Maintaining adequate separation distances between sources of air pollution and receptors;*
- *Using green infrastructure, in particular trees, where this can create a barrier or maintain separation between sources of pollution and receptors;*
- *Appropriate means of filtration and ventilation;*
- *Including infrastructure to promote modes of transport with a low impact on air quality (such as electric vehicle charging points);*
- *Controlling dust and emissions from construction, operation and demolition; and*
- *Contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development*.'

Local Planning Policy

Manchester Core Strategy Development Plan (2012-2027) (MCC, 2012)

6.23 The Manchester Core Strategy Development Plan (MCC, 2012) is the primary strategic planning document in the city's Local Development Framework. It outlines the council's vision for Manchester for a period of 15 years (from 2012 to 2027) and sets out planning policies that aim to help the city achieve the Local Development Framework's vision.

6.24 With particular regard to air quality, Policy EN 16 (Air Quality) states that:

"The Council will seek to improve the air quality within Manchester, and particularly within Air Quality Management Areas, located along Manchester's principal traffic routes and at Manchester Airport. Developers will be expected to take measures to minimise and mitigate the local impact of emissions from traffic generated by the development, as well as emissions created by the use of the development itself, including from Combined Heat and Power and biomass plant.

When assessing the appropriateness of locations for new development the Council will consider the impacts on air quality, alongside other plan objectives. This includes cumulative impacts, particularly in Air Quality Management Areas."

6.25 Policy EN 7 (Energy Infrastructure opportunities) sets out a general presumption in favour of low and zero carbon decentralised energy schemes, subject to a number of considerations. Those that relate to air quality in particular are as follows:

- Any new generating plant capable of producing heat and cooling as well as electricity should be located in a way that facilitates future connection to a local distributed energy system.

- That any energy centre, including generating plant, standby/boiler plant and substations, shall be located and designed to a high quality so as to integrate with and contribute to the townscape.

- Biofuels should be obtained from sustainable sources and processes and in a way that minimise transport impacts, following a sequential approach in order to minimise CO2 emissions – firstly prioritising local and regional sources, followed by national, European and international.

- Consideration should be given to biofuel delivery by rail and waterways where possible. Where large-scale fuel or feedstock delivery is required by road the energy centre must be located in or adjacent to light industrial, industrial or leisure uses with any impact on local residential amenity minimised.

- The cumulative impact of energy schemes will be taken into account when considering applications, to include modelled impacts on air quality and landscape character, with reference to Policy EN 16 (Air Quality).

6.26 Policy DM1 (Development Management) outlines the key parameters that should be addressed as part of the planning proposal, those relevant to Air Quality include:

- Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals, which would be sensitive to existing environmental conditions, such as noise.

- Design for health

- Vehicular access and parking

- Effects relating to biodiversity, landscape, archaeological or built heritage.

- Green infrastructure including open space, both public and private.

The Greater Manchester Strategy (GMCA, 2017 – updated 2018)

6.27 The Greater Manchester Strategy sets out the city's ambition to become one of the top places in the world to live and work. The strategy addresses key priorities aimed at improving education and skills, health, wellbeing, the environment, work opportunities, and economic growth across the towns, cities, communities, and neighbourhoods that make up Greater Manchester. The strategy has been prepared by all 10 councils, the Mayor, the NHS, transport/police/and fire services and has had input from a number of key stakeholders (the public, businesses, voluntary/community/social enterprise organisations, etc.).

6.28 With regards to improving the environmental conditions of Greater Manchester, particularly air quality, the following statement is made in the strategy (Priority 7 – A green city region and a high quality culture and leisure offer for all):

"Air pollution and greenhouse gas emissions cause significant harm to the environment, to the health of communities, and damage Greater Manchester's economy. Road transport contributes 32% of carbon dioxide emissions with emissions from commercial and domestic buildings accounting for 32% and 37% respectively."

6.29 The strategy highlights the need to rethink how energy is supplied, managed, and consumed in Greater Manchester. It identifies the need for "urgent innovation in our buildings, transport, and energy infrastructure." Greater Manchester will work with local and national stakeholders to develop a means of responding to these challenges through the preparation of their Climate Change and Low Emissions Implementation Plan and by defining "a robust low carbon pathway to 2050 to accelerate the point at which Greater Manchester can become carbon neutral."

6.30 Through a combination of sustained proactive national policy, aligning of priorities, and resources from Greater Manchester, the city will develop new local renewable energy sources

and improve the energy efficiency of new and existing building stock; in turn helping reduce emissions and energy bills for residents and businesses. Additionally, the strategy notes the importance of adapting to a rapidly changing energy system. With the challenges of decarbonisation, ageing infrastructure, and the expectation that energy availability should adapt to demand shows that there needs to be a change in the way we supply, manage, and consume energy. As such, the Greater Manchester Strategy highlights a need to deploy smart energy systems such as storage systems to reduce energy consumption and shift/reduce peak demand. In turn, helping consumers be aware of and minimise their energy usage and bills.

Climate Change and Low Emission Strategies' Whole Place Implementation Plan (2016-2020) (GMCA, 2016)

6.31 Greater Manchester's Implementation Plan is the city's whole place low carbon plan for the period between 2016 and 2020. Building upon the city's 2012 Climate Change Strategy, the Implementation Plan sets out the city's priority actions and delivery plan to address both climate change and improve air quality in Greater Manchester. Some of the key objectives of the plan are to achieve a 48% carbon reduction target by 2020, to promote carbon literacy, and to transition Greater Manchester into a low carbon and low emissions economy with clean air and sustainable lifestyles; all as a means of preparing the city to adapt to the unavoidable threat of climate change.

6.32 Ten key actions have been identified within the Implementation Plan to achieve the 2020 targets and lay strong foundations for a long-term future low carbon economy and society:

1. "*Major infrastructure changes: Identifying spatial, technological and market opportunities and funding to deploy the type and scale of energy efficient/low carbon development, generation, distribution, storage and smart technologies required to deliver carbon and emission targets;*

2. *Reducing fossil fuels in transport: Decreasing reliance on fossil fuels across all transport activities and influencing how and when people choose to travel;*

3. *Living low carbon lives: Reaching out to Greater Manchester's communities, to increase understanding of the opportunities and implications of climate change, incentivising and supporting action to make the transition to a low carbon economy;*

4. *Trading energy intelligently: Intervening in how energy is traded to ensure cost effective energy efficient/low carbon energy generation is prioritised at cost effective and fair prices for consumers;*

5. *Supporting clean businesses: Supporting our businesses to become more resource efficient, access new low carbon market opportunities and make the transition to a low carbon economy;*

6. *Making informed decisions: Making sure our existing and planned major investments, assets, purchases and programmes comply with our climate change goals;*

7. *Preparing for a volatile climate: Addressing the existing and future effects of climate change, equipping residents, businesses and communities with the skills and resources needed to be fit for a changed climate;*

8. *Local to global climate action: Using local experience to shape national and international performance, by negotiating with national government to continue to secure devolved responsibilities, funding, freedoms and flexibilities and collaborating with local, national and international cities and partners to secure supportive legal, policy and fiscal frameworks;*

9. *Reinforcing the right behaviours: Make sure our plans have the intended effect, by considering setting and enforcing clear standards and a more diverse landscape of incentives and penalties to ensure that the required results are achieved; and*

10. *Planning for the future: We will put in place post 2020 targets, plans, programmes and key milestones to reach a clean energy future, and integrate these across Greater Manchester's wider strategies, plans, policies and projects*."

Greater Manchester's Plan for Homes, Jobs and the Environment (Greater Manchester Spatial Framework 2019 Draft)

6.33 GMCA are currently in the process of consultation of the new Greater Manchester Spatial Framework, with the hope of adopting the plan by the end of 2021. The draft plan strengthens the objectives and targets of Air Quality specifically with Policy GM-S 6- Clean Air, which offers a comprehensive range of measures to improve air quality, and adds emphasis on minimising exposure at residential locations and areas where at risk individuals are likely to be (e.g. schools and nurseries).

6.34 The ten clean air measures are:

1. *"Locating and designing development, and focusing transport investment, so as to reduce reliance on forms of transport that generate air pollution;*

2. *Determining planning applications in accordance with the most recent development and planning control guidance published jointly by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK), and the most recent IAQM Guidance on the Assessment of Dust from Demolition and Construction, or relevant successor guidance, including the requirement for developers to submit construction management plans as appropriate;*

3. *Requiring applications for developments that could have an adverse impact on air quality to submit relevant air pollution data and, if approved, to make appropriate provision for future monitoring of air pollution;*

4. *Restricting and carefully regulating developments that would generate significant point source pollution such as some types of industrial activity and energy generation;*

5. *Significantly expanding the network of electric vehicle charging points, both for public and private use, including as part of new developments;*

6. *Investigating measures to reduce concentrations of NO_2 to legal Limit Values in the shortest possible time, including (but not limited to) different types of Clean Air Zone and travel demand measures;*

7. *Facilitating the more sustainable distribution of goods within the urban area, including through accommodating urban consolidation centres and urban distribution centres that use ultra-low emission vehicles, and local delivery facilities to reduce repeat delivery attempts;*

8. *Designing streets to avoid trapping air pollution at ground level, including through the appropriate location and scale of buildings and trees;*

9. *Controlling traffic and parking within and around schools and early years sites; and*

10. *Promoting actions that help remove pollutants from the air, such as enhancing the green infrastructure network and using innovative building materials that capture air pollutants. Development should be located in areas that maximise the use of sustainable travel modes and be designed to minimise exposure to high levels of air pollution, particularly for vulnerable users."(GMCA, 2019)*

GMCA Air Quality Action Plan

6.35 An AQMA has been declared across the City of Manchester owing to exceedances of the annual mean Air Quality Objective for nitrogen dioxide (NO2). These exceedances have been identified as being predominantly from road transport sources with 65% of NO2 emissions within Greater Manchester being attributable to road transport. Of the road transport emissions, the majority were from diesel cars and diesel light goods vehicles.

6.36 As a result of the declaration of the Greater Manchester AQMA, an Air Quality Action Plan has been produced by the GMCA, which outlines the mitigation measures and strategic approach to improve air quality within the city and surrounding boroughs. The seven targeted actions aimed at improving air quality, and specific mitigation measures, are outlined below:

Actions for Managing New Development*:*

6.37 Creation and management of a database of significant planning application and related air quality assessments.

Actions for Freight Vehicles:

6.38 Locations for potential distribution centres will be identified in the Greater Manchester Spatial Framework.

Actions for Buses:

6.39 Consideration and trial of a range-extender bus or other ultra-low emission vehicles, which can be implemented to the wider public transport strategy.

Actions for Cycling:

6.40 Improvement to the cycle networks focusing on safe green routes, away from areas of high pollution.

Actions for Travel Choices:

6.41 Appraisal of existing car sharing schemes and their impacts on modal shift. Use this information to expand existing schemes and inform future areas of focus.

Actions for Car:

6.42 Continual expansion of EV charging points through the Plugged-in-Places programme.

Actions for Information and Resources:

6.43 More resource and investment to the Great Air Manchester website (Great Air Manchester, 2019).

Assessment Methodology and Significance Criteria

Construction Impacts

6.44 Potential construction impacts have been assessed in accordance with the Institute of Air Quality Management (IAQM) best practice guidance (Holman, et al. 2014). This guidance provides a methodology for assessing air quality impacts from demolition, earthworks, construction and trackout activities which may be associated with a development.

6.45 The IAQM dust assessment methodology involves the following steps:

1. A screening assessment to identify the need for detailed assessment. Detailed assessment will be required where there is:

- A human receptor within:
  - 350m of the site boundary; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

- An ecological receptor within:
  - 50m of the site boundary; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

2. Assess the risk of dust impacts by:
   (a) defining the potential dust emission magnitude,
   (b) defining the sensitivity of the area, and
   (c) assessing the risk of impacts. Criteria for defining the dust impacts are shown in Appendix A of the guidance.

3. Determine site-specific mitigation for each of the four possible construction activities; and,

4. Examine residual effects to determine whether or not these are significant.

6.46 The assessment will focus on earthworks, construction, and trackout. IAQM guidance suggests that the significance of any adverse effects are reported post-mitigation, assuming all actions to avoid or reduce environmental effects are an inherent part of the Proposed Development.

6.47 The full methodology, including significance criteria, and thresholds for key parameters considered as part of the construction assessment are included in Appendix A of the guidance.

Operational Impacts

6.48 Environmental Protection UK (EPUK) and the IAQM have published guidance (Moorcroft et al., 2017) on the consideration of air quality within the planning and development control process. This guidance includes criteria that identify when relevant operational impacts can be screened out, or require further assessment. Criteria relevant to this assessment are detailed in Table 6.2.

Table 6.2 Indicative criteria for requiring an air quality assessment

The development will:	Indicative criteria to proceed to an air quality assessment
Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors.	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors.	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB, this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO_x emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

Traffic Emissions

6.49 Road traffic emissions are considered in relation to the impact from a change in traffic as a result of the Proposed Development. The assessment also takes into account traffic flows associated with future committed developments.

6.50 Traffic data has been provided by BuroHappold transport consultants for roads that will experience an increase of more than 100 vehicles per day (annual average daily traffic (AADT))

as a result of the Proposed Development. Traffic data for roads that have been taken into consideration in the assessment are presented in Appendix 6.2.

6.51 Pollutant concentrations are predicted at worst case existing and proposed future receptor locations using the dispersion model ADMS-Roads (v4.1). This model is developed by Cambridge Environmental Research Consultants (CERC) and can be used to assess the impact of vehicle emissions and industrial sources on local air quality. Unlike simpler spreadsheet screening tools, it can include parameters such as variable meteorological conditions, complex road networks (including the combined contribution of multiple road links on single sensitive receptors) and the capability of including the effects of complex terrain, atmospheric chemistry and street-canyon effects. The model is widely used by local authorities in the UK as part of their review and assessment obligations.

6.52 This assessment considers traffic-related pollutant concentrations (NO_2, PM_{10}) at existing receptors in the vicinity of the Proposed Development. The assessment considers existing traffic flows on the local road network as well as the predicted change in traffic as a result of the Proposed Development.

6.53 Pollutant concentrations are predicted at receptors for the following assessment years:

- 2018 Existing Baseline;
- 2021 Do Nothing – Future baseline for construction peak year (including committed developments flows) without the Proposed Development;
- 2021 Do Something - Peak Construction Year; future baseline (including committed development with construction flows).
- 2023 Do Nothing – Opening year baseline (including committed developments) without the Proposed Development;
- 2023 Do Something – Opening year baseline (including committed developments) with the Proposed Development operational flows (circa 120 events);
- 2026 Do Nothing – Future baseline (including committed developments) without the Proposed Development; and,
- 2026 Do Something – Future baseline (including committed developments) with the Proposed Development operational flows (circa 180 events).

6.54 The impact of the Proposed Development has been assessed by comparing the Do Nothing and Do Something scenarios for both the 2023 and the 2026 scenarios.

6.55 Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 9.0) published by Defra. In line with IAQM's position statement (IAQM, 2018), a sensitivity test has also been carried out for NO2 that involves assuming higher NOx emissions from some diesel vehicles than have been predicted by Defra, using the CURED V3A tool (AQC, 2017). In order to provide a worst case assessment, modelled results have been based on the CURED tool.

6.56 Hourly sequential meteorological data from Manchester Airport for 2018 have been used in the model.

6.57 Pollutant concentrations were predicted at existing receptor locations likely to be worst affected by emissions generated by the project. Receptor locations include existing residential properties and amenity spaces. Receptor locations are detailed in Appendix 6.3 and presented in Figure 6.1.

6.58 Figure 6.1 shows the road network included within the model and defines the study area.

Combustion Plant Emissions

6.59 The Proposed Development includes the following combustion plant:

- 2 No. Hamworthy Wessex ModuMax MK3 (totalling 1200kW)
- 2 No. AJ Power Engine Backup Generators (totalling 1524kW)

6.60 The impact of emissions from the proposed plant have been predicted using point sources within the ADMS Roads dispersion model. The model has been run to predict the contribution of plant emissions to annual mean and the 99.79th percentile of 1-hour mean nitrogen oxides concentrations.

6.61 The emission parameters used in the modelling are set out in Table 6.3

6.62 Entrainment of the plume into the wake of the buildings (building downwash effect) has been considered in the model. The building dimensions and flue location have been obtained from architectural drawings. The location of the flues and the building set ups are shown in Figure 6.2.

6.63 Hourly sequential meteorological data from Manchester Airport for 2014, 2015, 2016, 2017 and 2018 have been used in the model.

6.64 The maximum concentration at each receptor from any meteorological year has been used to assess the impact of combustion plant emissions.

6.65 For the boilers, annual mean model outputs have been determined taking into account the predicted annual energy usage in order to give a realistic prediction of the long-term impact, whilst short term impacts have been assessed assuming that boilers will be in use at 100% load all year round.

6.66 For the generators, both long term and short term impacts have been assessed based on the estimated 50 hours testing that is planned to take place on an annual basis. The short term impacts of the operational emissions have only been considered in the 2023 Do Something scenarios as these will represent worse case emissions as the background concentrations are higher.

6.67 Plant contribution has been predicted at the same receptors as for the traffic emissions study, in order to combine the predicted impact associated with the development.

Table 6.3 Plant Specifications and Modelled Emissions and Release Conditions

Parameter	Value
Boilers	
Flue Internal Diameter (m)	0.45
Flue Height (m)	32
Volume Flux (m^3/s)	0.13
Specified NO_x Emission Rate (g/s)	0.0129
Specified Exhaust Temperature (°C)	83
Stack Location (X, Y)	386879, 398912
Backup Generators (A, B)	
Flue Internal Diameter (m)	0.25
Flue Height (m)	32
Volume Flux (m^3/s)	5.15
Specified NO_x Emission Rate (g/s)	9.5
Specified Exhaust Temperature (°C)	500
Stack Location (X, Y)	386892, 398834

Background Concentrations

6.68 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2018a).

6.69 The road-traffic components of nitrogen dioxide in the background maps have been uplifted in future years following the Cured V3A methodology in order to ensure worst case results are predicted. Details of the approach are provided in a report prepared by Air Quality Consultants[5].

Model Verification

6.70 The ADMS-Roads model was used to assess operational emissions. In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

6.71 The full verification process has been outlined in Appendix 6.5 Model Verification. The final verification factor of 1.2797 has been applied to the modelled road NOx concentrations for each receptor to provide adjusted concentrations, which are then added to background concentrations and process using the NO_x to NO_2 calculator.

6.72 It is not common practice to verify point source emissions against existing air quality monitoring data, thus these results have not been verified but instead added to the final concentration in the DS scenario.

6.73 PM_{10} concentrations have been adjusted applying the verification factor calculated for road NO_x.

Receptor sensitivity

6.74 Sensitive receptors are considered for both construction and operational phases of the Proposed Development. Receptor sensitivity is defined in line with air quality guidance and therefore differs from the standard approach used elsewhere in the ES.

Model post-processing

6.75 The model predicts road- NO_x concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2 has been processed through the NO_x to NO_2 calculator available on the Defra LAQM Support website (Defra, 2018b). The traffic mix within the calculator has been set to "All other urban traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road- NO_x and the background NO_2.

6.76 ADMS-Roads has been run to predict the contribution of the proposed combustion plant emissions to annual mean (long-term) concentrations of nitrogen oxides, and to the 99.79th percentile of 1-hour mean (short-term) nitrogen oxides concentrations. The following adjustments have taken place on the predicted NO_x values to ascertain NO_2 concentration, in line with Environment Agency guidance (Environment Agency, 2005):

- Long-term NO_2 concentrations = long-term NO_x concentration x 0.7
- Short-term NO_2 concentrations = short term NO_x concentrations x 0.35.

Construction

6.77 IAQM construction guidance describes a construction dust receptor as "a location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust".

6.78 In accordance with IAQM guidance, the principles that are applied to assess and classify sensitivity of receptors are described in Table 6.4.

Table 6.4 Receptor sensitivity principles: construction

Sensitivity of receptor	Sensitivity to dust soiling	Sensitivity to health effect of PM_{10}	Sensitivity to ecological effects
High	Areas where a high level of amenity would be reasonably expected; Areas where the appearance, aesthetics or value of a property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land; Indicative examples include dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objective, a relevant location would be one where individuals may be exposed for eight hours or more in a day; Indicative examples include residential properties, hospitals, schools and residential care homes.	Locations with an international or national designation and the designated features may be affected by dust soiling; Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain; Indicative examples include a Special Area of conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; The appearance, aesthetics or value of their property could be diminished by soiling; The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods; Indicative examples include parks and places of work.	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day); Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; Locations with a national designation where the features may be affected by dust deposition; Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	The enjoyment of amenity would not reasonably be expected; Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time; Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	Locations where human exposure is transient; Indicative examples include public footpaths, playing fields, parks and shopping streets.	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a local Nature Reserve with dust sensitive features.

Operation

6.79 Operational impacts are considered at receptor locations where there is relevant exposure to national air quality objectives, in line with LAQM TG16 (Defra, 2018c). Examples of receptors, dependent on the averaging period for pollutant concentration, are shown in Table 6.5. Air quality objectives are based on standards which are set at a level below the lowest concentration at which more sensitive members of the public have been observed to be affected by pollutant exposure. As any member of the public could be present at receptors which have relevant exposure, it is considered that all receptors are of equal sensitivity. Therefore all receptors considered, where there is relevant exposure, will be of high sensitivity.

Table 6.5 Receptor sensitivity principles: operation

Averaging period	Sensitive receptors occur at	Sensitive receptors generally do not occur at
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24 hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
Hourly mean	All locations where the annual mean and 24 -hour mean objective apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access.

Significance criteria

6.80 EPUK and IAQM have produced guidance (Moorcroft and Barrowcliffe, et al., 2017) to ensure adequate consideration of air quality matters in the development control process. This guidance provides a framework for describing the degree of impact resulting from a change in air pollutant concentration (Table 6.6).

6.81 Impact is described by expressing the magnitude of incremental change as a proportion of a relevant assessment level and then to examine this change in the context of the new total concentration and its relationship with the assessment criterion (or Air Quality Assessment Level (AQAL)).

6.82 With regards to short term impacts, the framework for describing significance is presented in Table 6.7. It should be noted that assessment of short term impacts is made without the need to take into account background or baseline conditions. This is due to the fact that on an annual average basis, background concentrations will be a much smaller quantity than the peak concentration from a substantial plume and it is the contribution that is used as a measure of the impact, not the overall concentration.

Table 6.6 Long term impact descriptors for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Table 6.7 Short term impact descriptors for individual receptors

% process contribution relative to Air Quality Assessment Level (AQAL)	Impact descriptor
0-10%	Negligible
11-20%	Slight
21-50%	Moderate
>51%	Substantial

Baseline Conditions

6.83 Baseline data was gathered from the following sources:

- MCC Air Quality Annual Status Report 2019;
- Defra's national air quality background maps, reference year 2017; and,
- Baseline traffic flows (in Annual Average Daily Traffic (AADT)) supplied by the project transport consultant.

Local Air Quality Management

6.84 An AQMA has been declared across the City of Manchester owing to exceedances of the annual mean Air Quality Objective for nitrogen dioxide (NO_2). These exceedances have been identified as being predominantly from road transport sources with 65% (GMCA, 2019) of NO_2 emissions within Greater Manchester being attributable to road transport.

6.85 The Proposed Development is located adjacent to the Greater Manchester AQMA, as shown in Figure 6.3.

6.86 In 2018, GMCA were one of 33 Local Authorities who were issued a ministerial direction from the UK Government to tackle poor air quality and achieve compliance with air quality objectives in

the shortest time possible. In response to this GMCA have carried out feasibility studies into the implementation of a CAZ. This study will assess the different ways to implement a CAZ, an air quality assessment, health impact assessment and an economic assessment. As of August 2019 it is expected that a CAZ will be implemented in Manchester by 2021 but specific details regarding the CAZ are still being developed.

Local Air Quality Monitoring

6.87 GMCA undertake air quality monitoring at 200+ monitoring sites across the 10 boroughs within Greater Manchester; 37 of these sites are located within MCC. Within MCC there are two automatic monitors and 35 non-automatic monitoring sites (diffusion tubes). There are a number of diffusion tube monitoring sites located in the vicinity of the Proposed Development site. Nearby monitoring locations are presented in Figure 6.4.

6.88 Data from nearby diffusion tube monitoring sites is presented in Table 6.8. Monitoring results indicate that the annual mean NO2 air quality objective has been exceeded at roadside monitoring sites in the city centre (sites 71 and 9) in years 2016-2018.

6.89 At roadsides further away from the city centre, pollution levels are lower; sites 28 and 36 met the annual mean NO_2 air quality limit in 2018. All five monitoring sites show decreasing NO_2 concentrations; NO_2 concentrations have been gradually decreasing since 2016 at the urban background site 14.

Table 6.8 Nearby diffusion tube monitoring results

Site ID	Location	Site type	NO_2 concentration (µg/m³)		
			2016	2017	2018
9A/B	Newton Street	Roadside	**51.9**	**51.1**	**45.8**
14	Market Street	Urban Background	23.3	22.1	18.6
28	Ashton Old Road	Roadside	**41.0**	38.5	37.1
36	Rochdale Road	Roadside	**40.1**	34.0	33.1
71	Great Ancoats Street	Roadside	**51.2**	**50.4**	**46.1**

Figures in **bold** indicate an exceedance of the long term air quality objective

Background Air Quality

6.90 The Defra website includes estimated background air pollution data for NOx, NO_2 and PM_{10} for each 1km by 1km OS grid square. Background pollutant concentrations are modelled from the reference year of 2017 based on ambient monitoring and meteorological data from 2017 and includes projections for future years up to 2030.

6.91 Predicted background concentrations for 2018 in the grid square where development lies are outlined in Table 6.9. Annual mean concentrations of NO_2 and PM_{10} meet their relevant objectives. The predicted background concentrations (21.8µg/m³) are marginally higher than the monitored value at Site 14 (18.6µg/m³).

Table 6.9 Predicted Defra mapped background concentrations of NO_2, and PM_{10} for 2018

Pollutant	Annual mean background concentrations (µg/m³)
	2018
Nitrogen dioxide (NO_2)	21.8
Particulate matter (PM_{10})	12.0

Future baseline

6.92 Defra's mapped background concentrations include projections from 2017 to 2030, and serve as a good indication of changing pollutant concentrations.

6.93 Predicted background concentrations for 2021 (peak construction year) and 2023 (operational year) in the grid square where the Proposed Development lies are outlined in Table 6.10 Annual mean concentrations of NO_2 and PM_{10} are noticeably lower in both future scenarios predominantly due to decreased emissions from the national fleet.

Table 6.10 Predicted Defra mapped background concentrations of NOx, NO_2, and PM_{10} for 2021 and 2023

Pollutant	Annual mean background concentrations (µg/m^3)	
	2021	2023
Nitrogen dioxide (NO_2)	19.2	17.9
Particulate matter (PM_{10})	11.6	11.4

Meteorological Conditions

6.94 Manchester Airport meteorological station is located 15.5 km south of the site, this meteorological station is the closest to the Site and deemed to be the most representative. As shown in Figure 6.5 the prevailing winds are from the south at speeds of between 2-4ms^{-1}. Winds from the west were also common which reached slightly higher speeds of up to 10ms^{-1}.

Identification and Evaluation of Significant Effects

Construction Effects/Assessment

6.95 The IAQM guidance criteria used to assess the potential impacts from construction activities is detailed in Appendix 6.1. The following steps explain the site specific assessment in the context of the IAQM criteria detailed in Appendix 6.1.

Step 1: Screen the need for a detailed assessment

6.96 In accordance with screening criteria in the IAQM guidance, an assessment is required as receptors are located within 350m of the Site boundary, within 50m of the routes used by construction vehicles on the public highway within 500m of the site entrance.

Step 2A: Define the Potential Dust Emission Magnitude

6.97 Dust emission magnitudes for relevant construction activities are shown in Table 6.11.

Table 6.11 Dust Emission Magnitude

Activity	Dust emission magnitude
Earthworks	Large
Construction	Medium
Trackout	Large

6.98 No demolition works are to take place; the site is currently used as an overspill surface level car park and has no permanent structures, and so demolition has been scoped out of this assessment.

6.99 The Site area is 20,100m2, the estimated building volume is 47,000m3 meaning the earthworks and construction magnitude are large and medium respectively. There are high levels of HDVs expected to visit the Site daily; however few residential receptors are located within relevant distance to the trackout routes; in order to capture potential worst-case impacts, trackout emission magnitude is considered large.

Step 2B: Define the sensitivity of the area

6.100 The sensitivity of the surrounding area to potential construction impacts is detailed in Table 6.12.

Table 6.12 Sensitivity of the surrounding area

Potential impact	Sensitivity of surrounding area		
	Earthworks	Construction	Trackout
Dust soiling	Medium	Medium	Medium
Human health	Low	Low	Low
Ecological	Medium	Medium	Medium

6.101 The surrounding area has a medium sensitivity to potential dust soiling impacts with respect to human receptors. This level of sensitivity has been determined due to the proximity of nearby car parks for both the Etihad stadium and nearby tennis centre. There is no residential receptors in close proximity to the Site. The nearest residential receptor is the apartment block on Stuart Street, 54m to the east of the Site. There is also a school playing field located 100m to the north-east of the site.

6.102 The sensitivity of the area to human health impacts is determined to be low as the annual mean PM10 concentration is <24 µg/m3. Trackout routes will be along Alan Turing Way; a key arterial road that has few residential properties adjacent to the road so sensitivity is considered medium to low with respect to dust soiling and human health impacts. Figure 6.6 shows receptor locations considered as part of the of construction assessment.

6.103 Due to the close proximity (<20m) of the river to the south of the site, the ecological sensitivity is high.

Step 2C: Define the risks of impacts

6.104 The risk of dust impacts for relevant construction activities are summarised in Table 6.13. These results take into account both the potential dust emission magnitude and the sensitivity of the area. The overall risk has been established following the methodology in Appendix 6.1, specifically Table 6.8. The results show that the risk is at worst medium risk for earthworks, construction, and trackout activities.

6.105 It should be noted that activities on site will be temporary in nature, mitigation appropriate to the level of risk and in line with good industry practices will be implemented across the site to ensure any adverse effects are minimised.

Table 6.13 Summary of risk from dust impacts

Source	Dust soiling	Human health	Ecological
Earthworks	Medium Risk	Low Risk	Medium Risk
Construction	Medium Risk	Low Risk	Medium Risk
Trackout	Medium Risk	Low Risk	Medium Risk

Construction Traffic Emissions

6.106 Vehicle emissions from construction traffic generated as a result of the construction phase will have an impact on local air quality conditions, notably at receptors in close proximity to trackout routes.

6.107 Construction vehicle flows from the peak construction year have been used within the model to capture the worst-case scenarios. The additional vehicles are predominantly HDV's and the highest increase HDV movements is predicted on Queens Road, North of Vickers Street.

6.108 Predicted pollutant concentrations at selected receptors are presented in Appendix 6.4.

6.109 The impact from construction traffic emissions is predicted to be **negligible at all modelled receptor locations**. The largest increase as a result of construction traffic emissions is predicted at receptor 36, owing to the increase in HDV's on Alan Turing way. The construction traffic routes planned to be used during the construction phase are major roads, meaning the majority of existing sensitive receptors are set back from the roadside.

Operational Assessment

6.110 The following operational aspects will have a potential impact on local air quality:

- Vehicle emissions from traffic generated as a result of the Proposed Development on the local road network; and
- Combustion plant emissions.

6.111 Predicted pollutant concentrations at selected receptors are presented in Appendix 6.6 and Appendix 6.7. The contribution from both traffic and combustion plant emissions has been added to give the total predicted concentrations.

6.112 The combined impact of operational traffic and combustion plant emissions associated with the Proposed Development is predicted to be **negligible** at all considered receptors for both the 2023 and the 2026 scenarios.

6.113 With regards to short term impacts, the maximum predicted 99.79th percentile of hourly mean NO_2 from combustion plant (boiler and generator emissions) is 10.1µg/m^3, or 6% of the short term AQAL, which represents a **negligible impact**.

6.114 With regards to short term air quality objectives, in accordance with LAQM.TG(16), it is considered that as all annual mean NO_2 concentrations are below 60µg/m^3, the hourly objective will be met.

6.115 With regards to PM_{10}, dispersion models are inherently less accurate at predicting the number of exceedances of the 24-hour mean objective for PM_{10} than the annual mean objective. Accordingly, the relationship between annual mean and the number of 24-hour mean exceedances of 50 µg/m^3, devised by LAQM.TG(16), has been used for assessment of the short-term PM_{10} objective (No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206/annual mean). The maximum number of days exceeding the objective concentration is two, which is predicted at three receptors with the majority predicting one day of exceedance. This is well within the allowable 35 exceedances which are permitted in the objective.

Mitigation Measures

Construction Effects

6.116 Step 3 of the IAQM guidance sets out a framework for determining appropriate mitigation measures based on the predicted risk (step 2C), and also allowing for a level of professional judgment. The following mitigation measures can be incorporated into the Proposed Development so as to ensure that the residual effects from construction are insignificant.

6.117 Mitigation measures that should be considered for inclusion into a Construction Environmental Management Plan (CEMP), based on the perceived level of risk, include the following:

Communications:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.
- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this

document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
- Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport deliveries which might be using the same strategic road network routes.

Monitoring

- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.
- Record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust.

Site Maintenance

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Vehicle Operation and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management:

- Avoid bonfires and burning of waste materials.

Mitigation measures specific for Construction:

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

Mitigation measures specific for trackout:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.

- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10m from receptors where possible.

Operational Effects

6.118 As the predicted operational impact is not significant in EIA terms, no further mitigation measures are necessary.

Cumulative Effects

Demolition and construction

6.119 It is assumed that an appropriate assessment of potential construction impacts will have been carried out and necessary mitigation for the cumulative developments will have been identified. Mitigation for the application site will therefore complement the mitigation identified for the other cumulative developments.

Operational

6.120 Traffic flows from cumulative developments are included within the traffic data provided by the project transport consultant upon which the operational assessment is based, therefore cumulative effects are considered inherently in the assessment.

Residual Effects

Table 6.14 – Summary of Receptors, Likely Significant Effects, Mitigation Measures, and Residual Effects

	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Construction	Nuisance from dust deposition and impact from elevated PM_{10} concentrations on human health	Major Adverse	Best practice mitigation measures for controlling dust/emissions during construction	Implemented into construction management plan and adhered to throughout construction phase.	Minor adverse/negligible (not significant)
Construction	Construction traffic generated by	Negligible	n/a	n/a	Negligible

	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
	the Proposed Development				
Operational	Operational impacts from traffic and combustion plant emissions	Negligible	N/A	N/A	Negligible

Reference List

6.121 This ES Chapter has been prepared by reference to the following:

- AQC (2017) CURED v3A, Available: http://www.aqconsultants.co.uk/Resources/DownloadReports.aspx
- Defra (2018a) 2017 Reference Year Background Map. https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017
- Defra (2018b) Local Air Quality Management Tools. NOx to NO2 Calculator v7.1. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
- Defra (2018c) Part IV of the Environment Act 1995: Local Air Quality Management: Technical Guidance (TG16), Department for Environment Food and Rural Affairs, February 2018
- Environment Agency (2005) Conversion ratios for NOx and NO2, Available: http://webarchive.nationalarchives.gov.uk/20140328084622/http:/www.environmentagency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf.
- GMCA (2019) Greater Manchester's Plan for Homes, Jobs and The Environment. Revised Draft. January 2019. https://www.greatermanchester-ca.gov.uk/media/1710/gm_plan_for_homes_jobs_and_the_environment_1101-web.pdf
- Great Air Manchester, (2019) : https://cleanairgm.com/
- Holman et al (2014). IAQM Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London. www.iaqm/wpcontent/uploads/guidance/dust_assessment.pdf
- IAQM Position Statement; Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments July 2018 | Version 1.1
- Moorcroft and Barrowcliffe. et al. (2017) Land-use Planning & Development Control: Planning for Air Quality v1.2. Institute of Air Quality Management, London. http://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

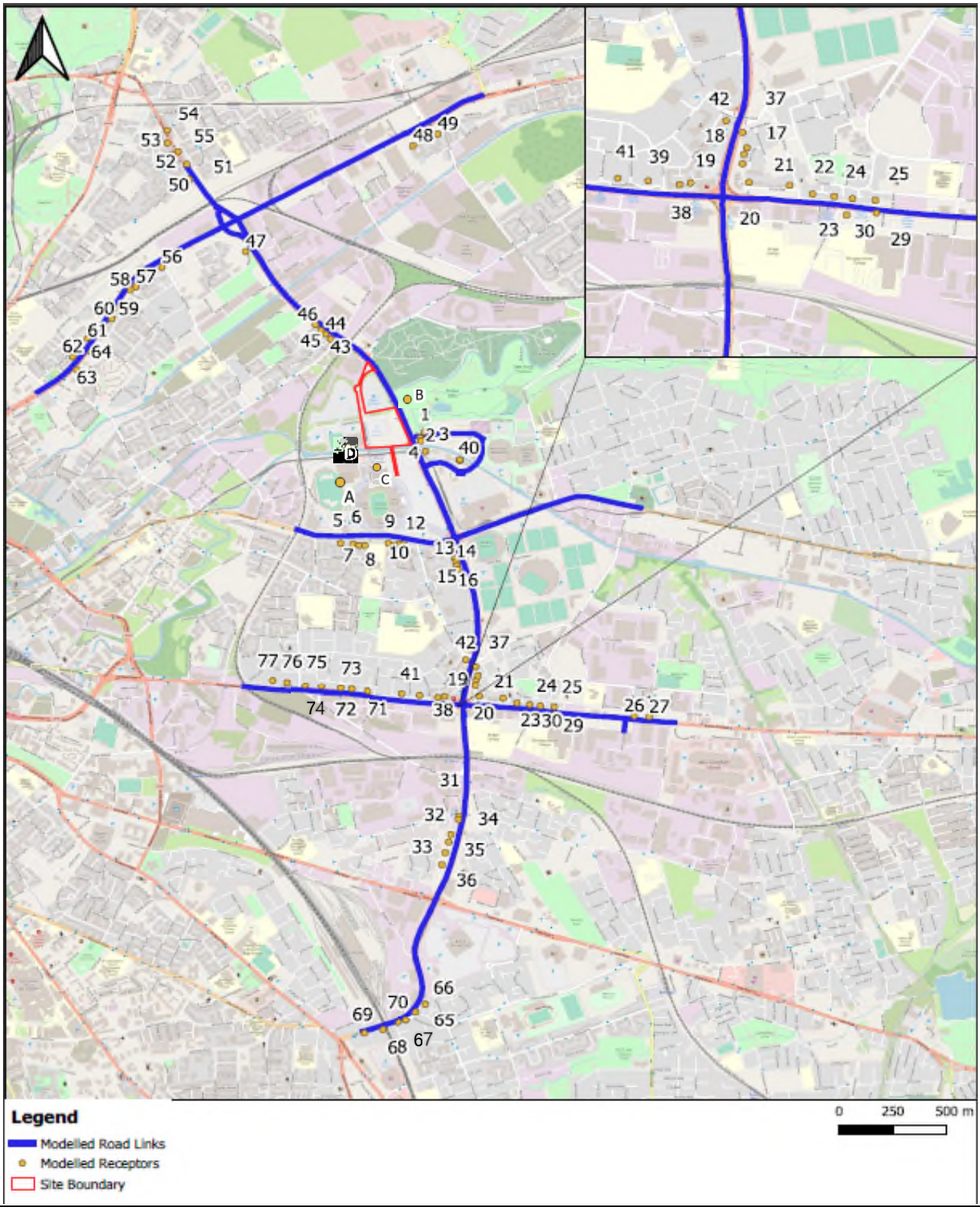
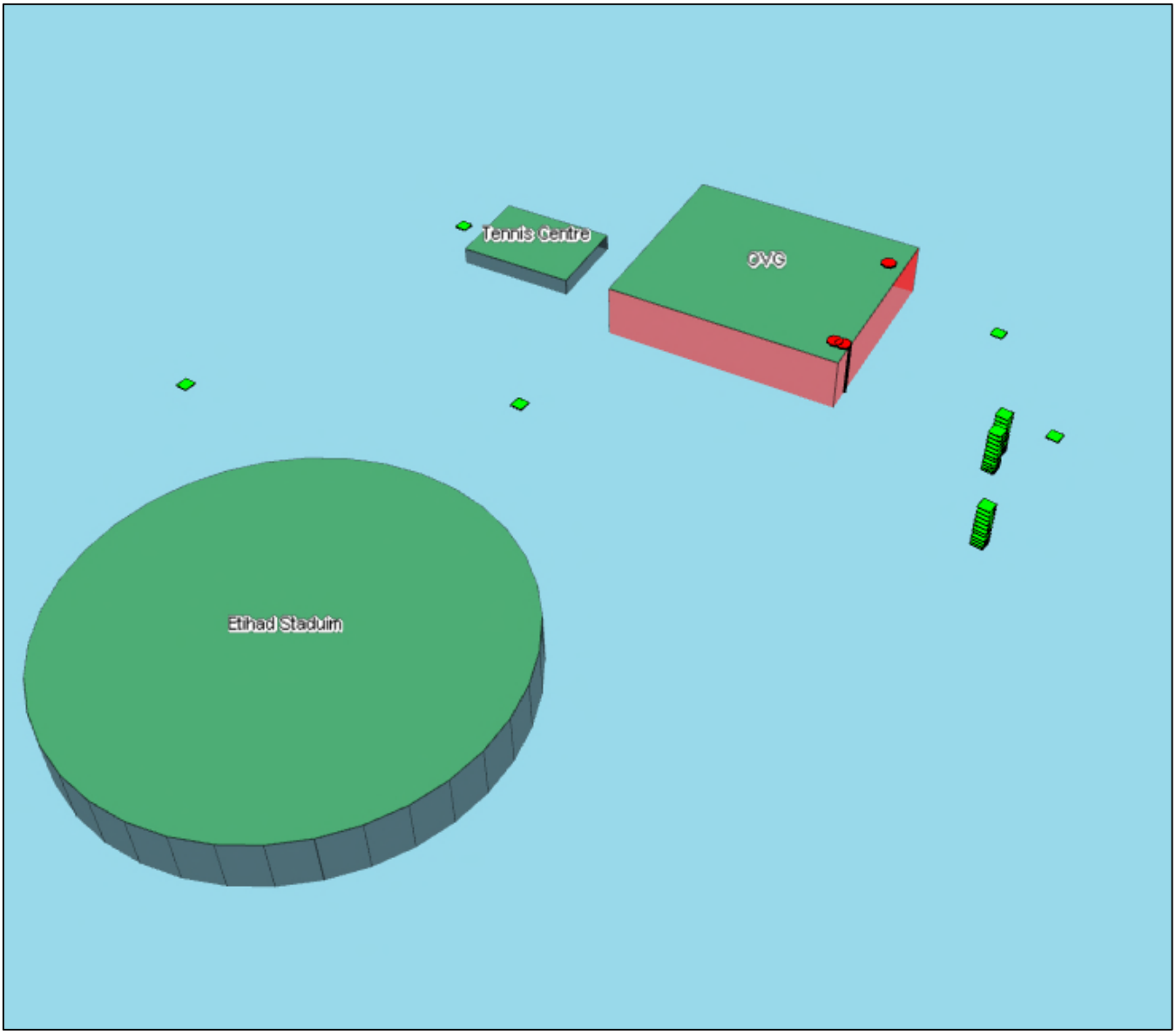


	Figure:	6.1		
	Title:	Modelled Receptors and Road Network		
	Project:	OVG Manchester		
	Date:	January 2020	Scale:	NTS



Legend

- ☑ Energy Centre Flues
- ☑ Buildings
- ☑ Modelled Receptors

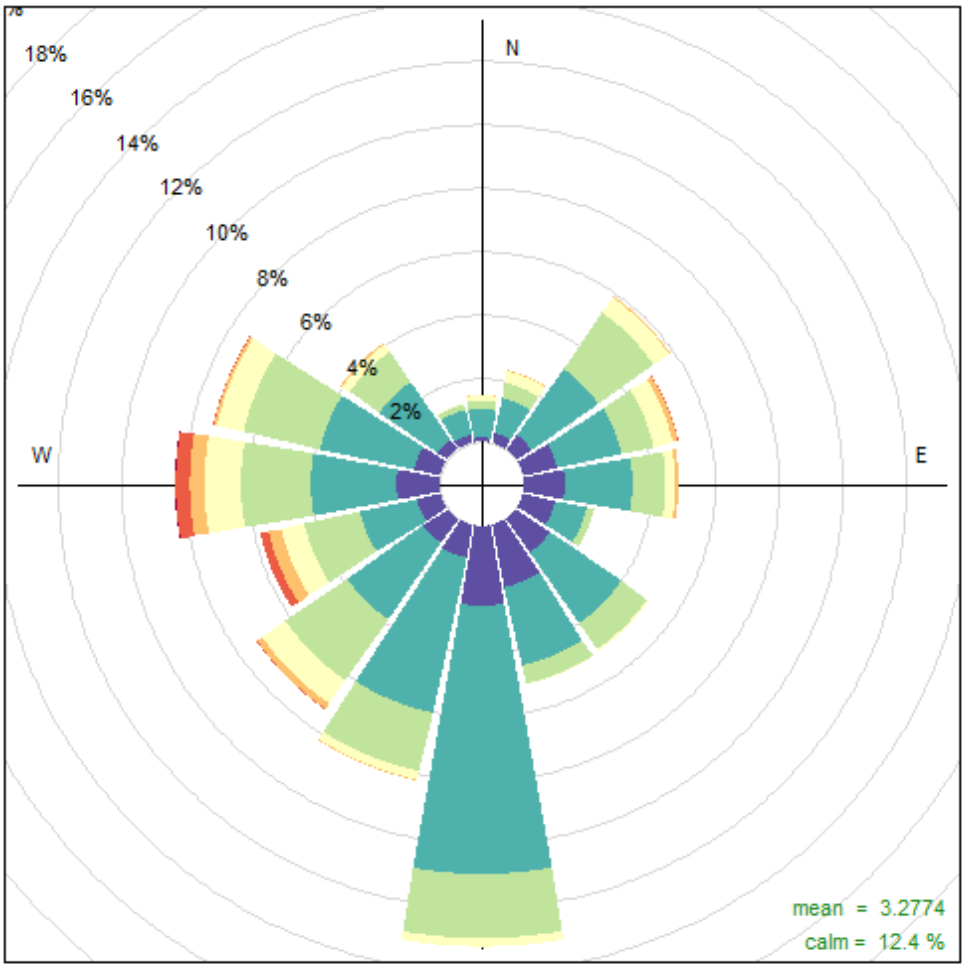
	Figure:	**6.2**		
	Title:	**3D Model Set-up**		
	Project:	**OVG Manchester**		
	Date:	**January 2020**	**Scale:**	**NTS**



	Figure	**6.3**		
	Title:	**Modelled Receptors and Road Network**		
	Project:	**OVG Manchester**		
	Date:	**January 2020**	**Scale**	**NTS**



	Figure:	**6.4**		
	Title:	**Nearby air quality monitoring sites**		
	Project:	**OVG Manchester**		
	Date:	**January 2020**	**Scale:**	**NTS**



Frequency of counts by wind direction (%)

National Oceanic and Atmospheric Administration (NOAA) Integrated Surface Database	**Figure:**	**6.5**		
	Title:	**Manchester Airport wind rose 2018**		
	Project:	**OVG Manchester**		
	Date:	**January 2020**	**Scale:**	**NTS**

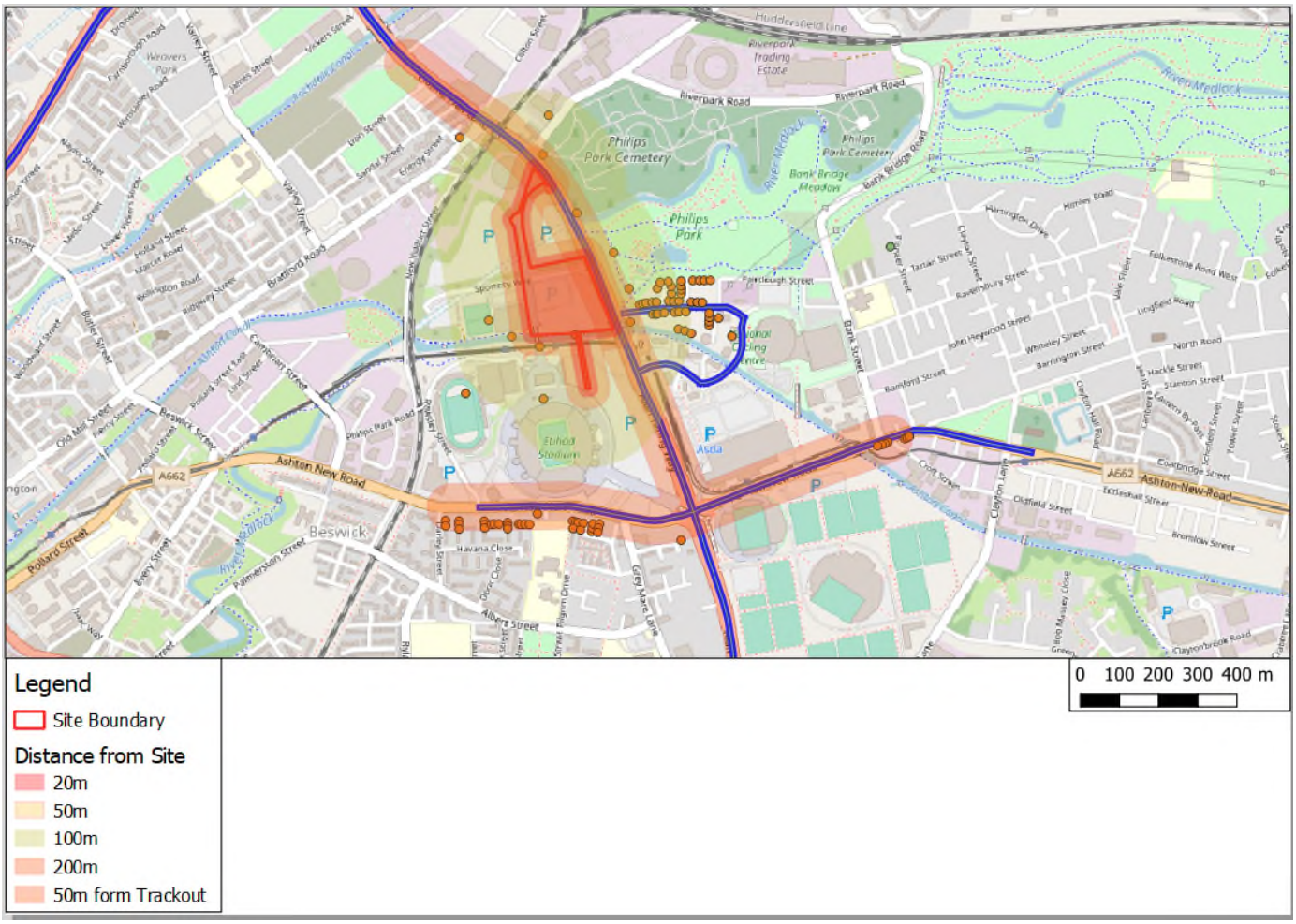


	Figure:	**6.6**		
	Title:	**Construction assessment receptors**		
	Project:	**OVG Manchester**		
	Date:	**January 2020**	**Scale:**	**NTS**

7 Ground Conditions

Introduction

7.1 This Chapter of the ES has been prepared by BuroHappold and assesses the likely ground condition impacts of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts; the existing baseline conditions; the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts; and the likely residual impacts after these methods have been adopted.

7.2 This Chapter is accompanied by two technical appendices, a Geoenvironmental and Geotechnical Desk Study Report (Appendix 7.1), a Coal Mining Assessment (Appendix 7.2) and an Engineering Interpretive Report (Appendix 7.3).

7.3 The Ground Conditions Chapter has been written by a geoscientist with relevant qualifications (BSc hons in Geology) and experience (up to 5 years). The Chapter has been reviewed by competent chartered personnel (C.WEM and C.ENG) with over 10 years of experience.

Limitations and Assumptions

7.4 A Geoenvironmental and Geotechnical Desk Study Report (Appendix 7.1) was completed by BuroHappold in June 2019 and updated in December 2019.

7.5 There are historic gasholders located adjacent to the Site. Given the nature of the former use of these gasholders, and as they will not be brought back into active use in the future, a process has been underway to remove the two associated Control of Major Accident Hazards Regulations (COMAH) zones that overlapped the Site. There is ongoing dialogue around the COMAH zones; however, it is understood that the revocation orders are due for issue by the Secretary of State imminently.

7.6 Positive or negative effects to the relevant receptors during construction and operation are identified and assessed. Beneficial (or positive) effects are associated with the mitigation of risks associated with contamination (e.g. as a result of the breaking of a pollutant linkage). The adverse (or negative) effects are temporary during the construction phase and relate to the increased potential for contaminant exposure (e.g. from the generation of contaminated dusts), and are long-term from the use of the Site during the operational phase (e.g. associated with any residual contamination).

7.7 The significance of an effect also reflects the timescales involved, i.e. short-term (less than 3 years duration), medium-term (between 3 and 10 years duration) or long term (in excess of 10 years duration), the extent of the area affected and the nature of the effect (i.e. its permanency). The significance of a potential effect is derived by considering both sensitivity of the receptor and the magnitude of change, as set out in Table 7.4.

7.8 Effects that are generated as a result of the enabling and construction works (i.e. those that last for this set period of time) are classed as 'temporary'. These may be further classified as either 'short term' or 'medium-term' effects depending on the duration of the enabling and construction works that generate the effect in question. Effects that result from the completed and operational Proposed Development are classed as 'permanent' or 'long-term' effects.

Legislative and Policy Context

Legislation

7.9 Land contamination is regulated under several regimes including: environmental protection, pollution prevention and control, waste management, planning and development control and health and safety legislation. The primary regulatory regimes under which contaminated land is managed in the UK are the planning process described in the National Planning Policy Framework (MHCLG, 2019) and associated guidance (www.gov.uk/guidance/land-contamination-risk-management) and Part 2A of the Environmental Protection Act 1990 (as amended) (HM

Government, 1990). The framework for the assessment of potential land contamination adopted in this assessment is based on current guidance documents regarding the implementation of these regimes and the assessment of potentially contaminated land, with particular reference to: Model Procedures for the management of land contamination (Environment Agency, 2004) and its replacement, currently in draft, Land Contamination: risk management (Environment Agency, 2019) and their Guiding Principles Managing and Reducing Land Contamination, 2010 and the relevant British Standard 10175 (British Standards Institute, 2017).

National Planning Policy

7.10 Within the NPPF, reference to ground conditions and pollution has been made within paragraphs 178, 179 and 183.

7.11 The NPPF states that to prevent unacceptable risks from pollution, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the Site to adverse effects from pollution, should be taken into account. After remediation, the land, as a minimum, should not be capable of being determined as contaminated land under Part IIa of the Environmental Protection Act (HM Government 1990). There should be adequate site investigation, prepared by a competent person, to inform these assessments. Where a site is affected by contamination, responsibility for securing a safe development rests with the developer and/or landowner.

Local Planning Policy

7.12 The Manchester Core Strategy Development Plan Document (DPD) is the primary strategic planning document in the City's Local Development Framework. Reference to contaminated land has been made within the Core Strategy, Policy EN 17 Water Quality and Policy EN 18 Contaminated Land and Ground Stability.

7.13 Policy EN 17 Water Quality: Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses.

7.14 Policy EN 18 Contaminated Land and Ground Stability: The council will give priority for the remediation of contaminated land to strategic locations as identified within this document. Any proposal for development of contaminated land must be accompanied by a health risk assessment. All new development within former mining areas shall undertake as assessment of any associated risk to the Proposed Development and, if necessary incorporate appropriate mitigation measures to address them.

7.15 Policy EN 18 refers to the extensive industrial past particularly in the east of Manchester which has left considerable levels of contamination. Manchester City Council recognise the potential of public safety hazards unless the risks associated with the contamination are fully considered and appropriate treatment/mitigation measures are incorporated within new developments in line with the NPPF.

7.16 The Council's target is for 90% of new development to be on previously developed land. This is in line with historical trends across Manchester and will ensure a sustainable approach is taken with regard to the use of land as a limited resource.

Assessment Methodology and Significance Criteria

EIA Scoping

7.17 A formal request for an EIA scoping opinion was submitted to MCC on 13 November 2019. The ground condition's responses from MCC's scoping response, received on 15 January 2019, are covered in the scope of this assessment and the supporting appendices

Baseline study methodology

7.18 The baseline assessment covers the Site and surrounding areas which may impact the Proposed Development or be susceptible to impact as a result of the Proposed Development. The baseline review will take into account the following baseline scenarios:

- Existing baseline, or the assessment baseline (conditions in 2019, when the assessment is made); and

- Future baseline (conditions in 2023, the year of completion).

7.19 It should be noted that the future baseline accounts for how existing baseline conditions could change, by the year of completion, in the absence of the Proposed Development (referred to as the 'Do Nothing' scenario).

Assessment Approach

7.20 A conceptual model of the Site that describes its environmental features, together with the expected interaction of potential contamination sources with the environment, has been developed by undertaking a Source–Pathway–Receptor analysis of the Site in accordance with relevant good practice guidance.

7.21 These terms are defined here:

- Sources: potential or known sources of potential contamination associated with historic or recent/current land uses (e.g. disposal of wastes, spills and leaks);

- Pathways: mechanisms/systems through which exposure of a receptor to a contaminant could occur e.g. direct contact with contaminated soils, migration through air, over land or via permeable ground; and

- Receptors: receptors of varying sensitivity that could be adversely affected by contact (direct or indirect) with a contaminant e.g. residents, workers or visitors on the Site, groundwater and surface water bodies, and ecological resources (flora and fauna).

7.22 Where a source, relevant pathway, and receptor are present, a 'contaminant linkage' is created whereby there is a circumstance through which some level of environmental harm could occur which has to be assessed and mitigated as appropriate.

7.23 The baseline conditions have been assessed for the Proposed Development confines and for a distance of up to 250m beyond. This "halo" around the Proposed Development boundary is considered in order to take into account the potential for off-site contamination sources and receptors. The baseline data was sourced from a desk based study (Appendix 7.1) of extensive data on the geological and geoenvironmental conditions from existing site investigations and remedial activities, together with published information and existing borehole logs published by the British Geological Survey.

7.24 Committed developments (as set out in Appendix 2.4) surrounding the Site are over 250m from the Site boundary therefore won't be impacted by the Proposed Development.

Assessment of effects

7.25 The methodology for impact prediction is based on assessing both the magnitude of the changes expected and the sensitivity of the receptors. Criteria for assessing the significance of potential human and environmental effects are based on a qualitative assessment of magnitude of the effect (or how far the impact deviates from the baseline condition) and the receptor sensitivity.

7.26 The resources/receptors and the main potential effects outlined in Table 7.1 are considered in the assessment. It is not anticipated that all these resources/receptors will be significantly affected, but it is necessary to demonstrate that these important receptors have been considered.

Table 7.1 Resources/receptors and potential effects

Receptor	Effect
Investigation and construction workers	Health effects due to the direct or indirect ingestion of contaminated soil and groundwater, dermal contact or inhalation of dusts and/or hazardous fibrous substances or vapours (volatile compounds). Exposure to hazardous gases
Visitors and future occupiers	Health effects due to dermal contact with or the direct or indirect ingestion of any residual contaminated soil, inhalation of contaminated dusts and/or hazardous fibrous substances, inhalation of vapours (volatile compounds). Exposure to hazardous gases.
Surrounding land users (neighbours)	Health effects due to inhalation of wind-borne contaminated dusts and/or hazardous fibrous substances (mainly during construction but also in operation). Health effects due to inhalation of vapours (volatile compounds) or hazardous gases that migrate via permeable strata and air.
Controlled waters (groundwater and surface waters)	Contamination of water resources (shallow Secondary Aquifer, Chalk Principal Aquifer and River Thames) by mobile contamination that migrates via run-off or via permeable strata.
Ecology	Phytotoxic effects on plant health and growth. Indirect effects on aquatic flora and fauna via contamination of water resources.
Built infrastructure	Loss of integrity of below ground concrete, permeation of plastic water supply pipework by direct contact with contaminated soil.

Receptor Sensitivity

7.27 The criteria used to assess receptor sensitivity is described in Table 7.2.

Table 7.2 Criteria for determining receptor sensitivity

Sensitivity	Criteria
High	People (on site or on neighbouring properties) occupying land in residential use with gardens, or using allotments, children's play areas etc. Construction workers engaged in extensive earthworks. Principal aquifer of regional importance used for potable water supply. Highly ecologically sensitive watercourse or water bodies. Nationally or internationally designated ecological sites. Buildings of high historic or local importance.
Moderate	People (on site or on neighbouring properties) occupying land in residential use without gardens, or using public areas of soft landscaping/open spaces Construction workers engaged in moderate earthworks Secondary aquifer, local watercourse or non-designated water bodies not used for large scale human consumption which can be used for industrial purposes; may be important for local recreational purposes Locally designated ecological sites Buildings, including services and foundations
Low	People (on site or on neighbouring properties) occupying or using commercial or industrial buildings, car parking, hard landscaping Construction workers site but with minimal disturbance to the ground Non-potable water resources, water body of low recreational qualities Sites of low ecological value and flora and fauna occupying non-designated open areas Infrastructure (e.g. roads, highways and railways)

Sensitivity	Criteria
Negligible	Land with no access to people and no neighbouring properties Construction workers on site, but with no disturbance to the ground on site Non-aquifer, no nearby watercourses or water bodies within 1km No sites of significant ecological value and no built development within 1km

Magnitude of change/impact

7.28 The criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, are described in Table 7.3.

Table 7.3 Criteria for determining magnitude of change

Magnitude	Criteria
Large	Short term (acute) or long term (chronic) adverse effects on human health, broadly equivalent to "significant harm" as defined by the Environmental Protection Act 1990 (HM Government, 1990). Persistent and extensive pollution of water resource or ecosystem equivalent to Category 1 pollution incident (major pollution release). Catastrophic damage to crops/building/infrastructure.
Medium	Short term (acute) or long term (chronic) adverse effects on human health but not equivalent to "significant harm" as defined by the Environmental Protection Act 1990. Non-persistent pollution of water resource or ecosystem equivalent to Category 2 pollution incident (moderate pollution release). Significant damage to crops/buildings/infrastructure (on or off site). Contamination of off-site soils.
Small	Easily preventable, non-permanent health effects on humans. Minor, low-level, localised, temporary pollution of water resources or ecosystem. Easily repairable damage to crops/buildings/infrastructure. Easily preventable, permanent health effects on humans. Localised damage to buildings/infrastructure (on or off site).
Negligible	No discernible negative effects.

Significance evaluation

7.29 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 7.4.

Table 7.4 Matrix for determining effect significance

		Magnitude of change/impact			
		Large	Medium	Small	Negligible
Receptor sensitivity	High	Major	Major	Moderate/ Minor	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate/ Minor	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

7.30 Note that moderate and major effects are considered to be 'significant'. Those which are moderate/minor may be considered significant, based on a judgement made by the assessor in particular circumstances.

7.31 Effects can also be described, for example, as:

- Beneficial or adverse;
- Permanent or reversible; and,
- Short, medium or long term.

Baseline Conditions

Current Baseline (2019)

7.32 An initial understanding of the baseline has been obtained from a review of available data, previous site investigations and existing reports, this information is all presented in Appendix 7.1. This current text is presented with the purpose of presenting an initial appreciation of the baseline ground conditions.

Site History

7.33 Until the min-1800s, the Site and surrounding area was occupied by agricultural land with the River Medlock meandering through the north-west of the Site. The Ashton canal and lock formed the southern boundary and Mill Lane the east. Victoria Gardens were located to the north and in part occupied the north of the Site.

7.34 By the early 1890s, the River Medlock had been straightened and diverted further north, away from the Site. A large cutting occupied the Site and a small unknown structure was present within this cutting. This could have potentially been associated with the mining activities. Industrial works began to occupy the land south of the Canal and some residential development occupied the eastern part of the Site.

7.35 During the early 1900s the River Medlock was culverted, Forge Lane was constructed running centrally through the Site (north/south) and other residential roads connecting Forge Lane to the residential developments. West of Forge Lane several cutting slopes were shown in the central and southern part of the Site, suggesting the Site levels in the northern section have been significantly reduced in order to construct the later factories and rail sidings. The largest change at this time was the development of Bradford Road Gas Works, which included tanks, gas holders, tramways and large buildings (some within the Site boundary).

7.36 By the early 1930s there was further development to these gas works and developments to the industrial works to the south, beyond the canal. There were no further significant changes to the Site and its surroundings until late 1970s whereby the majority of these works were cleared, including most buildings associated with Bradford Road Gas Works. Between the late 1980s and late 1990s there were changes to the land use east of Forge Lane within the Site boundary and by 1995 Mill Lane developed into Alan Turing Way.

7.37 By 2002, construction of the Etihad Stadium (formally Manchester Stadium) to the south was underway and road layouts in the surrounding area developed. A temporary BMX track occupied the Site in 2009 and by 2010 the Site was cleared.

Existing Land Use

7.38 The Site is located off Sportcity Way in Manchester, with Ashton canal to the south, Joe Mercer Way to the west and Alan Turing Way to the east. BuroHappold completed a site walkover on the 6th June 2019, finding that the Site is currently a vacant open area that is occasionally used for car parking. The ground surface is typically flat with a shallow downward gradient northward across the Site, with a more significant drop to Sportcity Way in the north. Generally, the surface is compact granular fill, with vegetation present toward the Site boundaries.

Geology

7.39 The ground conditions comprise variable thicknesses of Made Ground (Fill), ranging between 1.3m up to 17.5m thick. Typically, Made Ground was recorded to greater depths in the north and western parts of the Site. The variations can be attributed to the development history (e.g. Bradford Road Gas Works), treatment to mine workings and numerous phases of enabling works across the Site.

7.40 Below the Made Ground the natural geological sequence is formed of the following;

- Alluvium and/or River Terrace Deposits (<0.5m to 2.5m thick) to the west and north [superficial deposits];
- Glacial Till (0.5m to 10.7m thick) to the east and south [superficial deposits];
- The Pennine Upper, Middle and Lower Coal Measures (>11m to >100m thick, base not proven).

7.41 The Site is located within an area previously worked for coal. According to the geological maps, there are four coal seams sub-cropping on the Site. Previous investigations suggest approximately eight seams have the potential to lie beneath the Site. The main worked seams (and most heavily investigated and reported) comprise, Bradford Four Foot, Bradford Three Quarters, and Charlotte Mine. Other seams that have been recorded within previous investigations and reports include: 18 Inch, three thin seams labelled as A, B and C (located between the Charlotte Mine seam and the Bradford Three Quarter seam), a Fireclay horizon (located between the 18Inch and the Bradford Four Foot seam) and a number of others (namely Openshaw, Yard Mine and Smut seams).

7.42 The Coal Mining Authority report six seams of coal that may have been subject to underground mining within the Site bounds. These would have last been worked in 1961 and are anticipated to be between 50 and 900m depth. The Authority also report that coal is present at or close to the surface.

7.43 A series of Abandonment Plans show workings within a seams known as Roger seam and Crombouke seam. Roger seam is located beneath the Site and works commenced from shafts at Bradford Colliery, south of the Canal. The plan indicates the seam to lie >700m below the ground level and also 26yards (23.8m) below Crombouke seam. Roger seam is shown to have been worked using long wall method, the method of working was not clearly shown for Crombouke seam but long wall is assumed, as per the Roger seam. A Parker Mine Abandonment Plan show workings beneath the site carried out between 1903 and 1907. The depth of the workings or which seam they targeted was not specified. Another feature shown on unknown abandonment plans was a possible adit connecting workings to the former location of the River Medlock.

7.44 Treatment to the Bradford Four Foot and Bradford Three Quarter seams was carried out by BWB in 2011.

7.45 The Coal Mining Authority also report that there are three mine entries located on the Site, these include:

- 386398-004 – Drilled, grouted and capped in 1986 by Ward Ashcroft and Parkman.
- 386398-003 – Drilled grouted and capped in 1986 by Ward Ashcroft and Parkman. Further grouted in October 2010 using 55 tonnes of cement based mix. Capping was estimated as being 300mm thick and positioned 11mbgl.
- 386398-010 – Shaft searched for in 1977 but not located. Searched and located in 2010 using a series of probe holes. Shaft was pressure grouted using 5.5 tonnes of pulverised fly ash (PFA) / cement mix grout. A grout plug was installed above the shaft.

7.46 Shafts on site are referred to differently within different historical reports. There is potentially an additional shaft on Site, although this has been deemed as a possible duplicate of Shaft 386398-003.

Hydrogeology

7.47 The superficial deposits have been classified as Secondary (undifferentiated) Aquifer. Secondary (undifferentiated) Aquifer is assigned where it is not possible to attribute either category A or B to the rock type. In general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. In this instance reflective of the variable nature of the Glacial Till.

7.48 The Coal Measures are classified as Secondary (A) Aquifer, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

7.49 There is a groundwater abstraction located within 1km of the Site relating to a borehole at Norton Street, Miles Platting, Manchester (888m north). However, the Site is not within a groundwater source protection zone.

Hydrology

7.50 The Ashton Canal is located along the southern boundary of the Site (8m south). The canal climbs for 10.8km through 18 locks toward Ashton-under-Lyne. Lock No.9 is located adjacent to the Site resulting in approximately 3.5m ground level change. The east side of Lock No. 9 (SE of the Site) is at approximately +60.4mOD and west of the lock (SW of the Site) the ground drops to +56.7mOD. A steep embankment up to the Site is present on the west side with the Site at approximately +59.0mOD.

7.51 The River Medlock is located 24m to the north-west of the Site and flows south and west toward the River Irwell in Manchester city centre. The course of the River Medlock initially crossed through the north-western part of the Site before being diverted further north during the late 1840s. By the early 1890s the Medlock had been diverted off the Site, and straightened. By 1905, the Medlock was contained within a 600m-long culvert below the former Bradford Road Gas Works, north of the Site.

Ground Contamination

7.52 The historical uses of the Site present the potential for ground contamination. Numerous site investigations have already been carried out across the Site, these include, 1986 by Norwest Holst Soil Engineering Ltd, 1993 by Northern Foundations Ltd and 2009 by May Gurney, these investigations have been reviewed and are summarised in the Desk Study report (Appendix 7.1). These works identified visual and olfactory evidence of contamination confirmed by chemical analysis. Elevated concentrations of heavy metals, total petroleum hydrocarbons, polyaromatic hydrocarbons and asbestos containing materials were recorded. Elevated concentrations of hazardous gas/vapours were also recorded.

7.53 Phase 3 Enabling and Remediation Works took place in late 2003 to early 2004 by AWG Construction Services. These works targeted the eastern part of the Site formerly proposed for a hotel development. Decommission and removal of a tank in the south-east of the Site was also included as part of these works.

7.54 In 2011, BWB Consulting excavated the top 2m of Made Ground across the Site (with the exception of the former proposed hotel development as this was previously remediated), inspected the material for gross contamination and any below ground obstructions. Reinforced concrete slabs approximately 1m thick were encountered within the north-western corner of the Site, assumed to be associated with the former Gas Works. This was not removed across the whole Site and as a consequence of the encounter obstructions were then only removed to a maximum depth of 2m. A capping layer was placed, however this layer contained elevated concentrations of petroleum hydrocarbons contradicting the remedial strategy (completed by Buckingham Contracting Ltd in 2010).

7.55 In 2019-2020, Structural Soils Ltd carried out a site investigation designed by BuroHappold. The investigation findings are detailed with the Interpretative Report (Appendix 7.3) identified visual and olfactory evidence of contamination confirmed by chemical analysis. Elevated concentrations of total petroleum hydrocarbons, some heavy metals and asbestos containing materials were recorded. Elevated concentrations of hazardous gas/vapours were also recorded. A risk assessment was completed and is included within the Interpretative Report (Appendix 7.3).

Unexploded Ordnance

7.56 No reference to unexploded ordnance (UXO) was made within any of the reviewed historical information. A Preliminary UXO Risk Assessment has been carried out by BuroHappold in accordance with CIRIA C681 this is presented within Appendix C of the Desk Study report (Appendix 7.1). The assessment concluded that the risks associated with UXO are Moderate. BAE

initially provided a detailed assessment for the on-going ground investigation only, the assessed risk for the Ground Investigation works was Low. A full detailed report has now been issued, this includes an assessed risk to enabling works and construction works. The risk is Moderate.

Future Baseline (2023)

7.57 The future baseline year is 2023. There will be no changes to the baseline in 2023 to that of the current baseline (2019). All the assessed sensitivities will remain the same.

Identification and Evaluation of Significant Effects

Construction Effects

Relevant aspects of the scheme

7.58 The Proposed Development will involve earthworks, including excavation of soils/natural materials across the Site (see Chapter 5 Construction Methodology). It is anticipated that the total excavated volume (including bulking) will be approximately 101,103m3. This will present a potential for encountering contamination (of soils and shallow perched water) and for creating migration pathways from the near surface to the deeper strata. It will also remove a substantial volume of the Made Ground/contaminant source.

7.59 Assessment during construction period will consider the impact and associated effects of the construction on areas of potentially contaminated land within the spatial scope of the Site. The construction activities that could give rise to effects are related to any ground activities, including excavation of spoil, removal of below ground services and other infrastructure, treatment, and disposal of gross contamination. The potential effects arising from such activities could be relevant to both human (construction workers and neighbours) and environmental (flora, fauna, groundwater and surface waters) receptors.

7.60 Soil materials excavated to reach formation level will include contaminated Made Ground. There is a potential for on-site treatment/re-use (i.e. for pile mats). The contaminated Made Ground and the underlying inert natural uncontaminated strata are likely to be separately excavated and/or segregated during excavation and will be treated as controlled wastes for treatment, re-use and/or disposal at suitably licenced facilities. The indirect effects associated with these construction activities are addressed in the relevant Chapters of this ES (Chapter 12 Traffic and Transport, and Chapter 6 Air Quality and Dust).

7.61 The negative effects are temporary during the construction phase and relate to the increased potential for contaminant exposure (e.g. from the generation of contaminated dusts and the enhanced potential for leaching/migration). The construction will be informed by the Remediation Strategy (which is required to meet standard planning conditions as detailed from paragraph 7.95 of this Chapter, Mitigation Measures).

Potential effects of the Proposed Development and their significance

<u>Effects upon construction workers</u>

7.62 Construction workers are likely to be in contact with soils (including potential UXO) or contaminated shallow perched water during earthworks involved in remediation and below ground construction activities i.e. excavation to reach formation level. There is therefore the potential for human uptake (via ingestion, inhalation and dermal contact) of contaminants. Effects are generally likely to be short term and therefore the main contaminants of concern are those of potentially acute hazards (e.g. asbestos, carcinogens, etc.). The sensitivity of construction workers in these circumstances is high. The magnitude of potential impact is medium resulting in a potential effect of **major adverse significance without mitigation**.

<u>Effects upon off-site users and visitors to neighbouring land</u>

7.63 The construction works have the potential to create new airborne pathways for contaminants to migrate to adjacent land (e.g. as wind borne dusts, as detailed in Chapter 6 Air Quality and Dust). There is therefore the potential for human uptake via inhalation of contaminated dusts. Although, contaminant concentrations will reduce during migration and exposure is likely to be relatively short-term. The works may also lead to the creation of new pathways for ground gas/vapour migration, which could potentially result in the build-up of hazardous or explosive

gas within off-site buildings. Off-site users and visitors are moderate sensitivity receptors; the magnitude of the potential impact is small, resulting in a potential effect of **minor adverse significance without mitigation**.

Effects on groundwater, the River Medlock and Ashton Canal

7.64 During construction activities (including any remediation activities), there is a potential for the mobilisation and migration of contamination due to:

- Disturbance of contaminated infrastructure if present (e.g. underground tanks/structures, drains, etc.);
- Excavation of Made Ground and natural materials which may be contaminated from historic site uses;
- Increased rainwater infiltration during excavation/enabling works; and
- The construction of preferential migration pathways (e.g. piles) and increased run-off.

7.65 This could result in the contamination of groundwater within the underlying shallow aquifer (Secondary [A] Aquifer within the Coal Measures), to the Ashton Canal and the River Medlock located to the south and north-west respectively.

7.66 Contamination could spread through the horizontal and vertical migration of leachable contaminants within the shallow permeable strata. Such pathways could include drainage or other service trenches and shallow foundations.

7.67 The sensitivity of the Secondary [A] Aquifer is low. The magnitude of the potential impact is medium resulting in adverse effects of **minor significance**.

7.68 Although deep foundations (e.g. piles) present a potential for the creation of preferential migration pathways from the potentially contaminated Made Ground to the underlying Secondary [A] Aquifer, this is of limited consequence as the natural geology already presents some hydraulic continuity between the shallow strata and underlying Coal Measures aquifer.

7.69 The Ashton Canal is located along the southern boundary of the Site. The Site is currently located at +59.0mOD and the Canal is at +56.7mOD (to the east). Construction activities include excavation of up to 7m of material in the southern part of the Site. Therefore, there is a potential for migration of contamination via run-off and surface water drainage. The sensitivity of the Canal is high and the magnitude of the potential impact is medium resulting in adverse effects of **major significance**.

7.70 The River Medlock is located within a culvert 24m to the north-west of the Site. The nearest point of the River outside of the culvert is approximately 120m north. There is a potential for migration of contamination via permeable strata (in particular, superficial deposits of the former River location on Site). The sensitivity of the River is high and the magnitude of the potential impact is medium resulting in adverse effects of **major significance**.

Effects on the built environment

7.71 The Proposed Development requires significant earthwork operations to level the Site and includes a retaining solution around the perimeter, this will effectively remove some of the sources of potential contaminants that could otherwise impact upon neighbouring buildings/infrastructure. During construction, there is a potential for increased infiltration/mobilisation and migration of contamination to neighbouring properties and infrastructure (including drainage systems).

7.72 There is a limited potential for residual contamination and/or the natural strata to affect the integrity of below ground concrete and/or for any residual contamination to permeate any in-ground plastic water supply pipework of these neighbouring properties. The sensitivity of the built environment is moderate. The magnitude of the potential impact is small, resulting in adverse effects of **minor significance**.

7.73 During construction there is a potential for the structural integrity of the culvert to be impacted based on earthworks activities and increased use/load of the infrastructure above ground. Due to the distance from the Site and implementation of appropriate design there is very limited potential for the structural integrity of the culvert to be negatively impacted. The sensitivity is negligible, and the magnitude of the potential impact is negligible, resulting in **negligible significance**.

7.74 During construction there is a potential for the structural integrity of Ashton Canal to be impacted based on earthwork activities and design of the Proposed Development. However, appropriate consultation will be undertaken with the Canal and Rivers Trust to the show the structural integrity will not be compromised by any aspect of the development works. The sensitivity is negligible, and the magnitude of the potential impact is negligible, resulting in **negligible significance**.

Effects upon flora and fauna

7.75 Flora is present within the Site, however this is mostly limited to the Site perimeters. The plants currently growing on Site do not show any evidence of effects likely to be related to phytotoxic ground contamination. The current flora on site will be lost during construction. The Site does contain habitats which have potential to support fauna. Although any such fauna could be impacted by the Proposed Development, any ground contamination associated effects (such as contaminated dust and contaminated run off etc.) would be extremely limited. The flora/fauna is a low sensitivity receptor. The magnitude of the potential impact associated with ground contamination is negligible resulting in an adverse effect of **negligible significance**.

Unexploded ordnance (UXO)

7.76 Unexploded Ordnance (UXO) can pose a threat to human receptors and the built environment (high and moderate sensitivity receptors respectively). A detailed assessment has been carried out by BAE Systems, the results indicate potential to encounter UXO during enabling works and construction is a Moderate risk therefore supplementary remedial measures are recommended (i.e. downhole geophysics/watch and brief by qualified personnel).

Climate change and adaptation

7.77 It is unlikely that supplementary mitigation will be required due to climate change. Relevant aspects of the scheme and designed in mitigation will be sufficient for dealing with climate change and adaptation.

Summary of effects

7.78 Table 7.5 presents a summary of potentially significant effects during construction.

Table 7.5 Potentially significant effects during construction

Receptor	Sensitivity	Description of effect	Magnitude of change/ impact	Effect significance
Construction workers	High	During development, construction workers and site visitors may be exposed to contaminants and UXO via direct contact, inhalation or ingestion.	Medium adverse	Major adverse
Off-site users and visitors	Moderate	During development, neighbours may be exposed to contaminants via inhalation or ingestion.	Small adverse	Minor adverse
Groundwater [Secondary A Aquifer]	Low	Derogation of quality by leaching and migration of contamination into groundwater (leaching)	Medium adverse	Minor adverse

Receptor	Sensitivity	Description of effect	Magnitude of change/ impact	Effect significance
Controlled Waters [Ashton Canal]	High	Derogation of quality via run-off and surface water drainage	Medium adverse	Major adverse
Controlled Waters [River Medlock]	High	Derogation of quality via lateral migration of contamination via permeable strata.	Medium adverse	Major adverse
Built environment	Moderate	Potential for sulphate attack on neighbouring building foundations and for permeation of plastic water supply pipework	Small adverse	Minor adverse
	Negligible	Structural integrity of River Medlock culvert and the Ashton Canal	Negligible	Negligible
Flora and Fauna	Low	Flora and fauna currently present along site parameters, all flora will be removed during construction.	Negligible	Negligible

Operational Effects

Relevant aspects of the scheme

7.79 The Proposed Development is a large-scale arena structure with associated service yards. As proposed the footprint of the arena will take up the majority of the Site. The current scheme requires significant earthworks operations to level the Site and retaining solutions will be required around the perimeter.

7.80 As part of the enabling earthworks implemented during the construction phase, some remediation/mitigation of the potential risks will be undertaken by the nature of the works. For example, to create a development platform at suitable level, a considerable volume of Made Ground will be removed, therefore reducing the potential volume of contaminated soils on site. This construction process has been considered in the operational effects.

Potential effects of the Proposed Development and their significance

Effects on-site users and visitors

7.81 There is a limited potential for site users and visitors of the Proposed Development to come into contact with contaminated soil materials. The large portion of contaminated Made Ground will be removed by the construction of the Proposed Development. Any areas of open space will include an appropriate thickness of suitable subsoils and topsoils and landscape areas (on residual ground) will be completed with imported topsoils for horticultural purposes. These imported soils (and any re-used subsoils) will comply with the relevant British Standard (British Standards Institute, 2015) and meet appropriate chemical, physical and biological criteria (as set out in the Remediation Strategy). There is therefore very limited potential for human uptake (via ingestion, inhalation and dermal contact) of any contaminants in the residual contamination in the Made Ground or in the imported soils. These human receptors in this scenario are moderate sensitivity receptors. The magnitude of the potential impact is negligible, resulting in an effect of negligible beneficial significance with mitigation.

7.82 There is also a potential for site users to be exposed to ground gas/vapour within confined spaces. Results from the site investigation (Appendix 7.3) defines the nature of the ground gas regime and informs the risk assessment. The design of gas protection measures will be set out in a Remediation Strategy. Site users are high sensitivity receptors. The magnitude of the potential impact is negligible, resulting in an effect of **negligible beneficial significance** with mitigation.

Effects upon off-site users and visitors

7.83 There is a potential for the migration of ground gas/vapour off-site into confined spaces of neighbouring properties potentially resulting in the build-up of explosive gas within any such structures. Results from the site investigation (Appendix 7.3) defines the nature of the ground gas regime and informs the risk assessment. The design of gas protection measures will be set out in a Remediation Strategy. Off-site occupiers are moderate sensitivity receptors. The magnitude of the potential impact is negligible, resulting in an effect of **negligible beneficial significance with mitigation.**

Effects on groundwater, the River Medlock and Ashton Canal

7.84 In operation, some Made Ground will have been removed as a result of excavation for particular remediation (e.g. of any "hot spots" and for the construction of the Proposed Development). The majority of the Site will be covered by either buildings or hardstanding. If there are any soft landscaped areas, these will be capped. These, together with the surface water drainage system, will considerably inhibit infiltration. A Foundation Works Risk Assessment will be carried out in order to assess potential risks to controlled waters and outline the required mitigation measures (e.g. migration of contaminants to underlying aquifers via preferential pathways such as piled foundations).

7.85 The Secondary [A] Aquifer is of low sensitivity. The magnitude of the potential impact during operation is negligible. This results in an adverse effect of negligible adverse significance.

7.86 The removal of some contaminant source, together with the reduction of infiltration and control of surface water drainage associated with the Proposed Development, will inhibit horizontal and lateral migration of contamination. The River Medlock is of high sensitivity and the magnitude of the potential impact is negligible. This results in an adverse effect of negligible adverse significance.

7.87 The reduction in the Site level and control of surface water drainage/run-off associated with the Proposed Development, will inhibit lateral migration of contamination. The Ashton Canal is of high sensitivity and the magnitude of the impact is negligible. This results in an adverse effect of **negligible adverse significance**.

Effects upon Built Environment

7.88 There is a potential for residual contamination and/or the natural strata to affect integrity of below ground concrete and/or for any residual contamination to permeate any in ground plastic water supply pipework. Results of the site investigation define the nature and extent of contamination across the Site (see Appendix 7.3) and inform the risk assessment. Appropriate remediation measures will be set out in a Remediation Strategy. The sensitivity of the built environment is moderate, the magnitude of the potential impact is negligible, resulting in an effect of **negligible beneficial significance with mitigation**.

Effects upon flora and fauna

7.89 Where soft landscaped areas are included as part of the Proposed Development these will include an appropriate thickness of suitable subsoils and topsoils and all landscaped areas (on residual ground or in landscaped planters) will be completed with imported topsoils. The flora is thus isolated from any residual contaminated Made Ground soils. The imported soils will comply with the relevant British Standard (British Standards Institute 2015) and meet appropriate chemical, physical and biological criteria as defined in the Remediation Strategy.

7.90 The flora at the redeveloped site is a low sensitivity receptor. The magnitude of the potential impact is negligible, resulting in a potential effect of **negligible beneficial significance**.

Climate Change and Adaptation

7.91 It is not expected that supplementary mitigation will be required due to climate change. Relevant aspects of the scheme and designed-in mitigation will be sufficient to deal with climate change and adaptation.

Summary of effects

7.92 Table 7.6 presents a summary of effects during operation.

Table 7.6 Summary of operational effects

Receptor	Sensitivity	Description of effect	Magnitude of change / impact	Effect significance
On-site users and visitors	Moderate	Ingestion and dermal contact with contaminated materials in soft landscaped areas. Implementation of appropriate mitigation measures provide protection to human health.	Negligible	Negligible beneficial
	High	Gas/vapour build up in confined spaces resulting in build-up of explosive gases. Implementation of appropriate mitigation measures provide protection to human health.	Negligible	Negligible beneficial
Off-site users and visitors	Moderate	Gas/vapour build up in confined spaces of neighbouring properties resulting in build-up of explosive gases. Implementation of appropriate mitigation measures provide protection to human health.	Negligible	Negligible adverse
Groundwater [Secondary A Aquifer]	Low	Reduction in Secondary Aquifer groundwater quality. Implementation of appropriate mitigation measures inhibit infiltration of contaminants to Secondary Aquifer.	Negligible	Negligible adverse
Controlled Waters [River Medlock]	High	Reduction in water quality. Implementation of appropriate mitigation measures provide protection to River Medlock.	Negligible	Negligible beneficial
Controlled Waters [Ashton Canal]	High	Reduction in water quality. Implementation of appropriate mitigation measures provide protection to Ashton Canal.	Negligible	Negligible adverse
Built Environment	Moderate	Aggressive attack on below ground concrete and/or residual contamination permeating in ground plastic water supply pipework. Implementation of appropriate mitigation measures provide protection the below ground built environment.	Negligible	Negligible beneficial
Flora and Fauna	Low	Residual contamination within subsoils and topsoils. Implementation of appropriate mitigation measures introduce and provide protection to flora and fauna.	Negligible	Negligible beneficial

Cumulative Effects

7.93 This section assesses the likely significant effects of the Proposed Development cumulatively with the other committed developments in the surrounding area. All other committed developments are beyond the 250m radium of assessment applied. There are no cumulative effects for construction workers, neighbours or the natural or built environments relating to ground conditions and these surrounding committed developments.

7.94 Any cumulative effects associated with the ground, but where the primary effects are to controlled waters, air quality or traffic and transport, are addressed in those relevant

assessments (for example the transport of spoil during construction is addressed in the traffic and transport assessment).

Mitigation Measures

7.95 The measures necessary to mitigate the potential risks previously described (both potentially significant and otherwise) will be set out and described in a future Remediation Strategy and in plans prepared by the contractor the Construction Environment Management Plan (CEMP) and the Code of Construction Practice (CoCP). The need for, and scope of, remedial action will be determined following the results of the on-going site investigation (of soil, groundwater and ground gas regime) to be published in the Remediation Strategy. Implementation of the mitigation measures recorded within a Verification or Completion Report.

7.96 Waste characterisation assessment will also be carried out to enable appropriate preliminary classification of the excavated spoil. This will allow the potential for re-use to be determined, or suitable treatment and disposal to an appropriately licensed facility in accordance with the Environmental Protection (Duty of Care) Regulations 1991.

7.97 A summary of all these construction mitigation measures that are anticipated to form the Remediation Strategy are shown in Table 7.7.

Table 7.7 Summary of anticipated construction mitigation measures

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
Direct contact (people) during works	Implementation of appropriate health, safety and hygiene regime (to include PPE and welfare provisions) and good construction practice informed by the on-going site investigation.	Remediation Strategy, CEMP and CoCP to be secured by planning condition, implemented by contractor, recorded in a Verification or Completion Report	Prior to and during construction
Dust emissions during construction	Implementation of dust suppression measures (e.g. dampening, wheel washing, site vehicle speed and route control, control of drop height for spoil loading etc. All informed by the on-going site investigation.	Remediation Strategy, CEMP and CoCP to be secured by planning condition, implemented by contractor, recorded in a Verification or Completion Report	Prior to and during construction
Leaching and migration to groundwater [Secondary A Aquifer, River Medlock]	Carry out Foundation Works Risk Assessment informed by the on-going site investigation. Implement measures to minimise infiltration. Avoid stockpiling contaminated soil. Any stockpile covered/placed on impermeable surface. Remove/treat any gross contamination. Re-used soils to meet relevant chemical/physical properties. Control of groundwater during excavation.	Remediation Strategy, CEMP and CoCP to accord with Foundation Works Risk Assessment (FWRA), secured through planning condition, implemented by contractor, recorded in a Verification or Completion Report,	Prior to and during construction
Surface water run-off/drainage [Ashton Canal]	Implementation of good construction practice informed by the on-going site investigation. Control of surface water run-off/safe disposal to existing drainage system.	Remediation Strategy, CEMP and CoCP to be secured by planning condition, implemented by contractor, recorded in a Verification or Completion Report	Prior to and during construction
Vapour/gas migration to enclosed spaces	Nature of ground gas regime assessed and defined using the findings of the site investigation (presented in Appendix 7.3). A Remediation Strategy will inform the design of gas protection measures to buildings and inform health and safety for works in confined	Remediation Strategy, CEMP and CoCP to be secured by planning condition, implemented by contractor, recorded in a Verification or Completion Report	Prior to and during construction

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
	spaces. Control of entry into any enclosed below ground spaces.		
Unexploded Ordnance	Toolbox talks (ordnance awareness briefing), watching brief (to include a competent Explosive Ordnance Disposal Engineer) and health and safety plans as recommended within the BAE Systems detailed UXO assessment.	CEMP and CoCP to be secured through planning condition, and implemented by contractor.	Prior to and during construction
Disposal of excavated spoil	Preliminary waste characterisation informed by the site investigation (Appendix 7.3) and any earthworks. On-going bioremediation trial being carried out to further define treatment and re-use potential. Lorry movements and routing would be controlled as described in the ES Chapter 12 Traffic and Transport.	As described in the ES Chapter 12 Traffic and Transport	Prior to and during construction

7.98 A summary of the operational mitigation measures that are anticipated to form the Remediation Strategy are shown in Table 7.8.

Table 7.8 Summary of anticipated operational mitigation measures

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
Human contact with soils in soft landscaped areas and planters Plants in contact with soils in soft landscaped areas and planters	Importing of soil materials which meet appropriate chemical, physical and biological criteria	Topsoil specification to meet relevant British Standard (BS3882) (British Standards Institute 2015) set out in the Remediation Strategy. Implementation recorded in a Verification or Completion Report. Required to discharge planning condition.	Prior to and during construction
Human inhalation of ground gas/vapours	Design of ground gas/vapour protection measures. During construction, inform health and safety for works in confined spaces and control of entry into any enclosed below ground spaces.	Described in the Remediation Strategy, CEMP and CoCP. Required to discharge planning condition. Implemented by contractor, recorded in a Verification or Completion Report.	Prior to and during construction
Contamination of Secondary Aquifer, Ashton Canal and River Medlock	Suitable design of foundations and implementation of remediation measures including removal/treatment of any gross contamination.	Described in the Remediation Strategy. Implementation recorded in a Verification or Completion Report Required to discharge planning condition.	Prior to and during construction
Aggressive attack on below ground concrete	Design to meet requirements of ground conditions and BRE recommendations	Below ground concrete specified in foundation design and described in the Remediation Strategy. Implementation recorded in a Verification or Completion Report Required to discharge planning condition.	Prior to and during construction

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
Permeation of water supply pipes	Design to meet requirements of ground conditions and recommendations of United Utilities	Described in the Remediation Strategy. Implementation recorded in a Verification or Completion Report. Required to discharge planning condition.	Prior to and during construction

Residual Effects

7.99 There are limited potential risks to people and the environment associated with the Proposed Development and the ground conditions on-site during the construction phase. Mitigation measures, informed by the site investigations and defined in Remediation Strategy and contractors method statements, etc. will ensure appropriate design and construction during development. On completion of the Proposed Development, all potential operational effects assessed to be negligible and no supplementary measures are therefore considered necessary.

7.100 Table 7.9 provides a summary of the residual effects for the Proposed Development.

Table 7.9 Summary of residual effects during construction

Receptor	Description	Pre- mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
Construction workers	Direct contact (direct and indirect) of contaminated ground. Inhalation of contaminated dusts and/or gas/vapours. Contact with UXO.	Major adverse	Implementation of appropriate health, safety and hygiene regime (to include PPE and welfare provisions). Implementation of good construction practice [dust suppression (e.g. dampening, wheel washing, site vehicle speed and route control, control of drop height for spoil]. All detailed in the CoCP, CEMP and Method Statements. Implementation recorded in a Verification or Completion Report. Inform health and safety for works in confined spaces. Control of entry into any enclosed below ground spaces. Detailed UXO risk assessment to be carried out prior to any extensive earthworks. Toolbox talks, watching brief and health and safety plans as required.	Negligible beneficial
Off-site users/ visitors	Direct contact with contaminated ground. Inhalation of contaminated dusts and/or gas/vapours.	Minor adverse	Implementation of good construction practice [dust suppression (e.g. dampening, wheel washing, site vehicle speed and route control, control of drop height for spoil]. All detailed in the CoCP, CEMP and Method Statements. Design for any ground gas protection measures informed by site investigation, detailed within the Remediation Strategy. Implementation recorded in a Verification or Completion Report.	Negligible beneficial
Controlled Waters	Derogation of quality by	Minor adverse	Carry out Foundation Works Risk Assessment and implement the	Negligible adverse

Receptor	Description	Pre- mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
[Secondary A Aquifer]	leaching and migration		Remediation Strategy informed by a site investigation. Implement measures to minimise infiltration (e.g. control areas of open excavation, temporary sealing/drainage measures). Avoid stockpiling contaminated soil. Any stockpile covered/placed on impermeable surface. Remove/treat gross contamination. Control of groundwater during excavation. Record in a Verification or Completion Report.	
Controlled Waters [Ashton Canal]	Derogation of quality by surface water drainage and run-off	Major adverse		Negligible adverse
Controlled Waters [River Medlock]	Derogation of quality by leaching and migration	Major adverse		Negligible adverse
Buildings and Services	Sulphate attack and permeation of water supply pipework.	Minor adverse	Below ground concrete specified in foundation design informed by the site investigation to meet relevant BRE and Water UK Standards as set out in the Remediation Strategy. Implementation recorded in a Verification or Completion Report.	Negligible beneficial
Flora and Fauna	Impact on plant growth / health	Negligible	Not applicable during construction for existing vegetation. Imported subsoil and topsoil materials to meet appropriate chemical, physical and biological criteria to accord with British Standards (BS3882) as set out in the Remediation Strategy. Implementation recorded in a Verification or Completion Report.	Negligible beneficial

Table 7.10 Summary of residual effects during operation

Receptor	Description	Pre- mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
On-site users and visitors	Ingestion and dermal contact with contaminated materials in soft landscaped areas.	Negligible	Implementation of the approved Remediation Strategy during construction. Implementation recorded in a Verification or Completion Report.	Negligible
	Gas/vapour build up in confined spaces resulting in build-up of explosive gases.	Negligible		Negligible
Off-site users and visitors	Gas/vapour build up in confined spaces of neighbouring properties resulting in build-up of explosive gases.	Negligible		Negligible
Groundwater [Secondary A Aquifer]	Reduction in groundwater quality.	Negligible		Negligible
Controlled Waters [River Medlock]	Reduction in water quality.	Negligible		Negligible
Controlled Waters [Ashton Canal]	Reduction in water quality.	Negligible		Negligible

Receptor	Description	Pre- mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
Built Environment	Aggressive attack on below ground concrete and/or residual contamination permeating in ground plastic water supply pipework.	Negligible		Negligible
Flora and Fauna	Residual contamination within subsoils and topsoils.			Negligible

Reference List

7.101 This ES Chapter has been prepared by reference to the following:

- National Planning Policy Frameworks (MHCLG, 2019);
- Part 2A of the Environmental Protection Act 1990 (as amended) (HM Government, 1990);
- Model Procedures for the management of land contamination – contaminated land report (CLR11) (Environment Agency, 2004);
- Land Contamination: risk management (replacement of CLR11, currently in draft) (Environment Agency, 2019);
- Guiding Principles Managing and Reducing Land Contamination (Environment Agency 2010);
- BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice (British Standards Institute, 2017); and
- Manchester's Local Development Framework, Core Strategy, Development Plan Document (Manchester City Council 2012).

8 Socio-Economic Impacts

Introduction

8.1 This Chapter of the ES has been prepared by BuroHappold and assesses the likely socio-economic and human health impacts of the proposals upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts; the existing baseline conditions; the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts; and the likely residual impacts after these methods have been adopted.

8.2 This Chapter has been written by an Associate Economic Consultant with relevant qualifications (BA Geography, MSc Spatial Planning) and experience (over 15 Socio-Economic ES Chapters prepared for projects throughout the UK).

8.3 This Chapter is accompanied by two technical appendices as follows:

- 8.1 Market Assessment:
    - Volume 1: OVG Manchester, due diligence report Volume 1: UK Arena and Manchester Market Overview prepared by PwC.
    - Volume 2: UK Large Arena Market and Growth Scenarios 2018-2040 prepared by ekosgen.
- 8.2 Economic Impact of Two Arenas in Manchester prepared by ekosgen.

Limitations and Assumptions

8.4 The assessment of the significance of effects has been carried out against a benchmark of current socio-economic baseline conditions surrounding the Site. As with any dataset, these may be subject to change over time, which may influence the findings of the assessment and could lead to the assessment suffering from statistical time lag. Based on the availability of data there are also limitations with regards to the presentation of directly comparable data at similar spatial scales.

8.5 The Employment Densities Guide 3rd Edition (HCA, 2015) has been used as the basis for calculating the number of employees in the operational phase. It must be noted that uses described in the Guide that align closely with the Proposed Development have been used for the purposes of employment calculations. Depending upon how the facilities are operated in the future, there may be variations in the Full Time Equivalent (FTE) employment.

8.6 The Applicant has set out ambitious plans to develop a world class new arena with a full programme of activities and tickets sales of up to 1 million. The success of the Proposed Development will depend on how the UK arena market develops over the next ten and twenty years, and various growth scenarios have been reviewed in the technical appendices accompanying this chapter.

Legislative and Policy Context

National Planning Policy

National Planning Policy Framework (NPPF) (2019)

8.7 National Planning Policy is principally set out in the National Planning Policy Framework (NPPF) (MHCLG, 2019) and the National Planning Practice Guidance (NPPG) associated with it. The NPPF was adopted in March 2012, and updated and revised in July 2018 and February 2019.

8.8 At the heart of the NPPF is a presumption in favour of sustainable development. To achieve this objective, the NPPF notes the importance of helping to build a strong, responsive and competitive economy, by ensuring that both local business needs and wider opportunities for development are taken into account.

Sub-Regional Planning Policy

The Greater Manchester Spatial Framework (2019 Draft)

8.9 Regional policy guidance is contained in the Greater Manchester Spatial Framework (GMSF) (2019 Draft). As such it provides the spatial strategy and policy context to guide the development of Greater Manchester. It should be noted however that adoption of the framework has been delayed, with the current anticipated adoption date being December 2021.

8.10 The plan is put together by the Greater Manchester Combined Authority, comprised of the Mayor of Greater Manchester and the leaders of Greater Manchester's ten local councils. The Plan sets out their vision for Greater Manchester and provides a strategic approach to economic, housing, infrastructure, social and environmental development for the whole of the city region until 2037. The GMSF priorities include facilitating employment development.

8.11 One of the key objectives set out in the strategy is to ensure a thriving and productive economy, by ensuring there is adequate development land to meet employment needs, prioritising the use of brownfield land, ensuring that there is a diverse range of employment sites and premises and facilitating the development of high value clusters in prime sectors (advanced manufacturing, business, financial and professional services, creative and digital, health innovation and logistics).

8.12 The development falls within a key development location, stated as the 'Core Growth Area'. The draft GMSF seeks to focus development within the Core Growth Area, improving visitor facilities and promoting economic growth.

8.13 The strategy is accompanied by a number of policies. The following are relevant to the development:

- Policy GM-P 1: Supporting Long-Term Economic Growth – facilitating the development of high value clusters in prime sectors.
- Policy GM-Strat 1: protecting and enhancing the economic role of the Core Growth Area with development supporting major growth.

Greater Manchester Strategy (2019)

8.14 The Greater Manchester Strategy sets out the vision that by 2020 the Manchester city region will have pioneered a new model for sustainable economic growth. It is jointly owned by the Greater Manchester Local Enterprise Partnership and the Greater Manchester Combined Authority.

8.15 The strategy has identified priorities for the region to deliver the vision, one of which is to achieve a thriving and productive economy in all parts of Greater Manchester. By 2020, Greater Manchester aims to have 21,500 more residents in employment, relative to a 2016 baseline of 1,273,000.

Local Planning Policy

Manchester Core Strategy (2012)

8.16 Manchester adopted its Core Strategy in 2012 and this is the key overarching Development Plan Document (DPD) within the Local Development Framework. The Core Strategy sets out the City Council's vision for Manchester to 2027, along with the planning policies to guide development. Key challenges that the Core Strategy seeks to address include the skills gap between residents and available work and high rates of deprivation (fourth most deprived district in the country).

8.17 Specific policies relevant to this development are:

- Policy SP 1: Spatial Principles which guide the strategic development of Manchester to 2027. These focus on the Regional Centre as a focus for economic development, leisure and cultural activity. The development falls within the Regional Centre.
- Policy EC 1: Employment and Economic Growth in Manchester – a target of a minimum of 200ha of employment land which will be developed between 2010 and 2027, with an aim of supporting the city's economic performance, increasing productivity, growing the market, growing the labour force, attracting investment, improving skills, providing businesses with the right support, and spreading the benefits of this growth across the city.

- Policy EC 3: The Regional Centre – within this area, development for employment generating uses will be encouraged.
- Policy EC 5: East Manchester - focuses on economic development on the Eastern side of the city. East Manchester is expected to provide approximately 80-85ha of employment land. Provision of employment land will specifically be delivered through the Eastlands Strategic Employment Location as a major leisure visitor destination with ancillary retail and office. This is to provide an extension to City Centre employment opportunities, supporting a mix of employment uses and integrating East Manchester neighbourhoods with the City Centre.
- Policy EC 7: Eastlands Strategic Employment Location – a site compromising of the Etihad Stadium, the Eastlands District Centre, the Velodrome, the Openshaw West site and surrounding environs. It is in excess of 80ha and will accommodate 40-45ha of new development. The location is suitable for a major sports and leisure visitor destination with complementary commercial, retail and hotels. Proposals will be expected to support the continued social, economic and physical regeneration of East Manchester and ensure opportunities to employ residents from the local community. Development of complementary commercial uses will be supported on development sites to the north and west of the stadium to accommodate economic activities associated with the growth of Manchester City Football Club.

Other Guidance

Draft Eastlands Regeneration Framework (2019)

8.18 The Eastlands Regeneration Framework (ERF) was originally endorsed in 2011 which shaped and guided investment and development in East Manchester. It was updated in 2017 and 2019.

8.19 For clarification, the ERF sets out environmental, social, design and economic objectives which are relevant to the attainment of the regeneration of the East Manchester area which is supported by existing planning policy. It is not a planning policy document and it is not a site allocations document. As such this document has the status of a "Local Development Document" but not a "Development Plan Document" and should not be considered or viewed as planning policy, and does not set out a series of tests to be passed.

8.20 The role of the ERF is to seek to guide the content of planning applications so that they have in mind the objectives for East Manchester. Throughout the various iterations of the ERF, the promotion of East Manchester as a national and international destination and the development of a place with a globally competitive sports, leisure and recreation offer has remained consistent and has attracted significant and important investment over the years.

8.21 The 2019 Draft ERF was presented to the Council's Executive Committee in March 2019 for consultation. Following consultation, in July 2019 the Executive Committee resolved to delegate authority to the Strategic Director – Growth & Development, in consultation with the Leader of the Council and the Executive Member for Housing & Regeneration, to approve once certain matters have been addressed, including the requirement for the Draft ERF to reference the recently announced Carbon Reduction targets. At the time of writing, the revised version to address these issues has not been published.

8.22 The 2019 Draft ERF outlines a well-developed vision for East Manchester to continue to accelerate and deepen the East Manchester regeneration journey and support inclusive growth through a number of strategic ambitions for East Manchester, including to:

- Bring sport, education and commerce together;
- Expand a world-class sports destination;
- Become a destination for leisure and recreation facilities;
- Capitalise on the regeneration investment made;
- Support Manchester's Green City initiatives;
- Create a distinctive sense of place; and,

- Deliver improved social and economic outcomes.

8.23 The 2019 Draft ERF outlines the strategic direction for the Etihad Campus Commercial Zone for development which supports those economic sectors in which the city-region already has strengths, including the development of a sports, leisure and recreation economic cluster that will build upon the inherent sporting strengths of the Etihad Campus.

8.24 The 2019 Draft ERF identifies the opportunity to provide a new large indoor arena, which could add to the regeneration and local employment potential of the Etihad Campus and to the wider priorities for East Manchester. The strategy states that such an opportunity must be accompanied by robust transport planning and mitigation for residents living in the area to protect their amenity.

Our Manchester Strategy 2016-2025

8.25 The Our Manchester Strategy 2016-2025 was adopted by Manchester City Council in January 2016 and sets the ambitions for the City for the next decade. The Our Manchester Investment Board drives forward the development and implementation of the Our Manchester approach. The strategy sets out a vision for Manchester to namely have a competitive, dynamic and sustainable economy that draws on science, advanced manufacturing, culture, and creative and digital business, to possess highly skilled, enterprising and industrious people.

Assessment Methodology and Significance Criteria

8.26 This section of the ES Chapter outlines the methodology used to establish the potential economic and social effects of the Proposed Development assessed against the baseline conditions. The effects of the Proposed Development are considered at varying spatial levels according to the nature of the effect considered. This proposed approach follows Homes & Communities Agency (HCA) (HCA, 2014) Additionally Guide 4th Edition, which is the widely accepted guidance.

EIA Scoping

8.27 A formal request for an EIA scoping opinion was submitted to MCC on 26 November 2019. The socio-economic responses from MCC's scoping response, received on 15 January 20209, are covered in the scope of this assessment and the supporting appendices.

Baseline Study Methodology

8.28 The relevant baseline data has been accessed and analysed at the Site and/or local electoral ward level, and at the City and/or regional level where relevant. The baseline section of this assessment has been compiled using the following data sources:

- Census data (Office for National Statistics (ONS), 2011);
- Business Register and Employment Survey (ONS, 2018);
- Annual Population Survey (ONS, 2017);
- National Travel Survey 2018 (DfT, 2018);
- 2019 Index of Multiple Deprivation (DCLG, 2019);
- Appendices 8.1 and 8.2.

8.29 Although the baseline analysis has primarily been undertaken at the city of Manchester level (as the principal labour market catchment area), a substantial amount of data is also collected by the Office for National Statistics (ONS) at smaller geographical levels. For the purpose of this assessment, and where appropriate, data has also been collected at the ward level in order to assess whether conditions in the immediate locality of the Site differ materially from those of the metropolitan area as a whole. Where appropriate, baseline information has also been collected at smaller geographical levels; such as for open space provision.

8.30 The Site falls within the Ancoats and Beswick ward, but close to the boundaries of both the Clayton and Openshaw, and Miles Platting and Newton Heath wards. For the purpose of this assessment, these wards comprise the local area of impact, and represent approximately a 20-minute walking time from the Site (1,600-meter radius). It should be noted however that for

baseline data presented before 2018, the previous ward boundaries will be referred to. These include the Ancoats and Clayton, Bradford and Miles Platting and Newton Heath wards, as defined in the Census 2011.

8.31 A summary of the geographical areas of statistical data collection are defined in Table 8.1.

Table 8.1 Statistical Geographies

Area	Defined Geography
Local	Clayton and Openshaw, Miles Platting and Newton Heath wards
City	Manchester
Region	North West
National	England

Assessment Approach

8.32 The socio-economic assessment has been considered against existing socio-economic conditions. There are no obligatory standards or guidelines for defining socio-economic impacts and the significance of effects. In order to assess the significance of effects, professional judgement has been used to determine the proportionate impact of the Proposed Development in its local, regional and/or national context.

8.33 The principal economic effect of the Proposed Development is considered relative to Manchester (city) and the North West (regional), as these represent the principal labour market catchment areas.

8.34 The principal labour market is commonly known as the Travel to Work Area (TTWA) and can be derived by analysing 2011 Census data (ONS, 2011). The Site is accessible from all areas of Manchester and therefore the labour market catchment area incorporates the population that may reasonably be expected to travel to, and benefit from the Proposed Development.

8.35 Where possible, a quantitative assessment has been undertaken. This relates particularly to the assessment of employment and economic effects. Gross employment is calculated in relation to the construction phases of the Proposed Development project. The methodology applied for the calculation of gross employment generation in the construction phase is based on estimated turnover per construction employee. For the purpose of this assessment the average turnover per construction employee is £106,160 (ONS, 2017). The number of Full Time Equivalent (FTE) jobs created have been calculated based on the convention that each permanent full-time job is equivalent to ten person years of temporary employment.

8.36 At the operational stage, employment estimates for the uses within the Proposed Development have been provided by the Applicant based on their experience of operating similar venues within the UK.

8.37 In calculating the estimated number of jobs generated by the development, both at construction and operational stages, the methodology follows that set out in the HCA Additionally Guide 4th Edition (HCA, 2014). The guidance recommends that the gross number of jobs should be adjusted to arrive at a net figure which takes account of deadweight, leakage and displacement. The same guidance has been used when calculating the indirect and induced multiplier effects. For clarity, the definitions of these terms are summarised below:

Deadweight

8.38 Defined as the 'output that would have occurred without the intervention'. In this case the 'intervention' is the Proposed Development.

Leakage

8.39 Defined as the 'proportion of outputs that benefit those outside the programme/projects target area or group' (HCA, 2014). In the case of employment generation, this is interpreted as those taking up employment generated by the Proposed Development but living outside Manchester. Analysis carried out on Census 2011 data indicates that 62.3% of people working in Manchester live outside the area (ONS, 2011). This corresponds to a high leakage rate as set out within the HCA Additionally Guidance (HCA, 2014), and implies that the majority of employment opportunities will potentially go to people living outside of the target development area.

8.40 It is likely however that leakage rates from Manchester will have fallen since the 2011 Census. Whilst data is not available to support changes since 2011, it is likely that the leakage rate may have fallen given city centre urban regeneration initiatives and likely increases in city centre population. In addition, the client is committed to adopting a Local Labour Agreement (LLA) aimed at employing a significant proportion of the Project workforce from within the local area and ensuring that local communities have first and priority access to employment opportunities. The LLA will also set out commitments to identifying local skills gaps and training opportunities, as well as the development of employment pathways such as school leaver programmes and adoption of apprenticeship schemes.

8.41 Based on the adoption of a LLA and likely demographic changes which have occurred in Manchester since 2011, a medium leakage factor of 25% has been applied to both construction and operational job creation. This is in line with the HCA Additionality Guidance which suggests that a medium leakage rate implies that a reasonably high proportion of benefits will be retained within the target area.

Displacement

8.42 This refers to the 'proportion of project outputs/outcomes accounted for by reduced outputs/outcomes elsewhere in the target area' (HCA, 2014), thus additional jobs created cannot be regarded as net additional benefit.

8.43 Construction workers typically move between construction projects when delays occur or to help the workforce meet particular construction deadlines. Overall it is assumed that due to the flexibility of the labour market, and the fact that construction workers at the Proposed Development represent a small proportion of the Manchester labour force, displacement effects of the direct (i.e. gross effect) construction employment will be low.

8.44 With regards to operational employment, it is assumed that the majority of on-site employment opportunities will be hospitality jobs related to the food and beverage sector, as well as event management and security positions. Given the operational workforce of the Proposed Development will represent a small proportion of the Manchester labour force in this sector, it is assumed that the displacement effects of the direct operational employment will be low.

8.45 For the purposes of this assessment a low displacement factor of 25% has been applied to both construction and operational job creation based on guidance set out within the HCA Additionally Guidance.

Indirect and Induced Multiplier Effects

8.46 Defined as the 'further economic activity (jobs, expenditure or income) associated with the additional local income and local supplier purchases' (HCA, 2014). That is, jobs are also created down the supply chain (indirect) and through extra spending in the area based on the jobs created (induced). As such, initial investment will have proportionately greater economic benefits than the effect of the direct investment alone, known as the 'multiplier effect'. For the purposes of this assessment a multiplier of 1.38 has been applied based on strong supply chain linkages at the regional level for a recreational employment activity type.

Table 8.2 Geographic Area of Effect

Effect	Geographical Area of Effect	Rationale/Evidence Base for Effect Area
Employment generation during construction phase	Manchester and North West	Since construction employment is relatively mobile, it is not generally considered appropriate to assess the potential employment effects of the construction stage at the local level
Employment generation during operational phase	Manchester and North West	Given the scale and nature of the scheme it is likely that operational employment will have impacts at the city and regional scale
Additional local spending	Local, Manchester and North West	The impact of additional local spending could impact at all scales
Open space provision	Radius of 1km from the Site	Considered within a reasonable walking distance from the Site

8.47 The assessment of likely socio-economic effects is considered based on:

- Magnitude of change – this entails consideration of the absolute numbers of residents or employees affected and the size of the geographic area within which effects will be experienced;
- Scale of the impact – this requires consideration of the relative magnitude of each impact in its relevant market context;
- Duration of impact – more weight is given to long-term permanent changes than to short-term, temporary ones; and
- Conformity with standards for provision or accessibility as set out in relevant guidance and scope for mitigation is considered.

Assessment of Effects

8.48 The following criteria have been used to describe the sensitivity of the receptors, the magnitude of the impacts and the significance of the effects. There is no statutory definition of what constitutes a significant effect and guidance is of a generic nature. The assessment of effects in this Chapter has been based on the general methodology presented in Chapter 2 and expert judgement. The assessment has sought to be objective and to quantify effects where possible. Where quantification has not been possible, a qualitative assessment has been made and justified.

Receptor Sensitivity

8.49 The criteria used to assess receptor sensitivity is described in Table 8.3.

Table 8.3 Criteria for determining receptor sensitivity

Sensitivity	Criteria
High	Receptors that will be most directly affected by any effects of the Proposed Development and receptors with significant economic or social stake in the area (e.g. nearby local residents of the Proposed Development)
Moderate	Receptors that are sensitive to effects by virtue of proximity, accessibility or the specific facilities or uses provided by the Site (e.g. local community facilities, employees, businesses)
Low	This category represents receptors that are likely to experience some effect from the redevelopment proposals but at a low level (e.g. existing local businesses)

Sensitivity	Criteria
Negligible	Receptors with minimal connection to the Site and little likelihood of being affected by any development effects (e.g. regional population)

Magnitude of Change/Impact

8.50 The criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, are described in Table 8.4.

Table 8.4 Criteria for determining magnitude of change/impact

Magnitude	Criteria
High	Effects that would have a significant economic or social effect locally or would be felt more widely than the city scale. These effects are likely to directly affect a large number of receptors or those with high sensitivity.
Moderate	Effects that have a material economic or social effect locally or would be felt at a city scale.
Low	Effects that have some economic or social effect at a localised level.
Negligible	Effects that have minimal economic or social effects.

Significance Evaluation

8.51 This assessment uses the scale of significance described in Chapter 2 to assess the potential and residual effects of the Proposed Development against the baseline conditions. The assessment process aims to be objective and quantifies the effects as far as possible. However, some effects can only be evaluated on a qualitative basis.

8.52 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 8.5.

Table 8.5 Matrix for Determining Effect Significance

		Magnitude of Change / Impact			
		High	**Medium**	**Low**	**Negligible**
Receptor Sensitivity	**High**	Major	Major	Moderate/Minor	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate/Minor	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

8.53 Effects can also be described, for example, as:

- Beneficial or adverse;
- Permanent or reversible;
- Short, medium or long term; and
- Significant (major or substantial) or insignificant (indiscernible or minor).

8.54 The overall EIA methodology is set out in detail in Chapter 2 of this ES. In general, temporary, short to medium-term significant effects are considered to be those associated with the construction works. Long-term effects are those associated with the Proposed Development once complete and operational. The moderate and major effects are considered to be 'significant'.

8.55 Note that where moderate and major effects are identified, these are considered to be 'significant'. Where an effect is assessed as being within the 'Moderate/Minor' category professional judgment has been used to determine if it is considered a significant effect or not.

Baseline Conditions

Current Baseline (2019)

8.56 This section summarises the existing socio-economic conditions of the Site and its surroundings. As set out in the assessment methodology, the baseline socio-economic conditions have been established through the interpretation of a range of nationally recognised data sources, such as the 2011 Census. These conditions are considered in the context of the wider local, city, regional and national socio-economic context. This information provides the baseline against which the socio-economic effects of the Proposed Development are assessed.

Existing Site

8.57 The Site is currently used as an over-spill surface level car park for those attending events associated with the Etihad Stadium. There are currently no permanent employment or residential uses on site.

Socio-Economic Profile

Employment Profile

8.58 In 2018, the total employment in Manchester was estimated at 400,000 people (ONS, 2018a). Total employment is forecast to increase to 472,500 people by 2030, an increase of 18.1% (Oxford Economics, 2018), significantly higher than that observed for the North West as a whole. According to the Census 2011, 62.3% of the Manchester workforce at that time live outside the city (ONS, 2011).

8.59 Table 8.6 presents a breakdown of employment by broad industry group within the local study area, Manchester, the North West and England. In 2018, approximately 49,230 people were employed within the local area[1] out of a total of 400,000 people employed within Manchester as a whole. These employees are engaged in a wide range of industries (ONS, 2018) which reflects the diverse business environment of Manchester.

8.60 The industry groups with the highest proportion of workers within the local area include retail (11.0%), transport and storage (10.7%), professional, technical and scientific (11.3%) and the business administration and support services sectors (10.8%). In contrast, Manchester has a somewhat lower proportion of employees engaged in retail (8.8%) and transport and storage activities (7.5%), and a greater proportion engaged in professional, technical and scientific activities (12.5%) (ONS, 2018). The local area also has a significantly higher proportion of employment engaged in the manufacturing (7.9%) sector compared to average for Manchester (2.8%), although comparable to the regional and national averages (9.3% and 7.9% respectively).

8.61 The local area has a significantly lower proportion of employment concentrated in education (5.2%) and health activities (4.7%) compared to the average for Manchester (9.8% and 11.3%), the North West (8.2% and 13.1%) and England (8.6% and 12.5%) as a whole; all of which have a similar economic profile within these sectors (ONS, 2018).

[1] As defined in Table 8.1

Table 8.6 Proportion of Employment by Broad Industrial Group

Broad Industry Group	Local Area (%)	Manchester (%)	North West (%)	England (%)
Agriculture, forestry & fishing	0.1	0.0	1.1	1.3
Mining, quarrying & utilities	0.3	0.3	1.2	1.2
Manufacturing	7.9	2.8	9.3	7.9
Construction	3.1	2.3	4.8	4.8
Motor trades	0.8	0.5	1.8	1.9
Wholesale	6.0	3.8	4.5	4.1
Retail	11.0	8.8	10.6	9.4
Transport & storage (inc. postal)	10.7	7.5	5.4	4.9
Accommodation & food services	8.3	9.0	7.1	7.5
Information & communication	3.0	4.3	2.7	4.3
Financial & insurance	3.6	4.5	2.6	3.4
Property	1.5	2.5	1.9	1.9
Professional, scientific & technical	11.3	12.5	8.2	9.0
Business administration & support services	10.8	12.5	8.8	9.0
Public administration & defence	7.5	4.3	4.3	3.8
Education	5.2	9.8	8.2	8.6
Health	4.7	11.3	13.1	12.5
Arts, entertainment, recreation & other services	4.3	3.5	4.4	4.5

Source: BRES (2018)

8.62 In 2018, there were estimated to be approximately 160,900 private-sector construction workers within the North-West (ONS, 2018). The 2019 Construction Skills Network (CITB, 2019) forecasts that construction employment in the North West will increase at an annual average rate of 0.8%, with the total number of construction workers increasing from 279,000 in 2019 to over 284,000 by 2023. The growth is expected to cover the range of occupations relatively evenly (CITB, 2019). Table 8.6 shows that the proportion of people employed in construction in Manchester (2.3%) was lesser in 2017 than that recorded within the North West (4.8%) and England as a whole (4.9%).

8.63 It is observed that in 2011, there was a smaller proportion of residents employed within higher occupational groupings, particularly within managerial and professional occupations compared to all other geographies.

Table 8.7 Employment by Occupational Group (2011)

Broad Industry Group	Local Area (%)	Manchester (%)	North West (%)	England (%)
1. Managers, directors and senior officials	7.2%	7.5%	9.9%	10.9%
2. Professional occupations	15.7%	20.0%	16.3%	17.5%
3. Associate professional and technical occupations	12.6%	12.4%	11.5%	12.8%
4. Administrative and secretarial occupations	10.5%	10.4%	11.8%	11.5%
5. Skilled trades occupations	8.0%	7.5%	11.3%	11.4%
6. Caring, leisure and other service occupations	10.9%	9.8%	10.1%	9.3%
7. Sales and customer service occupations	11.4%	11.3%	9.4%	8.4%
8. Process plant and machine operatives	7.0%	6.3%	8.1%	7.2%
9. Elementary occupations	16.7%	14.8%	11.6%	11.1%

Source: Census (2011)

Labour Profile

8.64 In 2018, 394,900, or 71.4% of Manchester's residents were of working age (defined by the ONS as the sum of women and men aged 16 to 64) (ONS, 2019b). This is comparable to the 63.3% recorded within the North West and 63.1% recorded for England as a whole. According to the Annual Population Survey (ONS, 2019b), 76% of Manchester's population were economically active in 2018, slightly lower than that recorded within the North West (76.9%) and England as a whole (78.7%).

8.65 In 2018, 76.9% of people in Manchester aged 16+ had some form of qualification (ONS, 2019b). This rate is marginally higher than recorded within the North West (75.2%) but lower than the national average (77.5%). In addition, 28.9% of Manchester's population had a degree or a higher-level qualification (National Vocational Qualification Level 4+ (NVQ4+)); slightly higher than the average recorded within the North West (24.4%) and that recorded within England as a whole (27.4%) (Census, 2011).

8.66 In July 2019, the benefit claimant count within the local area, as a proportion of all residents aged 16-64, was approximately 5.2%, somewhat higher than the rate recorded within Manchester (4.3%) and significantly higher than that recorded within the North West as a whole (3.5%). The Miles Platting and Newton Heath ward, located to the north of the Site, has nearly double the Manchester average claimant count (4.3%).

8.67 In 2018 it was recorded that the average gross weekly pay per person within Manchester was £492.80, somewhat lower than the regional average (£529.60, -7.5%) and significantly lower than the national average (574.90, -16.7%).

Demographic Profile

Resident Population

8.68 The 2011 Census indicated that there were a total of 46,888 people residing within the local study area, as outlined in Table 8.8. The Site does not accommodate any residents.

Table 8.8 Population Levels for Each Study Geography

Population 2011	Local Area	Manchester	North West
All usual residents	46,888	503,127	7,052,177

Source: Census (2011)

8.69 According to the 2011 Census, the age structure across both the local area and Manchester is generally similar, although both geographies have a somewhat younger population (and subsequent higher working age population) compared to the North West as a whole, and a lower proportion of population aged 65 years and over.

Table 8.9 Age Structure of Population

Age Structure 2011	Local Area	Manchester	North West
Age 0-19	24.7%	25.9%	24.0%
Age 20-44	46.1%	46.7%	33.3%
Age 45–64	19.3%	18.0%	26.0%
Age 65+	9.9%	9.4%	16.6%
Working Age (16-64)	70.0%	71.2%	64.6%
Retirement Age (65+)	9.9%	9.4%	16.6%

Source: Census (2011)

8.70 According to the ONS Population Projections, the population of Manchester is expected to grow from 558,700 in 2019 to 600,000 in 2030, representing an 11.6% increase over the period (ONS, 2019). Over the same period, the North West is forecast to experience a significantly lower increase of 3.2%, whilst England as a whole will experience a slightly smaller population increase of 5.7%.

Ethnicity

8.71 As outlined in Table 8.10, a high proportion of the population of the local area are white (75%), compared to Manchester as a whole (67%), although slightly lower than regional and national averages (90% and 85% respectively). The local area has a slightly higher proportion of Black/African/Caribbean/Black British ethnic population (11%) compared to Manchester (9%), and significantly higher than regional (1%) and national (3%) averages.

Table 8.10 Proportion of the Population in each Ethnic Group - 2011

Ethnic Group 2011	Local Area	Manchester	North West	National
White	75%	67%	90%	85%
Mixed/Multiple Ethnic Groups	4%	5%	2%	2%

Ethnic Group 2011	Local Area	Manchester	North West	National
Asian / Asian British	8%	17%	6%	8%
Black/African/ Caribbean/Black British	11%	9%	1%	3%
Other Ethnic Group	2%	3%	1%	1%

Source: Census (2011)

Index of Deprivation

8.72 According to the Index of Multiple Deprivation (IMD) 2019, the LSOA within which the Site is located is the 22nd most derived LSOA within Manchester, and amongst the 10% most deprived nationally. This is similar for all the LSOAs surrounding the Site, with the Ancoats and Clayton, Bradford, and Miles Platting and Newton Heath wards representing a significant proportion of the most deprived LSOAs within Manchester.

8.73 Manchester, as a whole, ranks as England's sixth most deprived local authority which is an improvement from 2010, where Manchester was the 4th most deprived and 2015 where it was the fifth most deprived (CLG, 2019). Approximately 43.3% of Manchester's LSOAs are in the most deprived 10% of LSOAs nationally. This is an improvement on IMD 2010 when almost half were in the most deprived 10% (45.6%) but a slight worsening of that recorded in 2015 where 40.8% of LSOAs were in the most deprived 10%. There are also 282 LSOAs in Manchester, 23 more than ranked in the 2010 IMD, strengthening the improvement (CLG, 2019).

8.74 Although Manchester has improved in most domain deprivation rankings since 2010, employment scale has seen a negative change with a slight increase in the number of people who are employment deprived. The population of employment deprived people has risen from 48,190 in 2010 to 57,127 in 2015 but has since fallen to 49,276 in 2019. The figures do not account however for growth in overall population.

8.75 The health domain has been one of the largest factors in keeping Manchester's position in the top five most deprived in the national IMD, ranking Manchester 5th in the rank of average score and 6th in the rank of the proportion of LSOAs that are in the most deprived 10% nationally. This domain has a weighting of 13.5% in the IMD. (CLG, 2019). Crime also has a significant effect with Manchester ranked 1st in the rank of average score and 1st in the rank of the proportion of LSOAs that are in the most deprived 10% nationally.

Social Infrastructure

Open Space and Amenity Space

8.76 According to the Manchester City Council city wide open spaces, sport and recreation study (2009) there is a total of 859.28 Ha of open space within Manchester. In total it is estimated that within Greater Manchester there is currently 1.90 Ha of open space per 1,000 population.

8.77 Table 8.11 identified open space within 2 km distance of the Site. In total there are five open spaces open to public.

Table 8.11 Open Space Accessibility

Park	Estimated Size (Ha)	Distance from site to Open Space (Km)
Philips Park	12.5	0.5

Park	Estimated Size (Ha)	Distance from site to Open Space (Km)
Bradford Park	1.5	0.6
Clayton Vale	73	1.5
Pin Mill Brow	9.4	1.5
Victoria Mill Park	0.6	1.6

Source: BuroHappold Analysis (2019)

Entertainment and Leisure Provision and Demand

8.78 Manchester currently has one large arena venue, the Manchester Arena, which is located approximately 3km from the Site. The Arena has a total capacity of 21,000 people; one of the largest in the UK. It was recorded that in 2018, Manchester Arena hosted 27 events with an attendance of more than 12,000 people, with an average arena utilisation of 97% for these events indicating the venue is operating close to total capacity for large events (Appendix 8.2). It has been noted however that average annual utilisation of the arena is relatively low its design and lack of flexibility to accommodate a diverse range of events. The Manchester Arena is currently the most popular venue for touring artists outside of London.

8.79 The Site is also located adjacent to the Etihad Stadium which also hosts music concerts and live events with a total capacity of 55,097 (seated capacity) (Appendix 8.2).

Future Baseline

8.80 If the Proposed Development did not go ahead, it is unlikely that the future baseline within the Site would change significantly in terms of the current baseline conditions.

8.81 In terms of the wider socio-economic conditions, these can be considered in the context of projections for the city as a whole. The population of the city is forecast to grow by 11% between 2019 - 2030 (Oxford Economics, 2018). In addition, the city employment is forecast to grow by 8% over the same period.

Identification and Evaluation of Significant Effects

Construction Effects

8.82 This section of this ES Chapter analyses the scale, duration and significance of socio-economic effects relative to the baseline socio-economic conditions presented within the previous sections of this Chapter.

8.83 It estimates the gross construction employment arising from the Proposed Development and then takes into account leakage, displacement and multiplier effects in order to assess net impacts on the local and regional economies.

Relevant Aspects of the Scheme

8.84 Construction activity will result in employment creation which represents a positive economic effect that can be estimated as the function of the scale and type of construction (infrastructure and buildings).

8.85 It is assumed that the Proposed Development will involve a construction programme of approximately 36 months. Although temporary in nature, construction employment has positive economic effects, contributing to increased output in the UK economy.

Construction Employment and Economic Effects

8.86 The construction works associated with the Proposed Development will generate new construction employment opportunities. The scale of construction employment created has been estimated using standard ratios for gross output per employee in the construction sector as described in the Assessment Approach. The following sections estimate gross construction employment arising from the Proposed Development and then take into account leakage,

displacement and multiplier effects in order to assess net impacts on the local and regional economies.

Gross Direct Construction Employment

8.87 The construction period for the Proposed Development is estimated to be 36 months. Although these jobs are temporary, they represent a positive economic effect that can be estimated as a function of the scale and type of construction.

8.88 The direct expenditure involved in the construction phase of the Proposed Development will lead to an increased output generated in both the Manchester and UK economies. The employment resulting from the temporary construction phase can be estimated by applying an average output per construction industry employee to the estimated total construction cost.

8.89 This provides an estimated total gross impact of approximately 8,360 person years of construction employment on-site, on average per year during the construction phase. By using the convention of equating ten person years of employment to one FTE job in the construction sector, it is estimated that approximately 3,344 FTE construction jobs would be created in total during the construction phase (Appendix 8.1).

8.90 The Proposed Development has set a target of 5% of construction jobs to be taken by local apprentices and supported employment. Over the four years 100 apprentices will benefit from the construction activity and 66 in supported employment.

Leakage

8.91 Leakage effects are defined as the effects which occur outside of the effects area. For the Proposed Development leakage refers to the loss of employment outside of the target area, which is defined as Manchester[2].

8.92 Given the extent of out commuting from Manchester recorded within the Census 2011 (ONS, 2011), a 'medium' leakage rate has been assumed for the purpose of this assessment. This reflects the commitment of the client within the LLA to promote construction employment opportunities for local communities.

8.93 Applying a leakage rate of 25% to the estimated 3,344 gross direct construction jobs created by the Proposed Development, indicates that an estimated 2,508 persons from within Manchester and 836 persons from outside Manchester will be working on-site throughout the construction period.

Displacement Effects

8.94 Given the flexibility of the construction labour market and relative flexibility of the construction labour market within Manchester, a low displacement rate of 25% has been assumed for the purpose of this assessment.

8.95 Applying this level of displacement to the total gross direct construction figure of 3,344 jobs results in a net direct employment figure of 2,508 jobs, of which 1,881 jobs will be taken by people living within Manchester.

Multiplier Effects

8.96 In addition to the direct employment generated by the Proposed Development itself, there will be an increase in local employment arising from indirect and induced effects of the construction activity. Employment growth will arise locally through manufacturing services and suppliers to the construction process (indirect or supply linkage multipliers). Additionally, part of the income of the construction workers and suppliers will be spent in the Manchester area, generating further employment (in terms of induced or income multipliers).

[2] As defined in Table 8.1. Manchester is defined on the Manchester local authority administrative boundaries as per ONS.

8.97 Applying a multiplier of 1.51 to the total net direct employment figure of 2,508 net direct construction workers results in a net indirect and induced employment impact of 1,279 during the construction period, of which 959 will be taken by people living within Manchester.

Net Construction Employment Effects

8.98 Table 8.12 presents the temporary employment generated by construction of the Proposed Development, taking leakage, displacement and multiplier effects into account. For the Proposed Development, the total net additional employment created within Manchester is estimated to be 2,840 FTE jobs, supporting a total of 3,787 FTE net jobs created during the temporary construction phase.

Table 8.12 Net Construction Employment

	Manchester	Outside Manchester	Total
Gross Direct Employment	2,508	836	3,344
Displacement	627	209	836
Net Direct Employment	1,881	627	2,508
Indirect & Induced Employment	959	320	1,279
Total Net Employment	2,840	947	3,787

Source: BuroHappold Calculations (2020)

8.99 Since construction employment is relatively mobile, it is not generally considered appropriate to assess the potential employment effects of the construction stage at the local level. In the context of a large labour pool of construction workers in Manchester, the direct, indirect and induced employment and expenditure created by the temporary construction phase of the Proposed Development is assessed to result in a **moderate beneficial**, medium-term temporary effect on the Manchester economy.

Climate Change and Adaptation

8.100 There are not anticipated to be any discernible effects on socio-economics arising from climate change during the construction phase of the Proposed Development.

8.101 Table 8.13 provides a summary of the identified socio-economic effects during construction of the Proposed Development.

Table 8.13 Summary of Socio-economic Effects during Construction

Receptor	Sensitivity	Description of Effect	Magnitude of Change/Impact	Effect Significance
Manchester Workforce	Moderate	2,840 FTE direct, indirect and induced temporary jobs created during the construction phases within Manchester	Medium	Moderate Beneficial, Temporary

Supplementary Mitigation Measures

8.102 There are no significant adverse socio-economic effects identified for the Proposed Development that require mitigation during the construction phase.

Operational Effects

8.103 This section of the ES Chapter analyses the scale, duration and significance of socio-economic effects relative to the baseline socio-economic conditions recognised in the previous sections of this Chapter. Effects are assessed for the Proposed Development once completed and occupied.

Relevant Aspects of the Scheme

8.104 Key aspects of the scheme to consider in the context of the socio-economic assessment of operational effects include:

- There are no active employment uses on the Site and therefore it doesn't currently support operational employment uses; and
- There are no residential buildings on the Site and as such it does not currently support a residential population.

8.105 Once completed and operational the Proposed Development will generate employment opportunities within operational uses. The Proposed Development will include a number of employment generating uses including concert and event spaces, food and beverage uses.

Operational Employment and Economic Effects

8.106 The Proposed Development will generate long-term jobs once completed and operational. In estimating operational job generation, it is important to consider not just gross effects of the Proposed Development but also net effects taking into account leakage, displacement and multiplier effects.

Gross and Net Operational Employment

8.107 The Proposed Development once completed and operational will accommodate 68,608 sqm (GEA) of commercial and community floorspace within use classes; A1 (retail), A3 (restaurant and café), A4 (bar); D2 (assembly and leisure) as well as flexible retail units (A1/A3/A4). Once operational, the Proposed Development will have a maximum capacity of 23,500 people.

8.108 Based on information provided by the Applicant it is estimated that the Proposed Development will support approximately 47 full time 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. The estimation is based on the first twenty years of the operational phase. Given the operators considerable experience in managing venues of a similar scale and function to the Proposed Development, as well as the bespoke nature of these types of venues, these estimates are considered to be reasonable and robust for the purpose of assessment.

8.109 Assuming a leakage rate of 25%, a low level displacement (25%) and a multiplier of 1.38, it is estimated that the Proposed Development will result in a total net gain of an estimated 586 FTE jobs of which 439 FTE jobs will be created within Manchester. Table 8.14 presents further details.

Table 8.14 Net Operational Employment

	Manchester	Outside Manchester	Total
Gross Direct Employment	425	142	566
Displacement	106	35	142
Net Direct Employment	318	106	425
Indirect & Induced Employment	121	40	161
Total Net Employment	439	146	586

Source: BuroHappold Calculations (2019)

8.110 The Proposed Development will create flexible employment opportunities for residents residing within the City, particularly residents residing within the Wards close to the Proposed Development. Given the nature of the events industry, it is likely that many of the part time events roles will be relatively low skilled occupations, such as customer service, stewarding, hospitality, catering, cleaning and security. In addition to the lower skilled part time positions, there will also be a number of full time management positions created which will require higher education and professional qualifications.

8.111 The Arena operator is committed to providing a range of employment, skills and training initiatives to maximise the accessibility of employment opportunities to local residents within the City.

8.112 Taking into account the additional net direct, indirect and induced employment created by the permanent employment of the Proposed Development, it is assessed that there will be a **moderate beneficial**, long-term, permanent effect on the labour market within Manchester, and a minor beneficial, long-term, permanent effect at the regional and national level during the operational phase.

Visitor Spending

8.113 Once operational the Proposed Development will generate a significant number of visitors during event days. A number of these visitors will travel from outside of Manchester and would be expected to spend money within the local area and Manchester as a whole. The additional spending within the local economy is likely to be captured by restaurants, bar and shops and on accommodation and transport.

8.114 Based on information drawn from Appendix 8.2, it is estimated that 1 million visitors will use the Proposed Development per year. For the purpose of this assessment, it is assumed that 37% of Arena visitors will originate from outside Manchester, and approximately 66% of these visitors will stay overnight (Appendix 8.2). In addition, only expenditure by overnight visitors is assumed to be additional to the local visitor economy, given day visitors would likely have spent this money elsewhere in the absence of the Proposed Development. Furthermore, spending within the Proposed Development has been excluded from the total estimate of local additional spending, given spending within the Proposed Development is assumed to support direct operational employment on-site.

8.115 Based on an estimated 1 million ticket sales, the Proposed Development is estimated to generate an additional £36 million per year in direct annual local spending, benefiting shops, restaurants, cafes and bars and the hotel and accommodation sector (Appendix 8.2).

8.116 Taking into account the additional annual spending by visitors to the Proposed Development it is assessed that there will be a likely **major beneficial**, long-term permanent effect at the local and City level and a minor beneficial, long-term permanent effect at all other spatial scales.

Deprivation and Regeneration

8.117 The Proposed Development has the potential to positively influence a number of deprivation indices. In particular, the Proposed Development will have a positive impact on income and employment deprivation through the generation of approximately 566 direct jobs on site in a location which currently does not support any permanent employment.

8.118 The Site is currently used as an overspill car park for people attending events within the Etihad stadium. The Proposed Development will therefore significantly increase the number of people visiting the area (approximately 1 million per year) and generate additional local spending, benefiting the local economy. The Proposed Development will also help to deliver the aspirations of the Draft 2019 ERF, contributing to strengthening Eastlands role as a visitor destination within the City, as well as delivering associated improvements in crime and safety.

8.119 Based on the above assessment it is concluded that the Proposed Development is likely to have a **major beneficial**, long term, permanent effect on deprivation and regeneration objectives at the local level.

Access to Open Space and Amenity Space

8.120 The Baseline assessment shows that within 2 km of the Site there are five local parks and open spaces open to the public.

8.121 It is estimated the Proposed Development will support 3,344 gross direct employment during construction and 566 gross direct employment when operational, who will place additional demands on open space. The baseline analysis has shown that whilst there is a shortage of open spaces in immediate proximity to the Site, the Site has good access to large open spaces which could supply growing future demand.

8.122 The Site does not currently contain any publicly accessible areas of open space or amenity space. Therefore, the Proposed Development will not result in the loss of open space.

8.123 Once complete and operational, the Proposed Development will provide new areas of amenity space which can be used by both visitors and employees within the Site.

8.124 The Proposed Development will provide approximately 1,947sqm of new open space within the Site. The public realm design for the Site aims to create an attractive, accessible space for use during events and non-events. The public realm will be largely hardscaping comprised of podium plazas, tiered seating and a viewing platform, as well as green buffer areas and a wildflower area. The spaces will provide a number opportunities for passive recreation and will incorporate a number of seating areas around the Arena.

8.125 Based on the provision of new areas of open space, as well as accessibility of the Site to existing areas of public open space which could be utilised by employees within the Site, it is assessed that the Proposed Development will have a **negligible effect** on open space provision at the local level.

Entertainment and Leisure Provision and Demand

8.126 The Proposed Development will significantly increase the city's ability to host large scale events and attract additional and more diverse events as a result of the arena's location, facilities and flexible design. The Proposed Development will be extendable to a capacity of 23,500 for certain events, and will also include a range of modern features such as flexibility of space, large flat floor, external concourse spaces, and a range of catering offers (Appendix 8.1).

8.127 It is expected that the flexible design of the new arena will allow the Project to capture demand within the UK events market for emerging event formats including the increase in demand from live event formats such as E-Sports, family and theatre events. It is understood that the existing Manchester Arena is unable to meet current demand for live events within the city due to limited availability at peak demand (weekends, and seasonal periods) as well as restrictions with regards to events flexibility and external space.

8.128 Whilst the Proposed Development falls within the catchment markets for Liverpool and Leeds it is considered that the events market within the UK is predominantly supply led, and that new arenas within the UK events market are meeting demand for a greater range of event offerings. Analysis of the opening of the M&S Bank Arena in Liverpool and the First Direct Arena in Leeds indicates that there has been no impact on Manchester Arena with regards to event numbers. The market share of events within Manchester has however been falling over time (Appendix 8.1).

8.129 The provision of a new arena will help to address the loss in the market share of UK events within Manchester, which has been falling since 2013. The provision of a flexible arena, which can accommodate more complex staging arrangements without compromising on capacity will help to increase Manchester's share of the UK events market; particularly for large acts (Appendix 8.1).

8.130 Overall it is considered that the provision of a modern, flexible events areas and an increase in venue provision and capacity within Manchester represents a **major beneficial**, long term, permanent effect on entertainment and leisure venue provision at all spatial scales.

Climate Change and Adaptation

8.131 There are not anticipated to be any discernible effects on socio-economics arising from climate change during the operational phase of the Proposed Development.

8.132 Table 8.15 provides a summary of the identified socio-economic effects during operation of the Proposed Development.

Table 8.15 Summary of socio-economic effects during operation

Receptor	Sensitivity	Description of Effect	Magnitude of Change/ Impact	Effect Significance
Local Employment	Low	Generation of 586 net operational jobs once complete and occupied	High	Moderate beneficial, permanent
Local Businesses	Moderate	Attraction of approximately 1 million visitors a year will generate approximately £36 million in additional local spending per annum.	High	Major beneficial, permanent
	Moderate	The Proposed Development will significantly increase the City's ability to host large events.	High	Major beneficial, permanent
Local Residents and Local Businesses	Moderate / High	Improvements to regeneration objectives and several domains of deprivation including income and employment	High	Major beneficial, permanent
Local Residents	High	The Proposed Development will provide approximately 1,947 sqm of public open space / amenity space	Negligible	Negligible

Mitigation Measures

Mitigation and Monitoring during Construction

8.133 There are no adverse socio-economic effects assessed for the construction phase of the Proposed Development and therefore no additional mitigation measures have been identified.

Mitigation and Monitoring Once the Proposed Development is Complete and Occupied

8.134 There are no adverse socio-economic effects assessed for the occupied and operational phase of the Proposed Development and therefore no additional mitigation measures have been identified.

Cumulative Effects

8.135 This section assesses the socio-economic effects of the Proposed Development in combination with the potential socio-economic effects of other committed developments, as listed within Chapter 2: EIA Methodology.

8.136 There are a total of six committed developments in proximity to the Proposed Development, of which three have the potential to result in in-combination effects which could alter the significance of the effects described in this Chapter. These developments are set out in Table 8.16. The other three schemes have been excluded based on the fact they are wholly residential in nature and do not include any employment generating uses.

Table 8.16 Cumulative Schemes

Scheme	Distance	Description of Development
Pollard Yard, Pollard Street East, Manchester – Phase 1	1.0km	Application for temporary siting and use of site for 50 recycled shipping containers to provide co-working space (sui generis)
Pollard Yard, Pollard Street East, Manchester – Phase 2	0.98km	Application for temporary siting and use of site for 64 additional recycled shipping containers
Etihad Stadium Extension	0.44km	Alterations to the Etihad Stadium, including increasing the overall height of the South and North stands and associated elevational alterations, to allow an increase each stand capacity by up to 6,250 seats respectively and up to 2,000 additional pitch side seats creating a total match day capacity of up to 62,170 seats (from 47,670), expansions of concourse facilities, alteration to public realm including changes to car parking layout, landscaping and boundary treatments and associated infrastructure works

8.137 In addition to the three cumulative schemes listed in Table 8.16, the Proposed Development falls within the Draft 2019 ERF area. In line with adopted planning policy, the Draft 2019 ERF supports the on-going regeneration of the Eastlands area and proposes a number of potential development opportunities, including a mix of educational, sports, commercial workspace, leisure and hospitality developments and residential uses.

8.138 It is not possible to quantify the impacts of the Draft 2019 ERF given that the potential development opportunities are being bought forwards over a longer time period and as yet do not have planning permission. If all the development opportunities within the Draft 2019 ERF were to be delivered however, it is considered that they would have a significant effect on employment creation locally (construction and operational phases), as well as contributing significantly to the supply of employment floorspace in East Manchester and enhancing the reputation of the Etihad Campus as a globally competitive location for sport, leisure and recreation.

Construction Phase

8.139 The construction of the Proposed Development along with the three committed developments, albeit two are temporary in nature, will bring about additional construction related employment and spending at the local and regional levels. These cumulative effects cannot be readily quantified on the basis of the information available for each development. In addition, the timing and phasing of the construction periods for these schemes, along with the Proposed Development, may not occur over the same time periods. Therefore, the temporary construction related effects may not coincide.

8.140 Since construction employment is relatively mobile, it is not considered appropriate to assess the potential employment effects of the construction stage at the local level. The likely residual

cumulative effects in relation to construction employment and associated local spending would therefore be moderate beneficial in the context of the overall Manchester construction workforce.

Operational Phase

8.141 The committed developments will have an impact on employment opportunities locally. It is estimated that they will provide an additional 1,690sqm of workspace. The application of appropriate employment density assumptions (HCA, 2015) indicates that this new employment floorspace could support approximately 169 new gross direct jobs once complete and operational.

8.142 In addition, it is estimated that the expansion of the Etihad Stadium will generate an additional 110 match day jobs once complete and operational (Deloitte, 2013). It is likely that a significant proportion of these jobs will be taken by local residents within Manchester given the Club's local recruitment and procurement targets. Additionally, the increase in stadium capacity will have beneficial impacts on local spending locally from increased match day attendance.

8.143 In combination with the Proposed Development, it is assessed that the likely residual cumulative effects in relation to operational employment would therefore be moderate beneficial at the local level and minor beneficial at all other spatial scales.

8.144 The committed developments would increase the number of day time and event day employees within the local area, potentially increasing demand for areas of open space and amenity space for passive recreation. Given the provision of existing open space within vicinity of the Site, as well as the likely provision of new areas of amenity space within the committed developments, it is likely that there would be a negligible effect on open space at the local level.

Residual Effects

8.145 This section identifies the residual socio-economic effects, following the implementation of mitigation and monitoring measures, known as 'residual effects' which cannot be eliminated through design changes or the application of standard mitigation measures.

8.146 The Proposed Development will have an overall beneficial effect on the local economy, increasing economic activity through the provision of a new multi-use indoor arena and the attraction of approximately 1 million visitors per year. The Proposed Development will also have positive effects on the regeneration objectives for the Draft 2019 ERF area, supporting MCC's ambitions to create an international cultural, leisure and tourism destination.

8.147 Table 8.17 summarises the residual socio-economic effects of the Proposed Development during construction and Table 8.18 summarises the residual socio-economic effects of the Proposed Development during operation.

Table 8.17 Summary of residual effects during construction

Effect	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Manchester workforce	2,840 FTE direct, indirect and induced temporary jobs created during the construction phases within Manchester	Moderate Beneficial, Temporary	N/A	N/A	Moderate Beneficial, Temporary

Table 8.18 Summary of residual effects during operation

Effect	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Local Employment	Generation of 586 net operational jobs once complete and occupied	Moderate beneficial, permanent	N/A	N/A	Moderate beneficial, permanent
Local Businesses	Attraction of approximately 1 million visitors a year will generate approximately £36 million in additional local spending per annum.	Major beneficial, permanent	N/A	N/A	Major beneficial, permanent
	The Proposed Development will significantly increase the City's ability to host large events.	Major beneficial, permanent	N/A	N/A	Major beneficial, permanent
Local Residents and Local Businesses	Improvements to regeneration objectives and several domains of deprivation including income and employment	Major beneficial, permanent	N/A	N/A	Major beneficial, permanent
Local Residents	The Proposed Development will provide approximately 1,947 sqm of public open space / amenity space	Negligible	N/A	N/A	Negligible

Future Monitoring of Significant Residual Environmental Effects

8.148 There are no significant residual socio-economic effects which will require future monitoring.

Reference List

8.149 This ES Chapter has been prepared by reference to the following:

- CITB (2019); Construction Skills Network Forecasts 2019-2023 – UK;
- DCLG, (2019); Indices of Multiple Deprivation, DCLG;
- HCA (2014); Additionally Guidance: 4th Edition 2014;
- HCA (2015); Employment densities guide (3rd Edition);
- Manchester City Council (MCC), (2009); City Wide Open spaces, Sport and Recreation Study;

- MCC, (2012); Manchester's Local Development Framework: Core Strategy Development Plan Document;
- MCC, (2016); Our Manchester, MCC;
- MCC, (2019a); Eastlands Regeneration Framework: A 2019 Update;
- MCC, (2019b); Greater Manchester's Plan for Homes, Jobs and the Environment (Greater Manchester Spatial Framework 2019 Draft);
- Ministry of housing, Communities and Local Government (MHCLG) (2016); Planning Practice Guidance, MHCLG;
- MHCLG (2019). The National Planning Policy Framework and Relevant Planning Practice Guidance, MHCLG;
- Office for National Statistics (ONS), (2011); Census 2011;
- ONS (2017); Annual Business Survey – Turnover data;
- ONS (2018); Business Register and Employment Survey (BRES);
- ONS (2019a). Population Projections for Local Authorities: Table 2, ONS; and
- ONS (2019b). Annual Population Survey, ONS.

9 Lighting

Introduction

9.1 This Chapter of the ES has been prepared by ME Engineers and assesses the likely Lighting impacts of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts and the likely residual impacts after these methods have been adopted.

9.2 This Chapter is accompanied by two technical appendices, an Exterior Lighting Assessment (Appendix 9.1) and a Highway Safety Assessment (Appendix 9.2) (prepared by Curtins).

9.3 The principal author of this chapter is Alexandra Kalimeri MSc Hons, Interim CEng. Alexandra is a Lighting engineer at ME Engineers with five years of experience.

Limitations and Assumptions

9.4 The baseline conditions described in paragraphs 9.23-9.31 have been established during a site visit on the 12 September 2019. Thus, they are specific to the lighting conditions that were current on that day.

9.5 The assessment has been undertaken based on the assumption that the final external lighting design will include technical/environmental performance characteristics and lighting selections that adhere to the performance characteristics described within the Exterior Lighting Assessment which forms Appendix 9.1.

9.6 For the purpose of this report it is assumed that the lighting conditions at the Site will remain the same if the Proposed Development is not built.

Legislative and Policy Context

9.7 The following paragraphs present Legislation, Policies and Guidance documents related to artificial lighting installations.

Legislation

9.8 Environmental Protection Act 1990 defines the light statutory nuisance from artificial lighting and includes guidance on suggested controls for local authorities for exterior lighting dependant on context.

National Planning Policy

9.9 Paragraph 180 of the National Planning Policy Framework (NPPF) (2019) states: *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: …limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

Guidance

9.10 The Planning Practice Guidance (PPG) makes the following references to light pollution:

- Paragraph 001 (Reference ID: 31-001-20191101) states, *"Artificial lighting needs to be considered when a development may increase levels of lighting, or would be sensitive to prevailing levels of artificial lighting. Artificial light provides valuable benefits to society, including through extending opportunities for sport and recreation, and can be essential to a new development. However, for maximum benefit, it is important to get the right light, in the right place and for it to be used at the right time."*

- Paragraph 002 (Reference ID: 31-002-20191101) states, *"Where necessary, development proposed in the vicinity of existing activities may need to put suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme, reflecting the agent of change principle."*
- Paragraph 003 (Reference ID: 31-003-20191101) suggests light spill *"can usually be completely avoided with careful lamp design selection and positions: lighting near or above the horizontal is usually to be avoided to reduce glare and sky glow (the brightening of the night sky), and good design, correct installation and ongoing maintenance are essential to the effectiveness of lighting schemes."*
- Paragraph 004 (Reference ID: 31-004-20191101) of the PPG considers the use of lighting only when required in order to minimize light pollution and reduce harm to wildlife, improving people's ability to enjoy the night sky. The PPG suggests that lighting schemes could be turned off when not needed ('part-night lighting') or reduced between the hours of midnight and sunrise. It also recommends turning off or down the lighting to avoid adverse effects during sensitive periods, e.g. bird migration.
- Paragraph 005(Reference ID: 31-005-20191101) of the PPG considers the character of the area and surrounding environment with reference to how these may affect what is considered to be an appropriate level of lighting for the type of development proposed. It cautions to avoid glare and an appropriate selection of lighting so that it fulfils its purpose without over-lighting.

9.11 British Standards (BS) provide criteria that are intended to set a standard of quality for goods and services. BS documents applicable to both commercial and residential development of relevance to lighting include the following:

- BS 5489-1:2013 – Code of practice for the design of road lighting – Part 1: lighting of roads and public amenity areas. This document provides guidance on the design of lighting for roads and public amenity areas for identification of requirements and how they should be considered.
- BS EN 13201-2:2003 – Code of practice the design of road lighting – Part 2: performance requirements. This document provides performance requirements for lighting installed for roads or public areas in the form of lux levels and uniformities.
- BS EN 12464-2:2007 Lighting of work places - Part 2: Outdoor work places. This document provides guidance for a variety of outdoor workplaces and the anticipated lighting requirements, in the form of lux levels and uniformities that are used as part of standard practice.

9.12 The relevant guidance documents which assist with defining acceptable standards and thresholds for exterior lighting installations include the following:

- Chartered Institute of Building Services Engineers (CIBSE)/Society of Light and Lighting (SLL) – Lighting Guide 6 – The Outdoor Environment (2016);
- CIBSE/SLL – Lighting Factfile 7 – Design and Assessment of Exterior Lighting Schemes (2011);
- CIBSE/ SLL – Lighting Handbook (2012);
- Institution of Lighting Professionals (ILP) – Guidance Notes for the Reduction of Obtrusive Light (2011) (the 'ILP Guidance');
- Institute of Lighting Professionals and the Bat Conservation Trust – Guidance Note 8 Bats and Artificial Lighting (2018)
- Secured by Design – Lighting Against Crime (2011);
- CIE 150:2003 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations;
- 'Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment - a Good Practice Guide' (DETR 1995 and 1998); and

- CIBSE TR24 – A Practical Guide to the Development of Public Lighting Policy for Local Authorities (2009).

9.13 The ILP's '*Guidance Notes for the Reduction of Obtrusive Light'* (GN02:2011) provides the basis for analysis when defining whether an installation will be obtrusive to the environment and neighbouring properties. It assists in quantifying and providing acceptable maximum threshold recommendations for light spill, sky glow and glare.

Assessment Methodology and Significance Criteria

9.14 A site visit was carried out to record the existing lighting conditions and assist with the identification of receptors who might experience significant effects in their lighting conditions. Table 9.1 lists the identified receptors and the reason for each selection. Figure 9.1 illustrates the location of the receptors.

Table 9.1 Lighting Receptors

Reference	Receptor type	Reason for Identification
R1	Philips Park Cemetery	Potential skyglow for indirect views
R2	Philips Park	Potential skyglow for indirect views
R3	Residential Properties (lower than two floors)	Glare and skyglow for indirect views
R4	Residential Properties (higher than two floors)	Potential direct views to the Site, glare and skyglow for indirect views
R5	Ashton Canal	Potential effect of exterior lighting to wildlife habitat and species
R6	Site boundary	Potential effect of exterior lighting to wildlife habitat and species
R7	Alan Turing Way	Potential Light Spill on the highway above the required light levels for this type of road

9.15 By their nature, the effects which are assessed as part of a new or changed lighting installation are direct and reversible.

9.16 The lighting assessment at Appendix 9.1 includes an indicative layout with references for the suggested luminaires as well as diagrams showing the horizontal and/ or vertical illuminance at critical locations as produced by the lighting simulation.

9.17 The impact of a new or changed lighting condition on each receptor can be described in qualitative terms as a function of the magnitude of the change and the sensitivity of the receptor.

9.18 The magnitude of the impact of changes in the lighting conditions for each receptor can vary from Major to Negligible and the effect is evaluated based on the criteria presented in Table 9.2.

Table 9.2 Impact Magnitude

Magnitude of Impact	Criteria for assessing impact
Major	Increases or decreases to the local lighting condition are expected to be extensive, unmistakable and noticeable. Often this is linked to negative change which may be considered to be highly intrusive where the appearance, characteristics and effects of an installation to identified receptors may contribute to disruption, abandonment or predation to local wildlife / habitat and disruption or discomfort to local residents.
Moderate	Increases or decreases to the local lighting condition are expected to be noticeable, distinct, but not always intrusive. Change to the lighting condition affecting the appearance, characteristics and effects of an installation to identified receptors.

Magnitude of Impact	Criteria for assessing impact
Minor	Small change to an existing lighting condition or new lighting condition creates only a low level of change or new effects to identified receptors. An increase or decrease in brightness, sky glow, light spill or glare is expected to be noticeable but not to a high degree.
Negligible	No perceptible change to the local area lighting condition, barely noticeable increase or decrease in brightness, light spill, local area sky glow or glare. Meets good practice lighting criteria and is considered the equivalent of no change to identified receptors

9.19 The sensitivity of a receptor to changes in the lighting conditions vary from high to low. The effect of the change is described in Table 9.3.

Table 9.3 Receptor Sensitivity

Sensitivity	Receptors
High	Residential buildings with minimal to no baseline exposure to lighting in a typically rural environment and habitats with a high level of light sensitive ecology or protected/sensitive species frequently found utilising a Site for commuting/foraging. There is generally no if not low exposure to lighting, and street lighting is expected to be strictly regulated or not required. Instances of street lighting may be in use part-night or throughout the full night and during dusk and dawn periods. All other lighting is expected to be off, or be dimmed, between the hours of midnight (00:00) to 05.00, or other agreed dark period.
Moderate	Residential buildings with baseline exposure to a moderate amount of lighting in a typically urban environment, land used by sensitive/protected species for foraging/commuting activities and habitats with moderate level of light sensitive ecology. There is generally low to moderate exposure to lighting other than street lighting which is regulated, often including dusk and dawn periods, but typically off between the hours of midnight (00:00) to 05.00, or another agreed dark period.
Low	Industrial buildings, buildings with no windows, places that do not support habitat or foraging. There may be a high exposure to lighting other than statutory lighting during night time hours, including dusk, dawn and midnight (00:00) to 05.00.

9.20 Significance criteria, are used to evaluate the likely effects of a lighting condition for identified receptors given their sensitivity and the magnitude of the change experienced.

9.21 Each receptor can be assigned with a significance level from the impact significance matrix described in Table 9.4.

9.22 An effect is considered to be significant in EIA terms if it is moderate or major.

Table 9.4 Impact Significance Matrix

Magnitude	Sensitivity		
	High	Moderate	Low
Major	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Baseline Conditions

9.23 To obtain the baseline lighting conditions within the immediate surrounding of the Site, a survey was carried out on 12th of September 2019. The survey was carried out during low-light hours (21.30-00.00).

9.24 Lighting measurement locations are shown on Figure 9.2. Measurements were taken at a distance up to 500m from the Proposed Development. Measurement points are set at circa 40m to 50m intervals in the immediate surrounding- 150m radius- of the Site (points 11 to 25). Further measurements were taken at areas where residents are most likely to be affected within a 500m radius of the Proposed Development. This primarily focuses on the residential buildings to the north of Viaduct Road (points 5 to 8) and to the south of Philips Park (points 26 to 29) as indicated above.

9.25 Where measurement points are located local to residential properties, the readings are taken as close to the residential boundary as possible whilst keeping within the public realm.

9.26 The baseline light level readings are described in Table 9.5.

Table 9.5 Baseline Conditions- Light Levels Readings

Point	GPS Coordinates	Illuminance		
		Horizontal	Vertical	
			Towards the Site	Away from the Site
1	53°28'54"N 2°12'12"W	30.12	11.71	5.06
2	53°29'02"N 2°12'20"W	4.50	0.32	2.37
3	53°29'04"N 2°12'21"W	14.61	1.61	-
4	53°29'08"N 2°12'22"W	10.43	0.33	-
5	53°29'18"N 2°12'18"W	4.52	7.92	0.31
6	53°29'20"N 2°12'21"W	4.43	6.06	-
7	53°29'22"N 2°12'18"W	4.05	26.05	-
8	53°29'25"N 2°12'11"W	13.72	10.63	6.56
9	53°29'21"N 2°12'03"W	30.21	10.56	11.01
10	53°29'23"N 2°12'03"W	10.08	6.41	-
11	53°29'14"N 2°11'55"W	17.93	3.66	-
12	53°29'13"N 2°11'57"W	2.34	0.38	2.22
13	53°29'13"N 2°12'00"W	12.58	0.51	8.79
14	53°29'13"N 2°12'02"W	36.53	1.21	22.02
15	53°29'12"N 2°12'05"W	51.35	0.90	21.51
16	53°29'11"N 2°12'05"W	12.24	0.32	2.93
17	53°29'10"N 2°12'04"W	32.62	0.85	8.45
18	53°29'08"N 2°12'04"W	11.99	3.42	4.47
19	53°29'08"N 2°12'01"W	4.02	1.00	0.22
20	53°29'08"N 2°11'58"W	4.32	0.98	0.54
21	53°29'08"N 2°11'58"W	9.01	25.41	0.28
22	53°29'08"N 2°11'55"W	3.43	7.23	0.67
23	53°29'09"N 2°11'53"W	5.36	2.51	2.45
24	53°29'11"N 2°11'54"W	1.23	1.61	0.19
25	53°29'12"N 2°11'55"W	2.42	0.07	1.6
26	53°29'09"N 2°11'51"W	3.92	0.26	2.65
27	53°29'09"N 2°11'51"W	3.43	1.17	0.23
28	53°29'13"N 2°11'43"W	10.81	0.28	0.15
29	53°29'13"N 2°11'30"W	11.80	16.04	6.67
30	53°28'54"N 2°11'41"W	13.57	2.73	8.35

9.27 The ILP Guidance recommends that the immediate environment is classified according to specific Environmental Zone Criteria for light nuisance into windows. The criteria are defined in Table 9.6.

Table 9.6 Environmental Zone Criteria

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low district brightness	Village or relatively dark outer suburban location
E3	Suburban	Medium district brightness	Small town centres or suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

9.28 The Site is considered to belong to an E3 Suburban Environmental Zone. It is surrounded by Joe Mercer Way, Sportcity Way and Alan Turing Way, which are all well-lit. The path adjacent to Ashton Canal is lit by lighting columns. The residential areas south of Ashton New Road and west of New Viaduct Street are obstructed from direct view to the Site by existing structures and landform respectively.

9.29 The Proposed Development will introduce functional lighting to illuminate the public realm, façade lighting as well as three media screens and two illuminated signs at the fifth level of the Proposed Development. The lighting installation is described in Appendix 9.1.

9.30 The Proposed Development is located in an area with high street light levels and is situated adjacent to buildings with high intensity light sources (including the Etihad Stadium, Manchester Regional Arena). Thus the night time image of the area has already been affected by existing development.

9.31 For the purposes of this assessment it is assumed that the future baseline in the event of the Site not being developed would remain the same as the existing lighting condition.

Identification and Evaluation of Significant Effects

Construction Phase Effects

9.32 Artificial lighting will be required during the construction phase at early evening hours while works are carried out. Low illuminance safety lighting will be operating after working hours. The effect would be temporary and variable depending on the location of the construction activity in relation to each receptor. It is considered that the magnitude of change will be minor and the significance of the effect will be **minor adverse / negligible** for all recipients.

Operational Phase Effects

9.33 The effects of the Proposed Development at each identified receptor location is described below.

Areas of low illuminance

9.34 Receptors R1 and R2: Philips Park Cemetery and Philips Park are both areas of low illuminance and high sensitivity. Figure 9.7 in technical Appendix 9.1 illustrates the light spill in the area surrounding the new development. There will be no light spill of the Proposed Development to receptors R1 and R2 as indicated by the orange highlight on Table 9.7 and Table 9.8.

Table 9.7 Operational effect of Proposed Development on Philips Park Cemetery- Receptor R1

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Table 9.8 Operational effect of Proposed Development on Philips Park- Receptor R2

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Residential receptors

9.35 While operational the Proposed Development will have very limited visual impact on direct views of the Site from most residential properties east of Alan Turing Way with respect to skyglow (receptor R3). Residencies right east of Alan Turing Way will be impacted by direct views of the Site. Considering a carefully implemented new lighting installation, the effects of light spill and glare (luminaire source intensity) are considered to be **negligible**, as demonstrated by the orange highlight on Table 9.9. Residences at R4 are considered to have a High sensitivity to new lighting installations, effects are considered to be **Moderate Adverse without mitigation**, as demonstrated by the orange highlight on Table 9.10.

Table 9.9 Operational effect of Proposed Development on residencies - Receptor R3

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial

Magnitude	Sensitivity		
	High	Moderate	Low
Minor	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Table 9.10 Operational effect of Proposed Development on residencies - Receptor R4

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Moderate Adverse	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Minor Adverse	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Wildlife/Habitat Receptors

9.36 Wildlife or habitat receptors are species that are generally found local to the Site with reference to the ecological survey.

9.37 The highest potential for wildlife/habitat occurs in areas of dense planting and local wetlands and waterways which occur, primarily at the Ashton Canal Corridor, but potentially also within the Site boundary.

9.38 Wildlife – Habitat/Foraging: Wildlife using the Site or Ashton Canal as habitat or for foraging, are expected to have a 'Medium' to 'High' sensitivity to a change in lighting condition.

9.39 Figure 9.10 in technical Appendix 9.1 presents the light spill in the area above the canal (Calculation surface No.1, 2, 5 and 7). The light spill from the new development to the canal will be **negligible**.

Table 9.11 Operational effect of Proposed Development on Ashton canal - Receptor R5

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Table 9.12 Operational effect of Proposed Development on site boundary wildlife - Receptor R6

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Minor Adverse	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Motorised Traffic Routes

9.40 Excess light spill onto a motorised traffic route may raise the light levels beyond the suggested values and lower the light uniformity.

9.41 Figure 9.10 in technical Appendix 9.1 presents the light spill on Allan Turing Way (Calculation surface No.3). The light spill from the new development on the highway will be **negligible**.

Table 9.13 Operational effect of Proposed Development on Alan Turing Way - Receptor R7

Magnitude	Sensitivity		
	High	Moderate	Low
Substantial	Major Adverse-Beneficial	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial
Moderate	Major- Moderate Adverse-Beneficial	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial
Minor	Moderate- Minor Adverse-Beneficial	Minor Adverse-Beneficial	Minor- Negligible
Negligible	Negligible	Negligible	Negligible

Mitigation Measures

9.42 During construction, compound locations would require careful siting to minimise light pollution. The lighting installation should be designed following relevant lighting standards and guidance as set in paragraphs 9.8 to 9.12 to provide sensitive and appropriate lighting techniques and luminaire selections.

9.43 During operation, the lighting installation will be based on requirements set at relevant standards and suggestions by guidelines and good practice documents. The installation of a lighting control system that will allow the lighting installation to dim depending on daylight availability, will minimise the magnitude of the effect from Moderate Adverse to Negligible for the R3 and R4 receptors. With these control measures in place, no further mitigation is expected to be required.

Cumulative Effects

9.44 Although the construction and operational installations will be designed to respect and maintain the integrity of an environmental zoning categorisation of E3 and will be designed to meet best practice standards, there is the potential of additional increase in the night time lighting condition in the vicinity. From the committed developments which are within a 1km radius of the Site and are currently under consideration by the Local Planning Authority the extension of

Etihad Stadium is the one that might have the biggest impact. Mitigation through design measures such as careful selection of luminaires, implementation of lighting control devices and restricted operational hours (e.g. curfews) adapt usage and will result in a negligible to minor adverse change to the ambient night time lighting condition.

Residual Effects

9.45 With the implementation of the mitigation measures described above, it is anticipated that there will not be any additional residual effects.

Table 9.14 Summary of Receptors, Likely Significant Effects, Mitigation Measures, and Residual Effects

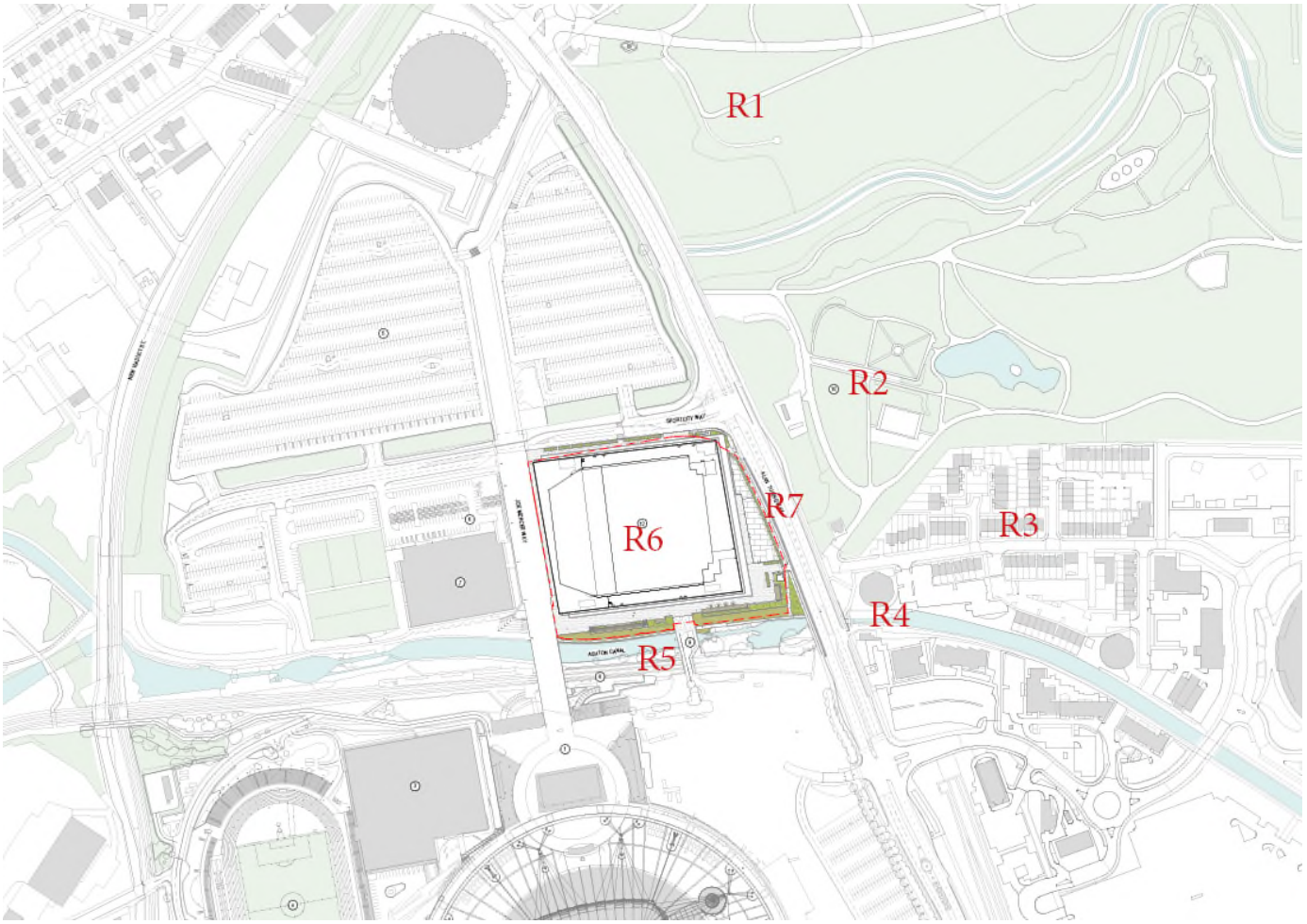
	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Construction	R1- Philips Park Cemetery	Negligible	-	Design	Negligible Temporary
	R2- Philips Park	Negligible	-	Design	Negligible Temporary
	R3- Residential Properties	Negligible	-	Design	Negligible Temporary
	R4- Residential Properties	Negligible	-	Design	Negligible Temporary
	R5- Ashton Canal	Negligible	-	Design	Negligible Temporary
	R6- Site boundary	Negligible	-	Design	Negligible Temporary
	R7- Alan Turing Way	Negligible	-	Design	Negligible Temporary
Operational	R1- Philips Park Cemetery	Negligible	-	Design	Negligible Permanent
	R2- Philips Park	Negligible	-	Design	Negligible Permanent
	R3- Residential Properties	Negligible	-	Design	Negligible Permanent
	R4- Residential Properties	Moderate-Adverse	Lighting Control System	Lighting Control-Dimming lighting	Negligible Permanent
	R5- Ashton Canal	Negligible	-	Design	Negligible Permanent
	R6- Site boundary	Minor- Adverse	Lighting Control System	Lighting Control-Dimming lighting	Negligible Permanent
	R7- Alan Turing Way	Negligible	-	Design	Negligible Permanent

Reference List

9.46 This ES Chapter has been prepared by reference to the following:

- Environmental Protection Act 1990
- National Planning Policy Framework 2019

- Planning Practice Guidance 2019
- BS 5489-1:2013 Code of Practice for the design of road lighting
- EN 12464-2 Lighting of work places (Outdoor work places)
- EN 13201-2-2003 Road Lighting - Performance Requirements
- CIBSE- SLL LG06 Outdoor Lighting
- CIBSE- SLL Factfile 7 Design and Assessment of Exterior Lighting Schemes (2011)
- CIBSE/ SLL – Lighting Handbook
- Institution of Lighting Professionals (ILP) – Guidance Notes for the Reduction of Obtrusive Light (2011)
- Institute of Lighting Professionals and the Bat Conservation Trust – Guidance Note 8 Bats and Artificial Lighting (2018)
- Secured by Design – Lighting Against Crime (2011)
- CIE 150:2003 Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations
- 'Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment - a Good Practice Guide' (DETR 1995 and 1998)
- CIBSE TR24 – A Practical Guide to the Development of Public Lighting Policy for Local Authorities (2009)



R1 Philips Park Cemetery
R2 Philips Park
R3 Residencies
R4 Residencies
R5 Ashton Canal
R6 Site
R7 Alan Turing Way

	Figure:	**9.1**		
	Title:	**Location of Identified Sensitive Receptors**		
	Project:	**OVG Manchester**		
	Date:	**16.12.2019**	**Scale:**	**Scale /NTS**

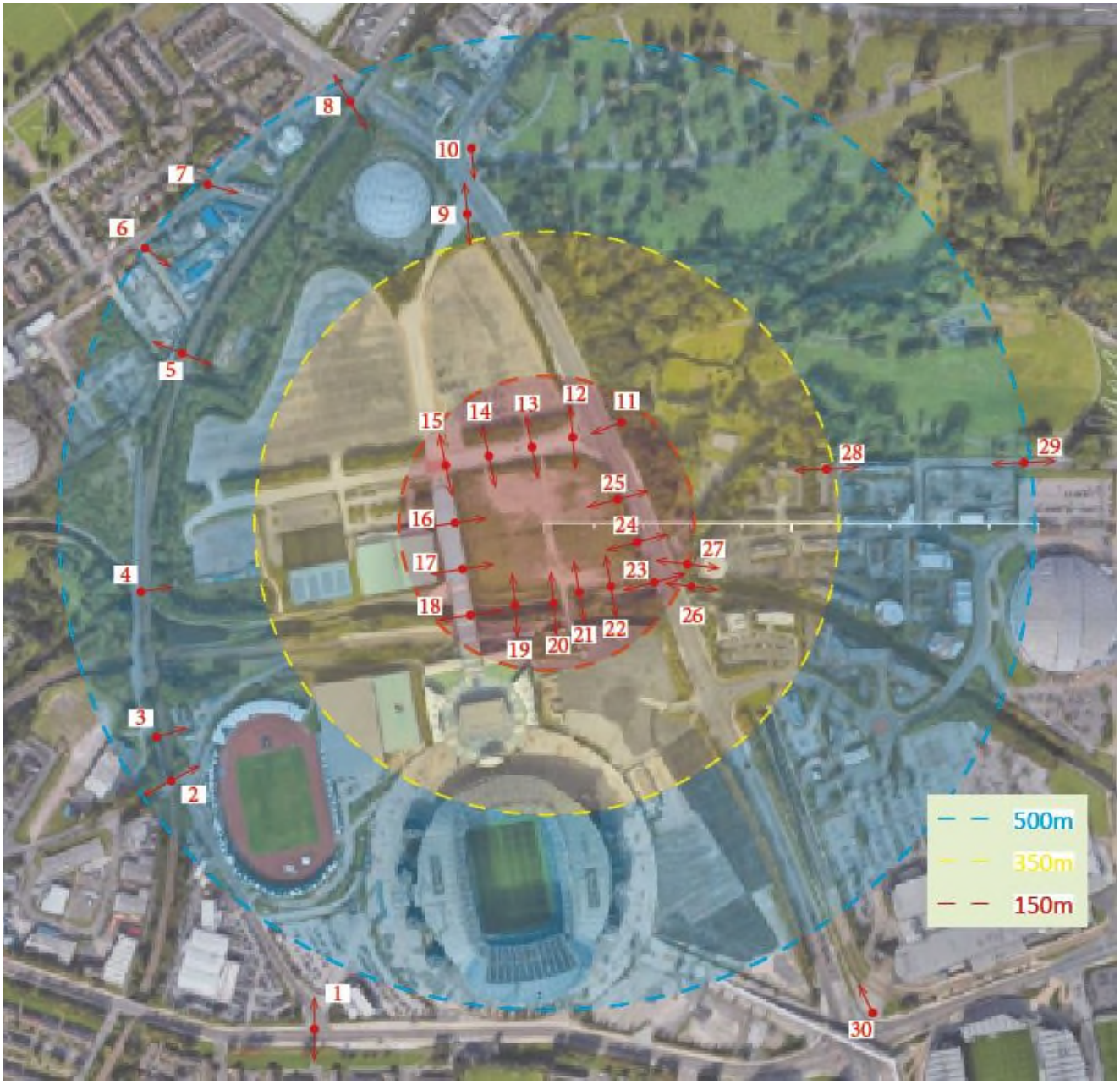


	Figure:	**9.2**		
	Title:	**Baseline condition- Lighting measurement locations**		
	Project:	**OVG Manchester**		
	Date:	**16.12.2019**	**Scale:**	**Scale /NTS**

10 Noise and Vibration

Introduction

10.1 This Chapter of the ES has been prepared by BuroHappold and assesses the likely noise impacts of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts and the likely residual impacts after these methods have been adopted.

10.2 This Chapter is accompanied by four technical appendices:

- Noise Survey Results (Appendix 10.1);
- Construction Noise Assessment (Appendix 10.2);
- Construction Traffic Noise (Appendix 10.3); and
- Operational Traffic Noise (Appendix 10.4).

10.3 This report's author holds a BSc (Hons), PGDip, and is a full member of the Institute of Acoustics.

Limitations and Assumptions

10.4 It is considered good practice (and is required in certain standards such as BS 4142:2014) to consider the degree of uncertainty inherent in any engineering calculations or predictions as well as details of difficulties (for example, technical deficiencies or lack of knowledge). Uncertainty should be reported and minimised wherever possible. Professional engineering consultants should acknowledge that all calculation-based modelling practices are ultimately an approximation (and this is reflected in standards such as BS 4142:2014).

10.5 However, rather than ignore this fact or consider the results absolute, it is considered good practice to honestly report factors which can affect the robustness of any assessment. The following is considered relevant to the project.

Distance and ground conditions

10.6 Ultimately, algorithms used to calculate distance attenuation are approximations. However, within all calculations, ground absorption and diffusion (which can be helpful in terms of attenuating sound with distance) have been set to pessimistic levels (i.e. assuming reflective ground).

10.7 In this way, a worst-case scenario can be modelled, increasing the robustness of the assessment.

Instrumentation

10.8 The instrumentation used is calibrated by UKAS-approved laboratories in accordance with the required schedule of frequency. It is, however, noted that the degree of measurement tolerance of most Class 1 sound level analysers is approximately 1-2 dB, meaning that two independently verified meters could measure the same sound level and report marginally differing values.

10.9 There is little that can realistically be done to avoid this phenomenon; however, this supports the assertion that professional judgement must be used in concert with quantitative values when making conclusions in support of the assessment.

Construction methodology

10.10 The construction methodology, plant selections and specific procedures on the Site have not been defined at this stage. An Outline Construction Management Plan by Turner and Townsend dated January 2020 (Appendix 5.1) provides a preliminary construction plan so that assumptions can be made regarding the likely activities and the type of machinery to be used during the site development.

Noise sensitive receptors

10.11 Receptors have been selected to account for existing receptors and any residential developments in the area that are currently under construction or are approved for development and which will be completed during the operational development construction phase of the Proposed Development.

Cumulative assessment

10.12 Due to distance attenuation, the only schemes that have been considered for the cumulative assessment are those within 200 m of the Proposed Development red line boundary. As no development falls within the 200 m radius from the Proposed Development, the cumulative noise and vibration effect can be assumed to have a negligible significance of effect.

Range of Events

10.13 It is expected that events in the opening year of 2023 will be in the region of 120 No. events and increasing to approximately 180 events by the year of 2026. The assessment of noise and vibration has been completed based on 180 No. events a year at the Proposed Development to represent the expected upper end of event numbers.

Legislative and Policy Context

10.14 This ES chapter has been considered in the context of up to date planning policy, as follows.

National Planning Policy

- National Planning Policy Framework (2019);
- The Noise Policy Statement for England (2010); and
- National Planning Practice Guidance on Noise (2019).

Local Planning Policy

- Manchester Core Strategy, Saved Policies of the UDP (2012)
- Manchester City Council (MCC), Planning and Noise, Technical Guidance (2015)

Relevant British Standards

- British Standard 4142:2014 Method for rating and assessing industrial and commercial sound;
- British Standard 7385:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration;
- British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting;
- British Standard 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise;
- British Standard 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration; and
- British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.

Other policy and guidance

- World Health Organisation (WHO), Guidelines for community noise (1999);
- Calculation of Road Traffic Noise (CRTN);
- Design Manual for Roads and Bridges (DMRB);
- CALTRANS transportation and construction induced vibration guidance manual (2013); and
- Institute of Environmental Management & Assessment (IEMA), Guidelines for environmental noise assessment (2014).

Assessment Methodology and Significance Criteria

EIA scoping

10.15 The approach to the assessment methodology has been agreed through an EIA Scoping process with MCC.

10.16 The residential properties which could potentially be affected are to the north, east and west of the Proposed Development, and are listed below (OS coordinates in brackets):

- Stuart Street (53.486018, -2.197371);
- Gibbon Street (53.485470, -2.196978);
- Broxton Street (53.489298, -2.204154); and
- Briscoe Lane (53.489879, -2.201055).

10.17 The scoping opinion for the development from MCC (dated 15 January 2020, ref. JA/DMN) states, "*Impact on the canal corridor and infrastructure should also be considered within this assessment in order to determine any potential impacts from vibrations and machinery during the construction phase given that vibrations could undermine the stability of associated infrastructure*". As such, this has been addressed in this assessment

10.18 A map of the Site is provided for reference in Figure 10.1.

Baseline study methodology

10.19 Noise monitoring surveys were undertaken to determine the existing background noise levels near the identified noise sensitive receptors (NSRs) and at the proposed site boundary. As such, measured traffic noise data has been used for baseline assessments. The attended and unattended surveys were carried out from Tuesday 18 June 2019 at 11:00 hours to Wednesday 20 June 2019 at 11:00 hours, at Locations 1, 2 and 3 (as presented in Figure 10-2). These dates and times were chosen to measure noise levels during an event (Metallica concert on the evening of the 18th June 2019) at the nearby Etihad stadium. These measurements are considered worst-case for the Proposed Development including consideration of football matches which are likely to have a lower attendance and limited use of sound systems i.e. lower noise level generation. However, where 'baseline' noise levels have been presented, these have been chosen according to noise levels when there was no event at the Etihad i.e. baseline conditions. The measurements were conducted with the microphone positioned on a tripod and located approximately 1.5 m above ground level. Results from this noise survey can be found in Appendix 10.1.

10.20 The measurements were conducted using a Class 1 sound level meter, which was calibrated before and after the measurements. No significant drift was observed. The meter was set to record the noise levels in 15-minute intervals. Weather conditions during the surveys were generally dry with periods of precipitation, temperature approx. 15°C, and wind speeds up to 10 m/s (occasionally gusty).

10.21 As the Proposed Development is located more than 25 m from the nearest greatest source of vibration, i.e. the Metrolink line to the south, it is expected that vibration impact will be negligible in terms of the impact upon the building. This follows BS 5228-2 advice that indicates that vibration activities are generally only considered when located 20 m or less from sensitive locations. As such, a pre-development baseline vibration survey has not been undertaken.

Assessment Approach

10.22 This ES chapter has been undertaken in accordance with best practice and has been informed by the guidance documentation described in the following Section "Assessment of effect". Specific guidance has been referenced within each of the assessments. Effect prediction has used a range of recognised calculation and modelling methodologies, which have been coordinated through the use of standard acoustic theory.

10.23 The assessment methodologies include:

Construction noise

- Construction noise prediction methodology (ABC method of BS 5229-1, 2009);
- Construction noise significance (Annex E of BS 5228-1, 2009);
- Construction vibration significance (BS 5228-2:2009+A1:2014; and,
- Construction traffic noise prediction methodology (Design Manual for Roads and Bridges, 2011).

Operational noise environmental impact

- Mechanical plant and equipment prediction method (BS 4142, 2014);
- Traffic noise prediction methodology (Design Manual for Roads and Bridges, 2011, "DMRB"); and
- Internal and external noise criteria from external noise sources (BS 8233, 2014; IEMA Noise Impact Assessment, 2016; and the World Health Organisation's "guidelines for community noise" (WHO).

10.24 This assessment considers the potential effect on the surrounding area from noise and vibration during the construction and operational phases of the Proposed Development.

10.25 The methodology for assessing the significance of effect is based on the sensitivity of the receptor and the numerical difference between the baseline level and predicted level.

Assessment of effects

Receptor sensitivity

10.26 The criteria used to assess receptor sensitivity is described in Table 10.1.

Table 10.1 Criteria for determining receptor sensitivity

Sensitivity	Criteria
High	The receptor has little ability to absorb change without altering its present character, or it is of international or national importance. Examples: Residential properties, hospitals, care homes, hotels, schools, universities, research facilities, national parks.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, or it is of high importance. Examples: Offices, shops, outdoor amenity spaces (e.g. parks and gardens), long distance footpaths, doctor surgeries, sport facilities, places of worship.
Low	The receptor is tolerant to change without detriment to its character, or it is of low or local importance. Examples: Warehouses, light industry, car parks, agricultural land.
Negligible	Heavy industry, motorways and railway line.

10.27 For the assessment of the Proposed Development, high sensitivity receptors have been assessed to identify the worst-case impacts. Other moderate / low / negligible sensitivity receptors are the same distance or further away than the identified high sensitivity receptors, and therefore as long as residential receptors are not adversely affected then less sensitive receptors will also not be adversely affected.

10.28 For this assessment the canal side is considered a low sensitivity receptor with regard to construction vibration effects.

Identified receptors and their sensitivity

10.29 The identified closest high sensitivity receptors along with their noise and vibration sensitivities are identified in Figure 10.2 and presented in Table 10.2.

Table 10.2 Identified receptors and their sensitivity

NSR #	Receptor	Sensitivity	Justification
A	Stuart Street	High	Residential
B	Gibbon Street	High	Residential
C	Broxton Street	High	Residential
D	Briscoe Lane	High	Residential

Note that moderate / low / negligible sensitivity receptors have not been identified in Figure 10.2 and Table 10.2 for the reasons stated in paragraph 10.27 above.

Magnitude of change / impact

10.30 The criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, are described in Table 10.3.

Table 10.3 Criteria for determining magnitude of change / impact

Magnitude	Criteria
Large	Total loss or major / substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character / composition / attributes will be fundamentally changed.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character / composition / attributes of the baseline will be materially changed.
Small	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible / detectable but not material. The underlying character / composition / attributes of the baseline condition will be similar to the pre-development circumstances/situation.
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

10.31 Table 10.4 presents a summary of the quantitative criteria used to assess the magnitude of impact of each assessment.

Table 10.4 Summary of criteria for determining the magnitude of impact

Magnitude	Criteria	
	Construction	**Operational**
Large	• **Construction noise:** +10.0 dB > Assessment category • **Construction traffic:** 5.0 dB or more - $L_{A10,18hours}$ noise change • **Construction vibration on humans:** 10 mm·s-1 PPV or more • **Construction vibration on buildings**: Greater than: – 60 mm/s at 4 Hz increasing to 80 mm/s at 15 Hz – 80 mm/s at 15 Hz increasing to 200 mm/s at 40 Hz and above	**Operational traffic:** 10.0 dB or more - $L_{A10,18hours}$ noise change **Operational noise:** +10.0 dB or more
Medium	• **Construction noise:** 5.0 to 10.0 dB > Assessment category • **Construction traffic:** 3.0 to 4.9 dB - $L_{A10,18hours}$ noise change • **Construction vibration on humans:** 1.0 mm·s-1 PPV or more	**Operational traffic:** 5.0 to 9.9 dB - $L_{A10,18hours}$ noise change **Operational noise:** 5.0 to 10.0 dB or more

Magnitude	Criteria	
	Construction	**Operational**
	• **Construction vibration on buildings**: Greater than: – 30 mm/s at 4 Hz increasing to 40 mm/s at 15 Hz – 40 mm/s at 15 Hz increasing to 100 mm/s at 40 Hz and above	
Small	• **Construction noise:** 3.0 to 5.0 dB > Assessment category • **Construction traffic:** 1.0 to 2.9 dB - $L_{A10,18hours}$ noise change • **Construction vibration on humans:** 0.3 to 1.0 mm·s-1 PPV • **Construction vibration on buildings**: Greater than: – 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz – 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above	**Operational traffic:** 3.0 to 4.9 dB - $L_{A10,18hours}$ noise change **Operational noise:** 0.0 to 5.0 dB
Negligible	• **Construction noise:** 1.0 to 3.0 dB > Assessment category • **Construction traffic:** 0.1 to 0.9 dB - $L_{A10,18hours}$ noise change • **Construction vibration on humans:** 0.14 to 0.3 mm·s-1 PPV • **Construction vibration on buildings**: Lower than: – 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz – 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above	**Operational traffic:** 0.1 to 2.9 dB - $L_{A10,18hours}$ noise change **Operational noise:** -10.0 (or less) to 0.0 dB
No change	• **Construction noise:** < Assessment category • **Construction traffic:** 0.0 dB - $L_{A10,18hours}$ noise change	**Operational traffic:** 0.0 dB - $L_{A10,18hours}$ noise change

Significance evaluation

10.32 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 10.5.

Table 10.5 Matrix for determining effect significance

		Magnitude of change / impact			
		Large	**Medium**	**Small**	**Negligible**
Receptor sensitivity	**High**	Major	Major	Moderate/Minor	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate/Minor	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

10.33 Note that moderate and major effects are considered to be 'significant' for the purposes of this assessment.

10.34 Effects can also be described, for example, as:

- Beneficial or adverse;
- Permanent or reversible;
- Short, medium or long term; and

- Significant (major or substantial) or insignificant (indiscernible or minor).

Baseline Conditions

Current baseline

10.35 The Site is positioned to the north of the Sportcity, Etihad Campus, Manchester. It is bounded by Sportcity Way to the north, Alan Turing Way to the east, the Ashton Canal to the south, and Joe Mercer Way to the west. Additionally, the 60,000 capacity Etihad Stadium is to the south of the Site, Manchester Tennis and Football Centre to the west, National Squash Centre to the south-west, and the Metro tram stop for Sportcity, Etihad Campus to the south.

10.36 The residential properties which could potentially be affected by the proposed works are to the north, east and west of the Proposed Development, and are listed below (OS coordinates in brackets):

- Stuart Street (53.486018, -2.197371);
- Gibbon Street (53.485470, -2.196978);
- Broxton Street (53.489298, -2.204154); and
- Briscoe Lane (53.489879, -2.201055).

10.37 The assessment baseline is considered to be the noise and vibration climate in the area just before the scheme commences construction.

10.38 Figure 10.2 outlines the location of the noise survey measurement positions that are described in the following sections.

Short-term Measurement Position 1 (ST-1) – Joe Mercer Way

10.39 The noise climate at this location was found to be subjectively quiet. Noise sources noted on site were road traffic from Alan Turing Way and Metrolink movements from the nearby Etihad Campus stop. Intermittent noise events included PA announcements from the Metrolink stop and airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way.

Short-term Measurement Position 2 (ST-2) – Sportcity Way

10.40 The noise climate at this location was found to be subjectively quiet. Intermittent noise events included noise from metal road ironmongering (when driven over) and from airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way.

Short-term Measurement Position 3 (ST-3) – Stuart Street (NSR)

10.41 The noise climate at this location was subjectively found to be moderately loud. Noise sources noted on site were road traffic on Alan Turing Way and Metrolink movements from the nearby tramline. Intermittent noise events included PA announcements from the Metrolink stop and airplanes overhead. The dominant noise source is considered to be road traffic noise from Alan Turing Way.

Long-term Measurement Position 1 (LT-1) – Alan Turing Way

10.42 A long-term survey was carried out over 48 hours at the south east corner of the proposed site opposite the NSR on Alan Turing Way (see Figure 10.2).

10.43 A full set of results from the noise survey can be found in Appendix 10.1. However, Table 10.6 summarises the baseline noise level data that is used in this assessment.

Table 10.6 Baseline noise level data used in the assessment

Measurement Position	$L_{Aeq,T}$ - dBA	$L_{AF,max}$ - dBA	$L_{A90,T}$ - dBA
	Daytime (07:00 – 23:00 hours)		
ST-1	51	67	48
ST-2	60	77	50

Measurement Position	$L_{Aeq,T}$ - dBA	$L_{AF,max}$ - dBA	$L_{A90,T}$ - dBA
ST-3	63	74	56
LT-1	69	81	57
Night-time (23:00 – 07:00 hours)			
LT-1	63	79	45

Future baseline - 2026 (without the development in place)

10.44 The future baseline conditions in absence of the Proposed Development are considered to be as follows. If the development did not go ahead, site conditions could experience these changes:

- Buildings/infrastructure development;
- Tramlines are likely to be busier; and,
- Potential for higher noise levels across site due to busier roads.

10.45 It is expected that events in the opening year (2023) will be in the region of 120 No. event, increasing to approximately 180 No. events by 2026. The assessment has therefore been undertaken using the anticipated upper end of 180 No. events in 2026.

10.46 It is likely that there would be minimal differences between "with development" and "do nothing" approach for noise in terms of the impact on the local area.

Identification and Evaluation of Significant Effects

Construction effects

10.47 Construction has the potential to generate high levels of noise and vibration through activities such as material movements, earthworks, ground improvement and piling, crushing and breaking. These activities have been assessed in Appendix 10.2. It is understood that the Site is currently an overspill surface level car park without any structures; as such this report does not require assessment of any demolition of buildings.

10.48 As the Proposed Development is located more than 25 m from the nearest residential receptor, i.e. the residential buildings to the east, it is expected that vibration impact will be negligible to residents and residential buildings in terms of ground-borne noise and vibration due to piling works This follows BS 5228-2 advice that indicates that vibration activities are generally only considered when located 20 m or less from sensitive locations. As such, a pre-development baseline vibration survey and assessment has not been undertaken.

10.49 In addition, scoping opinion for the development from MCC (dated 15 January 2020, ref. JA/DMN) states, *"Impact on the canal corridor and infrastructure should also be considered within this assessment in order to determine any potential impacts from vibrations and machinery during the construction phase given that vibrations could undermine the stability of associated infrastructure".*

10.50 For the purposes of this assessment, historical data found in BS 5288-2, has been used to determine the likely vibrational impact from piling activities on the nearest part of the canal side retaining wall.

10.51 It is understood that bored piling works, or similar high energy vibrational activities, will be taking place no less than 9 m from the canal corridor to the south of the development. Furthermore, it is understood that the site geology is rock with a shallow top layer of clay. Rock in this instance is considered a worst-case assessment.

10.52 Table 10.7 presents an example from BS 5228-2 equivalent to the activities proposed on-site, and applicable to this assessment.

Table 10.7: Case history data on vibration levels measured during impact rotary piling (source: BS 5228-2)

Year and location	Soil conditions	Pile dimensions	Mode	Plan distance	Measured peak particle velocity (PPV)
1982 Halifax (W. Yorks)	Loose rock fill over weathered rock over rock	500 mm diameter 15 m to 17 m depth	Boring	10 m	0.8 mm/s
			Base ramming	10 m	1.5 mm/s

10.53 Magnitude of impact is considered negligible for proposed piling activities to the nearest canal side wall based on the example above and criteria for vibrational effect on buildings (see Table 10.4) i.e. vibrational levels are expected to be significantly below 15 mm/s at 4 Hz and 20 mm/s at 15 Hz at a distance of 9 m from piling activities.

10.54 For this assessment Ashton Canal is considered a low sensitivity receptor as detailed in Table 10.1. As such, the effect of significance of piling activities on Ashton Canal is considered to be negligible.

Table 10.8: Significance of effect due to construction activities – Vibration

NSR #	Receiver sensitivity	Site Preparation	General site activities
E – Ashton Canal	Low	Negligible	Negligible

10.55 Construction vehicle movements also have the potential to generate noise, although typically the increase in road traffic associated with construction is minor, particularly in comparison to heavily trafficked roads such as those in the vicinity of the Site.

10.56 Construction work operations are usually characterised by temporary increases in ambient noise levels, which may result in short-term disturbance to nearby receptors, including an increase of traffic noise levels due to construction traffic. Likewise, ground-borne vibration can lead to human disturbance and/or building damage.

10.57 Some of the existing noise-sensitive receptors which have already been identified are around the boundaries of the Site, the residential areas being the ones more prone to suffer from construction disturbances. These impacts will be most significant during the early stages of the project, for example during groundworks, and sub and superstructure work of the Proposed Development. However, residential receptors are noted as being located at large separation distances.

10.58 In-line with MCC, Planning and Noise, Technical Guidance (2015), BS 5228-2 indicates that construction activities (particularly piling) "generally only generate vibration impacts when they are located less than 20 metres from sensitive locations". A construction vibration assessment has therefore not been undertaken for the identified receptors as they are located more than 20 metres from the Site. As such, the magnitude of impact on the nearest buildings is expected to be negligible.

10.59 The inherited site position before starting construction can be seen in Figure 10.3.

10.60 Based on the predicted noise levels from construction (found in Appendix 10.2), the significance of effect from construction noise at each identified NSR is summarised in Table 10.9. It should be noted that these significances are based on unmitigated noise levels with no hoardings around the perimeter of the Site. Therefore, this is representative of a worst-case scenario.

Table 10.9 Significance of effect due to construction activities – Noise

NSR #	Receiver sensitivity	Site Preparation	General site activities
A – Properties along Stuart Street	High	Negligible	Negligibe

NSR #	Receiver sensitivity	Site Preparation	General site activities
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

Construction traffic

10.61 Annual average weekday (AAWT) baseline traffic flow counts were carried out by the project transport consultant and are fully detailed in Appendix 10.3. Observed and construction traffic flows have been used to assess the magnitude of impact on the NSRs due to construction traffic. These are based on the worst-case scenario i.e. the greatest number of predicted construction traffic flows.

Table 10.10 Significance of effect at NSRs from construction traffic

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

Construction effects summary

Table 10.11 Summary of effects during construction on existing receptors

Receptor	Sensitivity	Description of effect	Magnitude of change / impact	Effect significance
A – Properties along Stuart Street	High	Construction noise due to site preparation	Negligible	Negligible
		Construction noise due to site activities	Negligible	Negligible
		Construction vibration – effect on humans	Negligible	Negligible
		Construction vibration – effect on buildings	Negligible	Negligible
		Construction traffic noise	Negligible	Negligible
B – Properties along Gibbon Street	High	Construction noise due to site preparation	Negligible	Negligible
		Construction noise due to site activities	Negligible	Negligible
		Construction vibration – effect on humans	Negligible	Negligible
		Construction vibration – effect on buildings	Negligible	Negligible
		Construction traffic noise	Negligible	Negligible
	High	Construction noise due to site preparation	Negligible	Negligible

Receptor	Sensitivity	Description of effect	Magnitude of change / impact	Effect significance
C – Properties along Broxton Street		Construction noise due to site activities	Negligible	Negligible
		Construction vibration – effect on humans	Negligible	Negligible
		Construction vibration – effect on buildings	Negligible	Negligible
		Construction traffic noise	Negligible	Negligible
D – Properties along Briscoe Lane	High	Construction noise due to site preparation	Negligible	Negligible
		Construction noise due to site activities	Negligible	Negligible
		Construction vibration – effect on humans	Negligible	Negligible
		Construction vibration – effect on buildings	Negligible	Negligible
		Construction traffic noise	Negligible	Negligible
E – Ashton Side	Low	Construction vibration – effect on buildings	Negligible	Negligible

Operational Effects

Operational noise from entertainment noise

10.62 The following criterion is from MCC, Planning and Noise, Technical Guidance document:

"A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open.

Entertainment noise (L_{Aeq}) should be controlled to 10 dB below the background noise level (L_{A90}) without the entertainment noise present, in each octave band at the nearest noise sensitive location"

10.63 The MCC, Planning and Noise, Technical Guidance document also provides advice on structurally connected venues by comparing the entertainment noise levels against a noise curve (Moorhouse et al., 2005) in order to assess likelihood of low frequency noise complaints. These levels provide a good pratical basis to assess low frequency noise. Furthermore, as stated in the MCC guidance:

"They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces.

Therefore a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be:

> *'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}), respectively'.*

This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue."

An attenuation of 5 dB, achieved by a façade containing an open window, has been applied at these low frequencies in order to derive an external noise level limit.

10.64 In addition, MCC guidance states that:

"Depending on the circumstances it could be that both the above criteria are applicable for the same development (new entertainment venue)".

10.65 It is noted, that L_{A90} noise levels at Measurement Position 3 and the Long-Term Measurement Position are similar. As such, LA90 spectral noise levels for use in the assessment to satisfy MCC criterion have been taken from the Long-Term Measurement Position and are considered representative of the nearest NSR.

10.66 For reference, L_{A90} spectral noise levels from the Long-Term Measurement position are presented in the table below. It should be noted that, daytime noise levels as presented below are taken between 21:00 to 23:00 hours, on a non-event day, to reflect the expected worst-case baseline values during typical operating hours.

Table 10.12 Measured L_{A90} spectral noise levels at the Long-Term Measurement Position

Location	Time Period	Target Incident $L_{eq,T}$ Noise Level Limits (dB) at Octave Band Centre Frequencies (Hz)								
		63	125	250	500	1K	2k	4k	8k	dBA
NSR A - Properties along Stuart Street	Daytime (07:00-23:00 hours)	57	52	52	51	52	42	29	21	54
	Night-time (23:00-07:00 hours)	51	46	44	42	42	32	26	20	45

10.67 Operational noise in the form of entertainment noise is considered a long-term effect in this case.

10.68 In-line with the above, the following noise level limits for noise break-out from the Proposed Development is proposed at 1m from the nearest NSR window. These are based on both sets of noise entertainment crtieria i.e. 10 dB below background noise levels and low frequency internal noise limits.

Table 10.13 Incident spectral noise level limits for the proposed arena at 1m from the nearest NSR (#1)

Location	Time Period	Target Incident $L_{eq,T}$ Noise Level Limits (dB) at Octave Band Centre Frequencies (Hz)								
		63	125	250	500	1K	2k	4k	8k	dBA
NSR A - Properties along Stuart Street	Daytime (07:00-23:00 hours)	52*	46*	42	41	42	32	19	11	44
	Night-time (23:00-07:00 hours)	52*	46*	34	32	32	22	16	10	35

* Based on the Moorhouse et al. internal noise limit for assessment of low frequency noise with 5 dB addition to account for the attenuation of a façade containing an open window (see 10.63).

10.69 Should an assessment of noise break-out levels be subject to façade reflections (e.g. the windows are closed on the NSR) then the noise level limits detailed above are subject to a 3 dB addition in all octave band frequencies.

10.70 It is noted that NSR A is the most exposed NSR and compliance with the above should protect other NSRs by default.

10.71 The following internal noise level limits are proposed within the 'bowl' of the Proposed Development. It is understood that the 'bowl' will enclose the main stage and performance arena, and that the structure forming the concourse areas surrounding it will significantly mitigate noise transmission into the concourse / external areas.

Table 10.14 Internal noise levels within the 'bowl'

Description	Noise levels at Octave Band Centre Frequencies (Hz)							dBA
	63	125	250	500	1K	2k	4k	
Internal concert noise level $L_{Aeq,5min}$ dB	116	110	104	101	100	92	88	104

10.72 Vanguardia acoustics have stated the following, "*An assumption has been made on the expected crowd noise in the foyer and concourse areas based on measured sound levels at other venues. This dominates the sound levels in these areas more than the impact of the sound from the arena bowl*." It has therefore been assumed, by Vanguardia acoustics, that in the foyer and concourse areas the noise levels will not exceed LAeq 80-85 dBA from combined transmission from the arena 'bowl', background music and crowd noise.

10.73 Vanguardia acoustics have specified the combined sound insulation performance for the envelope of the Proposed Development (as shown in Table 10.15), which is expected to be suitable in order to control noise break-out such that is meets the target incident noise levels at the nearest NSR as detailed above. It is worth noting that Vanguardia acoustics have provided spectral values for the 'bowl', and a single-figure sound insulation performance (R_w) for the outer façades.

Table 10.15 Noise Break-Out Envelope Sound Insulation Requirements

Description	Sound insulation at Octave Band Centre Frequencies (Hz)							R_w
	63	125	250	500	1K	2k	4k	
Sound insulation for 'bowl' envelope	40	38	36	42	47	38	39	-
Façade areas outside the 'bowl' e.g. foyer, concourse areas	-	-	-	-	-	-	-	40

10.74 In-line with the details above, the significance of effect from operational entertainment noise at each identified NSR is summarised in Table 10.16. It should be noted that these significances are based on assumed Vanguardia noise levels within the arena and proposed sound insulation requirements of the arena constructions.

Table 10.16 Significance of effect due to entertainment noise from OVG

NSR #	Receiver sensitivity	Significance of effect
A – Properties along Stuart Street	High	Negligible
B – Properties along Gibbon Street	High	Negligible
C – Properties along Broxton Street	High	Negligible
D – Properties along Briscoe Lane	High	Negligible

Operational noise from crowd noise

10.75 Guidance on the impact assessment of crowd noise associated with the Proposed Development is based on the magnitude of impact criteria outlined in Table 10.4 above.

10.76 Operational noise in the form of crowd noise is considered a long-term effect in this case.

10.77 To calculate the effect from crowd noise, an environmental 3D model has been created with CadnaA noise modelling software version 2019. Existing noise sources (roads and rail traffic) have been included in the model and it has been calibrated to the measured noise levels presented in Table 10.6. Known spectral sound power values for raised voices (taken from Building Bulletin 93 (BB93)) have been used within the noise model of the Proposed Development and surrounding area in order to predict noise levels at the nearest NSRs.

10.78 Raised voice sources have been placed in expected external congregation areas on the south and east boundaries of the Proposed Development within the noise model. Worst case noise levels from crowd noise is based on 10% of the 23,500 capacity arena speaking with a raised voice i.e. 2,350 No. of raised voices.

10.79 Crowd noise has been compared to baseline $L_{Aeq,T}$ daytime noise levels at Measurement Position 3. It is worth noting that baseline night-time $L_{Aeq,T}$ noise levels (as measured at the Long-term Measurement Position) are no greater than this, regardless. Modelled results presenting noise predictions without and with crowd noise can be seen in Figures 10.4 and 10.5 respectively.

10.80 Based on the predicted noise levels from crowd noise associated with the Proposed Development at each identified NSR the effect is summarised in Table 10.17.

Table 10.17 Significance of effect due to crowd noise

NSR #	Receiver sensitivity	Significance of effect
A – Properties along Stuart Street	High	Negligible
B – Properties along Gibbon Street	High	Negligible
C – Properties along Broxton Street	High	Negligible
D – Properties along Briscoe Lane	High	Negligible

10.81 Furthermore, it can be seen in Figures 10.4 and 10.5 that crowd noise impact on the canal corridor is likely to be localised. As such, crowd noise is likely to be up to 5 dB above the baseline noise measurement of L_{Aeq} 51 dBA at ST-1 within a 10 m of large groups (approx. 200 No.) of people. This is considered a small magnitude of effect according to operational noise criteria.

Operational noise from fixed plant and equipment

10.82 The impact of noise from mechanical services and plant will be informed by BS4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' in-line with the following MCCTG criterion:

"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5 dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location."

10.83 $L_{A90,T}$ spectral noise levels to satisfy the MCC plant noise criterion have been taken from the Long-Term Measurement Position. It is observed that measured $L_{Aeq,T}$ and $L_{A90,T}$ noise levels at the Long-Term Measurement Position are similar on event and non-event days indicating that events at the Etihad have a minimal impact on overall daytime and night-time noise levels.

10.84 Operational noise in the form of fixed plant and equipment noise is considered a long-term effect in this case.

10.85 Rating levels are given in the table below in-line with MCC criteria. It should be noted that (as the selection of plant is not currently known) these rating levels do not include any required

corrections for acoustically distinguishable features. On this basis, correction factors may need to be applied to final selections, to cover the effect of certain acoustic features such as the tonality, impulsivity and intermittency, in general accordance with BS 4142:2014+A1:2019.

Table 10.18 Measured background noise levels and limiting rating plant noise levels at NSRs

NSR	Modal measured daytime background noise level $L_{A90,15min}$ dBA (07:00-23:00)	Plant daytime rating limit at 1 metre from NSR Facades $L_{Ar,Tr}$ dBA (07:00-23:00)	Modal measured night-time background noise level $L_{A90,15min}$ dBA (23:00-07:00)	Plant night-time rating limit at 1 metre from NSR Facades $L_{Ar,Tr}$ dBA (23:00-07:00)
All	57	52	45	40

10.86 It should also be noted that the limits detailed above are for all items of plant operating simultaneously. If there are multiple plant units then the sound pressure level of each item would need to be lower in order to factor in the cumulative effect.

10.87 Assuming that all external plant is selected in accordance with the above, the effect on receptors is shown in the table below.

Table 10.19 Significance of effect at NSRs from operational noise from fixed plant and equipment

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

Operational traffic noise

10.88 Annual average weekday (AAWT) baseline traffic flow counts were carried out by the project transport consultant and are fully detailed in Appendix 10.4 and a summary of findings is shown in the tables below. Observed and predicted traffic flows have been used to assess the magnitude of impact on the NSRs due to operational traffic.

10.89 Operational noise in the form of traffic noise is considered a long-term effect in this case.

Table 10.20 Significance of effect at NSRs from operational traffic at year of opening

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

Table 10.21 Significance of effect at NSRs from operational traffic 15 years after project opening

NSR #	Receiver sensitivity	Magnitude of impact	Effect significance
A – Properties along Stuart Street	High	Negligible	Negligible
B – Properties along Gibbon Street	High	Negligible	Negligible
C – Properties along Broxton Street	High	Negligible	Negligible
D – Properties along Briscoe Lane	High	Negligible	Negligible

Operational effects summary

Table 10.22 summary of operational effects on existing receptors

Receptor	Sensitivity	Description of effect	Magnitude of change / impact	Effect significance
A – Properties along Stuart Street	High	Operational noise from entertainment noise	Negligible	Negligible
		Operational noise from crowd noise	Negligible	Negligible
		Operational noise from fixed plant and equipment	Negligible	Negligible
		Operational traffic noise at year of opening	Negligible	Negligible
		Operational traffic noise 15 years after year of opening	Negligible	Negligible
B – Properties along Gibbon Street	High	Operational noise from entertainment noise	Negligible	Negligible
		Operational noise from crowd noise	Negligible	Negligible
		Operational noise from fixed plant and equipment	Negligible	Negligible
		Operational traffic noise at year of opening	Negligible	Negligible
		Operational traffic noise 15 years after year of opening	Negligible	Negligible
C – Properties along Broxton Street	High	Operational noise from entertainment noise	Negligible	Negligible
		Operational noise from crowd noise	Negligible	Negligible
		Operational noise from fixed plant and equipment	Negligible	Negligible
		Operational traffic noise at year of opening	Negligible	Negligible
		Operational traffic noise 15 years after year of opening	Negligible	Negligible
D – Properties along Briscoe Lane	High	Operational noise from entertainment noise	Negligible	Negligible
		Operational noise from crowd noise	Negligible	Negligible
		Operational noise from fixed plant and equipment	Negligible	Negligible
		Operational traffic noise at year of opening	Negligible	Negligible
		Operational traffic noise 15 years after year of opening	Negligible	Negligible

Climate change and adaptation

10.90 The noise and vibration assessments are based on non-climate related sources; therefore, a change in the climate conditions is not expected to change the operational noise and vibration assessment carried out.

Mitigation Measures

10.91 Examples of mitigation measures that can be used to control construction noise are found in Section 8 of BS 5228-1:2009+A1:2014:

- Selecting quieter plant and equipment;
- Turning equipment off when they are not in use;
- Providing enclosures around fixed plant like power generators or using mains power;
- Ensuring that all plant and equipment is well maintained;
- Keep internal haul routes well maintained and avoid steep gradients;
- Use rubber linings in chutes and dumpers to reduce impact noise;
- Minimise drop heights of materials;
- Start plant up sequentially rather than simultaneously;
- Move fixed plant away from identified noise sensitive receptors;
- Modify existing plant with noise attenuation packages such as acoustic enclosures and attenuators;
- Avoid using diesel power generators and use local electricity grid wherever possible;
- For impact driven piling, a non-metallic dolly between the hammer and the driving helmet should be used;
- Introducing an acoustic shroud for impact driven piles;
- Choose a quieter piling method; and
- Avoiding unnecessary revving of engines.

Cumulative Effects

10.92 Due to distance attenuation, the only schemes that have been considered for the cumulative assessment are those within 200 m of the Proposed Development red line boundary.

10.93 The aerial image shown in Figure 10.6 contains a blue circle, which has a radius of 200 m. No cumulative schemes lie within this circle.

10.94 As no development falls within the 200 m radius from the Proposed Development, the cumulative noise and vibration effect can be assumed to have a negligible significance of effect.

10.95 On this basis the Committed Developments identified in Appendix 2.4 have not been considered further.

Residual Effects

10.96 The following table summarises the complete residual effects during both construction and operation.

Table 10.23 Summary of Receptors, Likely Significant Effects, Mitigation Measures, and Residual Effects

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
A – Properties along Stuart Street	Construction noise due to Site Preparation	Moderate / Minor adverse	Implementation of a CMP which includes the mitigation measures outlined above (Paragraph 10.91).	N/A	Negligible
	Construction noise due to site activities	Moderate / Minor adverse	Implementation of a CMP which includes the mitigation measures outlined above (Paragraph 10.91).	N/A	Negligible
	Construction vibration effect on humans	Negligible	N/A	N/A	Negligible
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible
B – Properties along Gibbon Street	Construction noise due to Site Preparation	Negligible	N/A	N/A	Negligible
	Construction noise due to site activities	Negligible	N/A	N/A	Negligible
	Construction vibration	Negligible	N/A	N/A	Negligible

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
	effect on humans				
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible
C – Properties along Broxton Street	Construction noise due to Site Preparation	Negligible	N/A	N/A	Negligible
	Construction noise due to site activities	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
	Construction vibration effect on humans	Negligible	N/A	N/A	Negligible
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible
	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible
D – Properties along Briscoe Lane	Construction noise due to Site Preparation	Negligible	N/A	N/A	Negligible
	Construction noise due to site activities	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
	Construction vibration effect on humans	Negligible	N/A	N/A	Negligible
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible
	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible
E – Ashton Canal	Construction vibration	Negligible	N/A	N/A	Negligible

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
	effect on buildings				

Reference List

10.97 This ES Chapter has been prepared by reference to the following:

- British Standards Institution, (2014). BS 4142:2014 Methods for rating and assessing industrial and commercial sound.
- British Standards Institution, (2009). BS 5228-1: 2009 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.
- British Standards Institution, (2009). BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.
- British Standards Institution, (2008). BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.
- British Standards Institution, (1993) BS 7385: 1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration.
- British Standards Institution, (2014). BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings.
- BuroHappold Engineering, (2019) OVG Manchester, EIA Scoping Report.
- Department for Environment Food and Rural Affairs (DEFRA) (2010). Noise Policy Statement for England (NPSE).
- Design Manual for Roads and Bridges, (2011). Volume 11. Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 7, HD 213/11, Noise and Vibration.
- Manchester City Council (MCC) (2015). Planning and Noise, Technical Guidance.
- Ministry for Housing, Communities and Local Government (MHCLG) (2019). National Planning Policy Framework, MHCLG.
- Ministry for Housing, Communities and Local Government (MHCLG) (2019). National Planning Practice Guidance on Noise, MHCLG.
- Jones & Stokes (2004). Transportation- and construction-induced vibration guidance manual. June. (J&S 02-039.) Sacramento, CA. Prepared for California Department of Transportation, Noise, Vibration, and Hazardous Waste Management Office, Sacramento, CA.

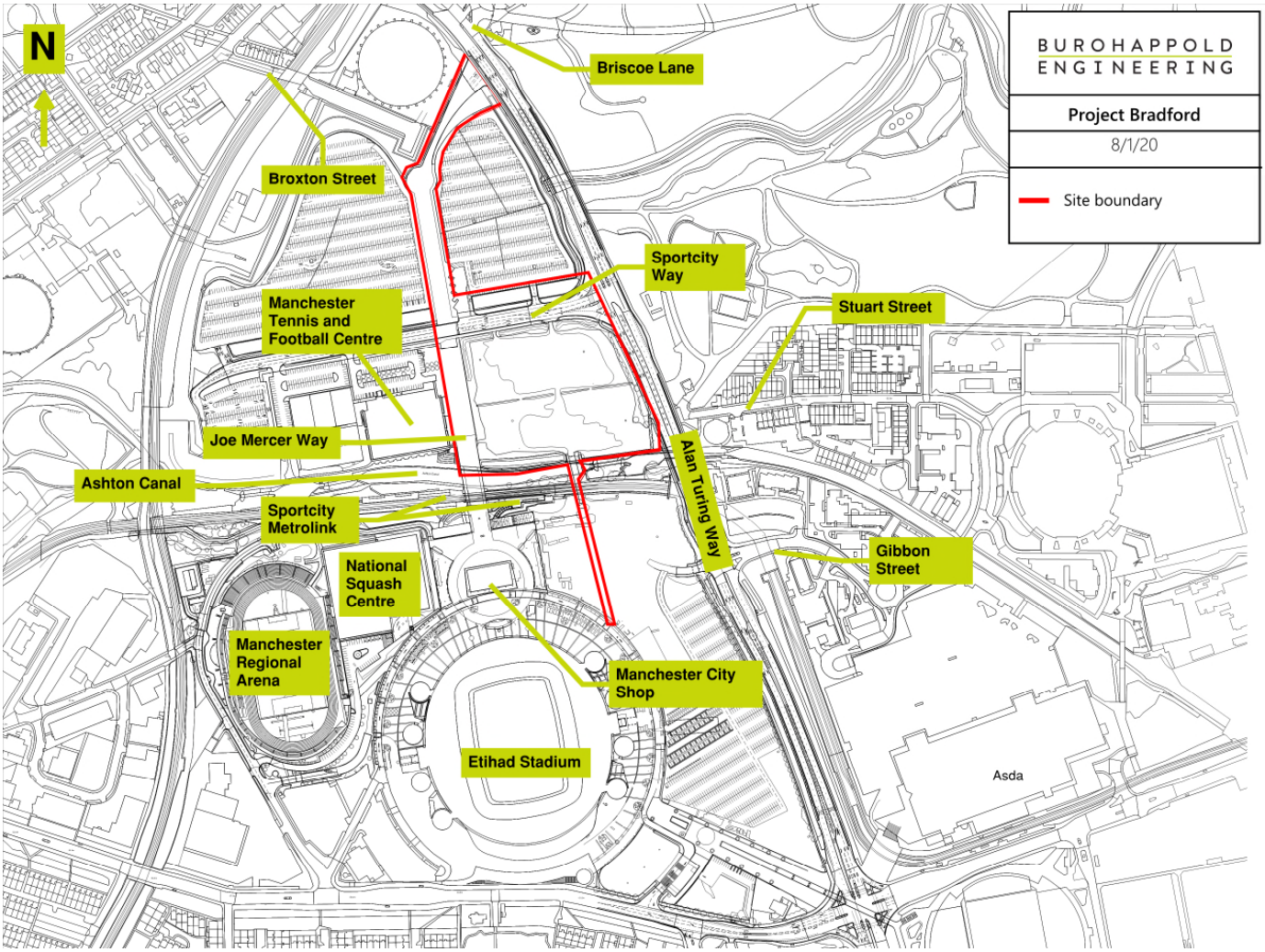


	Figure:	**10–1**		
	Title:	**Noise and Vibration Site plan**		
	Project:	**OVG Manchester**		
	Date:	**December 2019**	**Scale:**	**NTS**



	Figure:	**10–2**		
	Title:	**Noise monitoring positions and noise sensitive receivers**		
	Project:	**OVG Manchester**		
	Date:	**December 2019**	**Scale:**	**NTS**



	Figure:	**10-3**		
	Title:	**Existing Site Plan**		
	Project:	**OVG Manchester**		
	Date:	**December 2019**	**Scale:**	**NTS**

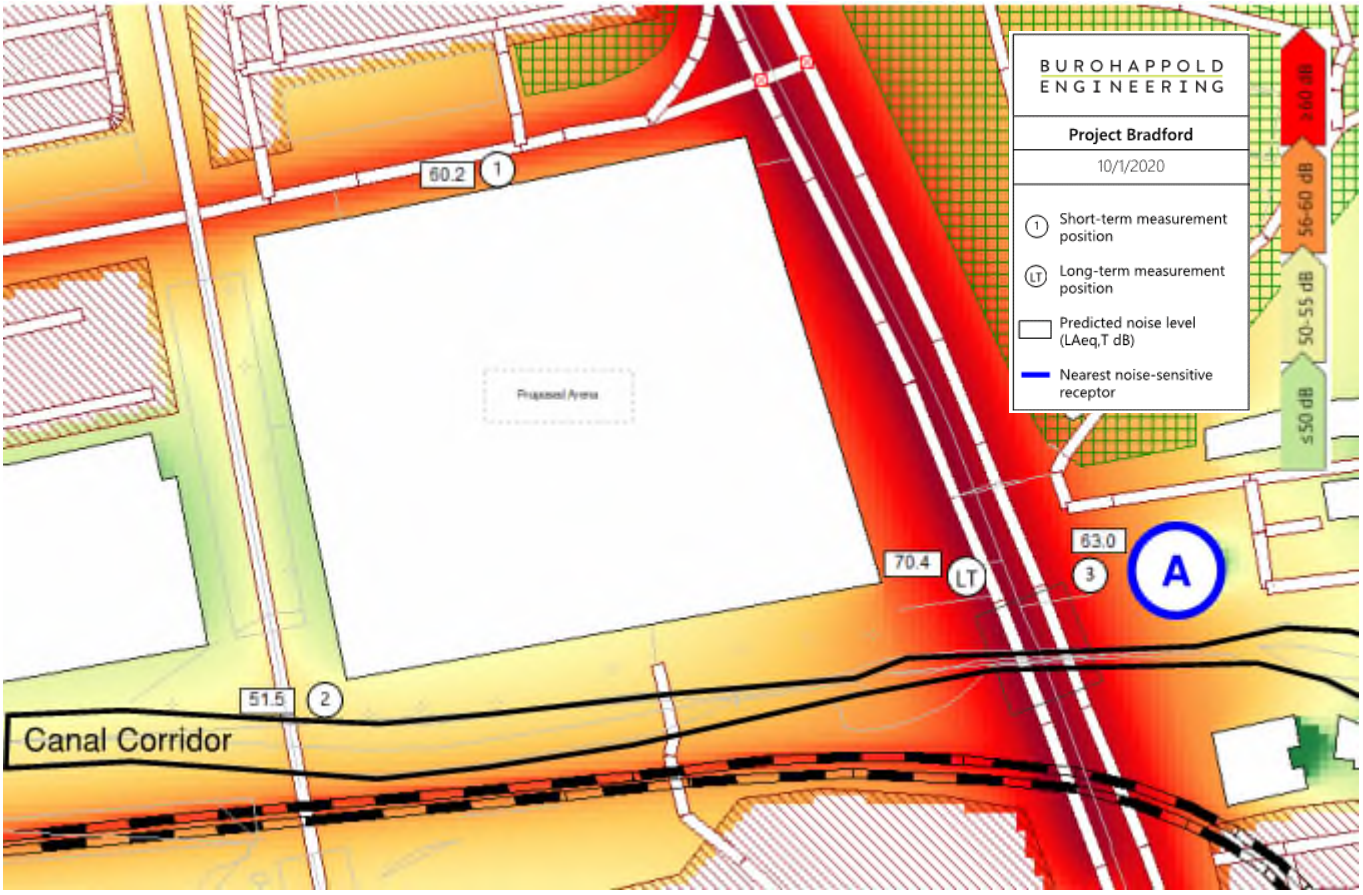


	Figure:	**10-4**		
	Title:	**Baseline Noise Predictions without Crowd Noise**		
	Project:	**OVG Manchester**		
	Date:	**December 2019**	**Scale:**	**NTS**

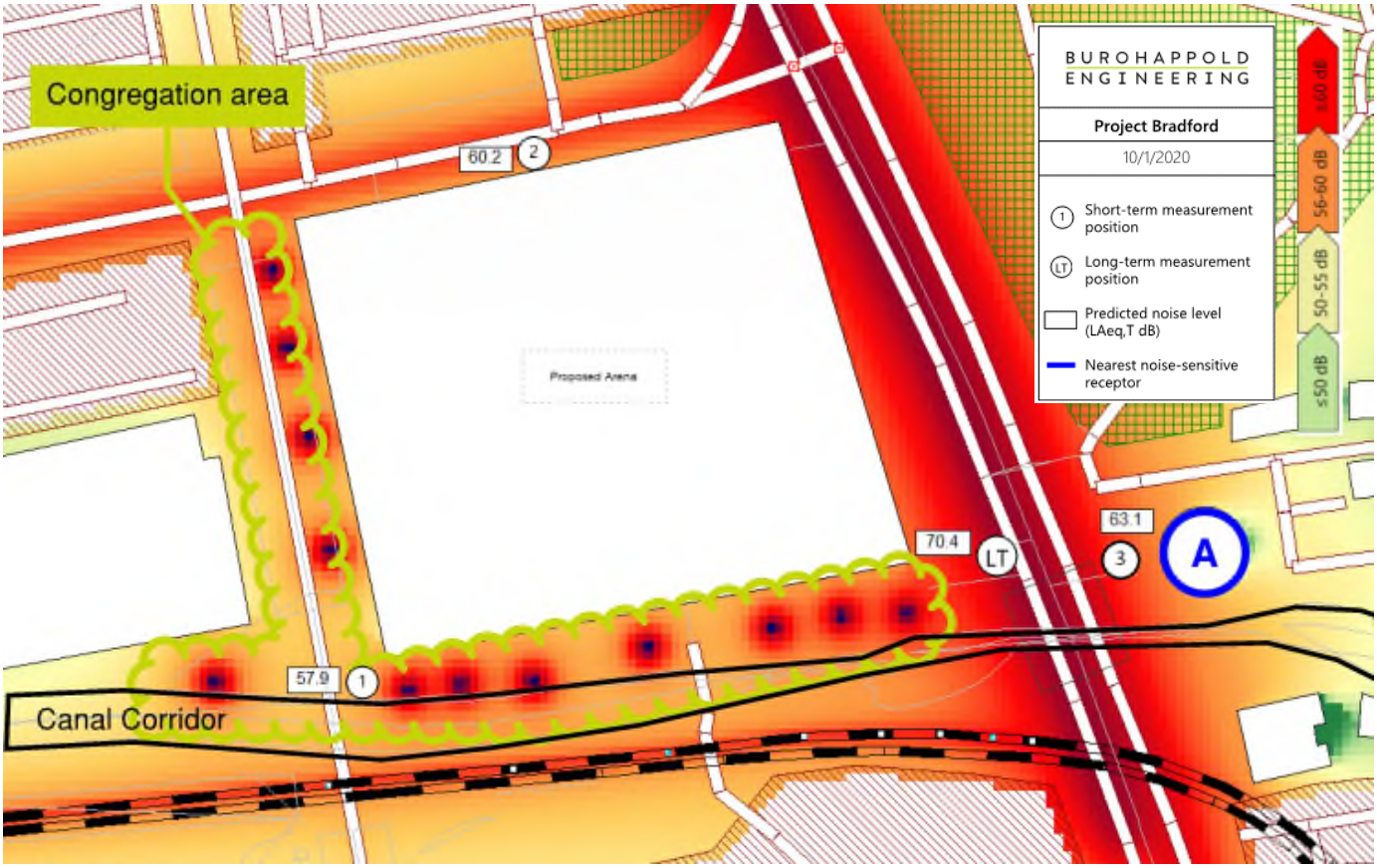
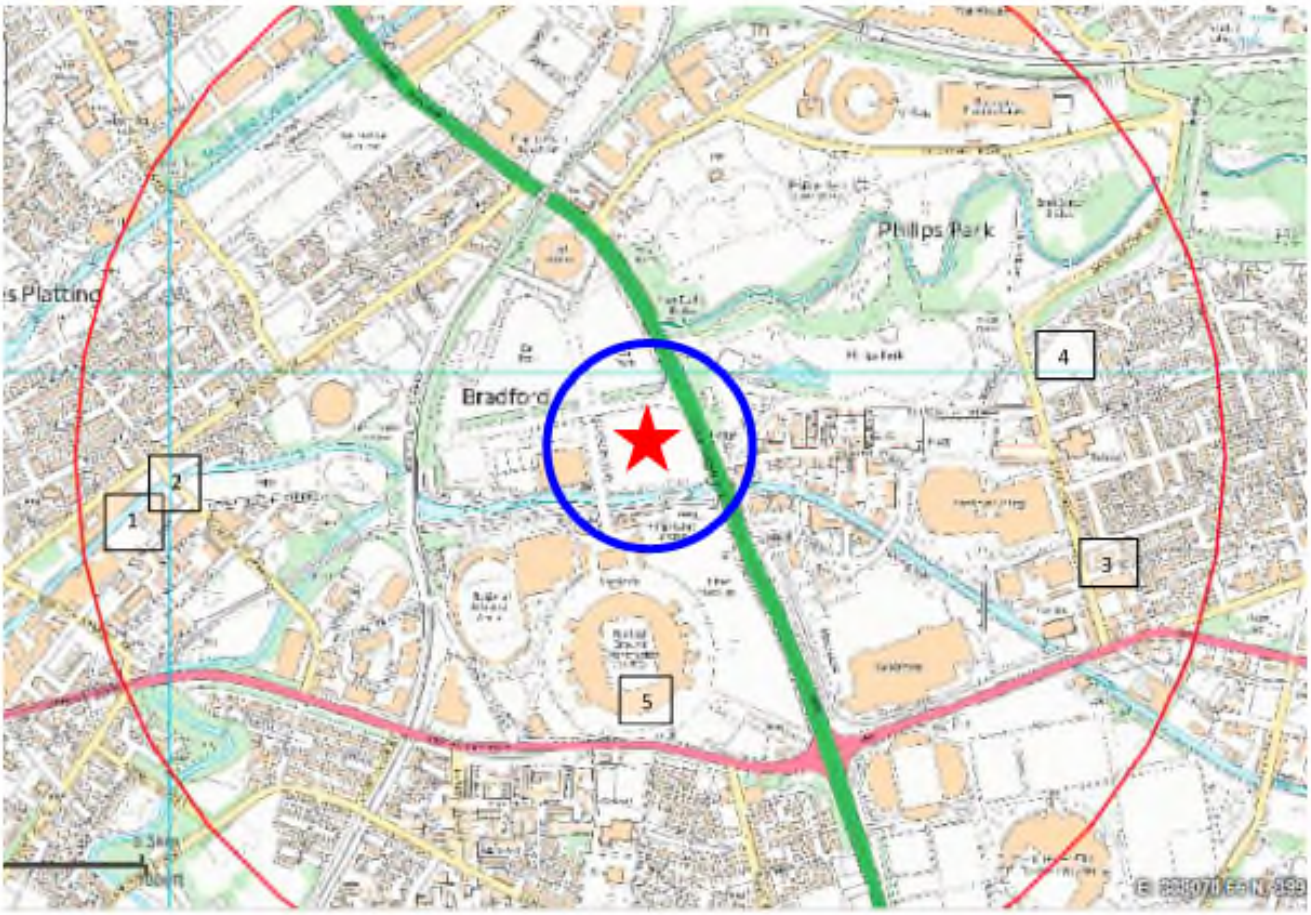


	Figure:	**10-5**		
	Title:	**Noise Predictions with Crowd Noise**		
	Project:	**OVG Manchester**		
	Date:	**December 2019**	**Scale:**	**NTS**

Map of Committed Developments*:



*Site is demarcated by a red star.

	Figure:	**10-6**		
	Title:	**Committed Development schemes within a 200 m radius of the site (blue circle)**		
	Project:	**OVG Manchester**		
	Date:	**December 2019**	**Scale:**	**NTS**

11 Townscape and Visual Impact

Introduction

11.1 This Chapter of the ES has been prepared by Planit-IE and assesses the likely townscape and visual impacts of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts and the likely residual impacts after these methods have been adopted.

11.2 This Chapter is accompanied by four technical appendices; Townscape baseline and Assessment table Appendix 11.1, Visual Baseline and Assessment table Appendix 11.2, Figures Appendix 11.3 and, Views and Photomontages Appendix 11.4.

11.3 Planit-IE is a registered practice of the Landscape Institute with considerable experience in townscape and visual assessment.

Legislative and Policy Context

Legislation

11.4 The European Landscape Convention (ELC, 2000) provides a foundation for closer co-operation on landscape issues across Europe and was ratified in the UK on the 21 November 2006, and became binding on 1 March 2007. The convention identifies the need to recognise landscape in law, to develop and promote landscape policies dedicated to the protection, management and creation of landscapes, and to establish procedures for the participation of the general public and other stakeholders in the evolution and implementation of landscape policies. It also encourages the integration of landscape into all relevant areas of policy, including cultural, economic and social policies.

11.5 The ELC defines landscape as *'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'*. It recognises that landscape has important cultural, ecological, environmental and social dimensions and is a key element of achieving sustainable development. In this context the use of the word 'landscape' is more appropriately termed 'townscape' though the constituent factors remain consistent.

National Planning Policy

11.6 The National Planning Policy Framework was updated in February 2019 and sets out the government's planning policies for England and how these are expected to be applied.

11.7 The purpose of the planning system is to contribute to the achievement of sustainable development through three overarching objectives:

- An economic objective - to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
- A social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and,
- An environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

11.8 The environmental objective is of particular relevance to the purpose of townscape and visual impact assessment.

11.9 Section 12 of the NPPF deals with the requirements of good design. The overarching principle is set out in paragraph 124, which state, *"the creation of high quality buildings and places is fundamental to what the planning and development process should achieve. Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities."*

11.10 Paragraph 127 of the NPPF sets out a number of principals of good design. In order to accord with these principles, it should be ensured that new developments:

- will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development;
- are visually attractive as a result of good architecture, layout and appropriate and effective landscaping;
- are sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change (such as increased densities);
- establish or maintain a strong sense of place, using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit;
- optimise the potential of the Site to accommodate and sustain an appropriate amount and mix of development (including green and other public space) and support local facilities and transport networks; and,
- create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion and resilience.

11.11 Section 16 of the NPPF concerns conserving and enhancing the historic environment. Paragraph 184 states that heritage assets are, "*an irreplaceable resource, and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations*".

11.12 Whilst the Site is not located in a Conservation Area and does not contain listed buildings, heritage is an intrinsic part of townscape assessment and potential views from Conservation Areas and the setting around listed buildings and parks have been considered as part of the assessment. There is also an overarching desirability set out within the NPPF for new development to contribute positively to local character and distinctiveness.

Guidance

11.13 The following guidance has been used in the assessment;

- Guidelines for Landscape & Visual Impact Assessment, 3rd Edition, 2013.
- Planning Practice Guidance.
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development, 2015.
- Historic England Advice Note 4 Tall Buildings.

Local Planning Policy

Manchester's Local Development Framework, Core Strategy Development Plan Document (2012)

11.14 Manchester's Core Strategy was adopted in July 2012. Relevant policies from the Strategy for the purposes of this chapter are outlined below.

Policy EN1 Design Principles and Strategic Character Areas

11.15 All development in Manchester will be expected to follow the seven principles of urban design, as identified in national planning guidance and listed above and have regard to the strategic character area in which the development is located. Opportunities for good design to enhance

the overall image of the City should be fully realised, particularly on major radial and orbital road and rail routes.

Policy EN3 Heritage

11.16 "Throughout the City, the Council will encourage development that complements and takes advantage of the distinct historic and heritage features of its districts and neighbourhoods"

11.17 New developments must be designed so as to support the Council in preserving or, where possible, enhancing the historic environment, the character, setting and accessibility of areas and buildings of acknowledged importance, including scheduled ancient monuments, listed buildings, registered parks and gardens, conservation areas and archaeological remains.

11.18 Proposals which enable the re-use of heritage assets will be encouraged where they are considered consistent with the significance of the heritage asset.

Policy EC5 East Manchester

11.19 East Manchester is expected to provide approximately 80-85ha of employment land. The majority of this provision will be within the Regional Centre, specifically:

- Central Park (see Policy EC6), B1, B2.
- Eastlands (see Policy EC7), a major leisure visitor destination with ancillary retail and offices.
- City Centre Fringe (see Policy CC1) along Great Ancoats Street, providing an extension to City Centre employment opportunities.

11.20 Development will also be supported in existing employment and economic development areas, including Alan Turing Way, along key radial routes and Ardwick Goods Yards.

11.21 The Council will promote development which:

- Ensures major employment opportunities are connected via non-car modes to residential neighbourhoods within East Manchester and North Manchester, these include the City Centre, Central Park, Eastlands and railway stations in the City Centre.
- Takes advantage of key transport infrastructure such as the arterial roads (Oldham Road, Ashton New Road, Ashton Old Road and Hyde Road) and public transport networks, such as bus routes and the proposed extension to Metrolink including two new lines and new stops; creates links to the Rochdale and Ashton Canals and links to the open space network including the Rochdale and Ashton Canals and the Medlock Valley, providing opportunities for walking and cycling to economic development opportunities;.
- Has regard to listed buildings and conservation areas including Ancoats and the industrial heritage of the area.

Policy EN9 Green Infrastructure

11.22 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. Where the benefits of a proposed development are considered to outweigh the loss of an existing element of green infrastructure, the developer will be required to demonstrate how this loss will be mitigated in terms of quantity, quality, function and future management.

11.23 The Council will seek to protect existing street trees and promote new planting, particularly where this can enhance green links in the urban area.

11.24 The provision of new, and improvements to the quality and accessibility of existing green infrastructure assets, to mitigate for any loss of green infrastructure.

Policy DM1 Development Management

11.25 All new developments should follow the 'Development Principles' and accord with the design guidance set out in the Supplementary Planning Documents. The key principle of relevance to this assessment is defined as follows:

- Appropriate siting, layout, scale, form, massing, materials and detail. Impact on the surrounding areas in terms of the design, scale and appearance of the Proposed Development. Development should have regard to the character of the surrounding area.

Guide to Development in Manchester SPD (2007)

11.26 In accordance with the Guide to Development in Manchester SPD, development in Manchester will be expected to follow the seven design principles set out below:

- Character: a place with its own identity.
- Continuity and enclosure: a place where public and private places are clearly distinguished.
- Quality of the public realm: a place with attractive, and successful outdoor areas.
- Ease of movement: a place that is easy to get to and move through.
- Legibility: a place that has a clear image and is easy to understand.
- Adaptability: a place that can change easily.
- Diversity: a place with variety and choice.

Draft Eastlands Regeneration Framework (2019)

11.27 The Site is located within the boundary of the draft 2019 ERF.

11.28 The Site is located within the 'Etihad Campus Commercial Zone', which outlines the following development opportunities for the area:

- "allow for commercial space to come forward in this location and allow for the opportunity for sports-based businesses to locate here (...)" (p. 45)
- "to develop a new Sport Tech cluster for the City there has also been a long term ambition to deliver a destination leisure and recreation offer as part of a diversified pattern of economic uses on the Campus." (p. 45)
- "a new large indoor arena (with a capacity in excess of 20,000 spectators)."
- "a multi-plex cinema, an expanded food and beverage offer, and hotel development are seen by investors and operators as being potentially viable propositions given the changing and growing market for entertainment activities." (p. 45)
- "the opportunity for an indoor arena within Manchester based on the Etihad Campus, along with the provision of other entertainment facilities should be allowed for in the next phase of development opportunities subject to detailed appraisal and analysis." (p. 45)

Assessment Methodology and Significance Criteria

EIA Scoping

11.29 A formal request for an EIA scoping opinion was submitted to MCC on 26 November 2019. The townscape and visual impact responses from MCC's scoping response, received on 15 January 2020, are covered in the scope of this assessment and the supporting appendices.

Assessment Methodology

11.30 This assessment has been carried out with reference to the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, 2013 (referred to hereafter as "the Guidelines") by Planit-IE Ltd, a registered practice of the Landscape Institute with considerable experience in landscape and visual assessment.

11.31 A three-stage assessment process has been adopted. Firstly, the nature of receptors (sensitivity) has been assessed, and secondly, the nature of effects (magnitude) likely to result from the

Proposed Development has been assessment. From this, the overall significance of the identified effects on receptors have been assessed.

11.32 The methodology is collated into a tabulated format where possible to provide structure for a consistent and methodical approach. Criteria and justifications are recorded in Appendix 11.1 and 11.2 for transparency. The overall assessment of significance has regard to paragraph 5.56, page 92 (significance of landscape effects) and paragraph 6.44, page 116 (significance of visual effects) of the Guidelines.

11.33 The study area for this assessment is illustrated in Figure 11.3.1 in Appendix 11.3. The assessment has considered the Proposed Development within the wider city context.

11.34 The assessment of the Proposed Development will also be supplemented by a cumulative assessment of committed developments where relevant; in order to understand if any further potential significant environmental effects are likely to arise. Cumulative effects are defined as impacts that result from additional changes to the townscape or visual amenity caused by the Proposed Development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.

11.35 A number of Sites within a 1km radius of the Site benefit from extant Planning Permission, or are currently under consideration by the Local Planning Authority. These are set out in Appendix 2.4.

11.36 In addition, the Site is located within the Eastlands Regeneration Framework (ERF) area. The ERF sets out environmental, social, design and economic objectives which are relevant to the attainment of the regeneration of the East Manchester area which is supported by existing planning policy.

11.37 The 2019 Draft ERF supports the on-going regeneration of the Eastlands area, which could encompass new development opportunities as follows:

- Etihad Campus – Sports and Innovation Zone: new higher education and support facilities, student accommodation and commercial workspace.
- Etihad Campus – Commercial Zone: commercial workspace, indoor arena, leisure and hotel development.
- Holt Town Central: mixed-use neighbourhood with residential, employment and community uses.
- Holt Town East: residential-led mixed-use development.
- Lower Medlock Valley: higher density residential use.
- Beswick: residential development (enhancement of existing and new) and potential sports hub.
- Croft Street Triangle and Eccleshall Street: residential neighbourhood and local retail.
- Manchester Abattoir / Riverpark Road Trading Estate: residential neighbourhood.
- Pollard Street: employment or employment-led, mixed use development.
- Central Retail Park: flexible office space, retail and leisure facilities.

11.38 Whilst the development opportunities identified in the ERF do not have the benefit of Planning Permission and there is limited information about the quantum and scale of likely development, the EIA should give qualitative consideration to the potential cumulation of effects of the Proposed Development and these development opportunities.

11.39 A total of six additional developments have been considered in the cumulative assessment. The locations are highlighted in Figure 11.3.12 in Appendix 11.3. The committed developments are:

- Co-Working (Pollard Yard Studios) - Application for temporary siting and use of site for 50 recycled shipping containers to provide co-working space (sui generis) for a temporary period of up to 5 years, with associated car parking, portable toilets and servicing from Pollard Street East

- Co-Working (Pollard Yard Studios) - Application for temporary siting and use of site for 64 additional recycled shipping containers (114 no. in total) to provide co-working space (sui generis) for a temporary period of up to 5 years, with associated car parking, portable toilets and servicing from Pollard Street East.
- Residential (Alpine/Ilk Street) – Outline application relating to matters of access in relation to a residential development comprising of 14 x two storey dwelling houses (Class C3) with all other matters reserved.
- Residential (Alpine/Ilk Street) - Proposed redevelopment of vacant land to create 66 no. 2, 3 and 4 bedroom dwellings incorporating new access roads off Bank Street and Tartan Street, pavements and associated landscaping and boundary treatments.
- Etihad Stadium Expansion - Alterations to the Etihad Stadium, including increasing the overall height of the South and North stands and associated elevational alterations, to allow an increase each stand capacity by up to 6,250 seats respectively and up to 2,000 additional pitch side seats creating a total match day capacity of up to 62,170 seats (from 47,670), expansions of concourse facilities, alteration to public realm including changes to car parking layout, landscaping and boundary treatments and associated infrastructure works.
- Residential (Buttler Street/ Bradford Road/ Halmore Road) – Proposed development of vacant land to create 12 new dwellings, a range of terraced and semi-detached typologies addressing Buttler Street, Bradford Road and Halmore Road. Vehicular access is provided from Ridgeway Street.

11.40 Desk based studies were carried out to collate and map baseline townscape information and carry out a review of policy and guidance to inform the assessment.

11.41 Potential viewpoints were initially identified through a process of desktop and onsite survey before being checked on site. Viewpoints were excluded where there was likely to be no significant impact beyond that which was already identified within the selected views.

11.42 Photographs for the selected viewpoints were taken by a professional photographer on the 29 October 2019. The visualisations were produced by Virtual Planit, a professional visualisation studio with extensive experience in the production of photomontages. The photography and visualisations were both produced to accord with best practice, in accordance with the Landscape Institute technical guidance note, "Visual Representation of Development Proposals', September 2019.

11.43 In order to provide the most comprehensive, rounded and objective view of the Townscape and Visual Impacts of the Proposed Development, assessed effects have been agreed following round-table review by a team of individual assessors.

Baseline Townscape Value

11.44 Townscapes may be valued at community, local, national level or above. Existing Townscape designations have been taken as the starting point for this assessment, as shown in Table 11.1 below. However, the value attached to undesignated townscapes also needs to be assessed and this is considered in Table 11.2.

11.45 Table 11.1 sets out the relative importance of generic townscape designations and descriptions

Table 11.1: Value of Designated Townscapes

Value	Description
High	Sites, features or areas of national or international importance with settings of high quality such as World Heritage Site, AONB, National Parks, Grade I and Grade II* Listed buildings or Registered Parks and Gardens.

Value	Description
Medium	Sites, features or areas of local or regional importance with intact character such as Grade II* and Grade II Listed Buildings or Registered Parks and Gardens, Conservation Areas, Scheduled Monuments, local nature site, long distance recreational routes. Tree Preservation Orders (TPO) and local designations that exhibit wider geographic, cultural or townscape significance.
Low	Areas or features of local importance such as Tree Preservation Orders (TPO), Public Right of Way (PROW) and locally listed buildings.

11.46 Whilst the assessment of value is partly based on the Planning Policy importance of the townscape, other criteria used to assess townscape value in more detail, including that of undesignated townscape, are set out in Table 11.2 below. The criteria are taken from the Planning Practice Guidance that supports the National Planning Policy Framework.

Table 11.2: Criteria for Assessing the Value of Non-Designated Townscapes

Attribute	Criteria
Functional	A building or place should be fit for purpose, designed and delivered in a way that delivers the intended function and achieves value for money in terms of lifetime costs.
Mix of uses	Mix of uses to ensure easy access to facilities and encourage a healthier environment, reducing the need to travel.
Well-designed public space	Functional and attractive hard and soft landscape elements, well orientated and designed routes, inclusion of facilities such as seats and play equipment and public art.
Buildings designed to be adaptable	Flexibility to be able to respond to a range of future needs – how easily buildings change be adapted for change of use, places that are easy and practical to manage with good access, natural surveillance and hard wearing materials that are easy to repair.
Distinctive character	Consideration of the local pattern of street blocks and plots; building forms; details and materials; style and vernacular.
Attractive spaces	Consideration of streetscapes, townscapes, buildings and elements within them all, microclimates and views should all be considered. This is also affected by the way a townscape is perceived using the senses and the effect of transient elements such as the presence of human activity and resulting tranquillity or vibrancy.
Promotes ease of movement	All users should be able to move safely, conveniently and efficiently to and within a place, appropriate number of legible routes to and through it, good connections with each other and other destinations.

11.47 An overall assessment of value has been made for each townscape receptors (refer to Appendix 11.1), based on an overview of the assessments made using each of the above criteria, in terms of high, medium and low value. The assessment of the value of a non-designated townscape is based on professional judgement. The assessment of a 'high' value would be given where a non-designated townscape is assessed as clearly displaying the criteria described above. A 'medium' assessment would be given where a non-designated townscape displays the criteria to a moderate extent, and an assessment of 'low' would be given where a non-designated townscape displays the above criteria to only a minor or negligible extent.

Baseline Susceptibility of Townscape Receptors to Change

11.48 Susceptibility of townscape receptors to change has been assessed using the criteria identified in Table 11.3, with reference to the baseline conditions.

Table 11.3: Townscape Receptor Susceptibility to Change

Susceptibility	Criteria
High	Little ability to accommodate the Proposed Development without undue harm.
Medium	Some ability to accommodate the Proposed Development without undue harm.
Low	Substantial ability to accommodate the Proposed Development without undue harm.

Overall Sensitivity of Townscape Receptors

11.49 The assessment of receptor sensitivity combines judgements on the susceptibility of the receptor to the specific type of development proposed and the value attributed to that receptor, as detailed within Appendix 11.1.

Criteria for Determining Sensitivity of Visual Receptors

Type of View and Number of Viewers

11.50 In terms of assessing the baseline visual sensitivity, key factors to consider are the type of view and the likely numbers of viewers (the visual receptors). The type of view and the number of viewers are described in the following terms:

- Glimpsed (i.e. in passing)/Filtered/Oblique/Framed/Open Views; and
- Few/Moderate/Many Viewers.

Value of Views

11.51 The value attached to views has regard to a number of factors, including:

- recognition through planning designations or heritage assets; and
- the popularity of the viewpoint, its appearance in guidebooks, literature or art, on tourist maps and the facilities provided for its enjoyment.

11.52 The assessment of the value of views is summarised in Table 11.4 below, in terms of High, Medium and Low value. These criteria are provided for guidance only and are not intended to be absolute.

Table 11.4: Value Attached to Views

Value	Criteria
High	Views from townscapes/viewpoints of national importance, or highly popular visitor attractions where the view forms an important part of the experience, or with important cultural associations.
Medium	Views from townscapes/viewpoints of regional/district importance or moderately popular visitor attractions where the view forms part of the experience, or with local cultural associations.
Low	Views from townscapes/viewpoints with limited designations, not particularly popular as a viewpoint and with minimal or no cultural associations.

Susceptibility of Visual Receptors to Change

11.53 The susceptibility of different types of visual receptor to changes in views is mainly a result of:

- The occupation or activity of the viewer at a given location; and,
- The extent to which a person's attention or interest may therefore be focussed on a view and the visual amenity experienced at a given view.

11.54 The assessment of a visual receptor to change is specific to the Proposed Development. However, the Guidelines for Landscape and Visual Impact Assessment offers the generic guidance identified in Table 11.5 as a starting point for the assessment.

Table 11.5: Visual Receptor Susceptibility to Change

Susceptibility	
High	• Users of public space, including users of public rights of way, whose attention is likely to be focussed on the townscape and on particular views; • Visitors to heritage assets or other attractions where views of the surroundings are an important part of the experience; • Communities where views contribute to the townscape setting enjoyed by residents; and, • Travellers on scenic routes.
Medium	• Travellers on road, rail or other transport routes, where the view is moderately important to the quality of the journey; and, • Users of public space, where the view is a part of the wider experience of the place.
Low	• People at their place of work, where the setting is not important to the quality of working life; • Travellers on road, rail or other transport routes, where the view is fleeting and incidental to the journey; and, • People engaged in outdoor sport or recreation, or users of a public space, which does not involve appreciation of views.

11.55 The Guidelines for Landscape and Visual Impact Assessment qualifies the above examples as follows:

"This division is not black and white and in reality, there will be a gradation in susceptibility to change. Each project needs to consider the nature of the groups of people who will be affected and the extent to which their attention is likely to be focussed on views and visual amenity." (page 114, paragraph 6.35).

Overall Sensitivity of Visual Receptors

11.56 The assessment of receptor sensitivity combines judgements on the susceptibility of the receptor to the specific type of development proposed and the value attributed to that receptor, as detailed in Appendix 11.2.

Predicted Townscape and Visual Impact Criteria

11.57 The predicted townscape and visual impacts of the Proposed Development are set out in Appendix 11.1 and Appendix 11.2 respectively.

Size and Scale of Effects

11.58 The size and/or scale of effects relates to the scale of physical changes in the townscape and the scale of the visible change in views, such as the loss or addition of features. This is broadly rated along the following scale:

- No Change – change will not be perceptible.
- Negligible – change will be just discernible.
- Minor – a small change will be perceptible.
- Moderate – change will be clearly noticeable.
- Major – total change will occur.

Geographical Extent of Effects

11.59 The geographical extent of effects relates to:

- the area over which townscape effects are likely to be experienced, i.e. this could be at the Site level, the immediate locality, across a neighbourhood or across a series of neighbourhoods (city-wide);
- the area over which the changes are likely to be visible, i.e. viewpoint within the Site, viewpoint within the immediate locality, viewpoint across/ through a neighbourhood or a vista or vantage point across neighbourhoods or the city skyline (city-wide).

Duration/ Reversibility

11.60 Effects may be experienced over a range of timescales. For this assessment, the following timescales are considered appropriate:

- Short-term: 1 year or below.
- Medium-term: Between 1 and 10 years in duration.
- Long-term: Greater than 10 years in duration.

11.61 Effects may be temporary, permanent or reversible over time. For example, visual effects arising from construction activities may be limited solely to the construction period and therefore only temporary. The assessment therefore considers the practicality of effects being reversed.

Magnitude of Townscape Effects

11.62 The magnitude of a townscape effect is assessed in terms of its size or scale, the geographical extent of the area influenced by that effect, its duration and degree of reversibility and the impact these are likely to have on the baseline character of the townscape element.

11.63 The magnitude of change in the townscape takes into consideration the following factors:

- the extent/proportion of townscape elements lost or added;
- the contribution of that element to townscape character and the degree to which aesthetic/perceptual aspects are altered; and,
- whether the effect is likely to change the key characteristics of the townscape, which are critical to its distinctive character.

Table 11.6: Magnitude of Townscape Effects

Category	Criteria
Major adverse townscape effect	The proposals will result in a total change in the key characteristics of townscape character; will introduce elements totally uncharacteristic to the attributes of the receiving townscape; and/or will result in a substantial or total loss, alteration or addition of key elements/features/characteristics.
Moderate adverse townscape effect	The proposals will result in a partial change in the key characteristics of townscape character; will introduce elements partially uncharacteristic to the attributes of the receiving townscape; and/or will result in partial loss, alteration or addition of key elements/features/characteristics.
Minor adverse townscape effect	The proposals will result in a small change in the key characteristics of townscape character; will introduce elements that are not uncharacteristic to the attributes of the receiving townscape; and/or will result in a minor loss, alteration or addition of elements/features/characteristics.
Negligible adverse townscape effect	The proposals will result in a just discernible change to townscape character/elements/features/characteristics.
Negligible townscape benefit	The proposals will result in a just discernible improvement to the townscape character/elements/features/characteristics.

Category	Criteria
Minor townscape benefit	The proposals will achieve a degree of fit with the townscape character/elements/features/characteristics and go some way towards improving the condition or character of the townscape.
Moderate townscape benefit	The proposals will achieve a good fit with the townscape character/elements/features/characteristics, or would noticeably improve the condition or character of the townscape.
Major townscape benefit	The proposals will totally accord with the townscape character/elements/features/characteristics, or would restore, recreate or permanently benefit the condition or character of the townscape.
No Change	The proposals will not cause any change to the townscape character/ elements/ features/ characteristics.

Magnitude of Visual Effects

11.64 The magnitude of a visual effect is assessed in terms of its size or scale, the geographical extent of the area influenced by that effect, its duration and degree of reversibility and the impact these are likely to have on the baseline character of the view.

11.65 The magnitude of change in the view relates to the degree of contrast or integration likely to result from the Proposed Development and is influenced by the relative time over which a view is experienced and whether it is a full, partial or glimpsed view.

11.66 The criteria identified in Table 11.7 are used to assess the magnitude of visual effects, based on the degree of change to the view or composition.

Table 11.7: Visual Effects - Magnitude

Category	Criteria
Major adverse or beneficial visual effect	The proposals will cause a dominant or complete change or contrast to the view, resulting from the loss or addition of substantial features in the view and will substantially alter the appreciation of the view.
Moderate adverse or beneficial visual effect	The proposals will cause a clearly noticeable change or contrast to the view, which would have some effect on the composition, resulting from the loss or addition of features in the view and will noticeably alter the appreciation of the view.
Minor adverse or beneficial visual effect	The proposals will cause a perceptible change or contrast to the view, but which would not materially affect the composition or the appreciation of the view.
Negligible adverse or beneficial visual effect	The proposals will cause a barely perceptible change or contrast to the view, which would not affect the composition or the appreciation of the view.
No change	The proposals will cause no change to the view.

Nature of Effects

11.67 The nature of effects may be positive or negative (beneficial or adverse), or neutral. Neutral effects recognise that there will be a change to the receptors, however this change is in keeping with the existing characteristics of the receptor.

11.68 Effects may also be direct or indirect. Direct effects are those that result directly from a development itself, whereas indirect effects may arise as a consequential change resulting from development.

Significance of Effects

11.69 The scale shown in Table 11.8 is used to guide the assessment of the significance of both townscape and visual effects, from a combination of the assessment of receptor sensitivity and the magnitude of effects:

Table 11.8: Assessment of Townscape or Visual Significance

Sensitivity of Receptor	Magnitude of Effect				
	Major Effect	**Moderate Effect**	**Minor Effect**	**Negligible Effect**	**Neutral/No Change**
High	Significant	Moderately Significant	Moderately Significant	Minor Significance	Not Significant
Medium	Moderately Significant	Moderately Significant	Minor Significance	Not Significant	Not Significant
Low	Moderately Significant	Minor Significance	Not Significant	Not Significant	Not Significant

11.70 The table has regard to guidance in the Guidelines for Landscape and Visual Impact Assessment, Third Edition, 2013, at paragraph 5.56, page 92 (significance of landscape effects) and paragraph 6.44, page 116 (significance of visual effects). This matrix is used as a guide to determine significance, along with professional judgement.

11.71 For the purposes of this Townscape and Visual Impact Assessment, only effects deemed Moderately Significant and Significant are considered to be Significant in the meaning of EIA Regulations (2017).

Consultation

11.72 The principal viewpoints were identified through a process of desktop study and on-site survey, and were then agreed with Local Planning Authority officers through pre-application discussions. As a result of the consultation process, an additional longer-range view was added from the junction of the A6010 Hulme Hall Lane, and Oldham Road to the North West.

11.73 The schemes included within the assessment for the purposes of cumulative assessment were identified through consultation with the Council and agreed through the EIA Scoping process.

Assumptions/Limitations

11.74 The methodology described above provides a robust and transparent process for assessment of townscape and visual effects. Production of verified photomontage views provides a high level of detail and technical accuracy. The TVIA process is based on the GLVIA guidelines, and the assessment has been presented in a tabular format in Appendices 11.1 and 11.2. The assessment is carried out by a team of assessors to provide scrutiny where professional judgement is relied upon.

11.75 Verified views have been produced to provide a high level of confidence in the assessment of effects resulting from the Proposed Development.

11.76 Due to the timing of the application, the photography and assessment has been carried out during the autumn months when the trees are still partially in leaf. The potential screening

effects of trees has been taken into account during the assessment of visual impact, in order to ensure assessment of 'worst case' scenario, in accordance with the Guidelines.

11.77 The cumulative visual assessment does give a clear indication which of the key viewpoints and townscape receptors are likely to be impacted on by committed development.

11.78 Acknowledging the limitations and assumptions, predicted effects are assessed against the criteria set out below in order to attribute a level of confidence to the assessment:

- High – The predicted effect is either certain, or very likely to occur, based on reliable information or previous experience.
- Medium – The predicted effect and its level are best estimates, based on on-site and desktop study.
- Low – The predicted effect and its level are best estimates, based on given knowledge and experience. More information may be needed to improve the level of confidence.

Baseline Conditions

Site Location

11.79 The location of the Site is presented in Figure 11.3.1 in Appendix 11.3. The Site is located approximately 2.2 km from Piccadilly Station, the primary arrival point into Manchester City Centre by rail. The Site is located to the immediate north of the Etihad Stadium, which was built in 2002 to host the Commonwealth Games. The stadium is the home of Manchester City Football Club, with a domestic football capacity of 55,097, making it the 10th largest in the UK.

11.80 The Site sits within the Eastlands Regeneration Framework, and is a prominent site within the wider Etihad Campus. Nearby landmarks include the Etihad Stadium, the Manchester Velodrome and National Cycling Centre as well as the Manchester Regional Arena. Surrounding residential neighbourhoods include Clayton to the east, Bradford and Beswick to the south and Miles Platting to the west.

11.81 The Site sits adjacent to Philips Park, a Grade II listed registered landscape that opened in 1846 and forms one of the world's oldest municipal parks.

Historical Development

11.82 The historical development of the Site through the twentieth century is recorded in Figure 11.3.2 in Appendix 11.3. At the turn of the 20th century the Site was comprised of open space, with the River Medlock running at ground level along the north western edge of the Site into Philips Park. A series of terraced properties are identifiable along the former Mill Street (now Alan Turing Way) along the eastern boundary.

11.83 By 1922 the Site, as well as its immediate surroundings, have been urbanised. Large footprint industrial units were present to the west and north west of the Site, and to the east. Forge Lane formed a new connection running north-south through the Site, lined to the east by terraced properties, which conjoin with earlier developed 'back-to-backs' to form a more coherent perimeter block. The Site retained a similar form until the late twentieth century, where industrial decline and associated clearances resulted in a fragmented urban grain on the Site and its surroundings to the west and north west.

Heritage Designations

11.84 There are no heritage designations within the Site. Heritage designations within the wider study area are shown in Figure 11.3.3 in Appendix 11.3.

11.85 The following listed buildings sit within the immediate vicinity of the Site.

- Ashton Canal Lock Keepers Cottage (Grade II)
- Ashton Canal Lock Number 6 (Grade II)
- Entrance Lodge to Main Entrance of Phillips Park Cemetery (Grade II)
- Gates and Railings to Main Entrance of Phillips Park Cemetery (Grade II)
- Cemetery Office at Philips Park Cemetery (Grade II)

- Cemetery Chapel at Philips Park Cemetery (Grade II)

11.86 Within the wider study area, a number of locks and bridges, as well as mills on Ashton Canal, including the Grade II* listed Hope Mill and Victoria Mill in Miles Platting.

11.87 Immediately east of the Site are two Grade II listed Parks and Gardens - Philips Park and Philips Park Cemetery.

Urban Grain

11.88 Urban grain on the Site and in the surrounding area is shown in Figure 11.3.4 of Appendix 11.3. The Site sits within a wider heterogenic and fragmented area, with a mix of large footprint sports stadia, big box retail and light industrial units and low density housing with pockets of high density multi-storey apartment blocks. The urban grain of the large scale sporting facilities contrasts sharply with the tight urban grain of neighbouring residential areas.

11.89 The Site itself is undeveloped and in conjunction with land to the north, forms a 'gap' in the urban grain at a key location in the wider city fringes.

11.90 The immediate area around the Site is primarily characterised by the extensive footprint of Etihad Stadium just south of the Site, along with neighbouring sporting facilities within the Etihad Campus and the National Cycling Centre. The stadia and sports facilities consist both of large scale built forms and open expanses of outdoor sports' courts and associated approaches and landscaped areas. Big box commercial sheds are found in larger groups to the very north of the surrounding area and along and in the vicinity of the Ashton Canal.

Land Use

11.91 Land use on the Site and in the surrounding area is shown in Figure 11.3.5 of Appendix 11.3. The land use in the immediate vicinity of the Site is mixed, but dominated by sports' facilities, including Manchester Tennis and Football Centre, Etihad Stadium and Manchester Regional Arena. Just east of the Site, less than 200 metres away, is a residential area comprised of higher density apartment blocks and lower density terrace housing.

11.92 Philips Park and Cemetery are major recreational spaces. Ashton Canal is an important city-wide recreational and commuting route.

11.93 Surrounding the immediate Etihad Campus area, land use is defined by a mix of sports facilities, low density residential housing and industrial sheds. Schools and churches are more or less regularly distributed within the residential neighbourhoods, which also at times include a shop or newsagent. Asda Eastlands Supercentre forms out as a major shopping destination to the east.

Building Heights

11.94 Building heights on the Site and in the surrounding area are shown in Figure 11.3.7 of Appendix 11.3.

11.95 The Site sits within a wider area generally characterized by buildings of two to three storeys, which reflects the predominantly residential and light industrial use. Although large in building footprint, the commercial sheds are rarely taller than 3 storeys. Etihad Stadium and the Gasholders within the immediate vicinity create a strong visual presence and sense of primacy, making them landmarks within the wider area.

11.96 Similarly, sports' facilities within the wider area deviate only slightly from that datum.

11.97 The height of the stadium is matched in part by some modern apartment blocks and towers on the opposite side of Alan Turing Way, with heights up to 10 and 14 storeys.

11.98 On the edges of the wider study area, the historic mills set a height datum of 6-8 storeys, accompanied by residential blocks and towers of a similar, or slightly higher storey height.

Topography and Site Levels

11.99 Topography and Site Levels of the Site and in the surrounding area are shown in Figure 11.3.9 of Appendix 11.3**.**

11.100 The ground levels within the Site have been manipulated historically to accommodate previous development, and more recently subsequent to site clearance and the requirement to accommodate existing surface car parking. Site levels are therefore not considered sensitive to any change required in order to accommodate future development on the Site. The Site falls approximately 6 metres from its southern boundary to the northern edge. A significant level change exists along the southern boundary, with levels dropping steeply to the canal.

11.101 The Site sits at a low point within its wider topographical context. Its location in close proximity to the River Medlock mean it sits within the dip of the valley, as ground levels fall towards the river.

Movement and Linkages

11.102 The movement framework surrounding the Site is shown in Figure 11.3.8 of Appendix 11.3. The Site is bound by Alan Turing Way to the east, Ashton Canal to the south, Joe Mercer pedestrian linkage to the Etihad Stadium to the west and Forge Lane to the north. Pedestrian access onto the Site is restricted, with gated access off Forge Lane and fencing around the perimeter to all sides.

11.103 Alan Turing Way is a major vehicular route running north to south, becoming Pottery Lane at Ashton Old Road to the south and Hulme Hall Lane to the north. It forms part of the A6010, which is in turn part of the Manchester Intermediate Ring Road, ultimately connecting Salford to the north with Chorlton to the south.

11.104 Ashton Canal towpath is an important recreational and commuting route for both pedestrians and cyclists, connecting Manchester with surrounding regional towns and cities. The towpath forms part of the National Cycle Network and is also the route of the Cheshire Ring Canal Walk and Medlock Valley Way.

11.105 Ashton New Road to the south of the Etihad Stadium, is a major route into and out of Manchester city centre and designated cycle lanes make it a popular commuting route for cyclists.

11.106 Two Metrolink tram services pass along the Site's southern edge, with regular services connecting Ashton-under-Lyne with Eccles and Ashton-under-Lyne with Media City UK. The Metrolink tram stop for the Etihad Stadium and wider campus is located immediately south of the Site.

Environmental Designation and Public Open Space

11.107 Environmental designations and public space surrounding the Site are shown in Figure 11.3.10 of Appendix 11.3. There are no environmental designations covering the Site, and no designated public open space.

11.108 Philips Park and Philips Park Cemetery located directly to the east, across Alan Turing Way, are both Grade II Listed and form major green space destinations. Ashton Canal, which runs along the Site's southern boundary is designated as a Site of Biological Importance, and also forms a major recreational resource.

Site Character

11.109 Figure 11.3.11 of Appendix 11.3 illustrates existing character of the Site. The Site is currently unoccupied by buildings and used as overspill surface car parking for events at the Etihad Stadium. It is fenced off on all sides, with views into the Site obstructed by self-seeded vegetation. Along Alan Turing Way, a planted row of trees defines the edge. Parking within the Site is informal, with large areas covered by self-seeded grass, shrubs and trees. The Site currently lacks permeability due to it being fenced off and lacking a use. The Site forms a noticeable 'gap' in the urban grain, in conjunction with surface car parking to the north, at a key location within the wider city fringe.

11.110 At present the Site does not contribute positively to its immediate surroundings, or the wider vision within the Core Strategy or the Eastlands Regeneration Framework. In addition, it has a negative relationship with the adjacent Ashton Canal due to perimeter fencing and the steep

level change. It is visually poor and does not provide enclosure or active frontage along Alan Turing Way, a key route around the city.

Potential Effects

Potential Construction Phase Effects

11.111 The Outline Construction Management Plan provides an initial summary of Construction Phase Effects. This represents a realistic 'worst case' assessment as the aforementioned detail often forms a means of mitigating against potential effects. The likely significant effects are assessed in more detail in Appendices 11.1 and 11.2.

11.112 Sources of townscape and visual construction effects include:

- Site setup and site compound (visual effects).
- Site/boundary fencing (visual effects).
- Highways alterations, site access and deliveries (movement and linkages - townscape.
- Site clearance, removal and disposal of existing vegetation and scrub as defined within the proposals (landscape and visual effects).
- Contractor parking, plant and equipment (visual effects).
- Works associated with service diversions and removal/ capping of redundant services (visual effects).
- Ground Works including site levelling & preparation (topography – townscape effects, and visual effects).
- Earthworks (incl. formation of retaining walls and piled foundations etc.) (topography – townscape effects, and visual effects).
- Works associated with construction of the new events area (visual effects).
- Public Realm and associated landscaping works (townscape and visual effects).

Potential Townscape Effects

11.113 The components of the townscape which may potentially be affected by the Proposed Development are known as the townscape receptors. These include the characteristics and character of the townscape, and the character and quality (or special qualities) of designated areas.

11.114 Likely townscape effects have been identified with reference to interactions between the Proposed Development and townscape receptors. The likely significant effects (highlighted below) are assessed in more detail in Appendix 11.1.

Table 11.9: Potential Townscape Effects

Townscape Element	Construction	Operation
Heritage Designations	Indirect effect/local extent of effect. Any visual relationships with between heritage assets and the Site will be assessed within the visual assessment.	Indirect. Any visual relationships between heritage assets and the Site will be assessed within the visual assessment.
Townscape Character	Direct effect/city-wide extent of effect.	Direct effect/city-wide extent of effect.
Urban Grain	Direct effect/local extent of effect.	Direct effect/local extent of effect.
Land Use	Direct effect/local extent of effect.	Direct effect/local extent of effect.
Building Heights	Direct effect/city-wide extent of effect.	Direct effect/city-wide extent of effect.

Townscape Element	Construction	Operation
Topography and Site Levels	Direct effect/site extent of effect.	Direct effect/local extent of effect.
Movement and Linkages	Direct effect/site extent of effect.	Direct effect/local extent of effect.
Environmental Designations and Public Open Space	Indirect effect/local extent of effect. Any visual relationships with between open space and the Site will be assessed within the visual assessment.	Indirect. Any visual relationships between open space and the Site will be assessed within the visual assessment.
Site Character	Direct effect/site extent of effect.	Direct effect/site extent of effect.

Potential Visual Effects

11.115 Likely visual effects have been identified with reference to interactions between the Proposed Development and visual receptors. The potential significant effects (highlighted below) are assessed in more detail in Appendix 11.2.

Table 11.10: Potential Visual Receptors

Viewpoint Location and No.	Construction	Operation
1. View south from pedestrian crossing on Alan Turing Way A6010, at the junction with Briscoe Lane.	Views of construction activities above tree line, and viewed in conjunction with listed Gatehouse.	Clear change in the view. Glimpsed views of Stadium beyond new arena.
2. View southwest from Grade II Listed Phillips Park.	Views of construction works beyond the treeline.	Clear change in the view. Stadium will appear above existing treeline.
3. View from eastern end of pedestrian footbridge leading to Commonwealth Way, Etihad Stadium.	Partial views of construction works.	The Proposed Development will be clearly visible from the elevated viewpoint, on what is a key approach route.
4. View north east from A662 Ashton New Road.	Partial views of construction works.	Minor change in the view. Screening provided by existing built form and tree cover.
5. View east from CityLink – a key pedestrian and cycle route from Piccadilly Station to the Etihad Stadium.	Partial views of construction works.	New focal element in the view.
6. View west along towpath/National Cycle Network Route 60/Bee Network: Beeway.	Views of construction works will be partially available beyond existing development and tree cover.	The character of the view changed with the addition of a major new landmark.
7. View northeast from Joe Mercer Way.	Clear views of construction works.	Clear views of new arena due to proximity of viewpoint.
8. View north along Grey Mare Lane.	Partial views of construction works.	Minor glimpsed view terminating view along street.
9. View east from Saxon Saint Park.	Minor, glimpsed views of construction works.	Minor, glimpsed views of arena.

Viewpoint Location and No.	Construction	Operation
10. View west along Stuart Street East	Partial views of construction works.	Change in the character of the view. Construction works will be clearly visible.
11. View south east along Hulme Hall Lane	Partial views of construction works.	Minor glimpsed views of arena. New focus for the view.

Mitigation Measures

11.116 'Embedded mitigation' is a form of mitigation that has been incorporated into the design of the development through an iterative design process, effectively 'designing out' potential townscape and visual effects.

Construction Phase – Embedded Mitigation

11.117 The following mitigation measures with relevance to townscape and views that are included in the 'Outline Construction Management Plan' are described in brief below:

Table 11.11: Summary of Embedded Construction Mitigation Measures

Mitigation Measures	Effects
Appropriate delivery routes will be established to limit the duration of vehicles occupy the network. Diverse routes will be managed by the Contractor to distribute vehicle movements across the network. Where possible, deliveries will be scheduled outside of peak traffic flow times to minimise the impact on the surrounding areas.	Reduce/limit the effects of construction vehicles on key routes.
Loading or unloading of plant and materials will not be permitted outside of the campus.	Reduce/ limit townscape and visual impact of loading or unloading of materials.
Contractor parking will be managed on campus within the Site compound and the North carpark.	Reduce/limit the effects of vehicles associated with construction on key routes.
To improve the accessibility of the Site and reduce the impact of the construction works on the surrounding areas and infrastructure, the S278 works associated with Highways alterations will be undertaken as 'first task' in the construction process.	Reduce/limit the effects of construction vehicles on key routes
Where reasonably practical, material will be retained and reused on site.	Reduce/limit the effects of construction vehicles on local routes
Site operating hours will adhere with Manchester City Council's (MCC) 'Environmental Protection Information for Developers. To reduce the impact on the existing transport and public transport infrastructure of operatives attending site, arrival of the workforce on site 30 minutes prior to the	Reduce the townscape and visual impact of construction during unsociable hours.

Mitigation Measures	Effects
permitted operating hours for setting up will be encouraged.	
Lighting associated with the Site and site establishment will be designed to minimise light spillage to limit the impact on adjacent properties and highways.	Reduce the townscape and visual effects of construction works.

Operational Phase – Embedded Mitigation

11.118 Forms of mitigation embedded within the operational phase are described in detail in Appendix 11.1 and 11.2. The key principles incorporated into the Proposed Development which form embedded mitigation include:

- High architectural quality, to deliver a world class arena proposal and key destination.
- Utilization of existing ground levels within the Site to facilitate arrival and access. The building sits on a concrete plinth, which resolves the level change across the Site from north to south.
- 'Stacked box' aesthetic of building creates an iconic identify and allows for dynamic façade activation, and creates canopies over external pedestrian spaces where pedestrians will be queuing.
- Strong pedestrian connections to Etihad Stadium using existing Joe Mercer Way and Forge Lane Bridge.
- Unifying approach to materials with create a strong identity and tie the arena into its setting.
- Use of green wall to provide a softer edge and pedestrian friendly environment at ground level.
- Contemporary approach to materials including black façade, to seamlessly incorporate LED screens which will activate the external building facades during the daytime and at night, and for different functions.
- Strong lighting concept to create an iconic new destination in keeping with the vision for the Etihad Campus.
- Use of perforated panel to reflect Manchester's Industrial Heritage.
- Solid/heavy plinth embeds the arena in its setting, with 'lighter' materials for upper sections.
- High quality proposals for the public realm, with historical references of the Site through choice of materials.
- Creation of a comprehensive pedestrian and vehicular circulation network around the Site, with active frontage along the Ashton Canal.
- Creation of a 'green ring' of landscape around the venue to create a pedestrian friendly environment, respond to the setting opposite Phillip's Park, and the setting adjacent to the Canal.
- Public realm proposals designed to fit both event and non-event days.

Supplementary Mitigation and Enhancement

11.119 Given the nature of the iterative design process leading to the extent of embedded mitigation into the design, the requirement for supplementary mitigation is limited. The mitigation

measures described below are focussed on ensuring that the management and maintenance of the Proposed Development limits any further adverse townscape and visual effects.

11.120 The implementation of good site management, maintenance and housekeeping would ensure that the temporary deterioration to townscape character and visual amenity during the construction phase would be kept to a practical minimum. Despite these better practice measures, there would still remain inevitable adverse effects during construction works.

11.121 An operational management strategy will be submitted with the application to provide further mitigation and maintenance once the Site is operational.

Cumulative Effects

11.122 A total of six additional committed developments have been considered following consultation with the Council. The locations are highlighted in Figure 11.3.12 in Appendix 11.3. The 6 schemes are listed at Paragraph 11.40 and illustrated in Figure 11.3.12 in Appendix 11.3. In addition, the Site is located within the Eastlands Regeneration Framework (ERF) area. The 2019 draft ERF supports the on-going regeneration of the Eastlands area in line with existing planning policy; the following development objectives could be supported:

- Etihad Campus – Sports and Innovation Zone: new higher education and support facilities, student accommodation and commercial workspace.
- Etihad Campus – Commercial Zone: commercial workspace, indoor arena, leisure and hotel development.

11.123 Whilst the development opportunities identified in the ERF do not have the benefit of Planning Permission and there is limited information about the quantum and scale of likely development, the ERF has been considered as part of the cumulative assessment.

11.124 The only committed development with the potential to result in cumulative townscape effects in conjunction with the Proposed Development is the Etihad Stadium Extension. The scheme includes alterations to the Etihad Stadium, including increasing the overall height of the South and North stands and associated elevational alterations, to allow an increase each stand capacity by up to 6,250 seats respectively and up to 2,000 additional pitch side seats creating a total match day capacity of up to 62,170 seats (from 47,670), expansions of concourse facilities, alteration to public realm including changes to car parking layout, landscaping and boundary treatments and associated infrastructure works.

11.125 The extension of the Etihad Stadium is not predicted to result in any significant additional effects on townscape when considered cumulatively in conjunction with the Proposed Development. The changes to the Stadium are relatively localised, and do not result in a significant change to the existing site character, wider townscape character, movement, linkages, public space, urban grain or heritage.

11.126 The Proposed Development accords with the wider principles set out for the 'Etihad Campus Commercial Zone', as outlined with the Eastlands Regeneration Framework.

11.127 The Etihad Expansion is the only consented scheme which has the potential for cumulative visual effects in conjunction with the Proposed Development. The proposed expansion will be visible from viewpoints 1, 2, 3, 4, 9 and 11, as shown in red in the cumulative photomontages in Appendix 11.4. The Stadium expansion is not predicted to result in any additional visual effects on these identified viewpoints when considered in conjunction with the Proposed Development. This is because the existing Stadium already forms a major landmark in the views, and therefore the extension does not change the character of views.

Summary of Residual Effects

11.128 The extent of mitigation 'designed in' to the Proposed Development means that townscape and visual effects are likely to remain as residual effects after any supplementary mitigation has been implemented.

11.129 The results of the townscape and visual assessment are set out in full within Appendices 11.1 and 11.2.

11.130 A summary of all residual effects are set out in Table 11.12 below, with effects assessed as significant highlighted in bold. For the purposed of this Townscape and Visual Impact Assessment, 'moderately significant' effects and 'significant' effects are considered to be significant in EIA terms (EIA Regulations 2017).

Table 11.12: Summary of Residual Effects

Receptor	Sensitivity	Phase	Magnitude/direction of change	Significance
Townscape				
Heritage Designations	Low	Construction	Minor Adverse	Not Significant
Heritage Designations	Low	Operational	Negligible	Not Significant
Townscape Character	Low	Construction	Minor Adverse	Not Significant
Townscape Character	Low	Operational	Major Beneficial	Moderately significant
Urban Grain	Low	Construction	Minor Adverse	Not Significant
Urban Grain	Low	Operational	Major Beneficial	Moderately significant
Land Use	Low	Construction	Negligible	Not Significant
Land Use	Low	Operational	Major Beneficial	Moderately significant
Building Heights	Medium	Construction	Negligible	Not Significant
Building Heights	Medium	Operational	Moderate Beneficial	Moderately significant
Topography and Site Levels	Low	Construction	Negligible	Not Significant
Topography and Site Levels	Low	Operational	Minor Beneficial	Not Significant
Movement and Linkages	Low	Construction	Minor Adverse	Not Significant
Movement and Linkages	Low	Operational	Moderate Beneficial	Not Significant
Environmental Designations & Public Open Space	Low	Construction	Moderate Adverse	Not Significant
Environmental Designations & Public Open Space	Low	Operational	Moderate Beneficial	Not Significant
Site Character	Low	Construction	Minor Adverse	Not Significant
Site Character	Low	Operational	Major Beneficial	Moderately significant

Receptor	Sensitivity	Phase	Magnitude/direction of change	Significance
Views				
Viewpoint 1	Medium	Construction	Moderate Adverse	Moderately significant
		Operational	Moderate Neutral	Not Significant
Viewpoint 2	High	Construction	Moderate Adverse	Moderately significant
		Operational	Moderate Adverse	Moderately significant
Viewpoint 3	High/medium	Operational	Moderate Beneficial	Moderately significant
		Operational – night-time view	Moderate Beneficial	Moderately significant
Viewpoint 4	Low	Construction	Minor Neutral	Not Significant
		Operational	Minor Beneficial	Not Significant
Viewpoint 5	High/medium	Construction	Minor Neutral	Not Significant
		Operational	Moderate Beneficial	Moderately significant
Viewpoint 6	High/medium	Construction	Moderate Adverse	Moderately significant
		Operational	Minor Beneficial	Moderately significant
Viewpoint 7	High/medium	Construction	Moderate Neutral	Not Significant
		Operational	Major Beneficial	Significant
		Operational – night-time view	Major Beneficial	Significant
Viewpoint 8	High/medium	Construction	Minor Neutral	Not Significant
		Operational	Minor Beneficial	Minor Significance
Viewpoint 9	Medium/low	Construction	Negligible	Not Significant
		Operational	Negligible	Not Significant
Viewpoint 10	Low	Construction	Moderate Adverse	Minor Significance
		Operational	Moderate Adverse	Minor Significance
Viewpoint 11	High/medium	Construction	Minor Neutral	Not Significant
		Operational	Minor Beneficial	Moderately significant

Summary

11.131 This report has assessed the townscape and visual impacts of the Proposed Development. The assessment has been carried out with reference to the Landscape Institute's Guidelines for Landscape and Visual Impact Assessment, 3rd Edition.

11.132 A three-stage assessment process has been adopted. Firstly, the nature of receptors (sensitivity) have been assessed, and secondly, the nature of the effects (magnitude) likely to result from the

Proposed Development have been assessed. From this the overall significance of the identified effects on receptors have been assessed.

11.133 The proposals have been formulated through a lengthy iterative process involving environmental assessment and consultation. This process has allowed site constraints and opportunities to directly influence development proposals. As a result, mitigation measures form part of the detailed design.

11.134 A total of 9 townscape receptors and 11 visual receptors were identified and considered as part of this assessment.

11.135 The assessment predicts that there will be moderately significant townscape effects during the operational phase on townscape character, urban grain, land use, building heights and site character. The effects are predicted to be beneficial in nature.

11.136 There are predicted to be significant adverse effects during the construction phase on a total of 3 key views (viewpoints 1, 3 and 6). This is primarily due to the sensitivity of the views, however the effects are temporary by their nature.

11.137 There is 1 view (viewpoint 2 from within Philips Park) which is predicted to result in a 'moderately adverse' effect during the operational phase, which is moderately significant. This is due to the sensitivity of the park, and the close proximity of the Proposed Development to the viewpoint location. The effect on this viewpoint must be considered as part of the assessment as a whole, and wider planning balance. It must also be noted that views of the Proposed Development are largely screened from within the park, the assessed viewpoint represents 'worst case scenario', in accordance with the Guidance.

11.138 A total of 6 views (viewpoints 2, 3, 5, 6, 7 and 11) are predicted to result in moderately significant or significant (viewpoint 7) beneficial effects as a result of the Proposed Development. This is primarily due to the Proposed Development consolidating the existing Campus character created by the Etihad Stadium, in accordance with the vision set out within the Eastlands Regeneration Framework.

11.139 The two night-time views (viewpoints 3 and 7) are predicted to result in moderately significant (view 3) and significant (view 7) beneficial effects. The night-time photomontages illustrate that the Proposed Development will form a cohesive character in conjunction with the Campus, and the lighting will create a dynamic, high quality new landmark destination in the area.

Reference List

- Department for Communities and Local Government (2012), National Planning Policy Framework, London, DCLG.
- Institute of Environmental Management & Assessment (IEMA), 2015. IEMA Environmental Impact Assessment Guide to Shaping Quality Development.
- Landscape Institute, IEMA, 2013. Guidelines for Landscape & Visual Impact Assessment, 3rd Edition, Oxon, Routledge.
- Landscape Institute, 2019. Visual Representation of Development Proposals, Landscape Institute Technical Guidance Note 06/11, London, Landscape Institute.
- Environmental Impact Assessment EU Directive and UK Regulations, (85/337/EEC).
- The Town and Country Planning (Environmental Impact Assessment.)

12 Traffic and Transport

Introduction

12.1 This chapter of the ES has been prepared by BuroHappold Transport & Mobility and assesses the environmental effects of the Proposed Development with respect to traffic and transportation. This chapter also describes the methods used to assess the effects; the baseline conditions at the Site and surrounding area; the mitigation measures required to prevent, reduce or offset any significant adverse effects, and the likely residual effects after these measures have been adopted.

12.2 The chapter has been informed by the following documents, which are appended to this ES chapter:

- 12.1 Transport Assessment (TA) and Transport Assessment Addendum; and
- 12.2 Framework Travel Plan.

12.3 It has also been informed by the Construction Logistics Plan (CLP) for the Proposed Development that is included within the Construction Management Plan (Appendix 5.1).

12.4 The author of this Chapter has a HNC in Civil Engineering and is a Member of the Chartered Institute of Highways and Transportation (MCIHT) with over 20 years' experience in transport development planning in the UK, including the preparation of ES Transport Chapters.

Limitations and Assumptions

12.5 This assessment has been undertaken using the material made available by the Applicant and members of their project team, together with other readily available and publicly accessible material including existing literature and studies, as well as discussions with MCC/TfGM.

12.6 Traffic flow data has been based on traffic survey information. All efforts have been made to ensure that the information used as a basis for the assessment is accurate and up to date. The team is not aware of any limitations of the underlying information or of any constraints that would materially affect the evaluations.

12.7 The Proposed Development would be operational all year round and is expected to hold circa 120 events in the opening year (2023), with the potential for up to 180 events by 2026.

12.8 Assumptions adopted in the evaluation of impacts reported in this chapter are often implicit and rely on expert judgement. Where technical deficiencies are known, or it has been necessary to make assumptions, these are documented.

Legislative and Policy Context

National Planning Policy and Guidance

National Planning Policy Framework (MHCLG, 2019)

12.9 The National Planning Policy Framework (NPPF) was published by Ministry of Housing, Communities & Local Government (MHCLG) in February 2019. The NPPF is centred on a presumption in favour of sustainable development.

12.10 Section 9 of the NPPF, from paragraph 102 to 111, sets out the approach for promoting sustainable transport. Paragraph 102 states that there is a requirement that transport should be considered at the earliest stages of development proposals for the potential impacts to be addressed.

12.11 When considering development proposals, the NPPF recommends that applications ensure that:

- *'appropriate opportunities to promote sustainable transport modes can be – or have been – taken up, given the type of development and its location;*

- *safe and suitable access to the site can be achieved for all users; and any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree.'*

12.1 Paragraph 109 states that development 'should only be prevented or refused on highways grounds if the residual cumulative impacts on the road network or road safety would be severe.'

12.2 Paragraph 110 states that applications for development should:

- '*give priority first to pedestrian and cycle movements, both within the scheme and with neighbouring areas; and second – so far as possible – to facilitating access to high quality public transport, with layouts that maximise the catchment area for bus or other public transport services, and appropriate facilities that encourage public transport use;*
- *address the needs of people with disabilities and reduced mobility in relation to all modes of transport;*
- *create places that are safe, secure and attractive – which minimise the scope for conflicts between pedestrians, cyclists and vehicles, avoid unnecessary street clutter, and respond to local character and design standards;*
- *allow for the efficient delivery of goods, and access by service and emergency vehicles; and*
- *be designed to enable charging of plug-in and other ultra-low emission vehicles in safe, accessible and convenient locations*.'

12.3 With regards to encouraging use of sustainable transport modes, Paragraph 111 states that 'all developments that will generate significant amounts of movement should be required to provide a travel plan, and the application should be supported by a transport statement or transport assessment so that the likely impacts of the proposal can be assessed.'

12.4 The NPPF includes advice on when Transport Assessments and Travel Plans are required, and what they should contain.

Regional Planning Policy and Guidance

Transport for the North's Strategic Transport Plan (TfN, 2019)

12.5 Transport for the North (TfN) became England's first Sub-national Transport Body in April 2018.

12.6 As a partnership, TfN encompasses 20 local transport authorities in northern England, together with Network Rail and Highways England, to plan and prioritise long-term infrastructure investment in the North.

12.7 TfN's role is to add strategic value by ensuring that funding and strategy decisions about transport in the North of England are informed by local knowledge and requirements.

12.8 TfN published its Strategic Transport Plan in 2019 setting out proposals for the northern transport network through to 2050.

12.9 The TfN's core vision is to have 'a thriving North of England, where world class transport supports sustainable economic growth, excellent quality of life and improved opportunities for all. Supporting this vision are the four pan-Northern transport objectives, which are as follows:

- Transforming economic performance;
- Increasing efficiency, reliability, integration, and resilience in the transport system;
- Improving inclusivity, health, and access to opportunities for all; and,
- Promoting and enhancing the built, historic and natural environment.

Greater Manchester's Plan for Homes, Jobs and the Environment: the Greater Manchester Spatial Framework (GMSF) – (2019 Draft)

12.10 The Greater Manchester Combined Authority (GMCA) was established in 2011. It is formed of 10 local authorities, including Manchester City Council (MCC). It is an administrative body that sets

out region-wide strategies, policies and objectives for housing, employment and industry and the environment. Transport for Greater Manchester (TfGM) is the executive body of the GMCA.

12.11 Greater Manchester's draft GMSF sets out GMCA's ambition to bring forward brownfield land, reduce the net loss of Green Belt and provide stronger protection for important environmental assets. It supports wider strategies around clean air, walking and cycling and underpins the ambition to be a carbon neutral city-region by 2038.

12.12 The final GMSF is expected to be adopted late 2021.

12.13 Policy GM-Strat 1 highlights a need for a strong focus on growth in the Core Growth Area (CGA). The CGA covers Manchester's city centre, the Quays and extends eastwards to include the Etihad Campus and westwards through Trafford Park. The policies seek to protect the economic role of the CGA with new development supporting major growth in jobs. Additionally, emphasis is placed on the importance of infrastructure relative to the growth of the CGA, in line with the Transport Strategy 2040.

Greater Manchester Transport Strategy 2040: Draft Delivery Plan 2020-2025 (GMCA 2019)

12.14 The Greater Manchester Transport Strategy (GMTS) sets out the long-term transport strategy to 2040.

12.15 The transport vision aims to deliver "World class connections that support long-term sustainable economic growth and access to opportunities for all" and to improve the transport system "to support a reduction in car use to no more than 50% of daily trips, with the remaining 50% made by public transport, walking and cycling."

12.16 Integration is at the heart of the strategy with an ambition to create a high-quality network for Greater Manchester that enables people to move efficiently and effortlessly between different modes of transport. Integrated land use and transport planning are recognised as key tools in realising this ambition.

12.17 Policy 4 of GMTS sets out TfGM's approach to spatial planning, who seek to continue to work in collaboration with planning authorities and developers to;

- Reduce the need to travel by car, and the distance travelled;
- Maximise accessibility to new developments by sustainable modes;
- Maximise the best use of existing infrastructure, ensure that development close to public transport nodes are high density;
- Developments are designed in a way that encourages and facilitates active travel.

12.18 Policy 17 explores the concept of streets as places, providing for sustainable modes, reducing congestion and balancing the needs of motorised traffic with cyclists, pedestrians, residents, shoppers and local businesses. It builds upon the 'Link and Place' concept that has been introduced in London and Birmingham.

Made to Move (TfGM 2017)

12.19 The Made to Move Strategy document was published in 2017 and sets out the 15 steps required to make Greater Manchester one of the best places in the world to walk and cycle.

12.20 This vision was then followed up by the Beelines vision to provide a fully joined up cycling and walking network in Greater Manchester. The Beelines network proposes 279 new or upgraded crossings in Manchester enabling 94% of the population to use Beelines. In addition, three miles of Beelines are proposed on busy roads.

Local Planning Policy

Manchester City Council's Core Strategy (2012)

12.21 MCC's Core Strategy, which was adopted in 2012, outlines MCC's vision for development in Manchester and covers the period to 2027. The Core Strategy forms part of Manchester's Local Development Framework and sets out the planning policies that will be used to deliver that vision.

12.22 In the context of Transport, the core development principles seek to maximise the potential of the City's transport infrastructure, in particular promoting walking, cycling and the use of public transport.

12.23 Strategic Objective 5 of the Core Strategy is Transport and the relevant transport policies are discussed in detail in the TA.

12.24 Policy T2 refers to the parking guidance stating that new development should provide appropriate car parking facilities in accordance with this guidance.

12.25 Policy EC 7 'Eastlands Strategic Employment Location' states that land around the City of Manchester Stadium is a focus for development and provides an opportunity "*for a leisure, recreation and entertainment visitor attraction of national significance."*

12.26 It also states that the area is "very accessible via public transport and sustainable transport modes".

12.27 Proposals at Eastlands will be expected to show how development of the area will:

- Consider the wider design and layout objectives, taking advantage of important frontages such as Alan Turing Way and Ashton New Road;
- Ensuring the site is accessible to the East/North Manchester communities by a choice of sustainable and public transport provision; and,
- Take advantage of the existing infrastructure on site and proposed improvements such as Metrolink and digital infrastructure.

Eastlands Regeneration Framework (Draft 2019 Update)

12.28 The 2019 Draft ERF outlines a well-developed vision for East Manchester to continue to accelerate and deepen the East Manchester regeneration journey and support inclusive growth through a number of strategic ambitions for East Manchester, including to:

- Bring sport, education and commerce together;
- Expand a world-class sports destination;
- Become a destination for leisure and recreation facilities;
- Capitalise on the regeneration investment made;
- Support Manchester's Green City initiatives;
- Create a distinctive sense of place; and,
- Deliver improved social and economic outcomes.

12.29 The 2019 Draft ERF outlines the strategic direction for the Etihad Campus Commercial Zone for development which supports those economic sectors in which the city-region already has strengths, including the development of a sports, leisure and recreation economic cluster that will build upon the inherent sporting strengths of the Etihad Campus.

12.30 The 2019 Draft ERF acknowledges that an Indoor Arena (with a capacity in excess of 20,000 spectators) could add significantly to the regeneration and local employment potential of the Etihad Campus. It also recognises the need to implement a controlled parking scheme (coverage to be agreed with MCC) in order to protect and enhance amenity in the surrounding area to the Etihad Stadium.

Supplementary Planning Document (SPD) Guide to Development in Manchester (MCC 2007)

12.31 MCC's SPD Guide to Development in Manchester adopted in 2007 provides guidance for developers including in respect of parking/servicing guidelines, design and travel plans.

12.32 The guidance emphasises that priority is to be given to pedestrians, disabled people and cyclists above the needs of the car, and that this should be taken into consideration in the location and design of any parking facilities. A Travel Plan will be required where appropriate to encourage and support walking, cycling and public transport use. It also provides detailed guidance on how

the need for car parking can be accommodated in the context of ensuring that priority is still given to the non-car user.

Design for Access 2 (MCC 2003)

12.33 MCC's Design for Access 2 provides best practice guidance for inclusive design and gives references for more detailed technical standards to be taken into account at the earliest possible stage in the design process. It includes guidance on public realm design, road infrastructure and parking layouts.

Assessment Methodology and Significance Criteria

EIA Scoping

12.34 An EIA Scoping Report was submitted to MCC on 26 November 2019. As detailed in Chapter 2 EIA Methodology, a Scoping Opinion was received from MCC on 15 January 2020, which includes comments from Manchester City Council and TfGM in relation to transport and access. These comments have been addressed within the EIA; the response to the comments is set out in Appendix 2.3 EIA Scoping Opinion Schedule of Comments and Responses.

12.35 Pre-planning application consultation has also been undertaken with highway officers at Manchester City Council and TfGM in relation to the scope of the TA. The scope of the TA reflects the output of this pre-application consultation process.

Baseline Study Methodology

12.36 The existing baseline year is 2019, which represents the date during which the planning application has been prepared (with submission taking place in March 2020).

12.37 The year of opening for the Proposed Development is assumed to be 2023 in line with the Construction Programme set out in Chapter 5 and this forms the future baseline year for the operational assessment.

12.38 The construction assessment has been undertaken for intermediate year 2021 as this is expected to be the peak construction year for the Proposed Development (described in more detail later in this chapter).

12.39 In accordance with the IEMA guidelines, the study area has been defined by identifying any road link where it is felt that potentially significant environmental effects may occur as a result of the Proposed Development. These highway links are shown on Figure 12.1.

12.40 Baseline conditions have been established using the following data:

- Automatic traffic counts (ATC's) were undertaken on Tuesday 29th October 2019 and Tuesday 26th November 2019 as well as a further seven days commencing Saturday 2nd November 2019.
- To take account of committed developments that would form part of a cumulative effects assessment, it was agreed with TfGM as part of the TA scoping discussions that local (TEMPRO) growth factors would be applied to derive the 2021 and 2023 future baseline flows (this is described in more detail in the TA at Appendix 12.1).
- Road traffic collision data for the most recent five years to March 2019 (data sourced from TfGM) and presented in the TA.

12.41 The number of trips forecast to be generated by the Proposed Development has been based on the methodology agreed with MCC/ TfGM as part of the TA scoping discussions, which assesses the Weekday evening period, where an evening football match coincides with an evening concert event at the proposed arena.

12.42 The Proposed Development would be operational all year round and is expected to hold up to 120 events in the opening year (2023), with the number of events expected to increase up to 180 events by 2026. The traffic data used as part of this assessment includes for these anticipated events. The operational effects of the Proposed Development have therefore been assessed against the 2023 and 2026 future baseline.

Assessment Approach

12.43 Reference has been made to the Design Manual for Roads and Bridges (DMRB) (Department for Transport (DfT)), Volume 11 Environmental Assessment (2011) to ensure that the environmental effects arising from the Proposed Development due to predicted changes in traffic levels are properly and comprehensively addressed. In addition, the approach to the assessment has been based on the the Institute of Environmental Management and Assessment (IEMA) 'Guidelines for Environmental Assessment of Road Traffic' (IEMA, 1993), which will be referred to as the 'IEMA Guidelines' throughout the remainder of this chapter.

12.44 The IEMA guidelines (Section 2: Analysis) identifies groups, locations and areas, which may be sensitive to changes in traffic conditions and environmental effects that may be considered to be potentially important when considering traffic from an individual development.

12.45 It includes a checklist of likely effects covering noise, vibration, visual impact, severance, driver delay, pedestrian delay, pedestrian amenity, fear and intimidation, accidents and safety, hazardous loads, air pollution, dust and dirt, ecological impact and heritage and conservation areas. Many of these effects are assessed elsewhere within this ES, including Townscape and Visual Impact (Chapter 11), Noise and Vibration (Chapter 10) and Air Quality (Chapter 6), or within standalone technical reports, including Ecology and Heritage Assessments.

12.46 The remaining effects that have been included in the scope of this assessment are defined below:

- Potential effects on the community associated with **severance** caused by an increase in traffic levels during construction and occupation of the Proposed Development.
- Potential effects on drivers associated with **driver delay** caused by additional traffic generated by the Proposed Development.
- Potential effects on **pedestrian**s associated with **delay**s caused by changes in traffic volume or speed of traffic.
- Potential effects on **pedestrian amenity** caused by the increase in traffic flow, traffic composition and pavement width/separation from traffic.
- Potential effects on pedestrians associated with **fear and intimidation** caused by increase in volume of traffic and its Heavy Goods Vehicle (HGV) composition.
- Potential effects of **highway safety** caused by the increase in traffic flow as a result of the approved development.

12.47 The potential effects of both construction traffic and operational traffic have been assessed in this chapter of the ES. It deals only with those transport effects likely to be relevant to the Proposed Development i.e. severance; pedestrian amenity (which for the purposes of this assessment includes fear and intimidation); driver delay; pedestrian delay; and highway safety.

12.48 The potential effects of both construction traffic and operational traffic have been assessed by comparing the likely trip generation of both construction and operation of the Proposed Development with future baseline traffic conditions in order to determine the percentage increase in traffic on each road that has been taken forward for assessment.

12.49 The scope of this assessment has been determined based on the IEMA Guidelines (Section 3: Traffic Impact Analysis), which indicate that roads should be included where traffic flows are predicted to increase by more than 30%, unless the road in question is located within a specifically sensitive area in which case the road should be included if traffic flows increase by 10% or more.

12.50 A desktop exercise has been undertaken, together with a site visit, to identify sensitive receptors within the study area.

12.51 To assist with identifying the magnitude of change as a result of the Proposed Development, with regard to traffic and transport, reference has been made to the IEMA Guidelines (Section 4: Assessment), whichidentifies considerations and thresholds in respect to changes in the volume

and composition of traffic. Where there is no set criteria, professional judgement has been used in line with best practice and industry standards.

12.52 In terms of public transport, the IEMA Guidelines do not identify a specific need to assess the impact of public transport changes. Where improvements involve material changes to public transport services and/or if they form part of a mitigation measure to reduce traffic generation (such as a Travel Plan) it may be necessary to consider this. The impact on public transport has been considered separately as part of the TA.

Assessment of Effects

12.53 In assessing the environmental effects of traffic and transport, two factors are considered. Firstly, the sensitivity of receptors within the study area and secondly the anticipated magnitude of change/impact.

12.54 The above two factors are then combined to give an effect significance that depends on the sensitivity of the receptor and the anticipated magnitude of change.

Receptor Sensitivity

12.55 The sensitivity of a road can be defined by the vulnerability of the user groups who may use it such as elderly people or children. A sensitive area is where pedestrian or cyclist activity may be high, for example, in the vicinity of a school or where there is already an existing accident issue. It should be noted that the sensitivity of the receptor is judged on the sensitivity of the road users. It also takes account of the existing nature of the road; for example an existing A-class road is likely to have a lower sensitivity than a minor residential road.

12.56 The criteria used to assess receptor sensitivity is described in Table 12.1.

Table 12.1 Criteria for Determining Receptor Sensitivity

Sensitivity	Criteria
High	The receptor has little ability to absorb change without fundamentally altering its present character, or is of high importance. Receptors of greatest sensitivity to traffic flow are where they are adjacent to schools, colleges, playgrounds, accident clusters, retirement homes, roads without footways that are used by pedestrians.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, or is of high importance. Traffic flow sensitive receptors include: congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, recreation facilities and busy transport interchanges.
Low	The receptor is tolerant of change without detriment to its character, is of low or local importance. Receptors with low sensitivity to traffic flow include: places of worship, public open space, tourist attractions and residential areas with adequate footway provision.

Magnitude of Change/Impact

12.57 The criteria used to assess how far an impact deviates from the baseline condition, which is the magnitude of change, are described here.

12.58 To assist with identifying the magnitude of change of the Proposed Development, with regard to traffic and transport, reference has been made to the previously noted DMRB/IEMA guidelines and where there is no set criteria, professional judgement has been applied in line with best practice and industry standards.

Severance

12.59 In terms of severance, this is defined as the perceived division that can occur within a community when it becomes separated by a major traffic artery. This may result from the difficulty of crossing a heavily trafficked road or a physical barrier created by the road itself.

12.60 The measurement and prediction of severance includes an assessment of a range of factors, some of which are related to an individual's perception and therefore difficult to quantify. Relevant factors can include road width, traffic flow, speed, the presence of crossing facilities, and the number of movements across the affected route.

12.61 The IEMA Guidelines (Section 4: Assessment) suggest that changes in traffic flow of 30%, 60% and 90% are regarded as producing 'minor', 'moderate' and 'major' changes in severance respectively. These percentages have been used to assess the likely effects of the Proposed Development in terms of severance.

12.62 In terms of pedestrian delay, IEMA Guidelines (Section 4: Assessment) note that changes in the volume, composition and/or speed of traffic may affect the ability of people to cross roads. Typically, increases in traffic levels result in increased pedestrian delay, although increased pedestrian activity itself also contributes to these delays. The guidelines do not set any thresholds, recommending instead that assessors use their judgement to determine the significance of the impact.

Pedestrian/Cycle Delay

12.63 Changes in the volume, composition or speed of traffic may affect the ability of people to cross roads, and therefore, increases in traffic levels are likely to lead to greater increases in delay. Delays will also depend upon the general level of pedestrian/cycle activity, visibility and general physical conditions of the crossing location.

12.64 Given the range of local factors and conditions which can influence pedestrian delay, the IEMA Guidelines (Section 4: Assessment) do not recommend that thresholds be used as a means to establish the significance of pedestrian delay but recommend that reasoned judgements be made instead.

12.65 Based on professional judgement, a two-way traffic flow of 1,400 vehicles per hour has been adopted as a lower threshold for this assessment. Below this flow level, pedestrian/cycle delay is unlikely to be a significant factor.

Pedestrian/Cycle Amenity

12.66 IEMA Guidelines (Section 4: Assessment) define pedestrian amenity as the relative pleasantness of a journey and can include fear and intimidation if relevant to the assessment. As with pedestrian delay, amenity is affected by traffic volumes and composition along with pavement width and pedestrian activity. The guidelines suggest thresholds of significance would be where the traffic flow is halved or doubled, with the former leading to a beneficial effect and the latter an adverse effect.

Driver Delay

12.67 Delays to non-development traffic can occur at several points on the local highway network as a result of the additional traffic that would be generated by a development.

12.68 The IEMA Guidelines (Section 4: Assessment) state that delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system.

12.69 The theoretical capacity of a road or a particular junction can be determined by assessing the Ratio of Flow Capacity (RFC). When an RFC value of 85% or more is experienced, queuing and congestion are likely to occur during busy periods.

12.70 The anticipated increases in two-way peak hour traffic flows as a result of the Proposed Development are expressed as a percentage of two-way peak hour future baseline traffic flows at the assumed Proposed Development opening year. A threshold value of 10% is generally used to determine whether or not development-generated traffic constitutes a material increase.

Where congestion already exists, thresholds of 5% or lower may be considered to be appropriate.

12.71 It is generally accepted that traffic increases of 2% or less are not considered 'material' since, in practice, changes of this magnitude would be difficult to differentiate from typical daily/hourly fluctuations in background traffic. This percentage impact assessment methodology is usually applied to determine the extent of the study area to be examined in the TA.

12.72 These impact thresholds have been adopted for the ES in order to quantify anticipated changes in traffic flows as a result of the Proposed Development and to provide a guide as to the likely effects in terms of driver delay.

Highway Safety

12.73 Where a Proposed Development is expected to produce a change in the character of the traffic on the local road network, as a result of increased Heavy Goods Vehicles (HGV) movements for example, the IEMA Guidelines state that the implications of local circumstances or factors which may elevate or lessen risks of accidents, such as junction conflicts, would require assessment in order to determine the potential significance of accident risk.

Public Transport

12.74 The IEMA Guidelines do not identify a specific need to assess the impact of public transport changes.

12.75 The effects of the Proposed Development on public transport have been considered separately as part of the TA.

Magnitude of Change Criteria

12.76 The criteria for determining magnitude of change/impact, that is how far an effect deviates from the baseline condition, is set out in Table 12.2.

Table 12.2 Criteria for Determining Magnitude of Change/Impact

Effect	Magnitude of Change			
	Negligible	**Minor**	**Moderate**	**Major**
Severance	Change in total traffic flows of 30% or less (Or increase in HGV flows under 10% based on the sensitivity of receptors).	Change in total traffic flows of 30% – 60% (Or increase in HGV flows over 10% based on the sensitivity of receptors).	Change in total traffic flows of 60% - 90% (Or increase in HGV flows over 10% based on the sensitivity of the receptors).	Change in total traffic flows of 90% or more (Or increase in HGV flows over 10% based on the sensitivity of receptors).
Pedestrian/Cycle Delay	Two-way traffic flow less than 1,400 vehicles per hour.	A judgement based on the characteristics of routes with a two-way traffic flow of more than 1,400 vehicles per hour.		
Pedestrian/Cycle Amenity	Change in traffic flow of less than 100%	A judgement based on the routes with greater than 100% change in context of their individual characteristics.		
Driver Delay	Change in traffic flow of 2% or less.	Change in traffic flow between 2% and 5%.	Change in traffic flow between 5% and 10%.	Change in traffic flow of 10% or more.
Highway Safety	A judgement based on the change in character of the traffic on the local road network and the findings of the baseline accident analysis.			

Significance Evaluation

12.77 The significance of the effect is judged on the relationship of the magnitude of impact to the assessed sensitivity and/or importance of the receptor. The predicted significance of the effects is summarised in Table 12.3

Table 12.3 Matrix for Determining the Significance of Effect

Receptor Sensitivity	Magnitude of Change			
	Major	**Moderate**	**Minor**	**Negligible**
High	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

12.78 Potential effects are therefore concluded to be of negligible, minor, moderate or major significance and can be either beneficial or adverse. Moderate and major effects are considered to be significant in EIA terms for the purposes of this assessment.

12.79 In terms of timescales, potential effects can be described as short, medium, long-term or permanent as shown below.

- Short-term – less than 12 months;
- Medium-term – 1 to 5 years;
- Long-term – more than 5 years; and,
- Permanent – effects that are considered to be 'irreversible' or extremely long-lasting.

Baseline Conditions

Current Baseline (2019)

12.80 The existing baseline conditions are described in detail in the TA and are summarised in the following sections.

Walking and Cycling

12.81 There is provision of pedestrian footways in the vicinity of the Site as illustrated on Figure 12.2.

12.82 Figure 12.3 shows the walking accessibility for the Site in 5, 10 and 15-minute walk catchments.

12.83 The Etihad Campus Metrolink tram station and wider Etihad Campus is located within a few minutes' walk of the Site.

12.84 The bus stops on A6010 Alan Turing Way and A662 Ashton New Road are within a 5-10-minute walk of the Site.

12.85 Cycle routes in the vicinity of the Site are shown on Figure 12.4.

12.86 A6010 Alan Turing Way forms part of the National Cycle Network (NCN) Route 60, which has on-road cycle lanes provided along both sides and provides the main north-south connection to/from the Site.

12.87 NCN Route 86 runs along the Ashton Canal with a 3m wide shared pedestrian/cycle footway along the northern side, which provides the main east-west connection to/from the Site. There is step access provided to/from the Ashton Canal and the Joe Mercer Way footbridge, which runs north-south from Sportcity Way, across Ashton Canal, to the Etihad Stadium.

12.88 Many of the roads in the area are subject to a speed limit of 20mph (as indicated on Figure 12.4), which provide recommended quiet routes for walking and cycling.

12.89 Figure 12.5 shows the cycling accessibility for the Site within a 10, 20, and 30-minute cycle ride.

12.90 Ashburys station is a 6-minute cycle from the site and Manchester City centre is within a 10-minute cycle ride, with other areas in Greater Manchester such as Ashton-Under-Lynne and Stockport within a 10 to 20-minute cycle and 20 to 30-minute cycle respectively.

12.91 In summary, the areas surrounding the Site has good local provision of adequate footways and crossing points for pedestrians and is well served by a network of on-road and traffic free cycle routes. This provides good pedestrian/cycle connectivity to local public transport services, Manchester city centre and other surrounding areas.

Public Transport

12.92 Greater Manchester has an extensive network of buses with A6010 Alan Turing Way, A662 Ashton New Road and Bradford Road forming the main bus route corridors in the vicinity of the Site. Bus stops along these routes are shown on Figure 12.6.

12.93 The local tramline and rail network is illustrated on Figure 12.7.

12.94 The nearest Metrolink tram stop serving the Site is Etihad Campus, which is located approximately 350 metres walking distance from the Site (less than 5 minutes' walk). Etihad Campus stop is on the Metrolink Blue line (Eccles to Ashton-Under Lyne) with trams every 12 minutes during the peak hours. It provides a direct westbound link to Manchester Piccadilly station (7-minute journey time) and to Manchester City centre (10 minute journey time) and eastbound to Ashton-under-Lyne station (24-minute journey time).

12.95 The Metrolink trams and stops are accessible for all and each stop has access ramps or lifts, tactile paving, high visibility handrails, disabled boarding points and help points.

12.96 Current passenger demands on the Metrolink are discussed in the TA (Appendix 12.1).

12.97 Ashburys is the nearest mainline railway station serving the Site, which is approximately 1.8 kilometres (24 minutes) walking distance or a 6-minute cycle ride. The station is served by Northern and provides services to destinations such as Manchester Piccadilly, Hadfield, New Mills Central and Rose Hill Marple.

12.98 Trains are every 10 minutes from Ashburys to Manchester Piccadilly and every 30 minutes approximately to eastbound stations via the Hope Valley Line to Sheffield and south-eastwards via Bredbury and Romiley to New Mills Central.

12.99 Manchester Piccadilly station also provides additional services to destinations including London, Birmingham, Liverpool, Glasgow, Edinburgh, Cardiff, Bristol, Exeter, Plymouth, Reading, Southampton, and Bournemouth.

12.100 There are also proposals for two new High Speed Two (HS2) tracks via Manchester Piccadilly station, which is intended to link London and Birmingham to Manchester, the East Midlands and Leeds. As part of this proposal, Manchester Piccadilly station is planned to be redeveloped to form a gateway to the city. Permeability at the station will also be improved, which in its present form is limited to its western end. These proposals are identified in the 2018 Piccadilly Strategic Regeneration Framework Area and are anticipated to be completed by 2032.

12.101 In summary, the site has a good level of accessibility to public transport.

Highway Network

12.102 Figure 12.8 shows the local highway network surrounding the site.

12.103 Sportscity Way provides the main access to the Site, which connects to the A6010 Alan Turing Way to the east in the form of a 3-arm signal junction.

12.104 Sportcity Way is a single carriageway approximately 12 metres wide with two lanes in each direction. It currently provides access to a number of car parks associated with the Etihad Campus.

12.105 The A6010 Alan Turing Way is a dual carriageway with two lanes in each direction subject to a 30mph speed limit. It provides the primary north-south connection to the wider highway network, including the A62 and the A57.

12.106 Approximately 700 metres south of Sportcity Way, the A6010 Alan Turing Way joins the A662 Ashton New Road in the form of a 4-arm signal junction.

12.107 A662 Ashton New Road is a single carriageway with one lane in each direction and subject to a 30mph speed limit.

12.108 In summary, the site is well located in terms of vehicular access to/from the strategic highway network.

Highway Safety

12.109 In terms of highway safety, collision data has been obtained from TfGM for key junctions and links within the study area for the most recent five-year period to March 2019 and this has been fully assessed as part of the TA (Appendix 12.1).

12.110 The TA identifies that 67 collisions were recorded in the five-year period up to the end of March 2019 on the highway network in the vicinity of the Site, which were identified as being caused primarily as a result of driver error. Pedestrians, cyclists and motorcyclists were involved in 14%, 14%, and 7% of these accidents respectively.

12.111 Based on this assessment, it is considered that the geometric layout of the local highway network does not suffer from any significant safety problems that are likely to result in higher than average accident rates.

Identified Receptors and their Sensitivity

12.112 A full audit has been undertaken of the highway network surrounding the Site to identify local roads that should be considered sensitive in accordance with the IEMA Guidelines, which includes evaluating:

- Potential effects on local roads and the users of these roads, including pedestrians and cyclists; and,
- Potential effects on land uses and environmental resources fronting those roads, including the relevant occupiers and users.

12.113 In order to define the scale and extent of this assessment, the IEMA Guidelines identify the following rules by which to undertake an assessment of potentially significant traffic-related environmental effects:

- Rule 1: Include roads where traffic flows are predicted to increase by more than 30%; and
- Rule 2: Include any specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

12.114 As a result of this audit, a number of local road links in the vicinity of the Site were identified as sensitive and these are set out in Table 12.4.

12.115 Potential effects of additional traffic on the highway network further afield have not been assessed as the effects would be negligible as development traffic dissipates across a variety of locations.

Table 12.4 Identified Receptors and their Sensitivity

Link Reference	Receptor	Sensitivity
1	A6010 Queens Road (south of Sedgeford Rd)	Low
2	A62 Oldham Road (east of New Street)	Low
3	A6010 Queens Road (north of Vickers Street)	Low
4	A62 Oldham Road (west of Hulme Hall Lane)	Low

Link Reference	Receptor	Sensitivity
5	Bradford Road (west of Saxon Street)	Low
6	Briscoe Lane (west of Riverpark Road)	Low
7	Stuart Street (east of Archer Street)	Low
8	Gibbon Street (east of Alan Turing Way)	Low
9	A6010 Alan Turing Way (south of Gibbon Street)	Low
10	A622 Ashton New Rd (east of Alan Turing Way)	Moderate
11	A6010 Alan Turing Way (south of Ashton New Rd)	Low
12	A622 Ashton New Road (west of Grey Mare Lane)	Moderate
13	A6010 Alan Turing Way (north of Ashton Old Road)	Low
14	A635 Ashton Old Road (west of Mill Street)	High
15	A6010 Pottery Lane (north of Ambrose Street)	Low
16	A635 Ashton Old Road (east Whitehurst Drive)	Low
17	Welcomb Street (north of Whitworth Street)	Low
18	A62 Oldham Road (east of Ten Acres Lane)	Low
19	A622 Ashton New Road (east of Linfield St)	Low
20	A635 Ashton Old Road (west of Louisa Street)	Low
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	Low
22	Ashton Old Road (east of Lime Bank Street)	Low
23	A662 Ashton New Road (west of Hillkirk St)	Low
24	A62 Oldham Road (east of New Allen Street)	Low
25	A6010 Queens Road (south of Signal Drive)	Low
26	A57 Hyde Road (West of A6010)	Low
27	A57 Hyde Road (East of A6010)	Low
28	A664 Rochdale Road (N)	Low
29	A664 Rochdale Road (S)	Low
30	A6010 Queens Road (west of Rochdale Road)	Low
31	A663 Broadway	Low
32	A62 Oldham Road (Failsworth)	Moderate

Link Reference	Receptor	Sensitivity
33	A665 Angel Street (north of Oldham Street)	Moderate
34	A665 Ring Road (north of Oldham Street)	Low
35	A665 Great Ancoats Street (north of Store Street)	Low
36	A665 Great Ancoats Street (south of Store Street)	Low
37	A635 Mancunian Way (east of Hoyle Street)	Low
38	A6 Stockport Road (north of A6010)	Low
39	A6 Stockport Road (south of A6010)	Low
40	A635 Manchester Road	Low
41	A6 Downing Street (south of A635)	Low
42	A635 Mancunian Way (west of A6)	Low
43	A635 Mancunian Way (east of A5103)	Low
44	A5103 Princess Road (south of A635)	Low

2019 Baseline Traffic Flows

12.116 The 2019 baseline traffic flows are shown in Table 12.5 in terms of Annual Average Daily and Weekday Traffic flows (AADT and AAWT).

Table 12.5 2019 Baseline Traffic Flows

Link Reference	Highway Link Receptor	2019 Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
1	A6010 Queens Road (south of Sedgeford Rd)	18,865	1,517	19,026	1,706
2	A62 Oldham Road (east of New Street)	24,110	2,416	24,251	2,612
3	A6010 Queens Road (north of Vickers Street)	19,276	2,044	19,338	2,316
4	A62 Oldham Road (west of Hulme Hall Lane)	22,017	2,051	22,234	2,185
5	Bradford Road (west of Saxon Street)	12,061	865	12,818	1,015
6	Briscoe Lane (west of Riverpark Road)	15,777	1,268	16,884	1,469
7	Stuart Street (east of Archer Street)	5,005	150	4,898	149
8	Gibbon Street (east of Alan Turing Way)	13,577	502	13,287	500

Link Reference	Highway Link Receptor	2019 Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
9	A6010 Alan Turing Way (south of Gibbon Street)	30,758	3,157	31,123	3,549
10	A622 Ashton New Rd (east of Alan Turing Way)	19,321	1,444	19,778	1,597
11	A6010 Alan Turing Way (sth of Ashton New Rd)	28,779	3,251	29,360	3,670
12	A622 Ashton New Road (west of Grey Mare Lane)	17,146	1,314	17,815	1,462
13	A6010 Alan Turing Way (north of Ashton Old Rd)	26,893	2,848	27,142	3,159
14	A635 Ashton Old Road (west of Mill Street)	24,918	2,660	25,020	2,839
15	A6010 Pottery Lane (north of Ambrose Street)	27,452	3,329	28,145	3,762
16	A635 Ashton Old Road (east Whitehurst Drive)	22,786	2,599	23,027	2,794
17	Welcomb Street (north of Whitworth Street)	1,827	307	2,235	333
18	A62 Oldham Road (east of Ten Acres Lane)	31,859	3,529	32,134	3,875
19	A622 Ashton New Road (east of Linfield St)	14,264	1,199	14,407	1,297
20	A635 Ashton Old Road (west of Louisa Street)	23,746	2,060	23,642	2,221
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	20,498	1,294	20,786	1,394
22	Ashton Old Road (east of Lime Bank Street)	27,864	2,762	28,328	2,916
23	A662 Ashton New Road (west of Hillkirk St)	13,398	1,177	13,767	1,270
24	A62 Oldham Road (east of New Allen Street)	20,246	2,631	20,285	2,907
25	A6010 Queens Road (south of Signal Drive)	21,577	1,374	21,991	1,504
26	A57 Hyde Road (West of A6010)	18,462	907	18,744	921
27	A57 Hyde Road (East of A6010)	23,346	1,083	23,703	1,099
28	A664 Rochdale Road (N)	18,300	910	18,580	924
29	A664 Rochdale Road (S)	14,181	926	14,398	941
30	A6010 Queens Road (west of Rochdale Road)	19,399	547	19,696	555
31	A663 Broadway	17,023	663	17,283	673
32	A62 Oldham Road (Failsworth)	16,959	763	17,218	774

Link Reference	Highway Link Receptor	2019 Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
33	A665 Angel Street (north of Oldham Street)	12,795	347	12,991	352
34	A665 Ring Road (north of Oldham Street)	16,655	418	16,909	424
35	A665 Great Ancoats Street (north of Store St)	35,953	1,405	36,502	1,427
36	A665 Great Ancoats Street (south of Store St)	35,098	927	35,634	942
37	A635 Mancunian Way (east of Hoyle Street)	46,657	1,642	48,054	1,805
38	A6 Stockport Road (north of A6010)	23,471	791	23,830	803
39	A6 Stockport Road (south of A6010)	17,463	821	17,730	833
40	A635 Manchester Road	31,022	1,170	31,496	1,188
41	A6 Downing Street (south of A635)	19,580	2,122	19,880	2,155
42	A635 Mancunian Way (west of A6)	47,590	1,920	48,317	1,949
43	A635 Mancunian Way (east of A5103)	60,041	2,297	60,958	2,332
44	A5103 Princess Road (south of A635)	40,876	988	41,501	1,003

Future Baseline (2023)

12.117 The year of opening for the Proposed Development is assumed to be 2023 and this forms the future baseline year for the operational assessment.

12.118 The construction assessment has been undertaken for intermediate year 2021 as this is expected to be the peak construction year for the Proposed Development (described in more detail later in this chapter).

12.119 The future baseline accounts for changes that would occur irrespective of the Proposed Development coming forward.

12.120 There are no notable changes anticipated in 2023 to that described in the existing baseline conditions.

12.121 Given that an intermediate construction assessment is required for 2021, The baseline traffic flows for 2021 are set out below in Table 12.6.

Table 12.6 2021 Future Baseline Traffic Flows

Link Reference	Highway Link Receptor	2021 Future Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
1	A6010 Queens Road (south of Sedgeford Rd)	19,487	1,567	19,654	1,762

Link Reference	Highway Link Receptor	2021 Future Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
2	A62 Oldham Road (east of New Street)	24,905	2,496	25,051	2,698
3	A6010 Queens Road (north of Vickers Street)	19,912	2,111	19,976	2,393
4	A62 Oldham Road (west of Hulme Hall Lane)	22,743	2,119	22,967	2,257
5	Bradford Road (west of Saxon Street)	12,459	894	13,241	1,048
6	Briscoe Lane (west of Riverpark Road)	16,298	1,309	17,442	1,518
7	Stuart Street (east of Archer Street)	5,170	154	5,060	154
8	Gibbon Street (east of Alan Turing Way)	14,025	518	13,726	517
9	A6010 Alan Turing Way (south of Gibbon Street)	31,773	3,262	32,150	3,666
10	A622 Ashton New Rd (east of Alan Turing Way)	19,959	1,491	20,431	1,649
11	A6010 Alan Turing Way (sth of Ashton New Rd)	29,729	3,359	30,329	3,792
12	A622 Ashton New Road (west of Grey Mare Lane)	17,712	1,357	18,403	1,510
13	A6010 Alan Turing Way (north of Ashton Old Rd)	27,781	2,942	28,038	3,263
14	A635 Ashton Old Road (west of Mill Street)	25,740	2,748	25,845	2,932
15	A6010 Pottery Lane (north of Ambrose Street)	28,358	3,439	29,074	3,886
16	A635 Ashton Old Road (east Whitehurst Drive)	23,538	2,684	23,787	2,886
17	Welcomb Street (north of Whitworth Street)	1,887	317	2,309	344
18	A62 Oldham Road (east of Ten Acres Lane)	32,910	3,646	33,194	4,003
19	A622 Ashton New Road (east of Linfield St)	14,735	1,238	14,883	1,339
20	A635 Ashton Old Road (west of Louisa Street)	24,530	2,128	24,422	2,294
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	21,174	1,337	21,472	1,440
22	Ashton Old Road (east of Lime Bank Street)	28,783	2,853	29,262	3,012
23	A662 Ashton New Road (west of Hillkirk St)	13,840	1,215	14,221	1,312
24	A62 Oldham Road (east of New Allen Street)	20,915	2,718	20,955	3,003

Link Reference	Highway Link Receptor	2021 Future Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
25	A6010 Queens Road (south of Signal Drive)	22,289	1,420	22,717	1,553
26	A57 Hyde Road (West of A6010)	19,071	937	19,363	951
27	A57 Hyde Road (East of A6010)	24,116	1,119	24,485	1,136
28	A664 Rochdale Road (N)	18,904	940	19,193	954
29	A664 Rochdale Road (S)	14,649	957	14,873	972
30	A6010 Queens Road (west of Rochdale Road)	20,040	565	20,346	574
31	A663 Broadway	17,585	685	17,854	695
32	A62 Oldham Road (Failsworth)	17,519	788	17,786	800
33	A665 Angel Street (north of Oldham Street)	13,217	358	13,419	364
34	A665 Ring Road (north of Oldham Street)	17,205	432	17,467	438
35	A665 Great Ancoats Street (north of Store St)	37,139	1,452	37,707	1,474
36	A665 Great Ancoats Street (south of Store St)	36,256	958	36,810	973
37	A635 Mancunian Way (east of Hoyle Street)	48,197	1,696	49,640	1,864
38	A6 Stockport Road (north of A6010)	24,245	817	24,616	830
39	A6 Stockport Road (south of A6010)	18,040	848	18,315	861
40	A635 Manchester Road	32,046	1,209	32,535	1,227
41	A6 Downing Street (south of A635)	20,227	2,192	20,536	2,226
42	A635 Mancunian Way (west of A6)	49,160	1,983	49,911	2,013
43	A635 Mancunian Way (east of A5103)	62,022	2,373	62,970	2,409
44	A5103 Princess Road (south of A635)	42,225	1,021	42,870	1,037

12.122 The 2023 future baseline traffic flows are shown in Table 12.7.

Table 12.7 2023 Future Baseline Traffic Flows

Link Reference	Highway Link Receptor	2023 Future Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
1	A6010 Queens Road (south of Sedgeford Rd)	19,882	1,599	20,052	1,797
2	A62 Oldham Road (east of New Street)	25,409	2,547	25,558	2,753
3	A6010 Queens Road (north of Vickers Street)	20,315	2,154	20,380	2,441
4	A62 Oldham Road (west of Hulme Hall Lane)	23,203	2,162	23,432	2,303
5	Bradford Road (west of Saxon Street)	12,711	912	13,509	1,069
6	Briscoe Lane (west of Riverpark Road)	16,628	1,336	17,795	1,548
7	Stuart Street (east of Archer Street)	5,275	158	5,162	157
8	Gibbon Street (east of Alan Turing Way)	14,309	529	14,003	527
9	A6010 Alan Turing Way (south of Gibbon Street)	32,416	3,328	32,801	3,740
10	A622 Ashton New Rd (east of Alan Turing Way)	20,363	1,522	20,844	1,683
11	A6010 Alan Turing Way (sth of Ashton New Rd)	30,330	3,427	30,943	3,868
12	A622 Ashton New Road (west of Grey Mare Lane)	18,070	1,385	18,775	1,541
13	A6010 Alan Turing Way (north of Ashton Old Rd)	28,343	3,001	28,605	3,329
14	A635 Ashton Old Road (west of Mill Street)	26,261	2,804	26,368	2,992
15	A6010 Pottery Lane (north of Ambrose Street)	28,932	3,509	29,662	3,965
16	A635 Ashton Old Road (east Whitehurst Drive)	24,014	2,739	24,268	2,944
17	Welcomb Street (north of Whitworth Street)	1,925	323	2,356	351
18	A62 Oldham Road (east of Ten Acres Lane)	33,576	3,720	33,866	4,084
19	A622 Ashton New Road (east of Linfield St)	15,033	1,264	15,184	1,367
20	A635 Ashton Old Road (west of Louisa Street)	25,026	2,171	24,916	2,341
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	21,603	1,364	21,907	1,469
22	Ashton Old Road (east of Lime Bank Street)	29,366	2,911	29,854	3,073

Link Reference	Highway Link Receptor	2023 Future Baseline Traffic Flows			
		AADT		AAWT	
		Total Vehs	HGVs	Total Vehs	HGVs
23	A662 Ashton New Road (west of Hillkirk St)	14,120	1,240	14,509	1,338
24	A62 Oldham Road (east of New Allen Street)	21,338	2,773	21,378	3,063
25	A6010 Queens Road (south of Signal Drive)	22,740	1,448	23,176	1,585
26	A57 Hyde Road (West of A6010)	19,457	956	19,754	971
27	A57 Hyde Road (East of A6010)	24,604	1,141	24,980	1,159
28	A664 Rochdale Road (N)	19,287	959	19,581	974
29	A664 Rochdale Road (S)	14,945	976	15,174	991
30	A6010 Queens Road (west of Rochdale Road)	20,445	577	20,757	585
31	A663 Broadway	17,941	699	18,215	709
32	A62 Oldham Road (Failsworth)	17,873	804	18,146	816
33	A665 Angel Street (north of Oldham Street)	13,485	365	13,691	371
34	A665 Ring Road (north of Oldham Street)	17,553	440	17,821	447
35	A665 Great Ancoats Street (north of Store St)	37,891	1,481	38,470	1,504
36	A665 Great Ancoats Street (south of Store St)	36,989	977	37,555	992
37	A635 Mancunian Way (east of Hoyle Street)	49,172	1,731	50,644	1,902
38	A6 Stockport Road (north of A6010)	24,736	834	25,114	846
39	A6 Stockport Road (south of A6010)	18,405	865	18,686	878
40	A635 Manchester Road	32,694	1,233	33,194	1,252
41	A6 Downing Street (south of A635)	20,636	2,237	20,951	2,271
42	A635 Mancunian Way (west of A6)	50,155	2,023	50,921	2,054
43	A635 Mancunian Way (east of A5103)	63,277	2,421	64,244	2,458
44	A5103 Princess Road (south of A635)	43,080	1,042	43,738	1,058

Identification and Evaluation of Significant Effects

Construction Effects

Relevant aspects of the Scheme

12.123 The construction of the Proposed Development will lead to additional construction vehicle movements on the highway network. The Construction Methodology Chapter (ES Chapter 5) sets

out the programme of works together with the anticipated timing and management for the construction activities. A Construction Management Plan together with a Construction Logistics Plan is provided at Appendix 5.1.

12.124 The assessment has been completed assuming that the measures outlined in the Construction Management Plan will be implemented as designed-in mitigation.

Potential effects of the Proposed Development and their Significance

12.125 Construction related traffic would comprise staff transport, deliveries and disposal of construction materials and excess excavated material. The Construction Methodology Chapter sets out the forecast number of construction vehicles during construction and this is shown in Table 12.8.

Table 12.8 Forecast of Construction Vehicles

Period		Typical Vehicle Arrivals Per Day	Per Hour
2020	Q1	0	0
	Q2	0	0
	Q3	16	2
	Q4	38	4
2021	Q1	115	12
	Q2	103	10
	Q3	103	10
	Q4	83	8
2022	Q1	72	7
	Q2	99	10
	Q3	100	10
	Q4	98	10
2023	Q1	92	9
	Q2	55	6
	Q3	0	0
	Q4	0	0

12.126 The construction data shows that 2021 is the peak construction year for the Proposed Development.

12.127 The 2021 baseline traffic flows set out in this chapter have been used for the purpose of assessing the construction impact.

12.128 In accordance with the IEMA Guidelines, a 30% increase in traffic (10% on the roads identified as sensitive) would trigger the need to assess the environmental effects associated with traffic and transport.

12.129 The identified receptors shown to have an increase in construction traffic in 2021 are shown below in Table 12.9 and 12.10.

Table 12.9 Increase in traffic during the Construction Phase (AADT)

Link Reference	Highway Link Receptor	AADT Traffic Flows		
		2021 Baseline	Increase in Construction Traffic	
		Total Vehs	Total Vehs	% Increase
1	A6010 Queens Road (south of Sedgeford Rd)	19,882	40	0.20%
2	A62 Oldham Road (east of New Street)	25,409	40	0.16%
3	A6010 Queens Road (north of Vickers Street)	20,315	79	0.39%
4	A62 Oldham Road (west of Hulme Hall Lane)	23,203	0	0%
5	Bradford Road (west of Saxon Street)	12,711	0	0%
6	Briscoe Lane (west of Riverpark Road)	16,628	0	0%
7	Stuart Street (east of Archer Street)	5,275	0	0%
8	Gibbon Street (east of Alan Turing Way)	14,309	0	0%
9	A6010 Alan Turing Way (south of Gibbon Street)	32,416	79	0.24%
10**	A622 Ashton New Rd (east of Alan Turing Way)	20,363	16	0.08%
11	A6010 Alan Turing Way (sth of Ashton New Rd)	30,330	64	0.21%
12**	A622 Ashton New Road (west of Grey Mare Lane)	18,070	0	0%
13	A6010 Alan Turing Way (north of Ashton Old Rd)	28,343	64	0.23%
14***	A635 Ashton Old Road (west of Mill Street)	26,261	32	0.12%
15	A6010 Pottery Lane (north of Ambrose Street)	28,932	32	0.11%
16	A635 Ashton Old Road (east Whitehurst Drive)	24,014	0	0%
17	Welcomb Street (north of Whitworth Street)	1,925	0	0%
18	A62 Oldham Road (east of Ten Acres Lane)	33,576	40	0.12%
19	A622 Ashton New Road (east of Linfield St)	15,033	16	0.11%

Link Reference	Highway Link Receptor	AADT Traffic Flows		
		2021 Baseline	Increase in Construction Traffic	
		Total Vehs	Total Vehs	% Increase
20	A635 Ashton Old Road (west of Louisa Street)	25,026	32	0.13%
21	A6010 Kirkmanshulme Lane (west of Victoria Ter)	21,603	32	0.15%
22	Ashton Old Road (east of Lime Bank Street)	29,366	0	0%
23	A662 Ashton New Road (west of Hillkirk St)	14,120	0	0%
24	A62 Oldham Road (east of New Allen Street)	21,338	0	0%
25	A6010 Queens Road (south of Signal Drive)	22,740	32	0.14%
26	A57 Hyde Road (West of A6010)	19,071	0	0%
27	A57 Hyde Road (East of A6010)	24,116	0	0%
28	A664 Rochdale Road (N)	18,904	30	0.16%
29	A664 Rochdale Road (S)	14,649	0	0%
30	A6010 Queens Road (west of Rochdale Road)	20,040	10	0.05%
31	A663 Broadway	17,585	25	0.14%
32**	A62 Oldham Road (Failsworth)	17,519	25	0.14%
33**	A665 Angel Street (north of Oldham Street)	13,217	0	0%
34	A665 Ring Road (north of Oldham Street)	17,205	0	0%
35	A665 Great Ancoats Street (north of Store St)	37,139	0	0%
36	A665 Great Ancoats Street (south of Store St)	36,256	0	0%
37	A635 Mancunian Way (east of Hoyle Street)	48,197	0	0%
38	A6 Stockport Road (north of A6010)	24,245	0	0%
39	A6 Stockport Road (south of A6010)	18,040	20	0.11%
40	A635 Manchester Road	32,046	61	0.19%
41	A6 Downing Street (south of A635)	20,227	0	0%
42	A635 Mancunian Way (west of A6)	49,160	0	0%
43	A635 Mancunian Way (east of A5103)	62,022	0	0%
44	A5103 Princess Road (south of A635)	42,225	0	0%

*** Receptor identified as Moderate Sensitivity *** Receptor identified as High Sensitivity*

Table 12.10 Increase in traffic during the Construction Phase (AAWT)

Link Reference	Highway Link Receptor	AAWT Traffic Flows		
		2021 Baseline	Increase in Construction Traffic	
		Total Vehs	Total Vehs	% Increase
1	A6010 Queens Road (south of Sedgeford Rd)	20,052	51	0.25%
2	A62 Oldham Road (east of New Street)	25,558	51	0.20%
3	A6010 Queens Road (north of Vickers Street)	20,380	101	0.50%
4	A62 Oldham Road (west of Hulme Hall Lane)	23,432	0	0%
5	Bradford Road (west of Saxon Street)	13,509	0	0%
6	Briscoe Lane (west of Riverpark Road)	17,795	0	0%
7	Stuart Street (east of Archer Street)	5,162	0	0%
8	Gibbon Street (east of Alan Turing Way)	14,003	0	0%
9	A6010 Alan Turing Way (south of Gibbon Street)	32,801	101	0.31%
10**	A622 Ashton New Rd (east of Alan Turing Way)	20,844	20	0.09%
11	A6010 Alan Turing Way (sth of Ashton New Rd)	30,943	81	0.26%
12**	A622 Ashton New Road (west of Grey Mare Lane)	18,775	0	0%
13	A6010 Alan Turing Way (north of Ashton Old Rd)	28,605	81	0.28%
14***	A635 Ashton Old Road (west of Mill Street)	26,368	40	0.15%
15	A6010 Pottery Lane (north of Ambrose Street)	29,662	40	0.13%
16	A635 Ashton Old Road (east Whitehurst Drive)	24,268	0	0%
17	Welcomb Street (north of Whitworth Street)	2,356	0	0%
18	A62 Oldham Road (east of Ten Acres Lane)	33,866	51	0.15%
19	A622 Ashton New Road (east of Linfield St)	15,184	20	0.13%
20	A635 Ashton Old Road (west of Louisa Street)	24,916	40	0.16%
21	A6010 Kirkmanshulme Lane (west of Victoria Ter)	21,907	40	0.18%
22	Ashton Old Road (east of Lime Bank Street)	29,854	0	0%

Link Reference	Highway Link Receptor	AAWT Traffic Flows		
		2021 Baseline	Increase in Construction Traffic	
		Total Vehs	Total Vehs	% Increase
23	A662 Ashton New Road (west of Hillkirk St)	14,509	0	0%
24	A62 Oldham Road (east of New Allen Street)	21,378	0	0%
25	A6010 Queens Road (south of Signal Drive)	23,176	40	0.17%
26	A57 Hyde Road (West of A6010)	19,363	0	0%
27	A57 Hyde Road (East of A6010)	24,485	0	0%
28	A664 Rochdale Road (N)	19,193	30	0.16%
29	A664 Rochdale Road (S)	14,873	0	0%
30	A6010 Queens Road (west of Rochdale Road)	20,346	10	0.05%
31	A663 Broadway	17,854	25	0.14%
32**	A62 Oldham Road (Failsworth)	17,786	25	0.14%
33**	A665 Angel Street (north of Oldham Street)	13,419	0	0%
34	A665 Ring Road (north of Oldham Street)	17,467	0	0%
35	A665 Great Ancoats Street (north of Store St)	37,707	0	0%
36	A665 Great Ancoats Street (south of Store St)	36,810	0	0%
37	A635 Mancunian Way (east of Hoyle Street)	49,640	0	0%
38	A6 Stockport Road (north of A6010)	24,616	0	0%
39	A6 Stockport Road (south of A6010)	18,315	20	0.11%
40	A635 Manchester Road	32,535	61	0.19%
41	A6 Downing Street (south of A635)	20,536	0	0%
42	A635 Mancunian Way (west of A6)	49,911	0	0%
43	A635 Mancunian Way (east of A5103)	62,970	0	0%
44	A5103 Princess Road (south of A635)	42,870	0	0%

** *Receptor identified as Moderate Sensitivity* *** *Receptor identified as High Sensitivity*

12.130 The increase in construction traffic is shown to be less than 1% on all receptor links.

12.131 According to IEMA guidance discussed earlier in this chapter, an increase in traffic levels of less than 10% would result in imperceptible changes in the environmental effects of traffic.

12.132 The construction phase would result in a **temporary impact of negligible significance** in relation to severance and driver delay on all receptor links.

12.133 In terms of highway safety, it is not appropriate to draw direct relationships between traffic flow increases and accident rates and therefore, professional judgement has been applied.

12.134 Given that the increased traffic levels are temporary and the mitigation measures that are required to minimise these effects such as: regular monitoring of the road conditions; the traffic management plan; and abnormal vehicle escorts, there is unlikely to be a determinable increase on the risk of accidents. As a result, the magnitude of the accidents and safety effects has been determined as being low for all sensitive receptors.

12.135 Whilst the increased construction vehicle movements on local pedestrian and cyclist routes would have the potential to affect the amenity for pedestrians and cyclists, this increase would result in temporary, local adverse effects of negligible significance to pedestrian and cyclist amenity (which for the purposes of this assessment includes fear and intimidation) on identified sensitive receptors.

12.136 The effects of HGVs in terms of noise levels and/or dust is assessed further in the ES in Chapter 10 Noise and Vibration and Chapter 6 Air Quality and Dust.

12.137 Any construction impact would be mitigated by managing construction traffic through the implementation of the CLP, which will control the routing and timing of HGV movements and ensure that sensitive routes and receptors are avoided. It is therefore considered that the impact of HGV traffic during the construction period will not be significant.

Climate Change and Adaptation

12.138 There are no climate change effects to be assessed in relation to traffic and transport.

Summary of Effects during Construction

12.139 Table 12.11 summarises the effects during construction.

Table 12.11 Summary of Effects during Demolition and Construction

Receptor and Sensitivity	Description of Effect	Magnitude of Change/Impact	Effect Significance
All local roads and road users	Construction impact on road users	Negligible	Negligible

Operational Effects

Relevant aspects of the scheme and designed-in mitigation

12.140 In addition to the benefits realised through the design in terms of pedestrian and cycle access in and around the Etihad Campus, a Travel Plan will be implemented to further encourage the use of sustainable transport.

12.141 The submission of a Travel Plan will ensure that visitors to the site are aware of their sustainable travel options, which is likely to create a beneficial effect on road users.

Potential effects of the development and their significance

Effect on Local Highway Network

12.142 The effect on the local highway network in 2023 (year of opening with 120 events per year) is set out in Table 12.12 and Table 12.13, which shows the percentage change in flows against the 2023 baseline.

Table 12.12 Change in Traffic Flows (2023 AADT)

Link Reference	Highway Link Receptor	AADT Traffic Flows		
		2023 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
1	A6010 Queens Road (south of Sedgeford Rd)	19,882	299	1.50%
2	A62 Oldham Road (east of New Street)	25,409	299	1.18%
3	A6010 Queens Road (north of Vickers Street)	20,315	786	**3.87%**
4	A62 Oldham Road (west of Hulme Hall Lane)	23,203	185	0.80%
5	Bradford Road (west of Saxon Street)	12,711	185	1.46%
6	Briscoe Lane (west of Riverpark Road)	16,628	185	1.11%
7	Stuart Street (east of Archer Street)	5,275	0	0%
8	Gibbon Street (east of Alan Turing Way)	14,309	113	0.79%
9	A6010 Alan Turing Way (south of Gibbon Street)	32,416	1,157	**3.57%**
10**	A622 Ashton New Rd (east of Alan Turing Way)	20,363	162	0.80%
11	A6010 Alan Turing Way (sth of Ashton New Rd)	30,330	833	**2.75%**
12**	A622 Ashton New Road (west of Grey Mare Lane)	18,070	162	0.90%
13	A6010 Alan Turing Way (north of Ashton Old Rd)	28,343	833	**2.94%**
14***	A635 Ashton Old Road (west of Mill Street)	26,261	173	0.66%
15	A6010 Pottery Lane (north of Ambrose Street)	28,932	486	1.68%
16	A635 Ashton Old Road (east Whitehurst Drive)	24,014	173	0.72%
17	Welcomb Street (north of Whitworth Street)	1,925	0	0%
18	A62 Oldham Road (east of Ten Acres Lane)	33,576	276	0.82%
19	A622 Ashton New Road (east of Linfield St)	15,033	162	1.08%
20	A635 Ashton Old Road (west of Louisa Street)	25,026	173	0.69%
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	21,603	231	1.07%
22	Ashton Old Road (east of Lime Bank Street)	29,366	185	0.63%

Link Reference	Highway Link Receptor	AADT Traffic Flows		
		2023 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
23	A662 Ashton New Road (west of Hillkirk St)	14,120	162	1.15%
24	A62 Oldham Road (east of New Allen Street)	21,338	184	0.86%
25	A6010 Queens Road (south of Signal Drive)	22,740	299	1.31%
26	A57 Hyde Road (West of A6010)	19,754	101	0.51%
27	A57 Hyde Road (East of A6010)	24,980	101	0.40%
28	A664 Rochdale Road (N)	19,581	107	0.55%
29	A664 Rochdale Road (S)	15,174	107	0.71%
30	A6010 Queens Road (west of Rochdale Road)	20,757	107	0.52%
31	A663 Broadway	18,215	107	0.59%
32**	A62 Oldham Road (Failsworth)	18,146	107	0.59%
33**	A665 Angel Street (north of Oldham Street)	13,691	101	0.74%
34	A665 Ring Road (north of Oldham Street)	17,821	101	0.57%
35	A665 Great Ancoats Street (north of Store St)	38,470	88	0.23%
36	A665 Great Ancoats Street (south of Store St)	37,555	88	0.23%
37	A635 Mancunian Way (east of Hoyle Street)	50,644	302	0.60%
38	A6 Stockport Road (north of A6010)	25,114	101	0.40%
39	A6 Stockport Road (south of A6010)	18,686	176	0.94%
40	A635 Manchester Road	33,194	201	0.61%
41	A6 Downing Street (south of A635)	20,951	75	0.36%
42	A635 Mancunian Way (west of A6)	50,921	251	0.49%
43	A635 Mancunian Way (east of A5103)	64,244	126	0.20%
44	A5103 Princess Road (south of A635)	43,738	126	0.29%

Table 12.13 Change in Traffic Flows (2023 AAWT)

Link Reference	Highway Link Receptor	AAWT Traffic Flows		
		2023 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
1	A6010 Queens Road (south of Sedgeford Rd)	20,052	269	1.34%
2	A62 Oldham Road (east of New Street)	25,558	269	1.05%
3	A6010 Queens Road (north of Vickers Street)	20,380	709	**3.48%**
4	A62 Oldham Road (west of Hulme Hall Lane)	23,432	167	0.71%
5	Bradford Road (west of Saxon Street)	13,509	167	1.24%
6	Briscoe Lane (west of Riverpark Road)	17,795	167	0.94%
7	Stuart Street (east of Archer Street)	5,162	0	0%
8	Gibbon Street (east of Alan Turing Way)	14,003	102	0.73%
9	A6010 Alan Turing Way (south of Gibbon Street)	32,801	1,043	**3.18%**
10**	A622 Ashton New Rd (east of Alan Turing Way)	20,844	146	0.70%
11	A6010 Alan Turing Way (sth of Ashton New Rd)	30,943	751	**2.43%**
12**	A622 Ashton New Road (west of Grey Mare Lane)	18,775	146	0.70%
13	A6010 Alan Turing Way (north of Ashton Old Rd)	28,605	751	**2.43%**
14***	A635 Ashton Old Road (west of Mill Street)	26,368	156	0.59%
15	A6010 Pottery Lane (north of Ambrose Street)	29,662	438	1.48%
16	A635 Ashton Old Road (east Whitehurst Drive)	24,268	156	0.64%
17	Welcomb Street (north of Whitworth Street)	2,356	0	0%
18	A62 Oldham Road (east of Ten Acres Lane)	33,866	249	0.82%
19	A622 Ashton New Road (east of Linfield St)	15,184	146	0.74%
20	A635 Ashton Old Road (west of Louisa Street)	24,916	156	0.63%
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	21,907	209	0.95%
22	Ashton Old Road (east of Lime Bank Street)	29,854	167	0.56%

Link Reference	Highway Link Receptor	AAWT Traffic Flows		
		2023 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
23	A662 Ashton New Road (west of Hillkirk St)	14,509	146	1.01%
24	A62 Oldham Road (east of New Allen Street)	21,378	166	0.78%
25	A6010 Queens Road (south of Signal Drive)	23,176	269	1.16%
26	A57 Hyde Road (West of A6010)	19,754	90	0.46%
27	A57 Hyde Road (East of A6010)	24,980	90	0.36%
28	A664 Rochdale Road (N)	19,581	96	0.49%
29	A664 Rochdale Road (S)	15,174	96	0.63%
30	A6010 Queens Road (west of Rochdale Road)	20,757	96	0.46%
31	A663 Broadway	18,215	96	0.46%
32**	A62 Oldham Road (Failsworth)	18,146	96	0.53%
33**	A665 Angel Street (north of Oldham Street)	13,691	90	0.66%
34	A665 Ring Road (north of Oldham Street)	17,821	90	0.51%
35	A665 Great Ancoats Street (north of Store St)	38,470	79	0.21%
36	A665 Great Ancoats Street (south of Store St)	37,555	79	0.20%
37	A635 Mancunian Way (east of Hoyle Street)	50,644	271	0.54%
38	A6 Stockport Road (north of A6010)	25,114	90	0.36%
39	A6 Stockport Road (south of A6010)	18,686	158	0.85%
40	A635 Manchester Road	33,194	181	0.61%
41	A6 Downing Street (south of A635)	20,951	68	0.32%
42	A635 Mancunian Way (west of A6)	50,921	226	0.44%
43	A635 Mancunian Way (east of A5103)	64,244	113	0.18%
44	A5103 Princess Road (south of A635)	43,738	113	0.26%

** *Receptor identified as Moderate Sensitivity* *** *Receptor identified as High Sensitivity*

12.143 Table 12.12 and Table 12.13 shows that the change in total vehicles on the majority of receptor links in 2023 is significantly less than 2% except for Links 3, 9, 11 and 13, which are shown to have a maximum increase of between 2.68% and 4.21%.

12.144 Therefore, the magnitude of change is minor in terms of driver delay and negligible in terms of severance, which results in a potential effect in terms of severance and driver delay of **negligible significance**.

12.145 The effect on the local highway network in 2026 (with 180 events per year) is set out in Table 12.14 and Table 12.15, which shows the percentage change in flows against the 2026 baseline.

Table 12.1410: Change in Traffic Flows (2026 AADT)

Link Ref.	Highway Link Receptor	AADT Traffic Flows		
		2026 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
1	A6010 Queens Road (south of Sedgeford Rd)	20,574	481	**2.34%**
2	A62 Oldham Road (east of New Street)	26,294	481	1.83%
3	A6010 Queens Road (north of Vickers Street)	21,022	1,263	**6.01%**
4	A62 Oldham Road (west of Hulme Hall Lane)	24,011	297	1.24%
5	Bradford Road (west of Saxon Street)	13,154	297	**2.26%**
6	Briscoe Lane (west of Riverpark Road)	17,207	297	1.73%
7	Stuart Street (east of Archer Street)	5,459	0	0%
8	Gibbon Street (east of Alan Turing Way)	14,807	182	1.23%
9	A6010 Alan Turing Way (south of Gibbon Street)	33,544	1,858	**5.54%**
10**	A622 Ashton New Rd (east of Alan Turing Way)	21,072	260	1.23%
11	A6010 Alan Turing Way (sth of Ashton New Rd)	31,387	1,337	**4.26%**
12**	A622 Ashton New Road (west of Grey Mare Lane)	18,699	260	1.39%
13	A6010 Alan Turing Way (north of Ashton Old Rd)	29,330	1,337	**4.56%**
14***	A635 Ashton Old Road (west of Mill Street)	27,175	279	1.03%
15	A6010 Pottery Lane (north of Ambrose Street)	29,940	780	**2.61%**
16	A635 Ashton Old Road (east Whitehurst Drive)	24,850	279	1.12%
17	Welcomb Street (north of Whitworth Street)	1,992	0	0%
18	A62 Oldham Road (east of Ten Acres Lane)	34,745	444	1.28%
19	A622 Ashton New Road (east of Linfield St)	15,557	260	1.67%
20	A635 Ashton Old Road (west of Louisa Street)	25,898	279	1.08%
21	A6010 Kirkmanshulme Lane (west of Victoria Terr)	22,355	372	1.67%

Link Ref.	Highway Link Receptor	AADT Traffic Flows		
		2026 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
22	Ashton Old Road (east of Lime Bank Street)	30,388	297	0.98%
23	A662 Ashton New Road (west of Hillkirk St)	14,612	260	1.78%
24	A62 Oldham Road (east of New Allen Street)	22,081	296	1.34%
25	A6010 Queens Road (south of Signal Drive)	23,532	481	**2.04%**
26	A57 Hyde Road (West of A6010)	20,135	149	0.74%
27	A57 Hyde Road (East of A6010)	25,461	149	0.59%
28	A664 Rochdale Road (N)	19,958	158	0.79%
29	A664 Rochdale Road (S)	15,466	158	1.02%
30	A6010 Queens Road (west of Rochdale Road)	21,157	158	0.75%
31	A663 Broadway	18,565	158	0.85%
32**	A62 Oldham Road (Failsworth)	18,496	158	0.85%
33**	A665 Angel Street (north of Oldham Street)	13,954	149	1.07%
34	A665 Ring Road (north of Oldham Street)	18,164	149	0.82%
35	A665 Great Ancoats Street (north of Store St)	39,210	130	0.33%
36	A665 Great Ancoats Street (south of Store St)	38,277	130	0.34%
37	A635 Mancunian Way (east of Hoyle Street)	50,884	446	0.88%
38	A6 Stockport Road (north of A6010)	25,597	149	0.58%
39	A6 Stockport Road (south of A6010)	19,046	260	1.37%
40	A635 Manchester Road	33,833	297	0.88%
41	A6 Downing Street (south of A635)	21,354	111	0.52%
42	A635 Mancunian Way (west of A6)	51,901	372	0.72%
43	A635 Mancunian Way (east of A5103)	65,481	186	0.28%
44	A5103 Princess Road (south of A635)	44,580	186	0.42%

** *Receptor identified as Moderate Sensitivity* *** *Receptor identified as High Sensitivity*

Table 12.15: Change in Traffic Flows (2026 AAWT)

Link Ref.	Highway Link Receptor	AADT Traffic Flows		
		2026 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
1	A6010 Queens Road (south of Sedgeford Rd)	20,750	430	**2.07%**
2	A62 Oldham Road (east of New Street)	26,448	430	1.63%
3	A6010 Queens Road (north of Vickers Street)	21,090	1,130	**5.36%**
4	A62 Oldham Road (west of Hulme Hall Lane)	24,248	266	1.10%
5	Bradford Road (west of Saxon Street)	13,979	266	1.90%
6	Briscoe Lane (west of Riverpark Road)	18,414	266	1.44%
7	Stuart Street (east of Archer Street)	5,342	0	0%
8	Gibbon Street (east of Alan Turing Way)	14,491	163	1.12%
9	A6010 Alan Turing Way (south of Gibbon Street)	33,943	1,661	**4.89%**
10**	A622 Ashton New Rd (east of Alan Turing Way)	21,570	233	1.07%
11	A6010 Alan Turing Way (sth of Ashton New Rd)	32,020	1,196	**3.74%**
12**	A622 Ashton New Road (west of Grey Mare Lane)	19,429	233	1.20%
13	A6010 Alan Turing Way (north of Ashton Old Rd)	29,602	1,196	**4.04%**
14***	A635 Ashton Old Road (west of Mill Street)	27,286	249	0.91%
15	A6010 Pottery Lane (north of Ambrose Street)	30,695	698	**2.27%**
16	A635 Ashton Old Road (east Whitehurst Drive)	25,114	249	0.99%
17	Welcomb Street (north of Whitworth Street)	2,438	0	0%
18	A62 Oldham Road (east of Ten Acres Lane)	35,045	397	1.13%
19	A622 Ashton New Road (east of Linfield St)	15,712	233	1.48%
20	A635 Ashton Old Road (west of Louisa Street)	25,784	249	0.97%
21	A6010 Kirkmanshulme Lane (west of Victoria Terrace)	22,669	332	1.46%
22	Ashton Old Road (east of Lime Bank Street)	30,894	266	0.86%
23	A662 Ashton New Road (west of Hillkirk St)	15,014	233	1.55%
24	A62 Oldham Road (east of New Allen Street)	22,123	265	1.20%

Link Ref.	Highway Link Receptor	AADT Traffic Flows		
		2026 Baseline	Development Traffic	
		Total Vehs	Total Vehs	% Increase
25	A6010 Queens Road (south of Signal Drive)	23,983	430	1.79%
26	A57 Hyde Road (West of A6010)	20,442	133	0.65%
27	A57 Hyde Road (East of A6010)	25,850	133	0.51%
28	A664 Rochdale Road (N)	20,263	141	0.69%
29	A664 Rochdale Road (S)	15,702	141	0.89%
30	A6010 Queens Road (west of Rochdale Road)	21,480	141	0.65%
31	A663 Broadway	18,849	141	0.75%
32**	A62 Oldham Road (Failsworth)	18,778	141	0.75%
33**	A665 Angel Street (north of Oldham Street)	14,167	133	0.94%
34	A665 Ring Road (north of Oldham Street)	18,441	133	0.72%
35	A665 Great Ancoats Street (north of Store St)	39,809	116	0.29%
36	A665 Great Ancoats Street (south of Store St)	38,862	116	0.30%
37	A635 Mancunian Way (east of Hoyle Street)	52,408	399	0.76%
38	A6 Stockport Road (north of A6010)	25,988	133	0.51%
39	A6 Stockport Road (south of A6010)	19,337	233	1.20%
40	A635 Manchester Road	34,350	266	0.77%
41	A6 Downing Street (south of A635)	21,681	100	0.46%
42	A635 Mancunian Way (west of A6)	52,694	332	0.63%
43	A635 Mancunian Way (east of A5103)	66,481	166	0.25%
44	A5103 Princess Road (south of A635)	45,261	166	0.37%

** *Receptor identified as Moderate Sensitivity* *** *Receptor identified as High Sensitivity*

12.146 Table 12.14 and Table 12.15 shows that the change in total vehicles on the majority of receptor links in 2026 (with 180 events per year) is significantly less than 2% except for Links 1, 3, 5, 9, 11, 13, 15 and 25, which are shown to have a maximum increase of between 2.04% and 6.01%.

12.147 Links 1, 3, 5, 9, 11, 13, 15 and 25 are all low sensitivity receptors, which means that the magnitude of change is negligible in terms of severance, which results in a potential effect of **negligible significance**.

12.148 In terms of driver delay, the magnitude of change on Links 1, 5, 9, 11, 13, 15 and 25 is minor. The magnitude of change on Link 3 (A6010 Queens Road north of Vickers Street) is moderate. This results in a potential **adverse effect of minor significance**.

Effect on Pedestrians and Cyclists

12.149 The total impact on the pedestrian network is the sum of those that walk as their main mode of transport to/from the Site plus those using public transport or parking off-site, as walking will make up the final mode of their journey to and from of the Site.

12.150 The increase in walking trips generated by the Proposed Development is shown in Table 12.16.

Table 12.16 Increase in Walking Trips for the Proposed Development

Mode	Daily		
	IN	OUT	TOTAL
Walk (Main Mode)	394	394	788
Walk (Public Transport)	2,015	2,015	4,031
Total	394	394	788

12.151 In terms of cyclists, the net increase in cycling trips generated by the Proposed Development is shown below in Table 12.17.

Table 12.17 Increase in Cycling Trips for the Proposed Development

Mode	Daily		
	IN	OUT	TOTAL
Cycle	48	48	96

12.152 The following receptors are shown to have a two-way traffic flow greater than 1,400 vehicles per hour in the 2023 future baseline scenario:

- (Link 2) A62 Oldham Road (east of New Street) (Low)
- (Link 4) A62 Oldham Road (west of Hulme Hall Lane) (Low)
- (Link 9) A6010 Alan Turing Way (south of Gibbon Street) (Low)
- (Link 10) A622 Ashton New Road (east of Alan Turing Way) (Moderate)
- (Link 11) A6010 Alan Turing Way (south of Ashton New Road) (Low)
- (Link 13) A6010 Alan Turing Way (north of Ashton Old Road) (Low)
- (Link 14) A635 Ashton Old Road (west of Mill Street) (High)
- (Link 15) A6010 Pottery Lane (north of Ambrose Street) (Low)
- (Link 16) A635 Ashton Old Road (east Whitehurst Drive) (Low)
- (Link 18) A62 Oldham Road (east of Ten Acres Lane) (Low)
- (Link 20) A635 Ashton Old Road (west of Louisa Street) (Low)
- (Link 22) Ashton Old Road (east of Lime Bank Street) (Low)
- (Link 24) A62 Oldham Road (east of New Allen Street) (Low)
- (Link 25) A6010 Queens Road (south of Signal Drive) (Low)

12.153 Given that the increase in pedestrian/cycle movements as a result of the Proposed Development would dissipate across the surrounding highway network, the magnitude of change is considered to be minor and thus, the significance of the effect will be **negligible**.

12.154 All other receptors have traffic flows below the threshold adopted for assessment, which means that pedestrian/cycle delay is unlikely to be a significant factor on these road links.

12.155 In terms of pedestrian/cycle amenity, there are no sensitive receptors with an increase in traffic flow greater than 100%. Therefore, it is considered that the additional traffic generated by the Proposed Development would not have a significant adverse effect on pedestrian/cycle amenity.

12.156 As part of the Proposed Development, there will be improvements to the public realm within and surrounding the Site. This is anticipated to have a **beneficial effect of minor significance** for pedestrian/cycle amenity.

Effect on Highway Safety

12.157 The Proposed Development is not predicted to generate significant volumes of HGV traffic. Therefore, it is unlikely to produce a change in the character of the traffic on the local road network.

12.158 The TA has demonstrated that the local highway network has sufficient capacity to accommodate the predicted traffic flows associated with the Proposed Development and does not result in any significant capacity issues at the junctions in the vicinity of the site. Accordingly, there is unlikely to be a determinable increase on the risk of accidents.

12.159 It is therefore considered that the additional traffic generated by the Proposed Development would not have a significant adverse effect on highway safety.

12.160 Given the magnitude and factors detailed above, the overall effect on highway safety on the surrounding road network is considered to be **negligible**.

Climate change and adaption

12.161 There are no climate change effects relevant to traffic and transport to be assessed.

Summary of effects during operation

12.162 Table 12.18 summarises the effects once the Proposed Development becomes operational.

Table 12.18 Summary of Operational Effects

Receptor and sensitivity	Description of effect	Effect Significance
All Local Roads and road users	Increase in traffic - Severance/Pedestrian and Cycle Delay/Pedestrian and Cycle Amenity/Highway Safety	Negligible
	Increase in traffic - Driver Delay	Minor Adverse
	Improvements to public realm and cycle/pedestrian amenity	Minor Beneficial

Mitigation Measures

Supplementary mitigation measures during construction

12.163 The assessment has demonstrated that there will be an impact of negligible significance on traffic and transportation as a result of the Proposed Development during construction, on the basis that the Construction Logistics Plan (CLP) is secured via planning condition and implemented.

12.164 The CLP will help manage all types of vehicles to and from the Site during construction; with the aim of improving the safety and reliability of deliveries to the Site and minimising the environmental impact.

12.165 No further measures are required beyond delivery of the CLP from a transport perspective. The full CLP is expected to be secured by condition. A Construction Environmental Management Plan (CEMP) is additionally expected to be secured by condition and will encompass a wide range of environmental considerations.

12.166 A summary of the supplementary mitigation measures during construction are set out in Table 12.19.

Table 12.19 Summary of Supplementary Mitigation Measures during Construction

Receptor	Adverse Effect	Mitigation Measure	Means of Implementation	Timing	Essential/Desirable
All local roads and road users	None	Construction Logistics Plan (CLP)	Contractor/ Applicant during construction	Throughout the construction period	Essential

Supplementary mitigation measures during operation

12.167 No significant adverse effects resulting from the Proposed Development have been identified in relation to severance, driver delay, pedestrian and cycle delay, pedestrian and cycle amenity, highway safety. This determination is based on the net change in trips over and above the future baseline traffic flows.

12.168 While no quantitative analysis can be undertaken to determine the overall effect of a Travel Plan it is widely acknowledged that a successful Travel Plan will have a beneficial effect on influencing sustainable travel modes, particularly as it will seek to encourage healthy modes of travel such a walking and cycling.

12.169 Therefore, there are no supplementary mitigation measures required over and above the designed-in mitigation measures described earlier.

Cumulative Effects

Construction

12.170 The construction of the scheme in combination with other committed developments in the area could create short term disruption to road users with temporary closures/diversions and increased driver stress as a result of delays caused by traffic management and diversions. It is assumed that all committed developments would be required to operate with a CEMP to mitigate environmental impacts and with such mitigation in place, the significance of the cumulative temporary effects in relation to severance, pedestrian/cycle delay and amenity, driver delay and highway safety on local roads is considered to be **negligible**.

Operational

12.171 Traffic flows from committed developments are included within the 2023/2026 future baseline traffic data upon which the operational assessment for the Proposed Development has been based. Therefore, cumulative effects are considered inherently as part the operational assessment and not required to be assessed separately.

Residual Effects

12.172 Residual effects are defined as those effects that remain following the implementation of mitigation measures.

12.173 It is considered that there would be no significant residual effects arising from the Proposed Development in relation to traffic and transportation.

12.174 A summary of the residual effects are set out in Table 12.20.

Table 12.20 Summary Residual Effects during Demolition and Construction

Receptor	Effect	Significance before supplementary mitigation	Supplementary mitigation	Residual effect significance
All local roads and road users	Construction Impact on all road users	Negligible	No further mitigation required. CLP should be implemented and secured through appropriate planning condition	Negligible

12.175 A summary of the residual effects during operation is set out below in Table 12.21.

Table 12.21 Summary of Residual Effects during Operation in 2023/2026

Receptor	Effect	Significance before supplementary mitigation	Supplementary mitigation	Residual effect significance
All local roads	Traffic Impact on all Road Users - severance, driver delay, pedestrian and cycle delay, pedestrian and cycle amenity, and highway safety	Negligible	None required	Negligible

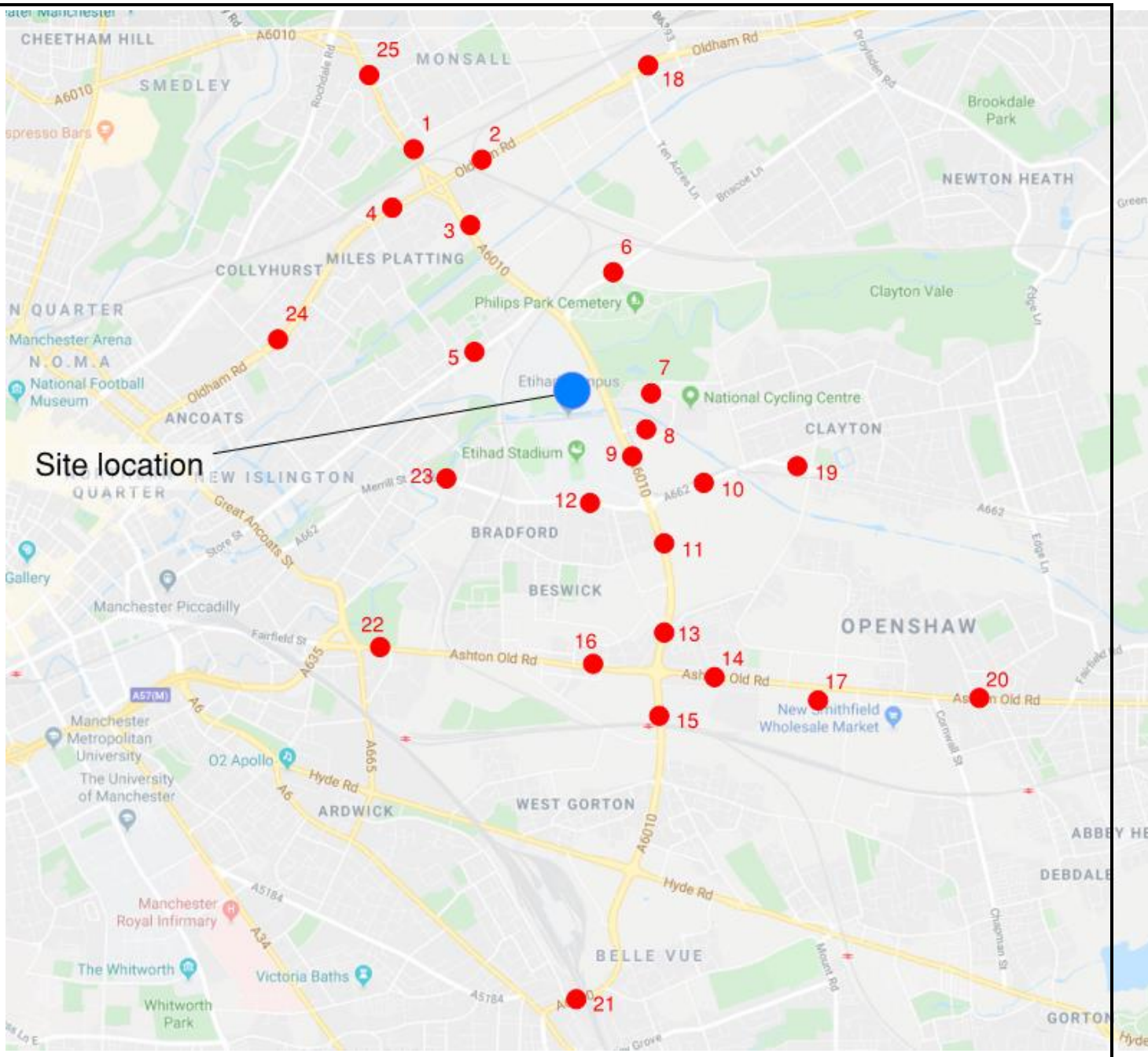


	Figure:	**12.1**		
	Title:	**Highway Links**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

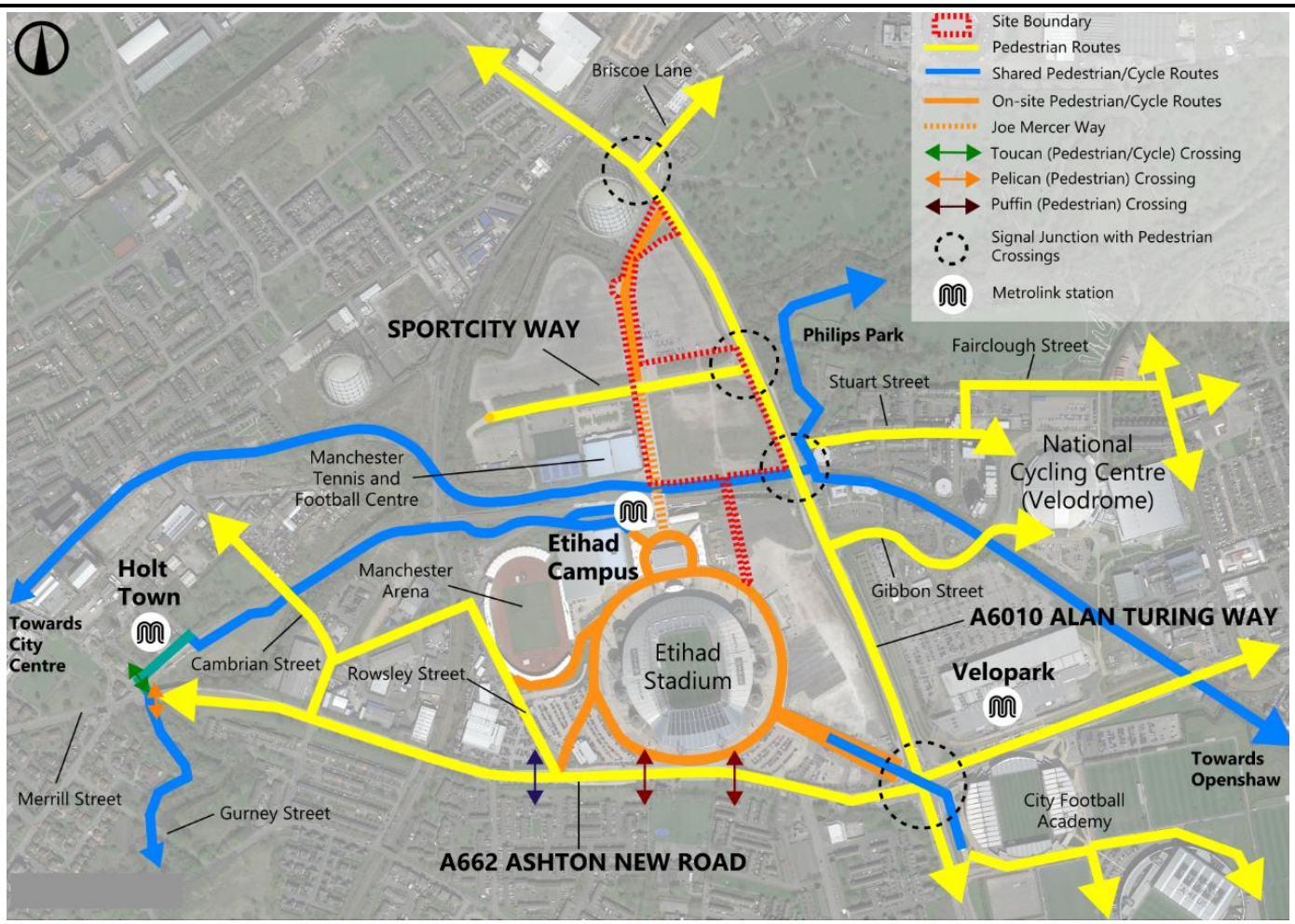


	Figure:	**12.2**		
	Title:	**Pedestrian infrastructure Surrounding the Site**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

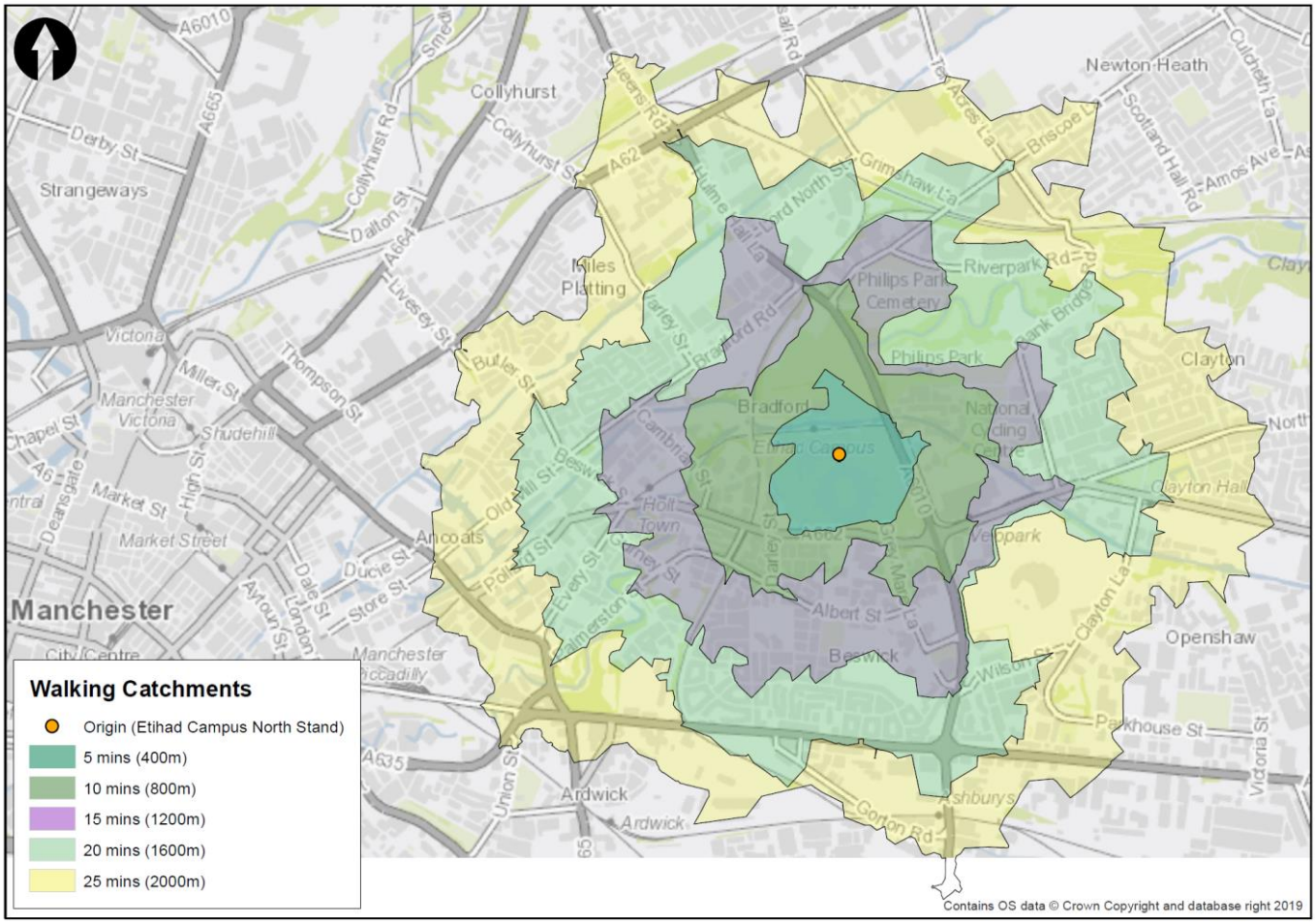


	Figure:	**12.3**		
	Title:	**Walking Accessibility**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

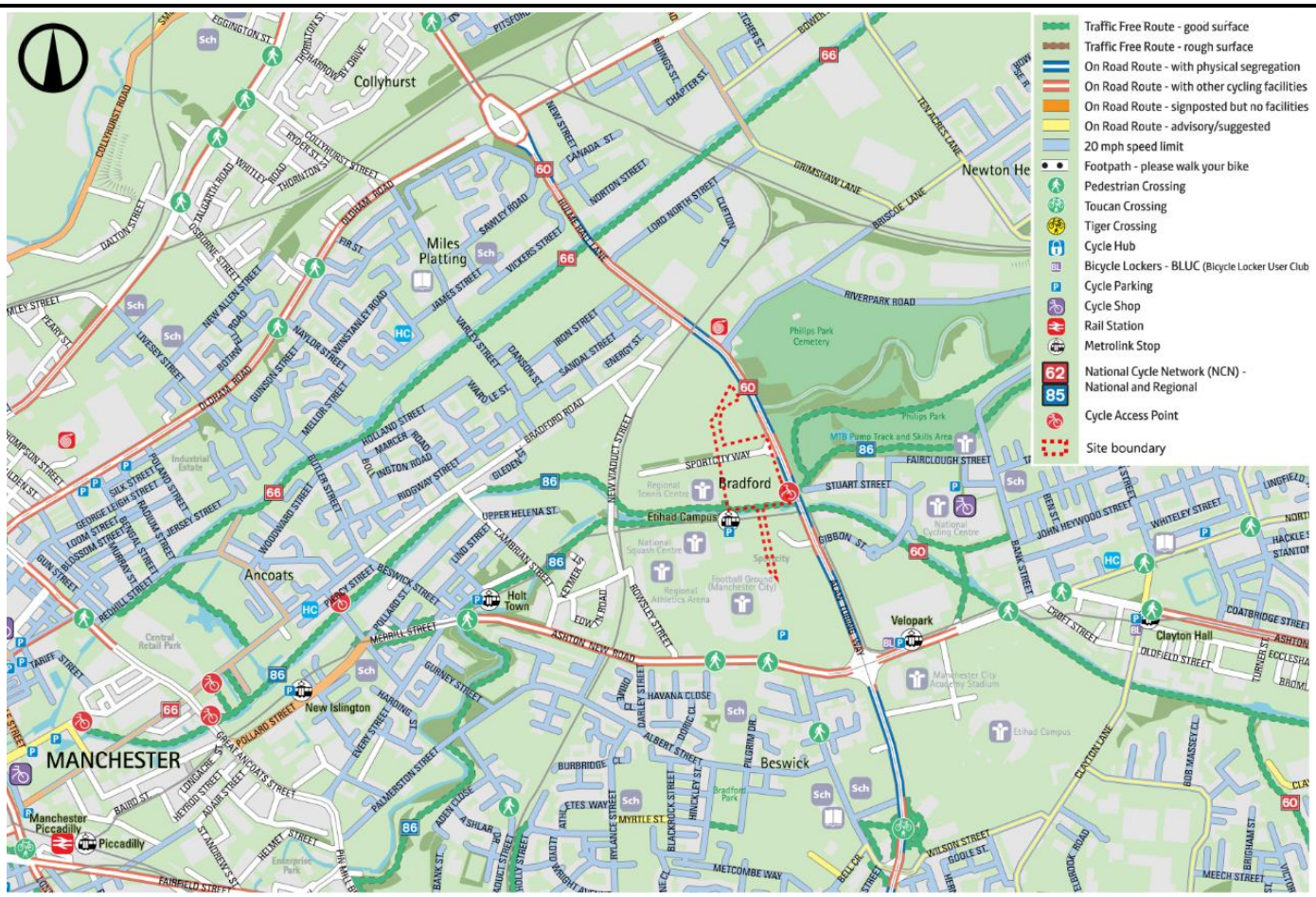


	Figure:	**12.4**		
	Title:	**Cycle Routes in the Vicinity of the Site**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

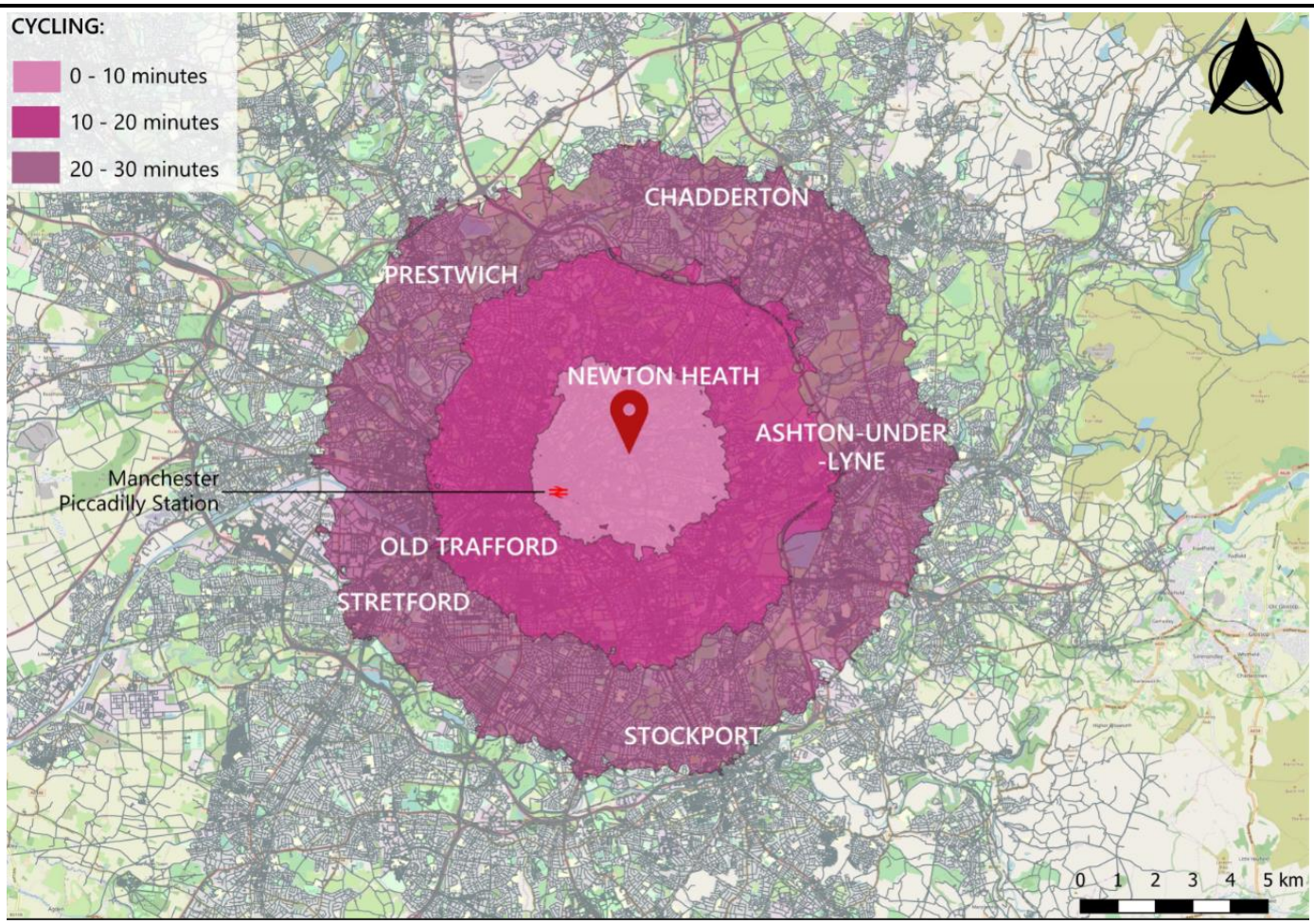


	Figure:	**12.5**		
	Title:	**Cycling Accessibility**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

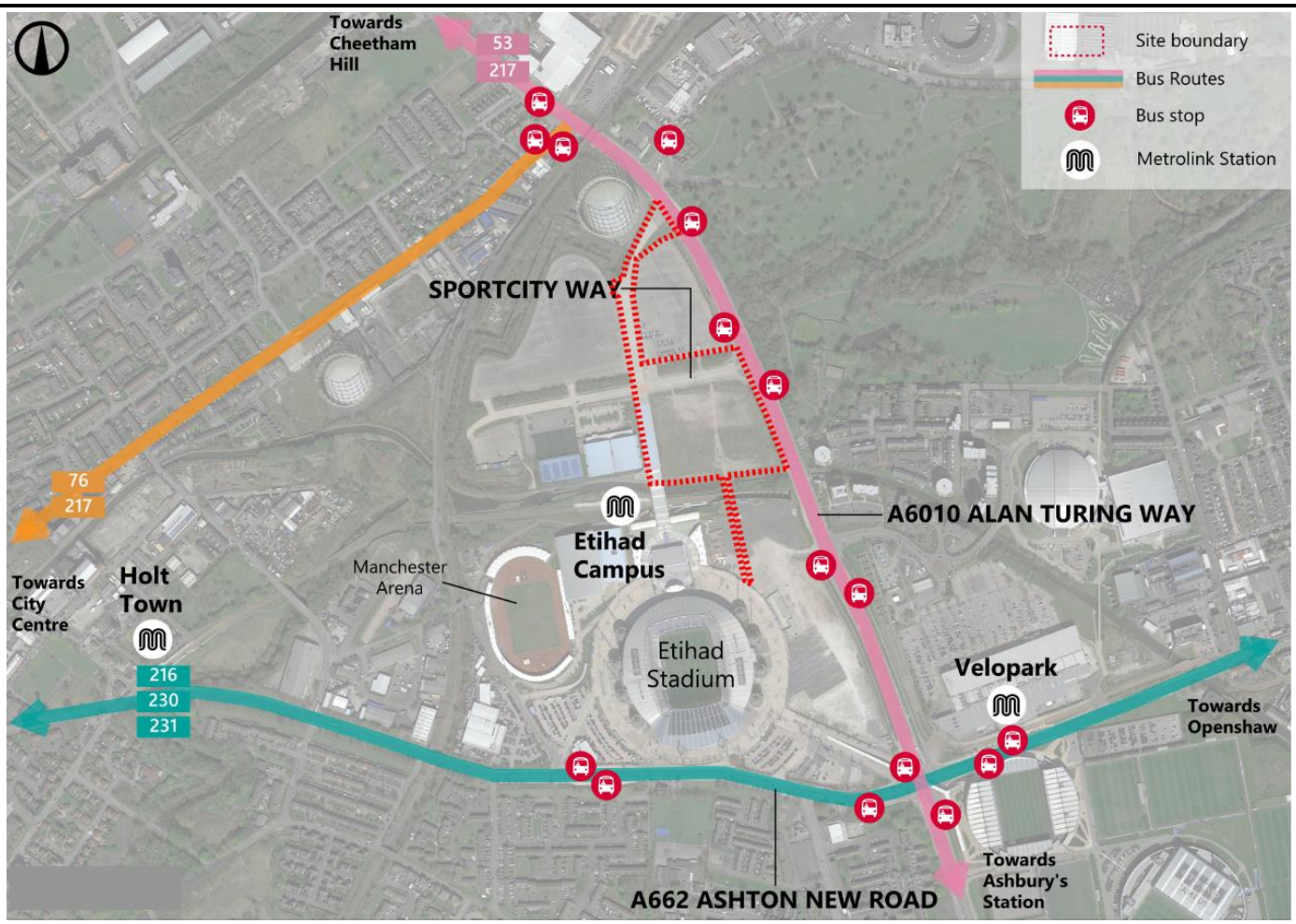


	Figure:	**12.6**		
	Title:	**Local Bus Stops and Bus Routes**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

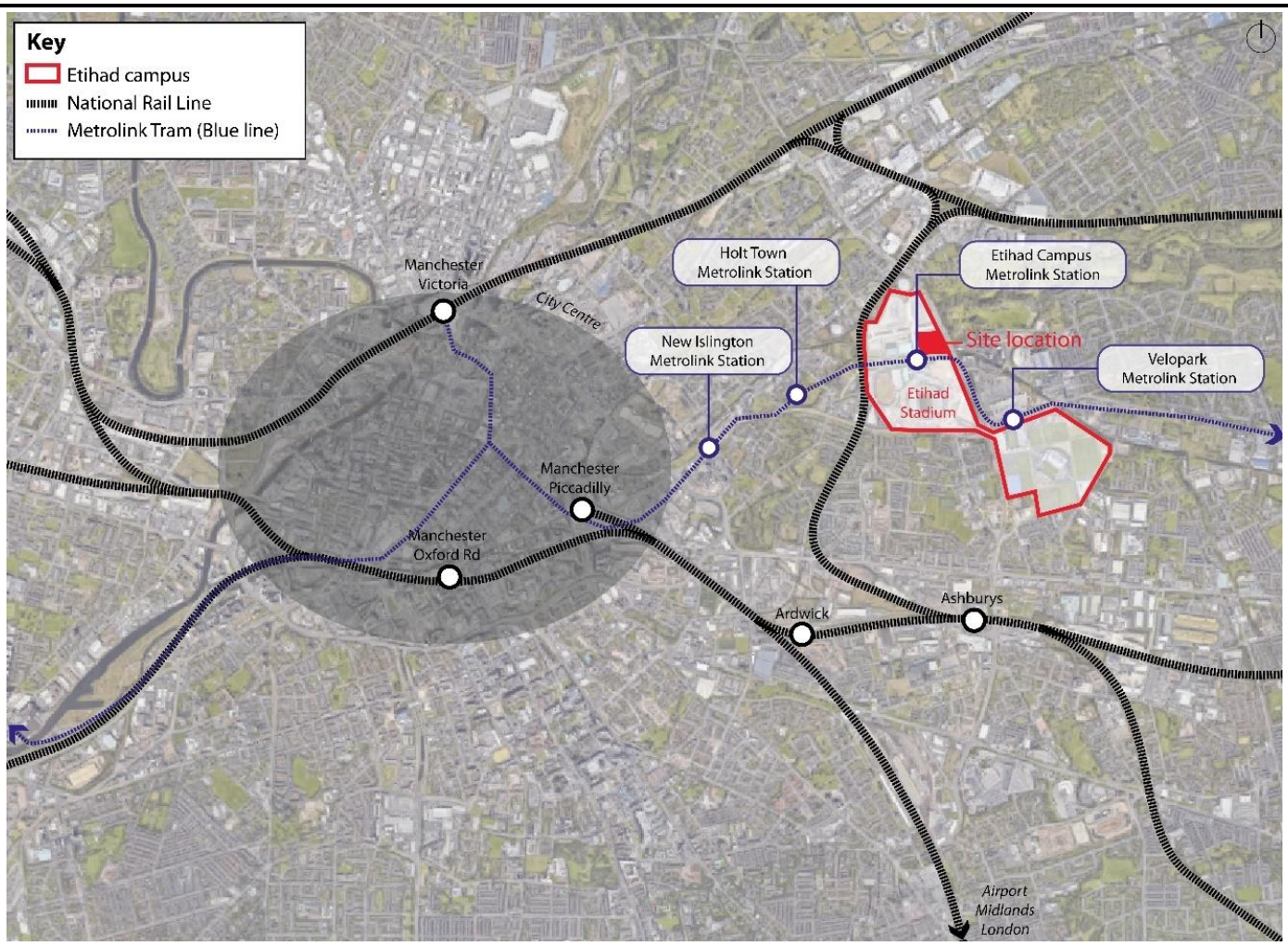


	Figure:	**12.7**		
	Title:	**Local Tramline and Rail Network**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

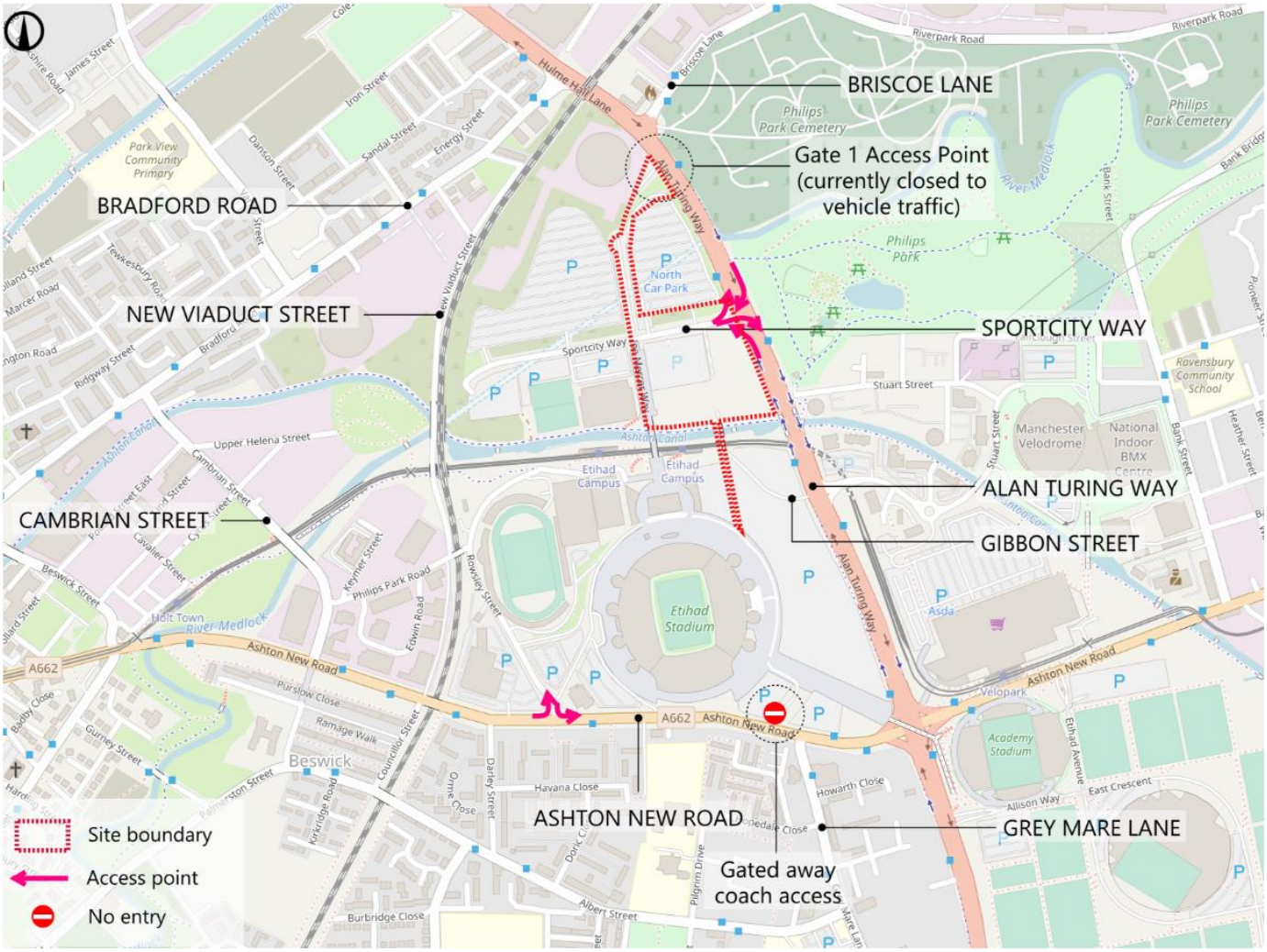


	Figure:	**12.8**		
	Title:	**Local Highway Network**		
	Project:	**OVG Manchester**		
	Date:	**March 2020**	**Scale:**	**Scale /NTS**

13 Water Quality, Drainage and Flood Risk

Introduction

13.1 This Chapter of the ES has been prepared by BuroHappold Engineering and assesses the likely Water Quality, Drainage, Water Supply and Flood Risk impacts and effects of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts and effects; the existing baseline conditions; the proposed mitigation measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these methods have been adopted.

13.2 This Chapter is accompanied by two technical appendices, a Flood Risk Assessment (FRA) (Appendix 13.1) and a Drainage Strategy (Appendix 13.2).

13.3 The following summarises the qualifications of those who have contributed to the production of this ES Chapter, the FRA and the Drainage Strategy:

- BSc (Hons) Environmental Science, with four years' experience in both public and private sector project management of hydrology/flood risk and coordination of EIAs for UK-based projects. Practitioner member of the Institute for Environmental Management and Assessment (IEMA).
- MEng in Civil Engineering and Chartered Engineer with the Institution of Civil Engineers. More than five years' experience in flood risk management and hydraulic modelling.
- BEng in Civil Engineering and Mst in Construction Engineering. IEng with the Institution of Civil Engineers and more than 12 years' experience.

Limitations and Assumptions

13.4 The water environment is well understood for the purpose of this assessment.

13.5 The understanding with regard to flood risk, foul water drainage and surface water drainage has been informed through best practice methodologies and surveys, to produce the most accurately available baseline and future scenario.

Legislative and Policy Context

13.6 The policy, guidance and legislation that has influenced this assessment is listed below.

National Planning Policy and Guidance

National Planning Policy Framework (NPPF) (MHCLG, 2019)

13.7 The NPPF sets out the Government's planning policies for England and how these should be applied. It provides a framework in which locally-prepared plans for development can be produced. Within the NPPF, the chapter which is the most relevant to this water chapter is section 14, which is entitled 'Meeting the challenge of climate change, flooding and coastal change'.

13.8 Within section 14, the NPPF defines flood risk and aims to avoid development in areas most vulnerable to flooding. This is attained through the implementation of a Sequential Test, which directs development towards areas with lowest flood risk. Where this is not possible, the NPPF requires that all new developments in flood risk areas are appropriately flood resilient and resistant, include safe access and egress routes where required and that residual risks of flooding are adequately managed.

National Planning Practice Guidance – Water Supply, Wastewater and Water Quality (MHCLG, 2015)

13.9 National Planning Practice Guidance (NPPG) provides supplementary, more in depth, information alongside the NPPF. This guidance advises on how planning can ensure water quality, and the delivery of adequate water and wastewater infrastructure.

13.10 This guidance includes where to find information on the water environment; the legal and policy framework of the water environment; and the consideration of water supply, wastewater and water quality in plan making.

National Planning Practice Guidance – Flood Risk and Coastal Change (MHCLG, 2014)

13.11 NPPG provides supplementary, more in depth, information alongside the NPPF. This guidance focuses on how to take account of and address the risks associated with flooding and coastal change in the planning process.

13.12 This guidance provides a wide range of information surrounding flood risk and coastal change in the planning system, including information on flood zoning, site-specific flood risk assessment, the Sequential Test and the Exception Test.

Future Water (2008)

13.13 This document provides a water strategy for England, setting out the Government's vision for water policy and management. By 2030 at the latest, the ambition is to have:

- Improved the quality of our water environment and the ecology which it supports, and continued to provide high levels of drinking water quality from our taps;
- sustainably managed risks from flooding and coastal erosion, with greater understanding and more effective management of surface water;
- ensured a sustainable use of water resources, and implemented fair, affordable and cost reflective water charges;
- cut greenhouse gas emissions; and
- embedded continuous adaptation to climate change and other pressures across the water.

13.14 This document includes chapters on water demand, water supply, water quality in the natural environment and surface water drainage.

Water for Life (white paper) (2011)

13.15 The Water for Life Report describes a vision for future water management in which the water sector is resilient, in which water companies are more efficient and customer focused, and in which water is valued as the precious and finite resource it is.

National Legislation

The Environmental Protection Act (1990)

13.16 This Act defines the fundamental structure and authority for waste management and control of emissions into the environment. The Act is split into the following parts:

- Part I: establishes a regime by which the Secretary of State can prescribe any process or substance and set limits on it respective of its emissions into the environment.
- Part II: sets out a regime for regulating and licensing the acceptable disposal of controlled waste on land.
- Part III: defines a class of statutory nuisances over which the local authority can demand remedial action supported by criminal penalties.
- Part IV: defines a set of criminal offences concerning litter.
- Part VI: defines a regime of statutory notification and risk assessment for genetically modified organisms (GMOs).

- Part VII: created three new organisations: the Nature Conservancy Council for England, the Nature Conservancy Council for Scotland, and the Countryside Council for Wales.

The Water Resources Act (1991)

13.17 This is an Act of Parliament that regulates water resources, water quality and pollution, and flood defence. Additionally, this Act set out the functions of the National Rivers Authority (now called the Environment Agency).

The Environment Act (1995)

13.18 This Act created a number of new agencies and set new standards for environmental management. The Act set up the following agencies:

- The Environment Agency;
- The Scottish Environmental Protection Agency; and
- The National Parks Authority.

The Anti-Pollution Works Regulations (1999)

13.19 These regulations supplement the anti-pollution works notice provisions contained in the Water Resources Act 1991. Under these Regulations, the Environment Agency can serve a notice requiring remedial action to be taken where there is actual or potential pollution affecting controlled waters.

The Control of Pollution (Oil Storage) (England) Regulations (2001)

13.20 These Regulations set minimum design standards for all new and existing above ground oil storage facilities. The key requirement is the provision of secondary containment (i.e. a 'bund' or 'drip tray') to ensure that any leaking or spilt oil cannot enter controlled waters.

The Water Resource Management Act (Amendment) (England and Wales) Regulations (2009)

13.21 These Regulations provided amendments to the Water Resources Act 1991 by making some changes to the powers to designate Water Protection Zones and the powers to carry out anti-pollution works and serve notices regarding such works.

Flood and Water Management Act (2010)

13.22 This Act encouraged the use of sustainable urban drainage systems (SUDs), amended the Water Industry Act to modernise the list of activities that can be restricted by water companies during a drought, and made it easier for water companies to offer lower tariffs to certain groups.

The Water Act (2014)

13.23 This Act deregulated the water industry, enabling greater competition for non-household customers. Additionally, this Act gave Ofwat new powers to make rules about charges and charges schemes, as well as making provisions for flood insurance and drainage boards.

The Environmental Damage Regulations (2015)

13.24 These Regulations oblige those who create environmental damage, to not only cease the damage, but also to implement a wide variety of remedial measures to restore affected areas. Environmental damage may be via water pollution, adversely affecting protected species or sites of special scientific interest (SSSIs), or by land pollution that causes risks to human health.

The Water Supply (Water Quality) Regulations (2016)

13.25 These Regulations consolidate legislation concerning the quality of water supplies for human consumption in England.

The Environmental Permitting (England and Wales) (Amendment (No. 2) Regulations (2016)

13.26 These Regulations consolidate and replace the Environmental Permitting (England and Wales) Regulations 2010.

13.27 The Regulations maintain the environmental permitting and compliance regime applying to various activities and industries. A key component is that it allows applicants that would otherwise require several permits for activities falling under various regulations on a single site to complete a single application, and to be issued with one permit. The framework introduces different levels of control, based on risk:

- Exclusions (activities that may be undertaken without any permit);
- Exemptions (activities that may be undertaken after registering, which is free);
- Standard rules permits (standard requirements and conditions for the relevant activities are set out so that applicants can determine in advance whether the permit is applicable to their proposals); and
- Bespoke permits (permits written specifically for activities which are unique or of higher risk).

The Water Environment (Water Framework Directive) (England and Wales) Regulations (2017)

13.28 These Regulations consolidate, revoke and replace the Water Environment (Water Framework Directive) (England and Wales) regulations 2003. These Regulations represent the transposition of the European Union Water Framework Directive (2014/101/EU) into UK law.

13.29 These regulations set out requirements to prevent the deterioration of aquatic ecosystems; protect, enhance and restore water bodies to 'good' status; and achieve compliance with standards and objectives for protected areas. Local planning authorities must, in exercising their functions, have regard to River Basin Management Plans.

13.30 Although the requirements of the Water Framework Directive mean that 'good' status should have been achieved by 2015, this time limit may be extended by a maximum of two River Basin Management Cycles in certain circumstances, therefore moving the deadline to 2027.

Sub-Regional Planning Policy

Draft Greater Manchester Spatial Framework (2019)

13.31 The draft Greater Manchester (GM) Plan for Homes, Jobs, and the Environment (the spatial framework) was put together by Greater Manchester Combined Authority and sets out how GM should develop up until 2037. This version has been rewritten and focuses more heavily on the environment than previous plans. Consultation ran from January 2019 to March 2019; the outcome of the consultation was published in September 2019 and it is currently anticipated that a final draft will be published for consultation in summer 2020, examination in 2021 and adoption in December 2021. The key areas of policy relating to water quality, drainage and flood risk are set out below:

13.32 Policy GM-S 5 (Flood Risk and the Water Environment) states:

"3. Locating and designing development so as to minimise the impacts of current and future flood risk, including retrofitting or relocating existing developments, infrastructure and places to increase resilience to flooding;

4. Expecting developments to manage surface water runoff through sustainable drainage systems and as close to source as possible (unless demonstrably inappropriate) so as to not exceed greenfield run-off rates or alternative rates specified in district local plans."

Environment Agency River Basin Management Plan: North West River Basin District (2015)

13.33 Prepared by the Environment Agency (EA), in conjunction with wider stakeholders, the EA River Basin Management Plan provides a framework for protecting and enhancing the benefits provided by the water environment, informing planning decisions and policy making. The intention is for all water bodies to achieve 'Good' status, as defined by the European Water Framework Directive (WFD). The plan is updated every six years and replaces the river basin management plan published in 2009.

Greater Manchester's Strategic Flood Risk Assessment (Level 1, 2010 and Level 2, 2011)

13.34 The Manchester City, Salford City and Trafford Councils Level 1 Strategic Flood Risk Assessment (SFRA) uses mostly existing data to assess flood risk from all sources, including flooding from rivers, canals, reservoirs, groundwater, surface water and sewers.

13.35 The Level 1 SFRA states that the main source of flood risk in Manchester is from the Grey Irwell, the Rivers Irk, Medlock and Mersey and Corn Brook. It also considers that surface water flooding is also a significant risk, and that there is a residual risk from the Ashton, Rochdale and Bridgewater Canals and several reservoirs. It makes recommendations for the Level 2 SFRA including analysing the fluvial flood risk, breach of defences, and overtopping of canals, and that a detailed surface water analysis should be undertaken.

13.36 The Level 2 SFRA builds on the Level 1 SFRA and provides a more detailed understanding of flood risk across the three local authorities from all sources and outlines the residual risks of flooding after all risk avoidance, substitution, control and mitigation measures have been taken into account.

Local Planning Policy

Manchester Green and Blue Infrastructure Strategy (2015)

13.37 Manchester City Council's (MCC) Green and Blue Infrastructure Strategy sets out a vision for how the city will continue to grow and evolve over the 10 years from 2015 – 2025. The Strategy acknowledges that Manchester's green infrastructure has been part of the city's success. The green and blue spaces that exist within urban areas include the five river valleys, three canals, over 160 parks, street trees, woodland, private gardens and other areas of natural environment.

13.38 The vision is 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 greenspaces 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.*"

13.39 The Strategy sets out four main objectives which enable the vision to be achieved:

> *"1. Improve the quality and function of existing green and blue Infrastructure, to maximise the benefits it delivers;*
>
> *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;*
>
> *3. Improve connectivity and accessibility to green and blue infrastructure within the city and beyond; and*
>
> *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."*

Local Flood Risk Management Strategy (MCC, 2014)

13.40 The Local Flood Risk Management Strategy (LFRMS) was adopted in 2014 and is a requirement under the Flood and Water Management Act 2010. The LFRMS's aim is 'to ensure that local flood risk is properly managed by using the full range of options in a coordinated way.'

13.41 The Strategy states a number of policies, including LFRM Policy 6: Ensure that local flood risk is properly considered for new development proposals. It states that the Lead Local Flood Authority (MCC in this case) should engage in the planning process to ensure flood risk is appropriately considered in new developments/landscaping.

Manchester Core Strategy Development Plan Document 2012-2027 (2012)

13.42 Manchester's Core Strategy was adopted in 2012 and is a key Development Plan document in the Local Development Framework, setting out the long term strategic policies for Manchester's future development and forming the framework against which planning applications will be assessed. The relevant policies with regard to water resource and flood risk are listed below:

- Policy EN8 Adaptation to Climate Change states that all new development "will be expected to be adaptable to climate change", through a range of measures such as surface water drainage, green infrastructure, and passive design;
- Policy EN9 Green Infrastructure states that new development "will be expected to maintain existing green infrastructure" and to "enhance the quality and quantity of green infrastructure" where the opportunity arises, including the city's rivers and canals;
- Policy EN14 Flood Risk states that an "appropriate FRA will also be required for all development proposals" and that "all new development should minimise surface water run-off, including through Sustainable Drainage Systems (SuDS) and the appropriate use of Green Infrastructure"; and
- Policy EN17 Water Quality states "development should avoid any adverse impact on water quality, including during the construction phase" and "should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses".

Guide to Development in Manchester Supplementary Planning Document and Planning Guidance (2007)

13.43 This document was officially adopted in 2007 and aims to support and enhance the ongoing shaping of the City by providing a set of reasoned principles to guide developers, designers and residents to the sort of development we all want to see in Manchester. It sets out MCC's stance on a wide range of issues, demonstrating, where applicable, their links to the Manchester Unitary Development Plan (UDP).

13.44 The guide covers environmental standards of specific interest to this Chapter, including a section on water management and weather resilience. This refers to applicable UDP policy around groundwater and watercourse pollution, surface water runoff and incorporation of SuDS, identifying areas of flood risk, the effects of climate change and using water efficiently.

Other relevant policy and guidance

Pollution Prevention Guidance Notes

13.45 The former EA Pollution Prevention Guidance (PPG) notes provide advice on statutory responsibilities and good environmental practice. Whilst this guidance was withdrawn and will no longer be updated by the EA, as of December 2015, it is still considered good practice. The guidance notes of particular relevance to the Proposed Development include:

- PPG1: General Guide to the Prevention of Pollution. This provides an introduction to pollution prevention and the pollution prevention guidance notes;
- PPG2: Above Ground Oil Storage Tanks. This provides guidance to those responsible for the storage of oil on construction sites. The document provides guidance on location, bunding, protection and operation of oil stored, in addition to maintenance and brief guidance on dealing with spills;
- PPG3: Use and Design of Oil Separators in Surface Water Drainage Systems. This provides guidance on when oil separators are appropriate and what size and type of separator is required;
- PPG5: Works In, Near or Liable to Affect Watercourses. This provides guidance on general precautions to take when working in the vicinity of a watercourse, along with more specific measures to prevent contamination and to minimise adverse impacts;

- PPG6: Working at Construction or Demolition sites. This document mirrors much of PPG5, but with particular emphasis on the situations likely to occur at demolition and construction sites;
- PPG7: Refuelling Activities. This provides information on the correct delivery, storage and dispensing of fuel to help reduce the risk of pollution; and
- PPG21: Pollution Incident Response Planning. This provides guidance to those developing site-specific pollution incident response plans to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.

Construction Industry Research and Information Association Guidance

13.46 The Construction industry Research and Information Association (CIRIA) carries out research activities and provides guidance for developers and contractors. The guidance with specific relevance to water resources and flood risk are:

- Guidance C532 – Control of Water Pollution from Construction Sites. This brings together the Environment Agency guidance but goes into more detail with regard to sources of water on construction sites, pollutants and pathways, in addition to providing guidance on planning for the type and location of suitable control measures; and
- Guidance C753 – The SuDS Manual. This provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their best effective implementation within developments.

Assessment Methodology and Significance Criteria

EIA Scoping

13.47 A formal request for an EIA scoping opinion was submitted to MCC on 26 November 2019. The water resource responses from MCC's scoping response, received on 15 January 2020, are covered in the scope of this assessment and the supporting appendices.

Baseline study methodology

13.48 The baseline assessment covers the Site and surrounding areas which may impact the Proposed Development or be susceptible to impact as a result of the Proposed Development; this includes major water bodies (i.e. the Ashton Canal and the River Medlock) within a material distance of the Site, as deemed by the assessment author. The baseline review will take into account the following baseline scenarios:

- Existing baseline, or the assessment baseline (conditions in 2019, when the assessment is made); and
- Future baseline (conditions in 2023, the year of completion).

13.49 It should be noted that the future baseline accounts for how existing baseline conditions could change, by the year of completion, in the absence of the Proposed Development (referred to as the 'Do Nothing' scenario).

Assessment approach

13.50 The methodology adopted in this assessment involves the following:

- Review of international, national, regional and local legislation, policies and guidelines in relation to water resources, water quality and flood risk;
- Establishment of baseline conditions on and around the Site through a literature review and analysis of existing data obtained from the Environment Agency (EA) and United Utilities (UU);
- Identification of sensitive receptors through a desk study and consultations with the EA as reported through the Flood Risk Assessment for the Proposed Development, and with UU as reported in the drainage strategy for the Proposed Development;

- Identification of risks to water quality, water resources and flooding from Proposed Development and hence the likely effects, magnitude of change and significance of environmental effects during both the demolition/construction and operational phases;
- Development of mitigation strategies through consultation with the design team;
- Identification of opportunities for enhancement of surface water quality and surface water management through design and mitigation;
- Identification of residual effects; and
- Identification of cumulative effects.

Assessment of effects

Receptor sensitivity

13.51 A qualitative assessment of receptor sensitivity is described in Table 13.1.

Table 13.1 Criteria for determining receptor sensitivity

Sensitivity	Criteria
High	Water body of high amenity value, including areas of bathing and water sports are regularly practiced. Water body of good or high chemical or ecological status. Includes designated bathing waters, shellfish and salmonid fisheries. A source used for public water supply or designated as a source protection zone. Site of Special Scientific Interest (SSSI), Special Protection Area (SPA)/Special Area of Conservation (SAC), Ramsar site or highly sensitive aquatic ecosystem. Water bodies currently failing water quality objectives. Areas which are highly vulnerable. With reference to flood risk. These can include essential infrastructure, emergency services and basement dwellings.
Moderate	Water body of moderate amenity value including public parks, boating, non-contact sports, popular footpaths adjacent to water courses, or watercourses running through housing developments/town centres. Water body of moderate ecological status and/ or non - public water supply or cyprinid fishery. Water body of nature conservation importance at the regional level or a moderately sensitive aquatic ecosystem e.g. Site of Nature Conservation Interest (SNCI). Areas which are more vulnerable. With reference to flood risk, these can include hospitals, residential units, educational facilities and waste management sites.
Low	Water body of poor ecological status. A source in close proximity to a source protection zone or abstraction point. Water body of particular local social/cultural/educational interest. Water body of low amenity value with only casual access, e.g. along a road or bridge in a rural area. Areas which are less vulnerable. With reference to flood risk, these can include retail, commercial and general industrial units, agricultural/forestry sites and water/sewage treatment plants.
Negligible	Low sensitivity aquatic ecosystem. Water of poor ecological status. Water body of no amenity value, seldom used for amenity purposes, in a remote or inaccessible area.

Sensitivity	Criteria
	Areas which are considered to be water-compatible. With reference to flood risk, these can include flood control infrastructure, docks/marinas, pumping stations and recreational/landscape areas.

13.52 The qualitative criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, is described in Table 13.2.

Table 13.2 Criteria for determining magnitude of change/impact

Magnitude	Criteria
Large	Wholesale changes to the watercourse channel, route or hydrology. Significant changes to soil erosion or sedimentation patterns. Major changes to the water chemistry of surface run-off and groundwater. Changes to site resulting in an increase in discharge/run-off with flood/sewerage exceedance potential. A large increase to flood risk of water bodies and areas downstream. A large risk of flooding to site infrastructure and users, as determined by an on-site FRA in accordance with NPPF.
Medium	Some fundamental changes to the watercourse and hydrology. Moderate changes to soil erosion or sedimentation patterns. Moderate changes to the water chemistry of surface run-off and groundwater. Changes to site resulting in an increase in discharge/run-off within system capacity. A medium increase to flood risk of water bodies and areas downstream. A medium risk of flooding to site infrastructure and users, as determined by an onsite FRA in accordance with NPPF.
Small	Minor changes to the watercourse. Minor changes to soil erosion or sedimentation patterns. Minor changes to the water chemistry of surface run-off and groundwater. Changes to site resulting in slight increase in discharge/run-off well within drainage system capacity. A small increase to flood risk of water bodies and areas downstream. A small risk of flooding to site infrastructure and users, as determined by an onsite FRA in accordance with NPFF.
Negligible	No change to the watercourse, run-off and soil erosion and sedimentation patterns and water chemistry. Very minor to no change in discharge run-off and increased pressure on sewer capacity. No increased flood risk to water bodies and areas downstream. No risk of flooding to site infrastructure and users, as determined by an onsite FRA in accordance with NPPF

13.53 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 13.3.

Table 13.3 Matrix for determining effect significance

		Magnitude of change / impact			
		Large	**Medium**	**Small**	**Negligible**
Receptor sensitivity	**High**	Major	Major	Moderate/ Minor	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate/ Minor	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

13.54 Note that moderate and major effects are considered to be 'significant'. Effects can also be described as:

- Beneficial or adverse;
- Permanent or reversible; and,
- Short, medium or long term.

Baseline Conditions

Current baseline (2019)

Existing land use

13.55 The existing use of the Site is an overspill surface level car park for attendees of events associated with the Etihad Stadium (providing around 500 parking spaces). The perimeter of the Site is mainly dense shrubbery and trees, and it is surrounded by fencing.

Existing site levels

13.56 The Site it largely flat with a variance of 6.2m across the Site. The highest levels are noted in the south-eastern corner at approximately +61.3m AOD and then the Site falls towards the northern boundary where the lowest level is +55.5m AOD in the north-eastern corner. A site-specific topographic survey was undertaken on 13 May 2019 by CFG Surveys.

Existing surface water drainage

13.57 According to the EA surface water velocity map, the direction of surface water flow from the Site is northerly, towards Sportcity Way. This direction has been confirmed through inspection of the Site-specific topographic survey. Surface water is understood to exit the Site, therefore presenting a low threat of ponding on the Site.

13.58 CCTV survey data has verified that the existing site drains to the highway network on Sportcity Way to the north of the Site. The CCTV survey also confirms that the Sportcity Way drainage subsequently outfalls to the River Medlock culvert via a hydrocarbon interceptor.

13.59 Discussions have been conducted with Manchester City Council (MCC) as the Lead Local Flood Authority (LLFA). Through these discussions, historical site use has been considered with proposed discharge rates aligned to brownfield rates of runoff.

Existing foul water drainage

13.60 The Site currently has no connection to a foul water sewer. However, United Utilities Asset Maps indicate that there are three main combined sewers running under the Site, flowing from south to north. Initial investigations of these sewers indicates that they are very deep (almost 12m at the southern manhole). The upstream flows to these sewers appear to have been abandoned and it is assumed these are no longer in use. This will be confirmed through a detailed CCTV drainage survey.

13.61 The sewers combine to the north of the Site, with discharge to a culvert flowing from north-east to south-west.

Surface water features

13.62 The nearest surface water features to the Site are:

- Ashton Canal – this runs for 10km from Ashton-under-Lyne to join the Rochdale Canal approximately 2km south-west of the Site at Ducie St Junction. It is immediately adjacent to the southern boundary of the Site; and
- River Medlock – The River Medlock is heavily modified and culverted for approximately 500m through the Etihad Campus. The culvert extents within the northern section of the Site boundary, as identified through a CCTV Survey conducted by Drain Alert on 28th August 2019. The course of the River Medlock through this culvert is assumed to be straight. The nearest un-culverted section of the River Medlock is 140m north east from the Site at its closest distance.

A full structural survey was recommended by the EA to establish the culvert condition and the exact depth, size and location of the culvert, if works were anticipated near/over the culvert. Due to the construction works being more than 8m away from the culverted Medlock, it is not considered that there will be any impact on the culvert.

To date BuroHappold have not carried out a structural survey of the culvert, as despite the fact that the red line boundary for planning crosses the culvert, the applicant is not the riparian landowner. BuroHappold have approached the Environment Agency to obtain the results of the most recent visual inspection and the EA suggested that BuroHappold approach the EA's GMMC address for this information. GMMC responded to say that the most recent inspection was carried out on 2 December 2019, however, GMMC were not able to provide information from this recent survey

Further information was sought on the culvert condition from Manchester City Council (MCC) as the riparian owner and the only information made available was for the River Medlock underneath Alan Turing Way and New Viaduct Street. No information was available for the culvert between these two public highways. As such BuroHappold have re-engaged with the EA to obtain the results of the December 2019 visual survey as this survey is likely to give a clear direction of whether there are any visual defects and/or blockages. BuroHappold are currently liaising with the EA to identify what further information is available.

BuroHappold have investigated the options for assessing the risk associated with collapse of the culvert. Normally this would be assessed through hydraulic modelling using an EA approved hydraulic model. Discussions with the EA have noted that there are currently significant limitations in the existing River Medlock hydraulic model which complicates the hydraulic modelling of the effect of blockage of the culvert. These include:

The upstream extent of the hydraulic model for the River Medlock is directly (~50m) upstream of Alan Turing Way. Any changes to the culvert conveyance in order to simulate blockage would result in backwater effects which would impinge on the model inflow. This would not normally be acceptable in the EA model review process.

The model extent doesn't consider the storage that would be available in Philips Park and therefore any model results would not correctly represent the potential increase in flood risk as a result of the blockage.

From recent engagement, the EA are considering the approach required to assess the impact of culvert failure as part of the planning process, for example whether there is an alternative manner acceptable to the EA to simulate the effect of culvert blockage which overcomes the limitations described in the points above. Once this methodology has been agreed then BuroHappold will provide an updated estimate of the risk.

River Medlock water quality

13.63 Water quality in the UK is managed via Legislation that transposes the EU Water Framework Directive into UK law. As part of the Directive, River Basin Management Plans (RBMP) have been established.

13.64 The River Medlock falls within the North West Basin District. The associated RBMP establishes a number of requirements that must be met to comply with the WFD. Data is provided through the EA Catchment Data Explorer, as outlined in Table 13.4. The most recent available dataset was collected in 2016.

13.65 The River Medlock, at this location within the Site, is classified as heavily modified under the WFD and has an obligation to achieve a 'good' ecological potential. By definition, artificial and heavily modified water bodies are not able to achieve natural conditions, and instead the classification and objectives for these water bodies are measured against ecological potential rather than status.

13.66 The ecological status of the River Medlock at this location is classified as 'moderate' owing to its poor biological quality elements (specifically fish), and high levels of specific pollutants. The chemical status of the River Medlock at this location is classified as 'good'. The river is expected to maintain this status at the end of this WFD planning cycle.

Table 13.4 WFD classification for the River Medlock (EA Catchment Data Explorer, accessed 24/09/19)

Classification item	2013	2014	2015	2016
Overall water body	Moderate	Moderate	Moderate	Moderate
Ecological	Moderate	Moderate	Moderate	Moderate
Chemical	Good	Good	Good	Good

Ashton Canal water quality

13.67 Though the Ashton Canal is not monitored under the WFD, it is a Site of Biological Interest (SBI) owing to its submerged aquatic flora of local importance. The water quality of the Ashton Canal will however be important to maintaining the aquatic flora assemblages supported by the canal, and ultimately maintaining its SBI status.

Water supply and existing demand

13.68 The Site is served by UU for both potable and foul water. The Site is located within the Strategic Water Resource Zone (WRZ) of the North West WRZ, within the UU supply area.

13.69 The level of water stress for the UU region identified as under 'moderate stress' in the final classifications of the 2013 Water Stressed Areas policy paper issued by the EA, under both of the current and future scenarios. This was classed as 'not serious'.

13.70 UU's current Water Resource Management Plan (WRMP) for 2020-2045 (published in 2019, also referred to as FWRMP19) highlights a significant water supply resilience risk to the Manchester and Pennines area, as a result of degrading infrastructure which will be addressed through replacing existing aqueduct tunnels with new tunnels. The WRMP identifies a surplus of water available to meet the projected demand over the next 20 years to 2040, with a deficit occurring from 2041 to 2045.

13.71 The existing daily water demand of the Site will be negligible, as there are no existing uses on the Site which would require a demand for water.

Existing on-site flood risk

13.72 A detailed assessment of the existing flood risk to the Site is provided in the FRA (Appendix 13.1).

Historical flooding

13.73 The Site location is not within the Environment agency's recorded historic fluvial flood extent. The Manchester City, Salford City and Trafford Councils SFRA (2010) did not record any historic flood events for the area.

Fluvial flooding

13.74 The Site is located entirely in Flood Zone 1. The River Medlock is heavily modified and culverted through the Etihad Campus. Flood Zone 1 is defined as a low probability of flooding from rivers and sea, which is an area that has a less than 1 in 1000 year annual probability of flooding.

13.75 The risk of fluvial and tidal flooding is therefore considered low.

Flooding from surface water

13.76 Surface water flooding can occur when the infiltration capacity during a storm event is low or when drainage systems do not have sufficient capacity to drain away rainwater. This results in water lying on or flowing over the ground surface. The excess water can develop pathways through built-up areas and open space and ponding in lower lying areas. This type of flooding is usually localised and associated with short duration heavy downpours or rain. The SFRA identifies part of the Site to have a low to intermediate susceptibility to surface water flooding. The Site appears to be located in a Critical Drainage Area, as confirmed in the Greater Manchester Level 2 Hybrid SFRA (2011), which is an area particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. MCC has also suggested that regular ponding was recorded on site after each rainfall event, indicating that a lot of rainfall does not drain into the drainage system.

13.77 Surface water runoff modelling done by the EA is presented in the FRA. The modelling shows surface water flooding in the northwest part of the Site for both the 1 in 100 and 1 in 1000 year flood events. Areas within the 1 in 1000 year flood extent are considered to be low risk areas, meaning each year this area has a chance of flooding of between 0.1% and 1%. Areas within the 1 in 100 year flood extents are considered to be at medium risk, meaning each year this area has a chance of flooding between 1% and 3.3%. The Site ground conditions consist mainly of made ground with very low permeability. It is believed that the made ground is causing localised ponding on site.

13.78 The risk of surface water flooding to the Site is therefore considered to be moderate.

Flooding from sewers

13.79 There is an intricate and well-connected network of rivers, streams, sewers and canals within Greater Manchester, however limited information exists in the SFRA regarding flooding from sewers. The Site location is not an area highlighted as at risk from flooding from sewers. Asset maps from the United Utilities show three main combined sewers running under the Site, however, the upstream flows to these sewers appear to have been abandoned and assumed to be no longer in use.

13.80 Consequently, the risk of flooding from sewers to the Site is considered low.

Flooding from groundwater

13.81 The Manchester City, Salford City and Trafford Councils SFRA (2010) shows the Proposed Development to be located in an area with no risk of groundwater flooding. The Manchester City, Salford City and Trafford Councils SFRA (2010) also recorded no reports of groundwater flooding in the area.

13.82 The Site is underlain by alluvium, glacial till, and Pennine Upper and Middle Coal Measures. The superficial deposits are classified as a Secondary (undifferentiated) Aquifer and the Coal Measures as Secondary (A) Aquifer. The superficial deposits have been highlighted as susceptible to groundwater flooding and the British Geological Survey has classified the Site as "High" relating to flooding confidence.

13.83 Groundwater monitoring is currently undertaken at 22 boreholes within the Site. The measurements are taken from the Deep (Coal measures) and Shallow (Made Ground/Glacial Till) strata. Measurements have been taken three times so far (25th October, 30th October and 7th November 2019), with three more measurements to follow in November 2019.

13.84 Shallow groundwater levels generally varied between 50.15 – 53.4m AOD in the southern parts of the Site where the ground levels are approximately at 60m AOD, while groundwater was recorded between 43.5 – 50.3m AOD in the northern parts (ground levels at 57m AOD).

13.85 Groundwater was encountered higher at the south-eastern corner of the Site, with the level recorded at 55.3m AOD (ground level at 60.5m AOD). However, this measurement was taken close to anther measurement point where groundwater levels were recorded at 50.4m AOD. Further tests will be undertaken locally to validate the measurements and investigate the difference in the recorded levels.

13.86 The Proposed Development's Ground Level is set at 55.0m AOD, generally higher than the measured groundwater levels, with the exception of one measurement taken at the south-eastern corner of the Site. Further investigations are undertaken to establish the source of the higher water level at this location.

13.87 If, following the completion of the groundwater monitoring, the levels are found to be in the vicinity of the Ground Level slab, then waterproofing will be required. The basement plant room and stormwater attenuation tank, as well as underground services will be designed to withstand any uplift forces and prevent water ingress. A bonded gas and waterproofing membrane will also be installed below ground concrete.

Flooding from reservoirs, canals and other artificial sources

13.88 Artificial sources include ponds, lakes, canals, and reservoirs. These can flood in the event of a structural failure or during peak storm events. The EA flood extent maps suggest no significant flood risk from reservoirs.

13.89 Ashton Canal bounds the Site to the south, as a broad canal it is a controlled water body so the flow is regulated, therefore does not present a direct flood risk. There is however a residual risk of flooding from overtopping or breaching of the canal from blockages or high inflows during flood conditions. The Manchester City, Salford City and Trafford Councils SFRA (2010) indicates a low risk for the overtopping of Ashton Canal but that the entire site is located in Canal Breach Zone B, which is defined as a 'less likely breach location'. The probability of a breach is managed by continued maintenance by the respective canal owners.

Future baseline (2023)

13.90 The future baseline year is 2023. The future baseline is likely to be similar in terms of sensitivity to that of the current baseline year of 2019.

River Medlock water quality

13.91 The River Medlock will need to continue to work towards achieving 'good' water quality status, as per the requirements of the Water Framework Directive. Once the requirements are met they will need to be maintained. The River Medlock will therefore retain its classification as highly sensitive.

13.92 According to the EA Catchment Data Explorer, accessed online, objectives have been set for the improvement of the River Medlock at this section (Lumb Brook to Irwell) by the year 2027 (the end of the third management cycle), as outlined in Table 13.5. No overall water body objective has been set for this section of river. However, as stated in the legislation section of this chapter, 'good' status must be achieved by 2027 at the latest.

13.93 As the majority of the objectives are targeted to be achieved by 2027, it is unlikely that they will have been achieved by 2023.

Table 13.5 Table outlining the objectives that have been set for the River Medlock.

Classification item	Status	Year	Reasons
Invertebrates	Good	2021	N/A
Supporting elements (Surface Water)	Good	2027	Cause of adverse impact unknown
Mitigation Measures Assessment	Good	2027	Cause of adverse impact unknown
Biological quality elements	Moderate	2027	Unfavourable balance of costs and benefits Disproportionate burdens No known technical solution is available
Fish	Moderate	2027	Unfavourable balance of costs and benefits Disproportionate burdens
Ammonia (Phys-Chem)	Good	2027	Disproportionate burdens

Foul and surface water sewer networks

13.94 The Site currently has no connection to a foul water sewer. However, there are existing sewage networks below the Site, as outlined in the current baseline section.

13.95 As the upstream flows to these sewers appear to have been abandoned, meaning that they are assumed to no longer be in use, the sensitivity of the receptor is deemed to be low.

Water supply

13.96 The UU 2019 WRMP states that the Manchester and Pennines region has an adequate water supply to meet demand over the next 25 years, and that investment is proposed to reduce the risk of the aqueduct supplying water to Manchester. As construction works are expected to complete in 2023, it is likely that by the future baseline year the risk to the water supply of this area would be of similar position to the existing baseline year.

Flood risk

13.97 The risk of flooding to the Site will need to be managed through the implementation of the NPPF and the North East Flood Risk Management Strategy. MCC state in their 2015 LFRMS that "climate change is expected to increase occurrences of severe weather, including more intense and extended periods of rainfall".

13.98 Over the build period, it is not expected that the conditions would change significantly with regards to surface water flood risk, therefore the Site would remain within Flood Zone 1. The risk of flooding from sewers, groundwater or reservoirs and canals is not likely to change significantly from the current baseline conditions.

Summary of identified receptors and their sensitivity

13.99 Based on the sensitivity criteria set out in Table 13.1 and the information provided in this baseline section, Table 13.6 classifies the sensitivity of the identified receptors, with justification provided for each one.

Table 13.6 Summary of the sensitivity of assessed receptors

Receptor	Sensitivity	Justification
Ashton Canal (Water Quality)	High	Amenity and biodiversity value associated with this water body. Note the drainage strategy (for when the development is operational) does not propose a direct surface water connection into the canal. Therefore, the assessment will focus on the potential for contamination to this water body during construction only from localised work adjacent to the canal.
River Medlock (Water Quality)	High	Failing to meet the quality standards of the Water Framework Directive. Connection to this water body via the existing and proposed surface water drainage strategy.
Water services infrastructure (supply)	Medium	There is an adequate supply of water identified in the WRMP, thus only designated as moderately sensitive.
Water services infrastructure (foul water drainage capacity)	Moderate	There are currently no known capacity issues with regard to the foul water network. Discussions held with United Utilities on 17 Oct 2019 has confirmed that foul water flows will be allowed to connect into foul water sewer at the north east connection manhole.
Water services infrastructure (surface water capacity i.e. surface water sewer network)	High	On site drainage infrastructure should be appropriately sized.
Humans/uses vulnerable to flood risk (Flood Risk)	High	Demolition and construction site workers and site users during operation.

Identification and Evaluation of Significant Effects

Construction effects

Relevant aspects of the scheme

13.100 The anticipated construction activities, as outlined in the Construction Management Plan (CMP) include highways alterations, site clearance, removal and disposal of existing scrub and reprofiling works, earthworks (including formation of retaining walls and piled foundations), public realm works and associated landscaping.

13.101 Therefore, the risks to the water environment during construction include:

- Increased water demand from construction site uses;
- Increased sediment loads caused by site run-off containing elevated suspended sediment levels. This can result from land clearance, excavation, dewatering of excavation, stockpiling, bunding, wheel washing and movement of materials to and from the Site;
- The release of hydrocarbons and oils into the on-site drainage system due to a large number of vehicles accessing the Site, leakage from oil/fuel storage tanks and accidental spillages;
- Accidental leaks and use of hazardous materials, particularly concrete and cement products, which can be contained in uncontrolled wash-down water and surface water run-off;
- Dust and debris caused by poor management of the Site;
- Leaks or breakage of temporary sewerage system infiltrating groundwater and/or migrating to surface waters;
- Increased discharge associated with dewatering of excavations;
- Flood risk associated with excavations;
- Climate change adaptation; and,
- These effects can be identified as temporary (construction activities) or permanent (loss of habitat) and risks relating to the water environment as a result of the Proposed Development are discussed in detail below.

Potential effects of the Proposed Development and their significance

Increased water demand

13.102 Processes during the Site preparation, excavation and construction phase of the Proposed Development are likely to demand significant volumes of water. These processes include the provision of sanitary facilities for staff, and the provision of infrastructure for wheel washing and washing down of construction vehicles.

13.103 The magnitude of change on strategic water supplies will be small and the sensitivity of the receptor is moderate. This will result in a likely **minor adverse** temporary/short term effect on strategic water supplies.

Increased sediment loads

13.104 Site runoff containing elevated levels of suspended sediment levels can result from land clearance, excavation, dewatering of excavation, stockpiling, bunding, wheel washing and movement of materials to and from the Site. Runoff with high sediment loads can have adverse effects on water bodies through increased turbidity (reducing light penetration, therefore reducing plant growth), and by smothering vegetation and bed substrates (effecting animal communities through the destruction of feeding areas, refuges and breeding/spawning areas).

13.105 Indirect adverse effects can also be associated with suspended sediments that have inorganic (e.g. heavy metals) or organic (e.g. pesticides) contaminants. Sediment can additionally cause issues within runoff channels through clogging and blockages resulting in reduced flow capacity.

13.106 As identified in the current baseline section, surface water from the Site flows into the River Medlock via the drainage system on Sportcity Way. The River Medlock could therefore be influenced by increased sediment loads filtering into surface water drainage.

13.107 There is potential for a large magnitude of impact on this water body, while the receptor sensitivity is deemed to be high. Therefore, the overall significant effect is considered to be major adverse for water quality in the River Medlock, in the absence of any further mitigation.

13.108 Sediment loads could additionally be accidentally released into the Ashton Canal due to localised works adjacent to the canal, without appropriate controls. The magnitude of change is potentially large and the effect significance **major adverse without mitigation**.

Hydrocarbons and oils

13.109 The release of hydrocarbons and oils into the onsite drainage system is a common form of pollution within urban areas. The risk of such pollution occurring will increase during construction due to a greater number of vehicles accessing the Site. Oils and fuels that are spilled on the Site during construction will be carried by surface water flows into the drainage system on Sportcity Way. This drainage system drains into the River Medlock.

13.110 Hydrocarbons form a film on the surface of the water body, deplete oxygen levels and can be toxic to freshwater fish. Even at very low concentrations the film can negatively affect the visual appearance of the water body. The effect is temporary, and the water quality within the affected water body would improve over time as pollutants disperse and are treated by natural processes.

13.111 The River Medlock could be influenced by increased hydrocarbons and oils getting into surface water runoff. There is potential for a large magnitude of impact on this water body, and the receptor sensitivity is deemed to be high. Therefore, the overall significant effect is considered to be major adverse for water quality in the River Medlock, in the absence of further mitigation.

13.112 Hydrocarbons and oils could additionally be accidentally released into the Ashton Canal due to localised works adjacent to the canal, without appropriate controls. The magnitude of change is potentially large and the effect significance **major adverse without mitigation**.

Accidental leaks of and use of hazardous materials

13.113 The use of concrete and cement products on-site can present a pollution risk because of the potential for uncontrolled release of wash-down and surface water run-off. If these activities are not carried out in designated areas; wastewater may enter the River Medlock and adversely affect the aquatic environment. Concrete products are highly alkaline and corrosive; fish can be physically damaged and their gills blocked, and both vegetation and the bed of the water body can be smothered.

13.114 During demolition and construction there is an elevated risk of potential leaks or accidental spillage of hazardous chemicals infiltrating to groundwater or migrating to surface water bodies. However, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the water body, that a significant risk of acute toxicity will arise in the receiving water body. The magnitude of any change will depend on the scale and nature of any potential incident and thus is difficult to predict.

13.115 These effects are likely to be temporary. Water quality within the affected water body will improve over time as pollutants are dispersed and diluted.

13.116 The River Medlock could be influenced by accidental leaks of hazardous materials getting into surface runoff. There is potential for a large magnitude of impact on this water body, and the sensitivity of the receptor is deemed to be high. Therefore, the overall significant effect is considered to be **major adverse** for water quality in the River Medlock, in the absence of further mitigation.

13.117 Hazardous materials could additionally be accidentally released into the Ashton Canal due to localised works adjacent to the canal, without appropriate controls. The magnitude of change is potentially large and the effect significance **major adverse without mitigation**.

Dust and debris

13.118 Demolition and construction activities located on site have the potential to release dust and debris that may be blown into adjacent water bodies. Increased dust levels in water bodies may reduce the levels of light reaching aquatic plant and animal species. Debris blown into water bodies can decrease the recreational and aesthetic quality of the water body. Effects will however be temporary, as water quality within the affected water body will improve over time as dust and debris settle or are trapped by vegetation.

13.119 Considering the adjacent proximity to the Ashton Canal, the magnitude of change without mitigation could be large. The sensitivity of the receptor is deemed to be high. Therefore, the significance of the effect is **major adverse, in the absence of further mitigation**. It should be noted that the River Medlock is considered too distant to be potentially affected by this issue.

Leak or breakage of the temporary sewage system

13.120 There are likely to be temporary toilet facilities on the Site for use by construction workers. Leaks and breakages of sewers from these temporary toilet facilities may result in crude sewage infiltrating groundwater or surface water flows. Sewage contains high levels of nutrients, organic matter, coliforms and suspended solids. These can result in nutrient enrichment and eutrophication, smoothing of water dwelling organisms and plants, and significantly reduced oxygen levels. The effects would be temporary as water quality within the affected water body would improve over time as organic matter is dispersed and treated by natural processes.

13.121 As surface water from the Site flows into the River Medlock, this could be influenced by leakage or breakage of the temporary sewage system. There is potential for a large magnitude of impact on this water body, and the sensitivity of the receptor is deemed to be high. Therefore, the overall significance is considered to be **major adverse** for water quality in the River Medlock, in the absence of further mitigation.

13.122 If placed in proximity to the canal, then the temporary leak or breakage of the temporary sewerage system could impact the Ashton Canal. The magnitude of change is potentially large and the effect significance **major adverse without mitigation**.

Dewatering of excavations

13.123 The dewatering of excavations may need to be discharged to the River Medlock or the sewer system under a formal agreement with the EA or the sewerage undertaker.

13.124 In the case of discharge to the sewer, the volume will minimise the flow capacity temporarily. The magnitude of change is likely to be large, therefore the significance of the effect is likely to be **moderate/minor adverse, without further mitigation**.

Flood risk to construction workers and construction plant

13.125 Measures should be taken to protect construction workers from surface water flooding, in addition to water ingress from any excavations on site. The magnitude of change on the construction workers and plant is likely to be small, while the sensitivity of the receptor is deemed to be high. Therefore, the significance of effect is considered to be **moderate adverse, without further mitigation**.

Climate change adaptation

13.126 The construction period is planned to last until 2023. Climate forecasts show that as a result of climate change, the North West of England is likely to have an increased chance of milder, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extreme weather.

13.127 Flood risk could therefore increase in the future with climate change, and the Drainage Strategy has recommended that a 40% allowance is made in the surface water drainage design, to allow for climate change increases and uncertainty. The effect significance is therefore considered to be **negligible**.

Summary of effects during construction

13.128 A summary of potential effects and their significance prior to mitigation is provided in Table 13.7.

Table 13.7 Summary of pre-mitigation effects during construction.

Receptor	Sensitivity	Description of effect	Magnitude of change/ impact	Effect significance
Ashton Canal water quality	High	Increased sediment loads	Large	Major adverse
		Accidental release of hydrocarbons	Large	Major adverse
		Accidental release of hazardous materials	Large	Major adverse
		Leak or breakage of temporary sewage system	Large	Major adverse
		Dust and debris blown from site	Large	Major adverse
River Medlock water quality	High	Increased sediment loads	Large	Major adverse
		Accidental release of hydrocarbons	Large	Major adverse
		Accidental release of hazardous materials	Large	Major adverse
		Leak or breakage of temporary sewage system	Large	Major adverse
Water services infrastructure (supply)	Medium	Increased water demand during the construction process	Small	Minor adverse
Water services infrastructure (surface water drainage capacity)	Medium	Dewatering of excavations	Large	Moderate / minor adverse
Flood risk to construction workers and plant users	High	Flood risk to site from workers	Small	Moderate adverse

Operational effects

Relevant aspects of the scheme and designed-in mitigation

Surface water drainage

13.129 The drainage strategy includes detailed proposals for surface water drainage from the Proposed Development.

13.130 In order to determine the permissible discharge rates off site, discussions have been undertaken with MCC as the LLFA for the area. As stated in the baseline section of this chapter, in discussions with the LLFA, historical site use has been considered with proposed discharge rates aligned to brownfield rates of runoff whilst providing 70% betterment on existing rates of runoff.

13.131 The proposed surface water drainage strategy is based on the initial correspondence with the LLFA (as per Appendix B of the drainage strategy) that indicated surface water flows from the Site will have to provide a minimum 50% betterment over the capacity of the existing pipework serving the Site. Attenuation tanks will be required to provide this betterment in offsite rate. It is proposed that surface water storage tanks are positioned below the ground floor slab in the service yard area and sized to store the 1 in 100-year rainfall event with 40% increase in rainfall intensities due to climate change.

13.132 As is currently the case, surface water from the Proposed Development will drain to the Sportcity Way highway drainage to the north. This water shall then flow into the River Medlock.

13.133 Not all Sustainable Urban Drainage (SuDS) features are appropriate for the Proposed Development. Therefore, the drainage strategy (Appendix 13.2) has ranked the suitability of different SuDS features, with those deemed to have high potential for the Site listed below:

- Permeable pavement;
- Sub-surface storage; and,
- Rainwater harvesting.

13.134 For ease of access and maintenance the attenuation tank has been positioned in the service yard. To maximise water re-use, the surface water attenuation tanks will be combined to function as rainwater harvesting tanks to allow collected surface water to be utilised for non-potable uses such as toilet flushing within the arena building.

13.135 The Site incorporates permeable paving, catchpit manholes and an attenuation tank which should all provide an improvement in the quality of surface water discharge from the Site. A hydrocarbon interceptor is not required for the Proposed Development as it does not accommodate any open car parking areas.

Foul water drainage

13.136 As stated in the baseline section of this chapter, existing sewers run beneath the Site, running from north to south. The upstream flows to these sewers appear to have been abandoned and it is therefore assumed that these are no longer in use. The sewers ultimately combine to the north of the Site, and discharge to a large culvert flowing from north-east to south-west.

13.137 Discussions held with United Utilities on 17 October 2019 has confirmed that foul water flows will be allowed to connect into foul water sewer at the north east connection manhole.

Flood risk

13.138 The Surface water drainage strategy has led to a reduction in the overall flood risk to the Site by providing underground tanks to store the 1 in 100-year rainfall event with 40% increase in rainfall intensities, while providing 70% reduction in discharge rates. A concrete channel is proposed in parallel to Sportcity Way to convey exceedance flows from the road and reduce the existing risk of surface water ponding.

Groundwater flooding

13.139 The Proposed Development is to have a bonded gas and waterproof membrane to all below ground concrete. This will protect any below ground components from groundwater flooding.

Potential effects of the Proposed Development and their significance

13.140 This section considers the potential effects that the Proposed Development will have on the water environment once operational.

Pollutants contained in surface water

13.141 Pollutants, such as silts and hydrocarbons resulting from activities on the Site (e.g. vehicle storage, vehicle washing and oil/fuel leaks) would be discharged into the River Medlock through surface water runoff. This is likely to increase turbidity, deplete oxygen levels and be toxic to the aquatic environment of the River Medlock.

13.142 The magnitude of change will depend on the activities present and their occurrence. The effect is considered permanent, although certain activities, such as accidental spillages, would be temporary.

13.143 Operational effects on all water bodies will likely be negligible due to the inclusion of SuDS features, as outlined in the drainage strategy, as part of the embedded mitigation. Therefore, the overall significant effect is envisioned to be **negligible** for the River Medlock.

13.144 According to the drainage strategy, no surface water from the Proposed Development will flow into the Ashton Canal during the operational phase. Therefore, the Ashton Canal will be unaffected by any surface water pollutants will during the operational phase.

Changes to flood risk

13.145 The flood risk assessment states that the drainage network will be designed to mitigate the impact of a 1 in 100-year storm event including an allowance for 40% increase in the intensity of rainfall due to climate change.

13.146 Therefore, there is no significant negative change in flood risk both on-site and off-site and the Proposed Development is safe from flooding for its designed lifetime. Residual flood risk will therefore be **negligible** with the implementation of the measures set out in the flood risk assessment, which form designed-in mitigation.

Future water demand

13.147 Due to the scale of the Proposed Development, and the current land use on the Site, the water demand once complete and operational will increase significantly from the baseline. Estimating the water demand is difficult due to the varying water demands of commercial activities (event space, hospitality and public amenity land uses). The number of people using the Site is anticipated to fluctuate greatly depending on whether an event is taking place.

13.148 To maximise water re-use, the surface water attenuation tanks will be combined to function as rainwater harvesting tanks to allow collected surface water to be utilised for non-potable uses such as toilet flushing within the Proposed Development.

13.149 Due to the Site not constantly being used, and the implementation of rainwater harvesting, the magnitude of change on the strategic water supply is deemed to be small. As the North East WRZ is not classed as under serious stress, it is classed a medium sensitivity receptor. Therefore, the increase in water demand from the Proposed Development is likely to be **minor adverse without further mitigation**.

Foul water drainage

13.150 Discussions held with United Utilities on 17 October 2019 has confirmed that foul water flows will be allowed to connect into foul water sewer at the north east connection manhole. Based on this, the sewer systems should have adequate capacity to take on the load from the Proposed Development. Due to there being sufficient capacity, the effect is believed to be **negligible**.

Climate change adaptation

13.151 Over the operational period, UKCP18 climate forecasts show that as a result of climate change, England would experience a greater chance of hotter, drier summers and warmer, wetter winters.

13.152 The flood risk assessment includes a number of designed-in mitigation measures, including the 40% climate allowance when sizing the water storage tanks to deal with this. The effects are therefore of a **negligible significance**.

Summary of effects during operation

13.153 A summary of the potential effects during operation can be found in Table 13.8.

Table 13.8 Summary of the potential effects during operation

Receptor	Sensitivity	Description of effect	Magnitude of change/impact	Effect significance
River Medlock water quality	High	Pollutants contained in surface water	Negligible	Negligible
Water services infrastructure (supply)	Medium	Increased potable water demand	Small	Minor adverse
Water services infrastructure (foul water capacity)	Medium	Increased foul water drainage demand	Negligible	Negligible
Water services infrastructure (surface water drainage capacity)	Medium	Increased flood risk	Negligible	Negligible
Humans/uses vulnerable to flood risk	High	Flood risk to humans/uses vulnerable to flood risk	Negligible	Negligible

Mitigation Measures

Supplementary mitigation measures during construction

13.154 The contractor will develop a Construction Environmental Management Plan (CEMP) to cover construction site works. It will include mitigation measures to protect the water environment.

13.155 This will set out how construction activities will be undertaken in accordance with good practice guidance, including the Pollution Prevention Guidelines (PPG) formerly published by the EA (and now available in the National Archives), particularly the following:

- 'PPG1 General guide to the prevention of water pollution';
- 'PPG2 Above ground oil storage tanks';
- 'PPG5 Works in, near or liable to affect watercourses'; and
- 'PPG6 Working at construction and demolition sites'.
- Other good construction guidance should also be followed, such as CIRIA 'Guidance C532 - Control of water pollution from construction sites'.

13.156 A summary of the mitigation measures proposed to reduce adverse effects of construction on the water and flood risk at site can be found in Table 13.9.

Table 13.9 Summary of construction mitigation measures

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
Dust and debris blown from site into the Ashton Canal	Apply dust management procedures which are typically implemented for air quality management issues, such as: • Damping down to suppress the creation of dust. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
Increased sediment loads in surface water	Development and implementation of a Construction Environment Management Plan (CEMP) that considers the following measures: • Keep gradients of the soil as shallow as possible to prevent large amounts of earth being washed away during periods of heavy rainfall. Areas which are exposed should be reseeded or surfaced as soon as practicable. • Enforce tight control of site boundaries including minimal land clearance and restrictions on the use of machinery adjacent to water bodies. Where possible, do not locate stockpiles within 10 m of water bodies or drainage lines. • Wheel washing facilities should be provided at all entry and exits points. Water from wheel wash facilities must not be discharged into the River Medlock or the on-site surface water sewerage network. • Capture runoff from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water body or the on-site surface water sewerage network. • Sediment should be removed from water pumped during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent. • Sediment/soils encountered during construction activities such as earthworks could be contaminated. This has an associated risk of mobilising pollutants, which could be released to surface waterbodies.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction
Accidental release of hydrocarbons and oils into the on-site drainage system	Development and implementation of a CEMP that considers the following measures: • Incorporation of interceptors where appropriate into the Site drainage system at high risk areas, such as parking, unloading and refuelling areas, to remove hydrocarbons and oils from surface water prior to discharge. Other measures including drip trays under equipment such as generators, and wheel washing facilities should also be implemented to minimise the risk of pollutants infiltrating groundwater or the surface water drainage network.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction
Accidental release of hazardous materials migrating into the on-site drainage system	Development and implementation of a CEMP that considers the following measures: • Provision of storage facilities and tanks and conduct refuelling of machinery within bunded areas, which should not be located within 10m of water bodies or drainage lines. • Storage and bunded areas to be constructed of impervious floors and walls	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
	with the capacity for the contents of the storage tank and an additional ten per cent safety margin. • As a remedial measure, spill containment equipment such as absorbent materials should be stored on site. Mixing of construction materials, such as cement, will be conducted in designated areas located away from water bodies and drainage lines.		
Leak or breakage of temporary sewage system	To improve groundwater and any subsequent impacts on health, the CEMP should consider the following: • Provision and maintenance of temporary septic tank, cesspit and/or sewerage connection for disposal of sewage from the toilet facilities to reduce the likelihood of crude sewage infiltrating groundwater or migrating towards water bodies. Any temporary toilet facilities will be positioned at least 10m away from the banks of the River Medlock.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction
Increased water demand during the construction process	All relevant contractors should investigate opportunities to minimise and reduce the use of water, such as: • Selection and specification of equipment; • Implementation of staff-based initiatives such as turning off taps, plant and equipment when not in use both onsite and within site offices; • Use of recycling water systems such as wheel washes, site toilets handwash; and • Use of a rainwater harvesting system for use in equipment and vehicle washing.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction
Dewatering of excavations	Capture runoff from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharged directly to a water body or the on-site surface water sewerage network. Sediment should be removed from pumped water during any extractions required. Sediment should be removed prior to discharges to the surface water network using a baffle tank system or equivalent.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction
Flood risk to construction workers and plant users	Construction workers should be made aware of risks associated with excess surface water caused by overland flows and standing water. For example, risks to excavations and damage to plant. To minimise any risk from groundwater flooding during excavation of the Site, cut levels should be limited to at least 0.5m above the groundwater level. Where this is not possible, dewatering and other groundwater control measures should be employed. Any such groundwater control measures will also require pollution control measures in accordance with EA guidance.	CEMP to be secured through planning condition and implemented by contractor	Prior to and during construction

Supplementary mitigation measures during operation

13.157 Supplementary mitigation issues identified during operation are detailed in Table 13.10.

Table 13.10 Summary of operational supplementary mitigation measures

Adverse effect	Mitigation measure	Responsibility/ Mechanism for implementation	Timing
Increased pressure on water services infrastructure (supply)	Early engagement with UU on the potable water needs for the Proposed Development, and any current restrictions and the need for any upgrades. Water efficiency measures that will reduce potable demand and subsequent foul flows including one or more of the following: • Low flow fittings: low flush toilets, spray taps and low flow showers, if necessary; • Efficient water supply: Leak detection, smart meters and pressure reduction The advantage of demand management is not only for reducing supply, but also for minimising the volume of the foul drainage element to the combined sewer.	Through the Proposed Development of potable water and foul water strategy between now and construction of the Proposed Development	strategies to be completed during detailed design stage

Cumulative Effects

Cumulative effects assessment

13.158 Two cumulative scenarios are considered below. The first scenario includes the Proposed Development and all identified nearby committed developments. The second scenario includes the Proposed Development and potential future developments that may be come forward under the Draft 2019 ERF.

13.159 Possible cumulative effects include demand on foul water, changes to the capacity of the sewer network/operation of combined sewer overflows, potable water demand and changes in downstream water quality. All committed developments listed will have the potential to contribute towards a cumulative effect with the Proposed Development.

Cumulative effects for cumulative scenario 1 (Proposed Development with nearby committed developments)

Construction effects

13.160 If there is overlap between construction programmes, there will be potential for cumulative effects with regards to pollutant loading within the River Medlock. However, this is not expected to be significant with compliance and implementation of mitigation measures (i.e. development of a CEMP). It is assumed that the committed developments will put into place similar mitigation measures to the Proposed Development.

13.161 Additionally, the committed developments are a relatively large distance from the Proposed Development, the nearest one being 440m away.

13.162 Potential cumulative effects at the construction phase are therefore not considered significant.

Operational effects

13.163 As is the case with the Proposed Development, other nearby committed developments are likely to discharge surface water into the River Medlock. There will be potential for cumulative effects with regards to increased risk of flooding from the River Medlock on the Site, as well as downstream of the Site. Through a number of measures recommended in the drainage strategy and flood risk assessment, and assuming that other schemes implement similar flood risk and pollution prevention measures in line with planning policy requirements, it can be assumed that flood risk will be managed through designed-in measures.

13.164 The discharge of surface water from committed developments into the River Medlock also has the potential to increase the risk of pollutant loading in the river. However, through the implementation of SuDS in line with planning policy, committed developments are unlikely to increase the risk of pollutant loading in the River Medlock.

13.165 Additionally, the committed development are a relatively large distance from the Proposed Development, the nearest one being 440m away.

13.166 Potential cumulative effects at the operational phase are therefore not considered significant.

Cumulative effects for cumulative scenario 2 (Proposed Development and potential future developments in line with the draft 2019 ERF)

13.167 The possible cumulative construction effects for scenario 2 are similar to those outlined in scenario 1.

Construction effects

13.168 If there is overlap between construction programmes, there will be potential for cumulative effects with regards to pollutant loading within the River Medlock. However, this is not expected to be significant with compliance and implementation of mitigation measures (i.e. development of a CEMP). It is assumed that the other development will put into place similar mitigation measures to the Proposed Development.

Operational effects

13.169 As is the case with the Proposed Development, other nearby approved developments are likely to discharge surface water into the River Medlock. There will be potential for cumulative effects with regards to increased risk of flooding from the River Medlock on the Site, as well as downstream of the Site. Through a number of measures recommended in the drainage and flood risk assessment, and assuming that other schemes implement similar flood risk and pollution prevention measures in line with planning policy, it can be assumed that flood risk will be managed through designed-in measures.

13.170 The discharge of surface water from approved developments into the River Medlock also has the potential to increase the risk of pollutant loading in the river. However, through the implementation of SuDS in line with planning policy, cumulative developments are unlikely to increase the risk of pollutant loading in the River Medlock.

13.171 Potential cumulative effects at the operational phase are therefore not considered significant.

Residual Effects

13.172 If the designed-in mitigation measures included in the flood risk assessment and drainage strategy, further mitigation measures outlined in this chapter, and good site practice is carried out, then residual construction effects on the water environment are considered to be negligible to minor adverse (and temporary) for the duration of the construction period.

13.173 Additionally, if the measures outlined in the flood risk assessment and drainage strategy are included, then residual effects during operation are likely to be negligible.

13.174 A summary of all the residual adverse or beneficial effects are detailed in Table 13.11.

Table 13.11 Residual effects table

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
Construction				
Ashton Canal water quality	Increased sediment loads	Major adverse	Implementation of a CEMP. Minimise areas of exposed surface by only removing vegetation and hardstanding when necessary. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exit points.	Minor adverse (temporary)

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
			Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures with are typically implemented for air quality management purposes. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	
	Accidental release of hydrocarbons	Major adverse	Implementation of a CEMP. Incorporate interceptors into the Site drainage system at high risk areas. Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse (temporary)
	Accidental release of hazardous materials	Major adverse	Implementation of a CEMP. Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	Minor adverse (temporary)
	Leak or breakage of temporary sewage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection.	Minor adverse (temporary)
	Dust and debris blown from site	Major adverse	Develop dust management plan which will include procedures aimed at minimising dust generation on-site.	Minor adverse (temporary)
River Medlock water quality	Increased sediment loads	Major adverse	Implementation of a CEMP. Minimise areas of exposed surface by only removing vegetation and hardstanding when necessary. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exit points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures with are typically implemented for air quality management purposes. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	Minor adverse (temporary)
	Accidental release of	Major adverse	Implementation of a CEMP. Incorporate interceptors into the Site drainage system at high risk areas.	Minor adverse (temporary)

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
	hydrocarbons		Use of drip trays under equipment such as generators and wheel washing facilities.	
	Leak or breakage of temporary sewage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection.	Minor adverse (temporary)
Water services infrastructure (supply)	Increased water demand during the construction process	Minor adverse	All contractors should investigate opportunities to minimise and reduce the use of water, such as: • Selection and specification of equipment; • Implementation of staff-based initiatives such as turning off taps, plant and equipment when not in use both onsite and within site offices; • Use of recycling water systems such as wheel washes, site toilets handwash; and • Use of a rainwater harvesting system for use in equipment and vehicle washing.	Negligible
Water services infrastructure (surface drainage capacity)	Dewatering of excavations	Moderate adverse	Capture run off from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Sediment should be removed from water during any extractions required. Sediment should be removed prior to discharges to the surface water network or on-site ponds through the use of a baffle tank system or equivalent. If there is a requirement for discharge to the foul sewer, this should be throttled to a flow rate that is agreed UU prior to commencing works.	Negligible
Flood risk to construction workers and plant users	Flood risk to site from workers	Moderate/ Minor adverse	Contractor to prepare a flood emergency and contingency plan. Construction site users made aware of risks.	Negligible
Operation				
River Medlock water quality	Pollutants contained in surface water	Negligible	No further measures required	Negligible
Water services infrastructure (supply)	Increased potable water demand	Minor adverse	Early engagement with UU on the potable water needs for the Proposed Development, and any current restrictions and the need for any upgrades.	Negligible

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
			Water efficiency measures that will reduce potable demand and subsequent foul flows including one or more of the following: • Low flow fittings: low flush toilets, spray taps and low flow showers, if necessary; • Efficient water supply: Leak detection, smart meters and pressure reduction. The advantage of demand management is not only for reducing supply, but also for minimising the volume of the foul drainage element to the combined sewer.	
Water services infrastructure (foul water capacity)	Increased foul water drainage demand	Negligible	No further measures required	Negligible
Water services infrastructure (surface water drainage capacity)	Increased flood risk	Negligible	No further measures required	Negligible
Humans/ uses vulnerable to flood risk	Flood risk to humans/ uses vulnerable to flood risk	Negligible	No further measures required	Negligible

Reference List

13.175 This ES Chapter has been prepared by reference to the following:

- Construction Industry Research and Information Association (CIRIA), (2019) CIRIA Guidance.
- Environment Agency, (2013) Water Stressed Areas: Final Classification. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf
- Environment Agency, (2015) River Basin Management Plan: North West River Basin District.
- European Commission, (2000) Water Framework Directive (2000/60/EC).
- Gov.uk, (2019) Pollution Prevention Guidance Notes.
- Greater Manchester Combined Authority, (2010) Greater Manchester's Strategic Flood Risk Assessment Level 1.
- Greater Manchester Combined Authority, (2011) Greater Manchester's Strategic Flood Risk Assessment Level 2.
- Greater Manchester Combined Authority, (2019) The Greater Manchester Spatial Framework.
- Her Majesty's Stationary Office (HMSO), (1991) The Water Resources Act 1991.
- Her Majesty's Stationary Office (HMSO), (1995) The Environment Act 1995.
- Her Majesty's Stationary Office (HMSO), (1999) The Anti-Pollution Works Regulations 1999.

- Her Majesty's Stationary Office (HMSO), (2001) The Control of Pollution (Oil Storage) (England) Regulations 2001.
- Her Majesty's Stationary Office (HMSO), (2009) The Water Resources Management Act (Amendment) (England and Wales) Regulations 2009.
- Her Majesty's Stationary Office (HMSO), (2010) Flood and Water Management Act 2010.
- Her Majesty's Stationary Office (HMSO), (2014) The Water Act 2014.
- Her Majesty's Stationary Office (HMSO), (2015) The Environmental Damage Regulations 2015.
- Her Majesty's Stationary Office (HMSO), (2016) The Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016.
- Her Majesty's Stationary Office (HMSO), (2016) The Water Supply (Water Quality) Regulations 2016.
- Her Majesty's Stationary Office (HMSO), (2017 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.
- Manchester City Council, (2007) Guide to Development in Manchester Supplementary Planning Document and Planning Guidance.
- Manchester City Council, (2012) Manchester Core Strategy Development Plan Document 2012-2027.
- Manchester City Council, (2014) Local Flood Risk Management Strategy.
- Manchester City Council, (2015) Manchester Green and Blue Infrastructure Strategy.
- Manchester City Council, (2017) Eastlands Development Framework.
- Met Office, (2018) UK Climate Projections 2018 (UKCP18).
- MHCLG, (2014) National Planning Practice Guidance. http://planningguidance.communities.gov.uk
- MHCLG, (2014) Planning Practice Guidance - Water supply, wastewater and water quality. http://planningguidance.communities.gov.uk/blog/guidance/water-supply-wastewater-and-water-quality
- MHCLG, (2018) National Planning Policy Framework. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685289/Draft_revised_National_Planning_Policy_Framework.pdf
- The Manchester City, Salford City and Trafford Councils, (2010) Strategic Flood Risk Assessment.
- United Utilities, (2019) Water Resource Management Plan.

14 Wind Microclimate

Introduction

14.1 This Chapter of the ES has been prepared by BuroHappold and assesses the likely Wind Microclimate impacts of the Proposed Development upon the Site and surrounding area. This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce or offset any significant negative effects and the likely residual impacts after these measures have been adopted.

14.2 This Chapter is accompanied by Wind Microclimate Figures 14.1 to 14.15.

14.3 The Wind Microclimate Chapter has been written by an Associate Director with relevant qualifications (PhD in Mechanical Engineering) and experience (more than 30 years' experience working in the built environment). Additionally, the author is a board member of the Wind Engineering Society UK.

Limitations and Assumptions

14.4 Future surrounding buildings are based on information available and current planning consents. If these buildings are amended in the future, the effects could alter the cumulative assessment. However, any future changes will need to be subject to an appropriate wind assessment as part of any amended planning application for each relevant scheme.

14.5 It should be noted that some changes have been made to the landscape strategy for the Proposed Development since undertaking the Wind Microclimate assessment. As these changes occurred after this assessment was undertaken, they were not accounted for within the modelling. These changes are:

- Change to the porous green wall on the east side of the podium, where previously it consisted of two north-south sections and one east-west section, and now is one straight line with an angle from north to south; and
- Removal of some of the trees at the immediate north side of the building.

14.6 These changes are not expected to have a significant effect on the results of the simulations undertaken in this assessment, and therefore would not result in changes to the conclusions or effects described in this assessment.

Legislative and Policy Context

Legislation

National Planning Policy

14.7 There are no national codes of practice or legislative policies relating to the assessment of environmental wind flows in the built environment.

14.8 The UK wide National Planning Policy Framework (NPPF) came into force in March 2012, and was updated in February 2019. There are no national planning policies directly relating to wind microclimate issues; however, the benefits of a high quality built environment are emphasised in the NPPF. An example of this is presented in section 12: "*…using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit*;". In addition, in section 10, it is mentioned that applications for development should "*…create places that are safe, secure and attractive*…".

14.9 The effect of environmental wind on pedestrian spaces and the subsequent suitability of these spaces for planned use are described by the Lawson Comfort Criteria (LCC) (Lawson, 2001), which are recognised by Local Planning Authorities (LPAs) as a suitable benchmark for wind assessments. LCC is applied in the wind assessment of the Proposed Development.

14.10 There is no specific national or regional legislation or policy guidance for the assessment of the local wind microclimate effects that a new development has on the comfort and safety of users.

Local Planning Policy

14.11 Manchester City Council (MCC) Core Strategy (adopted July 2012) contains guidance in Policy EN2 Tall Buildings, which defines tall buildings as buildings considered to be significantly taller than their neighbours and / or affect the skyline. Policy EN2 states that a tall building can have a significant effect on the local environment and microclimate. Policy EN 2 concludes that it is expected this effect should be modelled and that submissions relating to tall buildings should include measures to create an attractive, pedestrian friendly, local environment. Policy DM-1 Development Management also contains guidance on development with regards to the siting, layout, scale, form and massing and refers to the development principles outlined in MCC's Supplementary Planning Documents (SPDs).

14.12 Furthermore, the Guide to Development in Manchester Supplementary Planning Document and Planning Guidance (Adopted April 2007), mentions in section 2: "*Where the public realm includes hard landscaped areas, its design should reflect the level and nature of their use, and should consider issues such as overshadowing, prevailing winds and rain, and the potential to contribute to sustainable urban drainage. The opportunity will be taken to improve the quality of existing areas of public realm and to ensure that areas of public realm in new developments, are designed so that they can be enjoyed by residents and users, rather than being simply functional*."

Assessment Methodology and Significance Criteria

Assessment Methodology

14.13 The wind study includes a direct comparison between the baseline conditions and those created by the Proposed Development for 12 wind directions. The Chapter describes the quantitative assessment of the likely wind environment, and the qualitative judgements that are made in order to identify areas of potential significant environmental effect. This analysis includes an assessment of the relative forms, layouts and massing of the Site and the Proposed Development, as well as site landscaping and topography.

14.14 Impacts of the likely wind conditions are judged based on the Computational Fluid Dynamics (CFD) modelling results and BuroHappold's extensive experience of wind assessments, full-scale testing, CFD and wind tunnel modelling of similar developments.

14.15 The assessment is supported by CFD modelling of the full range of wind speeds and directions on site for four configurations, as follows:

- Configuration 1: Existing site (baseline);
- Configuration 2: Proposed Development with existing surroundings;
- Configuration 3: Proposed Development with existing surroundings and mitigation; and,
- Configuration 4: Proposed Development with future committed developments.

14.16 Wind microclimate comfort strongly depends on an individual's activity and has therefore been defined separately for each activity in terms of an average (mean) wind speed exceeded for a certain percentage of the year.

14.17 The pedestrian comfort criteria have been developed around the Beaufort scale (Lawson 2001), extending its applicability to environments in and around buildings.

14.18 The assessment has been undertaken to investigate the likely pedestrian conditions in and around the Proposed Development when it is subject to wind from different directions. An assessment of the appropriateness of different parts of the Site for their intended use has also been made.

14.19 Comfort maps were created to illustrate the assessment results. These maps include a direct correlation between the calculated wind speeds by the CFD simulations and the wind frequency data near the Site for the last 10 years. They provide a complete picture of the likely wind conditions related to certain activities, indicating when suitable conditions can be achieved for carrying out such activities or if distress is likely to be experienced. The maps cover the whole site on a plane 1.5 m above ground level, where wind speeds are measured.

14.20 The comfort maps were produced for the whole year, as well as for the summer and winter seasons, in order to determine when conditions would be suitable for various activities throughout the year.

14.21 The thresholds used to determine the effect for a given activity are specified as Unacceptable, Tolerable, and Acceptable. Example thresholds are given in Table 14.1 and are summarised below:

- Unacceptable: unpleasant conditions for the given activity, which should not normally be allowed to occur;
- Tolerable: conditions that would be described as 'windy' but which would be tolerated for the given activity; and,
- Acceptable: conditions that will elicit no adverse comment about wind conditions.

14.22 It is considered that effects that breach the "Unacceptable" threshold could be significant and it is these effects that are considered further. The Lawson criteria (Lawson 2001) is used to assess the wind speeds for different activities. The criteria that has been used to assess the unacceptable threshold for different activities as well as the distress criteria are listed in Table 14.1.

Table 14.1 Lawson Comfort Criteria

Use of Space	Lawson Comfort Criteria Classification Unacceptable	Beaufort Scale	Maximum allowable occurrence	Speed (m/s)
Any pedestrian uses	Distress	B6	0.025%	15
Pedestrian business walking	10	B5	6%	10.7
Pedestrians walking around buildings	9	B5	2%	10.7
Pedestrian walkthrough	8	B4	4%	7.9
Standing / entrances	6	B3	6%	5.4
Sitting	5	B3	3%	5.4

14.23 Sensitive receptors in respect of wind microclimate are the occupants and users of the Proposed Development and users of the public realm in the area surrounding the Site; the activities of these receptors are set out above.

Significance Criteria

14.24 A significant effect, that is considered to be of major significance for the purposes of this assessment, are effects on the safety of the receptors, i.e. effects that breach the distress criteria described in Table 14.1 above. These could be major adverse effects for areas where safety issues arise as a result of the Proposed Development, or major beneficial effects for areas where existing safety issues are removed as a result of the Proposed Development. These types of effects will require detailed and careful mitigation if they are adverse.

14.25 Moderate and minor effects are not considered to be significant. However, in order to reduce the effects further, and improve the comfort of receptors, mitigation measures will be specified to reduce effects from moderate adverse to minor adverse or better in the event that moderate adverse effects are identified.

Table 14.2 Significance Criteria

Effect	Description
Major	Any impact that affects safety (or distress)
Moderate	Any impact affecting pedestrian comfort where conditions change from suitable for existing activities to unsuitable for proposed activities would be considered moderate and vice versa for positive impacts
Minor	Conditions that are marginal with respect to the criteria or criteria are met during key seasons only
Negligible	Represents the cases of minimal or no effect on wind conditions that is likely to be experienced.

14.26 Effects can be described as:

- Adverse – detrimental or negative effects to an environmental resource or receptor compared with the baseline condition or proposed pedestrian activity; or
- Beneficial – advantageous or positive effect to an environmental resource or receptor compared with the baseline condition or proposed pedestrian activity.

CFD Modelling Assumptions

14.27 CFD modelling involves the solution of the fundamental equations of fluid motion using numerical techniques. The area of interest is divided into numerous small volumes, or cells, and the equations are solved within each cell. Values of the variables that are solved in the model are determined in each cell and so a comprehensive assessment of pressure and velocity variation within the calculation domain is obtained. To improve the resolution of the results, the 'mesh' or collection of cells is refined in the areas of most interest. This ensures that the large gradients of pressure and velocity at every location within the domain are modelled accurately.

Model Extents and Detail

14.28 The geometry of the baseline, Proposed Development and cumulative model was taken from a 3D model provided by the design team. All scenarios modelled are shown in Figure 14.1. Buildings close to the Site, which are likely to affect and be influenced by the presence of the Proposed Development, were modelled.

14.29 To account for the presence of buildings and terrain features, an aerodynamic roughness of 0.3 metres (m) was applied to the surface of neighbouring areas, which is typical for towns and medium density city fringe areas.

Atmospheric Boundary layer

14.30 The upwind and downwind boundaries of the model are representative of the atmosphere surrounding the Proposed Development.

14.31 For each of the 12 wind directions, a single, steady-state RANS (Reynolds Averaged Navier Stokes) calculation was undertaken using the commercial ANSYS CFX software. Turbulence was modelled using a k-ε model, with a production limiter used to ensure realistic flow predictions close to stagnation points. This method allows for the assessment of mean wind speeds of the Proposed Development.

Baseline Conditions

14.32 A quantitative assessment of the likely wind environment has been performed and judgements made in order to identify areas of potential significant environmental effect. A CFD study was carried out to support the wind assessment, which provides an indication of the wind effects on the Site.

14.33 Knowledge of the existing use of various parts of the Site and neighbouring buildings and open spaces was based on a site visit undertaken to assess the likely pedestrian activity. For the Proposed Development, the design team provided information regarding the intended usage of different parts of the Site. This included streets and paths proposed for pedestrian walkways and areas where outdoor amenity space will be located.

Wind Conditions

14.34 The prevailing wind across Manchester is from the south and southwest, with some lesser contributions from all other directions. During the winter there are some contributions from the northeast. Good quality long-term weather data is available from MET data for Manchester Airport.

14.35 Wind speeds are generally highest in the winter and spring with the seasonal pattern showing a very similar range of directions for winter, spring and autumn. Summer has southerly and westerly prevailing winds with the highest speeds from the south.

14.36 The data was translated to meteorological standard terrain (open country) and then to the Site. The method used was the method set out in 'The Designer's guide to wind loading of building structures, Part 1' (1985), N.J.Cook. This allows for the sheltering effect of neighbouring terrain, but does not allow for channelling of wind, for instance due to rivers and valleys. This effect is not expected to dominate conditions here, as the canal and local terrain features are not significant enough to drive the local wind patterns.

14.37 The predicted site wind rose is shown in Figure 14.2. This shows the direction the wind is blowing from, with long bars representing frequent winds and colour representing magnitude of wind speeds. The seasonal wind rose plots are shown in Figure 14.3. South and south-westerly winds are the prevailing direction for all four seasons. The highest wind speeds occur during the winter.

Site exposure – Configuration 1

14.38 In the baseline condition, the Site is largely open to the north, northeast and northwest, resulting in possible exposure to winds from these directions. To the east of the Site are two existing buildings that are 9 and 10 storeys in height. Further to the east, are low to mid rise buildings. The Site is fairly exposed to the southeast.

14.39 The large mass of the Etihad Stadium offers some protection from wind from the south, however, some wind moves around it and reaches the Site.

14.40 To the southwest of the Site are lower rise buildings, including the National Squash Centre and the Manchester Regional Arena. The west of the Site is also fairly open, except for the low rise Manchester Regional Tennis centre buildings.

14.41 There are no tall buildings in the vicinity of the Site, i.e. buildings that are significantly taller than their neighbours.

14.42 Wind is likely to move unopposed over the empty Site, only the existing landscape will affect the direction of the wind.

14.43 As the existing Site is currently empty, there are no current pedestrian activities (aside from occasional use as an overspill surface car park). Immediately surrounding the Site, the current pedestrian activity is walking, i.e. along the pavements and canal towpath bordering the Site. Conditions are likely to be suitable for this activity.

14.44 Comfort maps indicating the predicted pedestrian wind conditions are shown in Figures 14.4 and 14.5 for the baseline annual and winter conditions (worst season/near extreme scenario) respectively. The comfort map combines the calculated wind speeds from the CFD simulations and the wind frequency data for the last 10 years. The map provides an overall picture of the wind conditions relating to certain pedestrian activities, indicating when acceptable conditions are achieved for the proposed activities.

14.45 Analysis of wind speeds on the Site suggests that pedestrian level conditions in the exposed areas are suitable for walking for much of the year, with some smaller areas suitable for standing (see Figure 14.4). Areas to the northwest, north and northeast of the Site, are quite exposed and suitable for walking. Areas at the south of the Site, along the canal towpath, are more sheltered due to the lower elevation of this area, and are suitable for sitting. Wind conditions vary from being suitable for sitting to walking in the areas to the east and west of the Site.

14.46 In winter, conditions across the Site are suitable for walking almost everywhere. Some areas further to the north, northeast and east of the Site are seen to be more suitable for pedestrians walking around buildings (i.e. accessing areas of a building for maintenance purposes, for example), and would therefore feel somewhat uncomfortable for pedestrians in these areas during winter.

14.47 The annual safety map is shown in Figure 14.6 This shows one small existing area that exceeds the safety threshold, just to the south of the Manchester Regional Tennis centre buildings (and outside of the application boundary).

Future baseline

14.48 Although climate change is currently expected to have significant effects at a national level, wind conditions are not likely to change sufficiently to require specific analysis. No clear pattern of increasing strength or frequency of strong winds has thus far been identified (UKCP18, 2018). As such, it is normal practice to assume that historical wind conditions give a good indication of the likely range of future conditions.

14.49 The general pattern of increased development in the city is likely to lead to a general increase in shelter and modest reduction in wind speeds in the area. This means that the future baseline is the same as the current condition unless development on site or adjacent to the Proposed Development takes place.

Identification and the Evaluation of Key Impacts

Demolition and Construction

14.50 Conditions will gradually change from the baseline condition, to a more sheltered position as the buildings are erected, and then to the final conditions described in the operational effects section.

14.51 It is possible that as construction begins, there will be temporary localised wind acceleration across the Site. Since the effects are short-term and local, and the normal sheltering from standard site hoardings is expected to be sufficient, negligible effects are therefore expected.

14.52 During construction, localised wind acceleration is likely to result in a gradual transition to the new conditions. Impacts from this will be negated at ground level through the provision of hoardings (causing negligible effects).

Operation – Configuration 2

14.53 The annual and winter comfort maps for this scenario are shown in Figures 14.7 and 14.8. The effects described in this section are permanent and long-term, assuming no further development takes place close to the Site that would affect local wind conditions. It should be noted that although the effects are considered permanent, conditions would of course change with the seasons, giving rise to occasional periods of higher wind speed. However, the frequency of occurrence of these higher wind speeds would be low enough to ensure overall suitability for a particular pedestrian activity.

14.54 The annual comfort map shows that conditions across most of the Site are suitable for sitting. Conditions at the southeast and southwest corners of the level 01 podium are more suitable for standing/building entrances and walking. This is a result of the prevailing southerly winds causing façade downwash along the southern façade of the Proposed Development, leading to corner accelerations. The area of wind acceleration at the southeast corner of the podium is also contributed to by north-easterly winds, which are more frequent during the spring and winter. As the expected pedestrian activity on the podium is standing and walking, conditions are likely to be suitable throughout most of the year.

14.55 The roads surrounding the Proposed Development and within the redline boundary (i.e. Joe Mercer Way and Sportcity Way), are also shown to be suitable for their intended use.

14.56 Most areas immediately surrounding the Site are suitable for sitting and standing. However, some larger areas to the north, northwest, east and southeast of the Site are more suitable for walking. Compared to the baseline (Configuration 1), conditions are generally improved with the Proposed Development creating areas of shelter, leading to larger areas that are suitable for standing/building entrance and sitting. This is a **moderate beneficial** effect.

14.57 To the north and northwest of the Site are car parks and roads; the conditions are likely to continue to be suitable for these uses with the Proposed Development in place. To the east and southeast of the Site are various roads, pavements and Philip's Park and Cemetery, where the expected pedestrian activity will be walking. Therefore, conditions are still likely to be suitable. In Philip's Park, sitting may also occasionally be expected in the summer, although there are very few dedicated seating areas. Conditions in summer will be suitable for sitting or standing across most of Philip's Park. Therefore, conditions are likely to be suitable, as it is expected that this external space would be used when the weather permits. Compared to the baseline in summer, conditions are improved in Philip's Park, due to the shelter from south-westerly winds provided by the Proposed Development. Areas suitable for sitting in the baseline have become larger in extent with the introduction of the Proposed Development, and areas suitable for walking in the baseline have become suitable for standing. These are **minor to moderate beneficial effects**.

14.58 All the building entrances for the Proposed Development are located in areas suitable for entrances.

14.59 The winter comfort map shows more exposed conditions, as expected. Conditions are suitable for sitting and standing across most of the podium area. The areas at the southeast and southwest corners of the podium that are more suitable for walking are larger in winter, with an area at the southeast corner more suitable for pedestrians walking around buildings. This means that conditions are likely to feel uncomfortable for pedestrians in this area during winter. This is a **minor adverse effect**.

14.60 The roads surrounding the Proposed Development and within the redline boundary (i.e. Joe Mercer Way and Sportcity Way), are again shown to be suitable for their intended use.

14.61 Compared to the baseline, some areas of shelter have been created in the areas surrounding the Site, where conditions have improved from being suitable for walking to suitable for sitting or standing. However, some areas of wind acceleration have been created where conditions have changed from being suitable for walking to suitable for walking around buildings. Therefore, in winter, the overall effect on the immediately surrounding areas is **negligible**.

14.62 The annual safety map is shown in Figure 14.9. This shows several areas exceeding the safety threshold, i.e. at the southeast corner of the podium level, just to the south of the Proposed Development adjacent to the canal towpath, and to the east of the Site adjacent to a 10-storey residential building. These are major adverse effects, without mitigation. However, the existing safety issue noted in the baseline (Configuration 1), just to the south of the Manchester Regional Tennis centre buildings, has been removed. This is a **major beneficial effect**.

Mitigation Measures

Demolition and Construction

14.63 There are no significant construction effects anticipated, therefore no mitigation is required. However standard construction mitigation measures will be implemented including standard site hoardings to shelter neighbouring areas.

Operation – Configuration 3

Details of Mitigation Measures incorporated in the Design Proposal

14.64 Mitigation measures were suggested and implemented into the design in order to resolve the issues observed on the Level 01 podium of the Proposed Development, as follows:

- Landscape within the podium along the southern edge;
- Landscape at the east side of the podium (some of this has been incorporated as part of the design in the form of a porous fence that surrounds the compound on the east);
- Planters located along the southern façade and at the southeast corner of the Proposed Development on the podium level;
- Building entrances at the northwest corner of the podium set back into the façade.

14.65 In addition to this, existing landscape surrounding the Site was also modelled to determine its effect on the wind microclimate. There is a significant amount of existing landscape on and around the Site, with some large areas of dense canopies (e.g. Philip's Park to the northeast of the Site, and the area to the northwest and west of the Site along the railway lines), and several rows of large, dense shrubs or trees (e.g. bordering the Site, along Alan Turing Way, along the canal towpath to the south of the Site, and along Sport City Way).

14.66 The annual and winter comfort maps for this scenario are shown in Figures 14.10 and 14.11. Compared to the previous scenario without mitigation, it can be seen that the wind conditions have improved significantly across the entire Site and immediate surroundings. Conditions on the level 01 podium of the Proposed Development are now suitable for sitting in most areas. With conditions at the southwest corner more suitable for standing. These are moderate beneficial effects. Conditions beyond the Site are shown to be suitable for sitting and standing, instead of walking, which is also a **moderate beneficial effect**.

14.67 In winter, larger areas of the level 01 podium of the Proposed Development are suitable for sitting, compared to the scenario without mitigation. This is a moderate beneficial effect. Areas to the west, southwest, southeast and northwest of the podium are more suitable for walking. However, without mitigation, some of these areas were suitable for walking around buildings. Therefore, these are **minor beneficial effects**.

14.68 All entrances for the Proposed Development are seen to be located in areas that are suitable for entrances.

14.69 Conditions in the areas immediately surrounding the Proposed Development have also improved in winter. Areas shown to be suitable for pedestrians walking around buildings, have all been removed and are now suitable for walking or standing. These are minor to moderate beneficial effects. Many areas previously suitable for walking at the northwest, north, northeast, east and southeast of the Site, are now suitable for sitting. These are **moderate beneficial effects**.

14.70 The annual safety map for this scenario is shown in Figure 14.12, where it can be seen that all the safety issues previously described have been removed. These are **major beneficial effects**.

Cumulative Effects

Demolition and Construction

14.71 There are no significant cumulative construction effects anticipated, as any construction period will be temporary. Therefore, no cumulative effects are anticipated and no mitigation is required, however standard construction mitigation measures will be implemented including standard site hoardings to shelter neighbouring areas.

Operation – Configuration 4

14.72 Potential cumulative effects have also been assessed from an operational perspective, which are those that may arise from a combination of the Proposed Development's effect in combination with those of other future committed schemes in the area. Committed developments are described in Appendix 2.4; for the purposes of this assessment, the committed development likely to generate cumulative effects is the Etihad Stadium Expansion as other schemes are too distant from the Site.

14.73 The annual and winter comfort maps for this scenario are shown in Figures 14.13 and 14.14. Conditions are very similar to the previous scenario. The annual comfort map shows a small area where conditions are changed from being suitable for standing/building entrances to walking at the northwest of the Proposed Development. A similar area is seen to the south of the Proposed Development, between the Manchester City Shop building and the Etihad Stadium. These are minor adverse effects as the expected pedestrian activity in these areas is walking.

14.74 In winter, conditions are broadly similar in most areas of the Site and immediate surroundings, compared to the previous scenario. Areas suitable for walking at the northwest corner of the Proposed Development, to the southeast of the Site, and between the Manchester City Shop building and the Etihad Stadium, are seen to increase in size. These are minor adverse effects. A small area between the Manchester City Shop building and the Etihad Stadium is made more suitable for walking around buildings, therefore conditions may feel exposed for pedestrians in this area during winter. This is **a minor adverse effect**.

14.75 The annual safety map for this scenario is shown in Figure 14.15. No areas of the Site or immediate surroundings are seen to exceed the safety threshold, as in the previous scenario.

14.76 The Site is located within the draft 2019 ERF area. Several of the areas identified for potential future developments are within 500m of the Site, and could therefore affect the wind microclimate conditions on the Site. It is likely that increased development will provide more shelter from prevailing winds, potentially creating a reduction in wind speeds on site. If any of the nearby future developments comprise tall buildings, i.e. buildings significantly taller than their neighbours, these could create areas of local wind acceleration, which could also result in higher wind speeds on the Site if they are close enough to the Proposed Development. The final design of any further future buildings will dictate the final wind conditions around them, and their effect on the Site.

Residual Effects

Demolition and Construction

14.77 There are no significant residual construction effects, therefore no mitigation is required. However, standard construction mitigation measures will be implemented including standard site hoardings to shelter neighbouring areas.

Operation

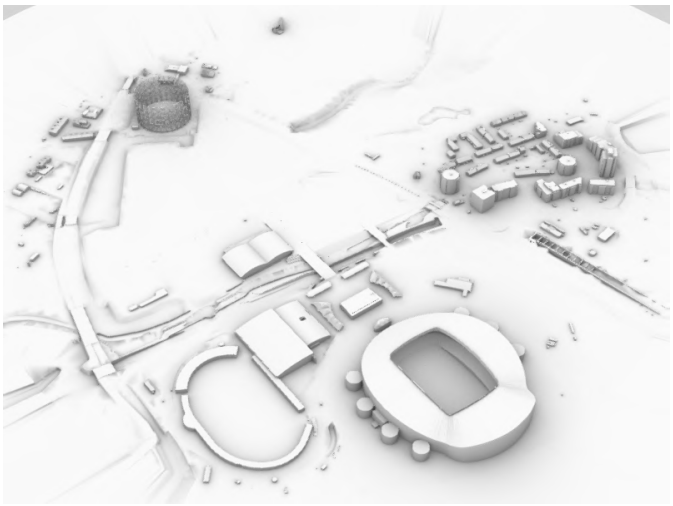
14.78 The residual effects including further mitigations measures recommended post planning can be seen in Table 14.3.

Table 14.3 Residual Effects

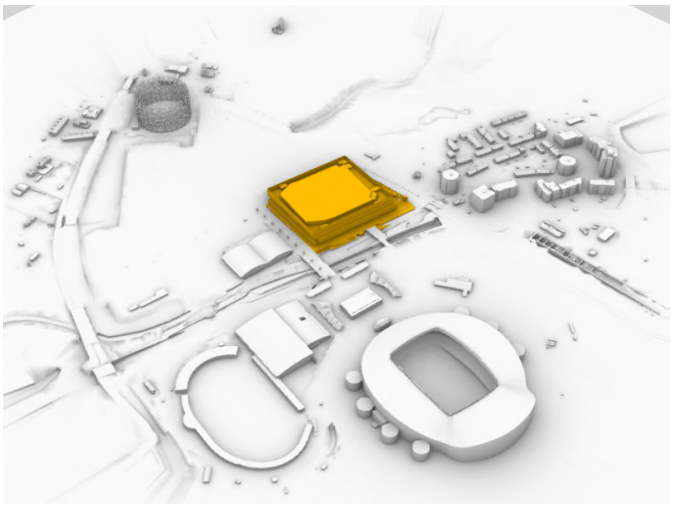
	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Construction	Pedestrians surrounding the Site during the demolition and construction phase	Negligible	None required, except for standard site hoardings	Implemented during construction	Negligible
Operational	Area of wind acceleration at the southeast corner of the podium during winter	Minor adverse	Planters and trees on the podium, porous green wall on the east side of the podium	Implemented during construction	Negligible
Operational	Wind acceleration leading to a safety issue at the southeast corner of the podium	Major adverse	Planters and trees on the podium, porous green wall on the east side of the podium	Implemented during construction	Negligible
Operational	Wind acceleration leading to a safety issue at the south of the Proposed Development	Major adverse	Existing landscape surrounding the Site	Already existing	Negligible
Operational	Wind acceleration leading to a safety issue to the east of the Site adjacent to a 10-storey residential building	Major adverse	Existing landscape surrounding the Site	Already existing	Negligible

References

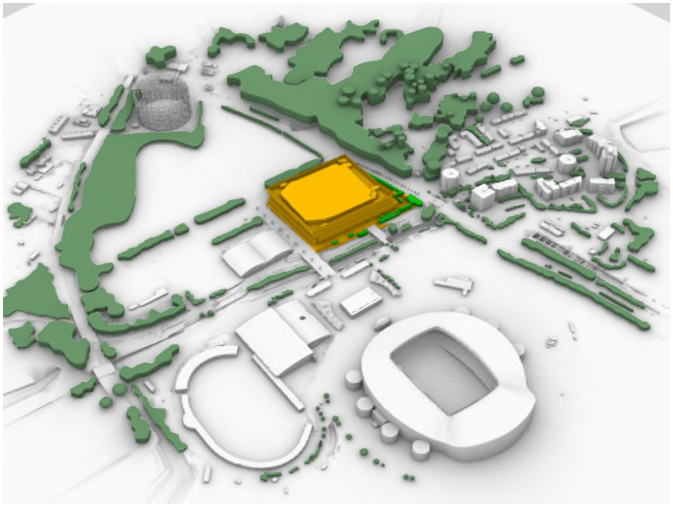
- T.V. Lawson. (2001). Building Aerodynamics, Imperial College Press (125-137).
- Lowe, J.A., et al. UKCP18 Science Overview report. Met Office. https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf



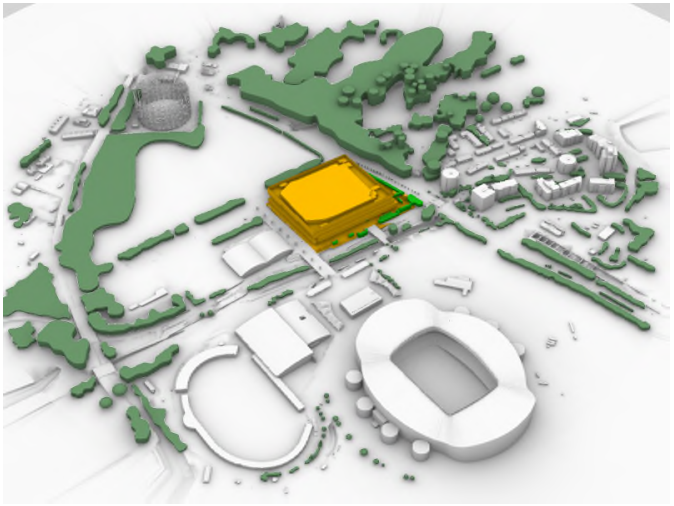
Configuration 1 – Existing site with existing surroundings



Configuration 2 – Proposed Development with existing surroundings

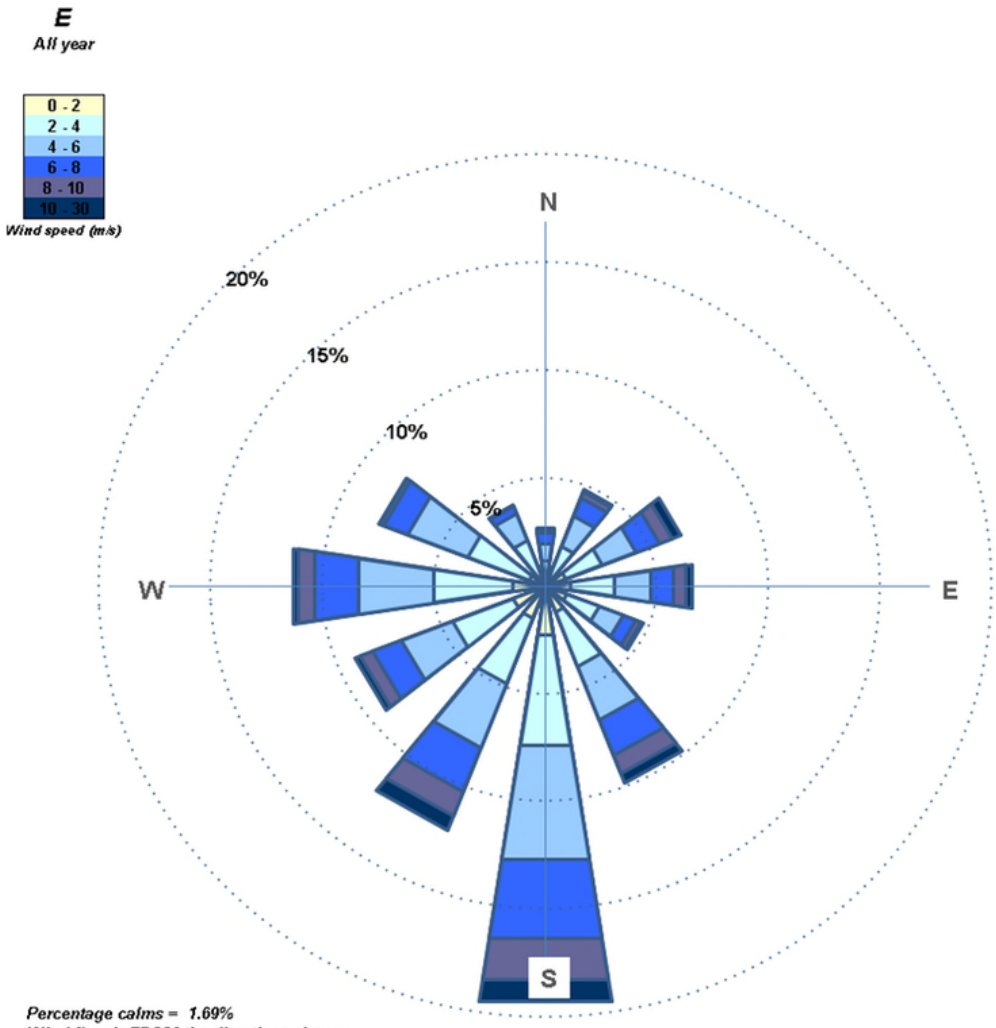


Configuration 3 – Proposed Development with existing surroundings and mitigation



Configuration 4 – Proposed Development with future committed developments

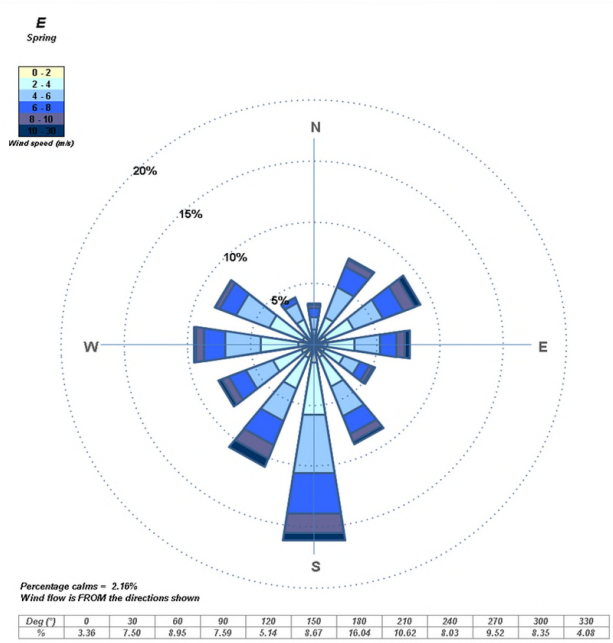
	Figure:	**14.1**		
	Title:	**CFD models analysed**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**



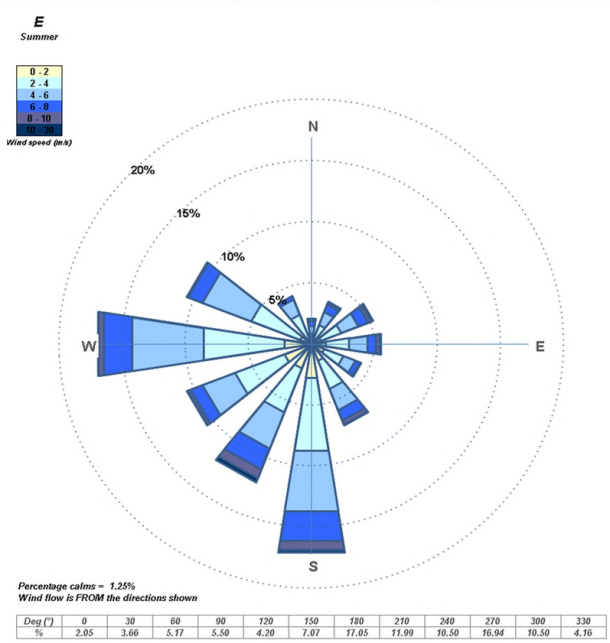
Percentage calms = 1.69%
Wind flow is FROM the directions shown

Deg (°)	0	30	60	90	120	150	180	210	240	270	300	330
%	2.66	4.73	6.43	6.59	4.65	9.69	19.24	12.00	9.09	11.33	7.91	3.97

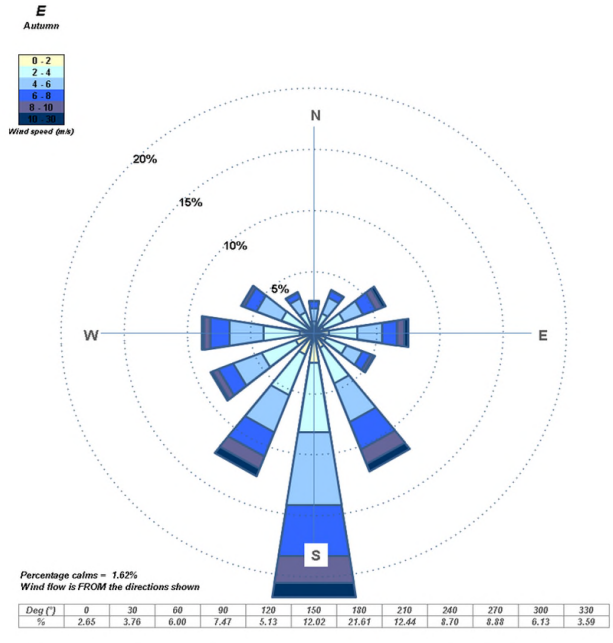
	Figure:	**14.2**		
	Title:	**Annual wind rose for the Site**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**



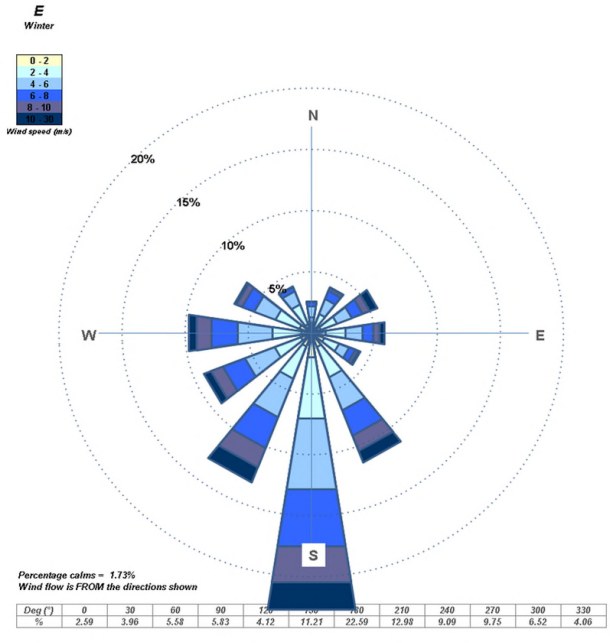
Deg (°)	0	30	60	90	120	150	180	210	240	270	300	330
%	3.36	7.50	8.95	7.59	5.14	8.67	16.04	10.62	8.03	9.52	8.35	4.08



Deg (°)	0	30	60	90	120	150	180	210	240	270	300	330
%	2.05	3.66	5.17	5.50	4.20	7.07	17.05	11.99	10.50	16.94	10.50	4.16



Deg (°)	0	30	60	90	120	150	180	210	240	270	300	330
%	2.65	3.76	6.00	7.41	5.13	12.02	21.61	12.44	8.70	8.88	6.13	3.59



Deg (°)	0	30	60	90	120	150	180	210	240	270	300	330
%	2.59	3.96	5.58	5.83	4.12	11.21	22.59	12.98	9.09	9.75	6.52	4.06

	Figure:	**14.3**		
	Title:	**Seasonal wind roses for the Site**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

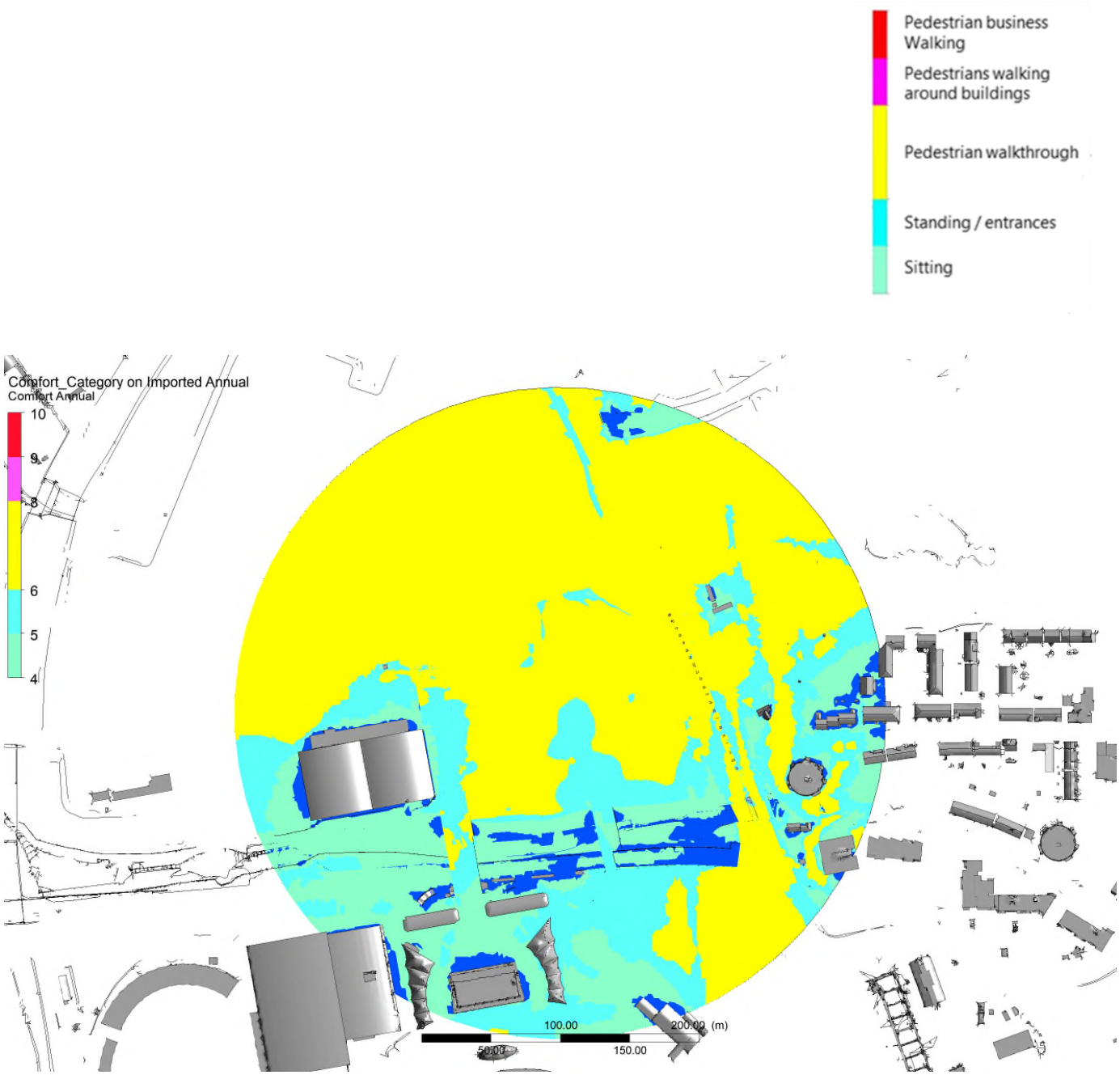


	Figure:	**14.4**		
	Title:	**Annual comfort map - Configuration 1 (existing site with existing surroundings)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

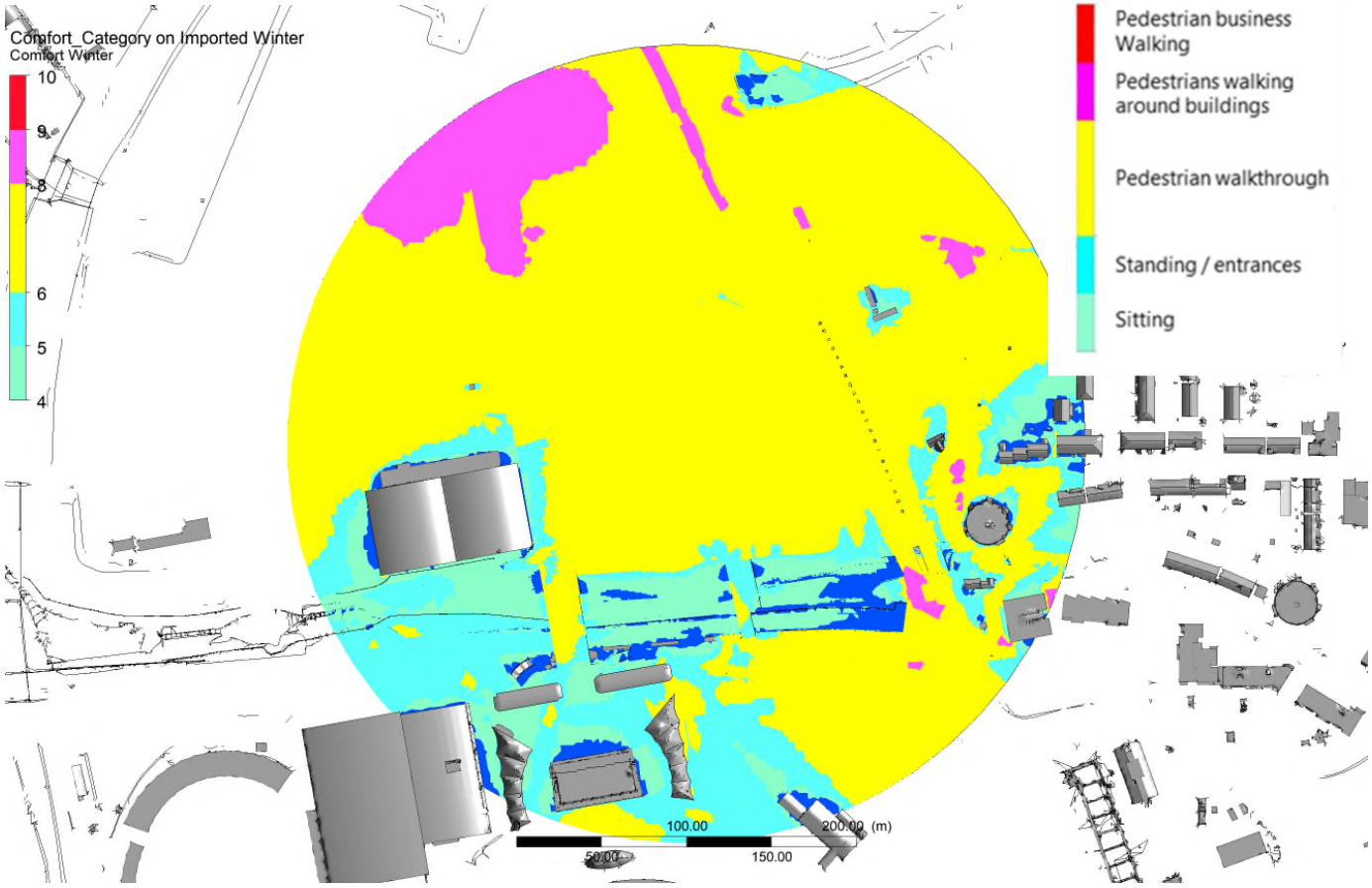


	Figure:	**14.5**		
	Title:	**Winter comfort map - Configuration 1 (existing site with existing surroundings)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

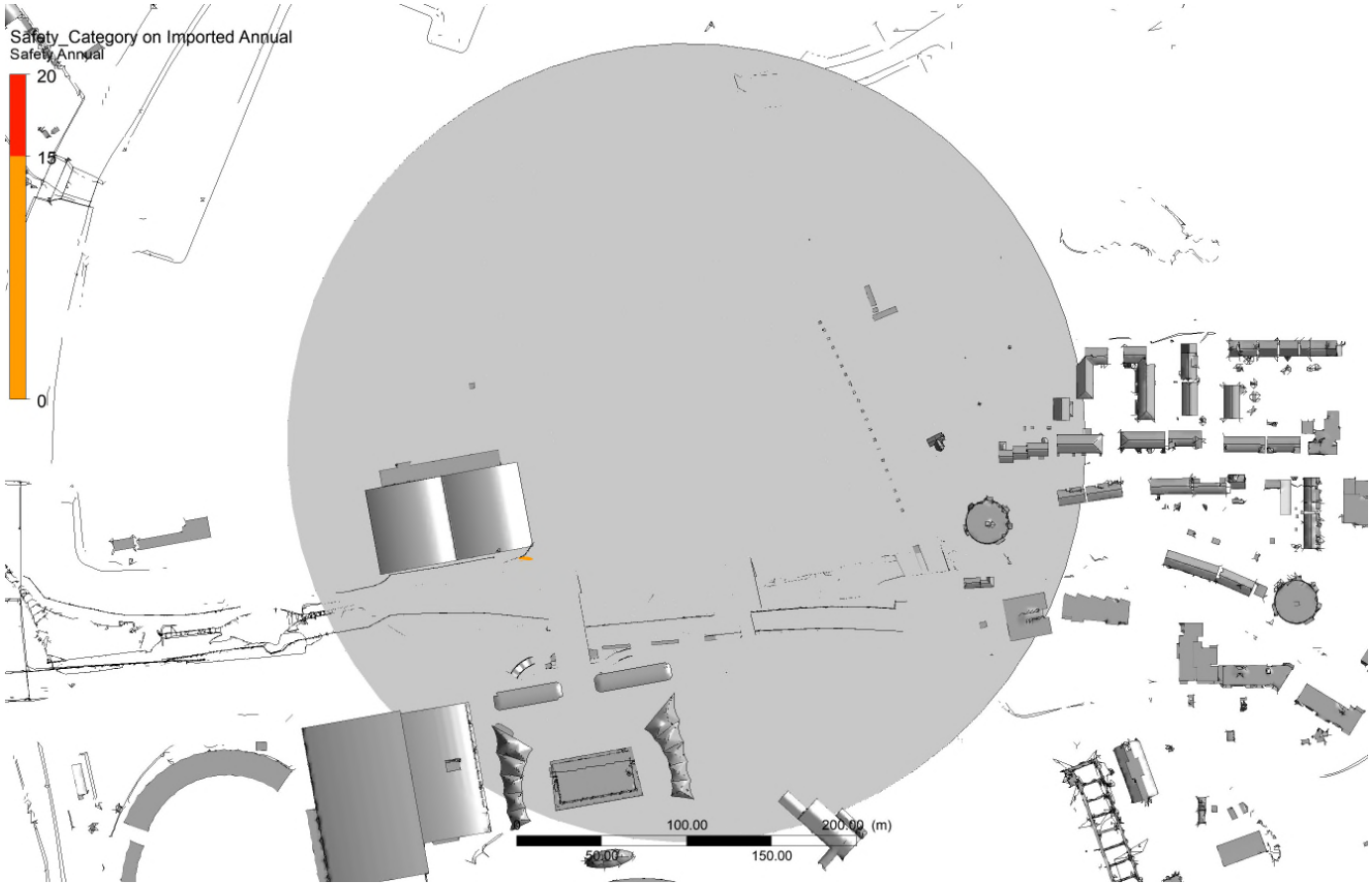


	Figure:	**14.6**		
	Title:	**Annual safety map - Configuration 1 (existing site with existing surroundings)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

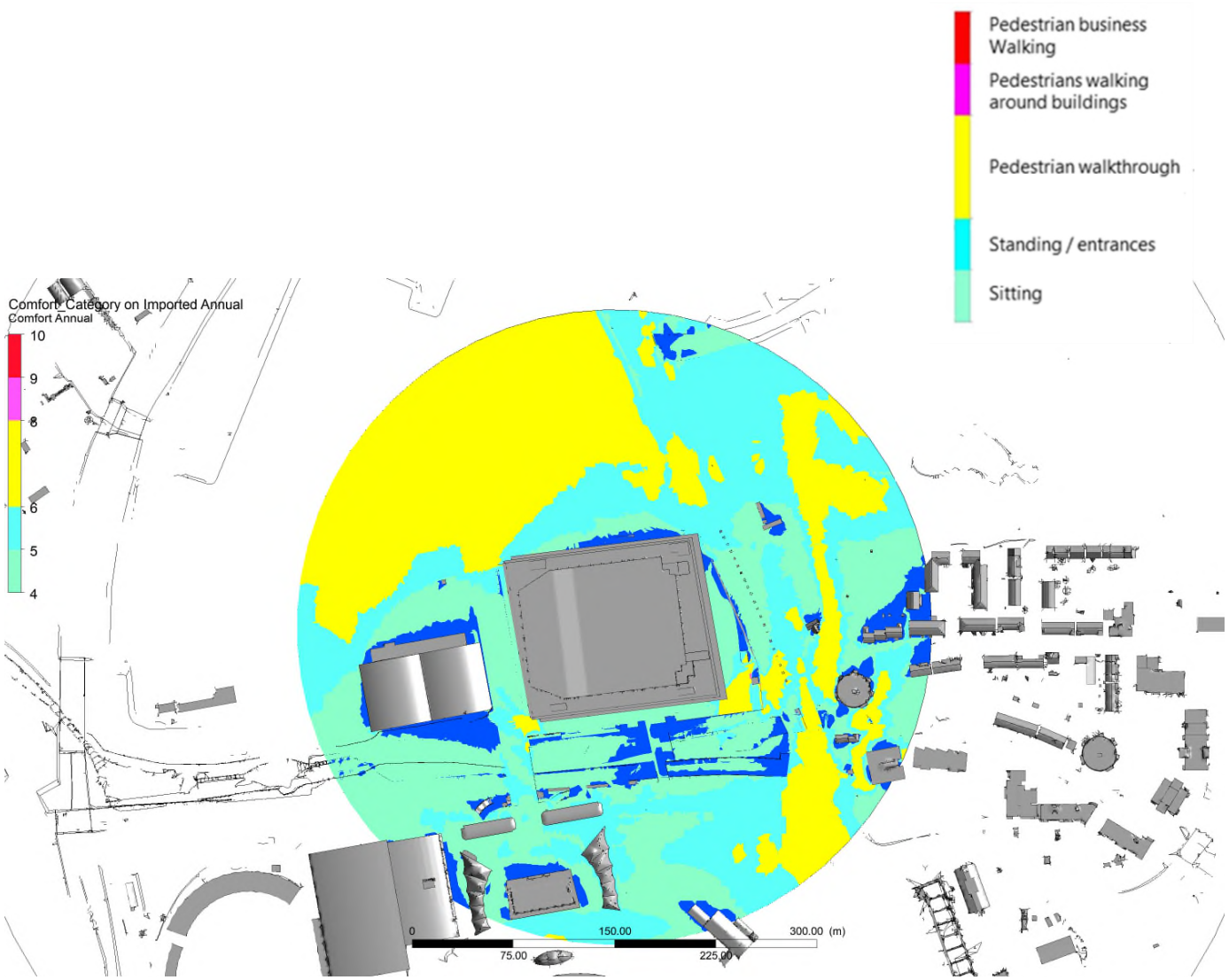


	Figure:	**14.7**		
	Title:	**Annual comfort map - Configuration 2 (Proposed Development with existing surroundings)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

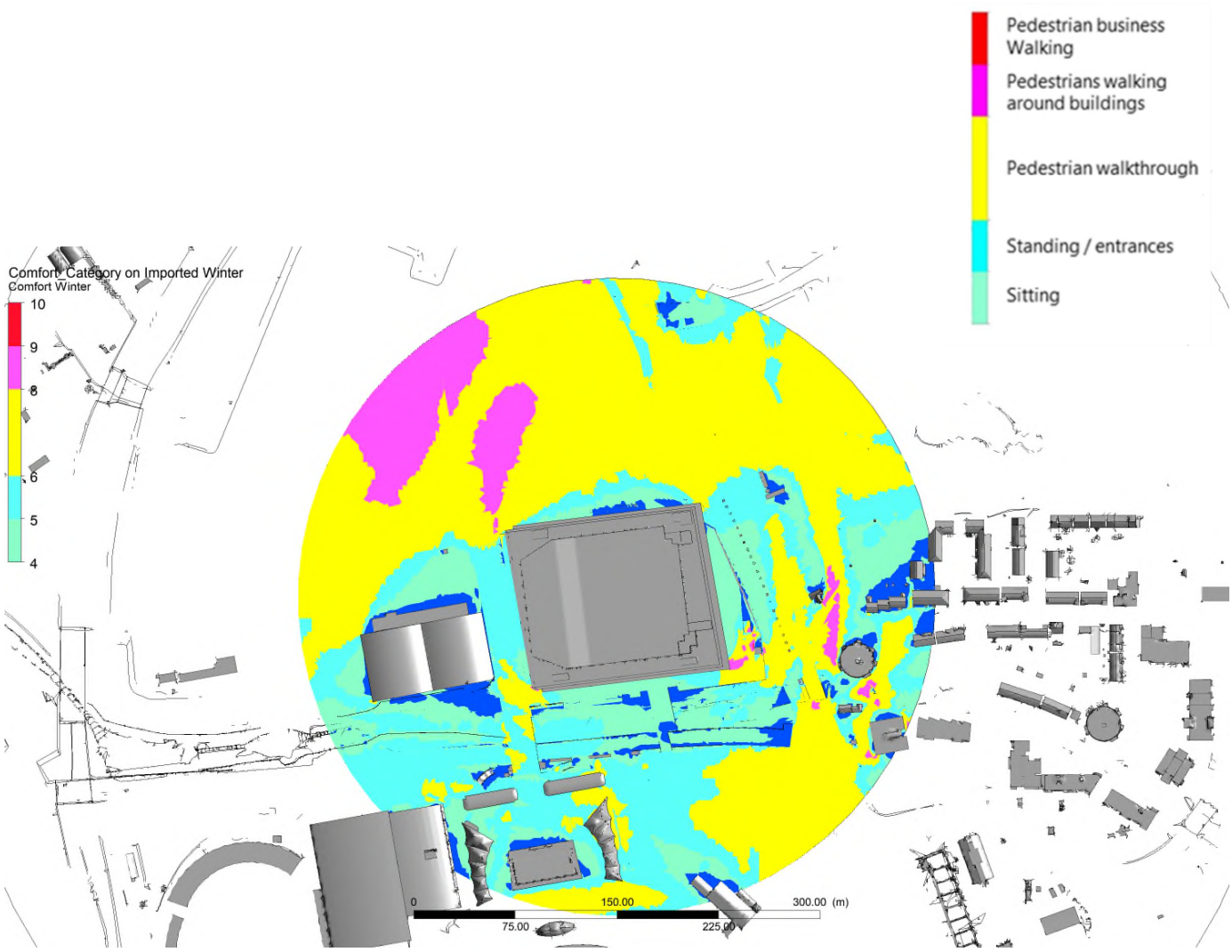


	Figure:	**14.8**		
	Title:	**Winter comfort map - Configuration 2 (Proposed Development with existing surroundings)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

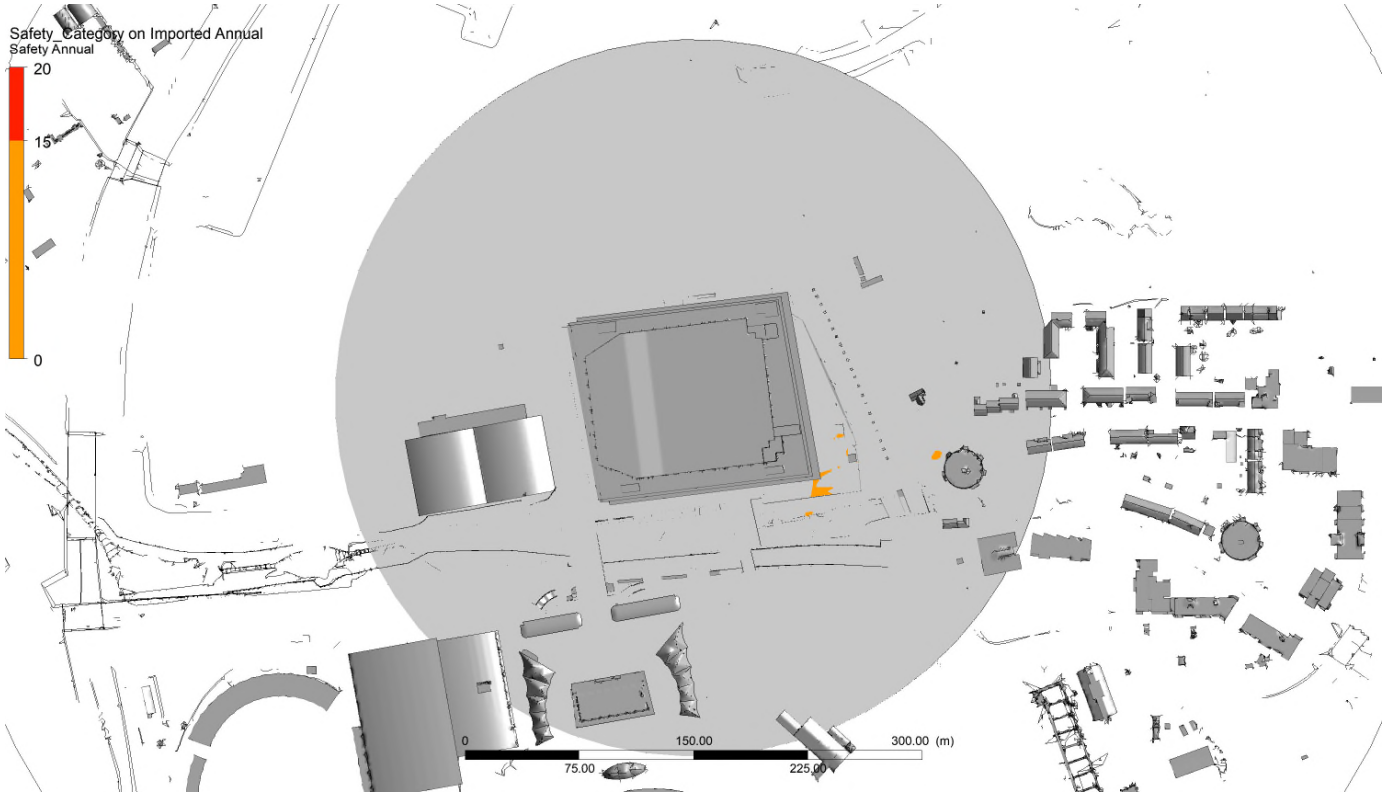


	Figure:	**14.9**		
	Title:	**Annual safety map - Configuration 2 (Proposed Development with existing surroundings)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

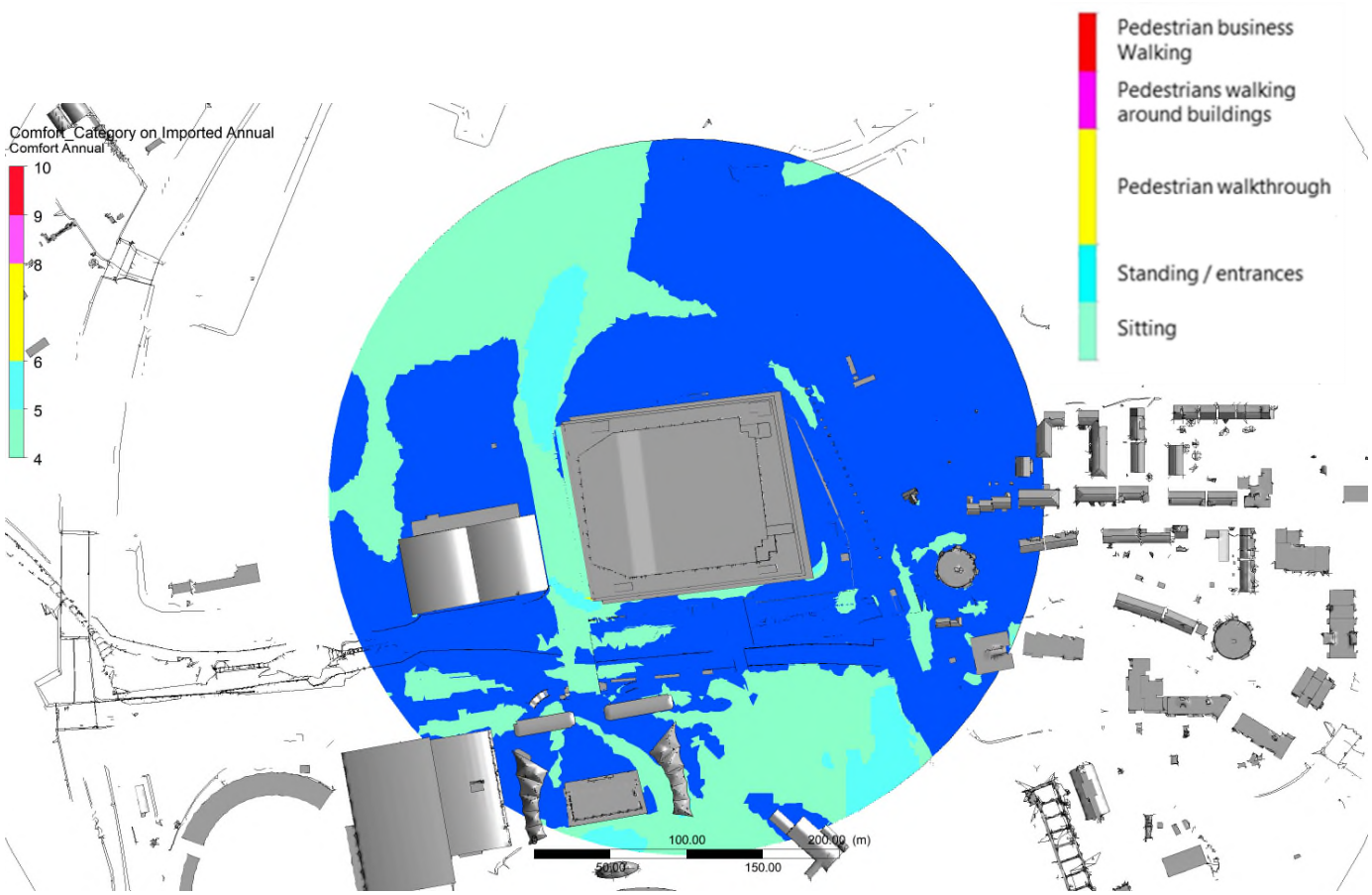


	Figure:	**14.10**		
	Title:	**Annual comfort map - Configuration 3 (Proposed Development with existing surroundings and mitigation)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

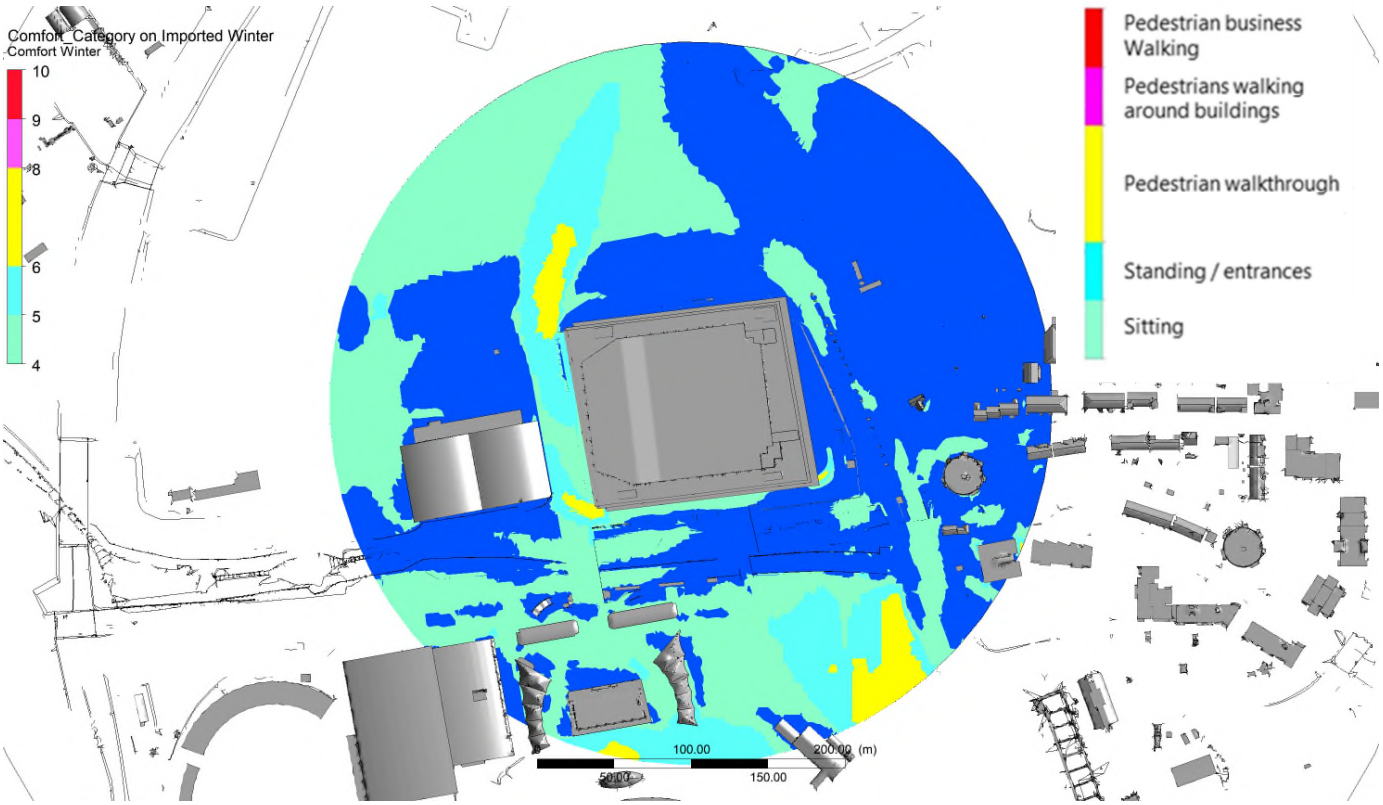


	Figure:	**14.11**		
	Title:	**Winter comfort map - Configuration 3 (Proposed Development with existing surroundings and mitigation)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

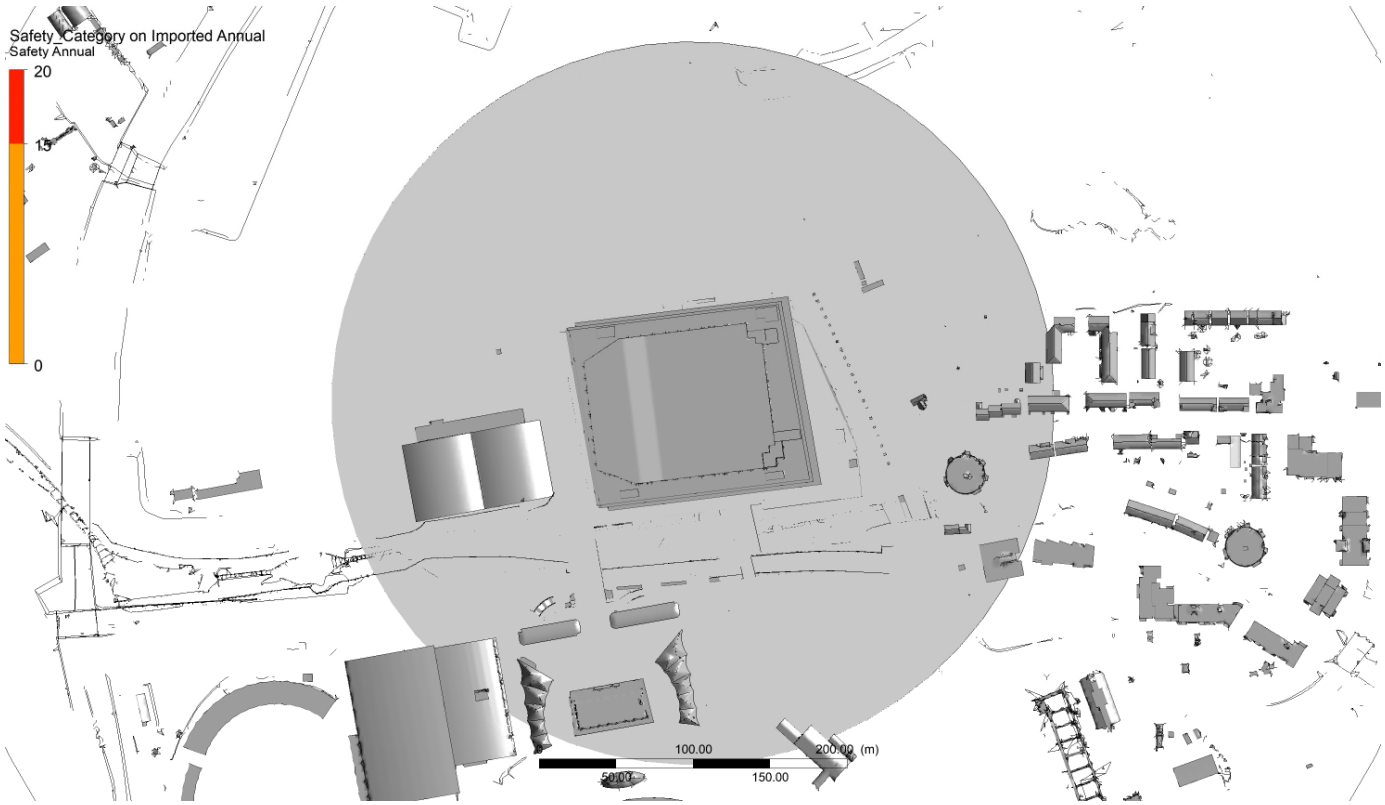


	Figure:	**14.12**		
	Title:	**Annual safety map - Configuration 3 (Proposed Development with existing surroundings and mitigation)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

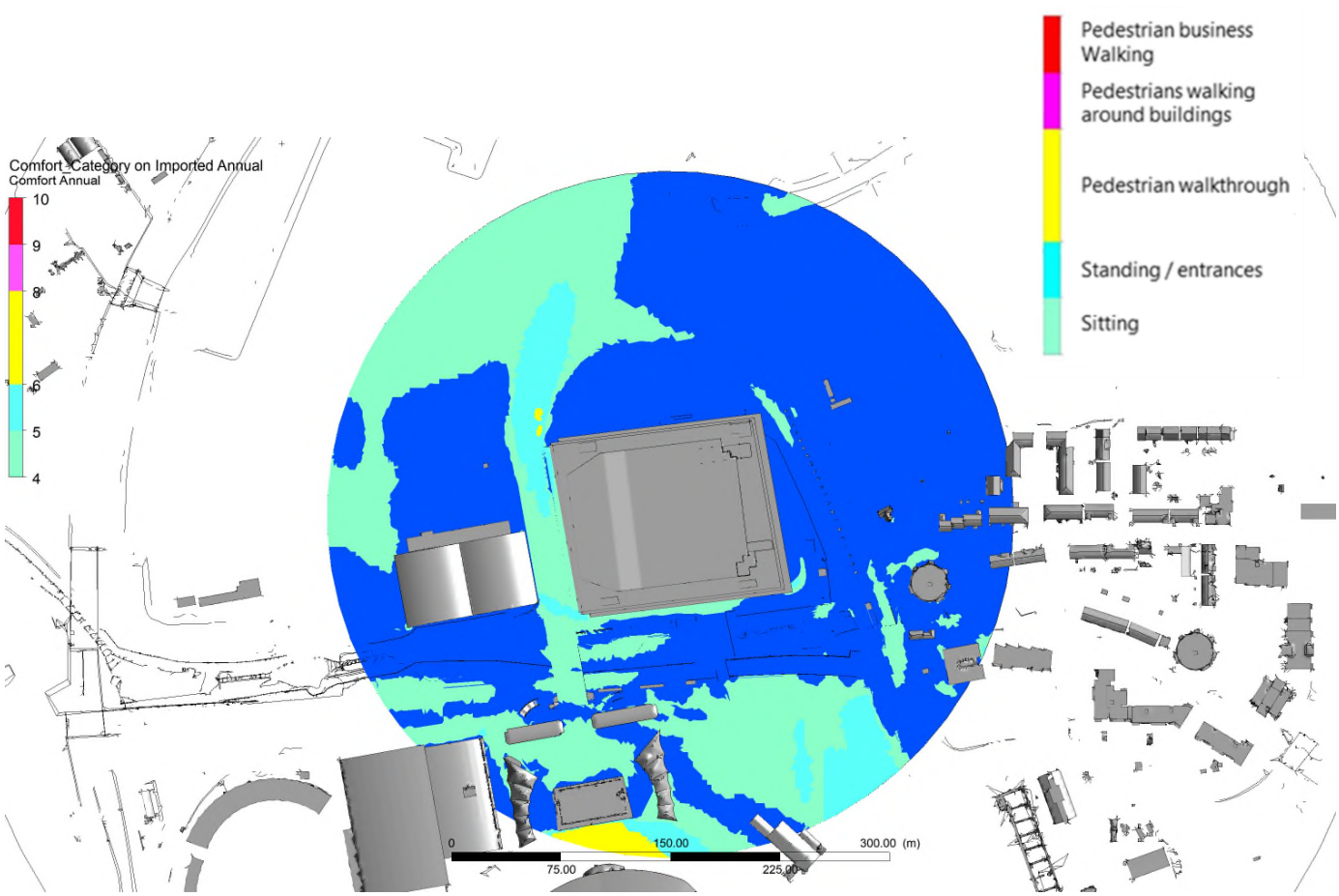


	Figure:	**14.13**		
	Title:	**Annual comfort map - Configuration 4 (Proposed Development with future committed developments)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

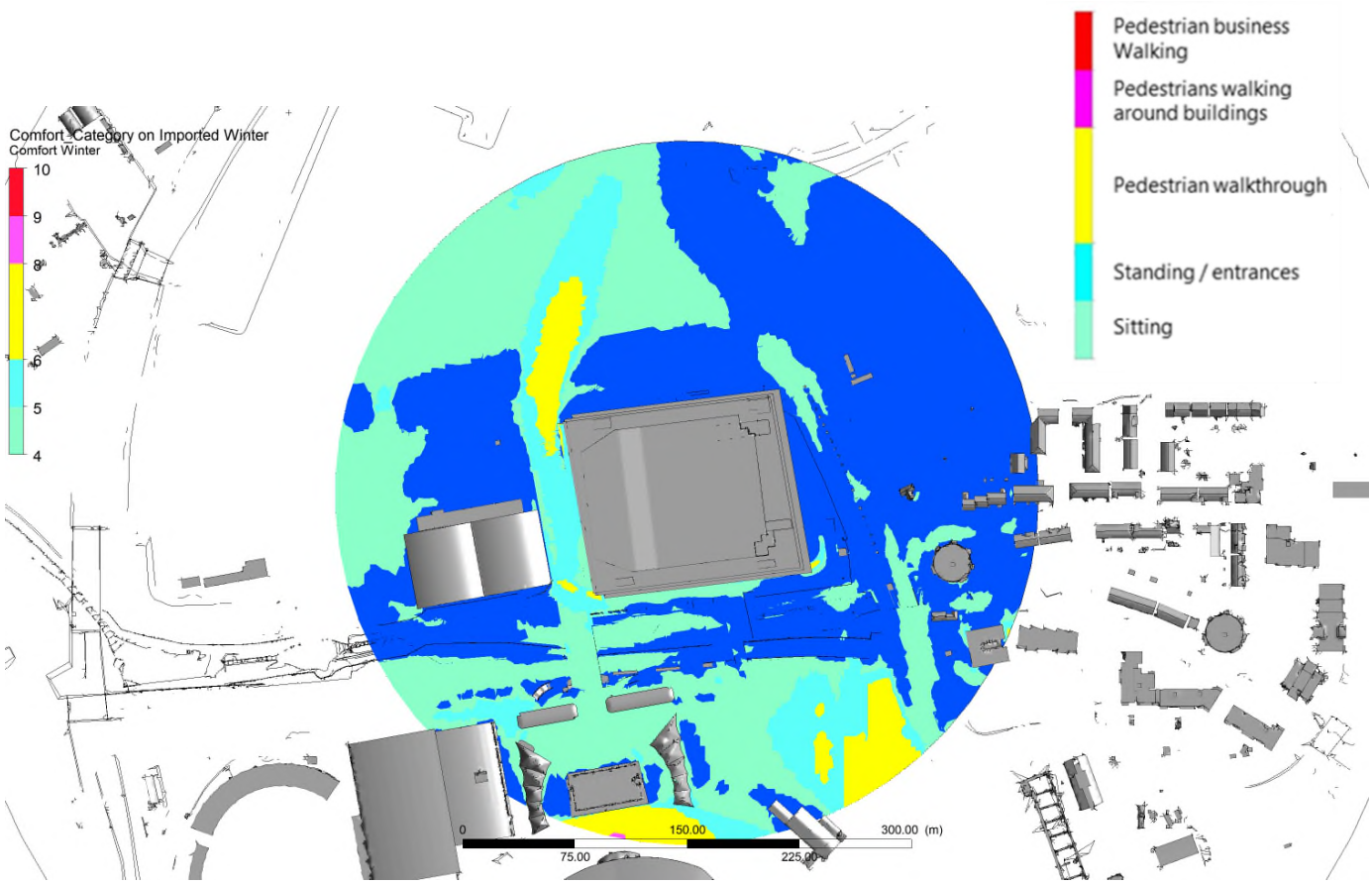


	Figure:	**14.14**		
	Title:	**Winter comfort map - Configuration 4 (Proposed Development with future committed developments)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

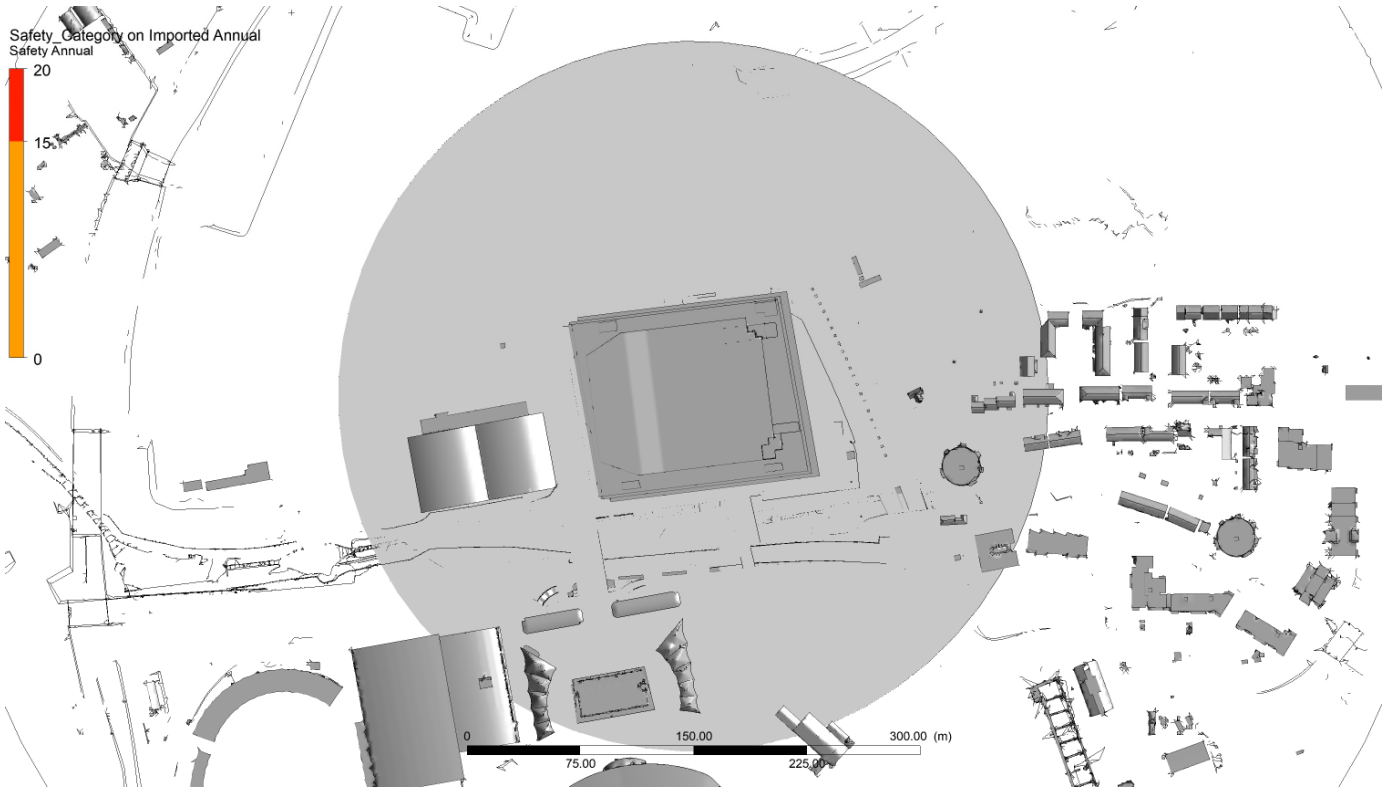


	Figure:	**14.15**		
	Title:	**Annual safety map - Configuration 4 (Proposed Development with future committed developments)**		
	Project:	**OVG Manchester**		
	Date:	**Dec 2019**	**Scale:**	**Scale /NTS**

15 Climate Change

Introduction

15.1 This Chapter of the ES has been prepared by BuroHappold and assesses the nature and magnitude of Greenhouse Gas (GHG) Emissions, which are likely to arise from the Proposed Development during construction and in operation, and the impact of this contribution to climate change. The vulnerability of the Proposed Development to climate change has been considered in detail under each relevant technical chapter, with key risks and conclusions summarised within this chapter.

15.2 This Chapter also describes the methods used to assess these impacts, the existing baseline conditions, the proposed mitigation measures required to prevent, reduce or offset any significant negative impacts and the likely residual impacts after these methods have been adopted.

15.3 This Chapter is accompanied by 1 technical appendix: Appendix 15.1 Greenhouse Gas Emissions Assessment – Data Inputs and Assumptions.

15.4 This report has been prepared by an Associate Sustainability Consultant with relevant qualifications (Chartered Engineer, Member of the Institution of Civil Engineers, Member of the Institution of Structural Engineers, Affiliate Member of the Institute of Environmental Management and Assessment, BREEAM Advisory Professional) and experience (Over 16 years' experience in the built environment, with over 8 years' experience specifically in sustainability planning policy, design and construction, carbon assessments and climate change resilience strategies).

15.5 The chapter is presented into two parts:

- **Part A: Climate Change Mitigation** – assessment of the nature and magnitude of GHG emissions likely to arise as a result of the Proposed Development during both the construction and operational phases, and proposed measures to reduce these emissions to minimise its contribution to climate change.
- **Part B: Climate Change Resilience** – focusing on the vulnerability of the Proposed Development to risks arising from a changing climate, and proposed measures to reduce these risks.

Limitations and Assumptions

15.6 GHG emissions associated with construction and operation of the Proposed Development has been determined based on the level of detail available at RIBA Stage 3 design supplemented by additional assumptions where required. All calculation inputs and assumptions can be found in Appendix 15.1.

Legislative and Policy Context

15.7 The legislation, policy and guidance that has influenced this assessment are listed below.

Legislation

Town and Country Planning (Environmental Impact Assessment) Regulations 2017

15.8 Schedule 4, Clause 5(f) of the Regulations notes information should be included in the ES on the likely significant effects of the development on the environment resulting from the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.

UK Climate Change Act 2008 (2050 Target Amendment)

15.9 Originally required the UK to reduce carbon emission by at least 80% by 2050 from a 1990 baseline.

15.10 On 27th June 2019, the UK Government increased the ambition to 100% reduction in carbon emissions by 2050.

15.11 Section 56 requires the UK Government to undertake a climate change risk assessment on a five-yearly cycle, with the subsequent development of an adaption programme to deliver resilience against these risks.

Environment Bill 2020

15.12 The Bill sets out how the government plans to protect and improve the natural environment in the UK, placing the ambition of the 25 Year Environment Plan (2018) on a statutory footing.

15.13 The Bill was re-introduced to parliament on the 30 January 2020.

National Planning Policy and Guidance

National Planning Policy Framework (MHCLG, 2019)

15.14 The National Planning Policy Framework sets out the Government's planning policies for England and provides guidance on its application. 'Chapter 14: Meeting the challenge of climate change, flooding and coastal change' states the planning system should support the transition to a low carbon future and help shape places in ways that contribute to radical reductions in GHG emissions, minimise vulnerability and improve resilience to a changing climate.

25 Year Environment Plan (DEFRA, 2018)

15.15 This plan sets out the Government's ambition to '…champion sustainable development, lead in environmental science, innovate to achieve clean growth and increase resource efficiency to provide benefits to both our environment and economy'.

15.16 Goal 7 of the Plan is to manage pressures on the environment by mitigating and adapting to climate change.

Sub-Regional Planning Policy

Draft Greater Manchester Spatial Framework (GMCA, 2019)

15.17 The Plan has been put together by Greater Manchester Combined Authority to set out how Greater Manchester should develop up until 2037.

15.18 'Section 5 A Sustainable and Resilient Greater Manchester' sets out Greater Manchester's Vision to be at the forefront of action on climate change and to make its 'fair' contribution to international commitments on climate change. This includes a commitment to be carbon neutral by 2038, with all new development to be net zero carbon from 2028.

15.19 Policies GM-S 4 and 5 set out the requirement for resilience against extreme temperatures, wind and increased rainfall associated with climate change and greater urbanisation.

Local Planning Policy

Manchester Core Strategy Development Plan (2012)

15.20 Manchester's Core Strategy was adopted in 2012 and is a key Development Plan document in the Local Development Framework, setting out the long-term strategic policies for Manchester's future development and forming the framework against which planning applications will be assessed.

15.21 Policies EN4 through to EN7 focus on reducing carbon emissions associated with development, focusing on energy efficiency, low carbon energy strategies and use of building materials with low embodied carbon.

15.22 'Policy EN8 Adaptation to Climate Change' sets out the expectation that all new development is adaptable to climate change in terms of the design, layout, siting and function of both buildings and associated external space. This includes addressing flood risk, urban heat island effect, overheating in buildings and species resilience of natural habitats.

Guide to Development in Manchester Supplementary Planning Document and Planning Guidance (2007)

15.23 The Guide to Development in Manchester 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.

15.24 'Section 4 Environmental Standards' sets out the Council's commitment to making Manchester "the Greenest City in Britain" with guidance on:

- Energy efficiency & Renewable energy;
- Environmental design;
- Water management and weather resilience;
- Waste management;
- Construction management;
- Biodiversity; and
- Climate resilience.

Our Manchester Strategy 2016-25

15.25 Following on from the city-wide consultation in 2015 with residents and businesses on what the vision for Manchester should look like, Our Manchester Strategy 2016-25 was published. Approximately one-third of the total responses were focused on climate change action and environmental sustainability. As a result, commitment to climate change is firmly embedded in the strategy and the Manchester Climate Change Board (MCCB) was formed.

Draft Manchester Zero Carbon Framework (2019)

15.26 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. Notably, Manchester is committed to be zero carbon by 2038. This was further reinforced by the Council declaring a Climate Emergency on 10 July 2019.

15.27 The draft Manchester Zero Carbon Framework has been developed by the Manchester Climate Change Board and Agency to set out the proposed approach for Manchester to achieve its climate change targets. A Final Framework and Action Plan is due to be published by March 2020.

15.28 The scope of carbon emissions included in the net zero definition are energy usage in buildings (domestic and non-domestic) and transport, i.e. the fuel and electricity directly consumed within the city boundary. However, it is acknowledged that product consumption within Manchester also causes a carbon footprint beyond its boundary, e.g. construction materials and consumer products produced elsewhere and waste disposal. As such, it is also important to actively reduce these carbon emissions contributions to the global carbon budget.

Guidance and British Standards

15.29 Climate change mitigation relates to the reduction in anthropogenic GHG emissions, the main cause of global warming and its related impacts. New development is a significant contributor, therefore quantifying and reducing associated GHG emissions plays an important role in reducing the magnitude and rate of climate change.

15.30 There is currently no standard methodology for quantifying GHG emissions within the EIA process, however, best practice has been drawn from the following documents:

- Net Zero Carbon Buildings: A Framework Definition (UKGBC, 2019)
- BREEAM UK New Construction 2018 Non-domestic Buildings v3.0 – Mat 01 Building Life Cycle Assessments (BRE, 2019)
- Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2017);

- Whole life carbon assessment for the built environment (RICS, 2017);
- British Standard BS EN 15978:2011 Sustainability of construction works – Assessment of environmental performance of buildings – Calculation Method; and,
- Cutting embodied carbon in construction projects (Waste & Resources Action Programme, 2011).

15.31 Climate change adaptation relates to identifying the risks of climate change, such as extreme weather events, and increasing the adaptive capacity of a development to maintain resilience to a changing climate over its lifetime.

15.32 There is currently no standard methodology for testing the effects of climate change adaptation within the EIA process. However, the assessment has been informed by the following guidance documents:

- UK Climate Change Risk Assessment 2017 (HM Government, 2017);
- National Adaptation Programme (Defra, 2018);
- EIA Guide to Climate Change Resilience and Adaptation (IEMA, 2015); and,
- ISO 14090:2019 Adaptation to Climate Change – Principles, Requirements and Guidelines.

Part A: Climate Change Mitigation

Assessment Methodology and Significance Criteria

Assessment Methodology

15.33 There is currently no standard methodology for quantifying GHG emissions within the EIA process. IEMA (2017) instead advocates flexibility for scoping and proportionality to suit the development under assessment.

15.34 The decision to include or exclude a source of GHG emission is based on:

- The opportunities for design and construction decisions to significantly influence the reduction of a GHG emissions source;
- The relative contribution of a GHG emissions source to the total GHG emissions over the whole life of the Proposed Development; and
- The availability of published benchmarks and certainty over future technologies and scenarios to meaningfully estimate the GHG emissions.

15.35 For building projects, the UKGBC (2019) guidance, 'Net Zero Carbon Buildings: A Framework Definition' is widely recognised as a robust methodology to define net zero carbon in terms of:

- Construction – embodied carbon associated with a building's product and construction stages
- Operational energy – carbon associated with the total energy consumption within a building in operation

15.36 These represent the two most significant sources of carbon for a new building which the project team can directly influence and therefore will be the focus of this assessment. This scope has been agreed with the Local Planning Authority following their request in the EIA Scoping Opinion dated 15 January 2020 for climate change to be scoped in to the EIA.

15.37 It is acknowledged that the Manchester City Council Zero Carbon 2038 also includes GHG emissions associated with transport. The Proposed Development has actively sought to make sustainable modes of travel to and from the site the most attractive options, as detailed within the Travel Plan and Transport Assessment. Carbon emissions associated with operational transport have not been assessed since actual modal split in operation is highly dependent on customer and staff behaviour. Instead, a Transport Assessment and Travel Plan accompanies this planning application, setting out how physical and operational interventions will be adopted to encourage sustainable modes of travel. Transport-related carbon emissions will be monitored through the Travel Plan and supporting surveys once the Proposed Development opens.

Construction

15.38 The scope of the embodied carbon assessment can be defined in line with BS EN 15978:2011 which sets out the standard Building Life Cycle Assessment Stages, as summarised in Table 15.1 with rationale for inclusion within this assessment.

Table 15.1 Life Cycle Assessment Stages

LCA Stage	Description	Inclusion?
A1-A3 Product Stage	GHG emissions associated with the material extraction, transportation and manufacturing of construction products.	Yes, in-line with UKGBC (2019) guidance. Product choice can be directly influenced by the project delivery team.
A4-A5 Construction Process Stage	GHG emissions associated with product delivery to site and the installation process.	Yes, in-line with UKGBC (2019) guidance. Product sourcing and construction processes can be directly influenced by the project delivery team.
B1-B5 In-use Stage	GHG emissions associated with maintenance, repair, replacement and refurbishment.	No, in-line with UKGBC (2019). Whilst durability of products will be considered, evidence base for quantifying in-use embodied carbon is still under development.
C1-C4 End of Life	GHG emissions associated with deconstruction through to disposal.	No, in-line with UKGBC (2019). Whilst circular economy principles will be considered to minimise end of life impact, evidence base for quantifying end of life embodied carbon is still under development.
D Benefits beyond the system boundary	Beneficial or adverse GHG emissions occurring outside of the system boundary. For example, benefits of future re-use of a component taken now.	No, not in-line with UKGBC (2019). Whilst circular economy principles will be considered to plan for re-use, there are no firm commitments and plans in place to ensure this happens to justify taking the benefit now.

15.39 Whilst the embodied carbon associated with in-use, end of life and future re-use have not been quantified, these have been considered qualitatively to set guiding sustainability principles for the design development and construction processes.

15.40 The scope of the embodied carbon assessment should further be considered in terms of which building elements to include. The scope defined by BREEAM UK New Construction 2018 (BRE, 2019) under the Mat 01 Life Cycle Assessment have been adopted. Full assumptions and exclusions are set out within Appendix 15.1.

15.41 Embodied carbon is calculated based on the following data (See Appendix 15.1 for details):

- Material quantities for the different building elements – sourced from current project design models; and
- Carbon factors for the different building elements and materials used, as determined using BRE accredited Life Cycle Assessment software (OneClick LCA). Specific products are unknown at this stage therefore for the purpose of the preliminary embodied carbon assessment, generic baseline specifications have been assumed.

Operational Energy

15.42 In line with Manchester City Council (2019) and UKGBC (2019) definition of net zero carbon, total energy will be considered. The total energy associated with the operation of the building comprises two components:

15.43 **Regulated** – energy directly associated with fixed building systems as defined under Building Regulations Part L 2013. i.e. heating, cooling, ventilation, hot water and lighting. These systems are fully within the direct influence of the project delivery team. This aligns with the Energy Statement for demonstrating Part L compliance.

15.44 **Unregulated** – all other energy associated with equipment, heavily influenced by the way a building is managed and used. Key equipment, such as catering and IT, can partially be influenced by the building operator and its suppliers. This goes beyond Part L compliance and is extra over the Energy Statement.

15.45 A preliminary prediction of the total operational energy has been undertaken for the project using the methodology outlined in CIBSE TM54 (2013) for evaluating operational energy performance of buildings during Design Stage.

15.46 The annual energy use has been projected over the study period, based on the following published carbon factors:

15.47 UK electricity grid carbon factors - Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - Data Table 1 – Grid average consumption-based carbon factors for commercial buildings (BEIS, March 2019). This data set provides carbon factors between 2010-2100 for longer term modelling and carbon footprinting, taking into account predicted decarbonisation over time.

15.48 Gas carbon factors - UK Government GHG Conversion Factors for Company Reporting 2019 (BEIS, 2019a)

15.49 It should be noted that the carbon factors used for the purpose of this GHG chapter, which align with those used for long term modelling and reporting in the UK, differ from the carbon factors stipulated within Building Regulations Part L 2013 used for demonstrating planning policy compliance within the Energy Statement. Carbon factors fixed within Building Regulations represent a snapshot in time and are currently higher, pending an overdue consultation and update.

15.50 As such, the calculated operational carbon figures and percentage savings presented are different. However, operational carbon calculations are based on the same energy consumption data as the 'Be Green' scenario within the Energy Statement.

Study Period

15.51 An assessment period of 60 years has been used, as per the principles outlined in British Standard EN 15978:2011. This is based on the typical expected service life of a non-residential building, aligned with available Life Cycle Assessment databases. The total estimated GHG emissions will be estimated to 60 years after the expected completion of the Proposed Development in 2023.

Significance criteria

15.52 In the context of climate change, GHG emissions arising from the operation of any new development are considered the key impact, with the principal receptor being atmospheric GHG concentrations. The consequence of the impact is increasing the levels of atmospheric GHG emissions towards its environmental limit, triggering subsequence effects on the global climate system.

15.53 In the absence of an industry-wide agreed and tested approach to defining the significance criteria and GHG emissions threshold at the local development site scale, IEMA (2017) guidance has been adopted. This highlights three over-arching principles which show all GHG emissions are potentially significant:

- GHG emissions from all projects will contribute to climate change, the largest inter-related cumulative environmental effect;
- Consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive; and

- GHG emissions have a combined environmental effect that is approaching a significantly defined environmental limit.

15.54 The IEMA recommendation can be further supported by reviewing the magnitude and sensitivity of atmospheric GHG concentrations to individual developments at the local level. In the absence of industry guidance and precedence studies, the following descriptors are based on professional judgement.

Magnitude of impact

15.55 Whilst it is recognised that the cumulative impact of GHG emissions arising from global human activity is Major adverse, the contribution from individual developments at national and local level has been defined in Table 15.2 using professional judgement. It is assumed that any GHG emissions would be adverse.

Table 15.2 Methodology for Determining Impact Magnitude

Magnitude of Impact	Criteria for assessing impact
Major	Long-term continued high net increase in GHG emissions resulting from the Proposed Development in construction and operation. Not in line with achieving net zero over the lifecycle of the Proposed Development.
Moderate	Medium-term net increase in GHG emissions resulting from the Proposed Development in construction and operation. Trending towards achieving net zero over the lifecycle of the Proposed Development, but not before 2038, as per the Manchester City Council commitments.
Minor	Short term net increase in GHG emissions resulting from the Proposed Development in construction and operation, trending to net zero by 2038, in line with Manchester City Council commitments.
Negligible	No net increase in GHG emissions from the construction and operations from Day 1 of operation.

Receptor Sensitivity

15.56 Sensitivity is defined by taking into consideration the value, vulnerability and reversibility of the receptor. With regard to the atmospheric GHG concentrations, sensitivity is considered High based on the following conclusions:

15.57 Value of the resource - the atmosphere and its role in regulating the global climate is of high ecological, social and economic value and underpins life on the planet therefore is of global critical value;

15.58 Vulnerability - is recognised by the Paris Agreement (2015) that the GHG concentrations in the atmosphere are already approaching its environmental limit and the effects of climate change are already evident; and

15.59 Reversibility of the effect – climate change is considered irreversible, with a delayed effect in any actions or technologies employed to reduce concentrations of GHG emissions already in the atmosphere.

Impact Significance

15.60 The significance of an environmental impact is determined by the interaction of magnitude and sensitivity. The Impact Significance Matrix is set out in Table 15.3.

15.61 Moderate and major effects are considered significant.

Table 15.3 Impact Significance Matrix

		Receptor Sensitivity		
		High	**Moderate**	**Low**
Impact Magnitude	**Major**	Major	Major-Moderate	Moderate-Minor
	Moderate	Major-Moderate	Moderate-Minor	Minor
	Minor	Moderate-Minor	Minor	Minor-Negligible
	Negligible	Negligible	Negligible	Negligible

Scenarios

15.62 The following testing scenarios will be considered within this chapter:

- Existing site (baseline);
- Existing site (baseline) with Proposed Development; and,
- Existing site (baseline) with Proposed Development and mitigation measures.

15.63 As per the IEMA (2017) guidance, any development will result in GHG emissions and the cumulative concentration in the atmosphere will contribute to climate change. The receptor and cumulative effects from nearby committed developments are therefore at the global rather than local scale.

15.64 As such, the following scenarios will not be tested:

- Existing site (baseline) with committed developments; and,
- Existing site (baseline) with Proposed Development and committed developments.

Baseline Conditions

15.65 In line with IEMA Guide (2017), the baseline for the Proposed Development is defined as the current GHG emissions arising from activities and infrastructure within the Site boundary.

15.66 The brownfield site is currently used as poor-quality occasional parking. It is a mixture of gravel, hard-standing and bare ground with an ecology survey identifying partial natural colonisation with unimproved neutral grassland, scrub encroachment and broadleaved trees typical of a site with ongoing disturbance.

15.67 Based on the scope of GHG emissions under consideration (operational energy and construction), the baseline can be considered as zero GHG emissions.

Future Baseline

15.68 If the Proposed Development did not go ahead and the site remained undeveloped over the study period, the 'do-nothing' scenario at the 2023 (completion year) and 2083 (end of 60-year study period) would remain as zero GHG emissions (based on the scope of GHG emissions under consideration).

Identification and Evaluation of Significant Effects

15.69 Design decisions can lock GHG emissions into the Proposed Development, both the embodied carbon relating to the construction process and the operational carbon relating to how the building is used over its lifetime. As such, the Applicant has given early consideration to opportunities to maximise reductions in GHG emissions and to ensure future reductions are not precluded by future design decisions.

Construction Effects

15.70 The primary source of GHG emissions during construction are those arising from construction materials and installation processes, referred to as the embodied carbon. Reference should be made to the Design and Access Statement accompanying this planning application for details of materials. In summary, the Proposed Development comprises a new indoor arena and supporting amenities with 62,000 m2 GIA of floor space. Key materials used for the major building components are:

- Reinforced concrete substructure, including piles and pile-caps;
- Reinforced concrete ground slab;
- Mixture of reinforced concrete and steel superstructure for the main arena building;
- Suspended composite floor slabs (reinforced concrete on metal decking) for the upper floors;
- Steel roof superstructure with standing seam aluminium cladding; and,
- Composite cladding panels and perforated aluminium cladding.

15.71 Mitigation measures designed-in to the Proposed Development concept design align with best practice guidance for designing out waste in building projects (WRAP, 2009), circular economy principles for the construction industry (UKGBC, 2019) and the LETI Embodied Carbon Primer (LETI, 2020). Measures are summarised in Table 15.4.

Table 15.4 Designed-in Mitigation Measures for Construction Effects

Mitigation measure	**Mitigation Effect** **(Embodied carbon reductions)**
Design for Materials Optimisation	
The internal volume has been optimised for the functional requirements on each floor, resulting in a series of staggered 'boxes' at each level.	Reduced materials required for the building envelope and structure.
The façade strategy development benefits from early supply chain engagement to adopt standard panel sizes.	Material wastage from offcuts minimised.
Design for off-site construction	
The relatively rectilinear building allows for significant repetition which simplifies construction and aids modularisation for off-site construction.	Modularisation reduces material wastage from offcuts. Off-site construction allows for more energy efficient assembly processes, material optimisation and less wastage from higher quality control and automation.
Components currently designed for off-site construction: Pre-cast concrete units for the bowl; Pre-cast concrete slabs;	As above. Additional co-benefits of reduced on-site activity and deliveries, which minimises disruption to the local community and minimises impact on local air quality.

Mitigation measure	Mitigation Effect (Embodied carbon reductions)
Steel frame; Curtain wall panels; and MEP systems where practical.	
Design for low carbon procurement	
A two-stage tender process has been adopted to enable early contractor engagement.	Unlocks opportunity for early supply chain engagement to inform the detailed design with regards to low carbon construction products, processes and waste minimalisation.
Design for flexibility and adaptability	
Adaptability of the event space is inherent in the design brief	Whole life carbon efficiencies by mitigating against the risk of redundancy before end of useful design life.
Spatial allowance for incorporating additional cooling in response to rising temperatures due to climate change.	Ease of retrofit to maintain comfortable temperatures reduces construction works associated with any required system upgrades.
Good access to back of house areas and dedicated loading zone on the roof facilitates plant replacement.	Ease of system maintenance and upgrade with minimal construction works.
Design for replacement and deconstruction	
Simple multi-layer panelised façade system will enable easy replacement.	Ease of replacement minimise construction works associated with any refurbishment. Ease of deconstruction also increases the opportunity for re-use or component recovery to reduce the demand for virgin material elsewhere.

15.72 Based on the current Proposed Development Stage 3 design, the preliminary estimated associated embodied carbon has been calculated as 56,761 tCO2e. Figure 15.1 shows the split of embodied carbon. It can be seen the superstructure and foundations are the dominant source of embodied carbon.

15.73 It should be noted that this is a preliminary estimate only, based on estimated quantities and generic material data. The purpose is to identify carbon hotspots and opportunities for reduction during RIBA Stage 4 detailed design and show industry leadership in encouraging data sharing and discussion around embodied carbon, which is still an emerging topic.

15.74 To ascertain the scale and significance of the impact, the embodied carbon for the Proposed Development has been put into context against best available industry benchmarks and targets in Table 15.5. However, it should be noted that arenas are bespoke, non-standard buildings and robust industry wide embodied carbon data is still limited therefore the comparison is illustrative only and not intended to be a measure of performance.

Table 15.5 Embodied Carbon Benchmark Comparison

Embodied Carbon Benchmark	**OVG Manchester Embodied Carbon Comparison** 56,761 tCO2e TOTAL 915 kgCO2e/m2 GIFA
Embodied Carbon benchmarks (Atkins Carbon Critical Masterplanning Tool, as quoted in RICS, 2012): 3250 kgCO2e/m^2 Specialist leisure 1250 kgCO2e/m2 High rise residential (16-25 storeys) 720 kgCO2e/m2 Mixed use city block (ground floor commercial, residential above)	The benchmark for specialist leisure should be treated as an upper boundary as this is over 10 years old and covers a range of global stadia, arena and major sports facilities. There will be huge variance of design, material specifications and carbon intensities associated with local industry. However, it can be seen that the preliminary estimate for OVG Manchester is much lower and comparable to typical high-rise buildings.
RIBA 2030 Climate Challenge targets for standard non-domestic buildings (RIBA, 2019): 1100 kgCO2e/m2 Current <650 kgCO2e/m2 by 2025 < 500 kgCO2e/m2 by 2030 LETI Embodied Carbon Primer for commercial office space (LETI, 2020): 1000 kgCO2e/m2 Current <500 kgCO2e/m2 by 2025 < 250 kgCO2e/m2 by 2030	Recent benchmarks set by RIBA and LETI are more up to date, although these are for standard non-domestic buildings (e.g. office blocks). It can be seen that the preliminary estimate for OVG Manchester is comparable to current typical non-domestic buildings. It should be noted that internal finishes have been excluded from the initial assessment, in line with BREEAM Mat 01. The limited glazing and simple lightweight façade system (perforated aluminium cladding supported from composite steel/mineral wool panels) is also likely to have reduced embodied carbon compared to a typical glazed curtain walling system.

15.75 Based on the above effects, the impact of construction (materials and processes) is considered moderate adverse, therefore significant. Whilst it is a short-term increase in GHG emissions outside the scope of Manchester City Council net zero carbon by 2038 commitment, it is recognised that there will be whole life impacts arising from maintenance, replacement and end-of-life that have currently not been estimated. Further mitigation opportunities exist to reduce these in-use and end-of-life sources of embodied carbon.

15.76 Table 15.6 summarises the potential construction effects and their significance prior to supplementary mitigation.

Table 15.6 Potential construction effects and their significance prior to supplementary mitigation

Receptor	**Sensitivity**	**Description of effect**	**Magnitude of change/ impact**	**Effect significance**
Atmospheric GHG Concentrations	High	Increased GHG emissions arising due to construction materials and processes.	Moderate	Major-Moderate adverse

Operational Effects

15.77 Carbon associated with the energy use within the Proposed Development over the 60-year study period will predominantly be from the following:

- Regulated – energy directly associated with fixed building systems as defined under Building Regulations Part L 2013. i.e. heating, cooling, ventilation, hot water and lighting.
- Unregulated – all other energy associated with equipment. For the Proposed Development, this will predominantly be specialist equipment associated with a show, catering and ICT.

15.78 Mitigation measures designed-in to the Proposed Development concept design align with industry best practice. These measures are summarised in Table 15.7. Reference should be made to the Energy Statement accompanying this planning application for full details.

Table 15.7 Designed-in Mitigation Measures for Operational Effects

Mitigation measure	**Mitigation Effect** **(Operational Energy carbon reductions)**
Lean – Use less energy	
Enhanced U-values and air tightness	Reduced heat loss therefore less energy required to heat the building.
Minimal windows, with enhanced glazing specification where specified. Perforated façade design and internal shading devices.	Reduced solar heat gain therefore less energy required to cool the building.
High efficiency boilers	Reduced energy use for required heating and hot water output.
Energy efficient demand-led ventilation systems with heat recovery	Variable volume sensor-controlled ventilation systems only operate as required therefore less energy required than standard fixed volume systems that operate for set periods. Heat recovery from outgoing air warms the incoming fresh air to reduce overall heating requirements in the building.
High efficiency EC motors with variable speed drives for fans and pumps	Less energy required for the operation of the building services systems.
Intelligent building services controls with zone activation	Zoning with sensor controls allows heating, cooling and ventilation to operate in occupied areas as required only rather than the whole building, therefore optimising energy usage for each mode of operation.
LED lighting with intelligent lighting control	Energy efficient light fittings with zoning and sensor controls to optimise energy usage as above.

Mitigation measure	Mitigation Effect (Operational Energy carbon reductions)
CIBSE TM54 total operational energy prediction is being undertaken to identify opportunities to optimise plant size and influence equipment choice.	Better understanding of true energy use than Building Regulations Part L compliance modelling to inform design decisions on reducing energy consumption and carbon emissions towards net zero carbon 2038. Also provides the baseline for future post occupancy evaluation.
Clean – Supply energy efficiently	
Currently no local district heating for connection but plant room space and systems have been designed to allow future connection	District heating connection would allow current gas boilers within the building (for hot water and supplementary heating) to be replaced by a low carbon heat source.
Green – Use renewable energy	
Air source heat pumps (ASHP) with heat recovery for heating and cooling	ASHPs are powered by electricity therefore will benefit from reducing carbon emissions as the national electricity grid decarbonises. The ASHPs within the arena bowl also use the warm air extracted from the bowl as a heat source for improved performance efficiency. *Co-benefit: Much reduced on-site fossil fuel combustion benefits local air quality.*
PV area on the roof maximised.	Thin-film next generation PV proposed for on-site zero carbon electricity generation to partially displace requirement for grid electricity. *Co-benefit: Thin-film PV have a much lower carbon footprint than traditional PV. The lightweight technology can be installed on any surface, negating the need for additional structural support (and associated embodied carbon).*
Seen – Post occupancy	
Building Management System with extensive smart metering	Extensive energy sub-metering monitored through the BMS to enable end-use energy consumption to be analysed for anomalies and opportunities to target interventions to reduce.
Seasonal commissioning of building services systems over a 12-month period.	System testing during full load conditions (heating during mid-winter, cooling during mid-summer, all systems during maximum capacity) helps to optimise

Mitigation measure	Mitigation Effect (Operational Energy carbon reductions)
	the system for energy efficiencies and occupant comfort.
3-year Post occupancy evaluation commitment	Structured review of building performance and occupant satisfaction to identify opportunities for fine-tuning the building systems for energy savings against the TM54 operational energy prediction baseline.

15.79 Based on the current Proposed Development design, the associated operational energy carbon has been estimated as shown in Fig 15-2 (appended). Over the total 60-year study period, it is estimated that the Proposed Development will emit 15,808 tCO2e. This includes assumptions over grid decarbonisation and an illustrative switch from gas boilers for nominal stair core heating and hot water with alternative electric powered low carbon technologies in 2030. The actual timing and technologies will be subject to ongoing review of viable low carbon technologies and plant replacement cycles in operation. Energy consumption associated with equipment use has also been assumed to be constant but in reality, this could benefit from increasing efficiencies and more energy conscious behaviour of users, as noted in Table 15.12 mitigation opportunities.

15.80 To ascertain the scale and significance of the impact, the operational carbon for the Proposed Development has been put into context against best available industry benchmarks and targets identified in Table 15.8. However, it should be noted that arenas are bespoke, non-standard buildings and published total in-use energy data for this type of building is limited. Therefore, the comparison is illustrative only and not intended to be a direct measure of performance.

Table 15.8 Operational Energy Carbon Benchmark Comparison

Operational Carbon Benchmark	**OVG Manchester Operational Carbon Comparison** 15,808 tCO2e TOTAL (60-years) 32 kgCO2e/m2 GIFA /yr (2023)
Baseline Building used in the Energy Statement. Assumes standard building services systems for Building Regulations Part L 2013 compliance, notably gas boiler for heating and hot water. 38, 850 tCO2e TOTAL (60-years)	**59% carbon emissions saved** over the 60-year standard life of a building based on the designed-in mitigation measures within the Proposed Development ('Be Green' scenario within the Energy Statement. See Fig 15-3 for a comparison between the two scenarios.
Operational Energy benchmarks (CIBSE TM46:2008): **Entertainment Halls** *Large assembly and seating areas, with associated ticketing and snack services, for performance events and films:* 150 kWh/m^2/yr electricity + 420 kWh/m^2/yr gas = 94 kgCO2e/m2*	**32 kgCO2e/m2/yr** (in 2023, year of opening) offers significant reduction against available benchmarks for entertainment halls. This is largely due to limiting gas use (heating provided by ASHP rather than traditional gas boilers), high performance building envelope, high efficiency building services, and the ongoing decarbonisation of the UK electricity grid.

* Based on following carbon factors:

0.184 kgCO2e/kWh Gas (GHG reporting conversion factors, BEIS 2019)
0.110 kgCO2e/kWh UK electricity (Green Book grid average consumption-based carbon factor for commercial buildings in 2023, BEIS 2019)

15.81 Based on the above effects, the impact of operational effects (energy in-use) is considered moderate adverse, therefore significant. The designed-in mitigation measures trend towards achieving net zero over the lifecycle of the Proposed Development but further mitigation during the first 15 years of operation is required to transition to net zero by 2038, in line with Manchester City Council commitments, as noted in Table 15.12 mitigation opportunities.

15.82 Table 15.9 summarises the potential operational effects and their significance with designed-in mitigation.

Table 15.9 Potential operational effects and their significance with designed-in mitigation

Receptor	**Sensitivity**	**Description of effect**	**Magnitude of change/ impact**	**Effect significance**
Atmospheric GHG Concentrations	High	Increased GHG emissions arising due to building energy use in operation	Moderate	Major moderate adverse

Whole Life Carbon Summary

15.83 Over the 60-year study period, the total carbon associated with the operational energy and initial construction is 72,570 tCO2e. It can be seen that the embodied carbon associated with construction is the dominant portion compared to the operational energy (Fig 15.4).

15.84 To put the carbon into context of Manchester City Council (2019) zero carbon 2038 route map, with the budgets in Table 15.10 aligning with the national legislated Carbon Budget periods under the UK Climate Change Act 2008. As noted in Paragraph 15.28 (Policy Context), the budget relates to carbon emissions associated with fuel and electricity directly consumed within the city boundary, i.e. energy use in buildings and transport.

15.85 The estimated carbon emissions associated with the operational energy of the Proposed Development are shown as percentages of the Manchester City Council carbon budgets for a sense of scale. However, it should be noted that most commercial developments considered in isolation will likely be minor in comparison to the budget (i.e. <0.1%) but cumulatively, all operational energy from new development in Manchester between now and 2038 could represent a significant contributor. As such, every development needs to play its part in reducing energy use in operation.

15.86 Based on the above, the MCC carbon budgets have not been used as a test of significance for the operational carbon associated with the Proposed Development. This would only be meaningful if there was a mechanism of apportioning the budget to new development, for example by floor area/total forecasted floor area ratio over the budget period.

Table 15.10 Operational energy carbon emissions relative to MCC carbon budgets

Total budget (2018-2100) **tCO2e**	**Immediate Term** **(2018-2022)** **tCO2e**	**Medium Term (2023-2027)** **tCO2e**	**Long Term (2028-2037)** **tCO2e**
15,187,610	6,928,620	3,593,560	3,046,920
OVG Manchester Carbon associated with operational energy use (% of budget shown in brackets):			
15,808 (0.1%)	0	3899 (0.11%)	6161.47 (0.20%)

15.87 As noted in Paragraph 15.28 (Policy Context), product consumption within Manchester also causes a carbon footprint beyond its boundary, such as the embodied carbon associated with construction materials, therefore it is important to also actively reduce these carbon emissions contributions to the global carbon budget, as identified within the subsequent section on mitigation measures. Whilst not included within the MCC carbon budget, it can be seen that the total embodied carbon (56,761 tCO2e) would represent 0.4% for sense of scale.

15.88 Considering the construction and operational carbon together, the whole life carbon of the Proposed Development (72,570 tCO2e) represents 0.5% of the total MCC carbon budget for sense of scale.

Mitigation Measures

15.89 The Proposed Development will seek to explore further opportunities for mitigation during detailed design and in discussion with the contractor.

Construction

15.90 Supplementary mitigation opportunities to be actively explored during construction are detailed in Table 15.11. Note, these will be subject to detailed design and market testing to confirm

scale of embodied carbon reduction possible prior to adoption. Consideration of additional mitigations will be monitored through the BREEAM Mat 01 credits as part of the BREEAM certification process and incorporated into the whole life carbon assessment Stage 4 update to demonstrate reductions.

Table 15.11 Supplementary Construction mitigation opportunities

Supplementary Mitigation Opportunities	Responsibility/ Mechanism for implementation	Timing
Construction Products and Materials		
Reduce concrete use by reviewing benefits of switching to a full steel frame superstructure.	Structural Engineer and Contractor. Conclusion to be reflected in the Stage 4a design specifications.	RIBA Stage 4a
Maximise recycled content in the steelwork.	Contractor to advise on recycled content achievable through market testing. Structural Engineer to include in the Structural Steelwork Specification.	4b Market testing
Maximise recycled content in the concrete mixes through cement replacements.	Structural Engineer and Contractor to review technical implications, market availability and any impact on programme. To be included in the Structural Concrete Specification.	RIBA Stage 4a Detailed design
Where practical, maximise recycled content in other key building and fit-out components (e.g. blockwork, internal plasterboard partitions, floor finishes)	Contractor via the BREEAM Sustainable Procurement Plan.	RIBA Stage 4b Market testing
Where practical, maximise use of recycled aggregates in the civil engineering works (e.g. sub-base, pipe bedding)	Civil Engineer and Contractor to review technical implications and market availability. To be included in the Civil Engineering Specification.	RIBA Stage 4a Detailed design
Review opportunities to minimise internal finishes such as dry lining, ceilings and decorative floor screeds / covering where not technically required (e.g. for acoustics or fire protection), opting for fair faced finishes instead.	Architect to review during detailed design development in collaboration with the structural engineer.	RIBA Stage 4a Detailed design
Review opportunity to use low carbon materials in the FF&E.	Architect to review during detailed design development.	RIBA Stage 4a Detailed design
Construction Transport		
Preference for materials and components that are locally sourced to minimise transportation distances	Contractor via the BREEAM Sustainable Procurement Plan and Construction Management Plan.	RIBA Stage 4b Market testing

Supplementary Mitigation Opportunities	Responsibility/ Mechanism for implementation	Timing
Off-site modular construction to consolidate delivery requirements.	Contractor to advise on opportunities during design review and development.	RIBA Stage 4a Detailed design
Travel plan for site staff	Contractor. To be included as part of the Construction Management Plan.	Site enabling works
Construction Installation Processes		
Off-site construction for energy efficient assembly and minimising site installation processes	Contractor to advise on opportunities during design review and development.	RIBA Stage 4a Detailed design
Temporary electrical supply connection to minimise the use of on-site diesel generators.	Contractor. To be included as part of the Construction Management Plan.	Site enabling works
Site energy monitoring and improvement programme	Contractor. Monitored through BREEAM Man 03 and Construction Management Plan.	Site enabling works

Operational

15.91 Supplementary mitigation opportunities to be implemented during operation are detailed in Table 15.12. These represent further actions during the first 15 years of operation to transition to net zero carbon by 2038, as per Manchester City Council commitments.

Table 15.12 Supplementary Operational mitigation opportunities

Supplementary Mitigation Opportunities	Responsibility/ Mechanism for implementation	Timing
Phase out the use of gas for catering (currently in two kitchens only, all of concessions will be electric).	Applicant, in discussion with future catering partners, as emerging non-fossil fuel catering equipment that delivers the same offering becomes viable. As technology and carbon factors are changing at a rapid pace, this will also be reviewed during detailed design and construction and the switch made prior to installation if viable.	In operation, prior to 2038.

Supplementary Mitigation Opportunities	Responsibility/ Mechanism for implementation	Timing
Phase out gas boilers for hot water and heating in the stair cores.	Applicant, as part of maintenance and replacement programme as emerging new low carbon technology becomes more efficient and viable. This could include district heating if such a network became available in the locality or integration of solar hot water into a future PV array.	In operation, prior to 2038.
Align with any future Manchester requirements for carbon offsetting to achieve net zero by 2038.	Applicant, in collaboration with Manchester City Council as details of the final Zero Carbon 2038 Framework and Action Plan are published.	2038
Behaviour change campaign to encourage energy conscious behaviour of building users (staff, visitors, touring community), tying into the 3-year POE	Applicant, as part of operational management procedures.	First 3-years of occupation

Cumulative Effects

15.92 Not assessed, as per the Methodology (Paragraph 15.63).

Residual Effects

Construction

15.93 An estimated 56,761 tCO2e of embodied carbon can be attributed to the construction phase, resulting from the products and materials used plus their delivery to site and installation. Embodied carbon does not form part of the MCC carbon budget associated with the net zero carbon 2038 target, therefore does not preclude MCC from achieving this target. Measuring and reporting embodied carbon is still not widespread in the industry, with guidance for consistency in approach, quality of data available, benchmarking and strategies for reduction still evolving. The Proposed Development has followed best available guidance to estimate and reduce embodied carbon at the concept stage, providing a strong baseline to inform detailed design decisions to reduce embodied carbon. Initial benchmarking shows the estimated embodied carbon betters typical specialist leisure facilities and typical non-residential buildings. Furthermore, undertaking the embodied carbon assessment shows industry leadership in encouraging data sharing and discussion around embodied carbon, which is still an emerging topic.

15.94 If the designed-in mitigation measures and the supplementary mitigation opportunities are investigated to identify beneficial and viable embodied carbon measures to implement, construction effects on climate change should still be considered significant at the global scale (since all GHG emissions are contributing to climate change) but can be considered minor adverse at the local level since it is a short term net increase in GHG emissions and not an ongoing contribution that precludes Manchester from achieving net zero carbon by 2038.

Operational

15.95 Over the 60-year study period, an estimated 15,808 tCO2e can be attributed to operational carbon associated with energy use within the building. This is equivalent to 0.1% of the MCC total carbon budget for 2018-2100. The Proposed Development has taken best available measures to minimise its operational carbon, incorporating latest viable low carbon design

(efficient building envelope and building services systems) and technology (ASHP for heating and cooling, PV) to reduce energy consumption as much as possible for day one of operation. This is evident in the estimated 59% saving in operational carbon compared to a standard Building Regulations compliant building with a gas boiler for heating. Furthermore, there is a committed route map (mitigation measures) to net zero carbon with regard to operational energy by 2038 through future low or zero carbon retrofits and offsetting.

15.96 If the designed-in mitigation measures and the supplementary mitigation opportunities for the operational effects are implemented, operational effects on climate change should still be considered significant at the global scale (since all GHG emissions are contributing to climate change). However, at the local scale, the operational effects can be considered minor adverse since the Proposed Development results in short/medium term net increase in GHG emissions but systems and commitments are in place for reductions towards net zero carbon in operation by 2038.

15.97 A summary of all the residual adverse or beneficial effects are detailed in Table 15.13.

Table 15.13 Summary of Receptors, Likely Significant Effects, Mitigation Measures and Residual Effects

Effects	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Construction	Embodied carbon emissions contribution to atmospheric GHG concentrations	Major-Moderate adverse	Review opportunities for material efficiency and use of construction products and materials with lower embodied carbon.	Stage 4 design review and early contractor engagement	Moderate-minor adverse
			Review opportunities to reduce construction transport trips and distances.	Construction Environmental Management Plan	
			Review opportunities to reduce energy association with construction installation processes.	Construction Environmental Management Plan	
Operational	Embodied carbon emissions contribution to atmospheric GHG concentrations	Major Moderate adverse	Phase out gas	Operational maintenance and refurbishment plan	Moderate-minor adverse
			Carbon offsetting	Operational environmental management plan	

Part B: Climate Change Resilience

Assessment Methodology

15.98 This part of the chapter provides a high-level review of the vulnerability of the Proposed Development to climate change. The assessment methodology takes into account the recommendations in the IEMA EIA guide to Climate Change Resilience and Adaptation (2015) and has been adapted to ensure the assessment is proportionate to the Proposed Development and stage of design (RIBA Stage 3).

15.99 Since climate change adaptation has been addressed in the relevant technical chapters, this section seeks to summarise the climate risks and adaptation measures rather than undertake a formal process to evaluate the significance in line with the standard EIA methodology.

Identification and Evaluation of Significant Risks

15.100 The potential climate risks relevant to the Proposed Development have been drawn from Policy EN 8 in the Core Strategy (MCC, 2012) and the UK Climate Change Risk Assessment 2017. The project response is summarised in Table 15.14 below.

Table 15.14 Climate Change Risks and Adaptation Measures

Climate Risk	Construction Adaptation Measures	Operational Adaptation Measures
Warmer, wetter winters leading to flooding	A Flood Risk Assessment has been undertaken which concludes the Proposed Development is at low risk of flooding from all sources. On-site surface water management (green infrastructure, permeable paving, attenuation tank, rainwater harvesting) will reduce run-off rates by over 50% relative to existing to reduce the risk of flooding downstream. The attenuation and rainwater harvesting systems are combined in an active system to optimise storage and on-site use. Drainage design includes a 40% uplift for climate change, as agreed with the Environment Agency.	Effectiveness of the active rainwater system will be monitored through the facilities management and maintenance plan.
Hotter, drier summers leading to drought	Water demand will be minimised through the specification of water efficient sanitaryware and catering (implemented through BREEAM Wat 01) and rainwater harvesting from the active rainwater management system to meet 100% of WC flushing requirements. The automatic irrigation reduces the waste of water caused by applying the water manually (watering manually uses approximately 50% more water). Precise timer set to operate the irrigation in certain times provide the right quantity of water needed by plant.	Water use will be monitored as part of the 3-year Post Occupancy Evaluation commitment.
Ability of natural habitats and species to adapt	Soft landscaping has been developed in conjunction with an ecologist to include new native species, drought tolerant planting and connectivity between habitats to the wider Etihad Campus and surrounding green infrastructure.	Site specific landscape and habitat management plan, which aligns with the best practice management and monitoring procedures already in place across the Etihad Campus.

Climate Risk	Construction Adaptation Measures	Operational Adaptation Measures
Hotter summers leading to over-heating of buildings impacting occupant health & wellbeing	Due to the nature of the building, there is limited glazing, which also reduces solar heat gain. The building services systems have been designed with adaptive capacity for potential future increases in cooling requirements, informed by a thermal comfort assessment using future weather projections published by the Chartered Institution of Building Services Engineers (CIBSE).	Occupant comfort will be monitored through the initial 3-year Post Occupancy Evaluation and subsequent and subsequent reviews.
Hotter, drier summers leading to the urban heat island effect impacting on occupant health & wellbeing	The biodiversity green ring around the site comprising green screens and tree planters to introduce green infrastructure and natural shading to a tight urban plot. Building overhang provides natural shading. Public realm adjacent to the canal has been activated with wildflower planting and shaded seating, benefiting from evaporative cooling in hot weather.	A Heatwave Plan will be put in place to ensure excessive queuing in prolonged hot weather is appropriately managed.

Conclusion

15.101 The Proposed Development seeks to minimise climate risks to the physical building, public realm and soft landscaping through adaptation measures implemented during construction that are proportionate to the level of certainty associated with climate projections for the UK with regional interpretation.

15.102 To manage uncertainty, the Proposed Development seeks to incorporate adaptive capacity for future adaptation alongside periodic assessment of climate change risks in operation.

15.103 With the designed-in adaptation measures and additional adaptive capacity where appropriate, it can be concluded that the vulnerability of the Proposed Development is low.

15.104 Furthermore, it does not increase the vulnerability of surrounding developments to climate change effects, notably downstream flood risk reduced through the 50% reduction of surface water run-off from the site compared to existing.

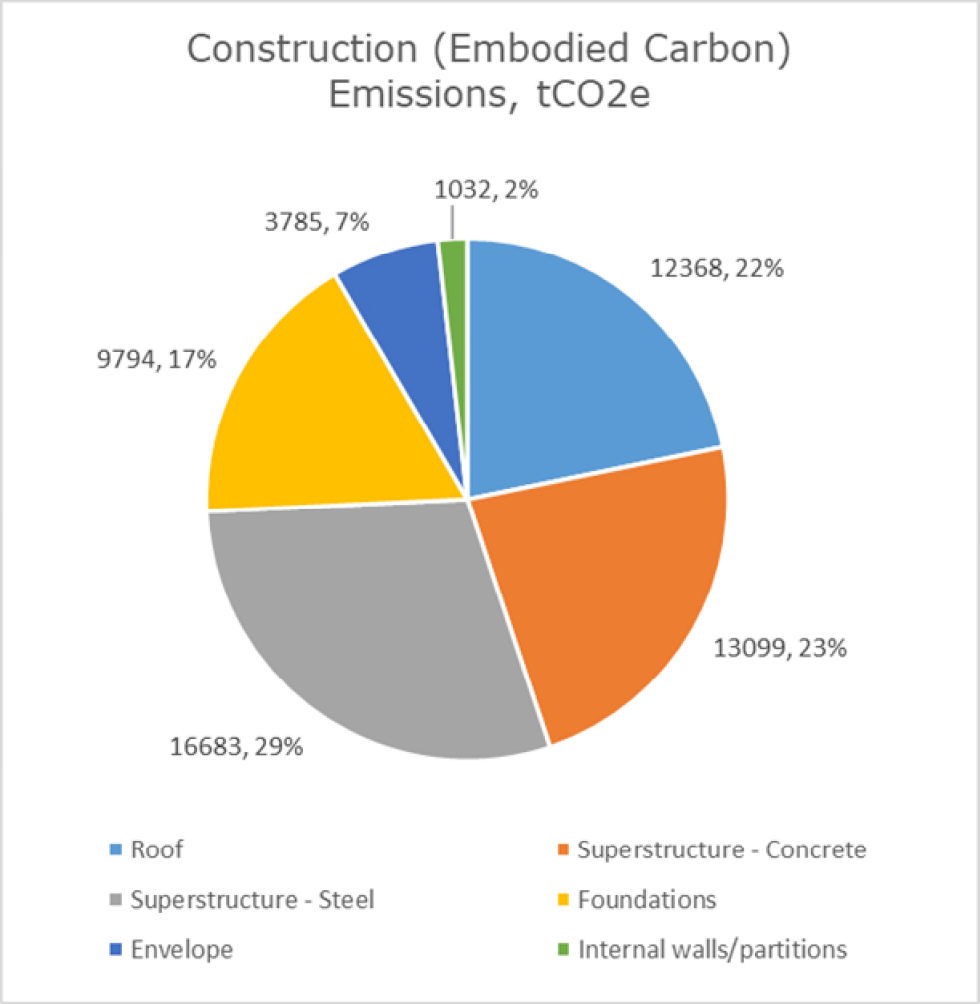
Reference List

15.105 This ES Chapter has been prepared by reference to the following:

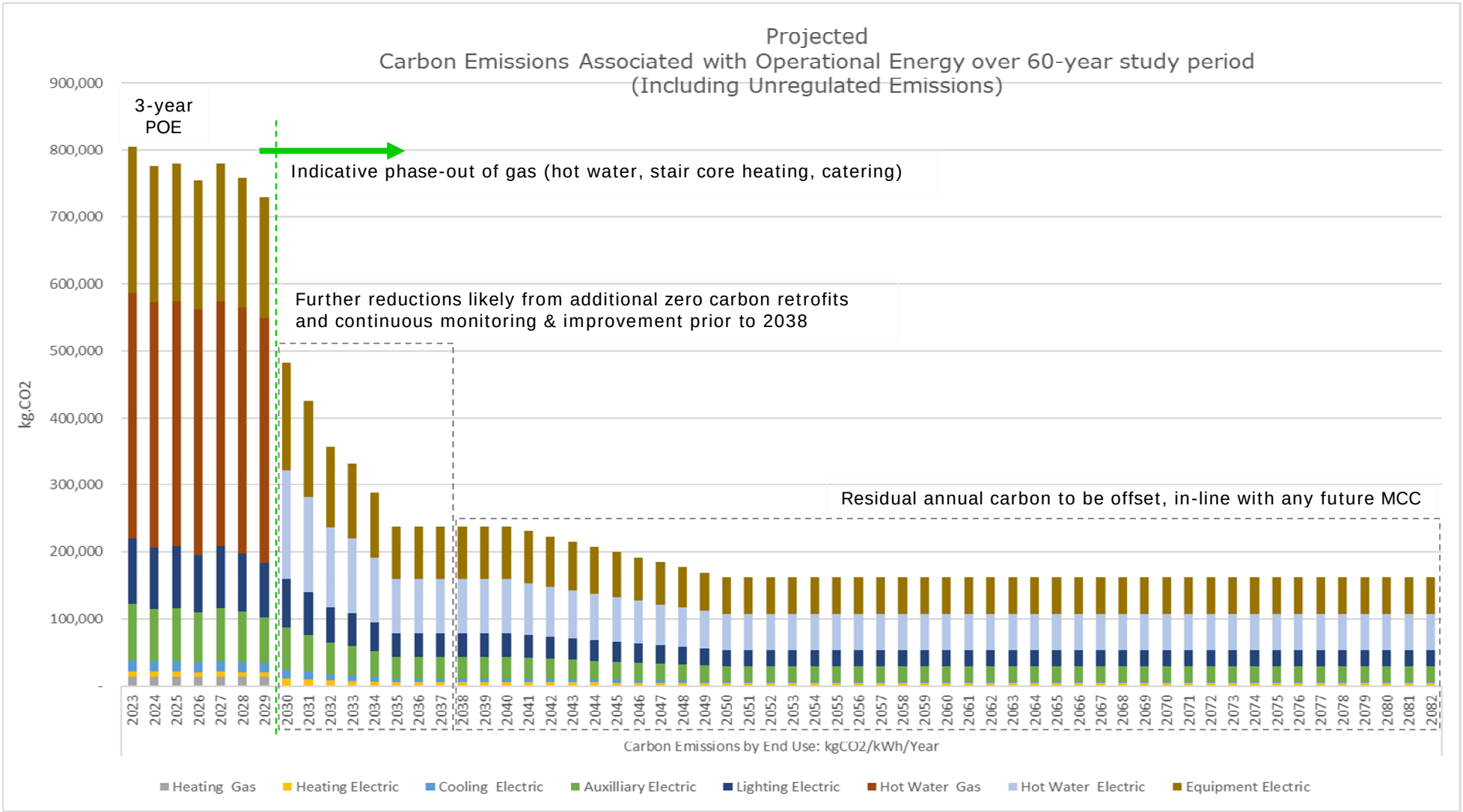
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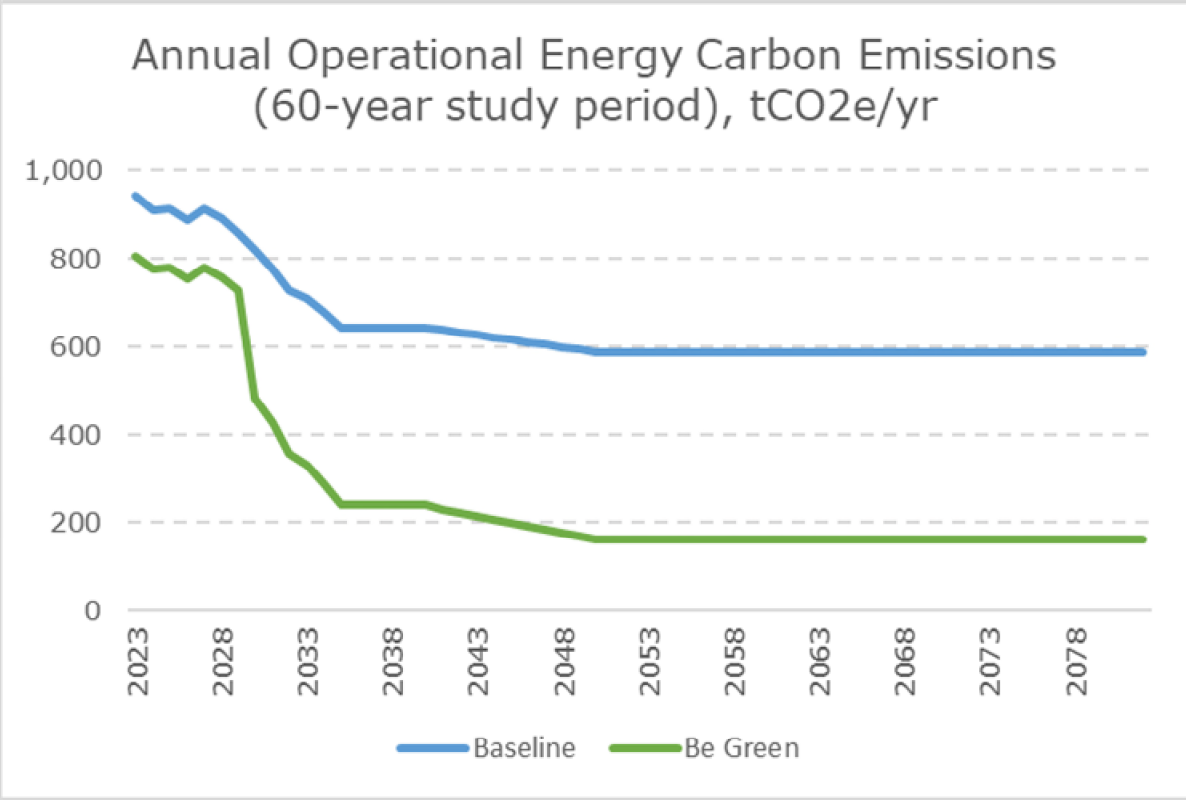
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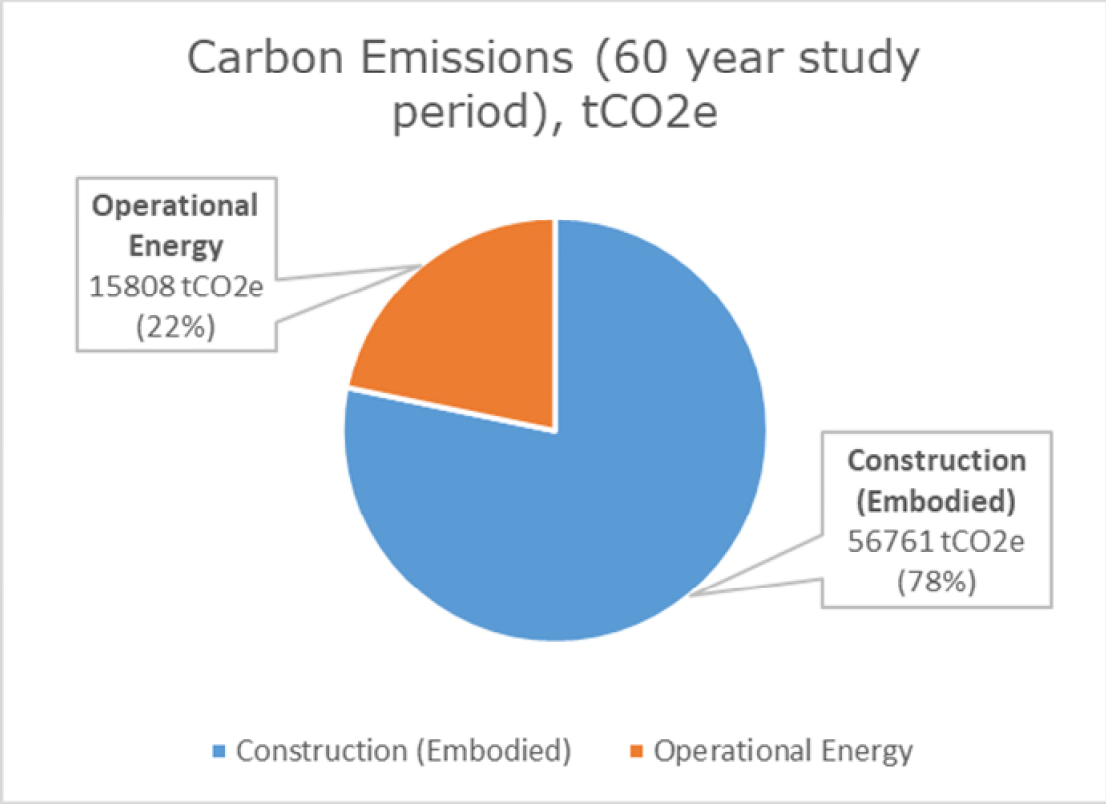
Environmental Statement **Chapter 15 Climate Change**	**Figure:**	**15.1**		
	Title:	**Embodied Carbon split by key building components**		
	Project:	**OVG Manchester**		
	Date:	**February 2020**	**Scale:**	**Scale /NTS**



Environmental Statement **Chapter 15 Climate Change**	**Figure:**	**15.2**		
	Title:	**Carbon Emissions Associated with Operational Energy over 60-year study period**		
	Project:	**OVG Manchester**		
	Date:	**February 2020**	**Scale:**	**Scale /NTS**



Environmental Statement **Chapter 15 Climate Change**	**Figure:**	**15.3**		
	Title:	**Embodied Carbon split by key building components**		
	Project:	**OVG Manchester**		
	Date:	**February 2020**	**Scale:**	**Scale /NTS**



Environmental Statement **Chapter 15 Climate Change**	**Figure:**	**15.4**		
	Title:	**Total construction and operational carbon associated with the Proposed Development over the 60-year study period**		
	Project:	**OVG Manchester**		
	Date:	**February 2020**	**Scale:**	**Scale /NTS**

16 Summary of Residual Effects

16.1 This chapter contains a summary of the residual effects of the Proposed Development.

Legislation, Policy and Guidance

Regulatory Requirement

16.2 The requirement for mitigation measures is specified in Schedule 4 (7) of the EIA Regulations, which states that Environmental Statements should include:

> *"A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases."*

16.3 The approach to mitigation measures is also echoed in Directive 2011/92/EU as amended by Directive 2014/52/EU at Article 5(1) and at Annex IV.

Planning Policy

16.4 This chapter considers policy relating to the mitigation of impacts from the Proposed Development. It should be read in conjunction with technical Chapters 6 - 14, where planning policy at the national, regional, county and local level is discussed in greater detail for each topic.

16.5 Paragraph 32 of the National Planning Policy Framework (NPPF) also outlines a hierarchical approach to mitigating effects:

> *"Significant adverse impacts on these [economic, social and environmental] objectives should be avoided and, wherever possible, alternative options which reduce or eliminate such impacts should be pursued. Where significant adverse impacts are unavoidable, suitable mitigation measures should be proposed (or, where this is not possible, compensatory measures should be considered)."*

Guidance

16.6 The Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Union, 2017) sets out that priority should be given to avoiding adverse impacts and with compensatory measures being considered only as a last resort.

Air Quality

Construction Phase

	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Construction	Nuisance from dust deposition and impact from elevated PM_{10} concentrations on human health	Major Adverse	Best practice mitigation measures for controlling dust/emissions during construction	Implemented into construction management plan and adhered to throughout construction phase.	Minor adverse/negligible (not significant)
Construction	Construction traffic generated by	Negligible	n/a	n/a	Negligible

	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
	the Proposed Development				

Operational Phase

	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Operational	Operational impacts from traffic and combustion plant emissions	Negligible	N/A	N/A	Negligible

Ground Conditions

Construction Phase

Receptor	Description	Pre-mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
Construction workers	Direct contact (direct and indirect) of contaminated ground. Inhalation of contaminated dusts and/or gas/vapours. Contact with UXO.	Major adverse	Implementation of appropriate health, safety and hygiene regime (to include PPE and welfare provisions). Implementation of good construction practice [dust suppression (e.g. dampening, wheel washing, site vehicle speed and route control, control of drop height for spoil]. All detailed in the CoCP, CEMP and Method Statements. Implementation recorded in a Verification or Completion Report. Inform health and safety for works in confined spaces. Control of entry into any enclosed below ground spaces. Detailed UXO risk assessment to be carried out prior to any extensive earthworks. Toolbox talks, watching brief and health and safety plans as required.	Negligible beneficial
Off-site users/ visitors	Direct contact with contaminated ground. Inhalation of contaminated dusts and/or gas/vapours.	Minor adverse	Implementation of good construction practice [dust suppression (e.g. dampening, wheel washing, site vehicle speed and route control, control of drop height for spoil]. All detailed in the CoCP, CEMP and Method Statements. Design for any ground gas protection measures informed by site investigation, detailed within the Remediation Strategy. Implementation recorded in a Verification or Completion Report.	Negligible beneficial
Controlled Waters [Secondary A Aquifer]	Derogation of quality by leaching and migration	Minor adverse	Carry out Foundation Works Risk Assessment and implement the Remediation Strategy informed by a site investigation.	Negligible adverse

Receptor	Description	Pre-mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
Controlled Waters [Ashton Canal]	Derogation of quality by surface water drainage and run-off	Major adverse	Implement measures to minimise infiltration (e.g. control areas of open excavation, temporary sealing/drainage measures). Avoid stockpiling contaminated soil. Any stockpile covered/placed on impermeable surface. Remove/treat gross contamination. Control of groundwater during excavation. Record in a Verification or Completion Report.	Negligible adverse
Controlled Waters [River Medlock]	Derogation of quality by leaching and migration	Major adverse		Negligible adverse
Buildings and Services	Sulphate attack and permeation of water supply pipework.	Minor adverse	Below ground concrete specified in foundation design informed by site investigation to meet relevant BRE and Water UK Standards as set out in the Remediation Strategy. Implementation recorded in a Verification or Completion Report.	Negligible beneficial
Flora and Fauna	Impact on plant growth / health	Negligible	Not applicable during construction for existing vegetation. Imported subsoil and topsoil materials to meet appropriate chemical, physical and biological criteria to accord with British Standards (BS3882) as set out in the Remediation Strategy. Implementation recorded in a Verification or Completion Report.	Negligible beneficial

Operational Phase

Receptor	Description	Pre-mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
On-site users and visitors	Ingestion and dermal contact with contaminated materials in soft landscaped areas.	Negligible	Implementation of the approved Remediation Strategy during construction. Implementation recorded in a Verification or Completion Report.	Negligible
	Gas/vapour build up in confined spaces resulting in build-up of explosive gases.	Negligible		Negligible
Off-site users and visitors	Gas/vapour build up in confined spaces of neighbouring properties resulting in build-up of explosive gases.	Negligible		Negligible
Groundwater [Secondary A Aquifer]	Reduction in groundwater quality.	Negligible		Negligible
Controlled Waters [River Medlock]	Reduction in water quality.	Negligible		Negligible
Controlled Waters [Ashton Canal]	Reduction in water quality.	Negligible		Negligible
Built Environment	Aggressive attack on below ground concrete and/or residual contamination	Negligible		Negligible

Receptor	Description	Pre-mitigation significance	Mitigation method and means of implementation	Post-Mitigation Significance and Duration
	permeating in ground plastic water supply pipework.			
Flora and Fauna	Residual contamination within subsoils and topsoils.			Negligible

Socio-Economic Impacts

Construction Phase

Effect	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Manchester workforce	1,894 FTE direct, indirect and induced temporary jobs created during the construction phases within Manchester	Moderate Beneficial, Temporary	N/A	N/A	Moderate Beneficial, Temporary

Operational Phase

Effect	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Local Employment	Generation of 586 net operational jobs once complete and occupied	Moderate beneficial, permanent	N/A	N/A	Moderate beneficial, permanent
Local Businesses	Attraction of approximately 1 million visitors a year will generate approximately £36 million in additional local spending per annum.	Major beneficial, permanent	N/A	N/A	Major beneficial, permanent
	The Proposed Development will significantly increase the City's ability to host large events.	Major beneficial, permanent	N/A	N/A	Major beneficial, permanent
Local Residents and Local Businesses	Improvements to regeneration objectives and several domains of deprivation including income and employment	Major beneficial, permanent	N/A	N/A	Major beneficial, permanent

Effect	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Local Residents	The Proposed Development will provide approximately 1,947 sqm of public open space / amenity space	Negligible	N/A	N/A	Negligible, permanent

Lighting

Construction Phase

Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
R1- Philips Park Cemetery	Negligible	-	Design	Negligible Temporary
R2- Philips Park	Negligible	-	Design	Negligible Temporary
R3- Residential Properties	Negligible	-	Design	Negligible Temporary
R4- Residential Properties	Negligible	-	Design	Negligible Temporary
R5- Ashton Canal	Negligible	-	Design	Negligible Temporary
R6- Site boundary	Negligible	-	Design	Negligible Temporary
R7- Alan Turing Way	Negligible	-	Design	Negligible Temporary

Operational Phase

Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
R1- Philips Park Cemetery	Negligible	-	Design	Negligible Permanent
R2- Philips Park	Negligible	-	Design	Negligible Permanent
R3- Residential Properties	Negligible	-	Design	Negligible Permanent
R4- Residential Properties	Moderate- Adverse	Lighting Control System	Lighting Control- Dimming lighting	Negligible Permanent
R5- Ashton Canal	Negligible	-	Design	Negligible Permanent
R6- Site boundary	Minor- Adverse	Lighting Control System	Lighting Control- Dimming lighting	Negligible Permanent
R7- Alan Turing Way	Negligible	-	Design	Negligible Permanent

Noise and Vibration

Construction Phase

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
A – Properties along Stuart Street	Construction noise due to Site Preparation	Moderate / Minor adverse	Implementation of a CMP which includes the mitigation measures outlined above (Paragraph 10.89).	N/A	Minor
	Construction noise due to site activities	Moderate / Minor adverse	Implementation of a CMP which includes the mitigation measures outlined above (Paragraph 10.89).	N/A	Minor
	Construction vibration effect on humans	Negligible	N/A	N/A	Negligible
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
B – Properties along Gibbon Street	Construction noise due to Site Preparation	Negligible	N/A	N/A	Negligible
	Construction noise due to site activities	Negligible	N/A	N/A	Negligible
	Construction vibration effect on humans	Negligible	N/A	N/A	Negligible
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
C – Properties along New Viaduct Street	Construction noise due to Site Prep	Negligible	N/A	N/A	Negligible
	Construction noise due to site activities	Negligible	N/A	N/A	Negligible
	Construction traffic noise	Negligible	N/A	N/A	Negligible
	Construction vibration effect on humans	Negligible	N/A	N/A	Negligible
	Construction vibration effect on buildings	Negligible	N/A	N/A	Negligible

Operational Phase

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
A – Properties along Stuart Street	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible
B – Properties along Gibbon Street	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible
C – Properties along New Viaduct Street	Operational noise from entertainment noise	Negligible	N/A	N/A	Negligible

NSR	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
	Operational noise from crowd noise	Negligible	N/A	N/A	Negligible
	Operational noise from fixed plant and equipment	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, year of opening	Negligible	N/A	N/A	Negligible
	Operational noise from traffic noise, 15 years after opening	Negligible	N/A	N/A	Negligible

Townscape and Visual Impact

Construction Phase

Receptor	Sensitivity	Phase	Magnitude/direction of change	Significance
Townscape				
Heritage Designations	Low	Construction	Minor Adverse	Not Significant
Townscape Character	Low	Construction	Minor Adverse	Not Significant
Urban Grain	Low	Construction	Minor Adverse	Not Significant
Land Use	Low	Construction	Negligible	Not Significant
Building Heights	Medium	Construction	Negligible	Not Significant
Topography and Site Levels	Low	Construction	Negligible	Not Significant
Movement and Linkages	Low	Construction	Minor Adverse	Not Significant
Environmental Designations & Public Open Space	Low	Construction	Moderate Adverse	Not Significant
Site Character	Low	Construction	Minor Adverse	Not Significant
Views				
Viewpoint 1	Medium	Construction	Moderate Adverse	Moderately significant
Viewpoint 2	High	Construction	Moderate Adverse	Moderately significant

Receptor	Sensitivity	Phase	Magnitude/direction of change	Significance
Viewpoint 4	Low	Construction	Minor Neutral	Not Significant
Viewpoint 5	High/medium	Construction	Minor Neutral	Not Significant
Viewpoint 6	High/medium	Construction	Moderate Adverse	Moderately significant
Viewpoint 7	High/medium	Construction	Moderate Neutral	Not Significant
Viewpoint 8	High/medium	Construction	Minor Neutral	Not Significant
Viewpoint 9	Medium/low	Construction	Negligible	Not Significant
Viewpoint 10	Low	Construction	Moderate Adverse	Minor Significance
Viewpoint 11	High/medium	Construction	Minor Neutral	Not Significant

Operational Phase

Receptor	Sensitivity	Phase	Magnitude/direction of change	Significance
Townscape				
Heritage Designations	Low	Operational	Negligible	Not Significant
Townscape Character	Low	Operational	Major Beneficial	Moderately significant
Urban Grain	Low	Operational	Major Beneficial	Moderately significant
Land Use	Low	Operational	Major Beneficial	Moderately significant
Building Heights	Medium	Operational	Moderate Beneficial	Moderately significant
Topography and Site Levels	Low	Operational	Minor Beneficial	Not Significant
Movement and Linkages	Low	Operational	Moderate Beneficial	Not Significant
Environmental Designations & Public Open Space	Low	Operational	Moderate Beneficial	Not Significant
Site Character	Low	Operational	Major Beneficial	Moderately significant
Views				
Viewpoint 1	Medium	Operational	Moderate Neutral	Not Significant
Viewpoint 2	High	Operational	Moderate Adverse	Moderately significant

Receptor	Sensitivity	Phase	Magnitude/direction of change	Significance
Viewpoint 3	High/medium	Operational	Moderate Beneficial	Moderately significant
		Operational – night-time view	Moderate Beneficial	Moderately significant
Viewpoint 4	Low	Operational	Minor Beneficial	Not Significant
Viewpoint 5	High/medium	Operational	Moderate Beneficial	Moderately significant
Viewpoint 6	High/medium	Operational	Minor Beneficial	Moderately significant
Viewpoint 7	High/medium	Operational	Major Beneficial	Significant
		Operational – night-time view	Major Beneficial	Significant
Viewpoint 8	High/medium	Operational	Minor Beneficial	Minor Significance
Viewpoint 9	Medium/low	Operational	Negligible	Not Significant
Viewpoint 10	Low	Operational	Moderate Adverse	Minor Significance
Viewpoint 11	High/medium	Operational	Minor Beneficial	Moderately significant

Traffic and Transport

Construction Phase

Receptor	Effect	Significance before supplementary mitigation	Supplementary mitigation	Residual effect significance
All local roads and road users	Construction Impact on all road users	Negligible	No further mitigation required. CLP should be implemented and secured through appropriate planning condition	Negligible

Operational Phase

Receptor	Effect	Significance before supplementary mitigation	Supplementary mitigation	Residual effect significance
All local roads	Traffic Impact on all Road Users - severance, driver delay, pedestrian and cycle delay, pedestrian and cycle amenity, and highway safety	Negligible	None required	Negligible

Water Quality, Drainage and Flood Risk

Construction Phase

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
Ashton Canal water quality	Increased sediment loads	Major adverse	Implementation of a CEMP. Minimise areas of exposed surface by only removing vegetation and hardstanding when necessary. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exit points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures with are typically implemented for air quality management purposes. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	Minor adverse (temporary)
	Accidental release of hydrocarbons	Major adverse	Implementation of a CEMP. Incorporate interceptors into the Site drainage system at high risk areas. Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse (temporary)
	Accidental release of hazardous materials	Major adverse	Implementation of a CEMP. Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	Minor adverse (temporary)
	Leak or breakage of temporary sewage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection.	Minor adverse (temporary)
	Dust and debris blown from site	Major adverse	Develop dust management plan which will include procedures aimed at minimising dust generation on-site.	Minor adverse (temporary)
River Medlock water quality	Increased sediment loads	Major adverse	Implementation of a CEMP. Minimise areas of exposed surface by only removing vegetation and hardstanding when necessary. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exit points.	Minor adverse (temporary)

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
			Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures with are typically implemented for air quality management purposes. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	
	Accidental release of hydrocarbons	Major adverse	Implementation of a CEMP. Incorporate interceptors into the Site drainage system at high risk areas. Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse (temporary)
	Leak or breakage of temporary sewage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection.	Minor adverse (temporary)
Water services infrastructure (supply)	Increased water demand during the construction process	Minor adverse	All contractors should investigate opportunities to minimise and reduce the use of water, such as: • Selection and specification of equipment; • Implementation of staff-based initiatives such as turning off taps, plant and equipment when not in use both onsite and within site offices; • Use of recycling water systems such as wheel washes, site toilets handwash; and • Use of a rainwater harvesting system for use in equipment and vehicle washing.	Negligible
Water services infrastructure (surface drainage capacity)	Dewatering of excavations	Moderate adverse	Capture run off from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Sediment should be removed from water during any extractions required. Sediment should be removed prior to discharges to the surface water network or on-site ponds through the use of a baffle tank system or equivalent. If there is a requirement for discharge to the foul sewer, this should be	Negligible

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
			throttled to a flow rate that is agreed UU prior to commencing works.	
Flood risk to construction workers and plant users	Flood risk to site from workers	Moderate/ Minor adverse	Contractor to prepare a flood emergency and contingency plan. Construction site users made aware of risks.	Negligible

Operational Phase

Receptor	Description	Pre-mitigation significance	Mitigation Method	Post-Mitigation Significance and Duration
River Medlock water quality	Pollutants contained in surface water	Negligible	No further measures required	Negligible
Water services infrastructure (supply)	Increased potable water demand	Minor adverse	Early engagement with UU on the potable water needs for the Proposed Development, and any current restrictions and the need for any upgrades. Water efficiency measures that will reduce potable demand and subsequent foul flows including one or more of the following: • Low flow fittings: low flush toilets, spray taps and low flow showers, if necessary; • Efficient water supply: Leak detection, smart meters and pressure reduction. The advantage of demand management is not only for reducing supply, but also for minimising the volume of the foul drainage element to the combined sewer.	Negligible
Water services infrastructure (foul water capacity)	Increased foul water drainage demand	Negligible	No further measures required	Negligible
Water services infrastructure (surface water drainage capacity)	Increased flood risk	Negligible	No further measures required	Negligible
Humans/ uses vulnerable to flood risk	Flood risk to humans/ uses vulnerable to flood risk	Negligible	No further measures required	Negligible

Wind Microclimate

Construction Phase

16.1 There are no significant residual construction effects, therefore no mitigation is required. However, standard construction mitigation measures will be implemented including standard site hoardings to shelter neighbouring areas.

Operational Phase

	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Operational	Area of wind acceleration at the southeast corner of the podium during winter	Minor adverse	Planters and trees on the podium, porous green wall on the east side of the podium	Implemented during construction	Negligible
Operational	Wind acceleration leading to a safety issue at the southeast corner of the podium	Major adverse	Planters and trees on the podium, porous green wall on the east side of the podium	Implemented during construction	Negligible
Operational	Wind acceleration leading to a safety issue at the south of the Proposed Development	Major adverse	Existing landscape surrounding the Site	Already existing	Negligible
Operational	Wind acceleration leading to a safety issue to the east of the Site adjacent to a 10-storey residential building	Major adverse	Existing landscape surrounding the Site	Already existing	Negligible

Climate Change

Construction Phase

Effects	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Construction	Embodied carbon emissions contribution to atmospheric GHG concentrations	Major-Moderate adverse	Review opportunities for material efficiency and use of construction products and materials with lower embodied carbon.	Stage 4 design review and early contractor engagement	Moderate-minor adverse
			Review opportunities to reduce construction transport trips and distances.	Construction Environmental Management Plan	

Effects	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
			Review opportunities to reduce energy association with construction installation processes.	Construction Environmental Management Plan	

Operational Phase

Effects	Description	Pre-mitigation significance	Mitigation Method	Means of Implementation	Post-Mitigation Significance and Duration
Operational	Embodied carbon emissions contribution to atmospheric GHG concentrations	Major Moderate adverse	Phase out gas	Operational maintenance and refurbishment plan	Moderate-minor adverse
			Carbon offsetting	Operational environmental management plan	

17 Type 1 Cumulative Assessment

17.1 This Chapter assesses 'Type 1' cumulative effects, drawing on the results of the technical assessments contained in Chapters 6 to 15 of this ES.

17.2 The assessment is informed by the results of the technical assessments, as summarised out in Chapter 16 of this ES.

17.3 Type 1 cumulative effects are also known as 'intra-project' effects, which are the effects that can occur between different environmental topics within the same proposal. These are the combined effects arising from the Proposed Development upon a set of defined sensitive receptors which are known as inter-relationship effects.

17.4 Type 2 cumulative effects are considered within Chapters 6 to 14 of this ES. As set out within Chapter 15 Climate Change, any development will result in GHG emissions and the cumulative concentration in the atmosphere will contribute to climate change. The receptor and cumulative effects from nearby committed developments are therefore at the global rather than local scale and as such there is no assessment of scenarios with committed developments.

17.5 The technical chapters also had regard to the potential for Type 1 cumulative effects, however for robustness the results of a standalone assessment of these is provided below.

Legislation, Policy and Guidance

Legislation

17.6 There is no legislation outlining how cumulative effects should be assessed. EIA Regulations Schedule 4(5) states that the EIA should consider cumulative effects. Cumulative is not defined in the EIA Directive or Regulations however a dictionary definition is 'increasing by one addition after another'.

17.7 The EIA Regulations require 'a description of the likely significant effects', including cumulative effects.

17.8 In the context of this assessment, 'cumulative effects' refers to the interactions between different likely residual effects resulting from the Proposed Development (Type 1). Both positive and negative effects are considered across the construction and operational phases.

Policy

17.9 As this chapter considers the cumulative effects of the technical areas within the ES, all relevant policy has already been reviewed within the individual technical chapters.

Guidance

17.10 A number of guidance documents which relate to assessing cumulative effects have been used to inform the assessment and include:

- European Commission (EC) Environment DG (May 1999), 'Study on the Assessment of Indirect and Cumulative Impacts as well as Impact Interaction', Hyder Consulting;
- Institute of Environmental Management and Assessment (1992), Guidelines for the Environmental Assessment of Road Traffic; and,
- IEMA, 'The State of Environmental Impact Assessment in Practice in the UK' (2011).

17.11 The EC guidelines 'are not intended to be formal or prescriptive, but are designed to assist EIA practitioners in developing an approach which is appropriate to a project'.

17.12 As set out in the IEMA article 'Cumulative effects assessment: a call to arms' (April 2019) there is currently little industry guidance on the assessment of Type 1 cumulative effects, with no clear, agreed approach.

Assessment Methodology and Significance Criteria

Methodology

17.13 This assessment is primarily concerned with the scenario where there is a likelihood of significant Type 1 cumulative effects occurring, in accordance with EIA practice and the NPPG guidance.

17.14 The assessment is based on experience and professional judgement, drawing upon relevant guidance as referenced above and the residual environmental effects identified within the results of the EIA technical assessments. The assessment has been undertaken by suitably qualified and experienced EIA practitioners.

17.15 The assessment has primarily focused on sensitive receptors identified on the Site and within close proximity to the Site, likely cumulative effects, and their capacity to accommodate changes that will occur as a result of the combined residual environmental effects.

17.16 Relevant guidance has been reviewed, and an approach has been developed that uses the residual environmental effects identified within the ES. An exercise that tabulates the residual effects against receptors or receptor groups has then been carried out in order to identify the potential for Type 1 cumulative effects which is presented in Chapter 17.

17.17 Negligible or neutral residual effects have been excluded from the assessment as, by their nature, they are considered to be imperceptible. Therefore, only minor, moderate or major effects have been given consideration during the Type 1 cumulative effects assessment.

17.18 For the purposes of the assessment, sensitive receptor groups have been identified as those on and surrounding the Site and those identified within the individual technical assessments.

Significance Criteria

17.19 The following terms have been used to define the significance of the effects identified:

- Major effect: where inter-relationship effects arising from the Proposed Development could be expected to have a very significant effect (either positive or negative) on a defined receptor / receiving environment;
- Moderate effect: where inter-relationship effects arising from the Proposed Development could be expected to have a noticeable effect (either positive or negative) on a defined receptor / receiving environment;
- Minor effect: where inter-relationship effects arising from the Proposed Development could be expected to result in a small, barely noticeable effect (either positive or negative) on a defined receptor / receiving environment; and
- Negligible: where no discernible inter-relationship effects are expected as a result of the Proposed Development on the defined receptor / receiving environment.

17.20 The significance level attributed to each effect has been assessed based on the magnitude of change due to the combination of residual effects and the sensitivity of the affected receptor/receiving environment to change, as outlined in Chapter 2 of the ES. Magnitude of change is assessed on a scale of major, moderate, minor and negligible and the sensitivity of the affected receptor/receiving environment is assessed on a scale of high, moderate, low and negligible.

Limitations and Assumptions

17.21 Due to the reliance on qualitative data and subjective opinion, there are limitations related to the range and depth in which the cumulative effects have been investigated. It must be realised that analysing the cumulative effects of developments is often speculative and cannot be predicted as clearly as individual effects such as the effects upon traffic of a development, which relies heavily upon quantitative data to inform the assessment. As a result, a number of assumptions have been made throughout in terms of the outcome of the accumulation of effects and based upon professional judgement. This section and the assessment process of identifying the likely significant Type 1 cumulative effects have, however, provided a reasoned consideration of, and insight into, the potentially significant Type 1 cumulative effects of the Proposed Development.

Identification of Likely Significant Type 1 Cumulative Effects

Construction Phase

17.22 As above, sensitive receptor groups are only considered further within the Type 1 cumulative effects assessment where an individual effect that is more than negligible has been identified as a residual effect post mitigation within technical chapters 6 to 15.

17.23 On that basis, the following sensitive receptors have been excluded from the Type 1 cumulative effects assessment as individual effects upon them were categorised has being negligible:

- Local Road Network.
- Local Road Users.
- Heritage assets, including nearby listed buildings and parks (Philips Park and Philips Park Cemetery).
- Ecology, Flora and Fauna.
- Water Supply.

17.24 Based on the methodology detailed above, Table 17.1 presents the results of the review of the potential for interactions of individual effects during the construction phase of the Proposed Development. The potential effect interactions are then discussed further.

Table 17.1: Construction Phase Type 1 Cumulative Effects

Sensitive Receptor Group	Construction Phase Residual Effects Likely Significant Effects	Likely Type 1 Cumulative Effects
Local Residents and Human Health	Minor adverse, short-term and temporay impact on air quality nuisance from dust deposit during construction. Minor adverse, short-term and temporary noise impacts on local residents living on Stuart Street.	Minor adverse, short-term and temporary cumulative impact on local residents and human health in relation to air quality and noise during the construction phase. The effect is not considered to be significanct in EIA terms
Construction Workers and Local Workforce, Human Health	Minor adverse / negligble, short-term and temporary effect from air quality in relation to dust deposition during construction. Moderate beneficial, short-term and temporary impact through the creation of new direct and indirect jobs. No other residual effects expected.	There will be combined intra-project effects on this receptor during the construction phase, some of which will be beneficial and other minor adverse to negligible, all short-term and temporary in nature. Overall, the cumulative effect is judged to be minor beneficial and therefore not considered to be significant in EIA terms.
Ashton Canal	Minor adverse, short-term and temporary impact on the water quality due to construction works. No other residual effects expected.	There are likely to be no significant intra-project effects on the Ashton Canal during the construction phase. Potential minor adverse effects in relation to water quality will be short-term and temporary in nature.
River Medlock	Minor adverse, short-term and temporary impact on the water quality due to construction works.	There are likely to be no significant intra-project effects on the River Medlock during the construction phase. Potential minor adverse effects in relation to water quality

Sensitive Receptor Group	Construction Phase Residual Effects Likely Significant Effects	Likely Type 1 Cumulative Effects
	No other residual effects expected.	will be short-term and temporary in nature
Local Townscape	Minor to Moderate adverse, short-term and temporary townscape and visual impact on a select number of viewpoints during the construction phase. No other residual effects expected	There are likely to be no significant intra-project effects on the local townscape during the construction phase.
Climate	Moderate-minor adverse effects in relation to emobided carbon emissions to atmoshperic Greenhouse Gas concentrations.	There are likely to be no significant intra-project effects on the local townscape during the construction phase.

17.25 Table 17.1 demonstrates that there is potential for inter-relationship Type 1 cumulative effects to arise during the construction phase; however, these are not expected to be significant in EIA terms and will be temporary and short term in duration.

17.26 Individual residual effects with the potential to give rise to a significant Type 1 cumulative effect are predominantly expected to relate to the interaction between temporary adverse construction (nuisance) impacts which are temporary and short term in duration.

Human Health during Construction Phase

17.27 Human health impacts are most likely to occur where the sensitive receptor group are Local Residents and Local Workforce and are assessed as part of the relevant technical chapters. During the construction phase there is likely to be a minor adverse impact on human health in relation to air quality (Chapter 6) and noise and vibration (Chapter 10). The adverse construction affects will be temporary in nature and largely mitigated through the implementation of a construction management plan, which will be controlled through a planning condition. An outline Construction Management Plan is set out in Appendix 5.1.

17.28 There will also be moderate beneficial effects in respect of the creation of direct and indirect employment for a temporary, short-term duration. The implementation of a Local Benefit Proposal during the construction phase will ensure training opportunities and apprenticeships are available to local residents and therefore may lead to higher incomes, which could be associated with better health outcomes and reduced mortality.

17.29 Overall, the intra-project effects in respect of human health during the construction period are considered to be not significant in EIA terms.

Operational Phase

17.30 As above, sensitive receptor groups are only considered further within the Type 1 cumulative effects assessment where an individual effect that is more than negligible has been identified within technical chapters 6 to 15.

17.31 On that basis, the following sensitive receptors have been excluded from the Type 1 cumulative effects assessment as individual effects upon them were categorised has being negligible:

- Local Road Network
- Local Road Users
- Heritage assets, including nearby listed buildings and parks (Philips Park and Philips Park Cemetery).
- River Medlock and Ashton Canal.

- Ecology, Flora and Fauna.

17.32 Based on the methodology detailed above, Table 17.2 presents the results of the review of the potential for interactions of individual effects during the operational phase of the Proposed Development. The potential effect interactions are then discussed further.

Table 17.2: Operation Phase Type 1 Cumulative Effects

Sensitive Receptor Group	Operational Phase Residual Effects Likely Significant Effects	Likely Type 1 Cumulative Effects
Local Residents and Human Health	Major beneficial and permanent, long-term improvements to regeneration objectives and several domains of deprivation including income and employment during the operational phase. Minor to Major beneficial effects arising out of improvements to the townscape, including townscape character, land use, movement and linkages, which will help to create an enhanced environment for local residents. No other residual effects expected.	Minor to Major beneficial, permanent and long-term impact on local residents and human health as a result of additional employment opportunities and an enhanced townscape as a result of regeneration.
Visitors to the Proposed Development and Human Health	Minor to Major beneficial effects arising out of improvements to the townscape, including townscape character, land use, movement and linkages, which will help to create an enhanced environment for local residents.	There are likely to be no significant intra-project effects on visitors and human health during the operational phase.
Local Businesses and Human Health	Moderate beneficial, permanent and long-term impact through the attraction of approximately 1 million visitors a year will generate approximately £36 million in additional local spending per annum. Major beneficial and permanent, long-term improvements to regeneration objectives and several domains of deprivation including income and employment. Minor to Major beneficial effects arising out of improvements to the townscape, including townscape character, land use, movement and linkages, which will help to create an enhanced environment for local businesses. No other residual effects expected.	Moderate to Major beneficial, permanent and long-term impact on local businesses as a result of additional footfall, business opportunities and an enhanced townscape as a result of regeneration.
Local Economy	Moderate beneficial, permanent and long-term impacts through the generation of 586 net operational jobs once complete and occupied. No other residual effects expected.	There are likely to be no significant intra-project effects on the local economy during the operational phase.
Local Townscape	Minor to Major beneficial, permanent townscape enhancements.	Overall, the operational phase of the Proposed Development will give

Sensitive Receptor Group	Operational Phase Residual Effects Likely Significant Effects	Likely Type 1 Cumulative Effects
	Moderate to minor adverse to moderate beneficial, permanent visual impact on a number of views. No other residual effects expected.	rise to minor to moderate effects on townscape and viewpoints. These intra-project effects are not considered to be significant in EIA terms.
Climate	Moderate-minor adverse effects in relation to embodied carbon emissions to atmospheric Greenhouse Gas concentrations.	There are likely to be no significant intra-project effects in relation to the climate during the operational phase.

17.33 Table 17.2 demonstrates that there is potential for inter-relationship Type 1 Cumulative Effects during the operational phase of the Proposed Development in relation to Local Residents and Human Health, Local Businesses and the Local Townscape.

17.34 The socio-economic impacts together with the townscape and visual impacts are likely to give rise to cumulative effects on local residents, human health and local businesses. It is considered that there are likely long-term, permanent beneficial impacts arising from the interaction of effects as described in Table 17.2.

Human Health during Operational Phase

17.35 Human Health is included in the relevant technical chapters which is considered a proportionate response for the Proposed Development. As with the construction phases, there are particular receptors which are more likely to experience a human health impact. During the operational phase these receptors are Local Residents, Local Economy and Local Businesses.

17.36 As set out in Chapter 16, post-mitigation the are considered to negligible operational impacts in terms of Air Quality, Ground Conditions, Lighting, Noise and Vibration, Traffic and Transport, Water Quality and Wind Microclimate. On this basis it is considered these are likely to lead to non-significant effects on Human Health in EIA terms.

17.37 There are however significant beneficial socio-economic impacts as a result of the Proposed Development. As with the construction phase, the Applicant is committed to working with Manchester City Council's Work and Skills Team and enter into a Local Benefit Proposal (see Local Benefit Proposal by OVG submitted in support of the planning application). The Local Labour Agreement will ensure that training and job opportunities are available for local residents. This training includes those at school and career pathway guidance. This therefore has the potential to increase income and social mobility which in turn is shown to improve a person's health. These benefits are not just felt by those directly employed by at the Proposed Development but also local business who will benefit from the increase in visitors to the area and ongoing regeneration benefits.

17.38 In addition, the Proposed Development will lead to landscaping enhancements, particularly along the Ashton Canal towpath which runs adjacent to the Site. The enhanced appearance may encourage more people to use the canal towpath for outdoors recreation and exercise as well as sustainable mode of transport.

17.39 Overall, the operational phase of the Proposed Development is considered to lead to minor beneficial impacts on Human Health.

Mitigation Measures

17.40 Where relevant, the individual residual effects which contribute to the identified Type 1 cumulative effects have been considered within the ES and mitigated where necessary and feasible. It is not considered that the Type 1 cumulative effects would be significant in EIA terms and therefore no further mitigation measures have been proposed.

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