# North West Bicester

## Outline Energy Statement

On behalf of **Firethorn Developments Limited**

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# Contents

## Figures



## Tables



## Appendices

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# Executive Summary

Stantec UK Limited (Stantec) has been appointed by Firethorn Developments Limited to prepare an outline energy statement to support an outline planning application of the proposed residential development at the site, Land at North West Bicester (NW Bicester).

The development proposals comprise up to 530 residential units with one electric vehicle charging point (EVCP) per unit. The description of the development is as follows:

*"Outline planning application for residential development (within Use Class C3), open space provision, access, internal estate roads, vehicle and cycle parking, drainage and all associated works and operations including but not limited to demolition, earthworks and engineering operations, with the details of appearance, landscaping, layout and scale reserved for later determination."*

In accordance with Policy ESD4 of Cherwell District Council's Local Plan, a preliminary assessment of district heating feasibility has been undertaken. With the impending changes to the Building Regulation Part L in 2021, it is likely that new homes connected to the Bicester Ecotown Heat Network run by SSE Enterprise, would fail Building Regulations compliance.

Currently SSE Enterprise are undertaking a further review of decarbonising their heat infrastructure assets to enable connection that will achieve Part L of the Building Regulations beyond 2021.

Alternative approaches to heating new homes has been assessed including an appraisal of 'multi-plot' renewable/low carbon energy generation solutions.

Air source heat pumps will provide the energy requirements for heating and water for all houses. There is also a 'suite' of 'building-specific' technologies that could potentially be deployed at the Proposed Development. At this stage, the most suitable technologies are anticipated to be roof-mounted photovoltaic solar panels (PV), and heat recovery technologies (e.g. wastewater and air heat recovery). Both thermal and electric batteries will also be considered to support reducing peak electrical demands which would help to support an electric led heating approach.

Opportunities for incorporating emerging technologies to actively manage the generation and use of energy, including active network management and broader 'smart' energy concepts have been considered.

All opportunities identified here must be subject to thorough technical feasibility and financial viability assessment. The final energy strategy will be detailed at the RMA stage and demonstrated through full Building Regulations (Part L) calculations for Building Control.

# 1 Introduction

## 1.1 Introduction

1.1.1 Stantec UK Limited (Stantec) has been appointed by Firethorn Developments Ltd (the 'Client') to prepare an energy statement (the 'Statement') to support the outline planning permission for the residential development (the 'Proposed Development') adjacent to,

1.1.2 The planning application comprises the construction of up to 530 new dwellings, open space provision, estate roads, vehicle and cycle parking, drainage and all associated works and operations.

1.1.3 The site is within the administrative boundary of Cherwell District Council (CDC).

## 1.2 Purpose of the Report

1.2.1 This Statement examines the relevant energy policies and targets that the development needs to consider and provides a preliminary assessment of the predicted energy demand and predicted carbon dioxide ($CO_2$) emissions of the proposed development. This Statement also considers opportunities to increase energy efficiency through Site layout, building design and energy supply, as well as the suitability of incorporating renewable, and/or low carbon energy generation technologies.

1.2.2 Between the outline planning approval and the commissioning of the final home, the UK will see a significant shift in terms of national energy policy, technology adoptions, and consumer needs. This Statement therefore sets out a framework for achieving $CO_2$ reductions through the planning, construction and operation of the development to allow for this evolution.

1.2.3 At each Reserved Matters Application (RMA) an energy statement will be produced to detail the final energy solutions aligned to the policy, technology available and viability needs at the time of the application.

1.2.4 This will include detailed SAP modelling of each dwelling, overheating analysis and detailed mechanical, electrical and public health (MEP) strategy.

## 1.3 Report Structure

1.3.1 The Statement is structured as follows:

- **Section 2: Proposed Development** – Introduces the Site context and development proposals.
- **Section 3: Policy and Regulation Context** – Sets out a review of the national and local regulations/ policy relevant to the Proposed Development.
- **Section 4**: **Existing District Heat Network and Technology Appraisal**– A summary of the local heat network and the potential ability to upgrade the existing facility.
- **Section 5: Energy Demand Reduction** – Examines how energy efficiency measures have been and will continue to be incorporated into the Proposed Development (both in the masterplan and in the building design).
- **Section 6: Energy Demand Assessment** – Provides a preliminary assessment of the predicted energy demands and predicted $CO_2$ emissions of the Proposed Development.

- **Section 7: Heating Strategy** – Provides a strategy for the provision of the energy required.
- **Section 8: Renewable and Low Carbon Energy Technologies** – Sets out a review of the suitability of renewable and/ or low carbon energy generations technologies at the Proposed Development.
- **Section 9: Smart Energy Infrastructure** – Sets out a review of the suitability of smart energy infrastructure technologies at the Proposed Development.
- **Section 10: Conclusions** – Concluding remarks and next steps.

## 1.4 Planning Submission and Design Evolution

1.4.1 This Statement presents a pragmatic framework for meeting Part L of the Building Regulations (Conservation of Fuel and Power), anticipated future changes and the local policy requirements. The energy strategy has been envisioned to be flexible and able to respond to regulatory changes, market forces and technological advances.

1.4.2 This Statement is based upon our current understanding of the development proposals and information set out in the Illustrative Plans (i.e. Site Location Plan, Illustrative Masterplan Layout and Parameter Plans) (**Appendix A**). It also considers the anticipated programme to detailed design and construction.

1.4.3 This Statement is designed to be a working document and should be reviewed and updated as necessary as the proposals are developed. The final energy measures implemented will be confirmed, and subject to development feasibility and viability testing, at the RMA stages.

# 2 Proposed Development

## 2.1 Introduction

2.1.1 This section described the Site, development proposals and development phasing.

## 2.2 Site Location

2.2.1 Land North West of Bicester (the 'Site') is located in Oxfordshire, approximately 15 miles north east of Oxford and is accessed off the B4100. The Site is within the administrative boundary of Cherwell District Council.

2.2.2 The Site is approximately 22 ha in size and currently comprises open farmland. It is located at GR SP 57615 24959

2.2.3 The Site falls within the North West Bicester Masterplan Framework.

2.2.4 On the South West boundary of the site is a woodland. With a water course running parallel to the South West and South East Boundaries.

## 2.3 Development Proposal

2.3.1 This Statement supports an outline planning application for residential development. The Proposed Development description includes:

*"Outline planning application for residential development (within Use Class C3), open space provision, access, internal estate roads, vehicle and cycle parking, drainage and all associated works and operations including but not limited to demolition, earthworks and engineering operations, with the details of appearance, landscaping, layout and scale reserved for later determination."*

2.3.2 The Proposed Development is characterised by low density, approximately 35-45 dwellings per hectare (dph), spread across the Site. The total developable area is 11.84 Ha. Resulting in an average density of 40 dph.

## 2.4 Development Use

2.4.1 The construction of the Proposed Development is anticipated to commence in 2022, taking approximately 4 years to complete.

2.4.2 The amount of development proposed in the outline housing schedule is:

- residential (use Class C3) – 530 dwellings of which up to 30% affordable;

# 3 Policy Context

## 3.1 Introduction

3.1.1 This section presents and summarises the key energy requirements for the Proposed Development, as defined by national policy, regulation, and CDC's planning policies. This is in relation to relevant energy, associated $CO_2$ emissions and development design policies.

## 3.2 National Planning Policy

### Climate Change Act 2008

3.2.1 Climate change is recognised as one of the most immediate global environmental challenges. Government legislation now includes numerous provisions designed to minimise climate change and mitigate the anticipated effects.

3.2.2 On 2nd May 2019, the Committee on Climate Change published the Net Zero report, which recommends that the UK Government introduce a target of at least a 100% reduction of greenhouse gas emissions by 2050, known as the Net Zero Target. The Order came into force as an amendment of the Climate Change Act (CCA) 2008 on 27th June 2019[1].The CCA 2008 now mandates that "*the net UK carbon account for the year 2050 is at least 100% lower than the 1990 baseline*."

3.2.3 The UK Government's international commitment (transposed into national and local planning policy) has sought to reduce $CO_2$ emissions associated with new buildings through energy demand reduction and the incorporation of low and zero carbon technologies to deliver electricity and heat. The national and local policy position is summarised in the following sections.

### National Planning Policy Framework 2019

3.2.4 The National Planning Policy Framework (NPPF) (2019) supports the role of the local plan process and maintains the "presumption in favour of sustainable development". Paragraphs 148-154 of the NPPF explain that the planning system should help to: "*shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure*".

3.2.5 Plans should take a proactive approach to mitigating and adapting to climate change and should be planned for in ways that:

- can help to reduce greenhouse gas emissions, such as through its location, orientation and design; and
- provide a positive strategy for renewable and low carbon energy sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily as well as identify suitable areas for renewable and low carbon energy sources, and opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems.

3.2.6 When determining planning applications, local planning authorities should expect new development to comply with any development plan policies on local requirements for

[1] Climate Change Act 2008. London: The Stationery Office, available online at: http://www.legislation.gov.uk/ukpga/2008/27/contents

decentralised energy supply (unless demonstrated to be unfeasible or unviable). Development should also take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

## 3.3 National Building Regulations – Part L (Conservation of Fuel and Power)

3.3.1 The UK's international commitments are also transposed into the national Building Regulations. The energy efficiency requirements of the Building Regulations are set out in Part L (Conservation of Fuel and Power). Part L is subject to 'step changes', becoming increasingly stringent as new revisions are adopted.

3.3.2 New development is encouraged to reduce carbon emissions in accordance with the energy hierarchy of reducing energy demands in the first instance, supplying energy efficiently, and finally the provision of appropriate renewable and low carbon energy technologies.

### Current

3.3.3 Approved Documents L1A sets out the requirements for conservation of fuel and power in dwellings.

3.3.4 The current edition of L1A 2013[2] came into effect on 6 April 2014. This strengthens the requirements of Part L1A to deliver 6% carbon savings across the new homes build mix relative to Part L 2010 and introduced a Fabric Energy Efficiency (FEE) target to encourage a minimum efficiency for building fabric (the longest-lasting part of a dwelling).

3.3.5 In their Productivity Plan[3], the Treasury confirmed that the scheduled changes to Part L of the Building Regulations in 2016 would not go ahead. As such, it did not proceed with the previously proposed increase in on-site energy efficiency standards, Zero Carbon Homes or the Allowable Solutions carbon offsetting scheme.

3.3.6 Therefore, the national energy target for the Proposed Development currently is Part L of the Building Regulations 2013 with the latest set of amendments made in 2016. This is subject to changes in the national Building Regulations.

### Emerging

3.3.7 In October 2019, the UK Government began a consultation on a proposed uplift to the energy efficiency requirements defined in the Building Regulations Part L, with the aim of implementing these changes by 2020, and a Future Homes Standard (FHS) for 2025[4]. The consultation closed on 7 February 2020 and the government release the summary of responses.

3.3.8 The consultation document set out two options to uplift energy efficiency standards and requirements in 2020:

- Option 1 ('Future Homes Fabric') – a 20% reduction in $CO_2$ from dwellings compared to the current standards delivered primarily through very high fabric standards (the same fabric standard as anticipated for the FHS).

[2] Conservation of fuel and power: Approved Document L, available online at: https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l

[3] HM Treasury (July 2015) Fixing the foundations: Creating a more prosperous nation, available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/443897/Productivity_Plan_print.pdf

[4] Ministry of Housing, Communities and Local Government (October 2019) The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings (online) available at: https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-thebuilding-regulations-for-new-dwellings (last accessed 24.09.2020)

- Option 2 ('Fabric plus technology') – a 31% reduction in $CO_2$ from dwellings compared to the current standards delivered through a combination of an increase in fabric standards (though not as high as for Option 1) and technology.

3.3.9 The consultation also set out what a home built to the FHS is likely to be like. It states:

"*We expect that an average home built to [the Future Homes Standard] will have 75-80% less carbon emissions than one built to the current energy efficiency requirements (Approved Document L 2013). We expect this will be achieved through very high fabric standards and a low carbon heating system. This means a new home built to the Future Homes Standard might have a heat pump, triple glazing and standards for walls, floors and roofs that significantly limit any heat loss*."

3.3.10 The FHS will build on the Prime Minister's Industrial Strategy Grand Challenge mission to at least halve the energy use of new buildings by 2030.

3.3.11 At the time of writing this Statement, formal metrics and standards have not been confirmed.

3.3.12 In his Spring Statement 2019[5], the former Chancellor Philip Hammond announced that from 2025 the end of fossil-fuel heating systems in all new homes would be mandated (though this has yet to be adopted as official policy).

3.3.13 An 'interim' Part L (Part L 2021), a new Part F (Ventilation) and new Overheating Regulations for domestic and non-domestic buildings are scheduled to be adopted in December 2021, coming into effect in June 2022.

3.3.14 The new Part L 2021 is expected to require a 31% CO2 reduction for new homes, compared to current Part L 2013 standards. It is also anticipated that the carbon emissions factors are going to change in the new Part L. In particular, the carbon emissions factor used for grid-supplied electricity will be reduced in the new Part L as it needs to consider future decarbonisation of the grid. This encourages the use of grid supplied electricity systems, such as air source heat pumps, over gas-fired plant.

3.3.15 Part L 2021 will form a 'stepping-stone' for the Future Homes Standard (FHS), which is expected to come into effect from 2025. The latest consultation document suggests this will require new homes to achieve at least a 75% CO2 reduction compared to Part L 2013. In addition, homes built under the FHS will be 'zero carbon ready' which means in the long term no further retrofit work will be necessary to enable them to become zero carbon homes as the electricity grid continues to decarbonise.

3.3.16 It is also anticipated that the carbon emissions factors used in Part L calculations (i.e. the Standard Assessment Procedure, SAP) will change as the electricity grid decarbonises. In particular, the carbon emission factor used for grid-supplied electricity will be reduced in the new Part L 2020 as it needs to consider decarbonisation of the grid.

3.3.17 This change is expected to see a shift from gas-led heating strategies in new buildings that have to achieve significant carbon savings, to electric-led strategies using technologies such as heat pumps and heat recovery systems over gas-fired plant. Furthermore, technologies generating on-site electricity (such as gas-engine CHP and photovoltaics) will not achieve the carbon savings they have to date (because they are offsetting less 'carbon' as the grid decarbonises). Grid decarbonisation is considered in the technology appraisal in **Section 7**.

[5] The Chancellor of the Exchequer, Philip Hammond presented his Spring Statement to Parliament on Wednesday 13 March 2019, available online at: https://www.gov.uk/government/topical-events/spring-statement-2019

## 3.4 Energy White Paper

3.4.1 The Government's Energy White Paper[6], December 2020, brings together a series of disparate and as yet unaligned sectors including transport, new homes, power generation and industrial growth under one common theme: Energy.

3.4.2 Rather than focussing on the energy sector alone, the white paper aims to set out how energy, and the move towards a net-zero carbon economy, will play a critical role in enabling interdependent infrastructure and post-COVID economic growth. It is critical to the levelling up agenda.

3.4.3 Specifically relating to housing growth, the White Paper continues to set out the delivering of the Future Homes Standard by 2025 as the mechanism for delivering zero carbon ready homes. It also notes that consultation on new energy performance of non-domestic buildings will be undertaken in due course.

3.4.4 The White Paper also sets out the Government's plan to consult on whether it is appropriate to end gas grid connections to new homes being built from 2025, in favour of clean energy alternatives.

## 3.5 Local Planning Policy

3.5.1 The local planning authority for the Proposed Development is Cherwell District Council (CDC). Their planning policy and guidance are set out in a suite of adopted documents. The relevant energy policies in relation to the proposed development are summarised below.

*3.5.2* In July 2019, CDC declared a climate emergency and set out a number of commitments. In October 2020, the Climate Action Framework was released. It outlines how the Council will address the climate emergency and has been endorsed by the Council.

"The challenge of addressing climate change cannot be underestimated. It requires rapid, far-reaching and unprecedented changes in all aspects of society."

3.5.3 CDC adopted the Local Plan on 20th July 2015. The Core Strategy sets out the development strategy and planning policies. These policies include the allocation of strategic employment and housing sites.

### CDC Core Strategy

**Policy PSD1: Presumption in Favour of Sustainable Development**

3.5.4 Policy PSD1 reiterates the requirement of presumption in favour of sustainable development as contained in the NPPF. The policy states:

*"When considering development proposals, the Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework (NPPF). It will work proactively with applicants to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social and environmental conditions in the area.*

*Planning applications that accord with the policies in the Core Strategy (and, where relevant, with policies in neighbourhood plans) will be approved without delay, unless material considerations indicate otherwise."*

[6] Government's Energy White Paper (December 2020), available online at: Energy White Paper (publishing.service.gov.uk)

**Policy ESD1 Mitigating and Adapting to Climate Change**

3.5.5 Policy ESD1 sets the requirements for developments to help mitigate and adapt to the anticipated effects of climate change. It covers at a strategic level how the district must:

- *"Distribute growth to the most sustainable locations as defined in this Local Plan 85 Cherwell Local Plan 2011-2031 Part 1 Section B - Policies for Development in Cherwell*
- *Delivering development that seeks to reduce the need to travel and which encourages sustainable travel options including walking, cycling and public transport to reduce dependence on private cars*
- *Designing developments to reduce carbon emissions and use resources more efficiently, including water (see Policy ESD 3 Sustainable Construction)*
- *Promoting the use of decentralised and renewable or low carbon energy where appropriate (see Policies ESD 4 Decentralised Energy Systems and ESD 5 Renewable Energy)."*

3.5.6 In order for development proposals to adapt to climate change, CDC lay out a range of measures that should be considered. These are:

- *"Taking into account the known physical and environmental constraints when identifying locations for development*
- *Demonstration of design approaches that are resilient to climate change impacts including the use of passive solar design for heating and cooling*
- *Minimising the risk of flooding and making use of sustainable drainage methods,*
- *and Reducing the effects of development on the microclimate (through the provision of green infrastructure including open space and water, planting, and green roofs)."*

**Policy ESD2: Energy Hierarchy and Allowable Solutions**

3.5.7 Policy ESD2 looks to achieve carbon emissions reductions, by promoting the energy hierarchy as follows:

- *"Reducing energy use, in particular by the use of sustainable design and construction measures*
- *Supplying energy efficiently and giving priority to decentralised energy supply*
- *Making use of renewable energy*
- *Making use of allowable solutions."*

**Policy ESD3: Sustainable Construction**

3.5.8 Policy ESD3 sets targets for sustainable design and construction technology to achieve zero carbon development. The key items relevant to this Energy statement are:

- *"Minimising both energy demands and energy loss*
- *Maximising passive solar lighting and natural ventilation*
- *Maximising resource efficiency*

- *Reducing the impact on the external environment and maximising opportunities for cooling and shading (by the provision of open space and water, planting, and green roofs, for example);*

- *and Making use of the embodied energy within buildings wherever possible and re-using materials where proposals involve demolition or redevelopment."*

**Policy ESD4: Decentralised Energy Systems**

3.5.9 Policy ESD4 identifies the Council's ambitions to support decentralised energy systems in new developments. It states:

"*A feasibility assessment for DH/CHP, including consideration of biomass fuelled CHP, will be required for:*

- *All residential developments for 100 dwellings or more*

- *All residential developments in off-gas areas for 50 dwellings or more*

- *All applications for non-domestic developments above 100 0m2 floorspace."*

*The feasibility assessment should be informed by the renewable energy map at Appendix 5 'Maps' and the national mapping of heat demand densities undertaken by the Department for Energy and Climate Change (DECC) (see Appendix 3: Evidence Base). Where feasibility assessments demonstrate that decentralised energy systems are deliverable and viable, such systems will be required as part of the development unless an alternative solution would deliver the same or increased benefit."*

**Policy ESD5: Renewable Energy**

3.5.10 Policy ESD5 identifies the Council's ambitions to support, whenever adverse impacts are addressed, the use of Renewable and low carbon energy. The policy requests a feasibility assessment to understand the potential for on site renewable energy provision.

**Policy Bicester 1**

3.5.11 Policy Bicester 1 discusses the North West Bicester Eco-Town development standards. It states that the Ecotown development will be:

"*A new zero carbon (i) mixed use development including 6,000 homes will be developed on land identified at North West Bicester."*

3.5.12 Within the policy significant requirements are laid out for the site wide master planning for the 6,000 homes. Here we have extracted sections which are specific to the development of this allocation of North West Bicester Eco-Town. The policy sets out a requirement for:

- *Layout to achieve Building for Life 12 and Lifetime Homes standards Homes to be constructed to be capable of achieving a minimum of Level 5 of the Code for Sustainable Homes on completion of each phase of development, including being equipped to meet the water consumption requirement of Code Level 5*

- *Have real time energy monitoring systems, real time public transport information and Superfast Broadband access, including next generation broadband where possible. Consideration should also be given to digital access to support assisted living and smart energy management systems.*

- *Embodied impacts of construction to be monitored, managed and minimised (ET21)"*

### North West Bicester Supplementary Planning Document (SPD).

3.5.13 This SPD provides further guidance on the interpretation of the Core Strategy Policies in relation to climate change mitigation and adaptation. It was adopted by the Council in July 2019.

3.5.14 The document states that:

*"The development of low and zero carbon district heating schemes is strongly supported and encouraged. New development will be required to adhere to the policy requirements to connect to district heating or include future proofing measures unless it has been demonstrated that it is not feasible or viable to do so"*

## 3.6 Summary

3.6.1 The construction of the Proposed Development is anticipated to commence in 2022, taking approximately 4 years to complete. This will mean the scheme will need to meet the progressed changes to the Building Regulations planned for 2025. This is critical in decision making on connecting to energy infrastructure.

3.6.2 In summary, the key targets for the Proposed Development as defined by national regulation and local policy are:

- Comply with Part L of the Building Regulations and consider anticipated future changes in 2025.
- Integrate measures into the design that will support mitigation and adaptation to the anticipated effects of climate change (**Policy ESD1**).
- Incorporate measures to reduce energy demands and supply energy efficiently in line with the energy hierarchy **(Policy ESD2).**
- Incorporate a high standard of energy efficiency measures into the design and aspire to achieve improvement over Part L 2013 where suitable **(Policy ESD3).**
- Understand the suitability of a decentralised heating system **(Policy ESD4).**
- Incorporate where suitable low carbon and/or renewable energy technologies for energy generation in order for the proposals to achieve a reduction of carbon dioxide emissions from residual energy (**ESD5).**

3.6.3 In addition the scheme will need to respond to the requirements of Policy ESD3, true zero carbon, where both regulated and unregulated emissions are met through directly connected renewable energy supplies. This requirement significantly affects the potential technology selection for heating new homes.

# 4 Existing District Heat Network and Technology Appraisal

4.1.1 The Ecotown development to the North West of Bicester is one of four Ecotowns that were originally given the green light by the government in 2009 to act as showcases for environmentally sustainable communities. A key component of this was that the Ecotown's residential properties and commercial units would be heated by an SSE operated district heating network.

4.1.2 The primary fuel of the district heating network's energy centre is currently natural gas, with the heat being supplied to the network generated by a CHP engine and top-up condensing and non-condensing boilers. The energy centre also houses thermal storage vessels which allow the CHP unit to operate on a more continual basis when economically beneficial and respond to electricity market price signals.

4.1.3 Changes to Part L of the Building Regulations in 2021 means that any source of heat from natural gas is currently is likely to fail Part L.

4.1.4 Firethorn Developments Limited will continue to liaise with SSE on the phased replacement of the technology in the existing energy centre. This solution may be considered subject to viability and a programme of replacement. However, until the heat network is decarbonised or guarantees are in place to ensure it is decarbonised connection to the network is not possible.

# 5 Energy Efficiency

## 5.1 Introduction

5.1.1 In line with Part L of the Building Regulations, new developments should seek to increase energy efficiency and reduce energy demands through sustainable design and construction. CDC also encourages new developments to adopt sustainable building principles, including energy efficiency and conservation measures. **Policy ESD3**, in particular, requires new developments to incorporate a high standard of energy efficiency, measures to provide resilience to climate change are also considered, e.g. through siting and positioning of buildings.

5.1.2 This section demonstrates that the Proposed Development will aim to be energy efficient by means of scheme layout, whilst each dwelling should seek to adopt a “fabric-first” approach to reduce energy demands in individual buildings. It examines how energy efficiency and demand reduction measures can be incorporated into the Proposed Development (both in the masterplan level and in individual building designs).

## 5.2 Energy Hierarchy

5.2.1 The Proposed Development will adopt the nationally and locally recognised energy hierarchy of reducing energy demand in the first instance, using energy efficiently and, only then, providing renewable and low carbon energy generation technologies where it is appropriate to do so. The energy hierarchy in urban development is illustrated in Figure 5.1

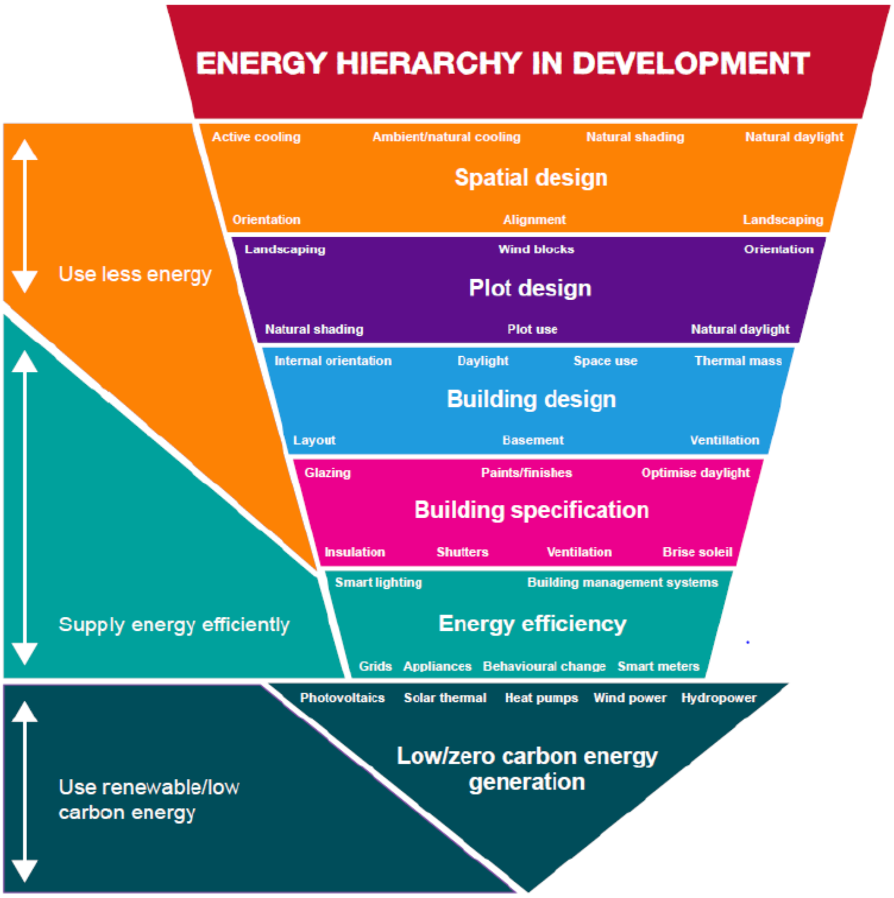



Figure 5.1 The energy hierarchy in new development

5.2.2 To meet the first principles of the hierarchy (i.e. passive demand reduction) it is important to consider passive design principles through spatial planning, green infrastructure provision and development context. These issues do not contribute to the $CO_2$ emission reduction calculations under the Building Regulations but can play a significant part in reducing the energy demands of a building.

5.2.3 **Section 5.3** below presents principles that have been considered within the Illustrative Plans (contained in **Appendix A**), in the context of other design considerations, and will continue to be considered as the design progresses to passively reduce the energy demands of the Proposed Development.

5.2.4 **Section 5.4** presents 'passive' and 'active' measures that will be considered in the design of individual buildings at the RMA stage to further reduce energy demands and use energy more efficiently.

## 5.3 Illustrative Masterplan Design Principles to Reduce Energy Demand

5.3.1 There are a series of design principles that can be adopted in masterplans to passively reduce the energy demands of a development.

5.3.2 The Proposed Development is set within is a comprehensive green infrastructure network with retained trees, as well as additional proposed trees planted across the development. Green and open areas will be located to the South and South East. Green open spaces such as these provide evaporative cooling at night, helping to reduce the heat island effect[7]. The permeability of green spaces throughout the Proposed Development, as well as the selection of plot layout and building location, will help to facilitate air movement and enhance natural ventilation.

5.3.3 The retention and creation of vegetation and tree planted areas will help provide shading and local cooling of the microclimate.

5.3.4 Where appropriate, the following may be incorporated into the scheme as the design progresses:

- Street-scene tree planting to provide naturally shaded areas and corridors connecting different land parcels.
- Optimisation of building orientation to take advantage of south-facing aspects for passive solar gains and roof-mounted renewable technologies.

5.3.5 Continued consideration of the spatial layout and plot design in this manner could provide significant $CO_2$ savings. The above aspects will be refined at the RMA stage.

## 5.4 Design Principles to Reduce Energy Demands and Increase Energy Efficiency

5.4.1 In accordance with the energy hierarchy, each plot should seek to adopt a "fabric-first" approach to building design (enhancing the performance of the components and materials that make up the building fabric itself, such as improving insulation and reducing cold bridging), before considering the use of mechanical or electrical services systems and renewable/ low carbon technologies.

[7] The term 'heat island' describes built up areas that are hotter than nearby rural areas. This is partly caused by the replacement of natural surface by built surfaces, which absorb a higher proportion of incident radiation, which is then released as heat.

5.4.2 Measures should be adopted in the detailed design of buildings to reduce energy demands, use energy more efficiently and, where possible, adapt to the predicted impacts of climate change. These measures can be split into 'passive' and 'active' measures.

5.4.3 'Passive' measures are design features, which can include building orientation, appropriate internal layouts and building fabric selection, that inherently reduce the buildings' energy requirements. 'Active' measures are building services design features that will increase the efficiency of the energy used, and therefore also reduce the energy demand requirements.

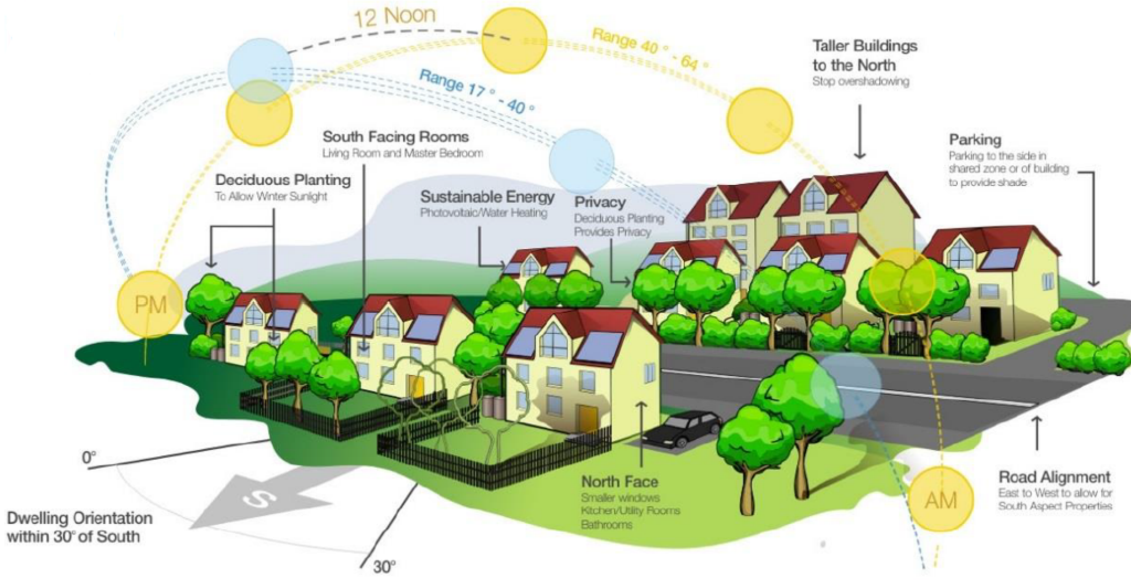



**Figure 5.2 General energy master planning principles**

## Passive Measures

5.4.4 The following 'passive' design measures will be considered in the detailed design of buildings to reduce energy requirements:

- Designing the external fabric (walls, floors and roofs) to have low U-values[8] to reduce thermal heat loss (i.e. by providing high efficiency insulation).
- Reducing the air permeability and thermal bridging coefficient of the building envelope to the lowest practical level to reduce uncontrolled heat loss.
- Incorporating building materials with high (and, where appropriate, exposed) thermal mass to help keep the internal building temperatures stable.
- Providing larger windows on south-facing aspects, where appropriate in the context of wider design considerations (such as residents' amenity), to allow natural daylighting and passive solar gains.
- Providing smaller windows on north-facing aspects, where appropriate, to reduce excessive heat loss.

[8] U values, otherwise known as thermal transmittance values, measure the thermal performance of a building fabric in terms of heat loss. The better insulated a structure is, the lower the U-value will be.

- Using architectural features that deflect sunlight to reduce excess heat gain in buildings (e.g. brise soleil and blinds).

### Active Measures

5.4.5 The following 'active' design measures will be considered in the mechanical and electrical elements of the buildings:

- Using Mechanical Ventilation with Heat Recovery (MVHR) systems where appropriate.
- Adopting water efficiency measures such as leak detection systems, flow control devices and pulsed water meters, to reduce the energy demands associated with water heating.
- Using controls to optimise and compensate for heating variations.
- Fitting variable speed drives fitted to appropriate pumps and fans to allow greater control of energy-consuming equipment.
- Installing 100% low energy lighting and using lighting-efficiency systems (e.g. daylight cut-off and Passive Infra-Red, PIR, lights).
- Selecting highly efficient white goods for kitchens and amenity rooms.
- Installing energy display devices to promote user behavioural change.
- Issuing residents with a Home User Guide that contains manuals for fitted appliances to promote and encourage user behavioural change.

5.4.6 The above lists of passive and active measures are not exhaustive. A combination of 'passive' and 'active' measures will result in well insulated, air-tight buildings with appropriate and efficient building services. As per the energy hierarchy discussed in **Section 5.2**, it is important to emphasise the benefits of optimising the long-lasting energy performance of buildings through fabric improvements, before employing low carbon and renewable energy technologies on site.

5.4.7 At this stage, the opportunities for delivering higher energy efficiency performance than the current Building Regulations needs to reflect the potential implementation of the Future Homes Standard in 2025 (subject to the current consultation).

# 6 Energy Demand Assessment

## 6.1 Introduction

6.1.1 The Government-approved methodologies for assessing $CO_2$ emissions to demonstrate compliance with Part L of the Building Regulations in England are:

- The Standard Assessment Procedure (SAP) for the energy rating of dwellings; and
- the National Calculation Methodology (NCM) implemented through the Simplified Building Energy Model (SBEM) for buildings other than dwellings.

6.1.2 At this early stage in the development process it is not possible to undertake SAP calculations because sufficient detailed design information is not available. Instead, a Predicted Energy Demand (PED) model has been developed using assumed notional building designs (based upon the principles outlined in **Section 5**).

6.1.3 The PED model predicts the regulated and unregulated energy demands of the Proposed Development by month-of-year and hour-of-day, as well as the associated $CO_2$ emissions. The model uses Building Services Research and Information Association (BSRIA) benchmark data and the Energy Efficiency in Buildings CIBSE Guide F in establishing broad demand profiles.

6.1.4 The model splits energy usage into regulated and unregulated energy usage where:

- Regulated energy is heat or power related to hot water, space heating, lighting and associated fans and pumps. This energy is regulated through the Building Regulations; and
- Unregulated energy is all other energy usages such as appliances, IT and cookers. There is currently no policy or regulation that controls unregulated energy demand.

6.1.5 The electrical demand required to charge electrical vehicles has not been considered as the policies, technologies and alternatives are at an early stage and are evolving.

6.1.6 The method and predicted results of the PED assessment for the development proposals are provided in **Appendix B**. The results are summarised below in **Section 6.3**.

## 6.2 Predicted Scenarios

6.2.1 It has been assumed within the PED model that heating provision will not involve any gas and will also reflect electricity grid decarbonisation and associated changes to Part L of the Building Regulations.

6.2.2 Part L 2021 will form a 'stepping-stone' for the Future Homes Standard (FHS), which is expected to come into effect from 2025. The latest consultation document suggests this will require new homes to achieve at least a 75% CO2 reduction compared to Part L 2013.

6.2.3 Two scenarios have been modelled as below:

6.2.4 **Baseline demand** – showing how the buildings would perform in terms of energy consumption and associated $CO_2$ emissions if all phases were built to the current Building Regulations Part L 2013 standard.

6.2.5 **Anticipated demand for Heating** – showing how the buildings would perform in terms of energy consumption and associated $CO_2$ emissions assuming that the site is built out to Part L

2025. This includes increasing energy efficiency standards (including the FHS) and electricity grid decarbonisation projections to assess the carbon benefits of using heat pump technology.

6.2.6 This is pertinent to the Proposed Development, as construction is estimated to start circa 2022/23 taking circa 4 years to complete (2026). Therefore, the energy demand and total $CO_2$ emissions will be significantly lower for the later phases when compared to early phases. There may also be higher energy performance targets which the Proposed Development must address within later phases. For this assessment we have appraised the carbon emission on completion of the development, i.e. 2026.

## 6.3 Results of the PED Model

6.3.1 The annual predicted energy demands for hot water, space heating, regulated electricity and unregulated electricity for the Proposed Development under these two scenarios are summarised in **Table 6.1**. The total $CO_2$ emissions in tonnes for heating, regulated electricity and unregulated electricity are also shown. The full results of the PED model can be found in **Appendix B**.

**Table 6.1 Baseline and predicted energy demands and $CO_2$ emissions of the Development**

| Scenario | Total Annual Predicted Energy Demand (MWh) | | | | Total Annual $CO_2$ Emissions (Tonnes) | | |
|---|---|---|---|---|---|---|---|
| | Hot Water | Space Heating | Regulated Electricity | Unregulated Electricity | Heating | Regulated Electricity | Unregulated Electricity |
| Baseline demand | 800 | 1,830 | 200 | 1490 | 650 | 110 | 780 |
| Predicted demand | 510 | 1,310 | 170 | 1,490 | 110 | 20 | 150 |

6.3.2 The predicted energy demand for heating is estimated to decrease by approximately 860 MWh/year between the baseline and predicted scenarios. This reduction, in conjunction with the decarbonisation of the National Grid, will result in significant savings in $CO_2$ emissions.

6.3.3 Projected decarbonisation of the National Grid and the use of electrical heating technologies after 2025 shows that regulated $CO_2$ emissions arising from the proposed development are expected to decrease by circa 80% within the predicted scenario's compared to the baseline. This will continue to decrease beyond the 2025 as the National Grid continues to decarbonise.

# 7 Renewable and Low Carbon Energy Technologies

## 7.1 Introduction

7.1.1 In accordance with the energy hierarchy, the proposed energy strategy for the project is to reduce energy demands and use energy efficiently by means of scheme layout and building design/ orientation and efficient heating strategy, prior to employing renewable and low carbon technologies. It is important to consider opportunities to incorporate renewable and low carbon energy technologies at an early stage in the design process.

7.1.2 **Policy ESD5** requires developments to consider renewable energy and/ or micro-generation equipment and consider this through a feasibility assessment. At this stage, the Site layout and orientation should be enhanced to maximise the potential for renewable technologies. This section addresses these requirements.

7.1.3 A review of the suitability of various renewable and low carbon technologies for the Site has been undertaken below, at both a 'multi-plot' level and 'building-specific' level. Further details on each technology are presented in **Appendix C**. In summary, the variables affecting suitability include:

- Environmental constraints: e.g. suitable geology for ground source heat pumps or the presence of protected ecological species that may be affected by the technology.
- Resource constraints: e.g. the availability and reliability of local biomass fuel supplies or the local wind resource.
- Social constraints**:** e.g. visual or health impacts of placing combustion-based technologies near housing.
- Infrastructure constraints: e.g. impacts on aviation from wind turbines or the availability of suitable transport infrastructure to import fuel, plant or equipment.

7.1.4 **Tables 7.1 and 7.2** below provide a summary of the multi-plot and building specific renewable/ low carbon technologies available to the Development respectively. The options highlighted in green are preferred options for further investigation, those in orange have some potential which should be explored once further detail is available, and those in red are considered to be the least appropriate for OGV at this stage. Each technology's carbon intensity has been qualitatively assessed and given a rating of low, medium or high. Technologies are evolving and costs are changing so the comments given below may be superseded over time.

## 7.2 Multi-plot Renewable and Low Carbon Opportunities

Table 7.1 Summary of multi-plot renewable and low carbon opportunities

| Technology | Technological risk | Energy availability | Potential contribution (kW / MW) | Suitability | Comment |
|---|---|---|---|---|---|
| Battery storage and balancing plant (active network management) | Medium/ high | Baseload/ as required | kW to MW | Potential to be further explored | A battery project could reduce peak electrical demands and support an electric led heating approach after 2025. However, the technology is currently expensive, and the energy storage markets are largely untested. This risk is likely to diminish over the next five to ten years.<br><br>Potential to explore further as detailed design progresses and at the RMA stage. |
| District heat network (ASHP) | Medium / high | Baseload | kW to MW | Yes | The Existing CHP plant on site has been assessed by SSE Enterprise to assess the suitability to upgrade to an Air Source Heat Pump. Whilst significant emissions reductions could be achieved the conclusion of the report indicated widespread deployment is still dependent on changes in the associated incentives, levies and prohibition of gas. |
| Ground source heat pumps | Medium | Baseload | kW to MW | No | The lack of retail assembly and leisure and any apartment blocks or complexes within the proposed development makes multi-plot ground source heat pumps unsuitable. |
| District heat network (Gas fueled) | Low | Baseload | kW to MW | No | A detailed Technology appraisal for zero carbon Homes has been undertaken for this scheme. The findings from this report confirm that “New homes will fail Part L of the Building Regulations if they are connected to a heat network supplied by gas boilers and CHP beyond 2021”. |
| Water source heat pumps | Medium / high | Baseload | kW to MW | No | No suitable watercourses identified in the vicinity of the Site and whilst the site is underlain by the ‘Triassic Sandstone aquifer, initial mapping indicates aquifer is of a significant depth below ground level. |
| Ground mounted photovoltaic solar panels (PV) | Low | Intermittent | kW to MW | No | There is no space within the site boundary for a large-scale, standalone PV installation. |
| Wind energy | Low | Intermittent | kW to MW | No | A large wind turbine development within the Site boundary would likely cause a significant noise, visual and wind-flicker disturbance, which would be detrimental to the amenity of residents and other site users. |
| Hydropower | Low | Baseload | kW to MW | No | No suitable watercourses in the vicinity of the Site. |

7.2.1 Based upon the Site's geography and the development proposals, a battery project could potentially be deployed to reduce peak electrical demands and support an electric led heating approach after 2025. This option should be further explored as the scheme progresses. The conversion of the existing heat network would also be an opportunity for the project.

7.2.2 Multi-plot ground source heat pumps, ground mounted PV, wind energy, gas led district heating and hydropower have been discounted as they are not appropriate for this development.

## 7.3 Building-specific Renewable and Low Carbon Opportunities

7.3.1 Following the appraisal of 'multi-plot' opportunities, Table 7.2 below examines opportunities to produce on-site low carbon heat for individual buildings and to provide building-integrated renewable electricity solutions.

Table 7.2 Summary of building-specific renewable and low carbon opportunities

| Technology | Technological risk | Energy availability | Potential contribution (kW / MW) | Suitability | Comment |
|---|---|---|---|---|---|
| PV | Low | Intermittent | kW (site total up to MW) | Most suitable | PV systems could be installed on suitable south facing roof spaces. Frame-mounted systems can be used on flat roofs to optimise performance. |
| Solar water heating (or solar thermal) | Low | Intermittent | kW | Most suitable | Could be installed on suitable south facing roof spaces to supply a portion of buildings' heat demands. However, this would compete with PV for roof space. |
| Air source heat pumps | Low | Baseload | kW | Most suitable | External condensers need careful positioning to avoid visual / noise disturbance.<br><br>Widespread use throughout the site is only suitable with spare electrical network capacity due to the impact on peak demand loadings. |
| Heat recovery | Low | Baseload | kW | Potential to be further explored | The use of air heat recovery technology can be aligned with the heat pump system. This technology is potentially suitable for air to air heat pump systems but become less viable with air to water heat pump systems. Their final suitability is subject to further viability assessment. |
| Ground source heat pumps | Low / medium | Baseload | kW | Potential to be further explored | May be opportunities to install small-scale systems with horizontal collector loops in individual gardens and localised areas of green open space. |

| Technology | Technological risk | Energy availability | Potential contribution (kW / MW) | Suitability | Comment |
|---|---|---|---|---|---|
| | | | | | The geology of the area is underlain by the 'Saltford Shale Member' mudstone bedrock and superficial deposits comprising Till. This may be suitable for ground source heating. However, this option is subject to further investigation of geological suitability in specific areas and the MEP design of buildings |
| Wood burning stoves | Low | As required | kW | No | Widespread use would have a detrimental impact on local air quality so is not recommended. |

7.3.2 There is a 'suite' of 'building-specific' technologies that could potentially be deployed at the Proposed Development. At this stage, the most suitable technologies are anticipated to be photovoltaic solar panels (PV), solar water heating systems (or solar thermal) and heat recovery technologies (e.g. wastewater and air heat recovery).

7.3.3 The specifications of such renewables will be confirmed at detailed design stage. This will be supported by a detailed SAP assessment.

# 8 Smart Energy Infrastructure

## 8.1 Introduction

8.1.1 This section considers the opportunity to integrate and manage all potential renewable and low carbon energy technologies that may be employed at the Proposed Development using emerging 'smart' energy infrastructure.

8.1.2 As part of OFGEM's RIIO 2 process Scottish and Southern Energy Networks (SSEN) are required to look at utilising new approaches to accommodate the decarbonisation of grid electricity and balance new demands such as electric heating or electric vehicles. The development will look to adopt approaches that will support SSEN in implementing their obligations.

8.1.3 As the Proposed Development progresses towards detailed design, there may be an opportunity to develop and deliver an integrated and 'smart' energy approach. This could form part of the wider strategy to deliver integrated infrastructure solutions to develop a high quality and well-functioning built environment. 'Smart' in this context relates to the use of data and the incorporation of information and communication technologies to deliver improved operational outcomes.

8.1.4 In relation to energy, the opportunities include potential incorporation of emerging technologies to actively manage the generation and use of energy. This section discusses two ways in which this could be explored going forward: through active network management, and through broader exploration of 'smart' energy concepts.

## 8.2 Active Network Management

8.2.1 Given the potential for decentralised energy generation at the Proposed Development, it could be possible to develop a distributed energy resource (DER) strategy across the scheme. This would connect the power generation distributed across the project with the development's energy demand through network controls (turning power and demand on and off accordingly).

8.2.2 This approach is driven by demand management in the first instance and followed by energy generation to support the management of demand. It is estimated that National Grid electricity will have lower associated carbon emissions than gas by 2025 (if not before). This will therefore need to be considered when appraising the amount and types of on-site low/zero carbon energy technologies for the Proposed Development in the context of carbon management and reduction.

8.2.3 DER is an energy system that links up several smaller, decentralised energy generation schemes and controls them via a central control system (remotely). This turns this decentralised energy into a Virtual Power Plant (VPP) for the scheme. A VPP is a system that integrates several types of power sources, (such as PV) to give a more reliable overall power supply.

8.2.4 The advantage of integrating these technologies with control mechanisms and potentially back-up storage systems is also that these technical interventions reduce the reliance on the distribution network for peak supply. In return this reduces the need for potential offsite grid reinforcements which can require early capital outlay.

8.2.5 The progression of this approach should be considered in parallel to any further appraisals of specific technologies at the RMA stage. If this option is to be considered further, a more detailed technical and commercial appraisal will be required following outline consent including engagement with the Distribution Network Operator (DNO) (SSEN), or an Independent DNO (IDNO), to see whether this option would be accepted.

## 8.3 Smart Technologies

8.3.1 Going forward, there could be opportunities to incorporate 'smart' technologies within homes or within the local power infrastructure. To explore this opportunity going forward, the project team will look to collaborate with local or national organisations active in this market at the RMA stage.

8.3.2 Opportunities could include incorporating 'building-specific' energy monitoring technologies, allowing occupants to have greater interaction with their resource consumption through 'smart' web-based applications.

8.3.3 Smart meters involve next-generation gas and electricity meter which sends regular meter readings to your energy supplier automatically. Smart meters record detailed energy consumption and share this data with customers in order to allow control of their energy consumption. This allows more accurate bills based on actual energy usage information as opposed to being based on estimates. In addition, smart meters also help visualise consumers' energy use through the use of an in-home display (IHD), a digital screen providing live information. This type of technology helps consumers monitor their energy use in both kilowatt hours (kWh), and in pounds and pence, incentivising behavioural change to a more sustainable one.

8.3.4 The DNO, SSEN has set in place the SSEN's Smart Metering team which installs and maintains a new generation of meters across the UK. The aim is to support energy users to lower energy costs and an improve their carbon impact. In addition, SSEN Smart Metering specialists support the provision of settlement Import/Export metering from micro-generation sites. They also provide generation or FiT metering to measure the total generation in accordance with industry standards.

8.3.5 Other new technologies are emerging on to the market that are currently not considered within standard housing typologies, but will play an important role in managing future heat demands. An example of such technology are thermal batteries that, in the future, will look to replace less efficient hot water cylinders reducing space requirements and energy losses[9].

8.3.6 The opportunities for including such technology will be considered at each reserved matters application.

[9] https://sunamp.com/residential/

# 9 Conclusions

## 9.1 Introduction

9.1.1 The options presented in this Outline Energy Statement are based upon current planning requirements and the Building Regulations, as well anticipated upcoming changes. As this is a large development that will progress over several years, the energy strategy needs to be flexible and able to respond to regulatory changes, market forces and technological advances.

9.1.2 The suitability of the various technologies should continue to be reviewed as the detailed design progresses. This is to ensure compatibility with detailed building designs and the mechanical and electricity strategy. The RMAs will include further detail of the proposed renewable and low carbon energy approach to achieve zero carbon standards.

## 9.2 Summary

9.2.1 The Outline Energy Statement has set the key principles for the Proposed Development to deliver the energy hierarchy. This includes:

- Go beyond the current Part L of the Building Regulations to align with the anticipated future changes.
- Incorporate measures to reduce energy demands and supply energy efficiently in line with the energy hierarchy. Incorporate a high standard of energy efficiency measures into the design and aspire to achieve improvement over Part L 2013 **(Policy ESD3).**
- Incorporate low carbon and/or renewable energy technologies for energy generation (**Policy ESD5).**
- Integrate measures into the design that will support mitigation and adaptation to the anticipated effects of climate change (**Policy ESD2**).

9.2.2 The Statement has also considered anticipated changes in Part L of the Building Regulations to reflect electricity grid decarbonisation are likely to see a shift towards electric-led heating strategies (rather than gas) in the coming years. Furthermore, the Government has indicated that gas may be banned as a heating source from 2025. In line with this, this Statement considered the anticipated shift towards electric-led heating strategies (rather than gas) in the coming years.

9.2.3 Projected decarbonisation of the National Grid and the use of electrical heating technologies after 2025 shows that $CO_2$ emissions arising from the Proposed Development are expected to decrease by circa 75% within the predicted scenario compared to the baseline of Part L 2013.

9.2.4 A series of design principles to increase energy efficiency have been considered through careful masterplan design. In accordance with the energy hierarchy, the Proposed Development will seek to adopt a “fabric-first” approach to building design (enhancing the performance of the components and materials that make up the building fabric itself, such as improving insulation and reducing cold bridging), before considering the use of MEP services systems and renewable/ low carbon technologies.

9.2.5 In accordance with **Policy ESD4**, a preliminary assessment of district heating feasibility has been undertaken. Connection to the existing heat network is likely to risk the project failing Part L of the Building Regulations in 2021. SSE Enterprise are currently assessing how their infrastructure can be decarbonised to meet Building Regulation compliance.

9.2.6 There is also a ‘suite’ of ‘building-specific’ technologies that could potentially be deployed at the Proposed Development. At this stage, the most suitable technologies are anticipated to be roof-mounted photovoltaic solar panels (PV), solar water heating systems (or solar thermal) and heat recovery technologies (e.g. wastewater and air heat recovery). Air source heat pumps are likely to feature prominently in any electric led heating strategy. There may also be potential for ground/ water source heating solutions, subject to further geological investigation and the detailed building designs.

9.2.7 Opportunities for incorporating emerging technologies to actively manage the generation and use of energy, including active network management and broader 'smart' energy concepts have been considered including thermal and electric batteries.

9.2.8 All opportunities identified here must be subject to thorough technical feasibility and financial viability assessment. The final energy strategy for each phase will be detailed at the RMA stage and demonstrated through full Building Regulations (Part L) calculations for Building Control.

# Appendix A Parameter Plans

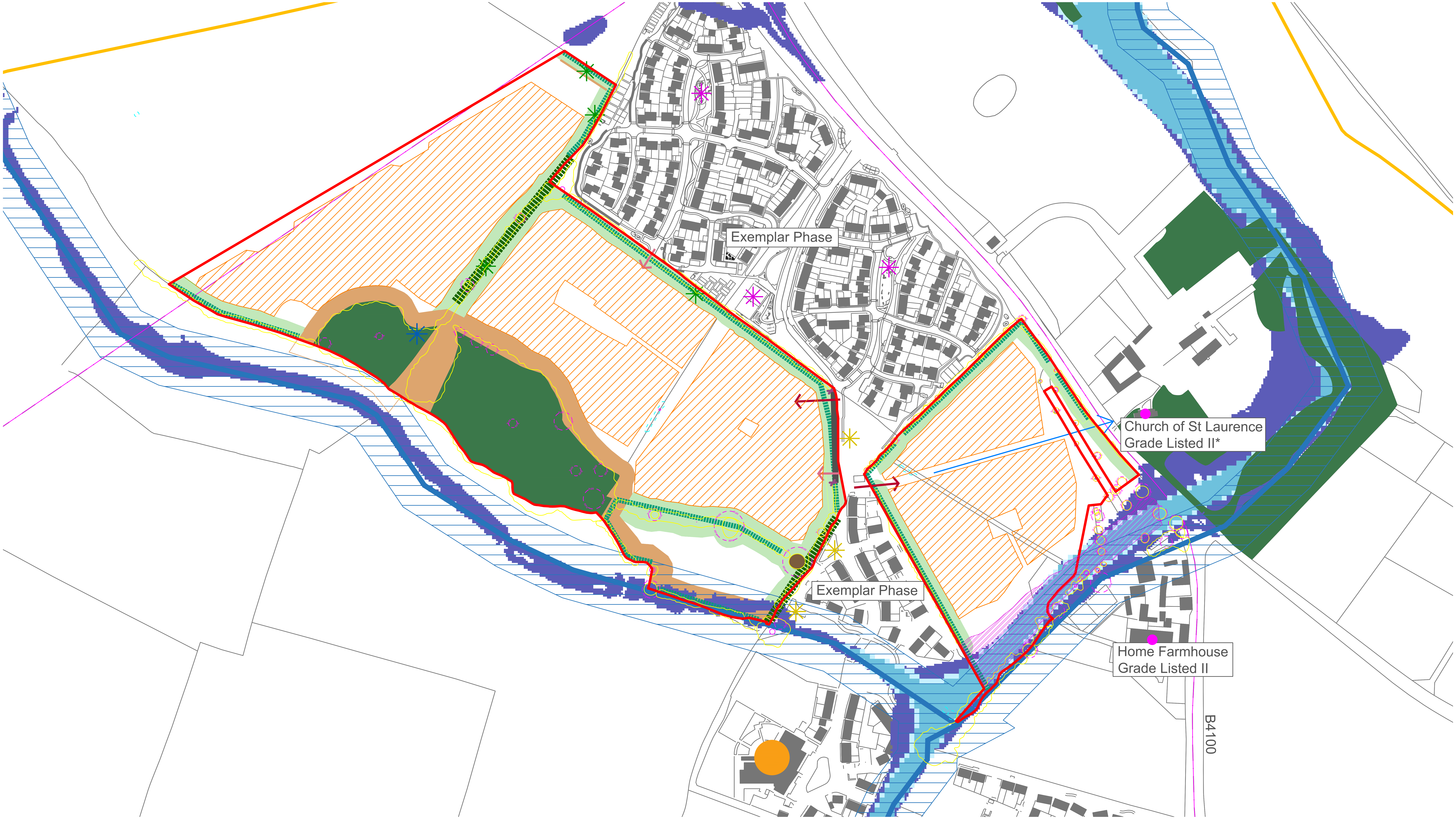

Project
Land at North West Bicester

Drawing Title
Location Plan

| Date | Scale | Drawn by | Check by |
| --- | --- | --- | --- |
| 02/02/2021 | 1:2,500 at A1 | ML | LA |

| Project No | Drawing No | Revision |
| --- | --- | --- |
| 1192 | 001 | E |

Mosaic




N

0 metres 100
(1:2,500)

- Site boundary
- Tree line (Aspect)
- Hedgerow (Aspect)
- Watercourse (OS)
- Priority Habitat Woodland (desktop)
- Dry ditch (Aspect)
- Dry pond (Aspect)
- Tree with High Bat Roosting Potential (Aspect)
- 30m watercourse buffer (SPD)
- Listed buildings (desktop)
- Public right of way (desktop)
- Flood zone 2 (Vectos)
- Flood zone 3 (Vectos)
- Parish boundary (desktop)
- Gagle Brook Primary School
- 15m woodland buffer and bat corridor (Aspect)
- 10m hedgerow buffer (SPD/Aspect)
- Historic hedgerow (Cotswold)
- Potential NDA
- Surface water flooding 1 in 1000 extent
- Servient Land (Velocity)
- Flood zone for the 1 in 100 year event + 35% climate change
- Potential access points (RP)
- Potential secondary access points (RP)
- View towards the Church of St Laurence (Cotswold)
- Access to be provided between this points (Velocity)
- Indicative tree root protection area - retention trees only (Flac)
- Trees for removal to facilitate development (Flac)
- Vegetation canpopy (Flac)
- Exemplar Phase Children's Play
- Exemplar Phase Growing Spaces

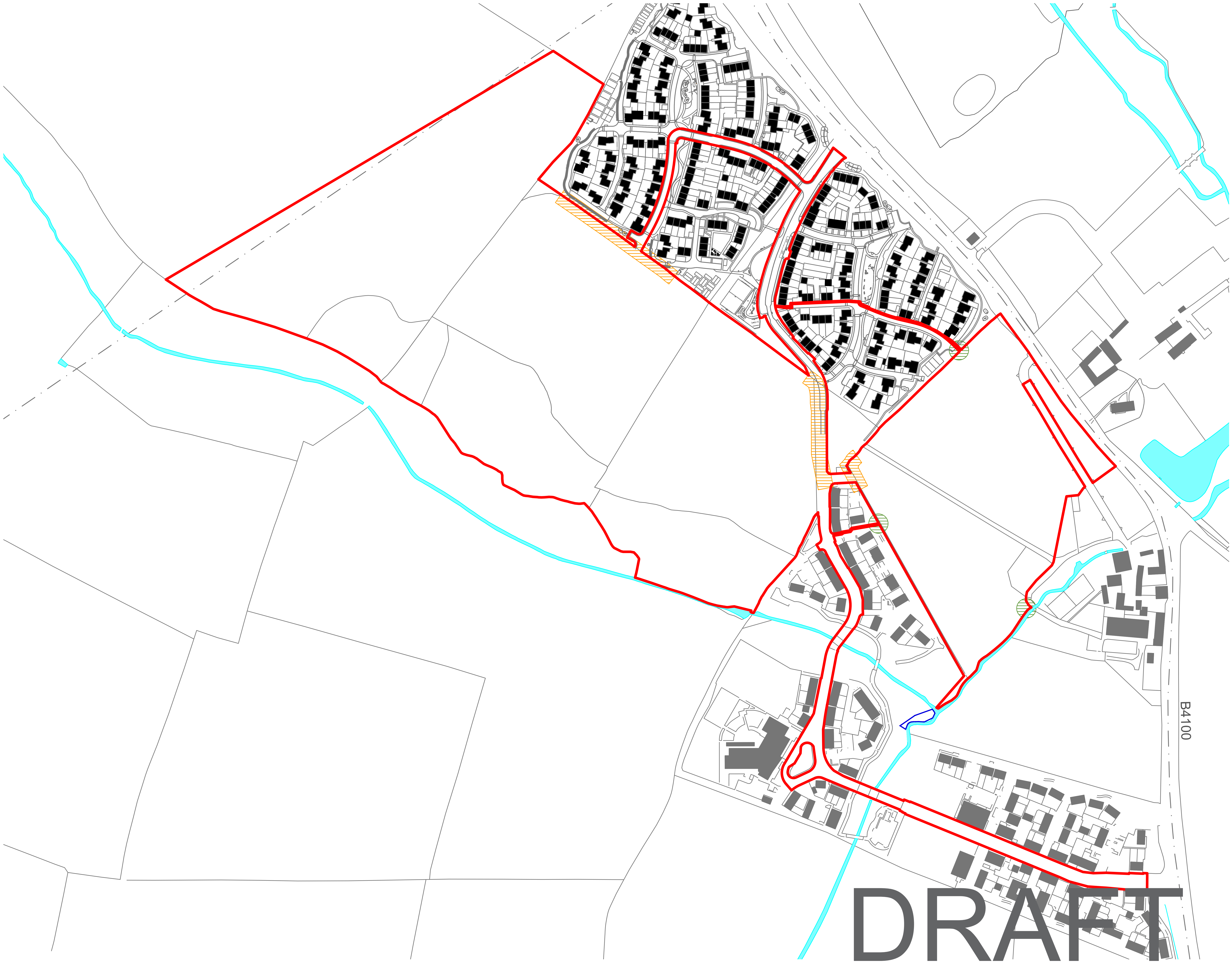
Project
Land at North West Bicester

Drawing Title
Considerations

| Date | Scale | Drawn by | Check by |
|---|---|---|---|
| 02/02/2021 | 1:2,5000 at A3 | ML | LA |

| Project No | Drawing No | Revision |
|---|---|---|
| 1192 | 002 | I |

Mosaic




Application boundary 23.93Ha

Ownership boundary 0.02Ha

Connection zone

Pedestrian and cycle only connection zone

N

0 metres 100

(1:2,500)

Project

Land at North West Bicester

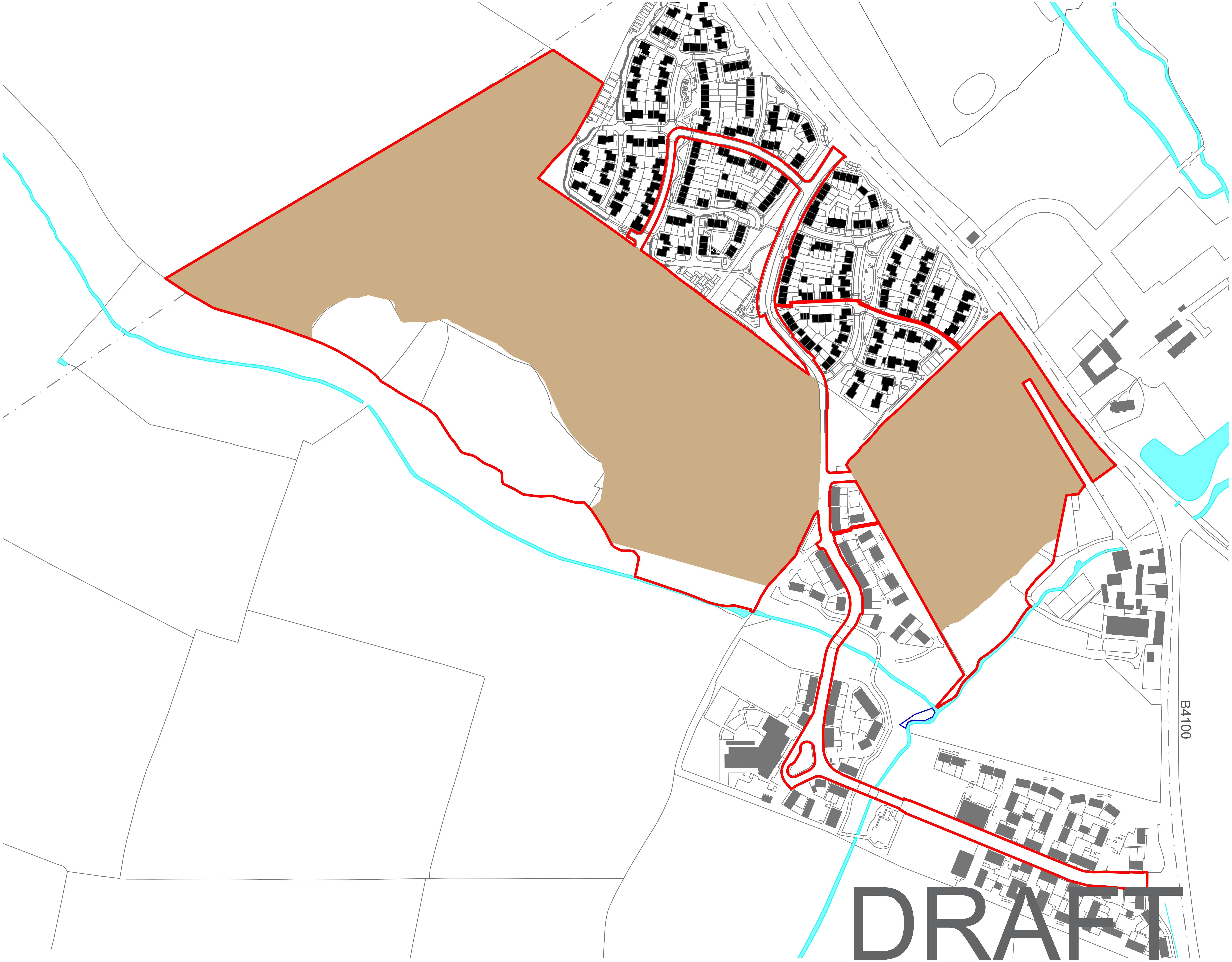
Drawing Title

Parameters Plan:
Access and movement

| Date | Scale | Drawn by | Check by |
|---|---|---|---|
| 02/02/2021 | 1:2,5000 at A3 | ML | LA |

| Project No | Drawing No | Revision |
|---|---|---|
| 1192 | 003D | D |

Mosaic




- Application boundary 23.93Ha
- Ownership boundary 0.02Ha
- Built form up to 12 m
- Built form up to at 16 m (location to be completed)

N

0 metres 100
(1:2,500)

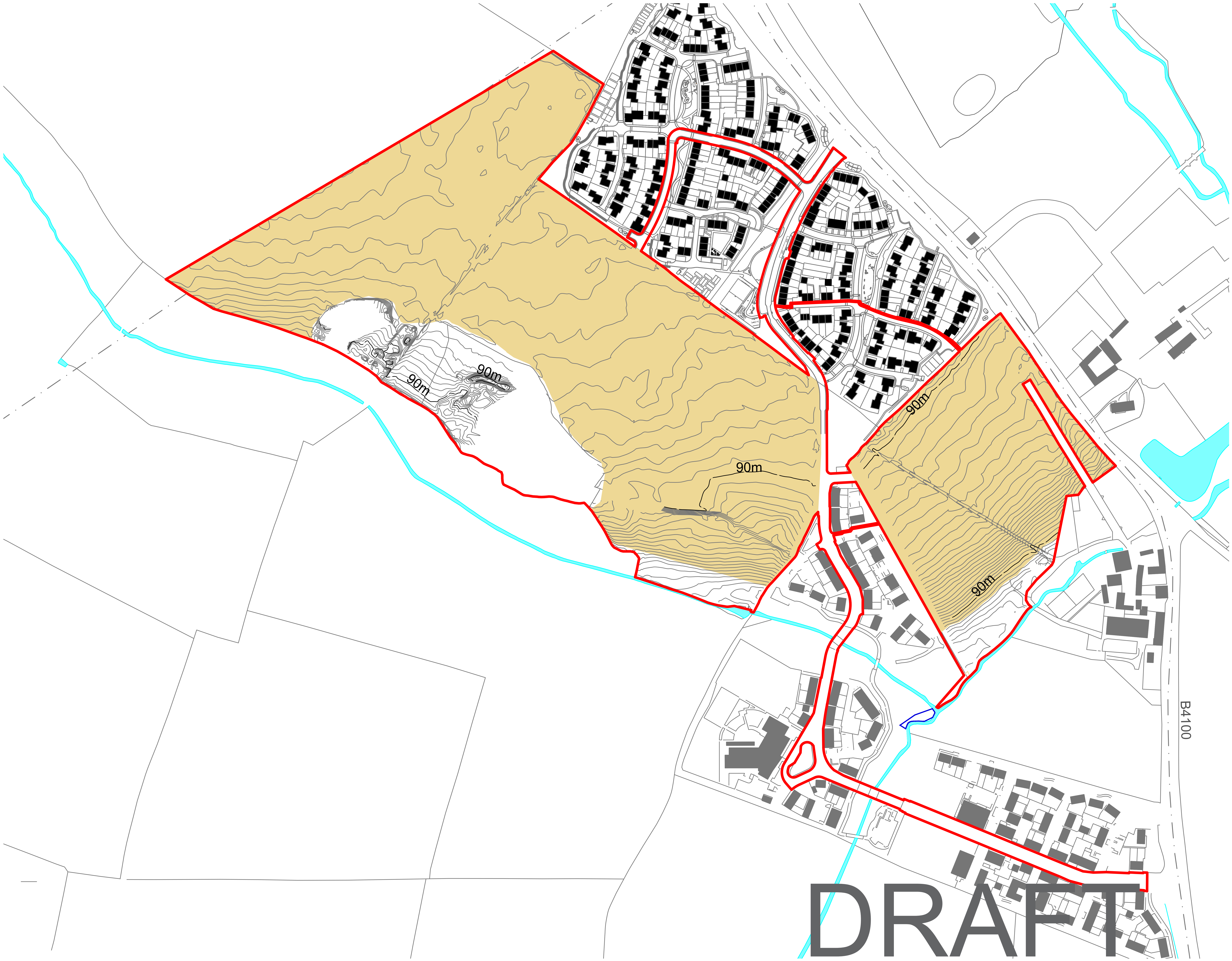
Project
**Land at North West Bicester**

Drawing Title
**Parameters Plan: Maximum building heights and footprint**

| Date | Scale | Drawn by | Check by |
|---|---|---|---|
| 02/02/2021 | 1:2,5000 at A3 | ML | LA |

| Project No | Drawing No | Revision |
|---|---|---|
| 1192 | 003C | D |

Mosaic




Application boundary 23.93Ha

Ownership boundary 0.02Ha

-1.5m to +1.5m from existing ground levels

0.2m contour lines

N

0 metres 100

(1:2,500)

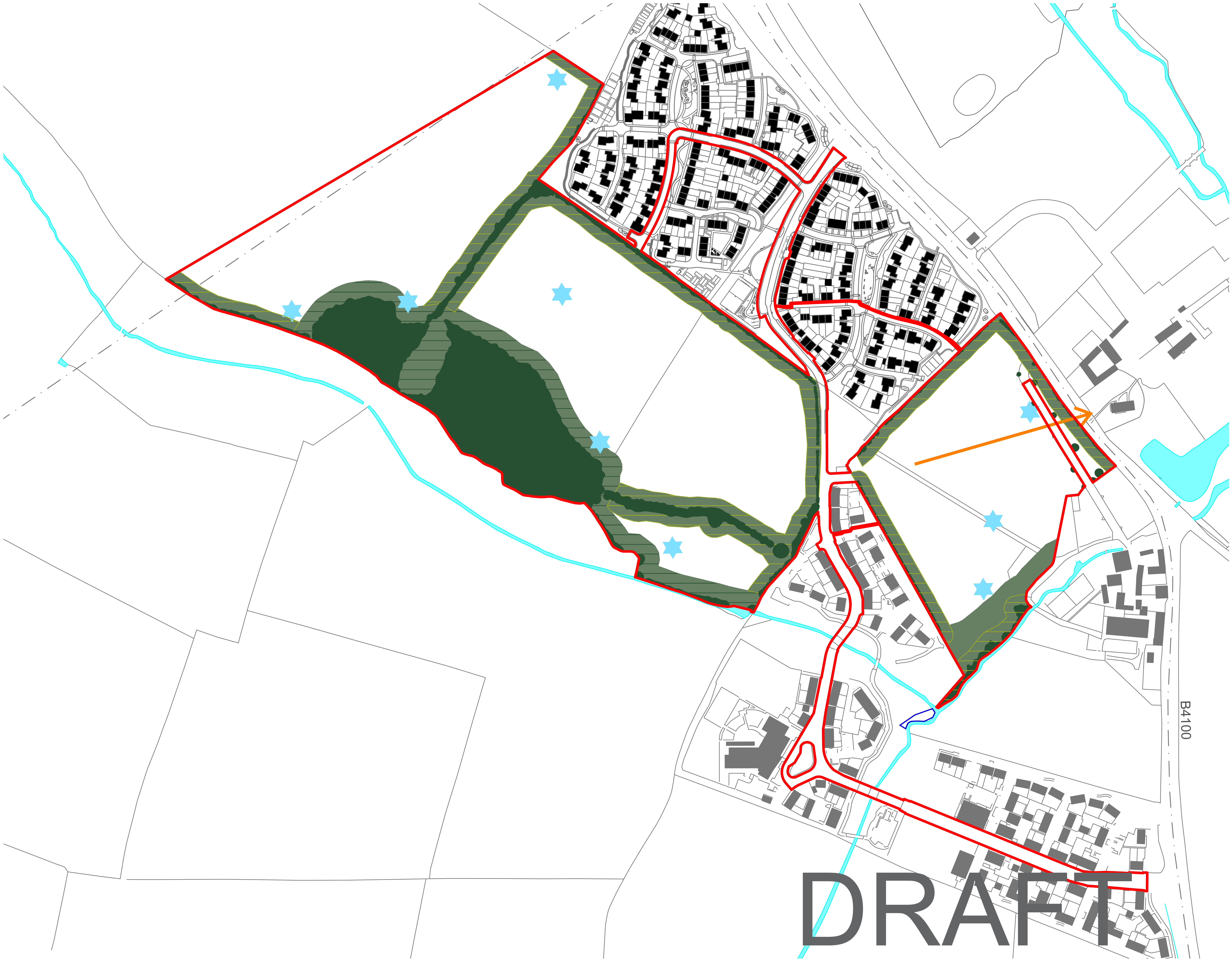
Project
Land at North West Bicester

Drawing Title
Parameters Plan:
Finished ground levels

| Date | Scale | Drawn by | Check by |
|---|---|---|---|
| 12/11/2021 | 1:2,5000 at A3 | ML | LA |

| Project No | Drawing No | Revision |
|---|---|---|
| 1192 | 003A | D |

Mosaic




- Application boundary 23.93Ha
- Ownership boundary 0.02Ha
- Multi-functional green space
- Retained vegetation
- Indicative location of attenuation basin
- 10m hedgerow buffer
- 15m woodland buffer and bat corridor
- View corridor set within landscape

N

0 metres 100
(1:2,500)

Project
Land at North West Bicester

Drawing Title
Parameters Plan:
Multi-functional Green Space

| Date | Scale | Drawn by | Check by |
| --- | --- | --- | --- |
| 12/11/2021 | 1:2,5000 at A3 | ML | LA |

| Project No | Drawing No | Revision |
| --- | --- | --- |
| 1192 | 003AB | D |

Mosaic

# Appendix B Predicted Energy Demand Model

Project Name: North West Bicester
Project No: 49656
Consultant: JR

# Masterplan Energy Model: Data Report

This data report provides a summary of the masterplan energy model and its results. These results are provided in line with the recommendations presented in the main body of the report and the limitations provided below.

## Key Performance Indicators and Assumptions

### Commercial and Industrial Use Class

#### Data References

Energy Efficiency in Buildings CIBSE Guide F 2016
BSRIA Rules of Thumb Fourth Edition 2018
Stantec Industry Experience 2021
BCO Guide to Specification 2018

#### Methodology

The benchmark data from the above references have been used to create Building Regulation 2016 compliance. Predicted energy demand reduction is based on efficiency in water and space heating only to meet the prevailing policy changes.

Additional carbon emission reductions required to meet standards for Building Regulations 2021 have been established through Stantec's knowledge of M&E and Structural Engineering and guidance presented by the BCO.

Unregulated energy demand has not been adjusted to reflect changes in demand use since 2016. Our assumption is that whilst appliances contributing to the unregulated demand continue to have improved efficiencies and lower energy requirements, more appliances and technologies are being bought and used, hence displacing the carbon emission savings achieved.

Each commercial use class has been subdivided into a use typology to provide a range of different use scenarios. High street and local centres have taken data from a range of end uses to provide an average energy demand for the use class.

## Domestic Use Classes

### Data References

The Government's Standard Assessment Procedure for Energy Rating of Dwellings 2016 edition
Government's Response to Future Homes Standard February 2021
BSRIA Rules of Thumb Fourth Edition 2003
Energy Efficiency in Buildings CIBSE Guide F 2016
BRE Domestic Energy Model (BREDEM 8 &12)

### Methodology

The baseline regulated energy demands for domestic use classes were primarily calculated using the methodology as set out in The Government's Standard Assessment Procedure (SAP). The baseline unregulated energy demand however was calculated using the methodology set out in BREDEM. These methodologies enabled a 2016 baseline to be calculated for domestic units directly.

In order to calculate the predicted energy demand for 2021 and 2025 SAP models were developed in line with the fabric standards defined within the Governments 2021 Future Home Standard.  Emission scenario are taken from SAP 10 and Treasuries Green Book Guide. The unregulated energy demand for residential units was assumed to remain the same as the baseline for the reasons stated above, which follows the BREDEM approach to calculating unregulated supply. Technology selection is based on gas boiler efficiencies of 85%, electric heating 100% and ASHP with CoP 2.5:1.

## RESULTS: Baseline Energy Demand

| Description | Quantity | Total Area (m2) | Total Predicted Energy Demand (MWh) | | | | | Total CO2 Emissions (Tonnes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hot Water | Space HTG | Reg Elec | Unreg Elec | Total | Heating | Reg. Electric | Unreg. Electric | Total |
| **Residential** | | | | | | | | | | | |
| Phase 1 | 474 | 44,850 | 795 | 1,832 | 206 | 1,492 | 4,325 | 652 | 107 | 775 | 1,534 |
| Phase 2 | 474 | 44,850 | 795 | 1,832 | 206 | 1,492 | 4,325 | 652 | 107 | 775 | 1,534 |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Subtotal** | **948** | **89,700** | **1,590** | **3,663** | **413** | **2,985** | **8,650** | **1,305** | **214** | **1,549** | **3,068** |
| **Non- Residential** | | | | | | | | | | | |
| Phase 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Phase 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Subtotal** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **GRAND TOTAL** | **948** | **89,700** | **1,590** | **3,663** | **413** | **2,985** | **8,650** | **1,305** | **214** | **1,549** | **3,068** |

| | | |
|---|---|---|
| **Residential** | **Average DFEE kwh/m2** | **58.5629** |

## RESULTS: Predicted energy demand

| Description | Quantity | Total Area (m2) | Total Predicted Energy Demand (MWh) | | | | | Total CO2 Emissions (Tonnes) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hot Water | Space HTG | Reg Elec | Unreg Elec | Total | Heating | Reg. Electric | Unreg. Electric | Total |
| **Residential** | | | | | | | | | | | |
| Phase 1 | 474 | 44,850 | 699 | 1,306 | 173 | 1,492 | 3,670 | 164 | 24 | 203 | 390 |
| Phase 2 | 474 | 44,850 | 699 | 1,306 | 173 | 1,492 | 3,670 | 235 | 24 | 203 | 461 |
| | | | 0 | | | | | | | | |
| | | | 0 | | | | | | | | |
| | | | 0 | | | | | | | | |
| | | | 0 | | | | | | | | |
| **Subtotal** | **948** | **89,700** | **1,399** | **2,612** | **346** | **2,985** | **7,341** | **398** | **47** | **406** | **851** |
| **Non- Residential** | | | | | | | | | | | |
| Phase 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Phase 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Subtotal** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **GRAND TOTAL** | **948** | **89,700** | **1,399** | **2,612** | **346** | **2,985** | **7,341** | **398** | **47** | **406** | **851** |

| | | |
|---|---|---|
| **Residential** | **Average DFEE kwh/m2** | **44.7108** |
| **Total regulated CO2 reduction over baseline** | | **71%** |
| **Total CO2 reduction over baseline** | | **72%** |

### Energy Efficiency % reduction for Space Heating over 2020 Baseline

| House Type | 2021 | 2025 | 2030 |
|---|---|---|---|
| Detached | 9% | 18% | 18% |
| Semi Detached | 9% | 18% | 18% |
| Terrace | 9% | 18% | 18% |
| Flat | 9% | 18% | 18% |

### Energy Efficiency % reduction for Hot water over 2020 baseline

| House Type | 2021 | 2025 | 2030 |
|---|---|---|---|
| Detached | 3% | 3% | 3% |
| Semi Detached | 3% | 3% | 3% |
| Terrace | 3% | 3% | 3% |
| Flat | 3% | 3% | 3% |

### Energy Efficiency % reduction for regulated electricity over 2020 baseline

| House Type | 2021 | 2025 | 2030 |
|---|---|---|---|
| Detached | 20% | 20% | 20% |
| Semi Detached | 20% | 20% | 20% |
| Terrace | 20% | 20% | 20% |
| Flat | 20% | 20% | 20% |

## Assumptions and Limitations

1. The masterplan energy model is based on published benchmark data. Stantec are not responsible for the benchmark data and its quality of collation or quality assurance.

2. The applications of rules of thumb have been used to adjust benchmark data to represent likely changes in the Building Regulations. Adjustments have been made through the use of industry guides and Stantec's experience in structural engineering and M&E engineering. It is recognised that through adjustments such as these a generic approach to energy demand modelling has been created.

3. The masterplan energy model is a generic model and not building specific. The development of detailed energy infrastructure or plant should not be based on high level assessment figures.

4. The domestic energy demand is aligned to the Office of the Communities and Local Government Standard Assessment Procedure. This masterplan energy model is therefore limited by the assumption, number and calculations presented within the SAP.

5. Domestic energy demand reductions are based on Energy Saving Trust guidance as benchmark reductions. The application of energy demand reductions are therefore limited to the standards set by the Energy Savings Trust.

6. The masterplan energy model is limited by the nature of information that is present at the outline planning stage. In this respect the model is based on the masterplan development schedule broken down as use classes where available. Where use classes are not available assumptions have been made to estimate the typology.

7. Use of the Homes and Community Agency's benchmark data for occupation has been utilised to assess the likely water consumption per person within each dwelling. It has been assumed that 33% of water used within a dwelling will be for hot water. Water reduction targets are taken from Building Regulations Part G.

8. BEIS future carbon emission projects have been used to assess the carbon benefits of energy used.

9. A wide variety of factors will influence the final energy demand of a development. Many of these factors cannot be incorporated within a model without significant conjecture. It is recommended that more detailed energy demand modelling is undertaken for the development once more detailed designs are available. Detailed modelling should use both the SAP and Simplified Building Energy Model.

10. Demand profiles have been normalised to enable them to be representative of the likely total energy demand. As such these profiles provide an indication of the energy profile.

# Appendix C Renewable and Low Carbon Technologies

## C.1 Introduction

This appendix provides additional information on certain renewable and low carbon energy technologies in support of the feasibility study presented in Section 6.

## C.2 Active network management and Distributed Energy Resource (DER)

Active network management (ANM) is a core part of the concept of a 'smart grid'. There is to date no industry-agreed definition of ANM. The Energy Networks Association uses the following summary definition: "using flexible network customers autonomously and in real-time to increase the utilisation of network assets without breaching operational limits, thereby reducing the need for reinforcement, speeding up connections and reducing costs."

Given the potential for decentralised energy generation at the Proposed Development, it could be possible to develop a distributed energy resource (DER) strategy across the scheme. This would connect the power generation distributed across the project with the development's energy demand through active network controls (turning power and demand on and off accordingly).

DER is an energy system which links up a number of smaller, decentralised energy generation schemes and controls them via a central control system (remotely). This turns this decentralised energy into a Virtual Power Plant (VPP) for the scheme. A VPP is a system that integrates several types of power sources, (such as PV) to give a more reliable overall power supply.

The advantage of integrating these technologies with control mechanisms and potentially backup storage systems (such as batteries) is also that these technical interventions reduce the reliance on the distribution network for peak supply. In return this reduces the need for potential offsite grid reinforcements which can require the need for early capital outlay.

## C.3 Ambient loop communal heat network ('5th generation network')

An ambient loop communal heat network (sometimes referred to as a '5th generation network') is generally an electric led-communal heating system. Brands include Glen Dimplex's Zeroth Energy System, but other similar systems are available.

Typically, these systems consist of in-apartment heat pumps connected to a refrigerant free communal energy loop. A centralised heating or cooling plant (e.g. roof-mounted air source heat pumps) keeps this water loop maintained at a regulated temperature (circa 25°C). Such systems have the capacity to provide future connection to a district heat network.

An integral unit is provided within each building unit (e.g. within each apartment) which contains the heat pump technology and a hot water cylinder. The heat pump can be specified to provide heating only or heating and cooling. The hot water cylinder is charged by the heat pump and an immersion heater. A range of hydronic emitters can be used to provide heating, including fan coils and underfloor heating.

## C.4 Photovoltaic Solar Panels (PV)

Photovoltaic (PV) solar panels convert solar energy into electricity and can be building-integrated (on roofs) or standalone (ground-mounted).

PV systems offset grid electricity and therefore provide a $CO_2$ saving (currently 0.519 kg $CO_2$/kWh, expected soon to reduce to 0.136 kg $CO_2$/kWh and reducing further as the grid decarbonises in the future). Payback periods for PV are now commercially attractive due to a significantly increased supply base and tariffs such as the Smart Export Guarantee (SEG).

PV arrays are connected to the electrical system of a building via inverters. The electricity generated by PV can be used on-site and, when not required, can be exported to the National Grid. This process requires no user intervention.

Sunshine is intermittent and often unreliable in England, which can significantly impact PV performance. PV also only operates in daylight hours, so cannot generate electricity continuously. PV is generally most efficient when it is positioned as south-facing at a pitch of 30-35° from horizontal, and in areas free from shading.

## C.5 Gas Engine CHP (Cogeneration)

Gas engine combined heat and power (CHP), sometimes referred to as cogeneration, is a system that generates heat and electricity simultaneously. The heat is used to providing space heating and hot water; the electricity is typically exported to the grid.

CHP systems can be sized to provide heat in single buildings (i.e. apartment blocks or commercial buildings) or a whole site via a heat network.

Gas-fired CHP systems fail to achieve Part L compliance under the new carbon emission factors (primarily because the on-site electricity generation is not offsetting as much ‘carbon’ in the electricity grid). Gas CHP is unlikely to be more favourable under the Future Homes Standard.

Increasingly there are concerns of placing combustion-based technology near housing due to air quality impacts.

Heat losses from a district heating network (especially in low density developments) can make this a less financially viable and resource efficient option.

## C.6 Wind Energy

Wind is a well-established energy source. The expertise and skills to undertake a range of wind turbine installations is extensive and the good supply base for wind energy means there is strong market competition. With this experience and knowledge behind wind energy generation, the financial risks are relatively low. A detailed assessment of the on-site wind regime would be needed before committing to a wind power strategy.

Roof-mounted turbines (1 – 2 kW) or small standalone, pole-mounted turbines (5 – 6 kW) can generate electricity on sites to compliment carbon reductions and “keep the lights on”. However, wind turbulence in the urban environment often reduces the performance of these systems. Roof-mounted turbines, in particular, do not provide long-term reliable performance and can cause structural vibration issues.

Larger (≥ 1 MW), pole-mounted turbines can also be used to generate electricity on or near a development site. Generally speaking, such turbines are not appropriate near residential properties due to noise and visual impacts and can negatively impact nearby landscape designations.

## C.7 Hydropower

Hydropower or hydroelectricity refers to the conversion of energy from flowing water into electricity. It is considered a renewable energy source because the water cycle is constantly renewed.  There are no hydropower opportunities at the site.

## C.8 Biomass Technologies

Biomass can be used as a fuel source for heat, power and CHP applications. Energy is typically derived from burning biomass in biomass boilers. Other potential technologies include gasification and pyrolysis, but these are less commercially proven.

Biomass plants can be scaled to meet the needs of a development and to reflect the availability of biomass in the area. Large biomass plants can be used to supply heat to multiple buildings via a heat network. Smaller systems can be used to heat a single building or room.

The lifecycle costs of biomass systems are typically greater than tradition fossil fuel heating systems. However, incentive schemes such as the Renewable Heat Incentive (RHI) can reduce the costs and provide financial returns.

As a solid fuel, biomass often requires transportation over significant distances. However, the carbon intensity of biomass can be less than traditional fossil fuels (oil and gas), even including the emissions associated with intercontinental transportation.

The use of biomass technologies is subject to the availability of long-term (preferably local) contracts to support security of supply and sufficient generation for a development. In addition, biomass is a bulky product that requires additional space for infrastructure (including storage and delivery space).

Stoves are becoming a popular choice in homes, using either biomass pellets or pieces of wood as fuel. The additional expense of incorporating chimneys (or equivalent) needs to be considered.

Combustion-based biomass systems can have detrimental impacts on local air quality (both from on-site combustion and HGV deliveries).

## C.9 Solar Water Heating (or Solar Thermal)

A solar panel ‘collector’ absorbs heat from the sun, the water in the panel is heated, pumped through a coil in the hot water cylinder and the heat transferred to the cylinder. The collector is usually roof mounted (although they are sometimes ground-mounted).

These systems can be used to offset a portion of heat demands in both the domestic and non-residential buildings. For example, in well-designed buildings, solar water heating can reduce the fuel consumption associated with hot water by circa 60-70% and the associated $CO_2$ emissions.

As with PV, solar water heating systems rely on solar energy and therefore the most effective heat production occurs during the daytime and sunny periods, and efficiencies are greatly reduced in winter. Therefore, their output for the ‘whole year’ is relatively low.

In order to accommodate solar water heating systems, buildings must be designed to allow space for hot water cylinders and flow/return pipework. As with PV, solar water heating operates most efficiently when installed on south-facing (or almost south-facing) roof space.

## C.10 Mechanical Ventilation with Heat Recovery

Mechanical ventilation with heat recovery (MVHR) provides fresh filtered air into a building whilst retaining most of the energy that has already been used in heating the building.

MVHR works by simply extracting the air from the polluted sources, usually wet rooms (e.g. kitchens, bathrooms, toilets and utility rooms), and supplying fresh air to 'living rooms' (e.g. bedrooms, living rooms, studies, etc.). The extract air is taken through a central heat exchanger and heat recovered into the supply air (usually at least 75% of the heat from exhaust air is recovered). This works both ways: if the air temperature inside the building is colder than the outside air temperature then the coolth is maintained in the building.

## C.11 Wastewater Heat Recovery

A wastewater heat recovery (WWHR) system typically works by extracting heat from the water drained from a bath or shower. The heat is used to warm the incoming mains water, reducing the strain on the main heating system and the energy required to heat the water up to the required temperature.

A system normally takes the form of a long vertical copper pipe (heat exchanger), where warm water runs alongside the colder mains water to exchange the heat. The devices are typically around 60% efficient, so convert 60% of the potential energy in the wastewater back into heat for the incoming water.

## C.12 Air Source Heat Pumps

An air source heat pump is an electric system that absorbs heat from the outside air and uses it to heat radiators, underfloor heating systems or warm air convectors and hot water in a building. They can be used to provide all heating in a building or a portion of heating in combination with supplementary systems (e.g. gas boilers).

Heat pumps have some impact on the environment as they need electricity to run the fans for air extraction and compressors (typically in excess of 2 kW).

Air source heat pumps require the installation of external condensers, which are usually mounted on roofs or rear/side walls. They also feature moving parts (an electrically driven fan) and therefore make noise when they operate.

Air source heat pumps are generally installed on individual homes, apartment blocks or commercial buildings. The use of numerous air source heat pump systems would have an impact on peak electrical loads and grid reinforcements

## C.13 Ground / Water Source Heat Pumps

These heat pumps draw heat energy from the ground or a water source, concentrate it and then release it into a property. Some heat pumps can reverse this process in the summer, thereby providing cooling in buildings.

The systems can be either 'open loop' or 'closed loop'. Closed loop systems are typical in the UK and consist of laying a series of coiled pipes in shallow trenches (horizontal collector loops) – which requires considerable land area - or down boreholes (vertical collector loops). In open loop systems, groundwater is abstracted at ambient temperature from the ground, passed through a heat pump before being reinjected back into the ground or discharged at the surface. Open loop systems have the advantage of limited underground infrastructure but require an environmental permit to extract and discharge water.

For these systems to operate effectively, buildings must achieve a high standard of fabric energy efficiency and, where appropriate, an underfloor heating system (wet system) could be incorporated to optimise system performance.

The efficiency and cost-effectiveness of these systems is affected by underlying ground conditions, the thermal conductivity of the geology, and/or the temperature / availability of the water source.