Test Valley Borough Council

Test Valley Renewable and Low Carbon Energy Study

Final report
Prepared by LUC in association with the Centre for Sustainable Energy (CSE)
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Test Valley Borough Council

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Contents

Contents

Executive Summary

Introduction

1. On the 4th September 2019, Test Valley Borough Council declared a climate emergency and made a commitment to investigate clear and effective options to become a carbon-neutral organisation. Alongside this, it was resolved that the Council would work with communities and partners to identify opportunities for making the Borough carbon neutral. The Council acknowledge that planning policy has a key role to play in achieving this and are in the process of preparing the next Local Plan.

2. LUC and the Centre for Sustainable Energy (CSE) were commissioned in January 2020 by Test Valley Borough Council to undertake a renewable and low carbon energy study. This study seeks to provide a robust evidence base to underpin planning policies relating to renewable and low carbon energy generation and low carbon development within the emerging Local Plan. It identifies the potential for different renewable and low carbon energy technologies at all scales within the Borough of Test Valley, and the opportunities for development to draw its energy supply from decentralised or low carbon energy sources.

Baseline Energy Demand and Energy Needs Assessment

3. Energy use and associated emissions across Test Valley were established to provide a baseline from which to measure future changes and monitor progress towards targets. Total energy consumption within Test Valley across the industrial/commercial, domestic and transport sectors for 2017 is estimated to be almost 3,456 GWh. The resulting Test Valley 'scope of influence' emissions for the same year total 708,017 tCO2. The average forecast annual emissions from new housing is estimated to be 804 tCO2, which represents around 0.4% of emissions from existing housing.

Renewable and Low Carbon Energy Opportunities

Existing Renewable and Low Carbon Generation

4. An exact figure for the amount of existing renewable energy capacity across the Borough is not possible to ascertain, although estimates for installed electricity generation capacity and output have been compiled. There is currently at least 177.7MW of operational renewable electricity generation across the Borough, with annual carbon emission savings of 37,532 tCO_2. This figure will increase to around 46,023 tCO_2 once all existing consented schemes are operating at full capacity. The majority of schemes are solar PV developments which are located in the north of the Borough, several of which are located along the A303 corridor. There is also a cluster of renewable developments, again mainly solar PV, located in the south of the Borough around Romsey.

5. The amount of existing renewable heat generation in Test Valley from biomass, solar water heating and heat pumps has also been estimated. There are 39 (9MW) non-domestic and 271 (2.8MW) domestic accredited full applications for the Renewable Heat Incentive[1] within Test Valley. In addition, there is 1MW of operational landfill gas development and 10MW of consented advanced conversion technologies incorporating CHP.

Potential for Renewable and Low Carbon Generation

6. A range of resources and technologies were assessed to establish the technical (theoretical potential) and deployable potential (potential that could realistically be delivered) for each type of renewable energy resource within Test Valley Borough.

Wind

7. The assessment results indicate that there is a technical potential to deliver up to around 1735MW of wind energy capacity in Test Valley, with the greatest potential for small turbines. Key issues that could affect the deployable potential of wind developments include landscape sensitivity, grid connection, development income and planning issues. Income considerations and planning in particular are identified as key barriers at the present time. A lack of financial incentives are currently restricting developer interest in onshore wind development in England. The National Planning Policy Framework also requires that wind energy development may only be permitted within areas identified suitable for wind energy developments within Local Plans and where the development has the backing of the local community.

Solar PV – Ground Mounted

8. As the full technical potential for ground mounted solar PV is very large, utilisation of 1%, 3% and 5% of the resource was quantified. Adopting 3% utilisation, the assessment results indicate that there is a technical potential to deliver up to around 425MW of ground mounted solar PV across the Borough – this approximately equates to an area of 8.5km^2. Key issues that could affect the deployable potential of ground mounted solar developments include landscape sensitivity, grid connection and development income.

[1] The Renewable Heat Incentive is a government financial incentive to promote the use of renewable heat. For more information, visit: https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi/about-domestic-rhi.

Solar – Rooftop

9. The technical potential for rooftop solar PV is estimated to be around 169MW, the majority of which relates to non-domestic properties. For rooftop solar water heating, the technical potential is around 196MW, the majority of which relates to homes. Key factors which are expected to influence uptake of solar PV include: its potential for integration with energy storage and smart power management technologies, and timescales for achieving grid parity, where power can be generated at or below the cost of mains electricity. The future uptake of solar water heating will be largely influenced by the extent to which heat pumps are deployed and their role in the provision of domestic hot water.

Biomass

10. In estimating the renewable energy resource from biomass, a range of feedstocks were considered. These include the following:

- **Virgin woodfuel:** from the sustainable management of forestry and arboricultural activities. Based on area of woodland across Test Valley, it is estimated that the resource could technically deliver annually around 104GWh of heat.
- **Energy crops:** from cultivation of short rotation coppice and miscanthus. Assuming 10% of suitable land is planted with the higher yielding miscanthus, this resource could technically deliver around 207GWh per year.
- **Municipal and commercial solid waste:** the technical resource for municipal and commercial waste, as a sustainable energy generating technology, is directly related to the amount of residual waste that is generated and collected within the Borough. This is complicated by the fact that waste disposal is dealt with at county level and involves energy recovery treatment plants located outside of the Borough. Indicative figures for 2016/17 suggest that Test Valley's residual 'black bin' household waste resulted in 23-31GWh of electricity generation, of which 50% could be classed as renewable. Recycled wood waste can also be part of this waste stream but its use as a separate energy resource is largely dependent on levels of contamination.
- **Agricultural residues and sewage:** the resource from agricultural residues is derived from numbers of cattle, pigs and poultry, and equates to around 11.4GWh per year. This would require the deployment of farm-scale anaerobic digestion plants which generate both heat and electricity.

Hydropower

11. Based on an existing study by the Environment Agency, the technical hydropower potential within Test Valley is around 527kW made up of 18 small scale sites. There are however significant barriers to deployment due to the environmental and regulatory constraints associated with hydro installations. The viability of this technology is highly site-specific and site surveys would be needed to establish local factors that affect deployment.

Ground and Air-source Heat Pumps

12. The heat pump technical resource is very large as almost any building could potentially have an air source heat pump. For simplicity, only air source heat pumps are considered in the assessment due to the space constraints of ground source heat pumps. It is estimated that technically a heat generation capacity of around 307MW, or 261GWh could be delivered heat per year. Heat pumps are expected to become significantly more widespread as their emissions performance increases as a result of the gradual decarbonisation of UK grid electricity, and there is a consequential shift towards the electrification of heat.

Water Source Heat Pumps

13. It has not been possible within the scope of this study to assess the potential for water source heat pumps, although a 2014 Government study suggests that the River Test may have a heat capacity of 5-25MW. Their viability would largely depend on identifying a sufficiently high heat demand local to the heat pump location.

Geothermal

14. Currently, geothermal energy, where heat is extracted from deep below the earth's surface, is only thought to be exploitable in a very limited number of locations around the UK, such as Cornwall and the Lake District/Weardale areas. However, potential has also been identified for small scale generation in Cheshire and in the Wessex sedimentary basin, with the latter area including Test Valley. Specialist surveys would be needed to investigate the localised potential resource within Test Valley.

Grid Capacity

15. The ability to connect to the electricity grid can be a limiting factor in the deployment of all larger energy developments where the energy generated is to be exported. The present capacity[2] of the network to accept new generation appears relatively constrained across the Borough, particularly in the north around Andover and its hinterland where most of the sub-stations have an overall 'red' classification, meaning they are constrained to additional generation connections.

[2] As accessed on 08/10/2020: ssen.co.uk/generationavailability.

There appears to be greater capacity to the south of the Borough around Romsey and beyond.

16. Energy storage technology, particularly batteries, has advanced considerably in recent years and is well placed to help alleviate the constraints that currently limit connections to the grid. By co-locating battery storage with renewable energy developments, developers can store excess power and sell during high demand. Also, similar to storage, albeit 'one-way' only, provision of Demand Side Response (DSR) capacity can help relieve grid constraints by businesses reducing power demand during times of high demand, and switching back on when peaks are over.

Potential Deployment Scenarios

17. Taking into account the technical potential, together with additional assumptions regarding deployment issues, an illustrative deployable resource potential is estimated for each technology. Although this is only one of many scenarios that could be considered, it aims to illustrate what could be achieved under the set of assumptions given in **Appendix A**. The resource is presented in terms of potential annual emission savings compared against Test Valley's 'scope of influence' Borough-wide emissions. Under the scenarios considered, the total potential emissions savings from the combined technologies correspond to around 58% of the 'scope of influence' Borough-wide emissions. However, savings from power generating technologies are expected to steadily decrease in the future as the national grid decarbonises and there is reduced benefit from offsetting mains electricity.

18. Results are also presented in terms of the estimated annual energy yields from each resource compared with district-wide energy consumption, split by electricity generation and heat. As an example, total Borough-wide electricity demand could potentially be met by deploying around 3% of the ground-mounted solar PV resource, equal to an area around 8.5km^2, or alternatively deploying around 14% of the identified wind resource. Decarbonising heat supplies is likely to pose the greater challenge in moving towards a net zero carbon future, and will largely rely on local exploitation of the biomass resource and national decarbonisation of the electricity grid for heat pump deployment. Issues around the sustainability of biomass supply in terms of achieving genuine carbon savings, along with air quality impacts of biomass plant may first need to be addressed. Achieving net-zero carbon will also depend on progress with energy demand reduction across the Borough and the decarbonisation of the transport sector.

19. In practice the deployable resource is likely to be considerably less than the scenarios considered above, as it depend on many variable factors specific to each technology. The scenarios should therefore be considered illustrative only as further site-specific appraisal work would be needed to estimate the deployable resource more accurately.

Potential for District Heating Networks

20. Borough-wide heat mapping was undertaken to establish the size and distribution of heat demand from buildings, including future new development. As expected, the resulting heat map shows heat demand density to be greatest in the more urban areas of the district. Subsequent analysis has identified a number of Heat Focus Areas, two of which (Central Andover and Nursling) were assessed for their potential to accommodate district heating networks. The results are presented in the form of illustrative heat networks for each area, as modelled using the THERMOS tool[3], to demonstrate the process of pre-feasibility analysis and the issues to be considered. Establishing the feasibility of these networks would require more detailed analysis, and should be considered alongside any nearby planned large new development sites, which can often act as the trigger for heat networks.

Enhanced Energy Performance Standards

21. Establishing a net-zero carbon standard in new development is considered to be vital to achieve an overall net-zero carbon reduction trajectory. This will require ambitious planning policies for new development which also ensures building energy performance is future-proofed. A widely accepted approach is to implement a baseline energy efficiency or 'fabric' target which then forms part of a hierarchical approach to a net zero carbon standard for new development. This supplements the baseline target with minimum levels of emissions reduction through onsite measures, and carbon offset requirements to achieve the overall net-zero target.

22. Any proposed emissions targets should be considered in the context of the Building Regulation proposals and local and national ambitions for net zero carbon. In particular, at the time of writing, decisions on the Government's Future Homes Standard consultation have yet to be published and this may affect the ability of Council's to set targets.

23. Examples of energy performance standards in the form of heat supply hierarchies and emission reduction targets are presented.

[3] THERMOS is a web-based software designed to optimise local district energy network planning processes and results according to user and project specific requirements such as budget, climate and energy targets.

Policy Options for Test Valley Borough Council

24. There are various policy options that the Council could consider including within the Local Plan in relation to renewables and low carbon energy within the Borough. Those which the study recommends including are:

- **Enhanced energy standards in new developments:** The Council should seek to set ambitious energy performance standards for new development (as outlined above), including an energy hierarchy, heat hierarchy, an onsite low or zero carbon energy generation target, a BREEAM 'Excellent' or above requirement for new non-residential development, and requirements for new residential dwellings to accommodate electric vehicle charging points.
- **Criteria based policies:** The council should include criteria-based policies designed to manage the development of renewable and low carbon technologies, but this should also be supported by guidance on the most suitable locations.
- **Areas of suitability (for wind energy):** In line with the National Planning Policy Framework, when considering applications for wind energy development, local planning authorities should only grant planning permission if the development site is in an area identified as suitable for wind energy development in a Local or Neighbourhood Plan. The Council should identify areas suitable for wind taking account of the findings of this report and the accompanying Landscape Sensitivity Assessment report.
- **Energy opportunity maps:** The Council could produce maps to clearly identify and map the Borough's renewable and low carbon sources of energy as a positive and proactive way to spatially plan for renewable and low carbon energy generation. With regard to heat networks, in order to encourage low carbon district heating schemes, search area maps could identify the locations that have greatest potential to locate district energy schemes.
- **Community renewables:** The Council's emerging Local Plan could broaden its support for community renewable schemes by stating that the Council would actively support community renewable energy schemes which are led by, or meet the needs of local communities.

25. All policy recommendations will also need to consider viability issues. The higher standards proposed in this study (and required to meet climate change targets) may affect on the viability of developments and as such, further work to understand this will be required.

Conclusions

26. The delivery of renewable and low carbon projects will also require changes not just to planning policy but also to the implementation of policy. It will be imperative that due weight and consideration is given to the importance of addressing climate change in development management decisions.

27. Local authorities are, however, well-placed to have a good understanding of their local area in terms of needs, opportunities and constraints whilst having influence through their multiple roles of major employers, community leaders, planning authorities and service providers. Test Valley Borough Council will therefore need to carefully examine its own sphere of influence in achieving a net-zero carbon target and be highly ambitious in tackling emissions in key sectors where it can exert meaningful influence. Increasing local renewable energy generation capacity will be a key component of the solution, sitting alongside energy efficiency, energy demand reduction, heat decarbonisation and providing infrastructure to accommodate the rapid growth in electric vehicles.

Chapter 1
Introduction

Background to the Study

1.1 LUC and the Centre for Sustainable Energy (CSE) were commissioned in January 2020 by Test Valley Borough Council to undertake a renewable and low carbon energy study. This study seeks to provide a robust evidence base to underpin planning policies relating to renewable and low carbon energy generation and low carbon development within the emerging Local Plan. It identifies the potential for different renewable and low carbon energy technologies at all scales within the Borough of Test Valley, and the opportunities for development to draw its energy supply from decentralised or low carbon energy sources.

Renewable energy refers to sources of energy that are not depleted when used, for example, wind and solar.

Low-carbon energy sources are technologies that produce power with substantially lower amounts of carbon dioxide emissions than are emitted from conventional fossil fuel power generation. An example of this is a heat pump. Whilst the heat from the ground is free and renewable, it still requires an electric pump to operate the system.

Decentralised energy generally refers to energy that is generated closer to where it will be used, rather than the more conventional very large scale 'centralised' energy plant that typically serve much wider areas.

1.2 On the 4th September 2019, Test Valley Borough Council declared a climate emergency and made a commitment to investigate clear and effective options to become a carbon-neutral organisation. Alongside this, it was resolved that the Council would work with communities and partners to identify opportunities for making the Borough carbon neutral. The Council has acknowledged that planning policy has a role to play in achieving this.

1.3 The Council is in the process of preparing its next Local Plan, to replace the current adopted Local Plan (2016)[4]. The new Local Plan will review all strategic issues affecting the plan area[5], as well as providing the development management policies required to deliver the strategy. At present, it is

[4] Test Valley Borough Council (January 2016) Revised Local Plan DPD Adopted Local Plan 2011-2029. Available at: testvalley.gov.uk/planning-and-building/planningpolicy/local-development-framework/dpd.

[5] Comprising the Borough of Test Valley, excluding that part which lies within the New Forest National Park.

envisaged that the plan period will extend to 2036. The current adopted Local Plan does not include any specific policies on renewable energy.

1.4 Section 14 of the National Planning Policy Framework (NPPF)[6] sets out the approach to climate change, with paragraphs 151 to 154 in particular considering renewable and low carbon energy and heat. Further detail is provided within the Planning Practice Guidance (PPG)[7].

1.5 Paragraph 151 of the NPPF (and associated PPG sections) indicates how plans should account for renewable and low carbon energy and heat, including through the provision of a positive strategy on such matters. It also covers the identification of suitable areas for renewable and low carbon energy sources and supporting infrastructure.

1.6 The Council is keen to ensure that sufficient evidence is available to inform its approach to these matters as part of the next Local Plan. It is also anticipated that the outputs of the study will be used by others, including local organisations preparing Neighbourhood Development Plans. This could assist them in the identification and delivery of local renewable energy opportunities. This study is not specifically intended to inform any investment or energy generation options by the Council itself.

Aims and Objectives

1.7 The key aim of the study is to prepare a renewable and low carbon energy study that will assist with the preparation of the Local Plan and the determination of planning applications. The study identifies where different renewable and low carbon energy technologies are most suitable within the Borough of Test Valley and what opportunities there are for development to draw its energy supply from decentralised or low carbon energy sources.

1.8 This study provides Test Valley Borough Council with a robust evidence base that can be used to underpin planning policies relating to renewable and low carbon energy generation and low carbon development within the emerging Local Plan. The evidence base and the recommended policies meet the requirements of the NPPF and PPG, and take into account the guidance and considerations set out in relevant national policy statements.

1.9 The evidence base and recommended policies will also help contribute towards the local ambitions for Test Valley to become carbon neutral, following the Council's declaration of a climate emergency.

1.10 In summary, the key objectives of the study were to:

- Review the technical potential for renewable and low carbon energy within the Borough and factors that may affect the extent to which these technologies can be deployed – i.e. grid connection, planning, finance etc.
- Review the potential opportunities for development to draw its energy from decentralised renewable or low carbon energy systems.
- Provide recommendations or appropriate policy options to include in the Local Plan regarding renewable and low carbon energy – including areas of potential suitability for wind, solar and other technologies.
- Undertake a landscape sensitivity study to inform the identification of suitable areas of potential for wind and solar. (This is provided in the separate Landscape Sensitivity Assessment of Renewable Energy report, and is cross referred to within this report)
- Set out specific recommendations for development management policies in terms of what would be reasonable to require in order to shift new development towards being carbon neutral, and general recommendations about the additional ways that potential allocations could be planned so as to be carbon neutral.

Study Approach and Scope

1.11 The study involved eight main tasks, as set out in **Figure 1.1** below.

1.12 A summary of the tasks is provided in **Table 1.1** below.

[6] Ministry of Housing, Communities & Local Government (2019) National Planning Policy Framework. Available at: www.gov.uk/government/publications/national-planning-policy-framework--2.

[7] Ministry of Housing, Communities & Local Government (2015) Planning practice guidance: Renewable and low carbon energy. Available at: www.gov.uk/guidance/renewable-and-low-carbon-energy.

Figure 1.1: Summary of main tasks and outputs.

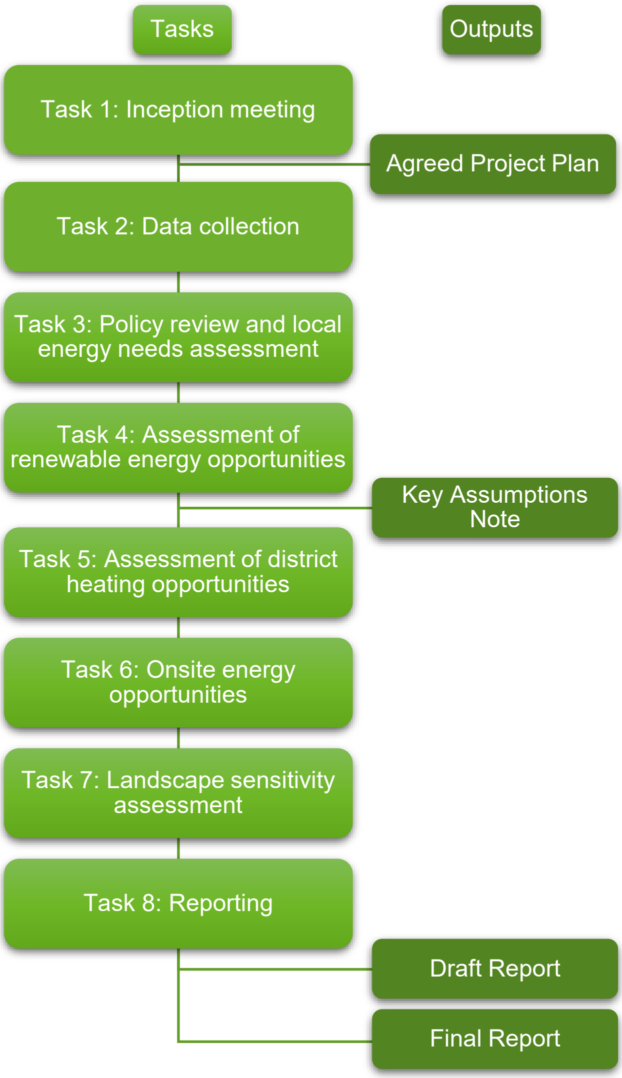


Table 1.1: Summary of key tasks.

Key Task	Detail
Task 1: Inception meeting	An inception meeting was held with Council officers in January 2020 to agree the scope of the study.
Task 2: Data collection	Background documentation was collected to build a comprehensive starting point for the energy and landscape evidence base, as well as the energy consumption, generation and emissions baseline, The emissions baseline gives a snapshot of current borough-wide annual carbon emissions against which future reductions can be measured.
Task 3: Policy review and local energy needs assessment	A review was undertaken of the relevant background information to the study. This included: ■ A review of the policy context for renewable energy and landscape at the national and local level (see **Chapter 2** and the separate Landscape Sensitivity Assessment of Renewable Energy report). ■ A review of the baseline energy consumption and assessment of local energy needs in Test Valley (see **Chapter 3**).

Key Task	Detail
Task 4: Assessment of renewable energy opportunities	An assessment was undertaken of the technical potential for renewable and low carbon energy within the Borough (see **Chapter 4**). A key assumptions note was produced setting out the assumptions used to undertake the assessment. This was sent to the Council for review prior to commencing the assessment.
Task 5: Assessment of district heating opportunities	An assessment was undertaken of the technical potential for district heating networks within the Borough (see **Chapter 5**).
Task 6: Onsite energy opportunities	An assessment was undertaken of the potential for enhanced energy performance standards in Test Valley (see **Chapter 6**).
Task 7: Landscape sensitivity assessment	A landscape sensitivity study was prepared assessing the sensitivity of Test Valley's landscape to wind and solar developments of varying types and scales. This is provided in the separate Landscape Sensitivity Assessment of the Renewable Energy Report.
Task 8: Reporting	The findings of the study are set out within this report and the accompanying Landscape Sensitivity Assessment of Renewable Energy.

1.13 A more detailed explanation of the methodologies used is provided in the relevant chapters (as outlined below).

Report Structure

1.14 The remainder of this report is structured as follows:

- **Chapter 2** provides a review of the policy context in relation to renewable and low carbon energy.
- **Chapter 3** provides a review of the baseline energy demands and sets out the findings of the Energy Needs assessments.
- **Chapter 4** presents the findings of the assessment of technical potential for renewable and low carbon energy.
- **Chapter 5** sets out the findings of the assessment of technical potential for district heating networks.
- **Chapter 6** presents the findings of the potential for setting enhanced energy performance standards.
- **Chapter 7** outlines the potential planning policy options for the emerging Local Plan.
- **Chapter 8** sets out the summary and study conclusions.

1.15 A separate Landscape Sensitivity Assessment report accompanies this report which assesses the sensitivity of Test Valley's landscape to wind and solar developments of varying types and scales.

Chapter 2
Renewable and Low Carbon Policy Context

Introduction

2.1 The following chapter provides a summary of the national and local legislation and policy context for the development of renewables and low carbon energy within Test Valley.

National Climate Change and Renewable Energy Legislation and Policy

2.2 The current profile of climate change on the world's stage has never been higher. The risks in failing to limit a global average temperature increase to 1.5°C have now been clearly set out in the IPCC Special Report 'Global Warming of 1.5°C'[8]. In response to this and the 2016 Paris Agreement, the UK's Committee on Climate Change (CCC) recommended in May 2019 a new emissions target for the UK: net zero greenhouse gases by 2050[9]. It also advised that that by 2030, current plans would at best deliver around half of the required reduction in emissions, and the Committee stated that *"current policy is insufficient for even existing targets"* and that targets are *"only possible if clear, stable and well-designed policies to reduce emissions further are introduced across the economy without delay."* In facing up to this challenge, the need for radical changes to adapt and mitigate the impacts of climate change is now broadly accepted in UK government and by an increasing proportion of civil society.

Climate Change Act

2.3 The UK's legally binding emission reduction targets were first set by the Climate Change Act 2008 and included a reduction of at least 80% by 2050 against the 1990 baseline[10]. However, on 1st May 2019, parliament declared a formal climate and environment emergency, and on 12th June 2019 the Government amended the Climate Change Act to target full net carbon neutrality (a 100% reduction of greenhouse gas emissions) in the UK by 2050[11]. This has been mirrored by widespread actions from local authorities and town and parish councils to adopt similar climate emergency declarations that target carbon neutrality by a variety of dates and are backed up with emerging action plans. This includes Test Valley Borough Council's declaration to investigate clear and

[8] IPCC (2018) Global Warming of 1.5°C. Available at: www.ipcc.ch/sr15.
[9] Committee on Climate Change (2019) Net Zero – The UK's contribution to stopping global warming. Available at: www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming.
[10] Climate Change Act 2008, c.27. Available at: www.legislation.gov.uk/ukpga/2008/27/contents.
[11] The Climate Change Act 2008 92050 Target Amendment) Order 2019. (2019). 2019/1056. Available at: www.legislation.gov.uk/uksi/2019/1056/contents/made.

effective options to become a carbon-neutral organisation, and to work with communities and partners to identify opportunities for making the Borough carbon neutral.

2.4 In response to its obligations to prepare policies to meet climate targets, the UK Government has also produced various sector specific policies and strategies. These include the UK National Energy & Climate Plan (2019), Clean Growth Strategy (2017) and the Industrial Strategy White Paper (2017) (further details below). In addition, the March 2020 UK HM Treasury Budget set out a suite of policies and financial support to progress the Government's clean growth agenda.

UK National Energy & Climate Plan

2.5 The Draft UK National Energy and Climate Plan (2019) sets out the UK's approach to meeting the five objectives of the Energy Union: energy security; energy efficiency; decarbonisation; the internal energy market; and research, innovation and competitiveness.

2.6 The Plan describes the current state of the energy sector in the UK, outlining the government's current approach to climate change mitigation through policy, and how this is expected to affect the five objectives of the Energy Union in future. This is supported by a summary table containing all the relevant UK policies that contribute to achieving the UK's climate goals, taken from the UK's National Communication with the United Nations Framework Convention on Climate Change (UNFCCC).

2.7 The report also includes scenario testing on the UK's projected emissions to 2035, with business as usual, all current measures and all current and planned measure scenarios. It demonstrates that the government's current measures have the potential to reduce baseline emissions by approximately 20% over the current measures in place, with a further 10% reduction through implementation of planned measures.

Clean Growth Strategy

2.8 In the context of the UK's legal requirements under the Climate Change Act, the UK's approach to reducing emissions as set out in the Clean Growth Strategy (CGS) (2017) has two guiding objectives:

- To meet domestic commitments at the lowest possible net cost to UK taxpayers, consumers and businesses; and,
- To maximise the social and economic benefits for the UK from this transition.

2.9 The CGS sets out three possible pathways to decarbonise the UK's economy by 2050:

1. Electric: including full deployment of electric vehicles (EVs), electric space heating, and industry moves to 'clean fuels';
2. Hydrogen: including heating homes and buildings, fuelling many vehicles and the power industry;
3. Emissions removal: including construction of sustainable biomass power stations with carbon capture and storage technology.

2.10 The Strategy also encourages local authorities to actively pursue a low carbon economy:

"Local areas are best placed to drive emission reductions through their unique position of managing policy on land, buildings, water, waste and transport. They can embed low carbon measures in strategic plans across areas such as health and social care, transport, and housing."[p118]

2.11 The strategy also announced up to £557 million in further Pot 2 (less established renewables) funding for Contract for Differences (CfD) -a 15-year contract that offers low-carbon electricity generators payments for the electricity they produce. This opened in May 2019.

Green Finance Taskforce and the Green Finance Strategy

2.12 One of the key proposals within the Clean Growth Strategy is to develop world leading Green Finance capabilities by setting up a Green Finance Taskforce, the aim of which is to *"provide recommendations for delivery of the public and private investment we need to meet our carbon budgets and maximise the UK's share of the global green finance market"*.

2.13 Building on the important work of the Green Finance Taskforce, this first Green Finance Strategy was produced in July 2019. This seeks:

- To align private sector financial flows with clean, environmentally sustainable and resilient growth, supported by Government action.
- To strengthen the competitiveness of the UK financial sector.

2.14 The Strategy notes the importance of local actors in directing potential investors towards opportunities that meet local priorities and so are more likely to secure local community support.

Industrial Strategy White Paper 2017

2.15 Achieving 'Clean Growth' is one of the future challenges the Government outlines as part of its Industrial Strategy. In order to maximise the advantages of the global shift to clean growth for the UK, the strategy proposes to:

- Develop smart systems for cheap and clean energy across power, heating and transport;
- Transform construction techniques to dramatically improve efficiency;
- Make our energy intensive industries competitive in the clean economy;
- Put the UK at the forefront of the global move to high efficiency agriculture;
- Make the UK the global standard setter for finance that supports clean growth;
- Support key areas of innovation, investing £725m over 4 years.

National Planning Legislation

Planning and Compulsory Purchase Act

2.16 The Planning and Compulsory Purchase Act (2004) sets out the structure of the local planning framework for England, including the duty on plan-making to mitigate and adapt to climate change. In other words, local planning authorities must make positive and proactive policies and decisions which contribute to the mitigation of, and adaptation to, climate change – polices and decisions that make measurable, ongoing reductions in carbon emissions reported in Council's annual monitoring reports. This legislation is supported by national planning policy and guidance set out below.

2.17 Section 19(1A) of the Planning and Compulsory Purchase Act 2004 (PCPA) requires that climate change is addressed through development plan documents and that obligations regarding annual monitoring of any targets or indicators are fulfilled:

"Development plan documents must (taken as a whole) include policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change" [Section 19(1A)]

"Every local planning authority must prepare reports containing such information as is prescribed as to…the extent to which the policies set out in the local development documents are being achieved." [Section 35(2)]

2.18 This means that local plans must consider how policies can deliver on these requirements, including having regard to the objectives and trajectories for reducing emissions set out within the Climate Change Act.

Planning Act and National Policy Statements

2.19 The Planning Act (2008) introduced a new planning regime for nationally significant infrastructure projects (NSIPs), including energy generation plants of capacity greater than 50 megawatts (50 MW). In 2011, six National Policy Statements (NPSs) for Energy were published. The energy NPSs are designed to ensure that major energy planning decisions are transparent and are considered against a clear policy framework. They set out national policy against which proposals for major energy projects will be determined by the National Infrastructure Directorate (NID) (formerly the Infrastructure Planning Commission or IPC).

2.20 The Overarching National Policy Statement for Energy (EN-1) sets out national policy for energy infrastructure and describes the need for new national significant energy infrastructure projects. EN-3 (NPS for Renewable Energy Infrastructure) provides the primary basis for decisions by the NID on applications it receives for nationally significant renewable energy infrastructure. It provides guidance on various technologies and their potential for significant effects. In 2016, onshore wind installations above 50MW were removed from the NSIP regime, and such these applications are now dealt with by local planning authorities, based on the NPPF.

Planning and Energy Act

2.21 The Planning and Energy Act (2008) enables local planning authorities to set requirements for energy use and energy efficiency in local plans, including a proportion of energy used in development to be generated from renewable and low carbon sources in the locality of the development. Such requirements can relate to specific types and scales of development but also broad areas within a local planning authority's area of influence, such as areas with optimal conditions for decentralised heat networks.

2.22 The Act also enables local authorities to require standards for energy efficiency in new buildings beyond those in the Building Regulations. In 2015 the energy efficiency requirements were proposed to be repealed, to effectively make the Building Regulations the sole authority regarding energy efficiency standards for residential development, and leaving local authorities no longer able to set their own energy efficiency standards. However, while the power was removed in principle and consultation on new Building Regulation has been undertaken, the Government has not yet produced a commencement date for repealing these powers, which therefore remain in place. More details on Part L of Building Regulations are set out in paragraphs 2.38-2.41.

National Planning Policy

National Planning Policy Framework (NPPF)

2.23 The Government published an updated and revised NPPF in February 2019, which sets out the environmental, social and economic planning policies for England. Central to the NPPF policies is a presumption in favour of sustainable development, that development should be planned for positively and individual proposals should be approved wherever possible. One of the overarching objectives that underpins the NPPF is set out in Paragraph 8: "*an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including …mitigating and adapting to climate change, including moving to a low carbon economy.*"

2.24 The revised NPPF supports the contents of the Neighbourhood Planning Act (2017) by making explicit reference to the need for local planning authorities to work with duty to cooperate partners on strategic priorities (paragraph 24) and defined strategic policies that make sufficient provision for climate change mitigation and adaptation (paragraph 20). These amendments provide a clear policy framework for local planning authorities to work collaboratively with partners and neighbours to tackle climate change mitigation and adaptation at a strategic scale and over the longer term.

2.25 Paragraph 149 of the NPPF states "*Plans should take a proactive approach to mitigating and adapting to climate change…in line with the objectives and provisions of the Climate Change Act 2008*". Paragraph 151 states that "*To help increase the use and supply of renewable and low carbon energy and heat, plans should:*

- **a.** *provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
- **b.** *consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
- **c.** *identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*"

2.26 Paragraph 152 states that local planning authorities should "*support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.*"

2.27 The NPPF goes on to state that "*When determining planning applications for renewable and low carbon development, local planning authorities should:*

- **a.** *not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and*
- **b.** *approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas" (Paragraph 154)*

2.28 The NPPF Footnote 49 also states that, other than the repowering of existing wind turbines, sites can only be developed if local authorities or local communities identify suitable locations within their Local Plan. Outside of the identified areas, onshore wind projects will not obtain planning permission.

National Planning Practice Guidance (PPG)

2.29 The online National Planning Practice Guidance (PPG) resource, published by the Ministry of Housing, Communities and Local Government (MHCLG) provides further interpretation of national planning policy for the benefit of local planning authorities and planning practitioners. Although the section on climate change has not been updated following the changes to the Climate Change Act and the UK Climate Emergency Declaration, it strongly asserts the importance of climate change within the planning system and the need for adequate policies if Local Plans are to be found sound[12]:

"Addressing climate change is one of the core land use planning principles which the National Planning Policy Framework expects to underpin both plan-making and decision-taking. To be found sound, local plans will need to reflect this principle and enable the delivery of sustainable development in accordance with the policies in the National Planning Policy Framework. These include the requirements for local authorities to adopt proactive strategies to mitigate and adapt to climate change in line with the provisions and objectives of the Climate Change Act 2008, and co-operate to

[12] Ministry of Housing, Communities & Local Government (2019) Guidance: Climate Change. Available at: www.gov.uk/guidance/climate-change.

deliver strategic priorities which include climate change." [Paragraph 1]

2.30 In respect of the approach to identifying climate mitigation measures for new development, the PPG also states:

"Every area will have different challenges and opportunities for reducing carbon emissions from new development such as homes, businesses, energy, transport and agricultural related development. Robust evaluation of future emissions will require consideration of different emission sources, likely trends taking into account requirements set in national legislation, and a range of development scenarios." [Paragraph 7]

2.31 The PPG also makes it clear with regards to renewable energy that[13]:

"When drawing up a Local Plan local planning authorities should first consider what the local potential is for renewable and low carbon energy generation. In considering that potential, the matters local planning authorities should think about include:

- *the range of technologies that could be accommodated and the policies needed to encourage their development in the right places;*
- *the costs of many renewable energy technologies are falling, potentially increasing their attractiveness and the number of proposals;*
- *different technologies have different impacts and the impacts can vary by place;*
- *the UK has legal commitments to cut greenhouse gases and meet increased energy demand from renewable sources. Whilst local authorities should design their policies to maximise renewable and low carbon energy development, there is no quota which the Local Plan has to deliver." [Paragraph 3]*

2.32 The role community led renewable energy initiatives have is outlined and states that they:

"are likely to play an increasingly important role and should be encouraged as a way of providing positive local benefit from renewable energy development…Local planning authorities may wish to establish policies which give positive weight to renewable and low carbon energy initiatives which have clear evidence of local community involvement and leadership." [Paragraph 4]

2.33 In terms of identifying suitable locations for renewable energy development, such as wind power, the NPPG section on 'Renewable and Low Carbon Energy'[14] states:

"There are no hard and fast rules about how suitable areas for renewable energy should be identified, but in considering locations, local planning authorities will need to ensure they take into account the requirements of the technology and, critically, the potential impacts on the local environment, including from cumulative impacts. There is a methodology available from the Department of Energy and Climate Change's website on assessing the capacity for renewable energy development which can be used and there may be existing local assessments. However, the impact of some types of technologies may have changed since assessments were drawn up (e.g. the size of wind turbines has been increasing). In considering impacts, assessments can use tools to identify where impacts are likely to be acceptable. For example, landscape character areas could form the basis for considering which technologies at which scale may be appropriate in different types of location." [Paragraph 5]

2.34 It also goes on to state that:

"local planning authorities should not rule out otherwise acceptable renewable energy developments through inflexible rules on buffer zones or separation distances. Other than when dealing with setback distances for safety, distance of itself does not necessarily determine whether the impact of a proposal is unacceptable." [Paragraph 8]

Neighbourhood Development Plans

2.35 Neighbourhood planning offers local communities an opportunity to produce positive and ambitious sustainable energy plans for their local area. The PPG on Renewable and Low Carbon Energy states that *"Local and neighbourhood plans are the key to delivering development that has the backing of local communities." [Paragraph 3]*

2.36 Across the country, the large majority of the numerous plans adopted so far, show little evidence of having considered the issue of climate change and energy to the level that is required to have meaningful impact.

2.37 However, given the right support, Neighbourhood Development Plan (NDP) groups can serve to convene and inform local communities and stimulate bottom-up renewable energy policies and development.

[13] Ministry of Housing, Communities & Local Government (2015) Guidance: Renewable and low carbon energy. Available at: www.gov.uk/guidance/renewable-and-low-carbon-energy.

[14] Ministry of Housing, Communities & Local Government (2015) Guidance: Renewable and low carbon energy. Available at: www.gov.uk/guidance/renewable-and-low-carbon-energy. Note: This has not been updated since June 2015 but remains valid at the time of writing.

Building Regulations – Part L

2.38 National standards for energy use and emissions within new developments are set by Part L1A and Part L2A of the Building Regulations, which concern the conservation of fuel and power in new dwellings and new buildings other than dwellings respectively. The current regulations came into operation in 2010 but were re-issued in 2013 and amended in 2016. The regulations apply a cap to a building's emissions through the use of a nominal Target Emissions Rate (TER) measured in $kgCO_2/m^2$/year, which for dwellings must not be exceeded by the Dwelling Emissions Rate (DER) as calculated according to the Standard Assessment Procedure (SAP) methodology.

2.39 In October 2019 the Government launched a consultation on the next revision of the Building Regulations and proposed a new 'Future Homes Standard' with the message that *"We must ensure that new homes are future-proofed to facilitate the installation of low-carbon heat, avoiding the need to be retrofitted later, and that home builders and supply chains are in a position to build to the Future Homes Standard by 2025"*.

2.40 The consultation considered two levels of emission reductions for new dwellings from 2020: either 20% or 31% over current 2013 Part L standards, and for the 2025 Future Homes Standard a 75-80% reduction together with low carbon heating systems. These standards aim to reduce or remove the dependency on fossil fuels and encourage the use of heat pumps, heat networks or in some circumstances direct electric heating in the context of a rapidly decarbonising UK electricity supply. The 2020 31% target ('Fabric plus technology') is stated as being the Government's preferred option and would most likely comprise energy efficiency measures with onsite low carbon generation, whereas the 20% option ('Future Homes Fabric') would require higher levels of fabric energy efficiency.

2.41 The consultation also proposed that from 2020 the energy efficiency of new dwellings should be assessed in terms of 'primary energy' as the basis for the Part L performance target (alongside emission targets), and that from 2020, homes should be future-proofed for low carbon heating. This is likely to mean that, if not already fitted, homes should have a low temperature heat distribution system so that they will be compatible with heat pumps. Additionally, in order to counteract existing variations in local authority-set performance standards, the consultation also proposed to remove the powers from local authorities to set their own standards above Part L (as granted under the Planning and Energy Act).

Local Policy and Guidance

Test Valley Borough Revised Local Plan DPD: Adopted Local Plan 2011-2029 (2016)[15]

2.42 The Test Valley Borough Revised Local Plan DPD: Adopted Local Plan 2011-2029 was adopted in January 2016. This plan does not include any policies regarding renewable energy generation. One of the objectives of the plan however is to *"Ensure development takes full account of climate change".* In addition, with regards to renewable energy, the supporting text within the Climate Change section of the plan states:

"The Council supports the principle of energy generating proposals which help mitigate and adapt to climate change within both defined settlements and the countryside. The Council will consider the merits of such proposals against the relevant policies of the Local Plan. In line with national guidance an applicant is not required to demonstrate the need for such proposals[16]." [Paragraph 7.50]

2.43 It is noted that a Ministerial Statement (2015) covering wind energy, which led to some of the provisions in the updated NPPF including identifying suitable areas for wind, was published during the examination of the adopted Local Plan.

2.44 In addition, with regards to building standards, the supporting text within the Climate Change section of the plan states:

"The Government has indicated its intention to use Building Regulations as a tool to deliver zero carbon housing by 2016 and non-domestic buildings by 2019. The Council is not proposing to apply an additional sustainability standard but will support proposals which exceed current Building Regulations". [Paragraph 7.50]

2.45 The Government position on this matter has since changed, so as not to implement the zero carbon homes and buildings targets on the timescales set out.

Sustainability Framework 2017[17]

2.46 The Council produced a Sustainability Framework in 2017, which sets out the Council's objectives relating to

[15] Test Valley Borough Council (2016) Test Valley Borough Revised Local Plan DPD: Adopted Local Plan 2011-2029. Available at: www.testvalley.gov.uk/planning-and-building/planningpolicy/local-development-framework/dpd.
[16] Department for Communities and Local Government (2012) National Planning Policy Framework. Available at: www.gov.uk/government/publications/national-planning-policy-framework--2.
[17] Test Valley Borough Council (2017) Sustainability Framework 2017. Available at: www.testvalley.gov.uk/aboutyourcouncil/corporatedirection/environmentandsustainability/environmental-strategies.

environmental sustainability considerations, whilst also documenting some of the achievements to date.

2.47 This Framework sets out objectives for the Council:

- *"Ensure sustainability is incorporated into our policies and procedures.*
- *Show leadership on environmental sustainability matters where it makes good business sense to do so.*
- *Use resources (including energy and water) more efficiently and try to encourage those living and working in the Borough to do the same.*
- *Continue look at ways to reduce carbon dioxide and other greenhouse gas emissions in order to contribute towards achieving national targets.*
- *Procure materials and resources from sustainable sources.*
- *Reduce the amount of waste generated, whilst increasing the proportion which is re-used, recycled or composted.*
- *Ensure that we plan appropriately for the long term, including adaptation to a changing climate and improving our long term resilience.*
- *Create the opportunities for more sustainable travel.*
- *Conserve, and where possible enhance, the local environment including biodiversity."*

Climate Emergency Action Plan 2020[18]

2.48 In June 2020, Test Valley Borough Council approved its climate emergency action plan. The plan sets out how the Council intends to respond to the climate emergency. It identifies short, medium and long term actions that focus on how the Council functions and its role as an employer. It identifies ways in which beneficial projects can be delivered and what the Council can learn from existing partnerships including with businesses and communities.

2.49 The actions cover the following seven categories:

- corporate action;
- property and energy;
- smarter working and use of technology;
- housing, development and infrastructure;
- transport, travel and plant;
- supporting communities and businesses; and
- natural environment.

2.50 With regard to renewable and low carbon energy, one of the short term actions listed within the housing, development and infrastructure category is to *"Complete the review of the potential for renewable and low carbon energy sources in the Borough and use to inform the next Local Plan"*. The anticipated outcome of this action is to enhance the Council's understanding of the Borough's potential for renewable and low carbon energy opportunities.

2.51 The plan also sets the following actions relating to renewable and low carbon energy within the property and energy category:

- *"Short term action: review energy purchasing and procurement.*
  - *Impact/outcome: to help the move towards renewable and low carbon energy sources, thus reducing emissions.*
- *Long term action: re-assess the feasibility of installing solar panels at Beech Hurst, Bourne House, the FMC and the Chantry Centre car park. Include a review of battery storage options.*
  - *Impact/outcome: We have previously looked at opportunities for solar panels at certain sites. However, the technologies have evolved, so it will be appropriate to review this work to seek opportunities to increasing the use of local renewable energy sources."*

Hampshire Renewable Energy Co-operative Renewable Energy in Hampshire report (2016)[19]

2.52 The Hampshire Renewable Energy Co-operative was formed by volunteers in 2013 to help change the way energy is produced in the county and supports the development of a range of renewable energy projects that produce low-carbon energy for the benefit of the people of Hampshire[20]. The Co-operative produced a report in 2016 assessing existing renewable energy provision in Hampshire[21]. It estimated that installed renewable electricity capacity in Hampshire was 397.44 Megawatt Peak (MWp), of which 79.28% is solar PV, making Hampshire the 3rd largest generator of solar energy in the UK at that time. Although other technologies are present, such as anaerobic digestion, biomass, wind, sewage gas and geothermal, these forms of renewable energy were considered to play a minor role.

[18] Test valley Borough Council (2020) Climate Emergency Action Plan. Available at: testvalley.gov.uk/aboutyourcouncil/corporatedirection/environmentandsustainability/climate-emergency-action-plan.

[19] Hampshire Renewable Energy Co-operative (2016) Renewable Energy in Hampshire. Available at: hampshire-energy.coop/co-operating-for-a-greener-hampshire.

[20] Hampshire Renewable Energy Co-operative (2020) Available at: hampshire-energy.coop.

[21] Including the Isle of Wight, Southampton and Portsmouth.

2.53 The report concluded that overall less than 2% of Hampshire's energy comes from renewable resources, and therefore almost the entire energy demand of Hampshire is met by fossil fuels or energy imports from other UK counties and further afield. It highlights that only 5.6% of electricity in Hampshire was produced by renewable sources in 2015, compared to 24.7% for the UK as a whole, and therefore Hampshire has an *"opportunity to make a far higher contribution to national targets than it is currently achieving".* It notes that there is need for better co-ordination between our national and local governments and with the community in order to *"exploit the wind, sun, tide and wave potential in Hampshire" as well as a "particular opportunity in the renewable heat market".*

South East Planning Partnership Board: Review of Renewable and Decentralise Energy Potential in South East England (2010)[22]

2.54 In 2010 LUC and TV Energy completed a 'Review of Renewable and Decentralised Energy Potential in South East England' which was prepared for the South East Planning Partnership Board. The report calculated potential energy capacity for a range of renewable energy technologies in South East counties, including Hampshire. In terms of technical potential (resource available), the Study identified significant potential for onshore wind, heat pumps, solar PV and solar hot water, energy from waste and biomass. Little technical potential was identified for small scale hydro. The Study concluded that the forms of renewable energy with greatest deployable renewable energy potential within the County under a 'high growth scenario' (i.e. assuming significant support for renewables) were:

- onshore wind (133MW);
- solar PV (74MW);
- solar hot water (116MW);
- energy from waste (15MW);
- wet organic and sewage waste (11MW); and
- biomass (2MW).

2.55 Under a Business as Usual Scenario, potential was only identified for onshore wind (2MW) and energy from waste (15 MW).

[22] LUC and TV Energy (2010) Review of Renewable and Decentralised Energy Potential in South East England. Available at: webarchive.nationalarchives.gov.uk/20100824194552/http://www.se-partnershipboard.org.uk/page/5/view/175/sub/77/energy.

Chapter 3

Baseline Energy Demand and Energy Needs Assessment

Introduction

3.1 This chapter outlines energy demand and CO_2 emissions across Test Valley, both 'existing' and 'estimated' (i.e. incorporating new development estimates up to 2029, the end of the plan period for the adopted Local Plan).

Baseline Energy Demand and Emissions

3.2 Estimating existing energy use and associated emissions across Test Valley is important to establish a baseline from which to measure future changes and monitor progress towards targets. According to the most recent statistics from the Department for Business, Energy and Industrial Strategy (BEIS)[23], total energy consumption within Test Valley across the industrial/commercial, domestic and transport sectors for 2017 was estimated to be almost 3,456 GWh.

3.3 Figure 3.1 shows the sector split of total tCO_2 emissions[24] during 2017, which are allocated on an 'end-user' basis i.e. where emissions are distributed according to the point of energy consumption (or point of emission if not energy related). The smaller 'LA scope of influence' emissions, totalling 708,017 tCO_2, are considered to be those within the scope of influence of local authorities and exclude large industrial sites, railways, motorways and land-use. The 'full emissions' total[25] of 874,647 tCO_2 represents approximately 12.0% of the total for Hampshire County and 1.9% of the South East region's emissions. **Table 3.1** presents energy consumption statistics for 2017 which shows building-related (i.e. non-transport) energy consumption across the Borough, mostly based on metered data, split between domestic and industrial/commercial users.

[23] Department for Business, Energy & Industrial Strategy (2019) Total final energy consumption at regional and local authority level 2005 to 2017. Available at: www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level.

[24] Department for Business, Energy & Industrial Strategy (2019) UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2017. Available at: www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2017.

[25] This total excludes a reduction of 55,591 tCO_2 due to Land Use, Land-use Change and Forestry (LULUCF). Taking this into account, the full emissions total would be 819,056 tCO_2.

Figure 3.1: Local CO_2 emissions sector split for Test Valley (2017 figures)

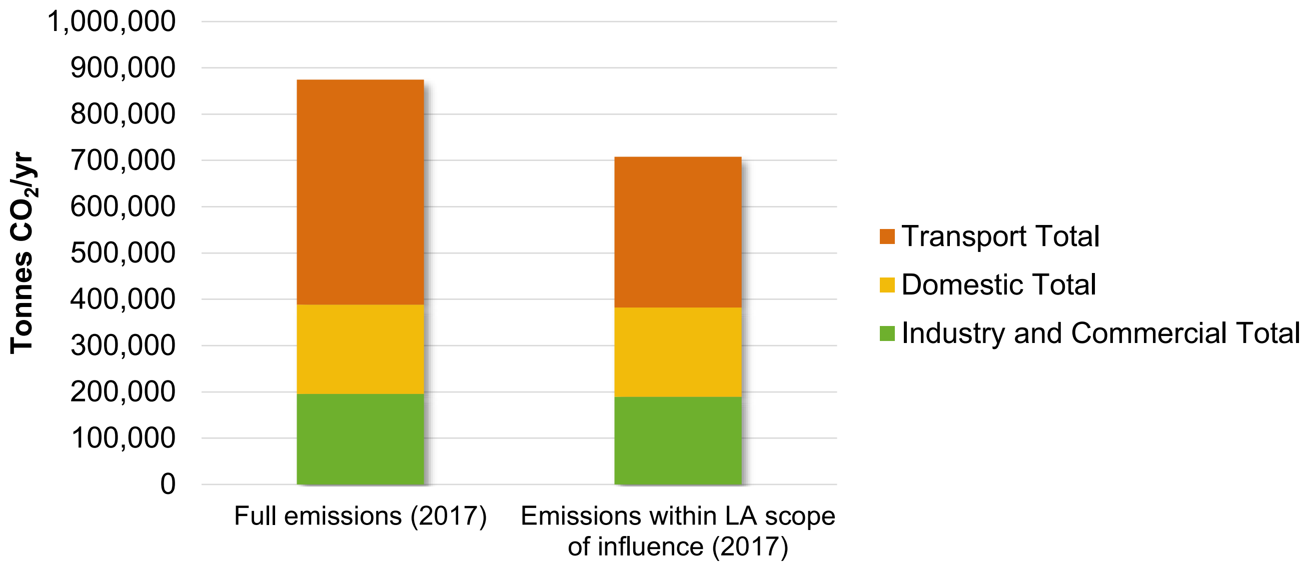


Table 3.1: Test Valley energy consumption statistics (non-transport) (2017 figures)

Sector	Electricity (GWh/year)	Gas (GWh/year)	Other fuels excl. bioenergy & waste (GWh/year)	Total (GWh/year)	CO_2 Emissions (kt/year)
Domestic	237.7	488.0	166.5	892.2	193.4
Industrial / commercial	330.6	202.5	195.2	781.3	195.2
Total	**568.3**	**690.5**	**185.7**	**1,673.5**	**388.6**

Table 3.2: Estimated CO_2 emissions from new housing types assuming SAP10 standards (tonnes/year) (2017 figures)[26]

Detached	End-terrace	Mid-terrace	Large flat (low rise)	Small flat (low rise)
2.58	2.02	1.91	1.35	1.13

Table 3.3: Estimated CO_2 emissions from new housing developments in Test Valley to 2029

Local Plan housing commitments 2011-2029	Remaining required housing completions 2019-2029	Homes to be built per year to 2029 (assuming linear build-out)	Annual CO_2 emissions from new housing applying SAP10 standards (tonnes/year)
10,584	7,563	447	804

[26] Figures estimated from analysis undertaken for West of England Local Authorities by Currie and Brown (www.cse.org.uk/downloads/file/cost-of-carbon-reduction-in-new-buildings.pdf).

Heat Demand

3.4 Heat demand from buildings throughout the Borough is modelled and quantified in **Chapter 5** and is presented as a district-wide heat map.

Impact of New Development

3.5 Unless new Building Regulations or planning policies are introduced to mandate developers to deliver net-zero carbon buildings then it is inevitable that emissions across Test Valley will rise as a result of new development. As well as total emissions from regulated and unregulated[27] operational use, whole-life cycle emissions including those resulting from construction will also need to be addressed to achieve true zero carbon.

3.6 Table 3.2 estimates operational emissions from different housing types built under the energy performance standards of SAP10[28]. **Table 3.3** then estimates the emissions resulting from new housing developments predicted for Test Valley up to 2029. Currently there is insufficient data to estimate the emissions of future non-domestic development.

3.7 The average forecast annual emissions from new housing, as shown in **Table 3.3**, represents a relatively small proportion (0.4%) of current total annual emissions from housing across Test Valley and this figure is likely to be an overestimate if the net-zero carbon standards being proposed in **Chapter 7** are adopted. Although these are important to implement, tackling emissions from the existing housing (and non-domestic building) stock represents a much bigger challenge in aligning with national net zero carbon emission targets.

[27] **Regulated** energy use refers to that controlled by Part L of the Building Regulations and includes energy used for space heating/cooling, water heating, fixed lighting, pumps and fans. **Unregulated** energy use refers to all other energy used within a building such as for cooking, appliances and small power. For non-domestic buildings, unregulated energy use also includes demands from lifts, manufacturing processes, server rooms etc.

[28] SAP10 (Standard Assessment Procedure 10) is expected to become part of the next update to Part L of the Building Regulations. See also Paragraph 6.28.

Chapter 4
Renewable and Low Carbon Energy Opportunities

Introduction

4.1 The chapter provides a summary of existing renewable and low carbon energy generation within the Borough. This is followed by the results of the assessment of the 'technical' and 'deployable' potential for renewables within Test Valley. The 'technical potential' is the total amount of renewable energy that could be delivered in the area based on a number of assumptions regarding the amount of resource and space. The chapter also includes a discussion of the issues that will affect what could be realistically delivered within the Borough – i.e. the 'deployable potential'. This includes the consideration of factors such as planning, economic viability and grid connection. It also considers landscape sensitivity, however, please refer to the separate Landscape Sensitivity Assessment of Renewable Energy Report for further details.

4.2 It is noted that the assumptions used to calculate 'technical potential' for each renewable technology have been applied at a strategic scale across the Borough, and that more detailed site assessments (i.e. as required for a planning application) would be required to determine if specific sites are suitable in planning terms.

Existing Renewable and Low Carbon Generation

Renewable Energy

4.3 An exact figure for the amount of existing renewable energy capacity across the Borough is not possible to ascertain, although estimates for installed electricity generation capacity and output have been compiled in **Table 4.1**. This draws on the following information:

- Sub-regional data from the Government's Feed-in Tariff[29] scheme.
- Department for Business Energy and Industrial Strategy (BEIS) Renewable Energy Planning Database[30] (REPD) data which lists all renewable electricity projects (>150 kW) including battery storage and combined heat and

[29] Department for Business, Energy & Industrial Strategy (2020) Sub-regional Feed-in Tariffs statistics. Available at: www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics.

[30] Department for Business, Energy & Industrial Strategy (July 2020) Renewable Energy Planning Database (REPD): June 2020. Available at: www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract.

power (CHP) projects that have acquired or are subject to planning permission.

- Planning application data provided by Test Valley Borough Council[31].

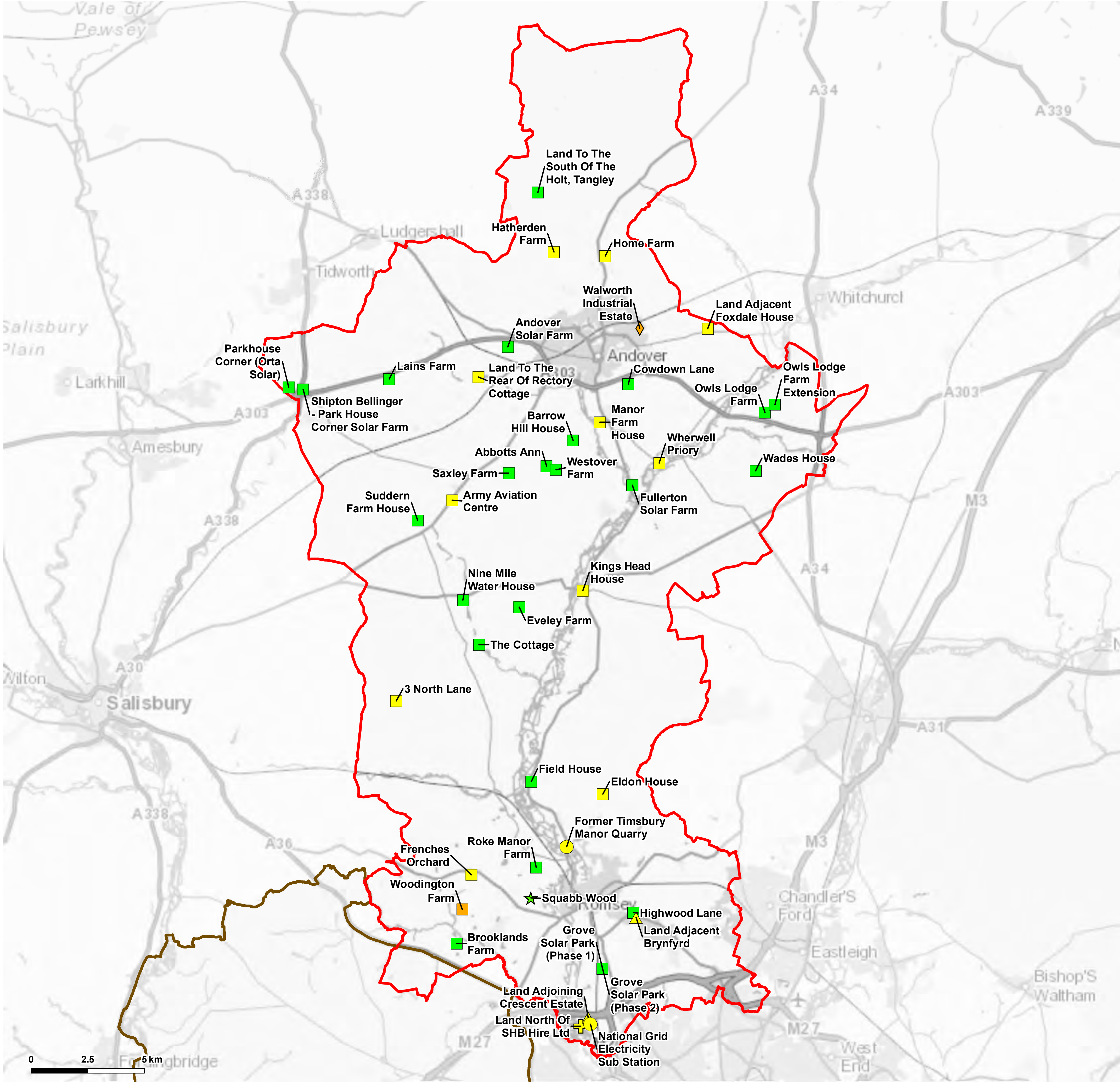
4.4 Table 4.1 only includes those that were registered as operational at the time of preparing this report.

4.5 The locations for existing and consented installations across Test Valley Borough, as currently listed in the Renewable Energy Planning Database and within the data held by Test Valley Borough Council are shown in **Figure 4.1**.

[31] Data was provided by the Council on the 15th April 2020 and therefore more recent applications maybe not be included.

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure 4.1: Existing and consented renewable energy installations within Test Valley



Test Valley Borough Council boundary
New Forest National Park

Renewable Energy Installations

- Solar Photovoltaics - Operational
- Landfill Gas - Operational
- Solar Photovoltaics - Awaiting Construction
- Advanced Conversion Technologies - Awaiting Construction
- Solar Photovoltaics - Permitted
- Battery storage - Permitted
- Flexible energy generation unit - Permitted
- Gas fired reserve facility - Permitted

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC Fig4_1_10953_r0_Existing_Consented_Renewables 14/12/2020
Source: Test Valley Borough Council

4.6 Figure 4.1 shows that the majority of solar PV developments are located in the north of the Borough, several of which are located along the A303 corridor. There is also a cluster of renewable developments, again mainly solar PV, located in the south of the Borough around Romsey.

4.7 As seen from **Table 4.1**, there is currently at least 177.7MW of operational renewable electricity generation across the Borough, with annual emission savings of 37,532 tCO_2. This figure will increase to around 46,023 tCO_2 once all consented schemes are operating at full capacity.

Table 4.1: Existing operational and consented renewable electricity installations in Test Valley.

Technology	Estimated total capacity (MW)	Electricity output (MWh/year)[32]	Potential CO_2 savings (tonnes/yr)
Operational			
Solar PV	176.66[33]	160,941.11	37,499.28
Landfill Gas, including CHP	1	N/A[34]	N/A[34]
Anaerobic Digestion	0.01	92.59	21.57
Hydro	<0.01	13.59	3.17
MicroCHP	<0.01	1.24	0.29
Wind Onshore	0.02	39.00	9.09
Total operational	**177.70**	**161,087.53**	**37,533.40**
Consented (permitted/awaiting construction)			
Solar PV	90.35[35]	2,312.57	19,178.83
Advanced Conversion Technologies, including CHP	10.00	N/A	N/A[34]
Battery storage	56	N/A[36]	N/A[36]
Flexible energy generation unit	20	N/A[36]	N/A[36]
Gas fired reserve facility	44	N/A[36]	N/A[36]
Total consented[37]	**216.95**	**82,312.57**	**19,178.83**
Total operational and consented[38]	**394.65**	**243,400.11**	**56,712.22**
Abandoned[39]			
Solar PV	5.00[40]	4,555.20	1,061.36
Application Refused			
Solar PV	54.00	49,196.16	11,462.71
Wind Onshore	6.00	11,142.72	2,596.25
Application Withdrawn			
Solar PV	19.00	17,309.76	4033.17
Battery storage	50.00	N/A[36]	N/A[36]

[32] Calculated using the formula MW x hours in a year x capacity factor. Capacity factor figure obtained from BEIS FiT load factors. Solar: Averaged at 10.4% for the South East region over the last eight years. Wind: Averaged at 21.2% for the London and the South East region over the period 2014/2015 to 2017/2018 . Data for most recent FiT Year 9: 2018/2019 for the London and the South East Region (16.9%) provided via email from BEIS on 23.09.2020 . Anaerobic Digestion: Averaged at 75.5% over the last five years. Hydro: Averaged at 38.77% over the last eight years. MicroCHP: Averaged at 14.21% over the last eight years. Available at: www.gov.uk/government/publications/quarterly-and-annual-load-factors.

[33] The Test Valley Borough Council data indicates that there are seven additional operational Solar PV developments within the Borough, however the installed capacity of these developments is unknown.

[34] Unable to calculate as capacity factor figure as not included in the BEIS FiT load factors data, available at: www.gov.uk/government/publications/quarterly-and-annual-load-factors.

[35] The Test Valley Borough Council data indicates that there are 12 additional consented Solar PV developments within the Borough, however the proposed capacity of these developments is unknown.

[36] Battery storage, flexible energy generation units and qas fired reserve facilities do not themselves generate energy and therefore can also not provide CO2 savings.

[37] Excluding data unknown.

[38] Excluding data unknown.

[39] A project that was granted planning permission but was subsequently not implemented by the developer and the planning permission has now expired,

[40] Only 3 turbines of the 14 turbine 6MW scheme were proposed within Text Valley Borough.

Renewable Heat

4.8 The amount of existing renewable heat generation in Test Valley from biomass, solar water heating and heat pumps has been estimated using sub-national data within the Renewable Heat Incentive (RHI) statistics. As shown in **Table 4.2**, the BEIS Renewable Heat Incentive statistics indicate that there are 39 (9MW) non-domestic and 271 (2.8MW) domestic accredited full applications for the Renewable Heat Incentive within Test Valley. Technology breakdowns for domestic installations are given in **Table 4.3**. In addition, **Table 4.1** indicates there is1MW of operational landfill gas development and 10MW of consented advanced conversion technologies incorporating CHP.

4.9 The Microgeneration Certification Scheme (MCS) installations database can provide another source of information, however access to this is restricted and relies on data input from installers. Having consulted with the MSC administrators and obtained access to subsets of this data for Test Valley it is apparent that installed capacity figures are currently unreliable and so have not been included in this study.

Table 4.2: Renewable Heat Incentive deployment data for Test Valley[41].

Type of Renewable Heat Incentive deployment	Number of accredited full applications	Installed capacity (MW)
Non-domestic[42]	39	9
Domestic[43]	271	2.8

Table 4.3: No. of RHI domestic accreditations by technology for Test Valley.

Technology	Number of accredited installations	Average system capacity (kW)	Approx. installed capacity (MW)[44]
Air source heat pump	181	9.9	1.79
Ground source heat pump	38	13.6	0.52
Biomass systems	14	26.1	0.37
Solar thermal	38	2.9	0.11

Assessment of Potential for Renewables

4.10 The following section summarises the assessment of technical and deployable potential for each form of renewable and low carbon technology. For each resource, where relevant it includes:

- A description of the technology.
- Summary of existing deployment within Test Valley.
- Assumptions used to calculate technical potential.
- Results of assessment of technical potential.
- Summary of issues affecting deployment.

4.11 The assessment approach is based on an up to date and local refinement of the former Department of Energy and Climate Change (DECC) Renewable and Low-Carbon Energy Capacity Methodology: Methodology for the English Regions (2010).[45]

Wind

Description of Technology

4.12 Onshore wind power is an established and proven technology with thousands of installations currently deployed across many countries throughout the world. The UK has the largest wind energy resource in Europe.

4.13 Turbine scales do not fall intrinsically into clear and unchanging size categories. At the largest scale, turbine dimensions and capacities are evolving quite rapidly. The deployment of turbines at particular 'typical' scales in the past has also been influenced by changing factors which include the availability of subsidies of different kinds. As defined scales need to be applied for the purpose of the resource assessment, the assessment has used five size categories based on consideration of current and historically 'typical' turbine models:

- Very large (150-200m tip height).
- Large (100-150m tip height).
- Medium (60-100m tip height).
- Small (25-60m tip height).
- Very small (<25m tip height).

4.14 An assessment of technical potential for very small wind (<25m height) was not undertaken as it is not possible to

[41] Department for Business, Energy & Industrial Strategy (May 2020) RHI monthly deployment data: April 2020. Available at: www.gov.uk/government/collections/renewable-heat-incentive-statistics.
[42] From November 2011 to April 2020.
[43] From April 2014 to April 2020.
[44] Estimated from average system sizes shown (taken from the source data)
[45] LUC and SQW (2010) Renewable and Low-carbon Energy Capacity Methodology: Methodology for the English Regions. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/226175/renewable_and_low_carbon_energy_capacity_methodology_jan2010.pdf.

define areas of suitability for these using the same assessment criteria. Notional turbine sizes for the purposes of the present resource assessment are approximately intermediate within each class size (**Table 4.4**).

Table 4.4: Notional turbines used for the resource assessment.

Scale	Typical Turbine Installed Capacity	Typical Turbine Height (maximum to blade tip)
Very large	4MW	175m
Large	2.5MW	125m
Medium	500kW	80m
Small	50kW	45m

4.15 Most turbines above the smallest scales have a direct connection into the electricity network. Smaller turbines may provide electricity for a single premises via a 'private wire' (e.g. a farm or occasionally a large energy use such as a factory), or be connected to the grid directly for export. Typically, turbines will be developed in larger groups (wind farms) only at the larger scales. The amount of energy that turbines generate will depend primarily on wind speed but will be limited by the maximum output of the individual turbine (expressed as 'installed capacity' in **Table 4.4**).

4.16 A review of wind turbine applications across the UK found that tip heights range from less than 20m up to around 200m, with larger turbine models particularly in demand from developers following the reduction in financial support from Government. The majority of operational and planned turbines range between 80m and 175m, with the majority at the larger end of the scale.

4.17 As of 2019, the UK had 14,183 MW of installed onshore wind capacity, providing 32,205 GWh electricity during the year[46]. Since the removal of financial support and restrictive modification to the national planning policy regime, onshore wind development activity has moved overwhelmingly away from England towards Scotland and Wales, where it is focusing particularly on sites with high wind speeds and the ability to accommodate large numbers of tall turbines.

Existing Development within Test Valley

4.18 As shown in **Table 4.1**, there is only 0.02MW of operational wind within Test Valley.

4.19 According to the most recent BEIS Renewable Energy Planning Database and data provided by Test Valley Borough Council, there is record of only one windfarm application being proposed within Test Valley. This was the Bullington Cross Wind Farm scheme, which stretched across Test Valley, Basingstoke and Deane, and Winchester City Council authorities. The scheme proposed a total 28MW capacity, 6MW of which was proposed within Test Valley. The application was refused in June 2014, due to potential landscape and visual impacts, including those on heritage assets and the Area of Outstanding Natural Beauty (AONB), as well as concerns related to protected species, aircraft and radar.

Assumptions used to Calculate Technical Potential

4.20 The assessment of technical potential for very large, large, medium and small turbines was undertaken using GIS (Geographical information Systems) involving spatial mapping of key constraints and opportunities. The assessment identified areas with potential viable wind speeds (applying a reasonable but relatively generous assumption in this respect, bearing in mind that only the highest wind speeds are potentially viable at the present time) and the number of turbines that could be theoretically be deployed within these areas. A series of constraints relating to physical features and environmental/heritage protection were then removed. The remaining areas have 'technical potential' for wind energy development.

4.21 The key constraints and opportunities considered are set out in detail in **Appendix A, Table A-7** and **Appendix B**.

Landscape Sensitivity Assessment

4.22 Landscape and Visual Impact (LVI) has historically often been the defining consenting consideration within the context of planning applications for wind developments, and has therefore been a particularly important influence on the choice of turbine scales and locations by developers.

4.23 As the degree of acceptable landscape and visual impact is generally a matter that needs to be considered within the context of an overall planning balance, no land was excluded from the GIS technical constraints assessment on landscape or visual grounds. Instead, a separate landscape sensitivity assessment was subsequently undertaken which considered all Landscape Character Areas defined within the Test Valley Landscape Character Assessment with technical potential for development, including those within the AONB, and excluding those within the New Forest National Park (as planning

[46] Department for Business, Energy & Industrial Strategy (May 2020) UK Renewables 2019 and October to December 2019: Table 6.1 - Renewable electricity capacity and generation (ET 6.1 - quarterly). Available at: www.gov.uk/government/statistics/energy-trends-section-6-renewables.

matters are under the remit of the National Park Authority). This can be used alongside the output of the GIS assessment, which maps and quantifies technical capacity, to determine landscape sensitivity to different scales of wind turbines.

4.24 Please refer to the separate Landscape Sensitivity Assessment of Renewable Energy Report for further details.

Results

Technical Potential

4.25 Table 4.5 below provides a summary of the technical potential for wind energy within Test Valley Borough. The analysis examined the potential for very large, large, medium and small turbines. Where potential existed for more than one size of turbine, it was assumed that the larger turbines would take precedence i.e. it was assumed that the largest potential turbine in each case would be installed. This was in order to calculate the maximum technical potential for wind.

4.26 The calculation of wind capacity involved applying an assumption concerning development density. Turbines are spaced within developments in practice based on varying multiples of the rotor diameter length (on different axes). Although separation distances vary, a 5 x 3 x rotor diameter oval spacing[47], oriented 135º, (greater in the prevailing wind direction, taken to be southwest as the 'default' assumption in the UK) was considered a reasonable general assumption at the present time in this respect. In practice, site-specific factors such as prevailing wind direction and turbulence are taken into account by developers, in discussion with manufacturers. Bearing in mind the strategic nature of the present study, the density calculation did not take into account the site shape and minimum site size, and a standardised density was used instead:

- Very large: 2 turbines per km²
- Large: 6 turbines per km²
- Medium: 20 turbines per km²
- Small: 182 turbines per km²

4.27 The calculation of potential energy yield then required application of a 'capacity factor' i.e. the average proportion of maximum turbine capacity that would be achieved in practice over a given period. Capacity factors vary in practice in accordance with wind speed, terrain and turbine scale. It was not possible to find suitable historic data on capacity factors, taking into account these kinds of variations for the present study, and so a single capacity factor of 21.2% was used for all turbine scales, as based on regional data[48].

4.28 The assessment results indicate that there is a technical potential to deliver up to around 1735.16 MW of wind energy capacity in Test Valley, with the greatest potential for small turbines (see **Figure 4.2** and **Table 4.5**).

Figure 4.2: Onshore wind potential capacity and carbon savings within Test Valley.

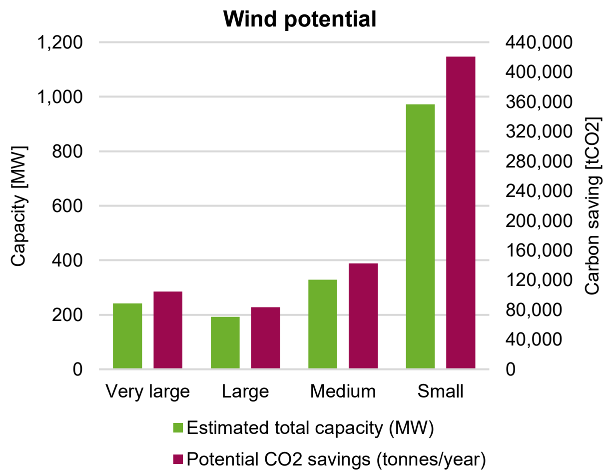


Table 4.5: Onshore wind potential capacity, output and carbon savings within Test Valley[49]

Development Scale	Estimated total capacity (MW)	Electricity output (MWh/year)	Potential CO_2 savings (tonnes/yr)
Very Large	242.14	449,687	104,777
Large	192.56	357,603	83,322
Medium	328.80	610,612	142,273
Small	971.66	1,804,491	420,446
Total	**1735.16**	**3,222,393**	**750,818**

[47] To mitigate impacts on the productivity of wind turbines located close to one another caused by wind turbulence, it is standard practice for developers to maintain an oval of separation between turbines that is equal to 5 times the turbine rotor diameter (the cross sectional dimension of the circle swept by the rotating blades) on the long axis, and 3 times the rotor diameter on the short axis.

[48] BEIS (2019) Quarterly and annual load factors: Annual Regional Wind Load Factors, at 21.2% for the London and the South East region over the period 2014/2015 to 2017/2018. Available at: www.gov.uk/government/publications/quarterly-and-annual-load-factors. Data for most recent FiT Year 9: 2018/2019 for the London and the South East Region (16.9%) provided via email from BEIS on 23.09.2020.

[49] Note that the area of unconstrained land is treated as a single block of land. This is not the case in reality. Note that land available for very large turbines will also be suitable for large, medium and small turbines; land available for large turbines will also be suitable for medium and small turbines; and land available for medium turbines will also be suitable for small turbines.

4.29 The maps included in **Appendix B** show the areas which have been identified via the GIS analysis to have technical potential for wind development at each considered turbine scale. These figures indicate that there is greatest potential for wind generation in the centre and north of the Borough.

4.30 In order to illustrate the GIS tool parameters, a series of opportunity and constraints maps were also produced. **Figure B - 1** in **Appendix B** shows the wind speed within the Borough at 50m above ground level (agl). This shows that the highest winds speeds are predominantly located in the far north of the Borough, with the lowest wind speeds located along the river valleys and in the south of the Borough. Other mapped constraints that have influenced the assessment outcomes are included in **Appendix B**. It is noted that maps depicting the physical constraints are only included for small and very large turbines for illustrative purposes, showing the minimum and maximum buffer distances applied to physical features depending on turbine size.

4.31 An assessment of this nature will necessarily have certain limitations, including:

- **Wind data** – it is important to note that the macro-scale wind data which was used for this assessment can be inaccurate at the site-specific level and therefore can only be used to give a high level indication of potential capacity and output within Test Valley. Developers will normally require wind speeds to be accurately monitored using anemometers for an extended period (typically at least one to two years) for commercial scale developments.
- **Cumulative effects** – multiple wind turbine developments can have a variety of cumulative effects. Cumulative landscape and visual effects, in particular, would clearly occur if all the identified small wind development potential were to be realised. Cumulative effects, however, cannot be taken into account in a high-level assessment of this nature and must be considered on a development-by-development basis.
- **Site-specific features and characteristics** – in practice, developments outside protected areas may potentially impact on amenity and sensitive 'receptors' such as protected species. These impacts can only be assessed via a site-specific survey.
- **Aviation** – although operational airports and airfields, as well as MOD land in active use, were considered to be constraints on wind development, airport safeguarding zones were only identified for information. Aviation interests were not used to define potentially suitable land as impacts and mitigation need to be considered on a development by development basis.
- **Development Allocations** – due to the timing of the resource assessment in relation to Test Valley's next Local Plan programme, only strategic site allocations from the adopted Test Valley Local Plan were considered to be constraints on wind development. These will either be a further constraint upon development (in relation to built elements) but may in some cases offer opportunities for development (e.g. where they include undeveloped land). It was not possible to take emerging allocations into account in the present assessment, as at the time of writing they had yet to be defined.

Issues affecting deployment

4.32 The technical wind development potential within Test Valley, as estimated through application of reasonable constraints within a GIS tool, is not the same as the development capacity that may be expected to be deployed in practice.

4.33 Certain limitations of the resource assessment with respect to deployable wind potential have already been noted in the previous section. For example, cumulative impacts can only be considered fully when developments come forward in practice, but would generally be expected to reduce the overall deployable capacity. However, there are four particular influences on deployable wind potential that merit individual consideration including: landscape sensitivity, grid connection, development income and planning issues. These are discussed in turn below:

Landscape Sensitivity

4.34 The south-western corner of Test Valley Borough falls within the New Forest National Park and planning matters are therefore under the remit of the National Park Authority. This area was therefore excluded from the assessment.

4.35 All parts of the North Wessex Downs AONB situated in the north of the Borough are considered within the assessment in principle. However, using the established assessment methodology, all areas within the AONB are assessed as having at least a moderate sensitivity to any wind development (see the Landscape Sensitivity Assessment Figure 3.1), with a high landscape sensitivity to all wind development larger than the 'very small' size category (see the Landscape Sensitivity Assessment Figure 3.2).

4.36 Large parts of the Borough at Landscape Character Area (LCA) scale are assessed as having a moderate sensitivity to any wind development, with all parts of the Borough having a moderate-high or high sensitivity to 'large' wind developments (see the Landscape Sensitivity Assessment Figure 3.4) and a high sensitivity to 'very large' wind developments (see the Landscape Sensitivity Assessment Figure 3.5).

4.37 As the sensitivity assessment notes, landscape sensitivity varies within LCAs in practice, and particular development sites may be identified within individual LCAs that have lower sensitivity than that of the LCA overall. LVI is also ultimately a consideration that needs to be weighed within the overall planning balance. The sensitivity assessment, however, can be used to guide development towards less sensitive areas in the first instance, and then to ensure that careful consideration is given to the choice of turbine locations, numbers and scales, particularly in areas identified to be of higher sensitivity. Please refer to the separate Landscape Sensitivity Assessment of Renewable Energy Report for further details.

Grid Connection

4.38 Historically, it has been possible to connect a variety of wind energy development scales into the distribution network at a wide range of distances from the nearest connection point. This situation has changed dramatically over recent years due to two factors in combination:

- The distribution network, and even the transmission network, have become increasingly congested, to the point at which connections in many cases cannot take place without extremely expensive network enforcement costs (which fall to the developer) being incurred, or generation being curtailed, or both.
- The Government's cancelling of subsidies for onshore wind in 2016 has reduced wind development incomes to the point at which previously affordable reinforcement works would now render many developments unviable, particularly those of smaller scale.

4.39 It is possible that, over the next Local Plan period, strategic changes to the network and its management may open up new connection opportunities. In particular, District Network Operators (DNOs) are making the transition to become District Service Operators (DSOs), and as DSOs, will have a greater range of tools that they will be able to use to manage the network. They may, for example, be able to facilitate an enhanced role for energy storage in balancing out the effects of increasing grid penetration of intermittent renewable generators. Further details on network capacity within the Borough are provided from paragraph 4.154.

Development Income

4.40 Financial support mechanisms in the form of Government subsidies (such as the Renewables Obligation (RO) and Feed in Tariff (FiT)) previously allowed onshore wind to be developed at a variety of scales and at a variety of wind speeds. The RO closed to all new generating capacity on 31 March 2017 and the FiT closed to new applicants from 1 April 2019.

4.41 The Contracts for Difference (CfD) scheme is now the Government's main mechanism for supporting low-carbon electricity generation[50]. Renewable generators located in the UK that meet the eligibility requirements can apply for a CfD by submitting what is a form of 'sealed bid'. The first auction included 'Pot 1' technologies; 'established' technologies, including onshore wind. The successful applicants of Round 1 of auctions, as announced in February 2015, included onshore wind developments. Since then, Round 2 and Round 3 of the auctions in September 2017 and September 2019 excluded Pot 1 technologies including onshore wind developments.

4.42 Round 4 of auctions is due to open in 2021, and the Government has confirmed that this will include Pot 1 technologies, such as onshore wind[51].As a result of the general decline in financial support for onshore wind, developers are predominantly interested in developing wind turbines in locations with high wind speeds, such as Scotland, Wales and northern England, to enable schemes to be financially viable.

4.43 Developers have found that CfDs do not make schemes financially viable in southern England where wind speeds are typically lower, and any potentially financially viable developments require a number of very large turbines to maximise the power output. These schemes are however, unlikely to be acceptable in most locations in southern England at the present time. Moreover, the resource assessment indicates that there are few opportunities of this scale in Test Valley Borough, which is unsurprising considering its location and geographical characteristics. The main opportunities are instead at the small scale, which are not considered by most developers to be financially viable at the present time.

4.44 Various initiatives can in theory improve wind development viability beyond the provision of subsidy. These could include, for example, establishment of local supply companies that can 'capture' the uplift from wholesale to retail energy prices. The signing of Power Purchase Agreements (PPA), such as between a developer and the Council, agreeing that the developer will sell the electricity generated to the Council, may make individual turbines viable such as on an industrial estate.

[50] Department for Business, Energy, and Industrial Strategy (2020) Contracts for Difference. Available at: www.gov.uk/government/publications/contracts-for-difference/contract-for-difference.
[51] Department for Business, Energy, and Industrial Strategy (2020) Contracts for Difference for Low Carbon Electricity Generation: Government response to consultation on proposed amendments to the scheme. Available at: www.gov.uk/government/collections/contracts-for-difference-cfd-allocation-round-4.

4.45 Capital costs such as turbine prices may also continue to fall[52], potentially driven in part by the loss of subsidy itself – although the migration of demand to larger turbines in a post-subsidy context is likely to limit any effect in this regard on smaller turbine sizes.

4.46 In addition, the Smart Export Guarantee has been introduced since January 2020[53]. This is an obligation set by the Government for licensed electricity suppliers to offer a tariff and make payment to small-scale low-carbon generators for electricity exported to the National Grid, providing certain criteria are met. Wind developments of up to 5MW capacity could benefit from this obligation. However, the obligation does not provide equal financial benefits to the previous Feed In Tariff (FT) scheme (which provided funding for smaller scale renewable energy developments), as it only provides payments for electricity export, not generation, and it does not provide a guaranteed price for exported electricity.

4.47 Overall, viability challenges, based on reduced income relative to capital costs, are a systemic challenge for wind development at all scales within southern England at the present time – to the extent that, if this challenge is not addressed by Government, the deployable wind potential within Test Valley is likely to be and remain close to zero.

Planning issues

4.48 In addition to the lack of financial support mechanisms, the NPPF requires that wind energy development may only be permitted within areas identified suitable for wind energy developments within Local Plans and where the development has the backing of the local community. The legitimate interpretation of this provision has not been definitively established via case law. However, it has had a discouraging influence on developers. Larger developers are therefore currently not interested in pursuing wind farm developments within southern England, although there may be scope for small scale, single turbine installations implemented by farmers or community energy groups.

Solar PV – Ground Mounted

Description of Technology

4.49 In addition to PV modules integrated on built development, there are a large number of ground-mounted solar PV arrays or solar farms within in the UK. These consist of groups of panels (generally arranged in linear rows) mounted on a frame. Due to ground clearance and spacing between rows (and between rows and field boundary features) solar arrays do not cover a whole field and allow vegetation to continue to grow between and even underneath panels.

4.50 Ground-mounted solar project sizes vary greatly across the UK although, as with wind, developers in a post-subsidy environment are increasingly focusing on large-scale development, with the largest currently consented scheme in England (Cleve Hill in Kent) being over 350 MW[54]. There is no one established standard for land take per MW of installed capacity, although land requirements for solar are comparatively high compared with wind. The presence of ground mounted solar panels restricts the use of the land beneath, whereas the smaller physical footprint of wind turbines enables standard agricultural practices to continue within wind farms. For the present assessment, an approximate requirement of 2 hectares per MW has been applied based on a combination of various existing and past guidance and recent development experience.

4.51 As of 2018, the UK had 13,616 MW of installed solar PV capacity, with this providing 12,677 GWh of electricity during the year[55] (the lower energy generation relative to wind despite the similar installed capacity is due to the lower capacity factors of solar PV generation). These figures include all forms of solar PV – although according to the most recent available data, ground-mounted schemes account for 57% of overall capacity[56]. Falling capital costs are rendering solar PV increasingly viable in a post-subsidy context, although as outlined above, at present developers are generally focusing on large developments in order to achieve economies of scale. Grid connection costs are also critical to project viability.

Existing Development within Test Valley

4.52 As shown in **Table 4.1**, there is at least 176.66MW of operational solar PV within Test Valley, with at least an additional 40MW consented.

4.53 The majority of solar PV developments are located in the north of the Borough, several of which are located along the A303 corridor. There is also a cluster of renewable developments located in the south of the Borough around Romsey (see **Figure 4.1**).

[52] IRENA (2020) Renewable Power Generation Costs in 2019. Available at: www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019.
[53] Ofgem (2020) About the Smart Export Guarantee (SEG). Available at: www.ofgem.gov.uk/environmental-programmes/smart-export-guarantee-seg/about-smart-export-guarantee-seg.
[54] Cleve Hill Solar Park (2020) Cleve Hill Solar Park granted development consent – 28/05/2020. Available at: www.clevehillsolar.com/.
[55] Department for Business, Energy & Industrial Strategy (May 2020) UK Renewables 2019 and October to December 2019: Table 6.1 - Renewable electricity capacity and generation (ET 6.1 - quarterly). Available at: www.gov.uk/government/statistics/energy-trends-section-6-renewables.
[56] Department for Business, Energy & Industrial Strategy (May 2020) Solar photovoltaics deployment: Using March 2020 data within Table 2, considering all FiTs (standalone), RO (ground mounted) and CfDs (ground-mounted) within the UK. Available at: www.gov.uk/government/statistics/solar-photovoltaics-deployment.

4.54 According to the most recent BEIS Renewable Energy Planning Database and data provided by Test Valley Borough Council, a total of five schemes, equating to 78MW, have been either abandoned, withdrawn or refused within Test Valley.

Assumptions used to Calculate Technical Potential

4.55 A GIS assessment of technically suitable land for solar development was undertaken using a similar approach to that undertaken for wind development. Solar development is more 'modular' than wind (developments size is dictated by the number of panels, which themselves do not differ greatly in size) and constraints are not affected by project scale in the way that they are for wind. Therefore, the identification of available land for solar has not been broken down into discrete project sizes but rather any land technically suitable for development has been identified. The GIS tool parameters are set out in **Table A - 9** in **Appendix A**.

Landscape Sensitivity Assessment

4.56 Although the landscape and visual impacts of solar PV tends not to be so contentious as wind development, it is still often a key consenting issue, particularly at larger development scales. The landscape sensitivity assessment therefore also considered solar PV, and as sensitivity varies in accordance with development scale, different development scales were considered based on land take:

- Very large solar PV installation: (50-120ha).
- Large solar PV installation: (20 to 50ha).
- Medium solar PV installation: (5 to 20ha).
- Small solar PV installation: (1 to 5ha).
- Very small solar PV installation: (Up to 1ha).

4.57 Based on the application of the indicative 2ha/MW development density, the sensitivity assessment therefore encompasses development capacities up to a (generous) 50MW. This is considered a reasonable maximum for the present purposes, bearing in mind the geographical characteristics of the Borough and the fact that any development in excess of 50MW would be considered under the national consenting framework.

4.58 Please refer to the separate Landscape Sensitivity Assessment of Renewable Energy Report for further details.

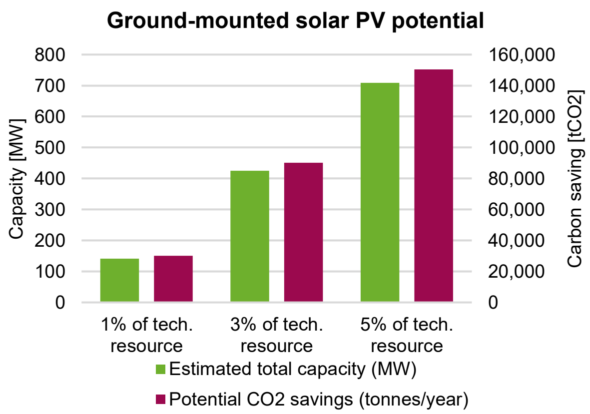
Results

Technical Potential

4.59 Figure 4.3 and **Table 4.6** below provide a summary estimate of the technical potential for ground-mounted solar PV within Test Valley. As the full technical potential is very large, utilisation of 1%, 3% and 5% of the resource is also quantified. Adopting the 3% development scale would result in a total potential technical capacity from ground mounted solar PV across the Borough of 425MW – this approximately equates to an area of 8.5km^2.

4.60 The calculation of potential energy yield then required application of a 'capacity factor' i.e. the average proportion of maximum PV capacity that would be achieved in practice over a given period. Capacity factors vary in practice in accordance with solar irradiation, which in turn is affected by location, slope and aspect. It was not possible to find suitable historic data on capacity factors taking into account these kinds of variations for the present study, and so a single capacity factor of 10.4% was used, as based on regional data[57].

Figure 4.3: Ground-mounted solar PV potential.



[57] BEIS (2019) Quarterly and annual load factors: Annual Regional PV Load Factors, averaged at 10.4% for the South East region over the last eight years. Available at: www.gov.uk/government/publications/quarterly-and-annual-load-factors.

Table 4.6: Potential Solar Capacity and Output[58]

Development Scale	Potential installed capacity (MW)	Electricity output (MWh/year)	Potential CO_2 savings (tonnes/yr)
100% of technical potential	14,171.67	12,910,955	3,008,253
1% of technical potential	141.72	129,110	30,083
3% technical potential	425.15	387,329	90,248
5% of technical potential	708.58	645,548	150,413

4.61 The key constraints and resulting potentially suitable land for solar development are presented in **Appendix A** and **Appendix C** respectively.

4.62 As with the wind resource assessment, the solar assessment has certain limitations. In particular, cumulative impact is again a key consideration that the tool cannot take into account but which would affect consideration of planning applications in practice. Due to the less constrained nature of solar, relative to wind, in terms of the factors that can reasonably be considered within a high-level resource assessment, a large area of land has been identified as technically suitable for ground mounted solar; but in practice development of all or even the majority of this land would clearly not be appropriate.

Issues Affecting Deployment

4.63 Considerations, other than cumulative impact, that would reduce the deployable potential of solar PV in practice include landscape sensitivity, grid connection and development income. These are discussed in turn below:

Landscape Sensitivity

4.64 As noted in paragraph 4.34, the south-western corner of Test Valley Borough falls within the New Forest National Park and planning matters are therefore under the remit of the National Park Authority. This area was therefore excluded from the assessment.

4.65 When assessed at a LCA level, all parts of the North Wessex Downs AONB within the Borough are assessed as having a moderate high landscape sensitivity to any solar PV development, with a high sensitivity to all development larger than the 'small' category (see the Landscape Sensitivity Assessment Figure 3.8). The rest of the Borough has at least a 'moderate' landscape sensitivity to any solar development larger than the 'small' category and moderate high or high sensitivity to 'very large' Solar PV category (see the Landscape Sensitivity Assessment Figure 3.10). The south of the Borough has a slightly lower sensitivity to solar development of all sized when assessed at an LCA level.

4.66 As the sensitivity assessment notes, landscape sensitivity varies within LCAs in practice, and particular development sites may be identified within individual LCAs that have lower sensitivity than that of the LCA overall. LVI is also ultimately a consideration that needs to be weighed within the overall planning balance. The sensitivity assessment, however, can be used to guide development towards less sensitive areas in the first instance, and then to ensure that careful consideration is given to the choice of solar PV development locations, numbers and scales, particularly in areas identified to be of higher sensitivity. Please refer to the separate Landscape Sensitivity Assessment of Renewable Energy Report for further details.

Grid Connection

4.67 As with wind, a key consideration in relation to solar PV development viability is the interaction between development income and grid connection costs. As noted above, at the present time viable solar developments are generally larger scale. It is understood, however, that even larger scale solar developments will only generally be viable at present where a grid connection is available in relatively close proximity to the development site, and does not involve significant network reinforcement costs. Although connections can in principle be made either into existing substations or into power lines (a ‘tee in’ connection), proximity requirements alone would limit the deployable solar PV potential in Test Valley at the present time, as indicated in the SSEN generation availability map (see paragraph 4.158).

4.68 The generally constrained nature of the electricity network in Test Valley presents a further challenge, with no substations having been identified at the present time with over 30MW available capacity.

4.69 Further details on network capacity within the Borough are provided from paragraph 4.154.

Development Income

4.70 As with wind, the lack of financial support for solar PV will particularly constrain the deployable potential of smaller schemes and schemes at greater distances from potential grid

[58] Note that the area of unconstrained land is treated as a single block of land. This is not the case in reality.

connection points. The present assessment cannot, however, rule out the potential for such schemes, bearing in mind that over the next Local Plan period the financial context could change (including via changes to Government policy).

4.71 Over recent years however, solar panel costs have reduced significantly, and as such solar energy schemes are financially viable at larger scales.

4.72 With regards to smaller scale solar developments, the Smart Export Guarantee has been introduced since January 2020[59]. As with wind, this could help to increase the financial viability of solar energy developments of up to 5MW capacity. However, as noted previously, the obligation does not provide financial benefits equal to the previous FiT scheme, as it only provides payments for electricity export, not generation, and it does not provide a guaranteed price for exported electricity. It therefore remains to be seen what the take-up of this support programme will be.

Solar – Rooftop

Description of Technology

4.73 Both solar PV and solar water heating are well-established technologies in the UK, with uptake having been significantly boosted through the Renewable Heat Incentive and the Feed-in Tariff schemes. The breadth of uses for solar PV technology is vast and spans many diverse applications, such as space vehicles, solar phone chargers, roof or ground-mounted power stations and solar streetlamps. Other applications being developed in the UK include 'floatovoltaics' (floating PV arrays), for example, a 6MW floating solar PV array has now been developed on one of Thames Water's reservoirs[60]. There is also a new design for a solar PV integrated motorway noise barrier that is being considered for use by Highways England[61], and a trial of track-side solar panels being used to power trains by Imperial College[62]. Solar car park canopies also offer potential, as demonstrated by the 88.5kW system installed at the Ken Martin Leisure Centre by Nottingham City Council[63].

4.74 Rooftop deployment is generally limited to roofs with minimal shading and which face south-west through to south-east with a pitch of 20-60 degrees. Systems can be roof-integrated, i.e. designed to form an integral part of the roof itself and therefore can offset some of the cost of conventional roofing materials using a range of PV materials including semi-transparent panels, tiles and shingles. Flats and non-domestic properties often have flat roofs and so orientation is not critical, although systems will then need tilted frames to house the solar array, with each frame suitably spaced in rows to avoid self-shading. For pitched roofs, solar PV generally needs around 7.5m^2 of roof space per kW for high efficiency panels (e.g. monocyrstalline silicon) and grid-connected systems that are able to export power, if there is insufficient load in the property at any one time. The rooftop size of solar water heating systems however is limited by the hot water demand of the property they are serving, with domestic systems typically requiring 1.5m^2 of flat panel per resident. Properties also need to have sufficient space to accommodate a hot water storage tank.

4.75 Standard installations of solar panels are considered to be 'permitted development' and therefore do not normally require planning consent. However, installations on listed buildings, or on buildings in designated areas (e.g. on the site of a scheduled monument or in a conservation area) are restricted in certain situations and may require planning consent.

Existing Development within Test Valley

4.76 Test Valley saw over 11MW of solar PV capacity installed between April 2010 (launch of the Feed-in Tariff) and March 2019 (when it closed), with half of this deployed on dwellings. Accredited domestic installations of solar water heating systems under the Renewable Heat Incentive (RHI) scheme from April 2014 to August 2020 totalled 38, which equates to approximately 0.1MW assuming an average system capacity of 2.9kW. Figures are not available for non-domestic installations.

Assumptions Used to Calculate Technical Potential

4.77 The theoretical potential for solar technologies considers the number of roofs that could support them. For the purposes of this study a high level assessment was undertaken which considered types and numbers of buildings across Test Valley and various assumptions on suitability - see **Appendix A**.

4.78 The combined capacities of the systems were then calculated to derive the total installed capacity. For the purpose of the resource assessment both technologies (i.e. PV and solar hot water heating) were considered to be mutually exclusive, i.e. no space restrictions were assumed as a result of locating both technologies on the same roof.

[59] Ofgem (2020) About the Smart Export Guarantee (SEG). Available at: www.ofgem.gov.uk/environmental-programmes/smart-export-guarantee-seg/about-smart-export-guarantee-seg.
[60] www.bbc.co.uk/news/science-environment-35868250
[61] Highways Agency Carbon Routemap (2014).
[62] Solare Power Portal. Available at: www.solarpowerportal.co.uk/news/imperial_college_trialling_track_side_solar_panels_to_power_trains
[63] BRE (2016) Solar car parks - A guide for owners and developers. Available at: www.bre.co.uk/filelibrary/nsc/Documents%20Library/BRE/89087-BRE_solar-carpark-guide-v2_bre114153_lowres.pdf (see p16).

Results

Technical Potential

4.79 The potential installed capacities, energy yields and savings for solar PV and solar water heating across Test Valley are presented below, according to the assumptions set out in **Appendix A**.

Figure 4.4: Roof-mounted solar PV potential

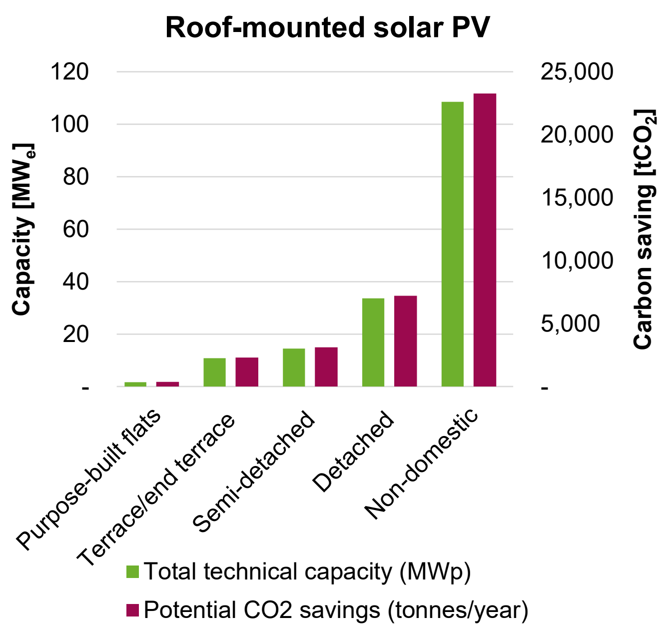


Table 4.7: Assessment of rooftop solar PV

Building category	Estimated capacity (MW)	Electricity output (MWh/year)	Potential CO_2 savings (tonnes/yr)
Domestic - flats	1.7	1,565	365
Domestic – terraced/end-terrace	10.8	9,919	2,311
Domestic – semi-detached	14.5	13,334	3,107
Domestic – detached	33.7	30,973	7,217
Non-domestic	108.6	99,842	23,263
Total	**169.2**	**155,633**	**36,262**

Figure 4.5: Solar water heating potential

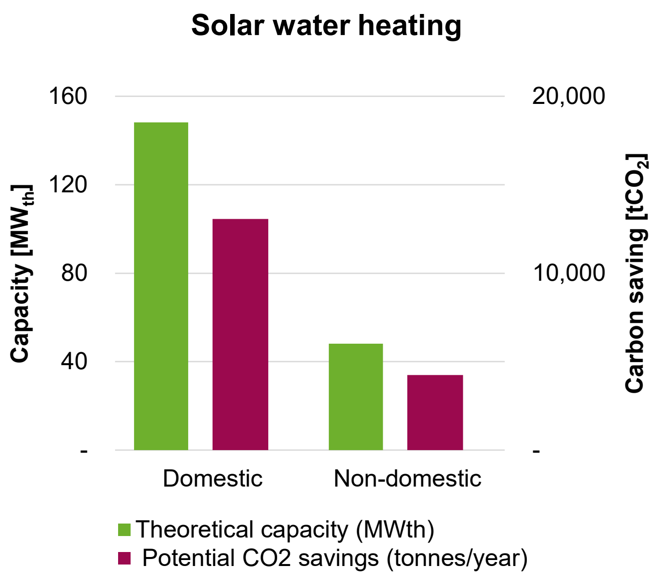


Table 4.8: Assessment of rooftop solar water heating

Building category	Estimated capacity (MW)	Delivered heat (MWh/year)	Potential CO_2 savings (tonnes/yr)
Domestic (excl. flats)	148.2	60,348	13,058
Non-domestic	48.1	19,582	4,237
Total	**196.3**	**79,930**	**17,295**

Issues Affecting Deployment

4.80 Solar PV is proving particularly attractive to developers as a relatively easy-to-install renewable energy technology, which helps to meet tightening building emissions standards through offsetting high carbon mains electricity. However, the gradual decarbonisation of mains grid electricity means that the ‘value’ of carbon offsets with solar PV will also continue to drop, although financial benefits will remain for those receiving free electricity from onsite PV systems.

4.81 The cost of solar PV has fallen dramatically over the last decade and this trend is likely to continue with UK grid parity (generation of power at or below the cost of mains power) expected in 1-3 years without the need of subsidies. In addition, the application of solar PV has benefitted from recent advances in energy storage systems and smart power management controls. When deployed with solar PV, systems such as time-of-use electricity tariffs could automate and optimise how generated power is used at any one time i.e.

whether it is used directly on site, stored or exported to the grid. The integration of domestic solar PV within a 'whole house' system which includes the management of electric vehicle charging may also provide an incentive for uptake of the technology.

4.82 Following the closure of the Feed-in Tariff scheme to new applicants in March 2019, the Government introduced the Smart Export Guarantee scheme in January 2020, which places an obligation on licensed electricity suppliers to offer a tariff and make payment to small-scale (>5MW) low carbon generators for electricity exported to the grid. However, this only applies to exported power rather than total generation and so is generally less beneficial than incentives offered under the Feed-in Tariff. In addition, in October 2019 the Government increased VAT payable on solar PV battery systems from 5% to 20%, although the reduced rate of 5% still applies for the domestic installation of solar panels (both solar PV and solar water heating).

4.83 Solar PV will therefore continue to play a vital role in the large majority of new developments and will make a significant contribution to total installed capacity. Future uptake on existing buildings however is difficult to predict and will be more limited until non-subsidy financial viability improves.

4.84 Solar water heating is much less common, with preference generally given to solar PV during the more lucrative Feed-in Tariff period, although installations on buildings located in off-gas areas can be financially advantageous due to the increased benefits of displacing higher cost heating fuels relative to mains gas, such as electricity and oil. Installations on non-domestic buildings are more limited as viability depends on hot water demand and competition with point-of-use hot water heating. Relative to heat pumps, the technology is likely to play a much lesser role in the decarbonisation of heat, particularly if grid electricity continues to decarbonise as predicted.

4.85 In certain circumstances, both solar PV and solar water heating can be considered to be permitted development[64] and as such may not need planning permission.

Biomass

Description of Resource

4.86 Biomass can be generally defined as material of recent biological origin, derived from plant or animal matter. It is often categorised as either 'dry' or 'wet' biomass, with the former more commonly combusted either to generate heat or to produce electricity, and the latter anaerobically digested to generate 'biogas' or used to produce a transport 'biofuel'.

4.87 Biomass materials such as wood are widely used in many countries as a feedstock for modern heating systems. Modern biomass heating technology is well developed and can be used to provide heat to buildings of all sizes, either through individual boilers or via district heating networks. Biomass is also increasingly being used to fuel electricity plant or combined heat and power (CHP) plant due to the low carbon emissions associated with its use. It is important however to ensure feedstocks are sustainably sourced and carbon emissions minimised during any processing and transport activities.

4.88 Organic wastes can also be considered as a low carbon resource if their use in energy production has prevented them from otherwise decomposing i.e. potentially releasing methane - a potent greenhouse gas.

4.89 The most common types of biomass feedstocks for energy production include:

- **Virgin woodfuel**, including forestry and woodland residues, and energy crops.
- **Waste residues**, including municipal and commercial solid waste, recycled wood waste, agricultural residues and sewage.

Virgin Woodfuel and Energy Crops

Description of Technology

4.90 The woodfuel resource considered here includes virgin, untreated wood residues (from forestry, arboriculture, tree surgery, etc.) and the energy crops Miscanthus and Short Rotation Coppice (SRC). There is some overlap with waste where virgin wood is present in certain waste streams, but this can be difficult to segregate from non-virgin (contaminated) wood. The distinction between virgin or contaminated wood will determine the areas of legislation that will apply to its use regarding emissions permits. Woodland residues and energy crops are generally considered to be clean or 'untreated' whereas other waste wood residues may contain contaminants such as paint, preservative, etc. and would fall under stricter emission and pollution prevention controls.

4.91 Wood is considered to be a sustainable fuel if it can be shown to have been sustainably sourced, which usually means it is renewable through re-growth as part of sustainable woodland management and does not carry excessive 'embodied' carbon from processing and transport. Logs and

[64] Subject to complying with criteria set out as Part 14 of the Town and Country Planning (General Permitted Development) (England) Order 2015 (as amended).

woodchip in particular are bulky fuels and should be sourced as locally as possible to their end-use. Wood from a sustainable source is therefore classed as a low carbon energy source as the carbon emissions released when combusted are balanced by that absorbed during its re-growth. Its use as part of a net-zero carbon future however would require that the amount of woodfuel being burnt is replaced by re-growth or re-planting (accounting for timescales), and that carbon emissions used in growing, processing and transport processes have also been mitigated.

4.92 Various processes are used to prepare the wood feedstock prior to it becoming suitable for use as fuel in a range of forms including logs, woodchips, pellets and briquettes. These processes largely dictate the final specification of the biomass in terms of moisture content, size and form. Quality control of these parameters is vital for use in specific types of boiler and thermal conversion processes. Both woodland residues and energy crops can be used to produce either heat-only or electricity and heat (combined heat and power) via a range of energy conversion technologies including direct combustion, gasification and pyrolysis.[65]

Existing Development within Test Valley

4.93 As of August 2020 there were 14 domestic biomass systems in Test Valley, accredited under the Renewable Heat Incentive (RHI) scheme. Taking an average capacity of 26kW per installation gives a total installed capacity of nearly 0.4MW. No further data was identified on use of woodfuel within the Borough, although there will be significant amounts used domestically in open fires, stoves and wood burners.

Results

Technical Potential of Forestry and Woodland Resource

4.94 Woodland and arboricultural residues are normally sourced as the residues of the sustainable management of existing woodland. The technically available resource can be assessed by calculating the total area of woodland in the study area and assuming a sustainable yield, which in this case is two odt/yr/ha (oven-dried tonnes/year/hectare) – a generally accepted figure across the industry. Annual tonnage of wood can then be obtained and its heat delivery potential estimated.

4.95 The Forestry Commission's National Forest Inventory (NFI) dataset has been used for this analysis. The NFI is produced by using satellite images to identify and classify areas of woodland, alongside ground surveys of sample areas[66]. It classifies areas of woodland into the following categories:

- Broadleaved.
- Coniferous.
- Coppice.
- Coppice with standards.
- Mixed.
- Shrub.
- Young trees.
- Felled.
- Ground prepared for planting.
- Low Density.

4.96 Felled areas, ground prepared for planting, low density, shrub and young trees are excluded from the analysis because they cannot provide a sustainable source of woodfuel. They have been mentioned here because they are in the NFI, and because felled areas may be replanted in the future, while young trees will mature over time into a viable resource. **Figure 4.6** show areas of woodland as mapped for the study area. The figures do not consider any constraints such as specific designations relating to ecological value e.g. ancient woodland.

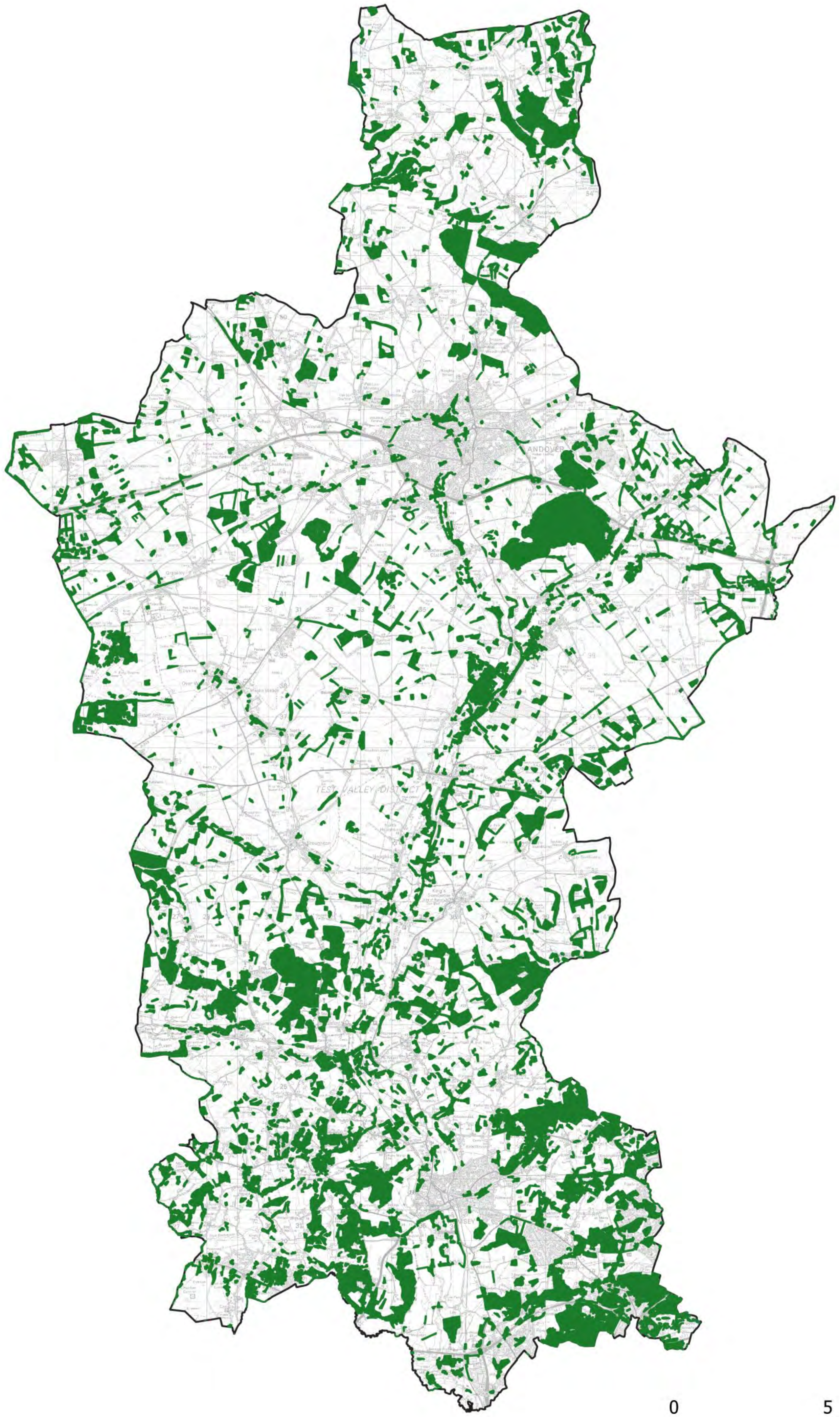
[65] Pyrolysis describes the process of heating an organic substance in the absence of oxygen, whereas with gasification oxygen is present, but in much reduced quantities compared to normal combustion. With biomass, this typically results in the production of combustible gases and residues which can be used as fuel.

[66] This means that there are occasional errors where patches in photographs have been erroneously identified.

Renewable and Low Carbon Energy Study

Test Valley Borough Council

Figure 4.6: Areas of woodland within Test Valley (all categories)



4.97 Using the GIS data behind the above map, the technically available resource by woodland category is shown in the table below. This estimates the annual tonnage of wood and its delivered heat potential – this has been assessed by using assumptions about the sustainable yield that can be obtained, heating plant efficiency and the energy content of wood. All assumptions are included in **Appendix A, Table A-5**.

Table 4.9: Woodfuel: assessment of forestry and woodland resource

Woodland category	Area (Hectares)	Sustainable woodfuel yield (odt/yr)	Delivered heat (MWh/year)	Potential CO_2 savings (tonnes/yr)
Broad-leaved	8,796	17,592	78,821	16,816
Coniferous	1,673	3,346	14,990	3,198
Felled	128	257	1,151	245
Mixed	497	995	4,458	951
Shrub	47	94	422	90
Young trees	333	665	2,980	636
Coppice	6.11	12	55	12
Coppice with standards	17.56	35	157	34
Ground prep	22.17	44	199	42
Low density	47.88	96	429	92
Total	11,568	23,136	103,661	22.116
Total excl. felled, ground prep, low density, shrub and young trees	10,990	21,980	98,480	21,011

4.98 The above figures relate to the resource within Test Valley only, but there is potential for surplus woodfuel to also be sourced from further afield if the cost and environmental impact of transporting the feedstock or final product is suitably assessed. The resource shown in **Table 4.9** would increase by more than 10 times if a 40km search radius was applied from the boundary of the Borough. This 40km buffer area includes the New Forest. It is likely however that a significant proportion of this resource is already being utilised for the woodfuel requirements of domestic log stoves and open fires.

4.99 A further potential source of woodfuel is from the cutting of hedgerows – however it has not been possible to assess this resource because there is no reliable yield factor for the amount of woodfuel that can be obtained from a given area or length of hedgerow.

Technical Potential of Energy Crops

4.100 The two main energy crops that can be used as woodfuel are Miscanthus and Short Rotation Coppice (SRC). These are usually planted specifically for heat and/or electricity production, and are from 'biofuel' crops such as sugar cane, maize and oilseed rape which tend to be used for transport fuels.

4.101 Miscanthus cultivation has the advantages of being able to use existing machinery, is higher yielding than SRC, undergoes annual harvesting with a relatively dry fuel product when cut, but it is more expensive to establish. SRC (commonly willow) is easier and cheaper to establish, is better for biodiversity and suitable for a wider range of boilers. However, it requires specialist machinery, is harvested every three years, and produces a wetter fuel that needs to dry before it can be used. Both crops have similar lead in times with around 4 years until they produce commercial harvests. Miscanthus will reach its peak yield in year 5 and SRC will achieve its peak yield in the second rotation which is harvested in year 7.

4.102 The technical resource for energy crops assumes that they can be grown on agricultural land of grades 2 or 3 (arable land)[67], which for Test Valley totals 47,282 hectares (around 75% of total land area) – see **Figure 4.7**. Grade 1 land is excluded from the analysis as this is the best quality agricultural land and it is assumed that food crops will be prioritised over energy crops in these areas. Other typical constraints to energy crops include areas having certain types of permanent pasture and moorland that would be inappropriate to plant on, public rights of way, woodland, historic parks and gardens, and for miscanthus, exposed areas with high average wind speeds.

[67] A description of UK agricultural land classification can be found here: www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land#agricultural-land-classification-alc.

Renewable and Low Carbon Energy Study

Test Valley Borough Council

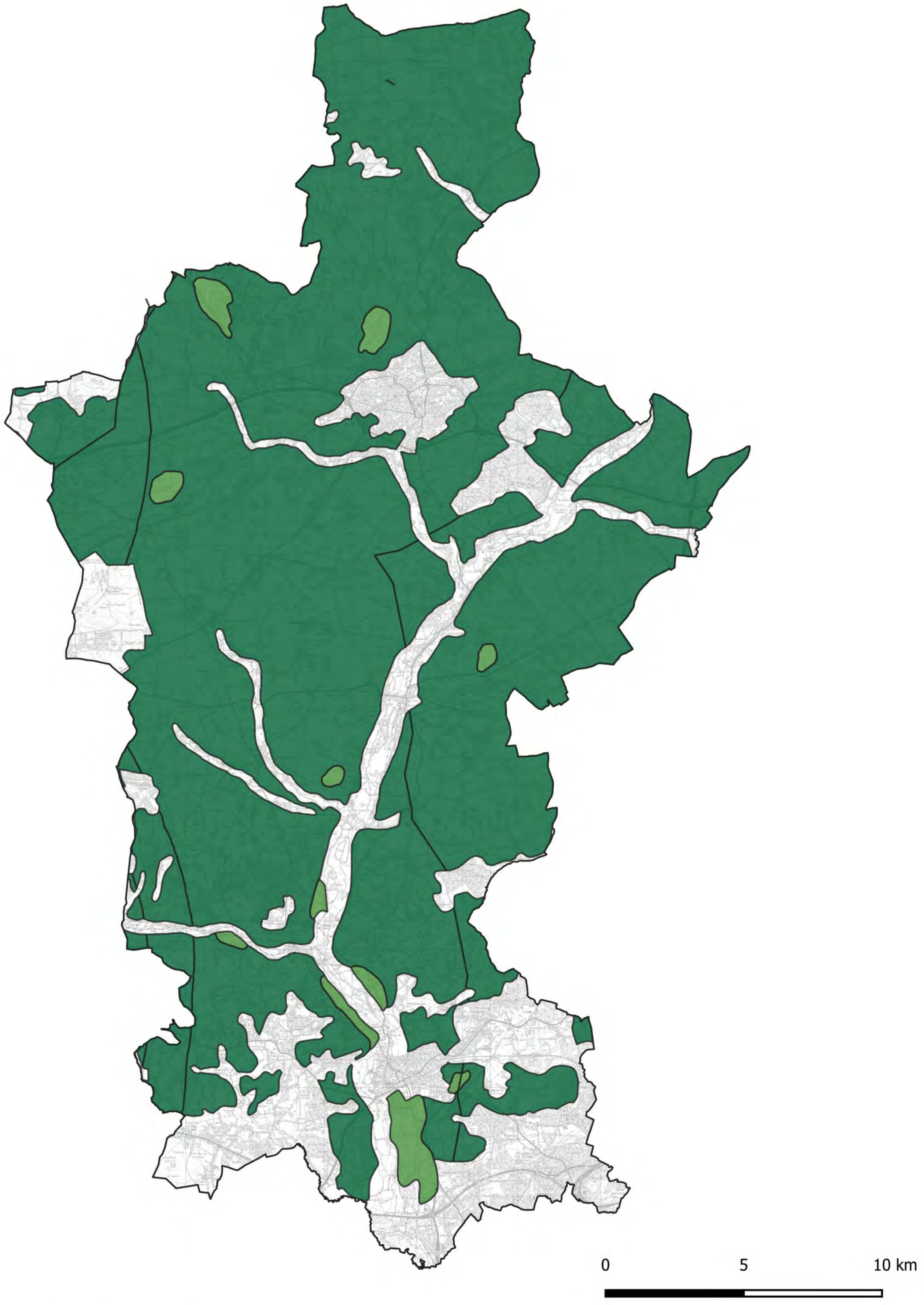


Figure 4.7: Agricultural land classification in Test Valley

Map scale 1:235,000

4.103 Annual yields are typically around 16-18 odt/ha for miscanthus and 8-10 odt/ha for SRC. Potential energy outputs and emissions savings are shown in **Table 4.10** below. This shows two scenarios: the resource for all suitable areas and (just for example) if 10% of this (4,728 hectares) was utilised.

Table 4.10: Potential yields and CO_2 savings for energy crops

Scenario	Area cultivated (Hectares)	Sustainable woodfuel yield (odt/yr)	Delivered heat (MWh/year)	Potential CO_2 savings (tonnes/yr)
Miscanthus	47,282	803,800	2,069,786	761,957
	4,728	80,380	206,979	76,196
SRC	47,282	425,541	1,095,769	403,389
	4,728	42,554	109,577	40,339

Issues Affecting Deployment

4.104 Assuming there is sufficient demand, the sourcing of clean recycled wood as woodfuel (see paragraph 4.118) will depend on suitable management of waste streams and separation processes, whereas the constraints on producing woodfuel from woodlands will depend on how much woodland can be brought under active management and the incentives available for landowners to extract and process woodfuel. The virgin woodfuel market is currently dominated by demand from domestic log-burners or stoves with woodchip and pellet boilers still only playing a minor role. Economic viability for the latter is better in off-gas areas due to the higher cost of predominant fuels such as oil, LPG and electricity (for direct heating), and the on-going Renewable Heat Incentive scheme. Woodfuel heating systems however will increasingly need to compete with heat pumps as the electricity grid decarbonises and will also have to contend with additional constraints such as space for fuel storage, solid fuel flue regulations and maintenance requirements.

4.105 Deployment of energy crops, and to some extent the management of woodland for woodfuel, will be influenced by economic viability, end-use/market, land ownership, existing farming activities, potential biodiversity impacts, protected landscapes and the presence of water-stressed areas. In particular, conflicts over land use for food production or energy crops (including transport biofuels) will need to be considered in relation to the scale of energy crop production envisaged.

4.106 The production of energy crops will also be dependent on landowners and farmers being offered sufficient incentive to grow and harvest the crops, with longer-term supply contracts often needing to be arranged well in advance with end-users. As with woodland residues, the logistics of fuel processing and establishing supply chains may initially act as a barrier to the widespread take-up of this resource. Other issues that may limit exploitation include the requirement for an Environmental Impact Assessment (EIA) of energy crop projects, the planning and permitting of energy generating plant and the question of alternative markets for Miscanthus and SRC.

4.107 Overall there is ambition at national level for biomass to play a key role in decarbonising the UK's energy supplies. Both the Government's Clean Growth Strategy (2017) and the Committee on Climate Change's *'Net Zero – the UK's contribution to stopping global warming'* report (2019) acknowledged the significant opportunities offered by biomass, particularly if it is used alongside carbon capture and storage (CCS) technology to both sequester carbon from the atmosphere via plant growth and capture that subsequently released in bioenergy conversion processes. The Committee on Climate Change have also reviewed the carbon and wider sustainability impacts of biomass production and use and concluded that sustainable low-carbon bioenergy is possible, but that this can only be achieved in certain circumstances, if certain practices and criteria are applied[68].

4.108 Since the 1960s, agricultural subsidy under the EU's Common Agricultural Policy (CAP) has significantly shaped farming practices in the UK, including the extent to which bioenergy initiatives have been deployed. The UK's 25 year Environment Plan and planned exit from the CAP now provide a new context for policies and strategies to scale up biomass production, not least by the Government's new Environmental Land Management (ELM) scheme which will pay farmers to deliver beneficial outcomes.

Waste Residues – Municipal and Commercial Solid Waste

Description of Technology

4.109 Generally referred to as 'Energy from Waste', this technology involves extracting energy using a process undertaken on the non-recyclable residual elements of waste streams. Solid dry materials can be processed into Refuse-Derived Fuel (RDF) and are usually incinerated to produce heat and/or electricity. A proportion of this fuel (usually up to 50% of the residual waste prior to being processed) could be considered as 'renewable' depending on its organic, non-fossil fuel content, for example as set out by Ofgem for the purposes of the Renewables Obligation[69]. However, the RDF itself remains a significant source of carbon emissions, particularly

[68] See 'Biomass in a low carbon economy' (2018), Committee on Climate Change, p12, Box 2.

[69] See: Renewables Obligation: Fuel Measurement and Sampling; Ofgem e-serve; 2016; p40

from the plastic content of the waste stream, so there is some debate whether it should be classed as a renewable or even a partially renewable fuel. Residual waste arisings should therefore be minimised at source as far as possible in order to reduce their impact on emissions.

4.110 Another form of energy from waste technology uses anaerobic digestion to process food waste. One of the by-products of the process is biogas which is then either combusted to generate electricity or processed into biomethane and injected directly into the gas grid.

Existing Development within Test Valley

4.111 In 2018 Test Valley Borough Council published their Waste Strategy 2018-2023[70], which focuses on waste services within Test Valley and seeks to further develop the services offered, as well as improve waste minimisation, reuse, recycling and composting. Test Valley is a partner in Project Integra, a partnership of 11 district/borough authorities and two unitary authorities in Hampshire, with Hampshire County Council and the waste management contractor Veolia Environmental Services, who are working to provide an integrated approach to the management of municipal waste in Hampshire. The partnership has also implemented a refreshed Waste Prevention Plan for the period 2017-2019[71].

4.112 In 2017, Hampshire sent 6.14% of waste to landfill with all other non-recyclable residual residential waste across the county disposed of in one of three existing incineration plants located in Chineham, Portsmouth and Southampton, all of which incorporate Energy Recovery Facilities (ERF) for electricity generation[72]. These facilities are understood to be electricity generation only. However, energy outputs and subsequent emission savings will be higher with combined heat and power (CHP) plants which serve local heat demands.

4.113 All of the recyclable materials from kerbside collections, or those taken to recycling centres, are sent to one of two Material Recovery Facilities in Hampshire, respectively located in Portsmouth and Alton[70]. The 'brown bin' recycling rate achieved in Test Valley in 2018/19 was 19.5%, which comprised 5,900 tonnes from dry recyclables (excluding 1,400 tonnes of contaminated materials removed at the Material Recovery Facilities). An additional 4,540 tonnes of garden green waste was also collected[73]. The Council does not currently collect household food waste.

Assumptions Used to Calculate Technical Potential

4.114 The calorific content of RDF typically ranges from 11-15 MJ/kg or 3.1-4.2MWh/tonne. When used in an energy from waste process for electricity generation only, an overall waste-to-electricity conversion efficiency of 30% can generally be assumed. For combined heat and power (CHP) processes, overall conversion efficiency can typically increase to 60-80%. Emission savings will however be dependent on finding a use for the heat which actively displaces fossil fuels. As indicated above, up to 50% of the RDF can generally be considered as a 'renewable' fuel.

4.115 Assumptions applied to each technology are outlined in **Appendix A**.

Results

Technical Potential

4.116 Test Valley's technical resource for municipal and commercial waste, as a sustainable energy generating technology, is directly related to the amount of residual waste that is generated and collected within the Borough, and whether all this can be treated using energy recovery processes. This is complicated by the fact that waste disposal is dealt with at county level and energy recovery treatment plants are located outside of the Borough. At the time of writing detailed data on commercial waste arisings in Test Valley had not been identified. However, in 2016/17 Test Valley collected around 25,500 tonnes of residual 'black bin' household waste[70]., which may typically generate around 23-31 GWh of electricity[74], of which 50% could be classed as renewable.

Issues Affecting Deployment

4.117 As discussed above, 'deployment' of this technology is related to levels of residual waste arisings within the Borough. These levels are likely to decrease in the future as waste minimisation and recycling initiatives increase to comply with tightening regulations. As a result, it is unlikely that energy from waste has much potential beyond current utilisation levels for the Borough.

[70] Test valley Borough Council (2018) Waste Strategy (2018-2023) Available at: www.testvalley.gov.uk/wasteandrecycling/waste-strategy-2018-2023.
[71] Project Integra Strategic Board (2017) PI Waste Prevention Plan. Available at: http://documents.hants.gov.uk/project-integra/WastePreventionPlan2017-19.docx.
[72] In early 2020 a proposal for a new waste to energy plant in Harewood was withdrawn by the developers.
[73] Original data sourced from Test Valley Borough Council email on 21 January 2020.
[74] Defra (2020) Structure of the agricultural industry in England and the UK at June. Available at: www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june

Waste Residues – Recycled Wood Waste

Description of Technology

4.118 Wood waste that is not recycled into products such as mulch, animal bedding, particle board, pallets etc, can be used in combustion, gasification or pyrolytic processes at various scales to produce heat and/or electricity. It is often shredded or chipped for ease of handling and to enable more efficient burning. Due to toxic emissions and air quality concerns, contaminated waste wood is generally not suitable to be used in small or medium scale thermal plant due to the lack of suitable exhaust gas clean-up equipment, which is costly and tends to be viable on larger scale plant only. Uncontaminated materials however can be used in smaller scale boilers, similar to those for virgin wood fuel (see above), although the fuel feedstock needs to be of a certain specification to suit the boiler type.

Existing Development within Test Valley

4.119 The extent to which waste wood is currently being used in the Borough for energy generation is not known.

Results

Technical Potential

4.120 Waste wood as a resource is difficult to quantify and would require a detailed survey to assess material collected at Local Recycling Centres and that present within commercial, industrial and construction waste streams. This will typically consist of clean, untreated material mixed with that contaminated with paint, preservative, fixings and other foreign materials. While clean waste wood can potentially be sourced directly from sawmills, carpenters, joineries, and so forth, a large proportion of this resource will be mixed with contaminated material in mainstream commercial and municipal solid waste streams. It is therefore likely that a significant amount (which is not already being recycled into other uses) is currently being treated as residual waste and may therefore end up at one of the three ERFs in Hampshire.

4.121 Note – the wood resource from woodland and arboricultural arisings are considered above (see virgin woodfuel).

Issues Affecting Deployment

4.122 In addition to the issues described around collecting and sorting the waste wood streams, feedstock processing and the setting up of reliable supply chains also require careful consideration. Particulate emissions from woodfuel combustion can also be an issue in areas which have Smoke Control Areas or Air Quality Management Areas in force, particularly when considering cumulative impacts on local air quality. Test Valley however does not currently have any such restrictions in place.

Waste Residues - Agricultural Residues and Sewage

Description of Technology

4.123 Agricultural waste also represents a potential renewable energy resource, particularly from using livestock slurry as a feedstock for the anaerobic digestion (AD) process. This describes the process by which organic matter is broken down by microbes in the absence of oxygen to produce methane-based biogas for heat and/or power generation, and a liquid or solid digestate residue, which can often safely be used as a fertiliser.

4.124 Biogas generation from the anaerobic digestion of sewage is also classed as a renewable form of energy, with most large plant generating heat and/or electricity for the site's own needs and exporting excess power to the local grid. Biogas can also be upgraded to biomethane and injected directly into the gas grid. Heat recovery systems can also be used with sewage or wastewater infrastructure to provide heat to local users, although this application is not yet widespread.

Existing Development within Test Valley

4.125 Sewage treatment in Test Valley is currently provided by a number of public wastewater treatment works across the borough, supplemented by a small proportion of private systems such as septic tanks, which do not have access to the public facilities. The renewable energy generation capacity of the existing wastewater treatment sites is currently unknown. Total installed AD capacity on the Feed-in Tariff Register for Test Valley as of March 2019 was just 14kW.

Results

Technical Potential

4.126 It is assumed that the large majority of the sewage produced in the Borough is already being treated in AD biogas plants, although it has not been possible to quantify amounts or the energy produced.

4.127 Using estimates from Defra statistics on animal numbers for 2016 and resulting slurry and biogas yields, an estimate has been made of the potential emissions savings in **Table 4.11**.

Table 4.11: Assessment of livestock slurry

Livestock	Numbers in Test Valley[75]	Volume of slurry[76] (tonnes/yr)	Biogas yield (m^3/tonne)	Delivered energy (MWh/yr)	Potential CO_2 savings (tonnes/yr)
Cattle	11,712	46,848	20	5,022	1,156
Pigs	8,959	6,459	20	692	159
Poultry	547,065	21,339	50	5,719	1,316
Total				11,433	2,631

Issues Affecting Development

4.128 As discussed, it is likely that most of the available sewage resource in the Borough is already being used for power generation, although the generation of heat as a useful by-product is more than likely being under-utilised. However, identifying suitable end-users of heat adjacent to sewage treatment plant can be challenging.

4.129 Animal slurry arisings are dispersed and not easy to transport so AD plants using this as a feedstock have generally been limited to deployment on medium-sized dairy and livestock farms and are typically sized up to 250kW power output capacity. Although the removal of the Feed-in Tariff in 2019 has resulted in reduced economic returns with this technology, the Renewable Heat Incentive may still provide feasible options for on-farm heat use at smaller scale e.g. burning biogas directly in boilers equipped with suitable burners.

4.130 Larger AD (or biomass) plants can also cause landscape impacts, with the presence of features such as storage tanks, lighting and ground disturbances having the potential to impact the landscape of the site itself and the landscape character of the surrounding area. The presence of the storage tanks and industrial buildings within AD plants could also impact views from key viewpoints and settlements, and multiple AD plants could have cumulative impacts on landscape character.

Hydropower

Description of Technology

4.131 Hydropower is a well-established and proven technology and there are few technological constraints to its use other than ensuring that water course heads (height difference) and flow rates are adequate throughout the year, the site has adequate access and can accommodate the necessary equipment, and that the electricity generated can be transmitted to its end use. For the same reasons, energy yields can be accurately predicted and economic viability established relatively easily.

4.132 Hydropower makes use of water flowing from a higher to a lower level to drive a turbine connected to an electrical generator, with the energy generated proportional to the volume of water and vertical drop or head. Although it is an established form of renewable energy, environmental constraints on large multi-MW scale plant means that most potential exists for mainly small or micro-scale schemes. Small scale hydropower plants in the UK generally refer to sites ranging up to a few hundred kilowatts where electricity is fed directly to the grid. Plants at the micro-scale (typically below 100kW) may include schemes providing power to a single home.

4.133 'Low head run of river' schemes are typically sites in lowland areas, often installed on historic mill sites using the existing channel system and weir or dam. 'High head run of river' schemes are typically found on steeper ground in upland areas and the diverted water is typically carried to the turbine via an enclosed penstock (pipeline).

4.134 Small-scale hydro schemes will typically include dams, weirs, leats, turbine houses and power lines, which will have a visual impact on the locality, but which can usually be minimised by careful siting and design. Other important considerations include hydrology and the river ecology. Hydro plants may have an impact on upstream water flows and waterfalls, and fish populations can be vulnerable to changes in water flows and from the risk of physical harm from the plant equipment. Measures such as 'fish passes' are often incorporated to mitigate these impacts.

4.135 Any potential impacts of hydro installations on the status indicators of a water body, as set out in the Water Framework Directive, will need due consideration. Requirements will normally include abstraction licences, discharge permits and flood defence consent from the Environment Agency. The cumulative impacts of hydro or other water abstraction activities along a river will need to be assessed for their impact on the protected rights of other river users. Additionally, permissions are normally issued with time limits on the abstraction period – unless these are reasonably long the developer may have concerns over the long term viability of the plant if there is a risk of these not being renewed in the future.

[75] Defra (2020) Structure of the agricultural industry in England and the UK at June. Available at: www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june.

[76] The Andersons Centre (2010) A Detailed Economic Assessment of Anaerobic Digestion Technology and its Suitability to UK Farming and Faste Fystem. Available at: http://www.organics-recycling.org.uk/uploads/category1060/10-010%20FINAL_Andersons_NNFCC_AD2010.pdf.

Existing Development within Test Valley

4.136 Test Valley currently has very little installed hydropower capacity, with only one installation providing 4kW indicated on the Central Feed-in Tariff Register.

Results

Technical Potential

4.137 It has not been possible within the scope of this study to undertake new assessment work on Test Valley's hydro resource. However, a study by the Environment Agency[77] is referenced to provide an indication of potential within the Borough. This is intended to provide national and regional overviews of the potential hydropower opportunities available, their locations, and their relative environmental sensitivity to exploitation. These data are indicative only and are not intended to replace any part of an individual site assessment, which is necessary for a full scheme appraisal.

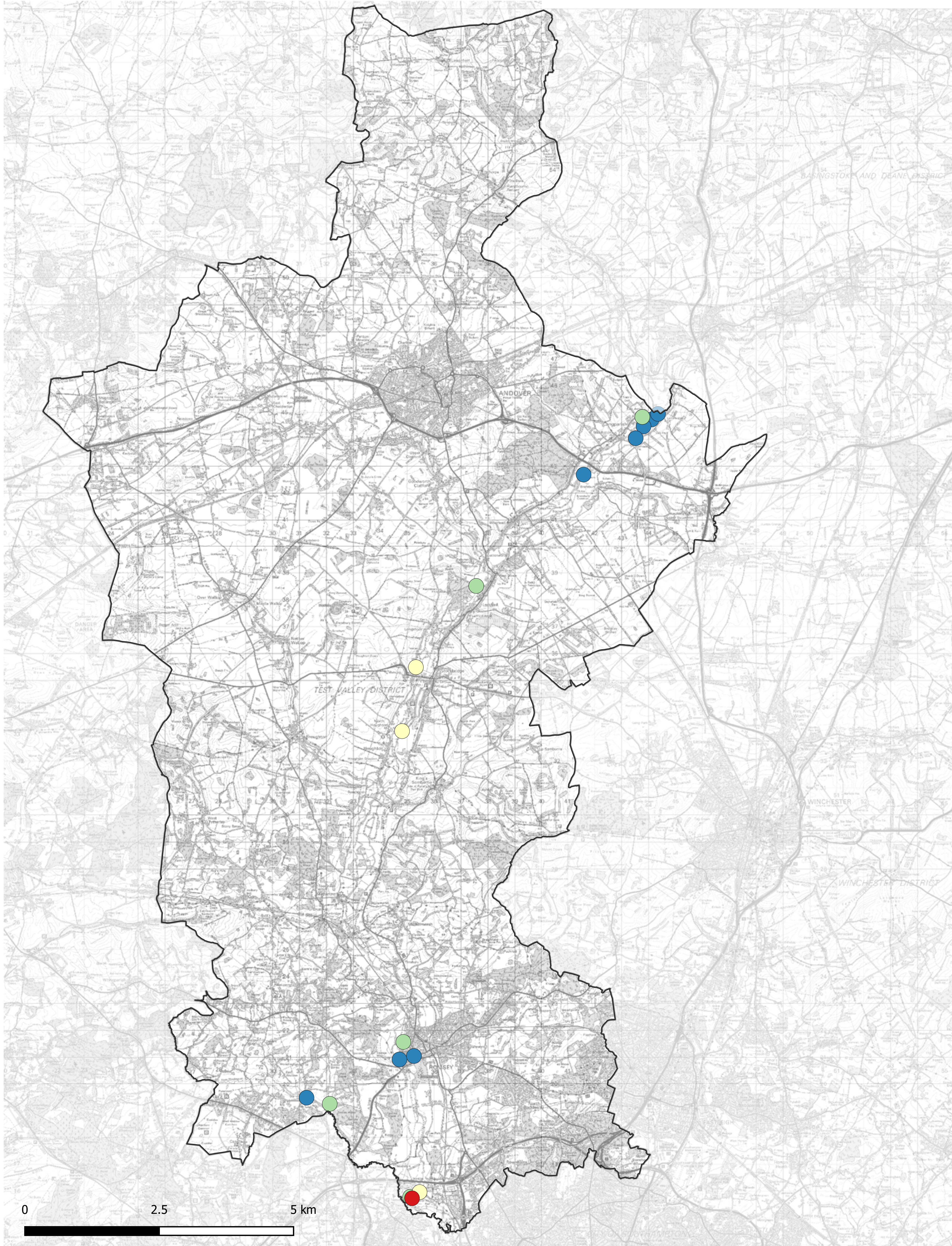
4.138 This study aimed to assess and map opportunities for small-scale hydropower on rivers in England and Wales and to assess the basic environmental sensitivity associated with exploiting them. Part of the analysis involved identifying 'heavily modified water bodies'[78] that, due to their characteristics, have the potential for the creation of a hydropower barrier to be beneficial to the passage of fish upstream. By overlaying these locations with sites having potentially suitable year-round flow characteristics, 'win-win' opportunities can be identified which could result in the delivery of good hydropower potential whilst improving the ecological status of a river. **Figure 4.8** shows an extract of the mapped results of the study, indicating the 'win-win' sites identified in the Test Valley area and categorised according to capacity range. The data shows that 18 such 'win-win' sites were identified in Test Valley making up a combined capacity of 527kW.

[77] Mapping Hydropower Opportunities and Sensitivities in England and Wales (2010)
[78] 'Heavily modified water bodies' are those identified as being at significant risk of failing to achieve good ecological status because of modifications to their hydromorphological characteristics resulting from past engineering works, including impounding works.

Renewable and Low Carbon Energy Study

Test Valley Borough Council

Figure 4.8: 'Win-win' hydropower sites identified in the Test Valley area
(Source: Environment Agency Hydropower Opportunities Mapping Project 2010)



Hydro Power

Power Category

- 10 - 20 kW
- 20 - 40 kW
- 40 - 60 kW
- 60 - 80 kW
- 80 - 90 kW

Map scale
1:160,000

Issues Affecting Deployment

4.139 Due to the scale of waterways in Test Valley and the technical, environmental and regulatory constraints of hydro power, there is little potential for significant deployment of this technology. Furthermore, it is likely that only a proportion of the 527kW capacity identified above would be deployable in practice as around half of this is made up of small (<25kW) sites, which are unlikely to be of sufficient scale to be economically viable. Future deployment is therefore likely to be significantly constrained, particularly after the closure of the Feed-in Tariff scheme in 2019. However, it should be noted that the Environment Agency analysis from which these results were obtained was undertaken at a high country-wide level and was largely desk-based, so it should not be considered as a definite conclusion on the resource in Test Valley. Viability of this technology is highly site-specific and site surveys are needed to establish the local factors that impact deployment.

Ground and Air-Source Heat Pumps

Description of Technology

4.140 Ground and air source heat pumps operate by using electricity to drive a standard refrigeration process to heat or cool buildings. Overall efficiency is sufficiently high in well-designed systems to make the technology a viable low carbon alternative to conventional heating or cooling systems. Space requirements for heat pumps vary according to type; ground source heat pumps require either space for bore holes or a larger area for trenching refrigerant pipes. For the latter, an area equivalent to twice the total floor area of the building to be heated may typically be needed. By contrast, air source heat pumps are physically similar to standard air conditioning units and do not need much space. This can mean that ground source systems are more constrained for use in retrofit projects in built up areas where space is limited. Ground conditions and the presence of groundwater can also impact feasibility and cost in a given location as boreholes are typically installed to a depth of 70-150m.

4.141 Heat pumps work best when coupled with low temperature heat distribution systems and therefore require properties to be well insulated in order for them to operate efficiently. They are often well-suited to new developments with high thermal insulation standards, but upgrades may need to be carried out with retrofit projects before heat pumps are considered a viable option.

4.142 In certain circumstances, both ground and air source heat pumps can be considered to be permitted development[79] and as such may not need planning permission. Air source heat pumps however are subject to additional restrictions due to issues of visibility and potential noise disturbance.

Existing Development within Test Valley

4.143 According to deployment data from the Renewable Heat Incentive scheme, there were 181 air source heat pump and 38 ground source heat pump domestic installations accredited in Test Valley from April 2014 to August 2020. Assuming average system capacities of 9.9kW for air source and 13.6kW for ground source, resulting total capacities are estimated at 1.8MW and 0.5MW respectively. Figures for non-domestic installations have not been identified.

Results

Technical Potential

4.144 Theoretically, almost any building could have an air source heat pump and so the technical resource is very large. For simplicity, only air source heat pumps are considered in the capacity assessment due to the space constraints of ground source heat pumps. Ground source systems however are more efficient due to their heat being sourced from the ground which has more stable year-round temperatures. Air source heat pumps take their heat from ambient air which is subject to large temperature fluctuations; unfortunately heat demand is highest when the heat source temperature is at its lowest (winter), which means a significant drop in efficiency during this period.

4.145 The standard measure of operational efficiency for heat pumps is the Seasonal Performance Factor (SPF) which indicates year-round efficiency (as opposed to Coefficient of Performance, which usually indicates efficiency during optimum conditions only). Typical SPFs for air source and ground source heat pumps in the UK are 3.3 and 3.8 respectively[80].

4.146 Due to the uncertainties in predicting the size of the technical resource, which is largely dependent on multiple factors relating to building suitability, an illustrative example has been modelled which assumes that 50% of properties achieve energy efficiency levels suitable for air source heat

[79] Subject to complying with criteria set out as Part 14 of the Town and Country Planning (General Permitted Development) (England) Order 2015 (as amended).

[80] As published in domestic RHI deployment data for August 2019, which includes average SPFs for all heat pumps installed under the RHI: www.gov.uk/government/statistics/rhi-monthly-deployment-data-august-2019.

pumps[81]. In practice however, most properties would also need to switch to low temperature heat distribution systems in order to function efficiently with heat pumps, which would involve wet systems with underfloor heating or extra-large radiators.

4.147 The potential installed capacity, heat output and CO_2 savings for air source heat pumps across Test Valley are presented below according to the assumptions set out in **Appendix A**.

Figure 4.9: Heat pumps (air source) potential

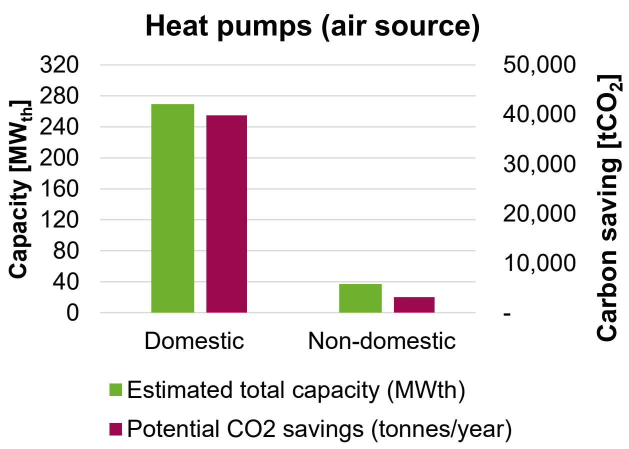


Table 4.12: Assessment of heat pumps (air source)

Building category	Estimated capacity (MW)`	Delivered heat (MWh/year)	Potential CO_2 savings (tonnes/yr)
Domestic	269.5	243,414	39,829
Non-domestic	37.1	17,811	3,133
Total	**306.7**	**261,225**	**42,962**

Issue affecting deployment

4.148 Heat pumps are expected to become significantly more widespread as their emissions performance increases as a result of the gradual decarbonisation of UK grid electricity, and there is a consequential shift towards the electrification of heat. They are particularly suited to new development for several reasons: they work much more efficiently with higher fabric thermal standards; low temperature heating distribution systems can be specified at the design stage; and their ability to provide 'passive' cooling can help mitigate overheating risks. The outcome of the Government consultation on the Future Homes Standard may also impact the uptake of heat pumps if they are perceived as a cost-effective and feasible technology to help meet emission targets for new homes of the future (see **Chapter 2**). Ground source heat pumps also have the added advantage of having no visible external equipment, and adequate space can usually be factored into the footprint of larger new developments to incorporate shared ground loop arrays to serve multiple properties.

4.149 The extent to which they are retrofitted to existing development will be dependent on several factors including capital cost reductions through mass production, the rate of electricity grid decarbonisation and energy efficiency retrofits to buildings. Regarding the latter point, it is noted that the Government's Clean Growth Strategy sets out an aspiration "*for as many homes as possible to be EPC Band C by 2035 where practical, cost-effective and affordable*", and that currently only around 30% of UK homes meet this target. Uptake in off-gas areas may be proportionally higher when competing against expensive fuels such as electricity (for direct heating) or LPG.

Water-Source Heat Pumps

4.150 Less is known about the potential for water source heat pumps. In the right locations, they have been shown to have the potential to provide efficient low carbon heating or cooling at scale as long as the buildings to be served are in close vicinity, as demonstrated by the Kingston Heights installation by the River Thames[82], which incorporates a 2.3MW water source heat pump for space and water heating of a mixed development.

4.151 Although it has not been possible within the scope of this study to assess the potential for water source heat pumps, the sensitivity analysis included in the 2014 DECC water source heat map[83] identified the River Test as having a heat capacity of between 5 and 25 MW. Viability would largely depend on having a sufficiently high heat demand local to the heat pump location.

Geothermal

4.152 The term 'geothermal energy' differs from ground source heat pump technology mainly in relation to the depth from which heat is extracted as geothermal bore holes often reach a depth of several kilometres below the earth's surface. Heat can be extracted using water or steam and used directly, or for areas having a more substantive higher temperature

[81] To put this in context, approximately 30% of UK housing currently achieves EPC Band C or above, which might generally be considered as the minimum fabric energy efficiency level for heat pumps to operate effectively.
[82] CIBSE (2014) CIBSE Case Study Kensington Heights. Available at: www.designingbuildings.co.uk/wiki/CIBSE_Case_Study_Kingston_Heights.
[83] DECC (2015) National Heat Map: Water source heat map layer. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/416660/water_source_heat_map.PDF.

resource, used to generate electricity with heat as a by-product. Heat only or combined heat and power systems are more suited to sources having lower temperatures.

4.153 Currently, geothermal energy is only thought to be exploitable in a very limited number of locations around the UK mainly in Cornwall and the Lake District/Weardale areas, although potential has also been identified for small scale generation in Cheshire and in the Wessex sedimentary basin, with the latter area including Test Valley. For Wessex, the resource potential is largely based on test boreholes located in Southampton[84], which is home to an existing district energy scheme where geothermal energy is used as part of the supply energy mix. There are currently no installations within the Test Valley area – specialist surveys would be needed to investigate localised potential. Before embarking on such work, it is suggested that the Council monitors progress on the development of this technology elsewhere (e.g. Cornwall), to gain a clearer understanding of technical and economic viability and how this may apply to the Test Valley area.

Grid Capacity – General Overview

4.154 As discussed above, the ability to connect to the electricity grid can be a limiting factor in the deployment of all larger energy developments where the energy generated is to be exported.

Overview of the Network

4.155 The UK distribution network was designed for a 'top down' flow of electricity, from small numbers of very large power stations. The increasing deployment of distributed generation is causing new challenges for the electricity network, with ever-larger areas of the network reaching maximum capacity. In these areas, the grid is no longer able to accept new grid connections for supply of power.

4.156 The near term opportunities for new renewable energy deployment presented by the distribution network are therefore limited to areas where there is capacity still available, or an existing connection which isn't being fully utilised. Such sites offer the opportunity to host additional generating capacity without the need for a new grid connection. Identifying such sites within Test Valley will require engagement with site operators and/or Scottish & Southern Electricity Networks (SSEN) - the Distribution Network Operator (DNO). Additionally, DNOs regularly upgrade the network to create extra capacity, which can be applied for in advance, even when these upgrades take years to come online. It is therefore worth periodically checking with the DNO on capacity at a specific site of interest.

4.157 SSEN maintains a generation availability map on their website[85], which provides an *"indication of the network's capability to connect large-scale developments to Major Substations."* Connections to substations are classified to be either red (constrained), amber (partially constrained) or green (unconstrained). However, it notes that:

- *"Connections to the substations with an overall RED classification are still possible, however there might be a requirement for significant network reinforcement to overcome the impact on the network constraints.*
- *Connections to the substations with an overall GREEN classification may still not be possible, because of up-stream requirement for significant network reinforcement to overcome the impact on the network constraints."*

4.158 The map can be viewed on the SSEN website at ssen.co.uk/generationavailability.

4.159 The present capacity[86] of the network to accept new generation appears relatively constrained across the Borough, particularly in the north around Andover and its hinterland where most of the sub-stations have an overall red classification. There appears to be greater capacity to the south of the Borough around Romsey and beyond.

Energy Storage and Demand Side Response

4.160 Energy storage technology, particularly batteries, has advanced considerably in recent years and is well placed to help alleviate the constraints that currently limit connections to the grid. By co-locating battery storage with renewable energy developments, developers can store excess power and sell during high demand. This also helps keep the grid 'in balance', can reduce voltage peaks and fluctuations, overheating and faults on the network and thus help to release capacity on the network for more renewable distributed generation. Detailed modelling is required to assess financial viability of investment in batteries, but initial attractiveness can be tested via engagement with SSEN to determine whether the generation site sits in an area which has significant network constraints.

4.161 At the domestic level, smart control systems are now available, which integrate onsite generation such as rooftop solar PV with battery storage, and optimise loads and power exports to the financial benefit of the occupant. Electric vehicles are also expected to integrate with such systems, potentially providing a significant amount of extra plug-in storage capacity.

[84] Deep Geothermal Review Study – Final Report; Department of Energy and Climate Change; Oct 2013.

[85] Scottish & Southern Electricity Networks (2020) Generation Availability Map. Available at: www.ssen.co.uk/generationavailability.

[86] As accessed on 8/10/2020.

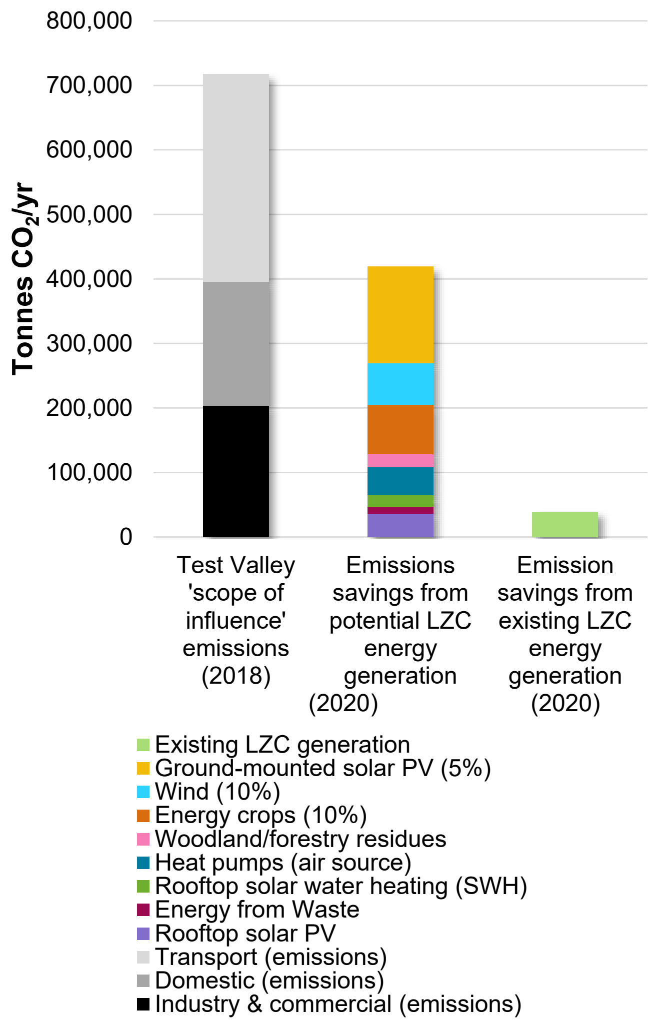
4.162 Similar to storage, albeit 'one-way' only, provision of Demand Side Response (DSR) capacity can help relieve grid constraints by businesses reducing power demand during times of high demand, and switching back on when such peaks are over. Again, this helps keep the grid 'in balance' and release capacity on the network for more renewable distributed generation. Businesses which represent most potential for provision of DSR, such as large commercial or industrial sites, can be identified in areas with known grid constraints and options considered. Typically, such sites should be able to provide a minimum 'downturn' of power of 50 kW to represent commercially viable opportunities.

Potential Deployment Scenario

4.163 The resource assessment described above has been undertaken to quantify, as far as possible, the low or zero carbon energy resources across the Borough, by examining opportunities and constraints for each energy source or technology. The approach taken has been to use a set of assumptions to establish a theoretical resource, which considers mostly technical constraints to deployment, rather than those imposed by political or financial issues.

4.164 Taking into account the technical potential, together with additional assumptions regarding deployment issues, an illustrative deployable resource potential has been estimated for each technology as presented in **Figure 4.10**. It is important to note that this is only one of many scenarios that could be considered, as 'deployability' will depend on many factors and assumptions that vary across the technologies. However, the scenario shown aims to illustrate what could be achieved under the assumptions given in **Appendix A**. This shows the potential deployable annual emission savings from each resource, and for context, their overall scale relative to Test Valley's 'scope of influence' Borough-wide emissions. Current savings from existing low or zero carbon (LZC) energy generation are also shown for comparison.

Figure 4.10: Summary of resource assessment expressed as potential emission savings compared to existing Borough-wide emissions



4.165 Additional assumptions relating to deployment issues have been applied in order to identify the potential deployable resource set out in Figure 4.10. Specifically, given that the technical resource for wind, ground-mounted PV and energy crops is based on suitable land area and is therefore very large, assumptions regarding a percentage uptake have been applied. A summary of the assumptions that have informed the assessment of deployable potential (as set out in **Figure 4.10**) are set out below. Further details are included in **Appendix A**.

- Wind – assumes that 10% of the total resource identified for large, medium and small turbines is deployed (149MW). It is assumed that very large turbines are highly unlikely to be deployed within the Borough. This assumes that within the life of the Local Plan there will be a change in the Government's current position towards onshore wind and that finance and planning constraints will be addressed. If these challenges are not addressed, the deployable wind potential within Test Valley is likely to be and remain close to zero.

- Ground-mounted solar PV – assumes that 5% of the total identified resource is deployed (1,417MW), which corresponds to an area of approximately 14 km^2. Again, this will be a significant change from the business as usual scenario.
- Energy crops – assumes that Miscanthus is cultivated across 10% of the total suitable area identified, which corresponds to a heat generation capacity of 52MW, assuming CHP plant is used. This will draw on a cultivated area of approximately 47km^2;
- Woodfuel/forestry residues – assumes a heat generation capacity of 80MW, drawing on the resource available across a total woodland area of 10,990ha;
- Heat pumps – assumes that a total heat generation capacity of 346MW is provided by air source heat pumps, which provide 85% of space and water heating demand to 50% of properties. This assumes they have attained a suitable level of fabric energy efficiency and have a compatible low-temperature heat distribution system;
- Rooftop solar water heating (SWH) – assumes that a total heat generation capacity of 184MW is deployed on 50% of dwellings and 80% of non-domestic properties;
- Rooftop solar PV – assumes that a total capacity of 147MW is deployed on 40% of dwellings and 80% of non-domestic properties;
- Energy from waste – assumes energy generation from approximately 3MW (electrical) capacity of CHP plant, drawing on the Borough's residual waste and agricultural livestock slurry;
- Existing generation – based on known resources, assumes 181MW of installed capacity[87], with approximately 98% of this comprised of solar PV. This will increase by a further 40MW when the proposed Woodington solar PV farm is operational.

[Note – the hydro power resource identified (0.5MW) is not included as it is too small to feature on the chart].

4.166 To summarise the results in terms of energy produced rather than emissions saved, **Figure 4.11** and **Figure 4.12** both compare the estimated annual energy yields from each resource against district-wide energy consumption, assuming the same scenarios as described in paragraph 4.163. Existing low or zero carbon generation is also included as a comparison. The resources have been split by electricity generation and heat, assuming that energy from waste and energy crops are able to generate both heat and electricity through combined heat and power technology. 'Other fuels' shown in **Figure 4.12** represents non-transport fuels that will mostly be used for heat generation including coal, manufactured fuels and petroleum products, but excluding electricity.

[87] Electrical and heat capacity.

Figure 4.11-: Potential LZC electricity generation resource compared to existing Borough-wide electricity consumption

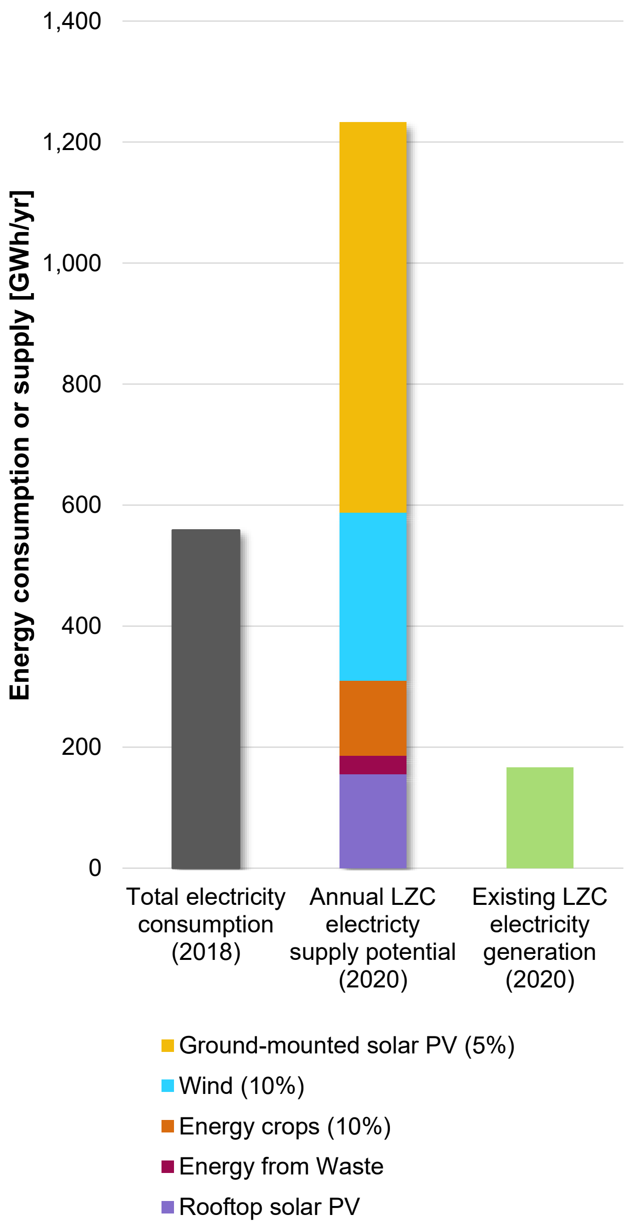
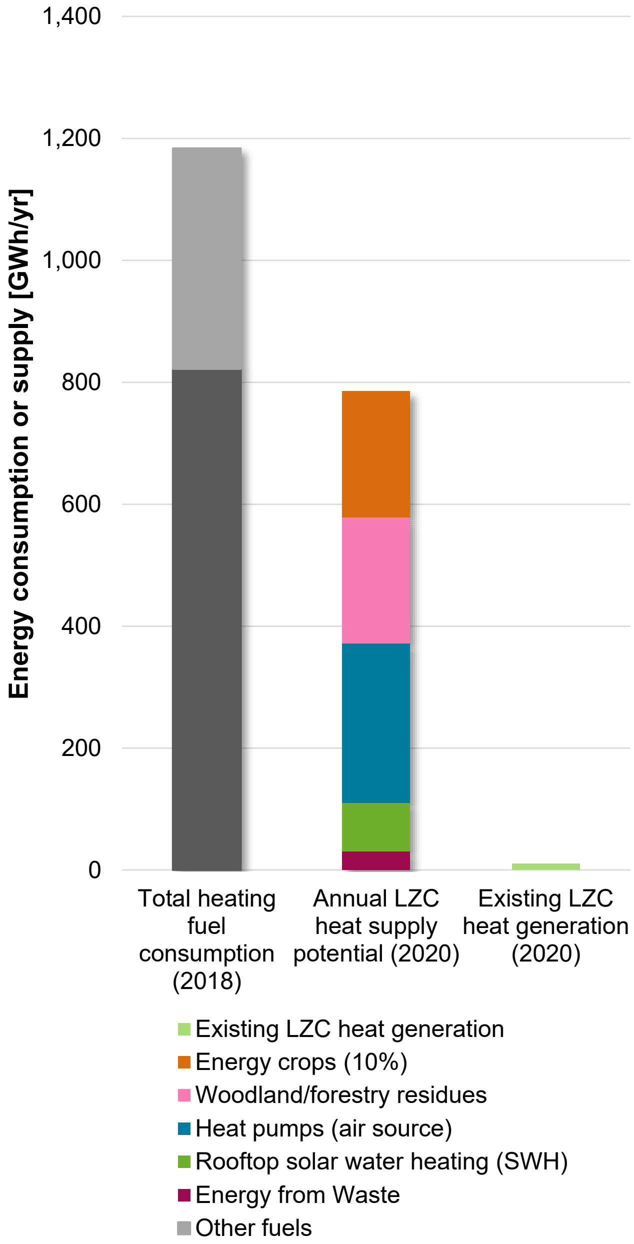


Figure 4.12 Potential LZC heat generation resource compared to existing Borough-wide heating fuel consumption



Conclusions

4.167 The above charts serve to illustrate that under the scenarios developed, Test Valley theoretically has the resources to generate an amount of low or zero carbon energy which could currently result in emission savings that exceed the amount of Borough-wide emissions that were produced from the domestic and industry/commercial sectors in 2018.

4.168 The savings are estimated as those that would result from displacing either mains electricity at the current carbon emissions factor[88] or fossil fuel. For electricity, the carbon emissions factor represents the current UK electricity generation mix. However, this is expected to steadily decrease in the future as the national grid decarbonises, resulting in less emissions reduction potential for renewable electricity generating technologies such as solar PV. This will not be the case however, where electricity-powered technologies are used to displace fossil fuel-fired heat, such as when gas boilers are replaced with heat pumps. In this case, emissions from heat pumps will continue to decrease from today's levels.

4.169 In practice the deployable resource is likely to be considerably less than the scenario considered above, as they will depend on many variable factors specific to each technology. The scenarios should therefore be considered illustrative, only as further site-specific appraisal work will be needed to estimate the deployable resource more accurately.

4.170 Existing low or zero carbon energy generation within the Borough shows a marked difference between electricity and heat. Currently electricity generation provides an amount equal to around 30% of total electricity consumption, with the vast majority of this sourced from solar PV. Total Borough-wide electricity demand could therefore be met by deploying around 3% of the ground-mounted solar PV resource, equal to an area around 8.5km^2, or around 14% (210MW) of the identified wind resource. By contrast, heat generation is much smaller, providing an amount of energy equal to around 0.5% of that from current mains gas demand.

4.171 Decarbonising heat supplies is therefore likely to pose the greater challenge in moving towards a net zero carbon future, and will largely rely on local exploitation of the biomass resource and national decarbonisation of the electricity grid for heat pump deployment. Issues around sustainability of biomass supply in terms of achieving genuine carbon savings, along with air quality impacts of biomass plant may first need to be addressed. Achieving net-zero carbon will also depend on progress with energy demand reduction across the Borough and the decarbonisation of the transport sector.

4.172 New developments will also contribute to low and zero carbon energy generation capacity within the Borough, particularly if a rapid trajectory towards operational net zero carbon is adopted for new buildings. It is difficult to quantify their impact as the mix of technologies used will depend on costs, onsite emission targets and applied emission factors, but it is likely that developers will focus on heat technologies such as heat pumps and rooftop solar. However, the additional capacity will not decrease overall emissions; it will instead limit the additional emissions resulting from the new development itself.

[88] See Table A-2 in Appendix A.

Chapter 5
Potential for District Heating Networks

Introduction

5.1 District heating is a technology which uses one heat source to provide heat to two or more properties. Instead of each property having its own heating system separate from any other property, a group of properties connected to a district or 'community' heating network all receive heat (in the form of hot water or steam) from a central source, via a network of insulated pipes. This can be more efficient than each property having its own heating system, because heat generation is more efficient at larger scales.

5.2 District heating is seen as playing a key role in the UK's path to achieving an affordable decarbonised heat supply and features largely in the Government's Clean Growth Strategy (2017) and the Committee on Climate Change's Net Zero report (2019). The latter's core Net Zero scenario suggests that around 5 million homes across the UK will need to be connected to heat networks by 2050, equivalent to around 18% of heat demand. In this context, the Clean Growth Strategy suggests that around one in five buildings will have the potential to access a largely low carbon district heat network by 2050.

5.3 The heat source of a district heating system is traditionally a basic boiler, although to minimise emissions the choice of energy supply technologies has now become more limited to highly efficient plant such as combined heat and power (CHP). Choice of fuel is also likely to move away from mains gas to using low or zero carbon forms of fuel such as electricity (to drive heat pumps), sustainable biomass (where this doesn't unduly impact air quality) or hydrogen. Use of waste heat will also become more viable where this is available.

5.4 CHP produces both heat (sometimes with cooling) and electricity, so with a CHP district heating system, as well as a network of pipes distributing heat/cooling, there is also a grid connection or network of wires to distribute electricity to one or more local users. In the latter case, where the output is not grid-connected, this is referred to as a private wire network.

Heat Mapping and District Heating Networks

Viability of District Heating

5.5 A large part of the cost of developing a district heating network is laying pipes, due to the need to excavate roads or other land, which is expensive. An energy centre, which houses the heat source, also needs to be established; this could be located within one of the buildings in the network, or it could be in its own separate building. Overall costs vary widely depending on the number and type of buildings connected and the area covered. Installing a heat network in a new development is usually cheaper than installing it in an existing development because pipes can be laid at the same time as other infrastructure when roads are built. In this way, new developments often act as a trigger for a network, but with the potential to also supply existing heat demands from buildings in the vicinity which may improve economic viability.

5.6 Properties connected to a district heating network normally pay the heating network operator for units of heat delivered. Therefore, the economics of a district heating system are dependent on the amount of heat provided per metre of pipe, known as the linear heat density; the higher the amount of heat delivered per metre of pipe, the better. Linear heat density is a critical factor in heat distribution economics, but this can only be calculated at the stage when a route has been defined.

5.7 As a proxy for linear heat density, spatial heat density (along with other factors) is used to find parts of the study area most likely to contain high concentrations of heat demand by means of an 'overlay analysis', which can then be investigated in more detail. Spatial density is the amount of heat per area (for example, per square metre).

Heat Mapping

5.8 Heat mapping is a process of using available datasets to make accurate estimates of heat demand from buildings within a given area, and presenting these visually on a map. The map can then be used to find areas of high heat demand, which may be suitable for district heating. This analysis uses data from the heat demand model of the THERMOS tool[89], which has been produced as part of an EC Horizon 2020-funded research project led by CSE. The THERMOS model incorporates a hierarchical approach to estimating demand, with the method used depending on the available input data. This starts with a basic heat demand estimation method using a 2-D representation of a building's polygon (e.g. where only OpenStreetMap data is available) or, as in the case of Test Valley, this can be improved using a more detailed model which uses LIDAR[90] data to estimate the 3-D shapes of buildings.

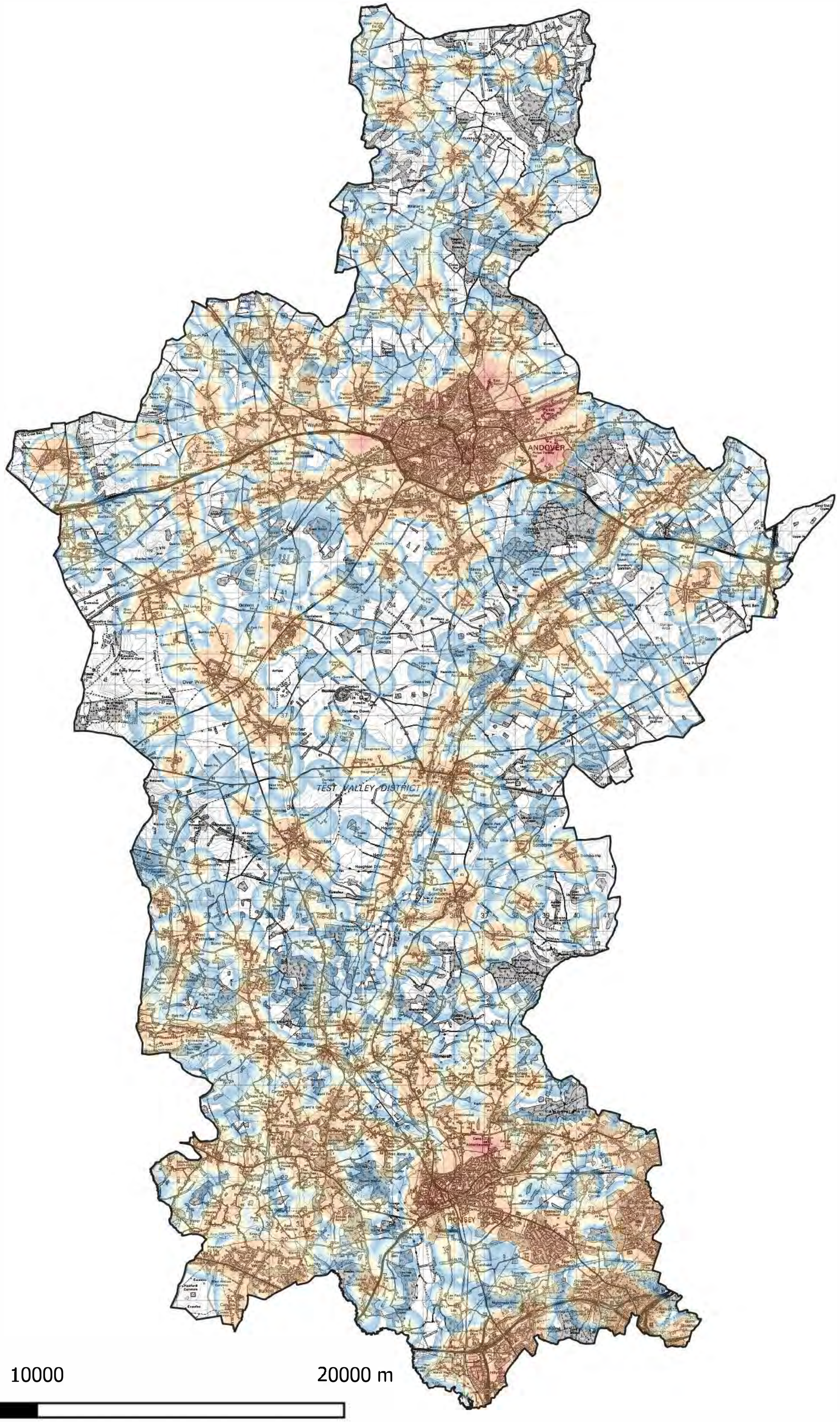
5.9 For this analysis, address-level heat demand data across Test Valley was first estimated using the THERMOS tool and a Geographic Information System (GIS) was then used to analyse the spatial distribution of heat demand. All addresses in the study area, along with their associated heat demand, were mapped using their OS Grid coordinates. A heat demand density map was then produced covering the study area – see **Figure 5.1**. This is a map layer which gives the estimated heat demand per unit of land area, based on the address-level heat demand data.

[89] THERMOS: www.thermos-project.eu/home/. THERMOS is an open-source web-based tool for the planning of heating and cooling networks and has been designed for use by local authorities, consultants and other stakeholders. More information on the tool, including training materials, can be found on the THERMOS website.

[90] LIDAR (Light Detection and Ranging) is a remote sensing method which can be used to create a digital surface model of the earth. With THERMOS, LIDAR data is used to establish the height of buildings and consequently estimations of their heat demand.

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure 5.1: Heat density in Test Valley



Heat density

- Low
-
-
-
- High

0 10000 20000 m

Map scale
1:258,923

CSE 22.06.20

5.10 Areas with high concentrations of heat demand have higher spatial density values. Heat density is shown on the map from blue to red, with blue areas being low density and red areas high density.

5.11 As would be expected, the heat map shows heat demand density to be greatest in the more urban areas of the district. The most prominent clusters appear to be located in the centre of Andover, as well as to the eastern and western fringes of the town, in the Abbotswood area of Romsey, and at the very south of the district near junction 3 of the M27 motorway.

District-Wide Overlay Analysis

5.12 With a large area to explore, a useful way of initially identifying areas which are more likely to be suitable for district heating is to find areas which satisfy three conditions favourable to district heating, relating to: overall heat demand; presence of potential anchor loads; and groups of dwellings with high heat demand (normally blocks of flats). These conditions are:

- Areas must be within the 5% of land area with the highest heat demand density.
- Areas must be within 200m of residential buildings with an annual heat demand of more than 100,000kWh per year.
- Areas must be within 200m of potential anchor loads.

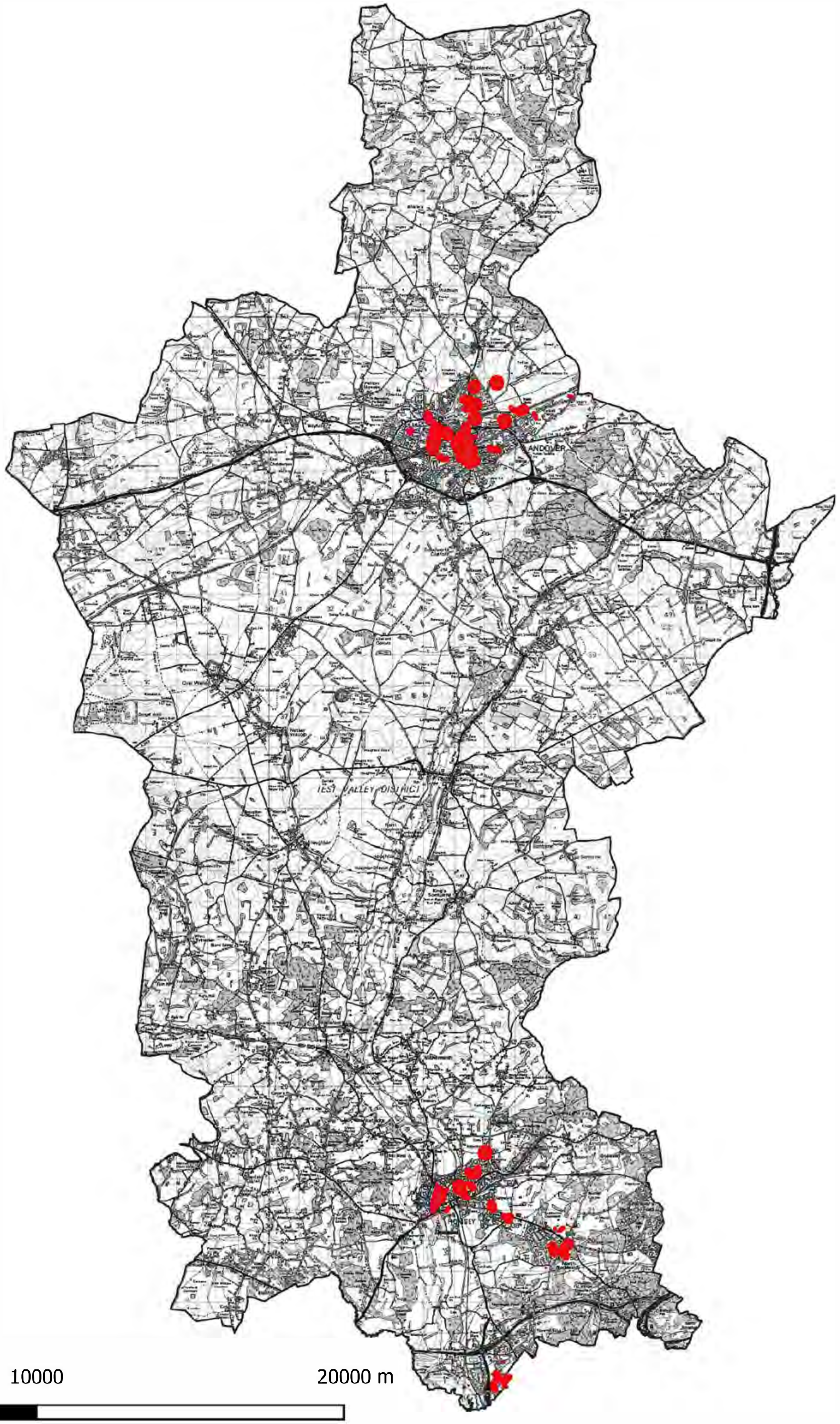
5.13 Anchor loads are defined as those types of buildings likely to have relatively high and stable heat demands and/or be in sectors more likely to participate in heat distribution projects. For the purpose of this study, this includes all buildings with an annual demand for heat of above 100,000kWh that fall within the following categories within the THERMOS heat demand model:

- Office
- Commercial
- Sport and Leisure
- Industrial
- Medical
- Hotel
- Prison

5.14 The THERMOS heat demand model uses data from a variety of sources which classify commercial buildings into different types. The categories are reasonably wide, so not all buildings in the above categories will actually be suitable as anchor loads (particularly in the case of industrial buildings). However, they provide a good basis for establishing the initial area of search. When these areas are established, the locations identified and the areas around them can be checked for suitability by examining Ordnance Survey maps and Google Streetview to find out more about the types of buildings and their appropriateness (for example, high heat demand can be caused by dense terraced housing, which is less suitable than larger loads due to the number of connections which would be required).

5.15 The Test Valley overlay analysis identified several areas that fulfil all three criteria and can be considered as Heat Focus Areas (HFAs) that may be worthy of further investigation (see **Figure 5.2**). These areas, however, should also be considered alongside planned large new development sites which offer particular opportunities for heat networks.

Figure 5.2: Heat priority areas in Test Valley



Heat priority areas

0 | 10000 | 20000 m

Map scale
1:258,923

5.16 In addition to the geographical aspects of heat demand, location of heat supply will also be a factor in planning a network. This is particularly the case when a specific building or piece of land may be under Council ownership and has the space to host an energy plant, or where waste heat from sources, such as industrial processes or data centres have been identified as potentially available.

5.17 Note – no such opportunities for heat supply had been identified prior to the following analysis for the areas considered.

New Development

5.18 When considering heat networks, new development creates an additional demand for heat and power, as well as an opportunity to find a more flexible site for an energy centre and to lay heat distribution pipework. Existing development in the close vicinity can also act as additional heat demands, which may improve the economic viability of a network, particularly where anchor loads may exist, along with other heat demand profiles which can smooth out the overall heat demand profile.

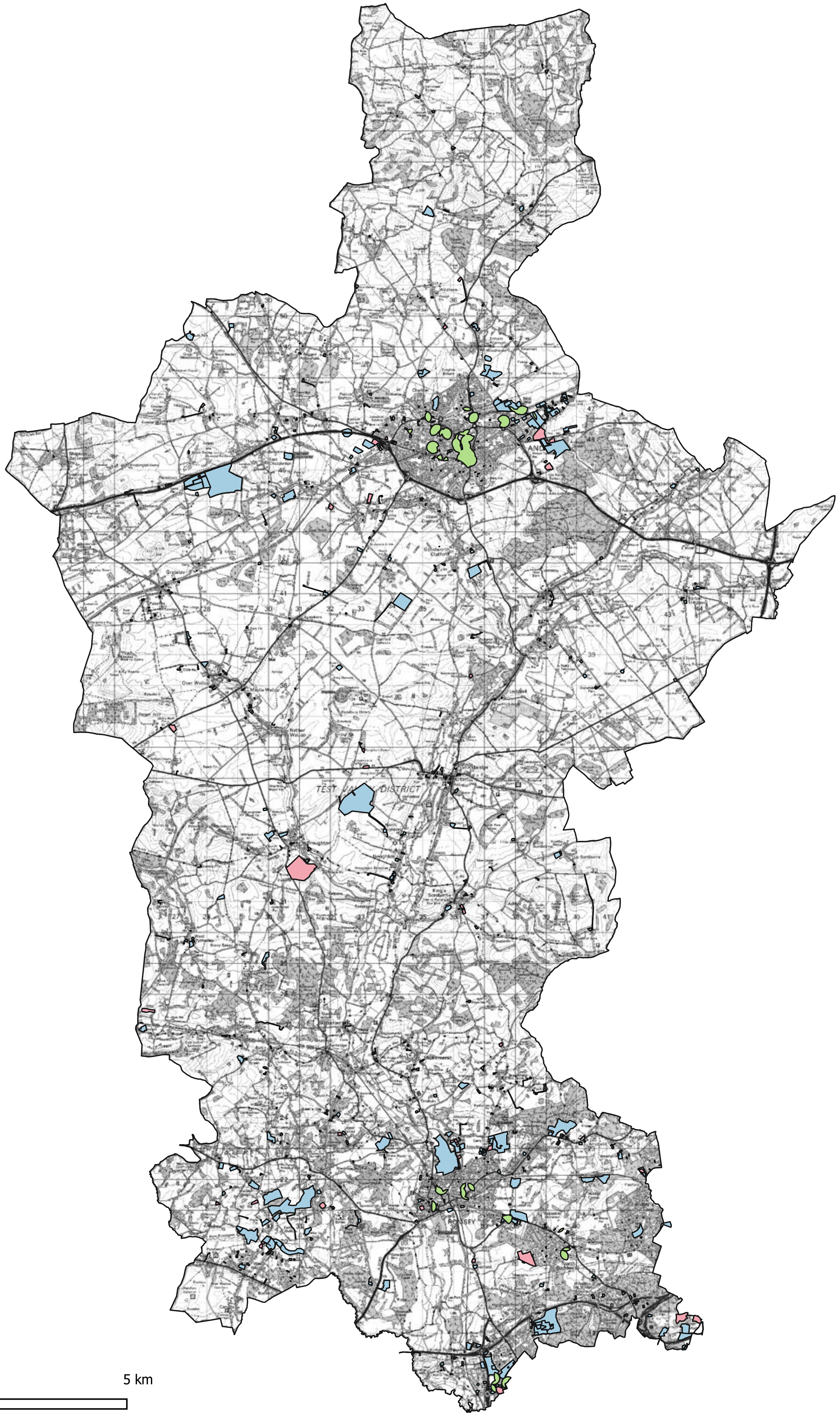
5.19 Sites that have planning permission for new development in the Test Valley area were mapped in GIS using information provided by the Council. Additionally, those where applications are pending (as at August 2020) were identified (these are separately marked on the maps). It should be noted that where planning permission is not yet in place, the proposals may be refused or subject to change.

5.20 This information was added alongside identified Heat Focus Areas in order to provide an indication of where new development might have a positive impact on the viability and layout of a heat network in the priority areas identified – see **Figure 5.3**.

Renewable and Low Carbon Energy Study

Test Valley Borough Council

Figure 5.3: Heat focus areas and planning applications in Test Valley



Focussed Analysis Using the THERMOS Tool

5.21 Following discussions with the Council, two areas have been selected for further analysis using the THERMOS tool. The first of these is central Andover, and the second is the Nursling area at the very south of the borough. This is a high level pre-feasibility analysis, assessing network route options, energy supply options and outline costs. It is based primarily on modelled data and indicative cost assumptions have been used for these examples. The analysis is indicative and is intended to be a starting point for more in-depth analysis.

5.22 The THERMOS software finds the optimal heat network layout in a given area based on one of two objectives:

1. Maximise Network NPV (net present value) - the goal is to choose which demands to connect to the network so as to maximize the NPV for the network operator. This is the sum of the revenues from demands minus the sum of costs for the network.
2. Maximise Whole System NPV - The goal is to choose how to supply heat (or abate demand) to the buildings in the area under consideration at the minimum overall cost. The internal transfer of money between buildings and network operator is not considered, so network revenues and tariffs have no effect. Other individual heating systems and insulation can be offered as better (more financially viable) scenarios.

5.23 For the purposes of this case study, both objectives have been explored at both sites. Phase 1 refers to the smaller site selected for the start of a heat network, and Phase 2 refers to a slightly larger site. In both areas, new developments have also been added to the Phase 2 maps.

5.24 The tool allows the user to select specific buildings to be considered within the analysis, and these can be marked as ‘required’ or ‘optional’ depending on user preferences. A building must also be selected to act as a supply point (i.e. the location of an energy centre to house the required plant to supply the network with heat).

5.25 As noted above, assumptions have been applied within the THERMOS application. The supply points have been set a maximum capacity of 5 MW. The capacity cost is set to £45 per kW, which is indicative of the capital cost of a gas boiler at this scale. The supply cost is set to 2p/kWh to provide a cheaper alternative to individual gas central heating. Other defaults within the software include but are not limited to the pipe costs, standard tariff for customers on the network and costs for individual heating systems to be installed.

Central Andover

5.26 Andover is the largest urban area and a number of heat focus areas (HFAs) have been identified within its limits, the most significant of these being in the very centre of the town. This area has recently been the subject of a comprehensive masterplanning exercise, the final outputs of which were published in September 2020[91]. Addressing climate change and working to eliminate the carbon footprint of the town centre are included as part of the vision set out in the documentation, and the focus on improving this area specifically may provide an opportunity to consider the development of a heat network in this location.

[91] https://www.thinkandovertowncentre.co.uk/andovermasterplan

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Test Valley Borough Council

Figure 5.4: Heat focus areas, central Andover

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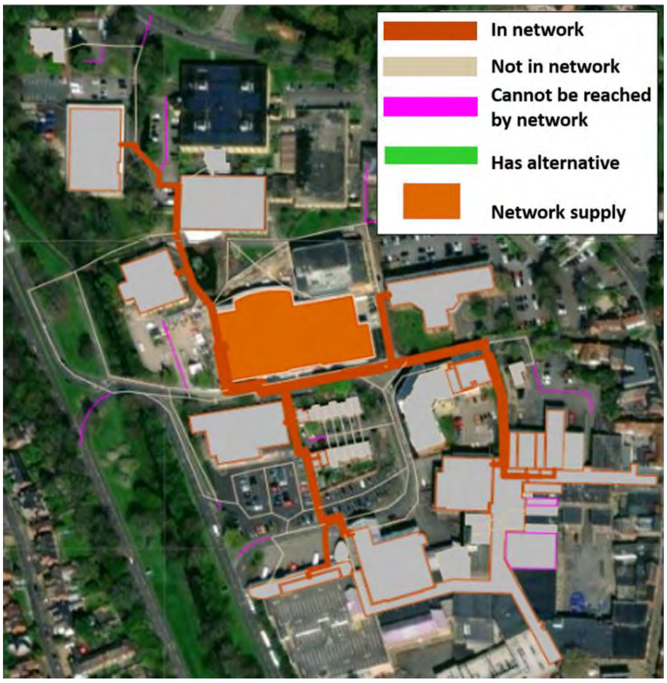
5.27 The scale of public sector land ownership in this area is likely to be of significant benefit in any attempt to coordinate a heat network development project. Andover College and Simplyhealth also own key sites here, and both have stated publicly their wish to enhance their facilities in Andover, and have so far engaged positively with the Council on the proposals for the regeneration of the town centre. Potential anchor loads and buildings of particular interest include the newly constructed leisure centre, Andover College and the Andover Data Centre.

5.28 There are a few major planning applications in the pipeline in central Andover. Those shown in **Figure 5.4** include the leisure centre redevelopment and the construction of a Skills and Technology Centre at Andover College, however both of these developments are now complete. There are a number of other applications for development on sites within or near to this HFA, however these are considered to be too small to significantly affect network viability (even when considered together).

5.29 Figure 5.5 provides the first example of a possible network layout in the central Andover area.

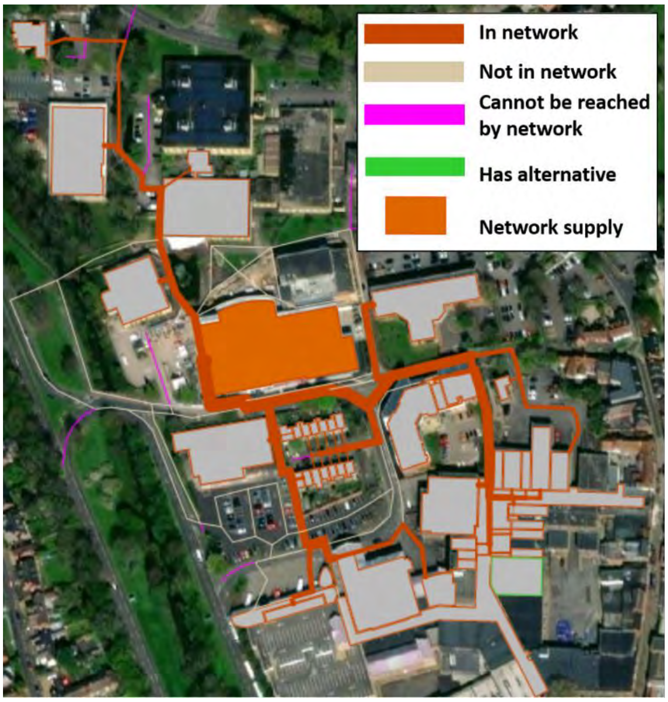
Figure 5.5: Andover example: Phase 1 Network NPV



5.30 In the above example, the analysis is aiming to maximise the network NPV by allowing all buildings to be 'optional'. This means that buildings will not be added if it is not optimal for the network operator. For the purpose of this exercise, it has been assumed that the plant will be housed within the building highlighted in orange (leisure centre). The suggested network includes multiple high energy demand buildings, including Andover College, Andover magistrates' court and a Lidl supermarket (note that some of the college buildings in the Google satellite base map are not included as buildings in the LiDAR data).

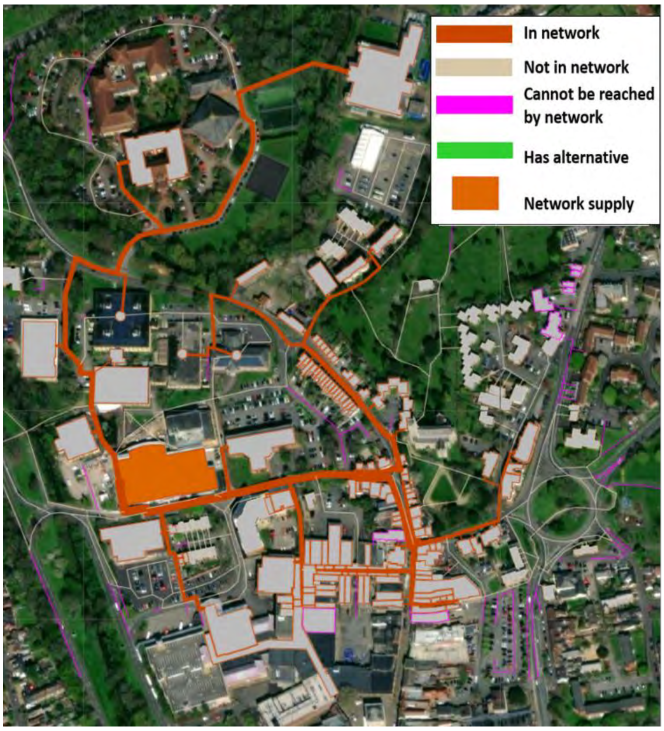
5.31 In **Figure 5.6** the analysis aims to include all buildings (these have been selected as 'required'). The analysis will be aiming to provide the cheapest scenario between properties connecting to the network and using individual heating systems. New connector paths have been added to better optimise this network. Only one building has an individual heating system installed, meaning that it would be better financially not to be part of the network. This may be due to the distance from the supply point and therefore extra pipe and connection costs.

Figure 5.6: Andover example: Phase 1 Whole System NPV



5.32 Figure 5.7 shows the Andover Leisure Centre network with the addition of college buildings which appear in an area earmarked for new development. The new buildings use the modelled heat demand and heat peak of an adjacent building of similar size (113 MWh/yr and heat peak 78kWp). These have been included in the scenario, as have some of the larger buildings north of the college site such as Charlton Place.

Figure 5.7: Andover example: Phase 2 Network NPV



5.33 The results of the analysis for the three examples above are set out in the **Table 5.1** below.

Table 5.1: Summary of outputs.

Andover	Phase 1 Network NPV	Phase 1 Whole System NPV	Phase 2 Network NPV
Net Present Value			
Network NPV (£k)	£3,750	£3,590	£4,550
Whole System NPV (£M)	-£3.63	-£4.44	-£7.08
Network Size			
Buildings	21	46	118
Paths	56	104	266
Pipework Solution			
Length (km)	0.75	1.41	2.92
Base Cost (£M)	£0.43	£0.81	1.67
Maximum pipe diameter (mm)	81.23	96.02	136.11
Total Capital Cost (£M)	0.618	1.07	2.29
Demand Solution			
Total Undiversified Peak Demand (MWp)	3.53	4.28	7.3
Total Demand (GWh/yr)	6.18	6.6	9.51
Revenue (£k/yr)	£310.22	£333	£481.25
Supply Solution			
Total Capacity Required (MW)	2.26	2.7	4.52
Output (GWh/yr)	6.33	6.85	10.08
Heat Production Costs (fuel) (£M)	5.06	5.48	8.06

5.34 The results table indicates that NPV for each of the three network options is positive, meaning that each network scenario could potentially be considered financially viable based on the parameters modelled, with the Phase 2 network having the highest return. Whole system NPVs are however negative, indicating these options are less viable.

Nursling

5.35 Two separate heat focus areas have been identified at the very south of the borough in Nursling, alongside a number of sites earmarked for new development (see **Figure 5.8**). Three buildings directly adjacent to the focus areas that could possibly act as anchor loads include the David Lloyd Leisure facility, the Holiday Inn at Redbridge Lane, and number 4 Adanac Drive (Ordnance Survey Offices).

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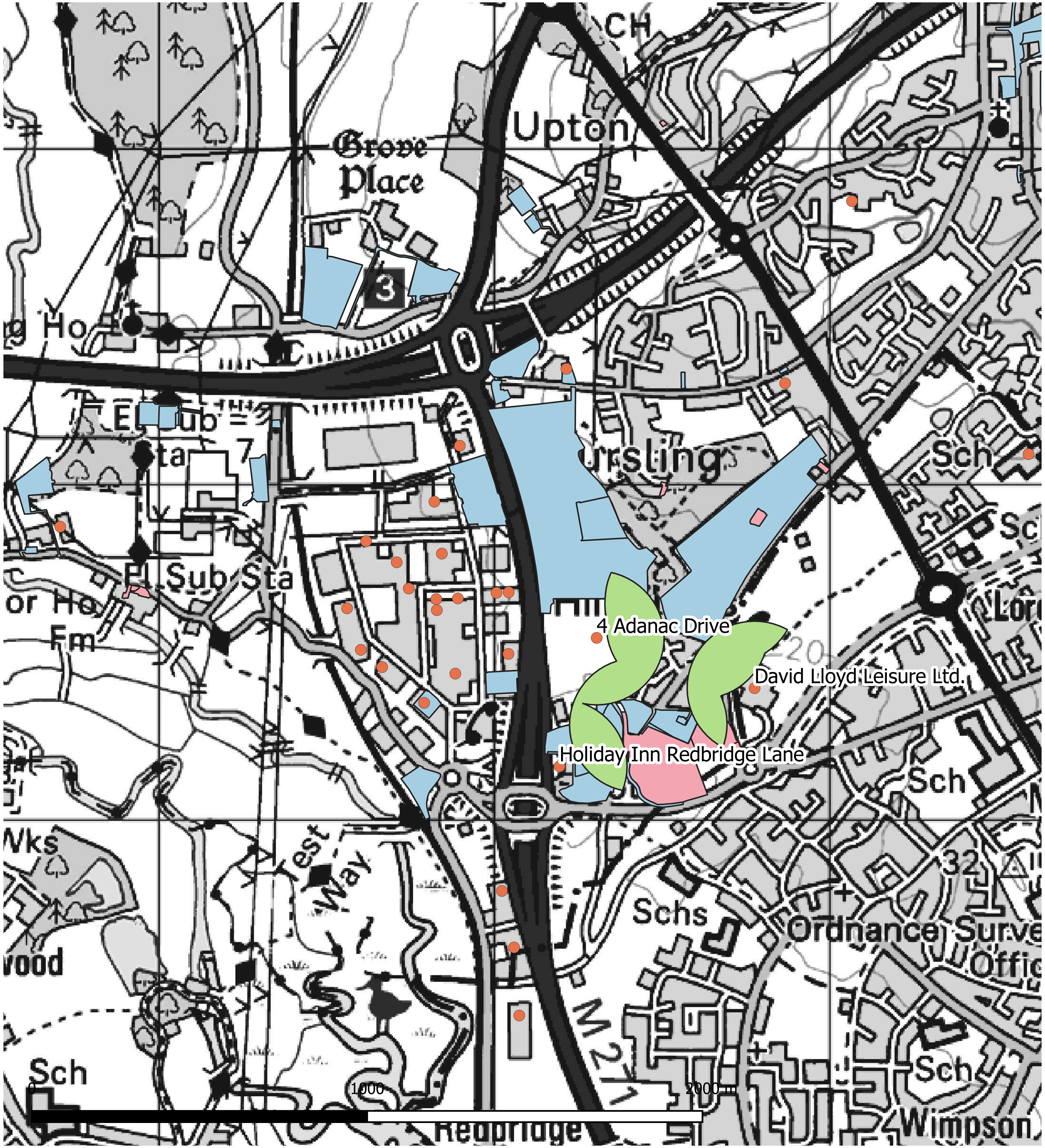
Test Valley Borough Council

Figure 5.8: Heat focus areas, Nursling



Heat focus area
Possible anchor loads
Planning approvals
Planning pending

Map scale
1:258,923

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5.36 Sites earmarked for new development that are considered to have the greatest potential to affect heat network viability are listed below.

- **Land at Bargain Farm (pending):** There are plans for the construction of a Health Campus to the south-east of the David Lloyd leisure facility (19/00374/OUTS). This development would be expected to comprise up to 12,000m^2 of health-related employment and ancillary uses. Adjacent to this site, there are also plans for the development of a care home scheme, which is to include a total of 137 bedrooms (18/03235/FULLS). For the purpose of illustration, the care home scheme alone could result in a demand for heat in the region of 2,665.2 MWh/yr.
- **Land West of Adanac Drive (permitted):** This site, adjacent to the Holiday Inn, is being developed to provide up to 20,583m^2 of business floorspace (14/00141/OUTS). This could result in a demand for heat in the region of 2,470 MWh/yr.
- **Land at Adanac Park (permitted):** A business park is to be constructed on this site (18/01543/OUTS), which is to the north-west of the heat focus areas. Land parcel AP4, which is north of the Ordnance Survey building and is closest to the heat focus areas, is expected to be developed into 10,840m^2 of business floorspace, and as such could be expected to lead to a demand for heat in the region of 1,300 MWh/yr (14/00134/OUTS).
- **Land at Redbridge Lane (permitted):** A total of 330 dwellings are expected to be built on this site, which is located to the north of the heat focus areas, along the borough boundary (15/01763/FULLS and 17/00466/FULLS). This could lead to a demand for heat that is in the region of 2026 MWh/yr.

5.37 The first example network is shown in **Figure 5.9** (below).

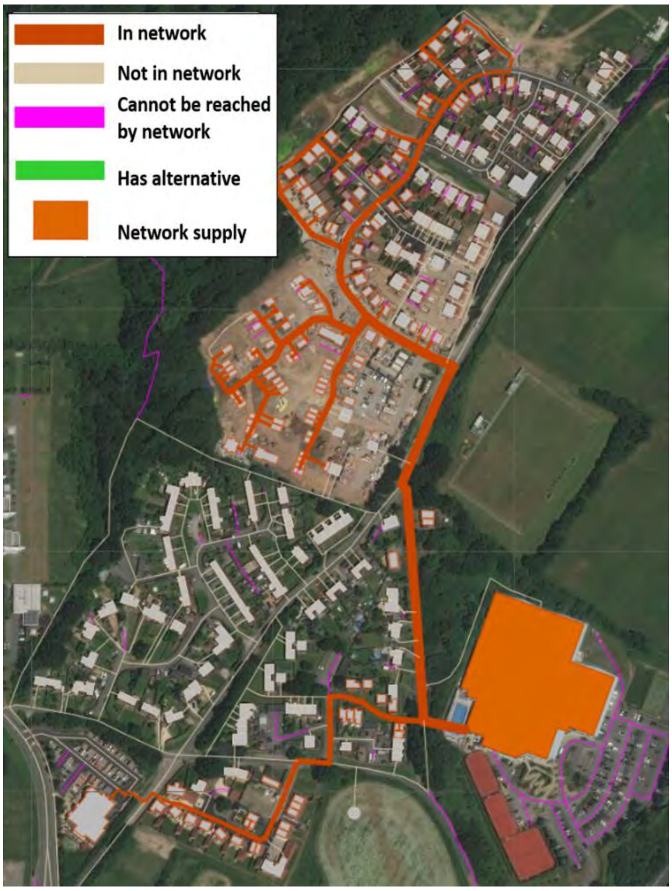
Figure 5.9: Nursling example: Phase 1 Network NPV

5.38 This analysis is aiming to maximise the network NPV by allowing all buildings to be 'optional'. Therefore, buildings will not be added if it is not optimal for the network operator. The chosen network is likely to be caused by the building in the bottom left hand corner, Walnut Tree Farm which is an inn with a high modelled heat demand. It is likely that the residential buildings on the path between the inn and the supply point have been added, as the pipe is already passing in close proximity. Therefore, the additional cost to add the houses to the network is lower than the achieved revenue from connecting them.

5.39 In **Figure 5.10** the analysis aims to include all buildings as they have been selected as 'required'. The network will be aiming to provide the cheapest scenario between the network and using individual heating systems. No individual systems have been installed, meaning that it would be better financially for every building to be part of the network rather than using individual heating systems. This may be due to the cost of the individual gas central heating (the capital cost has been set at £2,000 for installation and fuel is assumed to be 5p/kWh).

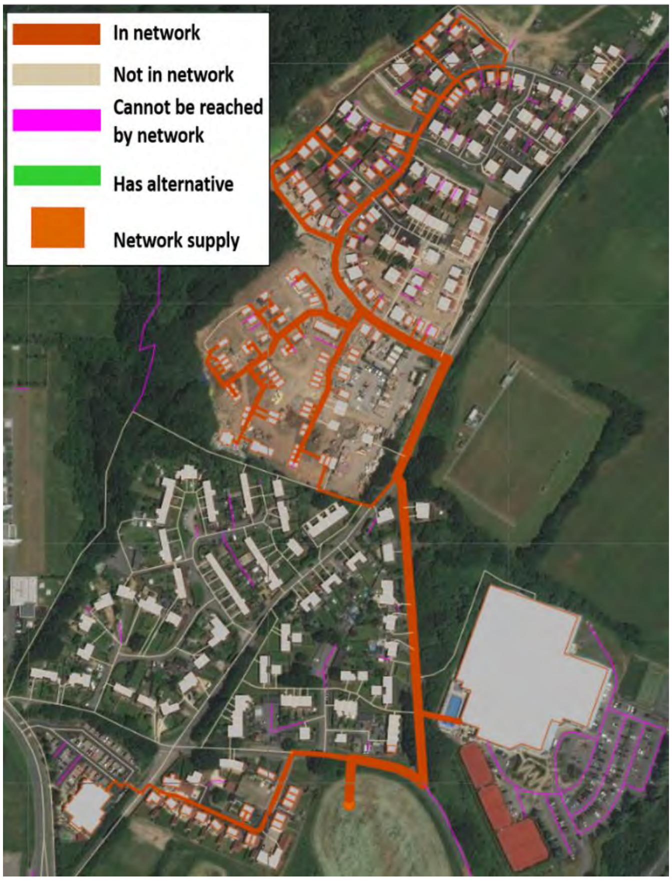
Figure 5.10: Nursling example: Phase 1 Whole System NPV

Figure 5.11: Nursling example: Phase 2 Network NPV



5.40 The network above includes the addition of the proposed nursing home development on the site located south West of the David Lloyd supply point (denoted by a small circle). In this network, the optimal solution does not include the nursing home development.

Figure 5.12: Nursling example: Phase 2 Network NPV Nursing Home Supply



5.41 Figure 5.12 shows the network when using the nursing home as a supply point instead of the David Lloyd leisure centre which has been used in the previous three examples. This provides a similar network to **Figure 5.11**, however both the David Lloyd leisure centre and the nursing home are included in this network, whereas the nursing home was excluded in the previous case. This network has a higher network NPV at £6.3M compared to £4.5M in **Figure 5.11**.

5.42 The results of the THERMOS analysis for each of the examples above is presented in **Table 5.2**.

Table 5.2: Summary of outputs

Nursling	Phase 1 Network NPV	Phase 1 Whole System NPV	Phase 2 Network NPV	Phase 2 Network NPV Nursing Home Supply
Net Present Value				
Network NPV (£k)	£889	-£269	£4,550	£6,330
Whole System NPV (£M)	-£1.36	-£4.10	-£7.08	-£8.40
Network Size				
Buildings	28	140	130	117
Paths	64	309	305	288
Pipework Solution				
Length (km)	0.55	3.41	2.65	2.67
Base Cost (£M)	£0.32	£1.95	1.52	1.53
Maximum pipe diameter (mm)	66.53	121.77	153.64	156.72
Total Capital Cost (£M)	0.423	2.38	2.23	2.29
Demand Solution				
Total Undiversified Peak Demand (MWp)	1.53	4.59	7.62	7.29
Total Demand (GWh/yr)	1.86	3.08	9.64	12.26
Revenue (£k/yr)	£94.38	£161	£488.36	£618.80
Supply Solution				
Total Capacity Required (MW)	0.967	2.84	4.73	4.71
Output (GWh/yr)	1.96	3.63	10.18	12.83
Heat Production Costs (fuel) (£M)	1.57	2.9	8.15	10.26

5.43 The results table indicates that NPV for three out of the four network options considered is positive, meaning that these network scenarios could potentially be considered financially viable based on the parameters modelled, with the Phase 2 network having the highest return. Whole system NPV's are however negative, indicating these options are less viable.

Next Steps

5.44 The heat mapping analysis presented above provides an indication of the areas within the Borough that are likely to have the most potential for heat networks. The subsequent analysis using the THERMOS tool illustrates some potential networks within these areas which have been selected by considering building clusters involving high heat demands and potential anchor loads. Due to limitations of the scope of this study, the analysis is principally intended to illustrate how the tool can be easily used to model a group of buildings with a chosen energy supply location and provide a useful basis for further study. As such, the buildings chosen and parameters used will need to be reviewed in more detail using local data and knowledge as far as possible, which will require additional work outside the scope of the current study. THERMOS is an open source web-based tool and has been designed specifically to allow local authorities, consultants or other stakeholders to input local data to improve the accuracy of its outputs. It also allows secure online collaborative working through the sharing of maps and projects.

5.45 THERMOS is mainly designed to assist the pre-feasibility phase of heat network planning, but given a robust set of input data it will also usefully contribute to, and help justify the need for a detailed techno-economic analysis. At this next stage, initial consideration should also be given to business planning around ownership, phasing, delivery and operation of the network. It is also important to explore at an early stage which stakeholders may be involved along the way and how to engage with them - particularly the heat customers. Further information on the development of heat networks is available from Government guidance[92]. Local authority funding towards the early stages of heat network development, including energy masterplanning, techno-economic feasibility and detailed project development is potentially available through the Government's Heat Networks Delivery Unit (HNDU). The latest round of such funding (Round 10) is open for applications until the end of 2020.

[92] Department for Business, Energy & Industrial Strategy (2020) Heat Networks – What area heat networks? Available at: https://www.gov.uk/guidance/heat-networks-overview#:~:text=A%20heat%20network%20%E2%80%93%20sometimes%20called,domestic%20or%20non%2Ddomestic%20buildings

Chapter 6
Enhanced Energy Performance Standards

Introduction

6.1 This chapter sets out the policy context and key issues associated with setting enhanced energy performance standards within the Local Plan.

Net Zero Emissions in New Development

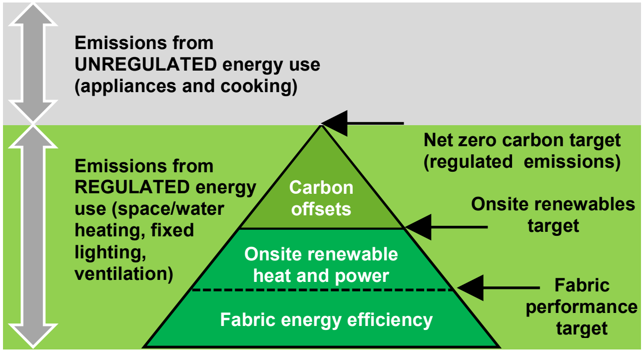
6.2 Where local authorities have followed the process of carbon auditing their plans, they have generally concluded that it would be very difficult to achieve the required carbon reduction trajectory, without new developments being built to a zero-carbon standard, due to the additional emissions growth inherent in new development commitments. This will require ambitious planning policies for new development which also ensures building energy performance is future-proofed.

6.3 A national definition of a net zero carbon building has yet to be agreed, although a framework definition was proposed in April 2019 by the UK Green Building Council (UKGBC) which is based on an *"industry consensus on how a net zero carbon building can be achieved today"*. UKGBC is currently pushing for net zero carbon in both construction and operational energy, and ultimately targets 'whole life' carbon impacts (including embodied emissions), although a detailed approach for the latter has yet to be developed.

6.4 For now, UKGBC is recommending that local authorities make plans for *"All new homes (and buildings) to be net zero carbon emissions in operation by 2030 at the latest"*, where operational energy is defined as *"When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset."* Confusingly, and depending on context, an 'operational' net zero carbon target can refer either to emissions from regulated energy use only, such as the Government's 2016 zero carbon homes definition (since abandoned), or to both regulated and unregulated energy use, which is considered 'true' zero carbon.

6.5 Any proposed emissions target should now be considered in the context of the Building Regulation proposals and local and national ambitions for net zero carbon. A widely accepted approach is to implement a baseline energy efficiency or 'fabric' target which then forms part of a hierarchical approach to a net zero carbon standard for new development. This supplements the baseline target with minimum levels of onsite renewable energy generation and carbon offset requirements to achieve net zero carbon as illustrated in **Figure 6.1.**

Figure 6.1: Hierarchy of emission reductions for new development



6.6 As discussed in **Chapter 2**, a number of energy and emission standards exist that local authorities need to understand when ensuring sustainable construction practices are applied to new development. Building Regulations set out the mandatory minimum standard for developers, on top of which local authorities have been granted powers to set enhanced local standards, with many having done so. However, whilst it is acknowledged that local authorities will need to comply with confirmed national planning policy and regulation, the direction of future regulation at the time of writing is unclear. In early 2020 widespread concerns were raised in response to the Government's Future Homes Standard consultation that the regulations being proposed would not reduce emissions as much as local policies already adopted by many local authorities and that the Part L 2020 standard would allow worse fabric efficiency than is currently permitted under Part L 2013. Furthermore whilst a proposal under the consultation was to remove the discretion of local authorities to impose enhanced standards, this has yet to be confirmed. The situation therefore remains that local authorities have powers to stipulate energy performance standards that exceed the Building Regulations by means of the Planning and Energy Act 2008.

6.7 In this context, the upgraded emission targets within the Climate Change Act, together with the growing number of local authority climate change emergency resolutions, strongly suggests that local authorities should continue to seek more ambitious energy performance standards for new development in their local plans, i.e. standards which adopt a net zero emissions approach. The proposals from UKGBC's net zero carbon framework and the lead taken by a number of other UK local authorities suggests that a net zero emissions policy is currently both feasible and lawful. Such a policy would typically comprise a hierarchical approach of high fabric energy efficiency standards, efficient supply of energy, use of on-site renewables and carbon offset financial contributions.

Hierarchical Approach

6.8 It is important to consider an overall energy hierarchy when progressing sustainable approaches to energy supply and demand. This prioritises reducing energy demand before considering the most sustainable ways of supplying energy to meet the reduced demand. The London Plan has featured an energy hierarchy since 2004, the basis of which requires developers to first reduce demand, secondly ensure energy is supplied efficiently and finally consider the use of renewable energy generation. The latest version as set out in the 'Intend to Publish' London Plan (Dec 2019)[93] sets out the hierarchy under part A of Policy SI 2 'Minimising greenhouse gas emissions' as follows:

1. be lean: use less energy and manage demand during operation
2. be clean: exploit local energy resources (such as secondary heat)[94] and supply energy efficiently and cleanly
3. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
4. be seen: monitor, verify and report on energy performance.

6.9 In the case of net zero carbon targets, financial contributions towards carbon offsetting would be a last resort for emissions that could not be mitigated within the above hierarchy.

6.10 In addition to The London Plan, other examples of plans which have included energy hierarchies include the adopted Milton Keynes Local Plan[95], Bristol Core Strategy[96], Bath and North East Somerset Local Plan[97], the Adur District Council Supplementary Planning Document[98], and the Flintshire

[93] Mayor of London (2019) Intend to Publish London plan. Available at: www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/intend-publish-london-plan-2019.
[94] Secondary heat sources are typically waste heat from industrial processes or ambient heat that exists in the air, water or ground.
[95] Milton Keynes Council (2019) Plan: MK. Available at: https://www.milton-keynes.gov.uk/planning-and-building/plan-mk.
[96] Bristol City Council (2011) Core Strategy. Available at: https://www.bristol.gov.uk/documents/20182/34540/Core%20Strategy%20WEB%20PDF%20(low%20res%20with%20links)_0.pdf/f350d129-d39c-4d48-9451-1f84713a0ed8.
[97] Bath & North East Somerset Council (2020) Core Strategy and Placemaking Plan. Available at: https://beta.bathnes.gov.uk/policy-and-documents-library/core-strategy-and-placemaking-plan.
[98] Ardur & Worthing Councils(2019) Supplementary Planning Document; Sustainable Energy. Available at: https://www.adur-worthing.gov.uk/adur-ldf/spd-and-guidance/#spd-sustainable-energy.

County Council Local Plan Supplementary Planning Guidance Note[99], as well as the emerging Greater Manchester Spatial Framework[100], North Norfolk Local Plan[101] and the Tunbridge Wells Local Plan[102].

6.11 To supplement the energy hierarchy, a similar hierarchical approach to heat supply is also useful to ensure developers consider a range of heat supply options and prioritise the most sustainable solutions, where feasible in the wider context of local sustainable energy planning. For example, this should ensure that the potential for establishing or linking up to any local district energy heating/cooling networks is fully explored.

6.12 The 'Intend to Publish' London Plan sets out its heating hierarchy under part D of Policy SI 3 'Energy infrastructure' as follows:

Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

1. *the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:*
   a. *connect to local existing or planned heat networks*
   b. *use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)*
   c. *use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)*
   d. *use ultra-low NOx gas boilers*
2. *CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality*
3. *where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.*

Onsite Energy Technology Considerations

6.13 Current Building Regulations require a new building's operational emissions to not exceed an overall Target Emissions Rate (TER). In addition, a Target Fabric Energy Efficiency rate (TFEE) also sets a maximum limit for energy demand based on the fabric energy efficiency of the building. In setting enhanced energy performance standards in local plans, many local authorities have used an overall onsite emissions reduction target, which is usually stated in terms of a percentage reduction over and above that required by Building Regulations. Often, however, this target is flexible in how the reductions are achieved i.e. allowing any mix of enhanced fabric measures or onsite renewable or low carbon energy generation . As this creates a risk of inappropriate trade-offs and misalignment with the energy hierarchy, it is also useful to specify an additional minimum emissions reduction target which must be achieved specifically through fabric measures.

6.14 In this way, the energy hierarchy approach is encouraged to minimise demand as far as possible before energy supply measures are considered. In terms of like-for-like emission reductions, improving building fabric energy efficiency levels beyond Part L 2013 can often be more expensive than onsite low or zero carbon generation options such as solar PV, but will result in the additional benefit of reducing energy demand and costs for the occupant. It will also help to lower peak demands on energy supply infrastructure.

6.15 An example of an onsite emissions reduction target within the context of an overall net zero emissions policy can be found in the 'Intend to Publish' London Plan, which sets targets under part C of Policy SI 2 as follows:

A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the Borough, either:

- *through a cash in lieu contribution to the borough's carbon offset fund, or*
- *off-site provided that an alternative proposal is identified and delivery is certain.*

6.16 In addition to The London Plan, other examples of plans which have included onsite emissions reduction targets include the adopted Milton Keynes Local Plan, Brighton and

[99] Flintshire County Council (2017) Supplementary Planning Guidance Note No. 20 Sustainable Buildings - Energy Conservation and Renewable Energy. Available at: https://www.flintshire.gov.uk/en/Resident/Planning/Supplementary-planning-guidance.aspx.
[100] Greater Manchester Combined Authority (2020) Greater Manchester Spatial Framework. Available at: https://www.greatermanchester-ca.gov.uk/what-we-do/housing/gmsf2020/.
[101] North Norfolk District Council (2019) First Draft Local Plan (Part 1). Available at: https://www.north-norfolk.gov.uk/media/5033/first-draft-local-plan-may-2019.pdf.
[102] Tunbridge Wells Borough Council (2019) Draft Local Plan. Available at: https://consult.tunbridgewells.gov.uk/kse/event/34828/section/s15421942818103#s15421942818103.

Hove City Local Plan, Eastleigh Borough Local Plan and the emerging Greater Manchester Spatial Framework.

6.17 Very high levels of energy efficiency within new buildings have been achieved from proprietary ultra-low energy housing construction standards that have been deployed at small scale in the UK. These include Passivhaus[103], which typically achieves 75% reduction in space heating requirements, compared to standard UK practice, and Energiesprong[104], a refurbishment and new build standard achieving net zero operational energy. Currently, however, these are unlikely to be economically competitive, with build solutions based on the net zero carbon hierarchical approach described above.

6.18 For new non-residential development, BREEAM standards such as 'Excellent' or 'Outstanding' can ensure high all-round environmental standards are achieved, but they do not provide a direct measure of emissions reduction compared to building regulations.

6.19 The energy efficiency targets of 10% and 15% respectively for major domestic and non-domestic developments are based on recommendations from analysis undertaken by AECOM[105] on behalf of the Greater London Authority (GLA) and have been supported by recent GLA energy monitoring data. Additional evidence on the viability of onsite emission reduction targets can be found in 'Cost of carbon reduction in new buildings' – a 2018 report by Currie and Brown for the West of England Authorities[106]. The analysis presented in this report suggests that it is possible to achieve net zero regulated carbon emissions, from a combination of energy efficiency onsite, carbon reductions and carbon offsetting for an additional capital cost of between 5-7% for homes and non-domestic buildings. Achieving net zero regulated and unregulated emissions is likely to result in a cost impact of 7-11% for homes. The analysis considered the differences in costs between various types of housing but did not consider locational factors. However, new homes with no reliance on gas may benefit from the avoided costs of mains gas connection.

6.20 Onsite emission reduction targets applied within the context of energy/heat supply hierarchies, therefore provide an effective approach to minimising onsite operational emissions within new development. When implemented as part of an overall net zero emissions policy, the approach can generally be considered reasonable, viable and sufficiently flexible to avoid placing undue burden on developers. Where onsite measures are considered to be unviable with respect to the targets, developers need to provide suitable evidence and agree alternative solutions, such as carbon offsetting, with the planning authority. Such hierarchical policies also usually include set requirements for monitoring and reporting on energy performance for an initial period of operation.

6.21 Including a development scale threshold as in the London example, assumes that the large majority of potential emission savings are from major developments, and that economy of scale makes it more difficult to viably achieve targets on small developments. Although this might simplify the planning process for small scale developments, it could be argued that net zero policies with suitable offsite emission reduction options offer a catch-all solution for all scales of development. However, for Test Valley, the ratio of minor/major development typical for the area and any consequential benefits of including minor development within such policies should first be evaluated, bearing in mind the overall context of the hierarchical policy being considered and impacts on viability.

Carbon Offsetting

6.22 Carbon offsets typically allow developers to make financial contributions to offset emissions that cannot be mitigated onsite. This system has already been in use for several years in London (see paragraph 6.15), where the developer pays a specified amount per tonne of carbon to be offset. Similar approaches are also being taken by an increasing number of local authorities elsewhere, including the West of England Combined Authorities and the Greater Manchester Combined Authorities. However, the resources to implement such schemes may make this option more difficult to adopt in smaller individual local authorities.

6.23 In the absence of developments which truly do not generate carbon emissions through their operation and occupation, carbon offset regimes can therefore provide funds to create new carbon saving projects, and bring forward the rate at which carbon emission reductions are achieved. In general, however, carbon offsetting is often viewed as a controversial area of carbon management both because of the risk that it distracts from the pressing need to reduce emissions at source by seeking to make up for carbon emissions which have already been emitted, and because the claimed savings can be difficult to monitor and verify. It is important therefore that policies are designed in such a manner as to ensure that all viable onsite methods of reducing carbon emissions are exhausted first. They should also be seen as temporary measures until regulatory regimes, development economics and the development industry deliver

[103] Passivhaus Trust: www.passivhaustrust.org.uk/what_is_passivhaus.php.
[104] Energiesprong UK: www.energiesprong.uk/.
[105] Greater London Authority (2017) GLA Energy Efficiency Target. Available at: www.london.gov.uk/sites/default/files/gla_energy_efficiency_target_-_development_case_studies_-_aecom.pdf.
[106] Currie & Brown (2018) Cost of Carbon Reduction in New Buildings. Available at: www.cse.org.uk/downloads/file/cost-of-carbon-reduction-in-new-buildings.pdf.

true carbon neutral or carbon positive developments on-site through use of sustainable materials, very high energy efficiency standards and integrated renewables. Care should also be taken to ensure that the emission reductions funded by carbon offset schemes are genuinely additional to what would have happened otherwise.

6.24 Where carbon offset regimes are in operation, the local authority takes on the responsibility for delivering carbon emission savings or reductions to offset for the residual carbon emissions from developments. Defined administration structures are needed to stimulate new markets and carbon saving activities to ensure that the system is keeping up with the pace of emissions it is intending to mitigate for. There is the potential to share back office processes with neighbourhood authorities to reduce costs.

6.25 Although, in the case of carbon offsetting linked to zero carbon planning policies, carbon offset payments are usually calculated on the basis of abating carbon emissions for only 30 years' worth of building occupancy, there is an assumption that during this period the decarbonisation of grid electricity and heat will be achieved through future technological and/or policy developments and therefore will account for emissions over the remaining life of the building. A carbon price to value offsets at £95 per tonne of CO_2 has been recommended for London boroughs in GLA guidance[107] and in a report for the West of England Authorities[108].

Other Considerations

6.26 Minimising whole life emissions from buildings, including those associated with embodied energy, unregulated emissions[109]and demolition can be considered further within a specific emission reduction policy or an appropriate policy on sustainable construction and design. As a minimum interim measure, it could be made a requirement that some or all of these are modelled and quantified in preparation for the introduction of future targets. In Policy SI 2 of the 'Intend to Publish' London Plan, there is a requirement that "Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions".

6.27 In order to set out how energy targets would be met and the reasoning behind the measures proposed, energy statements from developers would be required based on a detailed standard template. Validation procedures should be updated to take account of these new requirements. The inclusion of a planning condition to monitor and report on energy use and emissions during the initial period of a building's operation, is also recommended, where appropriate, to help evaluate the effectiveness of the policies and encourage on-going compliance.

6.28 Emission factors used by the 2013 Building Regulations are now considerably out of date and do not reflect the current level of electricity grid decarbonisation achieved in the UK. To address this issue, a draft SAP10 methodology[110] was published in 2018 for use within the next Building Regulations update. This would replace the existing SAP 2012 used in the 2013 Building Regulations and would reduce the carbon emissions factor from 0.519 to 0.233 gCO_2/kWh. This reduction will have a considerable impact on the contribution of renewable power generation technologies to emission reduction targets and therefore, a number of local authorities are now recommending that in their energy statements, developers use the SAP10 figure in the interim period before Building Regulations are formally updated.

6.29 Future proofing measures could be encouraged in anticipation of the Future Homes Standard and the increasing need to achieve net zero carbon onsite or through connection to zero carbon local energy networks. These might include use of low temperature heat distribution systems compatible with heat pumps, or making provisions for future connection to district heating networks.

6.30 In moving towards net zero emission buildings, fabric energy efficiency will continue to increase, bringing with it an increased risk of overheating. Appropriate mitigation measures should therefore be highlighted in sustainable design policy.

[107] Mayor of London (2018) Carbon Offset Funds - Greater London Authority guidance for London's Local Planning Authorities on establishing carbon offset funds. Available at: www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf.
[108] CSE (2019) West of England Carbon Reduction Requirement Study - Carbon offsetting in the West of England. Available at: www.cse.org.uk/downloads/reports-and-publications/policy/planning/west-of-england-carbon-reduction-requirement-study-carbon-offsetting-april-2019.pdf.
[109] Department for Business, Energy & Industrial Strategy (2020) Sub-regional Feed-in Tariffs statistics. Available at: www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics.
[110] SAP (Standard Assessment Procedure) is the methodology used by the Government to assess and compare the energy and environmental performance of dwellings.

Chapter 7
Policy Options for Test Valley Borough Council

7.1 There are various policy options the Council could consider including within the Local Plan in relation to renewables and low carbon energy within the Borough. The following section provides an overview of these policy options and the strengths and weaknesses of each policy approach. The options are summarised under the following headings:

- Enhanced energy standards in new developments.
- Separation distances (for wind energy).
- Criteria based policies.
- Areas of suitability (for wind energy).
- Energy opportunity maps.
- Allocation of sites.
- Community renewables.

Enhanced Standards in New Development

7.2 Considering Test Valley Borough Council's declaration of a climate emergency and commitment to investigating clear and effective options to become a carbon neutral organisation, as well as its commitment to identify opportunities to make the Borough carbon neutral, along with the upgraded targets within the Climate Change Act and other national policy on climate change mitigation, the Council should seek to set ambitious energy performance standards for new development. The proposals from UKGBC's net zero carbon framework and the lead taken by a number of other UK local authorities strongly suggest that these should exceed the requirements of current 2013 Part L Building Regulations and comprise a hierarchical approach of high energy efficiency standards, on-site renewables and carbon offset contributions. Policy options to consider include:

Energy Hierarchy

7.3 An energy hierarchy requires developers to first reduce demand ('Lean'), ensure energy is supplied efficiently ('Clean') then consider using onsite renewable/low carbon energy generation ('Green'). In the case of net-zero carbon targets, financial contributions towards carbon offsetting would be the final and least-preferred step in the hierarchy. Examples of Plans which have included Energy hierarchies are provided in paragraph 6.10.

Heat Hierarchy

7.4 A heat hierarchy requires developers to follow a heat supply hierarchy such as that within Policy SI3 in the Intend to Publish version of the New London Plan (as set out in **Chapter 6**of this report). This should take the form of a heat supply hierarchy which aims to discourage the use of gas as a heating fuel and future proof developments.

7.5 This should assume an order of preference beginning with connection to existing or new low or zero carbon heat networks, followed by use of zero carbon renewable heat or CHP, and finally use of local ambient or secondary heat sources (in conjunction with heat pumps if required – this approach assumes that the electricity grid will continue to decarbonise at a rate that makes this option viable). As this policy encourages heat networks, the Heat Network Priority Areas map (**Chapter 5**) could be referenced for guidance. Although to date the focus for heat networks has been predominantly in urban or city authorities, there is still potential for their deployment in more rural areas, although in most cases this would be at a smaller scale. Networks are likely to become easier, quicker and cheaper to deploy as they become more mainstream, which will in turn benefit their scalability for different applications.

Net-Zero Carbon Target for New Development

7.6 An onsite low or zero carbon energy generation target requires all development to have a minimum fabric energy efficiency backstop, and includes carbon offsetting as a mechanism through which developers can financially contribute (through S106 or CIL) to mitigate residual emissions that cannot be addressed onsite. This will ensure that net-zero carbon developments are achieved in terms of regulated emissions. Potential policy ambitions could include for example:

- Building Regulations (2013 issue) standard achieved through onsite energy efficiency plus a further minimum 19% improvement through onsite energy efficiency and/or onsite renewable energy generation; residual emissions to be offset through payments to carbon offset fund [UKGBC example[111]].
- At least 35% improvement on Building Regulations (2013 issue) achieved onsite, with a minimum of 10% achieved through onsite energy efficiency for residential, and 15% for non-residential; residual emissions to be offset through payments to carbon offset fund or off-site [See Chapter 6 - Intend to Publish London Plan, which sets this out under part C of Policy SI 2].

7.7 Examples of Plans which have included Energy hierarchies are provided in paragraph 6.16.

7.8 A carbon offset fund should be carefully designed to incentivise developers to mitigate a maximum amount of emissions through onsite measures before resorting to offset payments. Proceeds from the fund should be used wisely to secure genuinely additional emission savings that would not have occurred otherwise. It is also suggested that a requirement is introduced to quantify and minimise unregulated emissions, at least for major developments.

7.9 As noted in Chapter 6, in October 2019 consultation was launched on Part L of the Building Regulations and changes are likely to be introduced during 2020 which may affect elements of the above policy.

7.10 Previously, the 'Merton Rule' was considered good practice. This required developers to pledge to provide a set percentage of energy needs for new developments from renewable energy technologies. However, it has since been criticised as a 'bolt-on' approach to energy efficiency requirements and is no longer considered good practice.

BREEAM 'Excellent'

7.11 BREEAM 'Excellent' or above for new non-residential development – ensures high all-round environmental standards are achieved but does not provide a direct measure of emissions reduction.

7.12 In order to set out how the energy targets implied in the above standards would be met, energy statements from developers would be required based on a detailed template. Monitoring and reporting requirements on energy use and emissions during first year(s) of operation is also recommended to help evaluate the effectiveness of the policies and encourage on-going compliance.

Electric Vehicle Charging points

7.13 The Council may also wish to consider introducing a policy that applications for residential dwellings with off street parking must accommodate an active Electric Vehicle charging point per dwelling. It could also be stated that all applications for non-residential development must include at least 25% of their car parking provision to be served by active electric vehicle charging infrastructure and a further 25% of passive infrastructure to allow for future capacity, with a minimum of one parking space serviced by electric vehicle charging infrastructure for all schemes.

[111] UK Green Building Council (March 2020) The Policy Playbook: Driving sustainability in new homes -a resource for local authorities. Available at: https://www.ukgbc.org/wp-content/uploads/2020/03/The-Policy-Playbook-v.1.5-March-2020.pdf.

Strengths and weaknesses of energy performance standards

7.14 The strengths and weaknesses of adopting these types of energy performance standards are summarised below:

Strengths:

- Low carbon energy efficient homes have already been built at scale and the standard can be met using traditional construction methods and materials without adding substantial development costs.
- The evidence needed to confirm compliance can be prepared by the developers in a consistent easy to measure way.
- Enhanced building energy performance standards represent a cost-effective way of contributing to climate change commitments.
- Policies can be shaped to future-proof buildings to avoid the need for retrofitting in the future.

Weaknesses:

- To minimise the risk of challenges, developers need to be convinced of the benefits of going beyond the Building Regulation requirements and that there is no 'undue burden' or insurmountable impact on viability.
- Enhanced building energy standards still incur additional development costs.
- There is uncertainty over the standards that will result from the next revision of the Building Regulations due in 2020 and their compatibility with locally-set standards.

7.15 As part of any requirement for new development to be net zero carbon, this should be demonstrated through the submission of an Energy and Climate Statement, to show how the development will achieve net zero carbon, including how monitoring and reporting on how performance will be delivered. The Reading Borough Council Local Plan, Draft Flintshire Council Local Plan and the Milton Keynes Local Plan include the requirement for such statements. The Energy and Climate Change Statement could cover:

- calculation of energy demand and carbon emissions as well as the energy demand and carbon emissions of other elements of the development, including construction, operation and decommissioning.
- proposed measures to reduce carbon emissions through the design and proposed delivery of the development.
- how the use of decentralised energy and generation of onsite renewables has been considered, including demonstrating how the energy hierarchy has been followed.
- proposed measures within the design to adapt to climate change impacts for the lifetime of the development.
- how carbon offsetting of residual emissions will be undertaken (where relevant) to achieve net-zero carbon.
- proposed monitoring to ensure delivery of emissions reductions.

Separation Distances (for Wind Energy)

7.16 The proximity of large wind turbines to residential properties has become an important consideration in planning decisions for wind energy developments. Several councils in England have sought in the past to impose separation distances between proposed turbines and residential properties. However, developers and climate change groups are concerned that this effectively represents an "anti-wind farm policy" that is not based on evidence.

7.17 It is important to note that there are no minimum separation distances required in English planning law or guidance. The Planning Practice Guidance which accompanies the NPPF[112] clearly states that: *"Local planning authorities should not rule out otherwise acceptable renewable energy developments through inflexible rules on buffer zones or separation distances. Other than when dealing with setback distances for safety, distance of itself does not necessarily determine whether the impact of a proposal is unacceptable. Distance plays a part, but so does the local context including factors such as topography, the local environment and near-by land uses. This is why it is important to think about in what circumstances proposals are likely to be acceptable and plan on this basis."*

7.18 A number of local authorities have however sought to introduce separation distances. For example Wiltshire Council amended its Core Strategy Pre-Submission Document to impose minimum separation distances of 1 kilometre for turbines over 25 metres, 1.5 kilometres for turbines over 50 metres, 2 kilometres for turbines over 100 metres and 3 kilometres for wind turbines over 150 metres high. In that case, the Inspector ruled that it was contrary to the Planning Practice Guidance (PPG) and the policy was removed.

[112] Ministry of Housing, Communities & Local Government (2019) National Planning Policy Framework. Available at: www.gov.uk/government/publications/national-planning-policy-framework--2.

7.19 Reviews of appeal decisions have also shown that large scale wind turbines have been built with a wide range of separation distances and that they do not show any general rule, but rather judgements have been made according to the specifics of the case and local circumstances. This reflects the fact that the size of the turbines, orientation of views, local topography, buildings, background noise levels, vegetation and trees can all have a significant impact on what may be deemed an acceptable distance between a wind farm development and a residential property/settlement.

7.20 As outlined in paragraph 2.7.6 of the national policy statement for Renewable Energy Infrastructure (EN-3), the two main issues that determine the acceptable separation distance between residential properties and wind energy developments are visual amenity and noise. Shadow flicker can also potentially determine the minimum acceptable separation distance. Commercial-scale wind turbines are large structures and can have an effect on visual amenity from residential properties. All wind turbines also generate sound during their operation. As such, appropriate distances should be maintained between wind turbines and sensitive receptors to protect residential amenity. The key question however is whether these safeguards are best achieved through the application of blanket Borough-wide separation distances or through robust criteria based policies and appropriate guidance. The provision of guidance by the Council on how residential amenity and noise issues should be assessed arguably provides a much more robust framework which can be used to assess potential wind farm applications.

7.21 It is therefore not recommended to include a separation distance policy within the emerging Local Plan as there is a high risk that this will be rejected by the Inspector as it is contrary to the guidance provided in the PPG. If such a policy was included, it would need to be accompanied by a caveat recognising that site specific factors also need to be taken into consideration. However, with the inclusion of such a caveat, it is doubtful what purpose the policy would then be serving.

7.22 The strengths and weaknesses of adopting separation distance policies are summarised below:

Strengths:

- Puts the onus on the developer to set out why the distance between the wind turbine(s) and residential property is acceptable (if the proposed development is closer than the required distance). However, an Environmental Impact Assessment (EIA) for a wind energy development should already cover these issues.

Weaknesses:

- Contrary to National Planning Policy Guidance.
- Would require the inclusion of caveat to take account of local circumstances which makes the purpose of the policy questionable.
- Aim of policy could be better served through the provision of guidance on how developers should consider residential amenity and noise issues in their planning applications/ EIAs.

Criteria Based Policies

7.23 The NPPF states that local authorities should design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily. The PPG provides helpful guidance for local authorities on how to develop robust criteria based policies in relation to renewable and low carbon energy projects. Key points include:

- The criteria should be expressed positively (i.e. that proposals will be accepted where the impact is or can be made acceptable).
- Should consider the criteria in the National Policy Statements as these set out the impacts particular technologies can give rise to and how these should be addressed.
- Cumulative impacts require particular attention, especially the increasing impact that wind turbines and large scale solar farms can have on landscape and local amenity as the number of turbines and solar arrays in an area increases.
- Local topography is an important factor in assessing whether wind turbines and large scale solar farms could have a damaging effect on landscape and recognise that the impact can be as great in predominately flat landscapes as in hilly areas.
- Proposals in National Parks and Areas of Outstanding Natural Beauty, and in areas close to them where there could be an adverse impact on the protected area, will need careful consideration.
- Care should be taken to ensure heritage assets are conserved in a manner appropriate to their significance, including the impact of proposals on views important to their setting.
- Protecting local amenity is an important consideration which should be given proper weight in planning decisions.

7.24 Drawing on the guidance outlined in the PPG, after expressing positive support in principle for renewable and low carbon energy development, Local Plans should list the issues that will be taken into account in considering specific applications. This should not be a long negative list of constraints but it should set out the range of safeguards that seek to protect the environment – including landscape and townscape. Other key considerations may include residential amenity, aviation, heritage, tranquillity etc.

7.25 It is important that policy does not preclude the development of specific technologies other than in the most exceptional circumstances and does not purely repeat national policy but is relevant to the process of decision-making at the local level and focuses on locally distinctive criteria related to local assets, characteristics and sensitivities. In the context of Test Valley, this could specifically relate to managing the scale and impact of renewable and low carbon developments within the setting of the North Wessex Downs Area Outstanding Natural Beauty. It may also be appropriate for more detailed issues and guidance to be included in a Supplementary Planning Document (SPD) on renewables.

7.26 The Inspector's report which accompanied the Blackburn with Darwen Borough Council[113] Site Allocations and Development Management Policies Plan (adopted in 2015) noted that in order for the Plan to be found sound, the Borough's criteria-based policies would need to be supported by a Supplementary Planning Document (SPD) which identified suitable areas. It is therefore recommended that any criteria-based policy designed to manage the development of renewable and low carbon technologies should also be supported by guidance on the most suitable locations (see appropriate sections relating to suitable areas, energy opportunities and allocations below), either within the Local Plan or an accompanying SPD.

7.27 The strengths and weaknesses of adopting criteria-based policies are summarised below:

Strengths:

- Creates greater policy certainty for developers.
- Allows the Council to clearly set out the circumstances in which renewable energy proposals will and will not be permitted.

Weaknesses:

- Maybe perceived to be overly restrictive by certain stakeholders.

Identification of 'Suitable Areas for Wind Energy'

7.28 In line with the NPPF, when considering applications for wind energy development, local planning authorities should only grant planning permission if the development site is in an area identified as suitable for wind energy development in a Local or Neighbourhood Plan.

7.29 When identifying suitable areas for wind, the PPG does not dictate how suitable areas for renewable energy should be identified, but in considering locations, local planning authorities will need to ensure they take into account the requirements of the technology and, critically, the potential impacts on the local environment, including from cumulative impacts and views of affected local communities. It also makes reference to the former Department of Energy and Climate Change's (now part of the Department for Business, Energy and Industrial Strategy) methodology on assessing the capacity for renewable energy development. LUC was involved in the preparation of this guidance. The guidance notes the value of landscape character assessments in identifying which technologies are appropriate in different locations, including the appropriate scale of development.

7.30 The assessment of technical potential as set out in **Chapter 4** is based on a refinement of the methodology and identifies those areas which are technically viable for wind energy – i.e. they are not constrained by infrastructure, environmental or heritage constraints.

7.31 One of the key factors determining the acceptability or otherwise of wind turbines is their potential impacts on the local landscape – this is due to their height and the movement they introduce into the landscape (i.e. rotating blades). Different landscapes present different opportunities for renewable energy, and landscape sensitivity studies can assist both planners and developers in identifying what scale of development may be appropriate in which areas. This approach is endorsed by the PPG which states that *"landscape character areas could form the basis for considering which technologies at which scale may be appropriate in different types of location."*

7.32 The landscape sensitivity maps (see separate Landscape Sensitivity Assessment Report) could potentially be overlaid with the technical constraint maps, or otherwise referred to, in order to identify areas which are less sensitive to the different scales of wind turbines and hence identify locations where proposals are more likely to be supported.

[113] Blackburn with Darwin Borough Council (2015) Local Plan Part 1: Site Allocations and Development Management Policies. Available at: www.blackburn.gov.uk/planning/planning-policies-strategies-and-guides/local-plan-part-2.

7.33 It is important to note that if areas of suitability are identified in the Local Plan or Neighbourhood Plans they would be broad designations rather than allocations and would not therefore provide a definitive statement of the suitability of particular location for wind energy. Site specific assessment and design would still be required and all applications would still be assessed on their individual merits. It is also not possible at a strategic level, to take into account cumulative effects. Residential amenity, the setting of heritage assets, telecommunications, ecology and air traffic safety etc., would also need to be carefully considered at a site level.

7.34 All applications would also have to meet the second test set out in the NPPF i.e. that it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing. It is therefore recommended that such policies are also supported by development management criteria designed to judge individual planning applications against (see section on criteria-based policies above).

7.35 Examples of where identification of 'suitable areas for wind energy' has been included in local plans include Eden, Hull and Exmoor National Park – note that these are not necessarily examples of best practice, but serve to illustrate different approaches taken. The Redcar and Cleveland Local Plan[114] adopted in May 2018 includes Renewable and Low Carbon Energy Policy SD 6 which identifies areas with potential for wind and solar technologies in the Proposal Map accompanying the Local Plan. These areas were identified by undertaking a technical assessment of wind and solar potential overlaid with the findings of a landscape sensitivity assessment.

7.36 The strengths and weaknesses of adopting identified 'suitable areas for wind energy' are summarised below:

Strengths:

- Enables planners to have informed discussions with developers and communities about potential opportunities for wind– i.e. proactive rather than reactive planning.
- Meets NPPF, PPG and Ministerial statement that LPAs should consider identifying suitable areas for renewable and low carbon energy sources and supporting infrastructure.
- Can act as a useful tool for neighbourhood planning.

Weaknesses:

- There may be concern that it will lead to multiple wind energy applications within the areas identified as being suitable for wind. However, all applications would still need to be assessed on their own merits, in isolation and in combination with existing developments, and it would not be a replacement for detailed site studies.
- It does not provide a definitive statement on the suitability of a certain location for wind turbine development – each application must be assessed on its own merits. It is not a replacement for detailed site studies.

Development of 'Energy Opportunities Maps'

7.37 The NPPF and PPG encourage local planning authorities to "consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure." The Council should therefore consider identifying suitable areas for other forms of renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources.

7.38 Clearly identifying and mapping an area's renewable and low carbon sources of energy represents a positive and proactive way to spatially plan for renewable and low carbon energy generation. With a spatial map illustrating energy opportunities it is easier for local authorities to work with local communities and developers to identify the areas that would be most appropriate for development in strategic terms, accelerating the planning and development processes and avoiding conflict.

7.39 Energy opportunities maps can provide a spatial summary of the key opportunity areas (in terms of their technical potential) for various forms of renewable energy. These can be used to inform development decisions and discussions and guide development towards the most suitable areas. This has been undertaken for both wind and ground-mounted solar PV, as described elsewhere in this report, and has also been complemented by a Landscape Sensitivity Assessment, which can be used to guide developments away from the most sensitive landscapes and, in the case of solar, away from the 'best and most vulnerable' agricultural land, in line with PPG.

7.40 With regards to heat networks, in order to encourage low carbon district heating schemes, search area maps can identify locations that have greatest potential to locate district energy schemes, based on heat mapping outputs – see

[114] Redcar & Cleveland (2018) Local Plan. Available at: www.redcar-cleveland.gov.uk/resident/planning-and-building/strategic%20planning/Pages/local-plan.aspx.

Chapter 5. Opportunities in Test Valley Borough are limited due to the mainly rural characteristics of the area, but such heat maps can nevertheless indicate the areas most worthy of further study. In London, the Mayor has identified Heat Network Priority Areas, which can be found on the London Heat Map website[115]. The draft New London Plan states that major development in Heat Network Priority Areas should follow the heating hierarchy in policy SI3.

7.41 In addition to The London Plan, other examples of plans which have included policies regarding district heating networks include the adopted East Devon Local Plan[116], Kirklees Local Plan[117], Cheshire West and Chester Local Plan[118] and the Adur District Council Supplementary Planning Document[119].

7.42 With the introduction of neighbourhood planning, energy opportunities maps could also provide a useful tool for communities and other stakeholders to identify the key opportunities for renewables within their area. It is important to note however that it is not possible to identify locations for all types of renewable energy, as many technologies such as building integrated solar, heat pumps, farm-scale AD, and small-scale biomass can be located in nearly all areas.

7.43 The strengths and weaknesses of adopting 'Energy Opportunities Maps' are summarised below:

Strengths:

- Enables planners to have informed discussions with developers and communities about potential opportunities for renewable and low carbon energy technologies – i.e. proactive rather than reactive planning.
- Meets NPPF, PPG and Ministerial statement that LPAs should consider identifying suitable areas for renewable and low carbon energy sources and supporting infrastructure.
- Can act as a useful tool for neighbourhood planning.

Weaknesses:

- Not possible to identify locations for all types of renewable energy technologies.
- It does not provide a definitive statement on the suitability of a certain location for a particular development – each application must be assessed on its own merits. It is not a replacement for detailed site studies.
- May identify potential areas for renewable energy development that are unpopular.

Allocating Sites for Standalone Renewable and Low Carbon Energy Schemes

7.44 The Local Plan could allocate sites specifically for standalone renewable developments. This could provide more strategic direction to the siting of renewables for developers, investors, the local authority, statutory stakeholders and communities. It may be possible to allocate sites which have the greatest potential for sustainable energy and carbon reduction or sites that could potentially be developed for other purposes (e.g. resulting in the sterilisation of potential sites).

7.45 If sites exist that have potential for standalone renewable or low carbon energy use but are constrained in a way that would make them less attractive to commercial developers, then allocating the site is a way of promoting that site for renewable/low carbon development to a wider audience such as landowners or co-operatives. Alternatively or in addition, the Council could undertake a 'call for sites' exercise for renewable and low carbon development and consider the merits of promoted sites in isolation or in combination with other planned types of development. It should however be noted that such call for sites exercises tend to generate a relatively poor level response.

7.46 Again, it would be important that site allocations only highlight appropriate schemes/areas; site developers and communities would still be required to undertake detailed site-based assessment work to support individual development planning applications and if required Environmental Impact Assessments. Furthermore, site allocations should be framed such that they do not preclude projects in other locations.

Strengths:

- Provide strategic direction to the siting of renewables.
- Ensure sites with the greatest potential are identified.
- May promote sites to a wider audience such as co-operatives.

[115] CSE (2020) Mayor of London Heat Map. Available at: maps.london.gov.uk/heatmap.
[116] East Devon (2016) East Devon local Plan 2013 to 2031. Available at: https://eastdevon.gov.uk/media/1772841/local-plan-final-adopted-plan-2016.pdf.
[117] Kirklees Council (2019) Kirklees Local Plan. Available at: http://consult.kirklees.gov.uk/portal/pp/kirklees_local_plan/klp-sp?pointId=s1551718560001.
[118] Cheshire West & Chester council (2015) Local Plan (Part One) Strategic Policies. Available at: http://consult.cheshirewestandchester.gov.uk/portal/cwc_ldf/adopted_cwac_lp/lp_1_adopted?pointId=3252243.
[119] Ardur & Worthing Councils(2019) Supplementary Planning Document; Sustainable Energy. Available at: https://www.adur-worthing.gov.uk/adur-ldf/spd-and-guidance/#spd-sustainable-energy.

Weaknesses:

- Resource intensive to gather necessary evidence to justify allocation.
- Would be desirable to secure agreement of landowner which may be resource intensive.
- May identify potential sites for renewable energy development which are unpopular.

Encouraging Community Renewables

7.47 The NPPF states that local authorities should support community-led initiatives for renewable and low carbon energy, including developments being taken forward through neighbourhood planning. Community-led renewable energy projects are increasingly being seen as an attractive option for local communities wishing to contribute to local/national climate change targets and as a way to generate local revenue to directly benefit the community. For example, the Westmill Wind Farm Co-operative[120] in Swindon was the first 100% community owned wind farm to be built in the south of England.

7.48 Community groups can face considerable challenges in the pre-planning stage and there are a number of opportunities for local authorities to provide advice and guidance throughout this stage, including the provision of early advice on planning requirements and lending support to consultation activities within the community. Engaging communities in the earliest stages of plan-making and providing clear information on local issues and the decision making process can aid the development of community renewable energy projects.

7.49 Examples of plans that include policies to support community renewable energy schemes include the adopted Bath and North East Somerset Local Plan[121].

7.50 The Council's emerging Local Plan could broaden its support for community renewable schemes by stating that the Council would actively support community renewable energy schemes which are led by or meet the needs of local communities. Such developments would normally be conceived by and/or promoted within the community within which the renewable development will be undertaken, delivering economic, social and/or environmental benefits to the community. Neighbourhood plans provide a particular opportunity to define detailed local site allocation policies for renewable and low carbon technologies.

Strengths:

- Provides support to local communities to develop renewables and low carbon energy.
- Generates local revenue to directly benefit the local community.
- Can secure a broad base of local support for renewable energy schemes.

Weaknesses:

- Care may need to be taken not to prescribe the process of community ownership (i.e. shared ownership etc.) as it is not the role of the planning system to do this.

Supplementary Planning Document

7.51 Where there is not scope to include the relevant level of guidance within the Local Plan, this could be set out in an accompanying Supplementary Planning Document. This could include further guidance on the various renewable energy technologies, what is required in an Energy & Climate Statement, the findings of the Landscape Sensitivity Assessment and how this should be interpreted and/ or further development management guidance on how applications will be considered. It could also cover issues not just related to renewable and low carbon energy development but also climate change adaptation.

[120] Westmill Wind Farm Co-operative Limited: https://www.westmill.coop/.

[121] Bath & North East Somerset Council (2020) Core Strategy and Placemaking Plan. Available at: https://beta.bathnes.gov.uk/policy-and-documents-library/core-strategy-and-placemaking-plan.

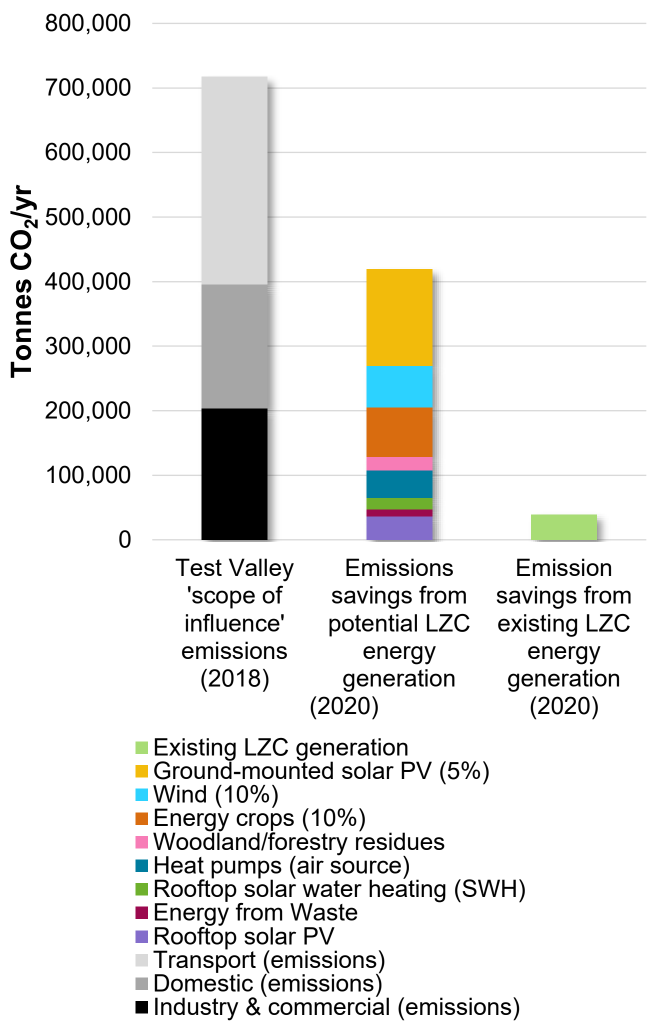
Chapter 8
Summary and Conclusions

Summary

8.1 On the 4th September 2019, Test Valley Borough Council declared a climate emergency and made a commitment to investigate clear and effective options to become a carbon-neutral organisation. Alongside this, it was resolved that the Council would work with communities and partners to identify opportunities for making the Borough carbon neutral. The Council has acknowledged that planning policy has a role to play in achieving this.

8.2 This study has sought to provide the Council with clear evidence of the potential for renewable and low carbon energy deployment within the Borough and how renewable and local issues could be embedded within the Council's emerging Local Plan.

8.3 The findings show that there is significant technical potential for renewable and low carbon energy within the Borough and that Test Valley theoretically has the resources to generate an amount of low or zero carbon energy which could currently result in emission savings that exceed the amount of Borough-wide emissions that were produced from the domestic and industry/commercial sectors in 2018. The greatest potential lies in the opportunity to use the power of the sun in the form of ground mounted solar PV, rooftop solar PV and solar hot water heating. See **Figure 4.10** which is repeated below.



8.4 One of the difficulties for local authorities in setting district-wide carbon targets is the co-dependency on national policy measures, such as those which will contribute to decarbonising both the electricity grid and heat supplies. Such measures are likely to be achieved through a mix of technologies, including some which most local authorities have little or no influence over such as offshore wind power and the development of hydrogen infrastructure. The rate at which grid decarbonisation occurs will be dependent on national policies and local authorities will in turn be largely dependent on a decarbonised grid to fulfil their own policy commitments.

8.5 In addition, the deployable resource as set out in **Figure 4.10** in practice is likely to be considerably less than the scenario considered above due to existing economic, grid, planning and other constraints. For some technologies such as onshore wind, there is unlikely to be any further significant deployment of this technology in southern England at the present time, unless the national financial and planning support mechanisms change. Decarbonising heat supplies is also likely to pose a significant challenge in moving towards a net zero carbon future, and will largely rely on local exploitation of the biomass resource and national decarbonisation of the electricity grid for heat pump deployment.

8.6 New developments do however have the potential to make a significant contribution towards low and zero carbon energy generation capacity within the Borough, particularly if a rapid trajectory towards operational net zero carbon is adopted for new buildings. It is difficult to quantify their impact as the mix of technologies used will depend on costs, onsite emission targets and applied emission factors, but it is likely that developers will focus on heat technologies such as heat pumps and rooftop solar. However, the additional capacity will not decrease overall emissions; it will instead limit the additional emissions resulting from the new development itself.

Conclusions

8.7 Achieving net zero is hugely challenging considering the radical changes that are needed to enact the necessary innovative transformative action across all sectors. However, in their 'Net Zero' report, the Committee on Climate Change view the UK-wide target as being *"achievable with known technologies, alongside improvements in people's lives… …However, this is only possible if clear, stable and well-designed policies to reduce emissions further are introduced across the economy without delay".*

8.8 As such, this study focusses primarily on the potential interventions through local planning for net zero carbon development, sustainable building design and renewable energy. With Test Valley in the process of preparing its next Local Plan, replacing the current adopted Local Plan (2016), there is a clear window of opportunity to ensure that the new Local Plan sets out a step change in the support given to the development of renewable and local carbon energy projects.

8.9 To support the deployment of renewable energy in the Borough, it is recommended that polices should be put in place supporting:

- Delivery of development in accordance with the energy hierarchy.
- Delivery of net zero carbon development, including residential and non-residential development, and support for electric vehicle charging infrastructure provision.
- Onsite renewable and low carbon energy generation via supportive and positively worded criteria based policies.
- Stand-alone renewable and low carbon energy schemes, including specific policies on solar PV and

wind energy identifying areas of suitability for these technologies.

- Community renewable and low carbon energy schemes.
- Heat networks (connections by developments and stations and network infrastructure).

8.10 Careful monitoring of the success of the policies should also be established to measure the Borough's progress towards its ultimate goal of becoming carbon neutral.

8.11 All policy recommendations will also need to consider viability issues. The higher standards proposed in this study (and required to meet climate change targets) may impact on the viability of developments and as such, further work to understand this will be required.

8.12 The delivery of renewable and low carbon projects will also require changes not just to planning policy but also to the implementation of policy. It will be imperative that due weight and consideration is given to the importance of addressing climate change in development management decisions.

8.13 Local authorities are, however, well-placed to have a good understanding of their local area in terms of needs, opportunities and constraints whilst having influence through their multiple roles of major employers, community leaders, planning authorities and service providers. Test Valley Borough Council will therefore need to carefully examine its own sphere of influence in achieving a net-zero carbon target and be highly ambitious in tackling emissions in key sectors where it can exert meaningful influence, such as power and heat generation, existing and new buildings, and waste, as well as transport as a result of allocating development sites. Increasing local renewable energy generation capacity will be a key component of the solution, sitting alongside energy efficiency, energy demand reduction, heat decarbonisation and providing infrastructure to accommodate the rapid growth in electric vehicles.

Appendix A

Resource Assessment Assumptions

Please note that some of the assumptions used in this study are presented as footnotes within the Chapters above and are not repeated within this Appendix.

Table A - 1: Property statistics for Test Valley

Property statistics for Test Valley		Source/ justification
Number of domestic properties		
Terrace/end-terrace dwelling	12,255	Dwelling statistics sourced from 2011 Census data: KS401EW - Dwellings, household spaces and accommodation type: www.nomisweb.co.uk/census/2011/ks401ew Data then updated to 2018 figures using Table 125: Dwelling stock estimates by local authority district: 2001 – 2018: www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants
Semi-detached dwelling	13,939	
Detached dwelling	21,046	
Dwelling in purpose-built block of flats or tenement	5,671	
Dwelling in part of a converted or shared house (including bedsits)	705	
Other	857	
Total	**54,473**	
Number of non-domestic properties		
Non-domestic properties	2,719	Derived from OS mapping datasets 2019
Miscellaneous		
Overall proportion of 'off-gas' properties	21.8%	2018 BEIS LSOA estimates of properties not connected to the gas network: www.gov.uk/government/statistics/lsoa-estimates-of-households-not-connected-to-the-gas-network
Average annual heat demand per dwelling	10,519 kWh	Derived from gas consumption statistics for Test Valley (2018) by assuming an average annual gas consumption per domestic meter of 12,190 kWh (of which 558 kWh* is used for cooking by 90% of households with gas meters) and boiler efficiency of 90%: www.gov.uk/government/statistical-data-sets/gas-sales-and-numbers-of-customers-by-region-and-local-authority *sourced from GB's Housing Energy Fact File

Table A - 2: Emission Factors

Fuel	Emission Factor [$kgCO_2e/kWh$]	Source/ justification
Grid electricity	0.233	Factor for grid electricity assumed to be that proposed for SAP10 (see www.bregroup.com/sap/sap10/) Other emission factors taken from UK Government GHG Conversion Factors for Company Reporting: www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020 Potential CO_2 savings (tonnes/yr) calculated by multiplying the potential electricity output or delivered heat (MWh/year) by the above emissions factors.
Mains gas (gross CV)	0.185	
Heating oil (gross CV)	0.247	
Woodfuel	0.015	

Table A - 3: Assumptions for roof-mounted solar resource

Assumptions for roof-mounted solar resource	
Solar PV	
• Proportion with suitable roof (estimate): o 40% of dwellings o 75% of non-domestic properties • Capacity Factor: 10.4% • Typical size of system: o Detached: 4.0 kW o Semi-detached: 2.6 kW o Terrace/end-terrace: 2.2 kW o Flats: 0.75 kW o Non-domestic: 53.2 kW	Proportions estimated from prior research undertaken by CSE considering suitable type and orientation of roof, and space availability. Capacity Factor taken from BEIS (2019) Quarterly and annual load factors: Annual Regional PV Load Factors, averaged for the South East region over the last eight years. https://www.gov.uk/government/publications/quarterly-and-annual-load-factors Average sized solar PV system in Test Valley for domestic installations recorded on the FiT Register up to March 2019 was 4.0kW, which is assumed to be predominantly deployed on detached dwellings. Typical sizes for other dwelling types were then estimated based on general prior research undertaken by CSE. Average sized solar PV system in Test Valley for non-domestic installations recorded on the FiT Register up to March 2019 was 53.2kW. www.gov.uk/government/statistical-data-sets/sub-regional-feed-in-tariffs-confirmed-on-the-cfr-statistics
Solar water heating	
• Proportion with suitable roof (estimate): o 50% of dwellings o 80% of non-domestic properties • Capacity Factor: 4.65% • Average size of system: o Domestic: 2.8 kW o Non-domestic: 17.7 kW • Heating fuel assumed to be offset: o Electricity: 50% of off-gas properties o Oil: 50% of off-gas properties o Gas: all on-gas properties	Proportions estimated from prior research undertaken by CSE considering suitable type and orientation of roof, space availability and suitable hot water demand. Capacity Factor taken from Table 3 of monthly forecasts for estimated committed RHI expenditure (30 Sept 2020) 'Plants using solar collectors – water heating): www.gov.uk/government/publications/rhi-mechanism-for-budget-management-estimated-commitments Average sizes taken for solar water heating system derived from RHI deployment statistics Apr 2014 – Nov 2019. www.gov.uk/government/statistics/rhi-monthly-deployment-data-november-2019 Actual proportions of off-gas heating fuels that could potentially be offset are not known so an illustrative 50:50 split has been assumed between electricity and oil.

Table A - 4 Assumptions for heat pumps

Assumptions for heat pumps	Source/ justification

• Uptake: 50% of properties
• Average annual dwelling heating demand: 10,519kWh
• Proportion of annual average dwelling heating demand served by heat pump: 85%
• Average annual non-domestic property heating demand served by heat pump: 13,101kWh
• Average size of air source heat pump:
  o for dwellings: 9.9kW
  o for non-domestic properties: 27.3kW
• Seasonal Performance Factor (SPF) of air source heat pump: 3.3
• Heating fuel assumed to be offset:
  o Electricity: 50% of off-gas properties
  o Oil: 50% of off-gas properties
  o Gas: all on-gas properties
	Uptake proportion assumed is dependent on multiple factors and so 50% is purely illustrative (see also paragraph 4.146)
	Derivation of average dwelling heat demand as described in Table A1.
	Proportion of annual average dwelling heating demand served by heat pump is estimated from prior research undertaken by CSE (assumes remaining heat supplied by secondary or back-up heating system).
	Average non-domestic property heat demand served by heat pump taken as the average annual heat delivered by air source heat pumps per installation as derived from RHI deployment statistics Apr 2014 – Nov 2019.
	www.gov.uk/government/statistics/rhi-monthly-deployment-data-november-2019
	Average size of air source heat pump derived from the average capacity for new installations as derived from RHI deployment statistics Apr 2014 – Nov 2019 (link above).
	Air source heat pump SPF taken as the average Seasonal Performance Factor for new installations as reported in RHI deployment statistics Apr 2014 – Nov 2019 (link above).
	Actual proportions of off-gas heating fuels that could potentially be offset are not known so an illustrative 50:50 split has been assumed between electricity and oil.

Table A - 5: Woodfuel – assumptions for forestry and woodland resource

Woodfuel – assumptions for forestry and woodland resource and energy crops	Source/ justification

• Woodland area data from National Inventory of Woodland and Trees ('felled', 'shrub' or 'young trees' categories are excluded)
• Due to a predominance of broadleaf woodland, the sustainable woodfuel yield is assumed to be 2 odt/yr (oven-dried tonnes/year)
• Yields for miscanthus and Short Rotation Coppice assumed to be 17 odt/yr and 9 odt/yr respectively
• Energy content of wood assumed to be 5,150 kWh/tonne
• Boiler efficiency assumed to be 87% (converting woodfuel to delivered heat)
• Efficiency of conversion process for energy crops assumed to be via CHP plant: 30% for electricity and 50% for heat
• Heating fuel assumed to be offset:
  o Electricity: 50% of off-gas properties
  o Oil: 50% of off-gas properties
  o Gas: all on-gas properties
• In calculating the woodfuel and energy crop resource in terms of MW heat capacity of plant, load factors of 14% and 46% respectively have been applied.
	The assumed sustainable woodfuel yield and energy crop yields are based on prior research by CSE: See 'Technical study – Woodfuel supply and demand in Dorset' by Crops for Energy and CSE (2009).
	Published figures for the energy content of oven-dry wood vary slightly so the value chosen aims to represent a mid-point of the range identified by CSE.
	Boiler and CHP plant conversion efficiency are based on prior research by CSE.
	For the forestry and woodland resource, it is assumed that the total sustainable yield will be used for heat production, while for energy crops, yields will be used for electricity and heat production in CHP plant. This is because energy crops are likely to be deployed at larger scale, with bulk outputs better suited to larger plant such as CHP rather than smaller scale boilers.
	Actual proportions of off-gas heating fuels that could potentially be offset are not known so an illustrative 50:50 split has been assumed between electricity and oil.
	MW plant heat capacity figures assume that small-scale boilers are used for woodfuel and CHP plant for energy crops:
	www.gov.uk/government/publications/rhi-mechanism-for-budget-management-estimated-commitments (Table 3) August 2020 forecast).

Table A - 6: Energy from Waste assumptions

Energy from Waste assumptions	Source/ justification
• Livestock numbers for Test Valley taken from 'Local Authority breakdown for key crops areas and livestock numbers on agricultural holdings' (2016 data): www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june • Biogas yields for animal slurr**ies** taken from; 'A detailed economic assessment of anaerobic digestion technology and its suitability to UK farming and waste systems' The Andersons Centre (2010) Table 16. From same source (p36), energy content of biogas assumed to be 6.7kWh/m^3 • Energy outputs based on CHP plant heat and electricity efficiency of 50% and 30% respectively. • Domestic residual 'black bin' waste arisings taken from Test Valley Waste Strategy 2018-2023, 'renewable' fraction of RDF assumed to be 50% with a calorific value of 3,614kWh/tonne.	Calorific content of RDF sourced from Table 1.0 of: https://assets.publishing.service.gov.uk/government/uploads /system/uploads/attachment_data/file/381621/rdf-market-sum-response-201412.pdf Livestock numbers for Test Valley taken from 'Local Authority breakdown for key crops areas and livestock numbers on agricultural holdings' (2016 data): https://www.gov.uk/government/statistical-data-sets/structure-of-the-agricultural-industry-in-england-and-the-uk-at-june Slurry and biogas yields taken from; 'A detailed economic assessment of anaerobic digestion technology and its suitability to UK farming and waste systems' The Andersons Centre (2010) Table 16. Energy content of biogas taken from p36 of same source.

Table A - 7: Wind Resource Assessment Parameters

Parameter	Assumption	Data source	Justification and Notes
Wind turbine size	Five turbine sizes were considered: • Very large (150-200m tip height) • Large (100-150m tip height) • Medium (60-100m tip height) • Small (25-60m tip height) • Very small (<25m tip height) Assessment was based on notional turbine sizes, approximately intermediate within each class size i.e. • Very large: 175m tip height • Large: 125m tip height • Medium: 80m tip height • Small: 45m tip height No mapped-based assessment of 'very small' turbines was undertaken. The type of buffers applied to constraints for the assessment of other turbine size categories in many cases do not reasonably apply to very small turbines. Equally, mapping a strategic district-wide 'resource' for very small turbines (which are generally developed singly in association with particular farm or other buildings) is not particularly meaningful. Instead, it is recommended that policy references the entire plan area as	• CSE and LUC • Research into turbine manufacturers • BEIS renewable energy planning database and other databases containing information on wind turbine applications	There are no standard categories for wind turbine sizes. The categories chosen are based on consideration of currently and historically 'typical' turbine models at various different scales. The approach is intended to be flexible in the light of uncertainty regarding future financial support for renewable energy. A review of wind turbine applications across the UK showed tip heights ranging from less than 20m up to around 200m, with larger turbine models in demand from developers following the reduction in financial support from Government. The majority of operational and planned turbines range between 80m and 175m. Due to the structure of the financial support system in the past, smaller turbines (those in the medium to small categories) have tended to be deployed as 1-2 turbine developments.

Parameter	Assumption	Data source	Justification and Notes
	suitable for very small wind in principle (subject to site-specific assessment) with the exception of a defined list of constraints such as designated ecological sites.		
Wind Speed	Include: • All areas with wind speed ≥5 m/s at 50m above ground level (agl)	• Global Wind Atlas/Vortex • Industry practice	The majority of the Borough meets and exceeds the minimum requirement of 5m/s. Wind speed requirements change with turbine scale and model. Some turbine manufacturers produce models which may operate at lower wind speeds and the configuration of certain turbine models can be altered to improve yield in lower wind speed environments. Future changes in government policy and turbine technology could allow developments to be deliverable at lower wind speeds than are currently viable. A 5m/s threshold was applied to take account of such changes.
Roads	Exclude: • Roads with a buffer of o the height of the turbine (to blade tip height) +50m (Large and Very Large scales) o the height of the turbine (to blade tip) x 1.5 (Medium and Small scales).	• Ordnance Survey VectorMap District.	These buffers were applied as a safety consideration. The proposed buffer distance is based on Department for Transport/Highways Agency guidance (2013)[122] as referenced in National Planning Practice Guidance (PPG). This guidance relates explicitly to the strategic road network, but as guidance is lacking relating to other roads, the same approach was applied to all roads for the purposes of consistency. The guidance states that different buffers should be applied based on the scale of the turbine being proposed. Note: Only line data for roads was available and in order to create a footprint from the road centre, it was assumed that single carriageways are 10m in width, dual carriageways 20m and motorways 30m.
Railways	Exclude: • Railways with a buffer of o the height of the turbine (to blade tip) +50m (Large and Very Large scales)the height of the turbine (to blade tip) x 1.5 (Medium and Small scales)	• Ordnance Survey VectorMap District.	This buffer was applied as a safety consideration, based on the same principles as used for roads. Note: In order to create a footprint from the railway centrelines data, it was assumed that railways are 15m in width.
Public Rights of Way **Cycle Paths**	Exclude: • Public Rights of Way and cycle paths with a buffer of the height of the turbine (to blade tip height) i.e. topple distance	• Test Valley Borough Council (TVBC) • SusTrans	This buffer was applied as a safety consideration. There has never been any statutory requirement relating to separation distances between wind turbines and pedestrian, equestrian and cycle routes. Applying a general separation distance based on tip height ('topple distance') is considered a reasonable approach, and was cited as a suitable buffer in the Companion Guide to Planning Policy Statement 22. Note: In order to create a footprint from the Public Rights of Way and cycle path centrelines data, it was assumed that Public Rights of Way, Bridleways and cycle paths are 3m in width.

[122] Department for Transport (2013) The strategic road network and the delivery of sustainable development. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/237412/dft-circular-strategic-road.pdf.

Parameter	Assumption	Data source	Justification and Notes
Transmission lines	Exclude: • Major transmission lines with a buffer of the height of the turbine (to blade tip height) +10%.	• OS Vector Mapping	This buffer was applied as a safety consideration. It is derived from guidance by the Energy Networks Association (Engineering Recommendation L44) and National Grid (Technical Advice Note 287)
Airports and Airfields	Exclude: • operational airports and airfields	• Ordnance Survey VectorMap Local	OS VectorMap Local Functional Site data with the theme Air Transport was used in the assessment
MOD Land	Exclude: • MOD land in active use	• Test Valley Borough Council • OS Mapping	Plan of MOD landholdings provided by the Council. Landholdings were digitised and cross referenced against OS 1:25000 mapping. Verification of boundaries and present use was sought from TVBC.
NATS Safeguarding Areas	Guidance includes reference to the following safeguarding areas: • 30km for aerodromes with a surveillance radar facility. • 17km for non-radar equipped aerodromes with a runway of 1,100 m or more, or 5km for those with a shorter runway. • 4km for non-radar equipped unlicensed aerodrome with a runway of more than 800m or 3km with a shorter runway. • 10km for the air-ground-air communication stations and navigation aids. • 15 nautical miles (nm) for secondary surveillance radar. These are indicative of potential constraints to wind development but cannot be used to definitively exclude land as unsuitable.	• NATS	Further consultation between potential developers and NATS is required to determine if there is any impact from a proposed development.
Noise	Exclude: • Residential and commercial buffer zones based on turbine size: o Very large scale: 500m for residential/ other sensitive receptors[123], 250m for non-residential. o Large scale: 480m for residential/ other sensitive receptors, 230m for non-residential. o Medium scale: 400m for residential/ other sensitive receptors, 180m for non-residential. o Small scale: 180m for residential/other sensitive receptors 80m for non-residential. For properties outside (but close to) the Borough Boundary,	• Test Valley Borough Council Local Land and Property Gazetteer (LLPG) Residential and Commercial address points • OS OpenMap Local Buildings layer for buildings adjacent to the Borough Boundary	Wind turbines generate sound during their operation, and their noise impacts upon nearby properties must be limited to appropriate levels, defined in particular by the 'ETSU' Guidance – The Assessment and Rating of Noise from Wind Farms (1995) (as supplemented by the Institute of Acoustics). The relationship between turbine size and the separation distance from properties at which acceptable noise levels will be achieved is in practice quite complex and variable. However, the present assessment has applied specialist acoustic advice to define minimum distances below which it is generally unlikely that the required noise levels under ETSU-R-97 will be achievable. The approach taken necessarily involves applying various assumptions, including: - an assumed single turbine development in all cases (rather than multiple turbines) - the assumption that no properties will be 'financially involved' in the wind development (financial involvement may

[123] Sensitive receptors include schools, hospitals and care homes. These were identified via the LLPG data.

Parameter	Assumption	Data source	Justification and Notes
	indicative buffers were applied to the available property/ buildings data from OS Vector Map. As this data does not distinguish commercial and residential properties, and it was not possible to verify uses by other means, residential buffers were used throughout.		allow higher noise levels to be accepted in individual cases). The limitations associated with such assumptions are considered preferable to avoiding the use of noise-related separation distances for the assessment, bearing in mind that noise is a key factor that influences the acceptable siting of turbines in practice. The assessment defines the *minimum* distances below which adherence to the Industry standard (ETSU-R-97)noise guidance would not be possible and it should not be inferred that the proposed distances represent acceptance of any given proposal within the areas of identified suitable potential as site based noise monitoring and assessments would still be required.
Shadow Flicker	No land excluded on this basis	• N/A	Wind turbines may in some circumstances cause 'shadow flicker' within nearby properties. However, shadow flicker effects are readily mitigated and so shadow flicker was not considered as a constraint for the purposes of this study.
Future developments	Exclude: • Strategic site allocations from adopted Test Valley Local Plan	• Test Valley Borough Council	Generally unsuitable for wind turbine development, unless allocations contain relatively large undeveloped portions. Identification of suitable land for wind within specific allocation boundaries would require a separate site-specific study.
Existing Renewable Energy Developments	Exclude: • Land boundaries of consented and operational renewable energy installations	• BEIS • Land Registry • Test Valley Borough Council	The quarterly BEIS Renewable Energy Planning Database was used to determine the locations of operational and consented renewable energy installations, supplemented by planning data from Test Valley Borough Council. This information was cross-referenced with Inspire land boundary data obtained from the Land Registry.
Terrain	Exclude: • Slopes greater than 15 degrees.	• OS Terrain 50	This is a development/ operational constraint. Developers have indicated that this is the maximum slope they would generally consider feasible for development. Although it is theoretically possible to develop on areas exceeding 15° slopes, turbine manufacturers are considered unlikely to allow turbine component delivery to sites where this is exceeded.
Water Environment	Exclude: • Watercourses and waterbodies with 50m buffer.	• Ordnance Survey Rivers • Ordnance Survey VectorMap District	A 50m buffer was applied around all rivers and waterbodies to take account of good practice such as that relating to pollution control during construction. OS Survey VectorMap District surface water data includes waterways of approximately a minimum of 2m width. OS Rivers data is line data, and so a 1m buffer was applied to approximate a footprint of smaller waterways.
Woodland	Exclude: • Woodland as shown on the National Forest Inventory and Ancient Woodland Inventory	• Forestry Commission • Natural England	All areas of woodland were excluded with a + 50m buffer to reduce risk of impact on bats. A 50m clearance distance of turbines from trees and other habitat features is standard practice and endorsed by Natural England guidance set out in 'TIN051'. A 50m horizontal buffer is a reasonable proxy clearance for the purposes of a strategic study bearing in mind unknowns concerning tree height and turbine dimensions. A 50m buffer cannot be applied to all linear habitat features and individual trees due to a lack of data for a study of this scale.

Parameter	Assumption	Data source	Justification and Notes
Landscape	Exclude: • National Park	• Natural England	A small area of the New Forest National Park falls within the Test Valley boundary but this area was excluded from the Study Area as it falls under separate planning control. The North Wessex Downs AONB was not excluded from the assessment as an absolute constraint.
Biodiversity (International designations)	Exclude international designations: • Special Protection Areas (SPA) • Special Areas of Conservation (SAC) • Ramsar sites	• Natural England	As protected by: • Conservation of Habitats and Species Regulations 2017 (as amended). LUC has reviewed information relating to the bat foraging zone associated with the Mottisfont bat SAC. On the basis of this information, it was concluded that site-specific bat surveys for development may result in the identification of unacceptable impacts on the SAC population in individual cases, but that it is not appropriate to apply the foraging zone as an unconditional constraint to all wind development in this area for the purposes of the present assessment.
Biodiversity (National designations)	Exclude national designations[124]: • Sites of Special Scientific Interest	• Natural England	As protected by: • Wildlife and Countryside Act 1981. • Conservation of Habitats and Species Regulations 2017 (as amended).
Biodiversity (Local designations)	Exclude other designations: • Local Nature Reserves • Sites of Importance for Nature Conservation • Hampshire and Isle of Wight Wildlife Trust Reserves • RSPB Reserves	• Natural England • Test Valley Borough Council • Hampshire and Isle of Wight Wildlife Trust • RSPB	Generally, would not be suitable for renewables development based on law/policy/guidance including: • National Planning Policy Framework. • Natural Environment and Rural Communities Act 2006.
Cultural heritage	Exclude[125]: • Registered Parks and Gardens • Scheduled Monuments • Listed Buildings • Conservation Areas	• Historic England • Test Valley Borough Council	As protected by: • National Planning Policy Framework. • The Convention Concerning the Protection of the World Cultural and Natural Heritage. • National Heritage Act 1983. • Ancient Monuments and Archaeological Areas Act of 1979. • Planning (Listed Buildings and Conservation Areas) Act 1990.

[124] There are no National Nature Reserves located within Test Valley Borough.
[125] There are no World Heritage Sites or Registered Battlefields located within Test Valley Borough.

Table A - 8: Wind Typology (for Resource Assessment and Landscape Sensitivity Assessment)

Type	Size range (tip) (m)	Candidate for assessment (tip) (m)	Candidate for assessment (rotor diameter (RD)[126]) (m)	Candidate capacity	Notes
Very Small	<25	N/A	N/A	N/A	Not to be included in GIS tool or resource calculations.
Small	25-60	45	20	50kw	Various 50-100kw machines have been deployed at around this spec in the past including Endurance 50kw.
Medium	60-100	80	55	0.5MW	Rough specification of the old ‘standard’ EWT 500kw turbine.
Large	100-150	125	90	2.5MW	From a review of planning applications of the Renewable Energy Planning Database, these are the typical sizes for large turbines.
Very large	150-200	175	130	4MW	This was becoming a rough standard for post-subsidy projects as of 2018-19, although capacities, tip heights and rotor diameters are continually increasing.

Table A - 9: Ground Mounted Solar Resource Assessment Parameters

Parameter	Assumption	Data source	Justification and Notes
Solar Irradiance	• Preliminary estimate of an average annual generation exceeding 1000kWh/kWp for a south facing, 38° tilted system. No shading taken into account.	• Global Solar Atlas	All of Test Valley considered theoretically suitable for solar development.
Roads	Exclude	• Ordnance Survey VectorMap District.	Physical features preventing the development of solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to solar PV. Note: Only line data for roads was available and in order to create a footprint from the road centre, it was assumed that single carriageways are

[126] The cross sectional dimension of the circle swept by the rotating blades of a turbine.

Parameter	Assumption	Data source	Justification and Notes
			10m in width, dual carriageways 20m and motorways 30m.
Railways	Exclude	• Ordnance Survey VectorMap District.	Physical features preventing the development of solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to solar PV. In order to create a footprint from the railway centrelines data, it was assumed that railways were 15m in width.
Public Rights of Way **Cycle Paths**	Exclude	• Test Valley Borough Council • SusTrans	Physical features preventing the development of solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to solar PV. In order to create a footprint from the Public Rights of Way and cycle path centrelines data, it was assumed that Public Rights of Way and Bridleways are 3m in width.
Transmission lines	Exclude • Line data buffered by 1m, forming a 2m exclusion footprint	• OS Vector Mapping	Physical features preventing the development of solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to solar PV. This exclusion was applied to account for shading and impacts on solar output.
Buildings	Exclude: • All buildings with a 20m buffer	• OS VectorMap data	Buildings were buffered by 20m to account for shading and impacts on solar output.
Water Environment	Exclude: • Watercourses and waterbodies.	• Ordnance Survey Rivers • Ordnance Survey VectorMap District	Physical features preventing the development of solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to solar PV. OS Survey VectorMap District surface water data includes waterways of approximately a minimum of 2m width. OS Rivers data is line data, and so a 1m buffer was applied to approximate a footprint of smaller waterways.
Minerals Sites	Exclude: • All operational minerals sites • Allocated minerals sites A 250m buffer is to be applied to both of the above	• Hampshire County Council	Operational and allocated mineral sites were buffered to account for dust emissions which will affect the generation output. The IAQM 2016 Guidance on the Assessment of Mineral Dust Impacts for Planning indicates that adverse dust impacts from sand and gravel sites are uncommon beyond 250m and beyond 400m from hard rock quarries measured from the nearest dust generating activities.
Waste Sites	Exclude: • All operational waste sites • Allocated waste sites	• N/A	Waste sites will frequently be quite highly constrained with respect to solar development (e.g. areas of active landfill) but equally may present opportunities in some circumstances, particularly when they are to be decommissioned/ restored

Parameter	Assumption	Data source	Justification and Notes
			during a plan period. Waste sites were excluded from the mapped solar resource but potentially subject to bespoke policy wording in the local plan. It was agreed with TVBC that there are in fact no relevant waste allocation sites to include in the assessment, as Squabb Wood landfill site will be restored for the majority of the Local Plan period.
Airfields and Airports	Exclude: • Operational airports and airfields	• Ordnance Survey VectorMap Local	OS VectorMap Local Functional Site data with the theme Air Transport was used in the assessment
MOD Land	Exclude: • MOD land	• Test Valley Borough Council • OS Mapping	Plan of MOD landholdings provided by the Council. Landholdings were digitised and cross referenced against OS 1:25000 mapping. Verification of boundaries and present use provided by TVBC.
Agricultural Land Use	Exclude: • Agricultural land use classifications grades 1 and 2	• Natural England	Agricultural Land Use is a consideration, with grades 1 and 2 land having higher value for food production. Further investigation would be required of grade 3 land to determine whether it is grade 3a or b, as available data does not distinguish these. Ground Mounted Solar PV projects, over 50kWp, should ideally utilise previously developed land, brownfield land, contaminated land, industrial land or agricultural land preferably of classification 3b, 4, and 5.
Woodland	Exclude: • Woodland as shown on the National Forest Inventory and Ancient Woodland Inventory	• Forestry Commission • Natural England	Forested areas were buffered by 20m to account for shading and impacts on solar output.
Biodiversity (International designations)	Exclude: • Special Areas of Conservation • Special Protection Areas • Ramsar sites	• Natural England	As protected by: • Conservation of Habitats and Species Regulations 2017 (as amended). As in relation to wind, it was not considered appropriate to exclude the foraging zone associated with the Mottisfont bat SAC from the assessment as an absolute constraint. TVBC confirmed that solar schemes have already been granted permission within this zone.
Biodiversity **(National designations)**	Exclude national designations[127]: • Sites of Special Scientific Interest •	• Natural England	As protected by: • Wildlife and Countryside Act 1981. • Conservation of Habitats and Species Regulations 2017 (as amended).

[127] There are no National Nature Reserves located within Test Valley Borough.

Parameter	Assumption	Data source	Justification and Notes
Biodiversity **(Regional and local designations)**	Exclude other designations: • Local Nature Reserves • Sites of Importance for Nature Conservation • Hampshire and Isle of Wight Wildlife Trust Reserves • RSPB Reserves	• Natural England • Test Valley Borough Council • Hampshire and Isle of Wight Wildlife Trust • RSPB	Generally, would not be suitable for renewables development based on law/policy/guidance including: • National Planning Policy Framework. • Natural Environment and Rural Communities Act 2006.
Historic environment	Exclude[128]: • Scheduled monuments • Registered parks and gardens • Listed buildings • Conservation Areas	• Historic England • Test Valley Borough Council	As protected by: • National Planning Policy Framework. • The Convention Concerning the Protection of the World Cultural and Natural Heritage. • National Heritage Act 1983. • Ancient Monuments and Archaeological Areas Act of 1979. • Planning (Listed Buildings and Conservation Areas) Act 1990.
Landscape	Exclude: • National Park	• Natural England	A small area of the New Forest National Park falls within the Test Valley boundary but this area was excluded from the Study Area as it falls under separate planning control. The North Wessex Downs AONB was not excluded from the assessment as an absolute constraint.
Terrain	Exclude: • Areas with north-east to north-west aspect and inclinations greater than 3 degrees • All areas with inclinations greater than 10 degrees	• OS Terrain 50	Although it is possible to develop Solar PV installations on slopes facing north-east to north-west, it would generally not be economically viable to do so. However, slopes that are north-east to north-west facing and below 3° are considered potentially suitable, as generation output will not be significantly affected.
Future developments	Exclude: • Strategic site allocations from adopted Test Valley Local Plan	• Test Valley Borough Council	Generally these will be unsuitable for ground-mounted solar, although there may be some potential for installations on undeveloped land/open space within these areas. Identification of this potential would require a separate, site-specific study.
Existing Renewable Energy Developments	Exclude: • Consented and operational solar energy installations, defined by their land boundaries	• BEIS • Land Registry • Test Valley Borough Council	The BEIS quarterly renewable energy database was used to determine the locations of operational and consented renewable energy installations. This data was subject to review and addition/modification by the Council. It was then cross-referenced with Inspire Land boundary data obtained from the Land Registry. Colocation with wind developments was considered as an opportunity.

[128] There are no World Heritage Sites or Registered Battlefields located within Test Valley Borough.

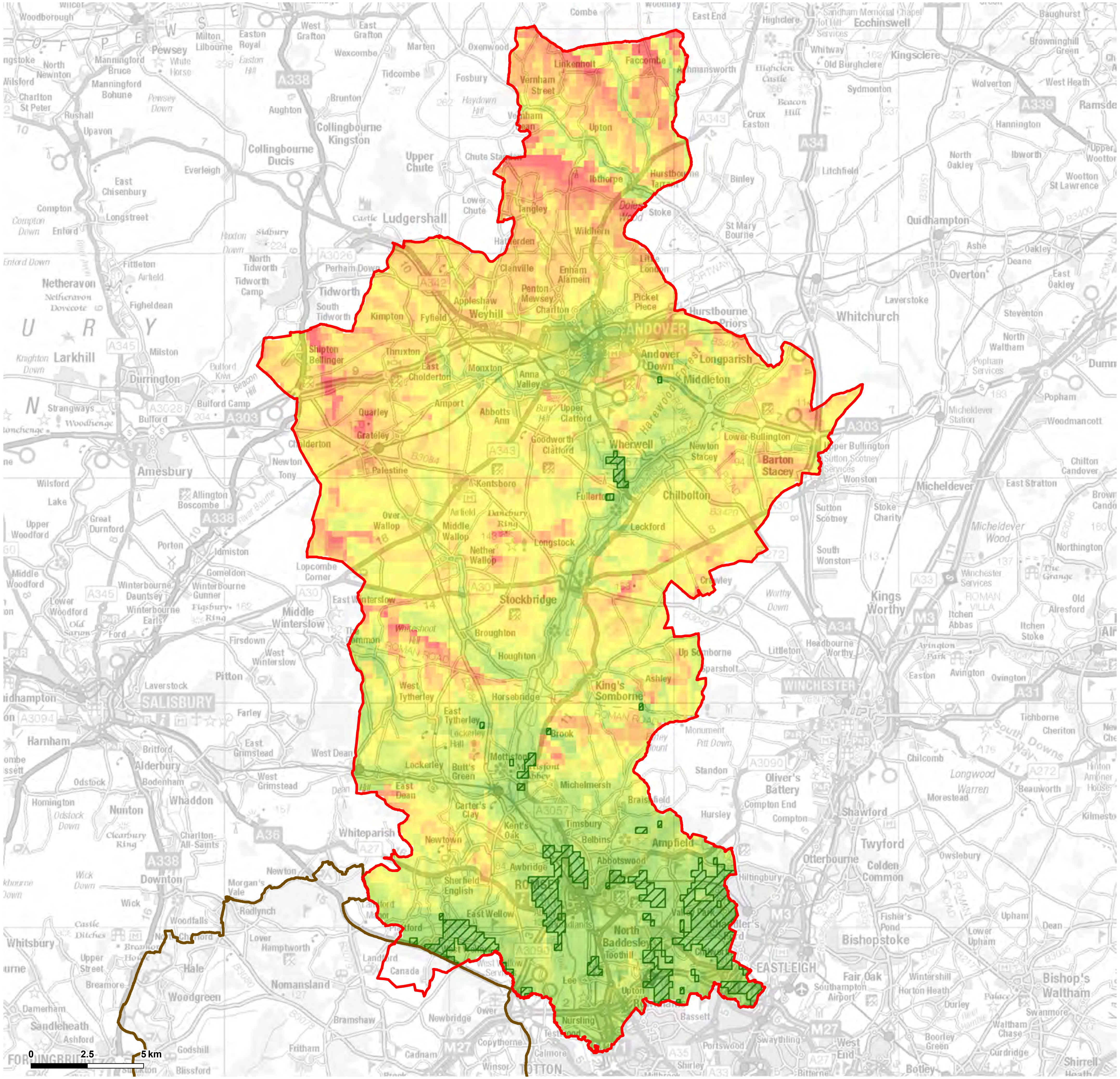
Parameter	Assumption	Data source	Justification and Notes
Planning/land use other	Exclude: • Common Land • Green/Open space, including: o Allotments o Sport and recreation o Cemeteries and religious grounds	• Natural England (Common Land) • OS Green Space: ‘Cemetery’ and ‘Religious Grounds’ data categories • TVBC Public Open Space Audit: all supplied data categories of ‘Allotments’, ‘Children and Teenagers’, ‘Informal’, ‘Outdoor Sports’ and ‘Parks and Public Gardens’	Due to land take requirements, these land uses/types were considered generally to constrain solar development, particularly at larger scales, although in some circumstances they may offer opportunities for smaller scale development collocated with their other facilities. They were excluded from the resource assessment but may be subject to bespoke policies with the Local Plan allowing development to take place in principle subject to defined criteria being satisfied.

Appendix B

Wind maps

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-1: Wind Speed at 50m above ground level



- Test Valley Borough Council boundary
- New Forest National Park
- Windspeed less than 5m/s

Wind Speed at 50m above ground level

7.2 m/s

4.6 m/s

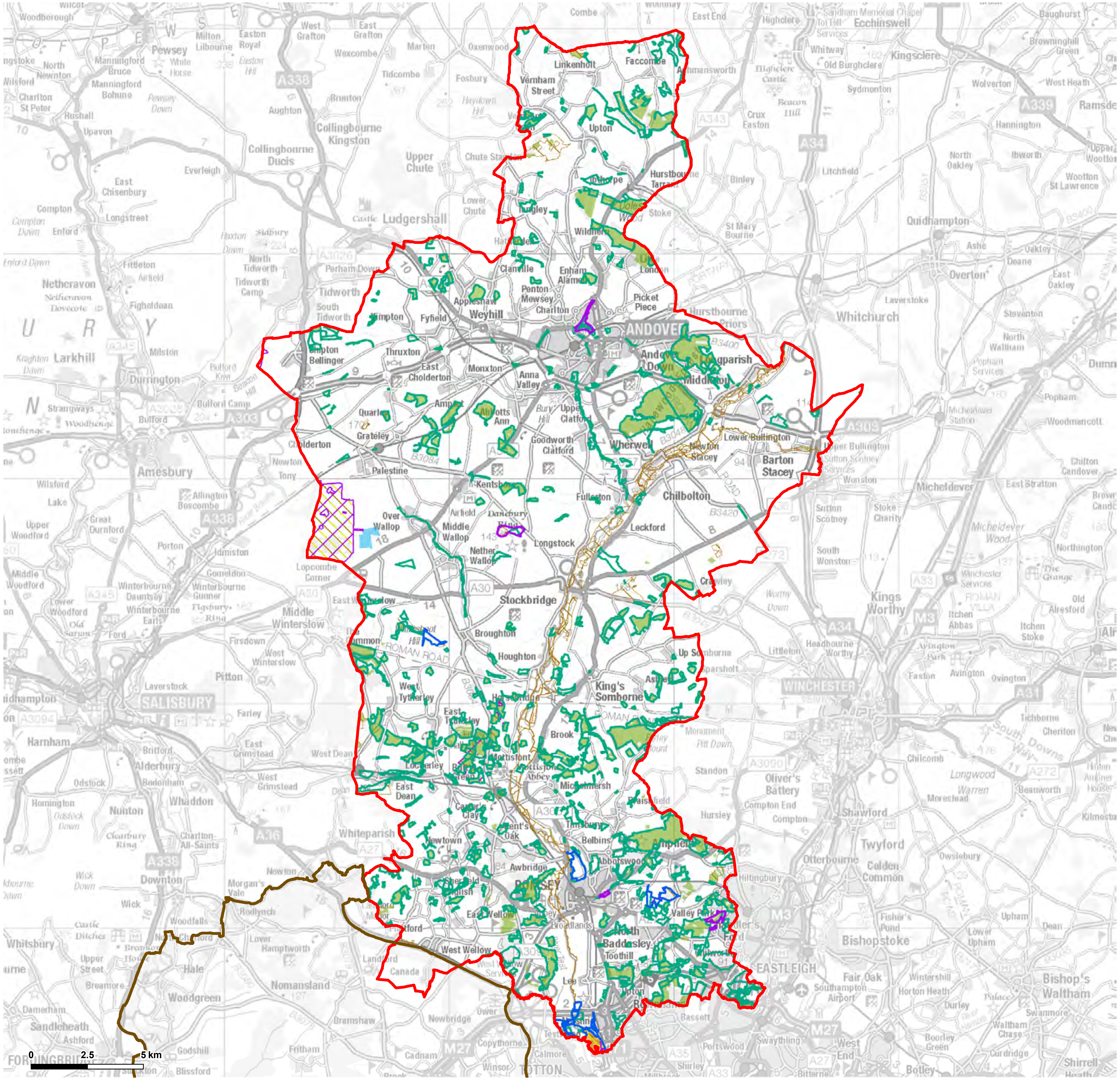
Map scale
1:175,000 @ A3

Data obtained from the Global Wind Atlas 3.0, a free, web-based application developed, owned and operated by the Technical University of Denmark (DTU). The Global Wind Atlas 3.0 is released in partnership with the World Bank Group, utilizing data provided by Vortex, using funding provided by the Energy Sector Management Assistance Program (ESMAP).
For additional information: https://globalwindatlas.info

CB:BP EB:Packham_B LUC FigB1_10953_r0_Windspeed_at_50m 10/12/2020
Source: Vortex

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-2: Natural Heritage Constraints



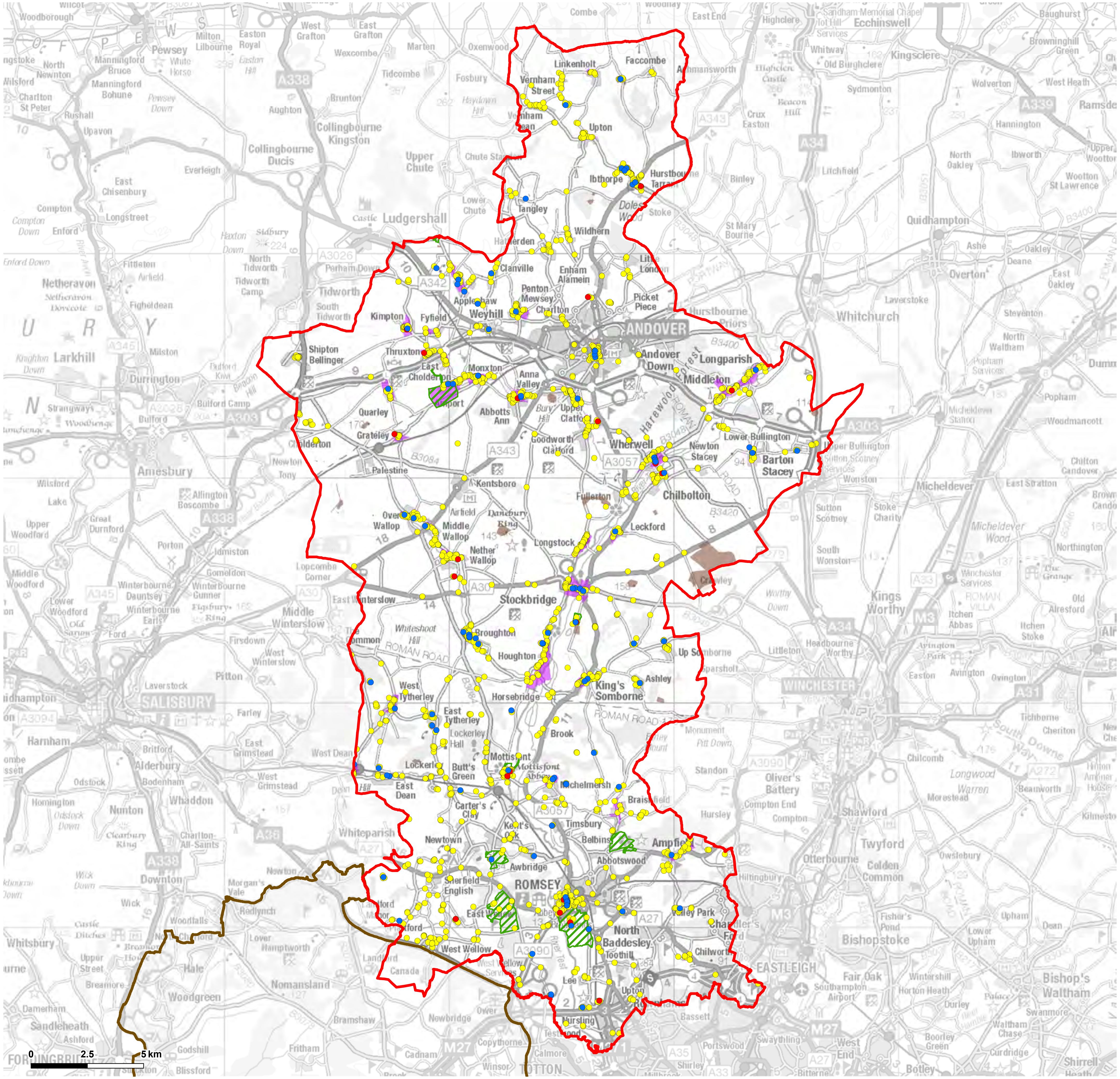
- Test Valley Borough Council boundary
- New Forest National Park
- Special Area of Conservation
- Special Protection Area
- Ramsar
- Site of Special Scientific Interest
- Ancient Woodland
- RSPB Reserves
- Local Nature Reserves
- Hampshire and Isle of Wight Wildlife Trust Reserves
- Site of Importance for Nature Conservation

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigB2_10953_r0_Nature_Designations 10/12/2020
Source: Natural England, Test Valley Borough Council, Hampshire and Isle of Wight Wildlife Trust, RSPB

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-3: Cultural Heritage Constraints



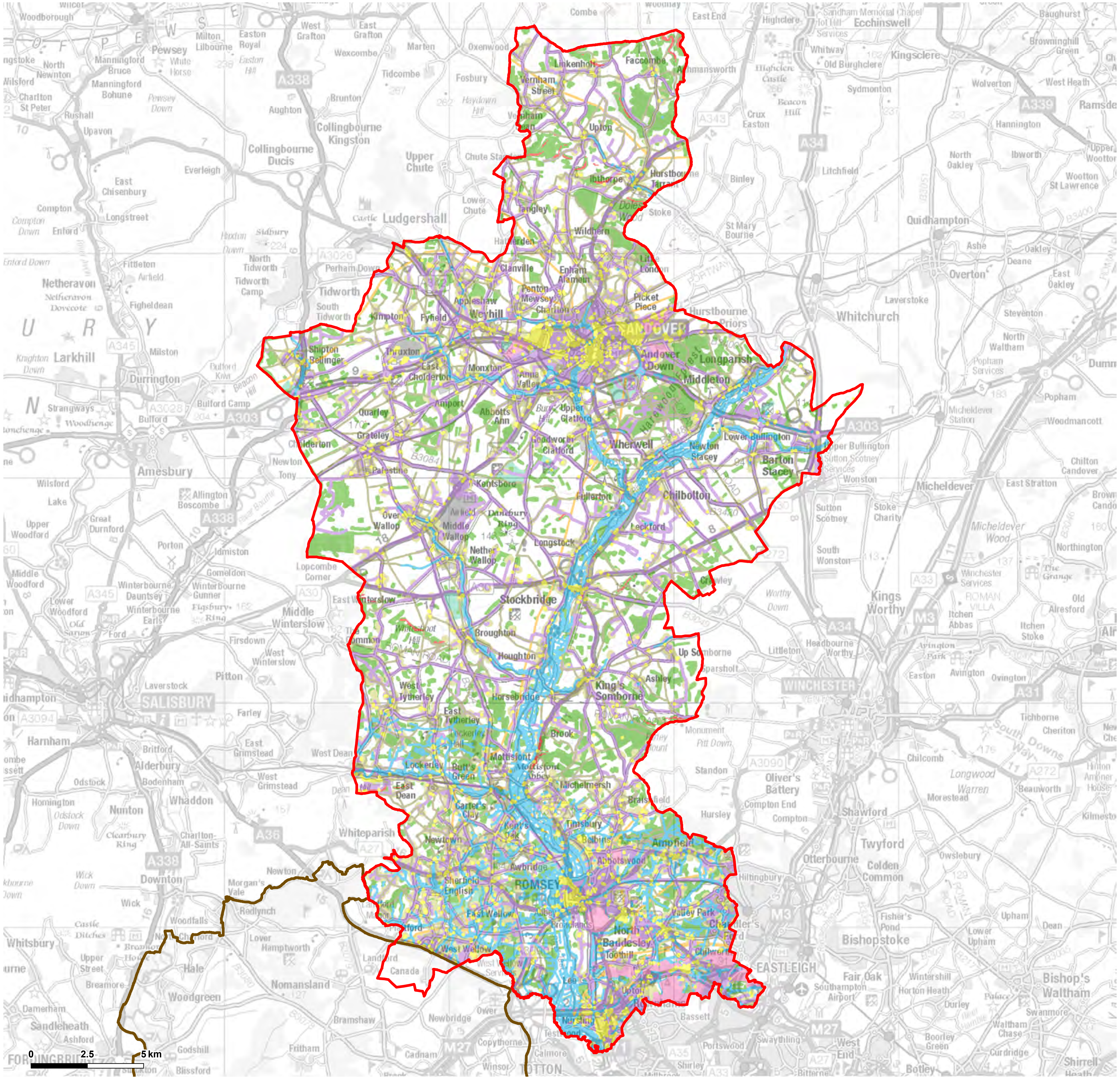
- Test Valley Borough Council boundary
- New Forest National Park
- Listed Building Grade I
- Listed Building Grade II*
- Listed Building Grade II
- Registered Parks and Gardens
- Conservation Area
- Scheduled Monument

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigB3_10953_r0_Heritage_Designations 07/10/2020
Source: Historic England, Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-4a: Physical Constraints for small scale wind development



- Test Valley Borough Council boundary
- New Forest National Park
- Sensitive Noise Receptors and Buildings outside of Test Valley Borough 180m Buffer
- Other Noise Receptors 80m Buffer
- Roads and Railways 67.5m Buffer
- Footpaths and Cyclepaths 45m Buffer
- Overhead Line 49.5m Buffer
- Woodland and Forestry 50m Buffer
- Watercourses and Waterbodies 50m Buffer
- Gradient >15°
- Allocated Sites
- Airfields and Airports
- Consented and Operational Renewable Energy projects

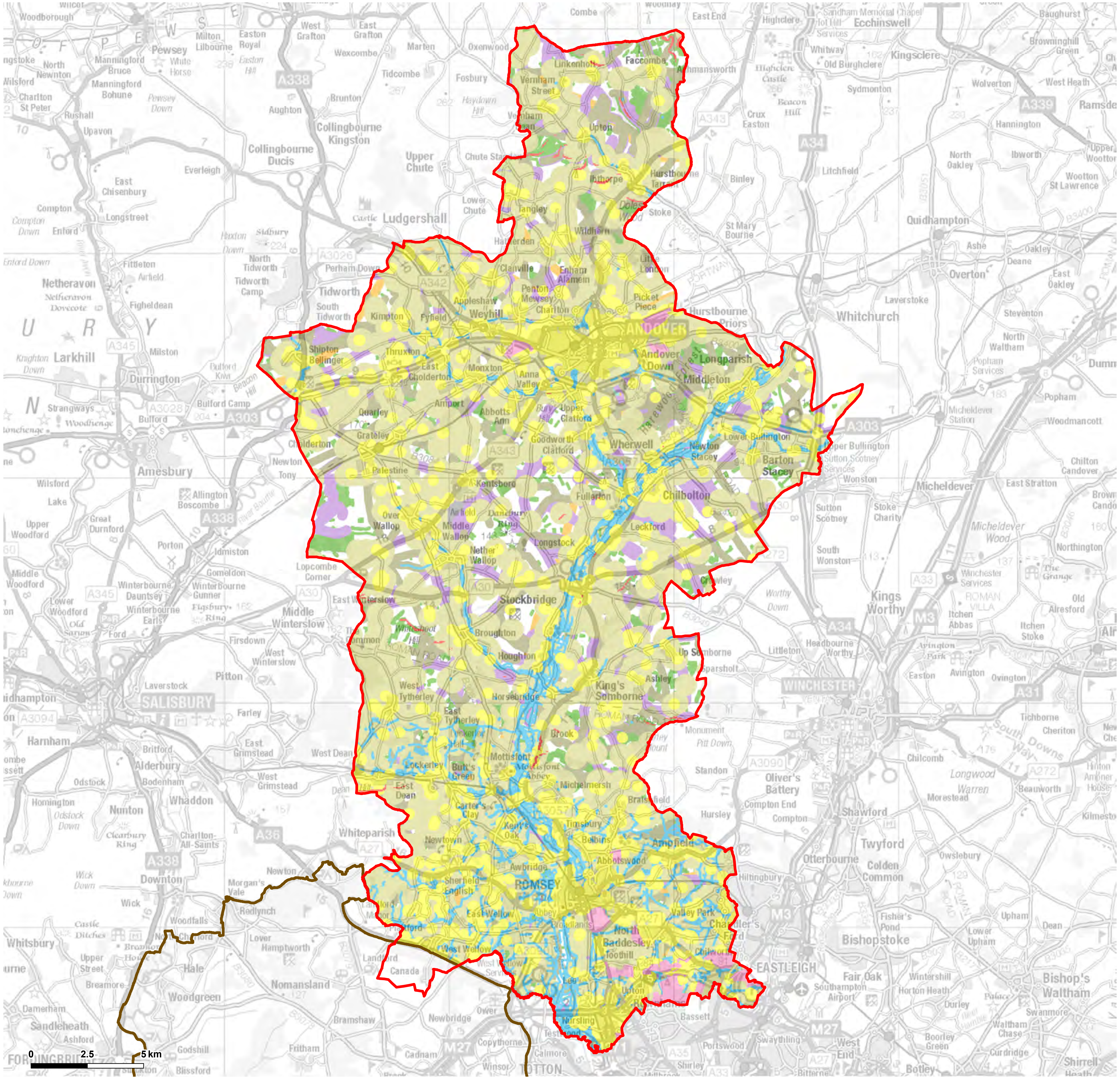
MOD land is not included within this map due to the sensitive nature of this information

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigB4_10953_r0_Physical_Constraints_Small_Scale 08/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-4b: Physical Constraints for very large scale wind development



- Test Valley Borough Council boundary
- New Forest National Park
- Sensitive Noise Receptors and Buildings outside of Test Valley Borough 500m Buffer
- Other Noise Receptors 250m Buffer
- Roads and Railway 225m Buffer
- Footpaths and Cyclepaths 175m Buffer
- Overhead Line 192.5m Buffer
- Woodland and Forestry 50m Buffer
- Watercourses and Waterbodies 50m Buffer
- Gradient >15°
- Allocated Sites
- Airfields and Airports
- Consented and Operational Renewable Energy projects

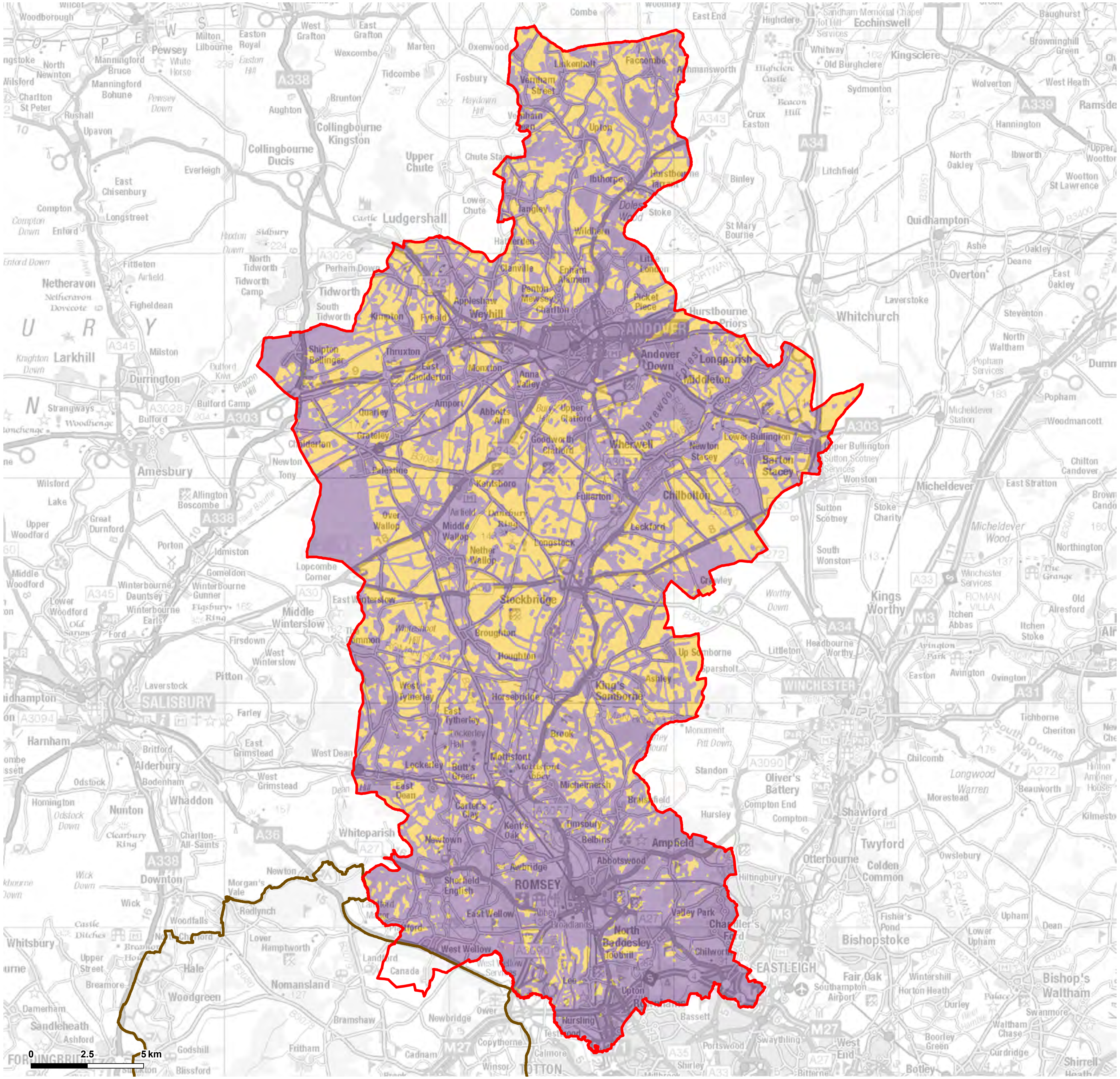
MOD land is not included within this map due to the sensitive nature of this information

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigB4a_10953_r0_Physical_Constraints_Very_Large_Scale 08/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-5a: Opportunities and Constraints: small scale wind development



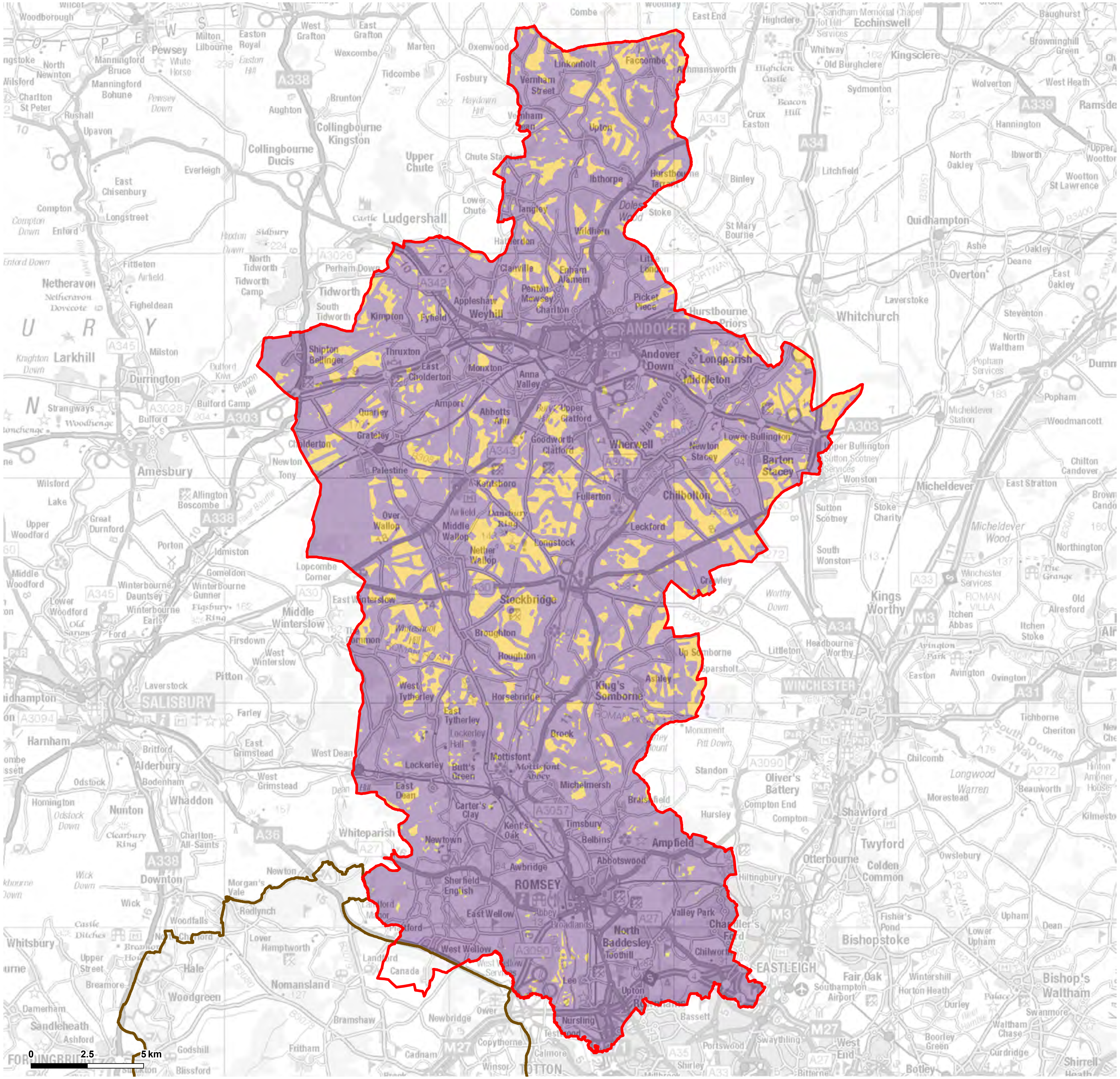
- Test Valley Borough Council boundary
- New Forest National Park
- Suitable areas for small scale wind
- Constrained areas for small scale wind development

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigB5_10953_r0_Opportunities_and_Constraints_Small_Scale 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-5b: Opportunities and Constraints: medium scale wind development



Test Valley Borough Council boundary
New Forest National Park
Suitable areas for medium scale wind
Constrained areas for medium scale wind development

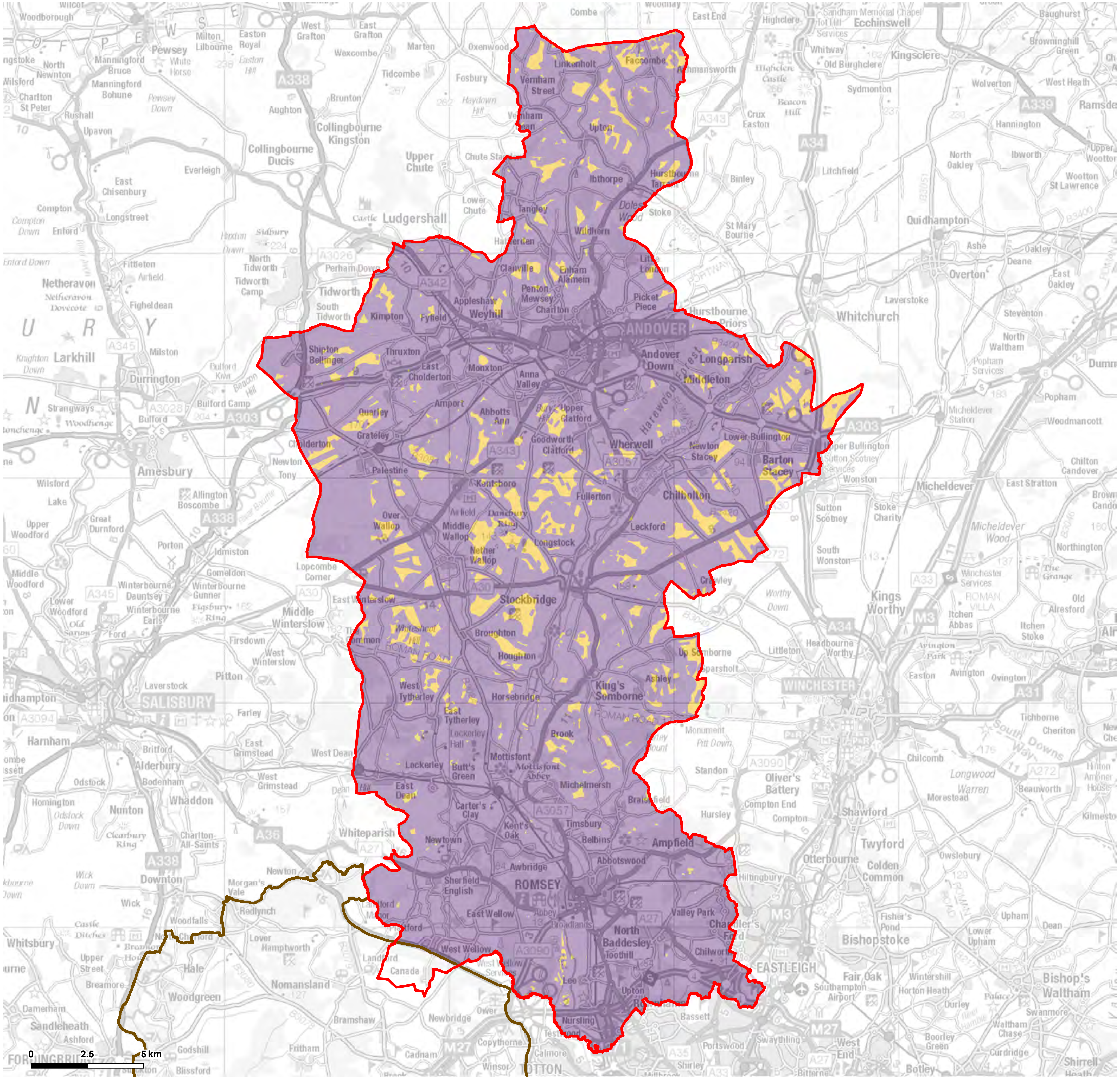
Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigB5_10953_r0_Opportunities_and_Constraints_Medium_Scale 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-5c: Opportunities and Constraints: large scale wind development

- Test Valley Borough Council boundary
- New Forest National Park
- Suitable areas for large scale wind
- Constrained areas for large scale wind development



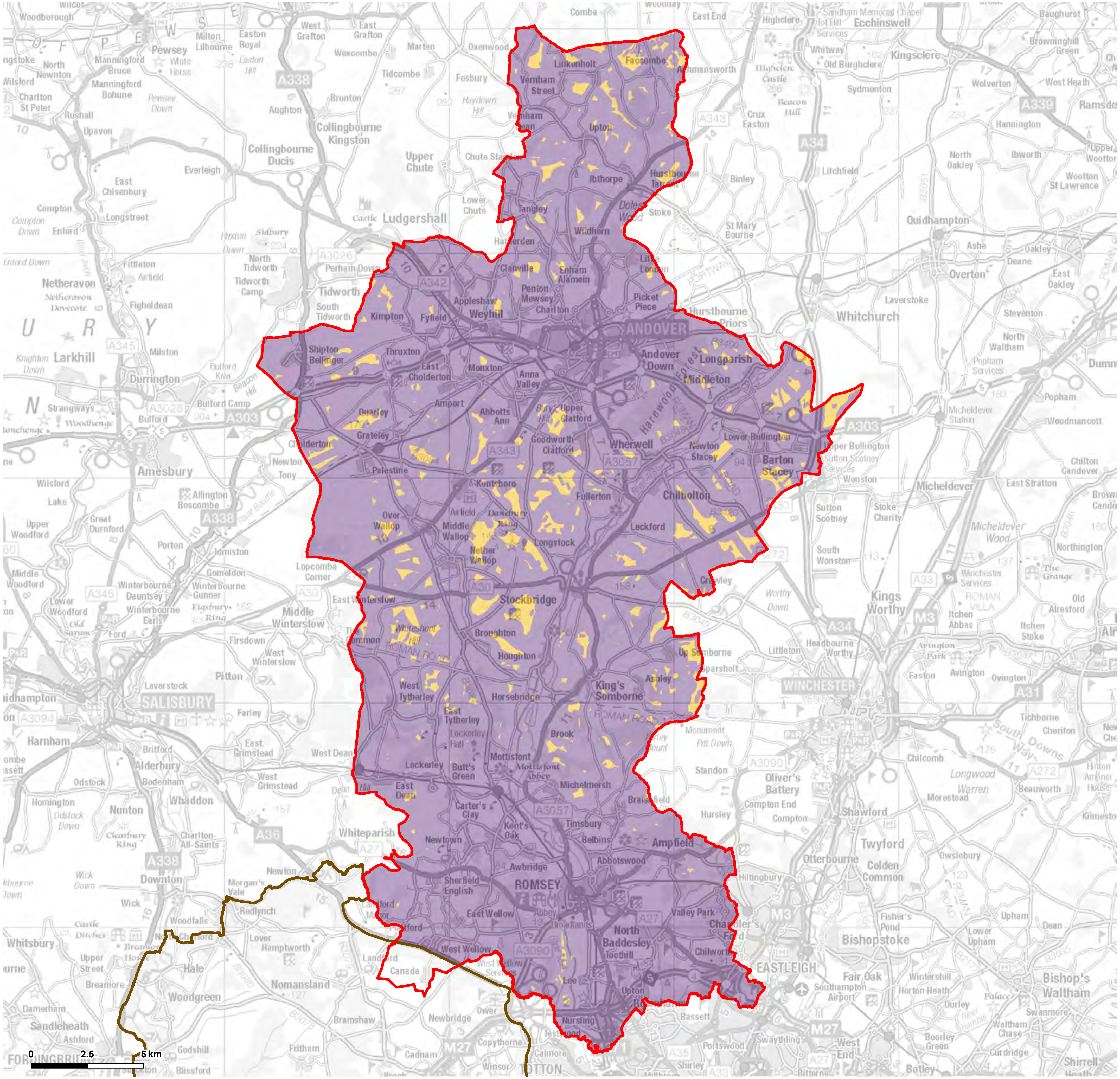
Map scale
1:175,000 @ A3

Test Valley Borough Council

CB:BP EB:Packham_B LUC FigB7_10953_r0_Opportunities_and_Constraints_Large_Scale 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

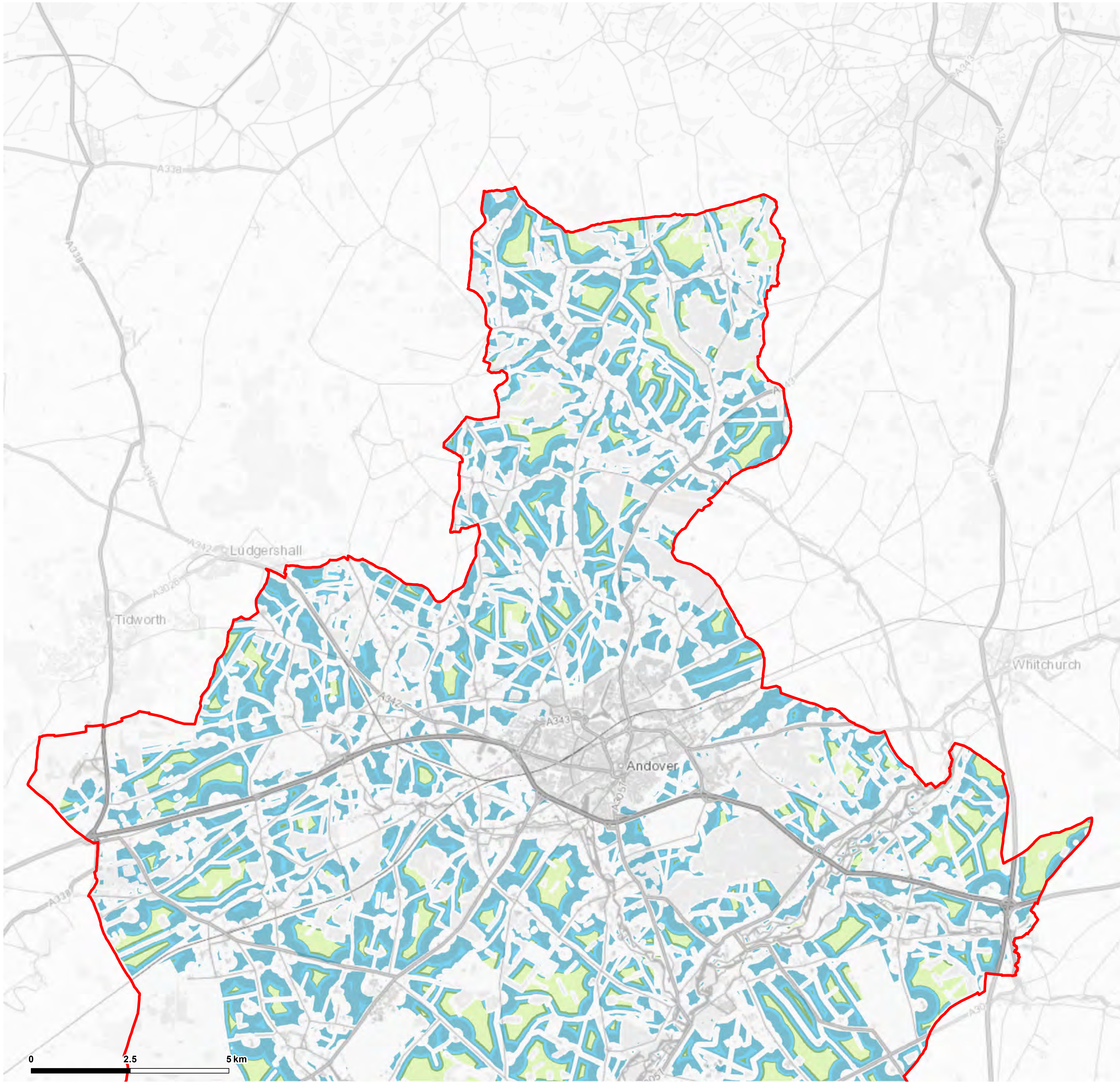
Figure B-5d: Opportunities and Constraints: very large scale wind development



CB:BP EB:Packham_B LUC FigB8_10953_r0_Opportunities_and_Constraints_Very_Large_Scale 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-6a: Opportunities for Wind Development All Scales (North)



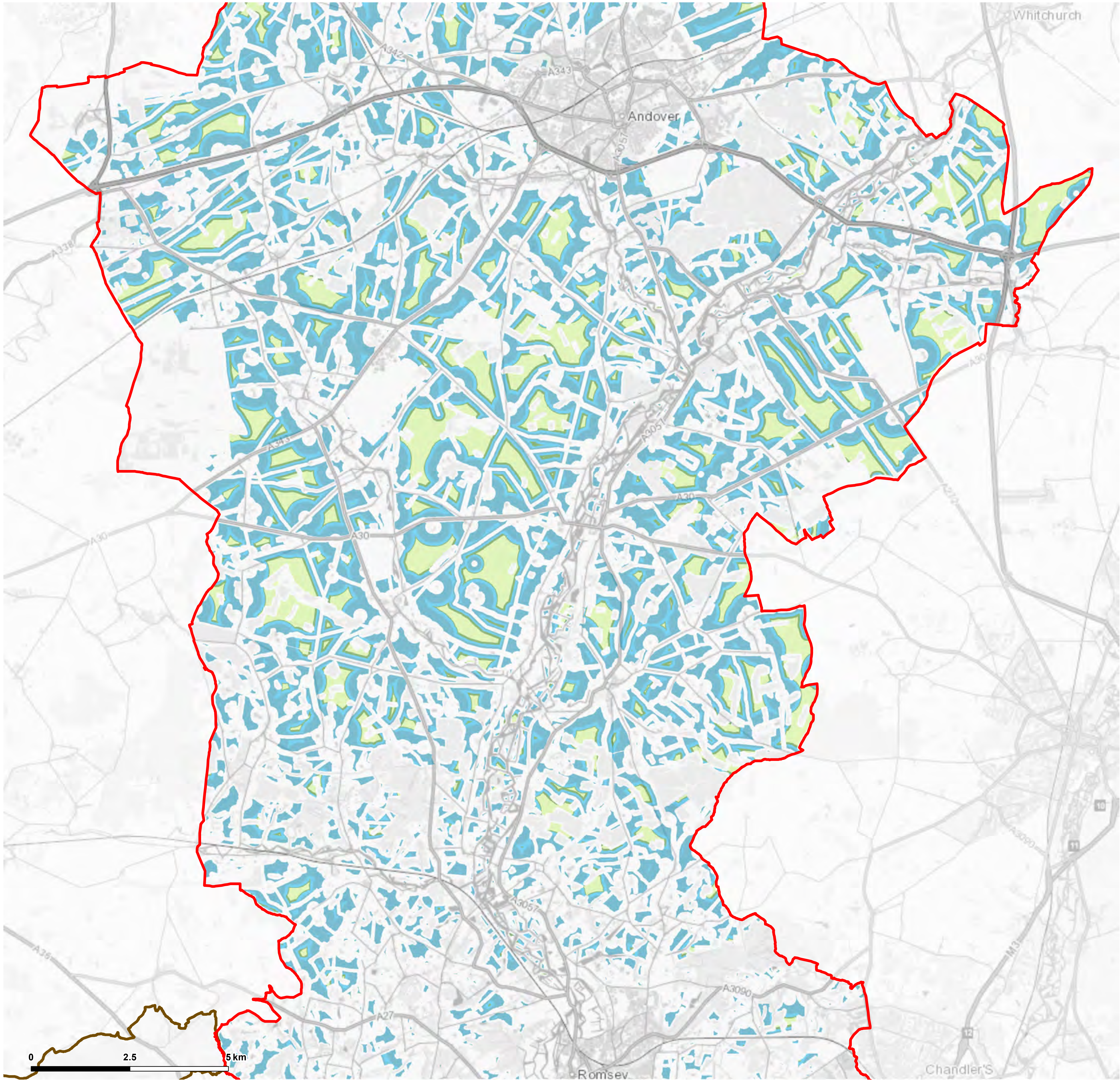
Test Valley Borough Council boundary
Small turbines only
Small to medium turbines only
Small to large turbines only
All turbine scales

Map scale
1:100,000 @ A3

CB:BP EB:Packham_B LUC FigB9a_10953_r0_Opportunities_for_Wind_Development_All_Scales 08/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-6b: Opportunities for Wind Development All Scales (Central)



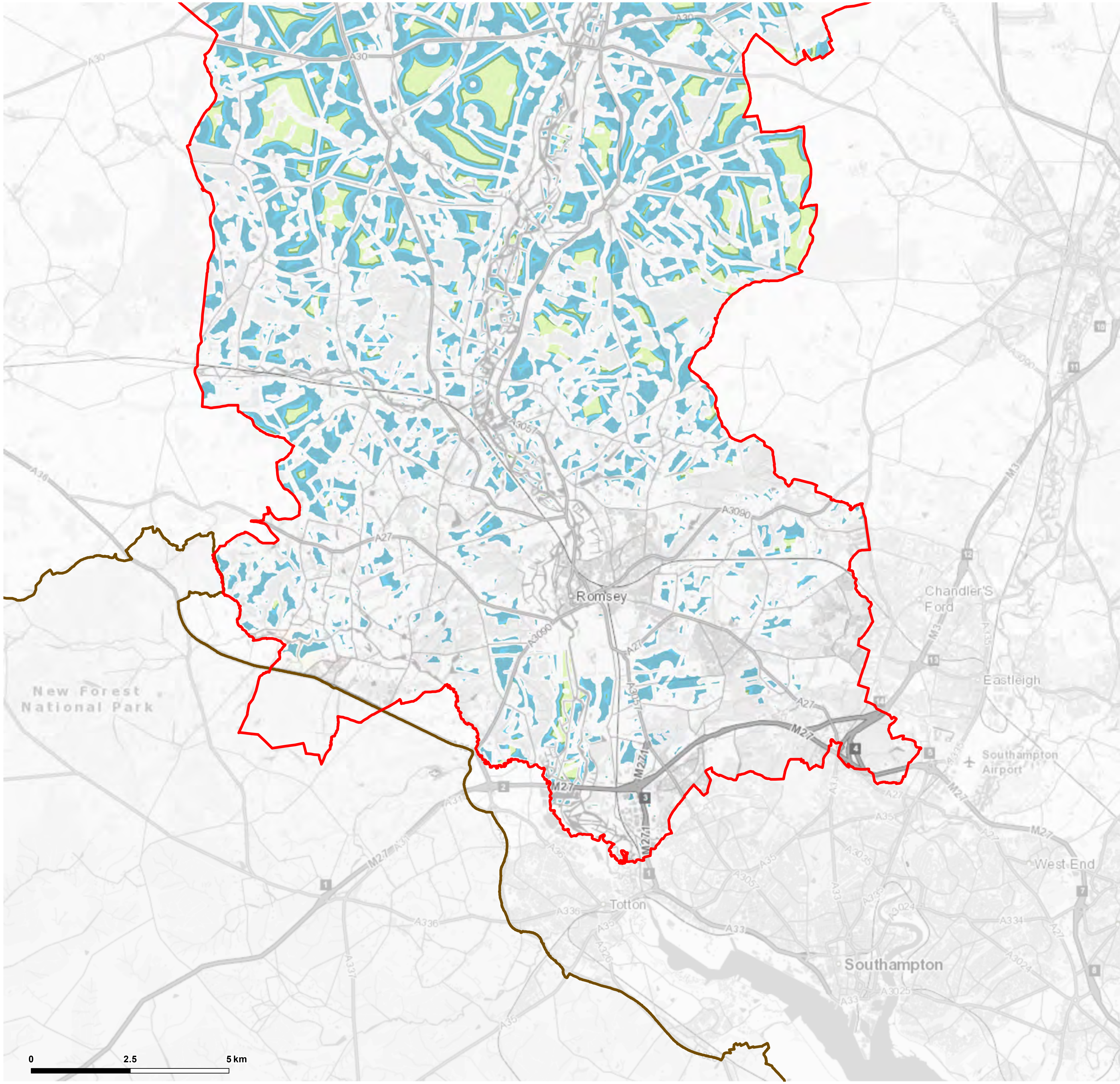
- Test Valley Borough Council boundary
- New Forest National Park
- Small turbines only
- Small to medium turbines only
- Small to large turbines only
- All turbine scales

Map scale
1:100,000 @ A3

CB:BP EB:Packham_B LUC FigB9a_10953_r0_Opportunities_for_Wind_Development_All_Scales 08/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure B-6c: Opportunities for Wind Development All Scales (South)



- Test Valley Borough Council boundary
- New Forest National Park
- Small turbines only
- Small to medium turbines only
- Small to large turbines only
- All turbine scales

Map scale
1:100,000 @ A3

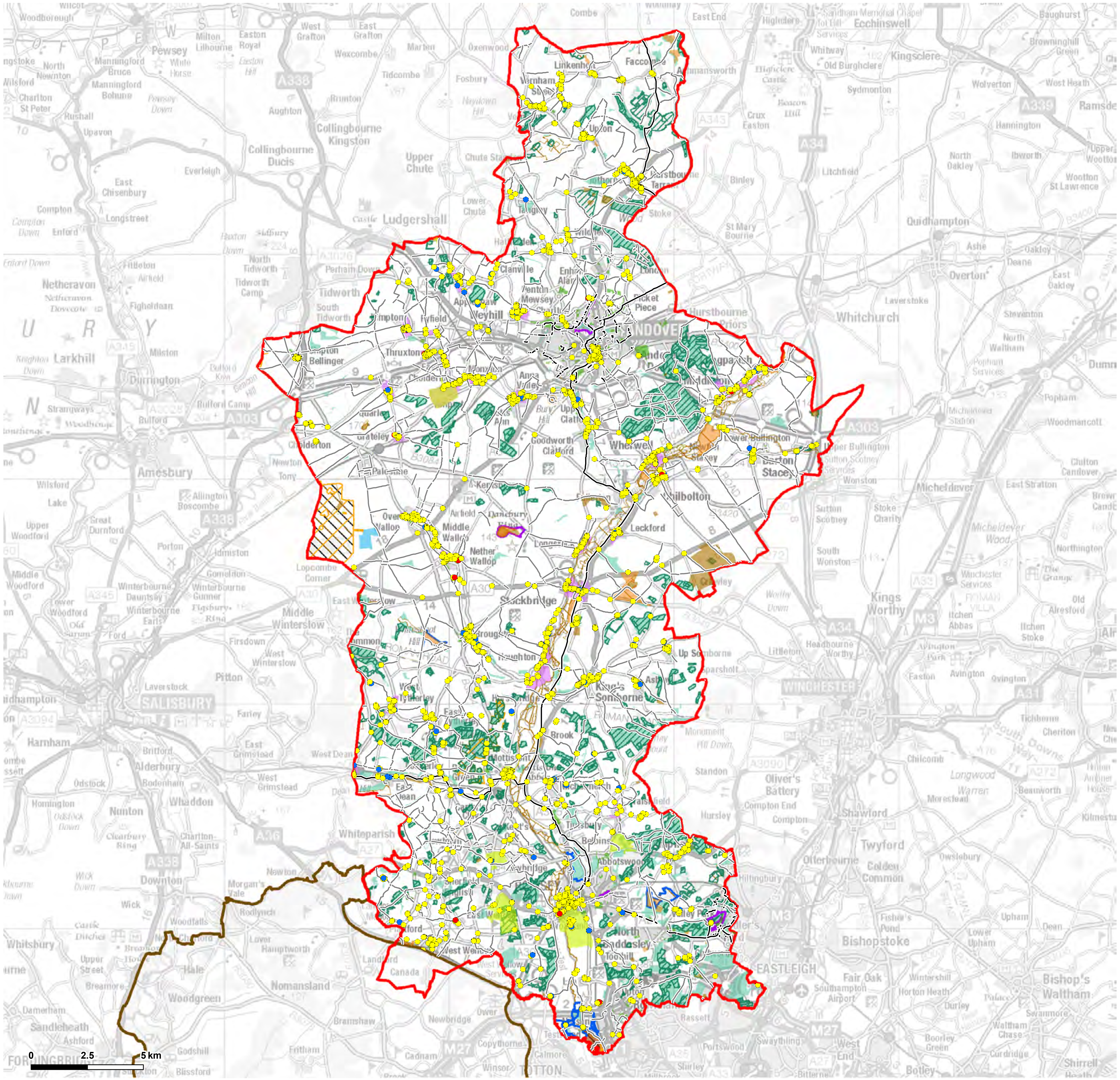
CB:BP EB:Packham_B LUC FigB9a_10953_r0_Opportunities_for_Wind_Development_All_Scales 08/10/2020
Source: Test Valley Borough Council

Appendix C

Ground-mounted solar PV maps

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure C-1: Solar Constraints - Natural Heritage, Cultural Heritage and Recreation



- Test Valley Borough Council boundary
- New Forest National Park

Natural Heritage

- Special Area of Conservation
- Special Protection Area
- Ramsar
- Site of Special Scientific Interest
- Ancient Woodland
- Local Nature Reserves
- Hampshire and Isle of Wight Wildlife Trust Reserves
- Site of Importance for Nature Conservation
- RSPB Reserves

Cultural Heritage

- Listed Building Grade I
- Listed Building Grade II*
- Listed Building Grade II
- Registered Parks and Gardens
- Conservation Area
- Scheduled Monument

Recreation

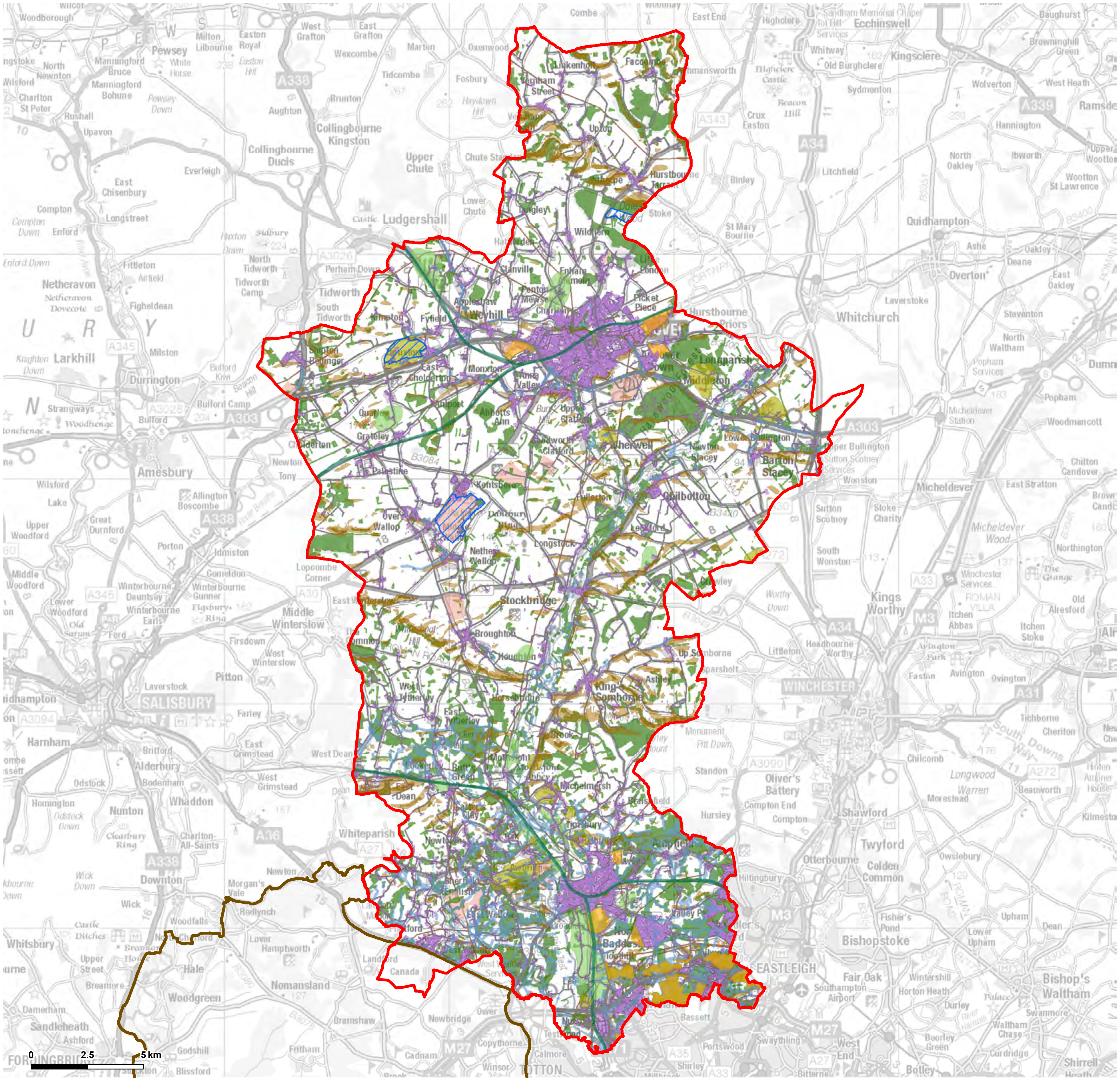
- Cycle Routes
- Public Rights of Way
- Open Access Land
- Green Space

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigC1_10953_r0_Solar_Natural_Cultural_Heritage_and_Recreation 10/12/2020
Source: Natural England, Test Valley Borough Council, Hampshire and Isle of Wight Wildlife Trust, RSPB, Historic England, Ordnance Survey

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure C-2: Solar Constraints - Physical, Landuse, Infrastructure



- Test Valley Borough Council boundary
- New Forest National Park
- Buildings with 20m Buffer
- Allocation sites
- Roads
- Railways
- Watercourses and Waterbodies
- Woodland and Forestry 20m Buffer
- Agricultural Land Classification Grade 1 and 2
- Operational and Allocated Minerals and Waste Sites with 250m Buffer
- Slope greater than 10° and Aspect NW to NE with slope greater than 3°
- Consented and Operational Renewable Energy projects
- Overhead Lines 2m Buffer
- Airfields and Airports

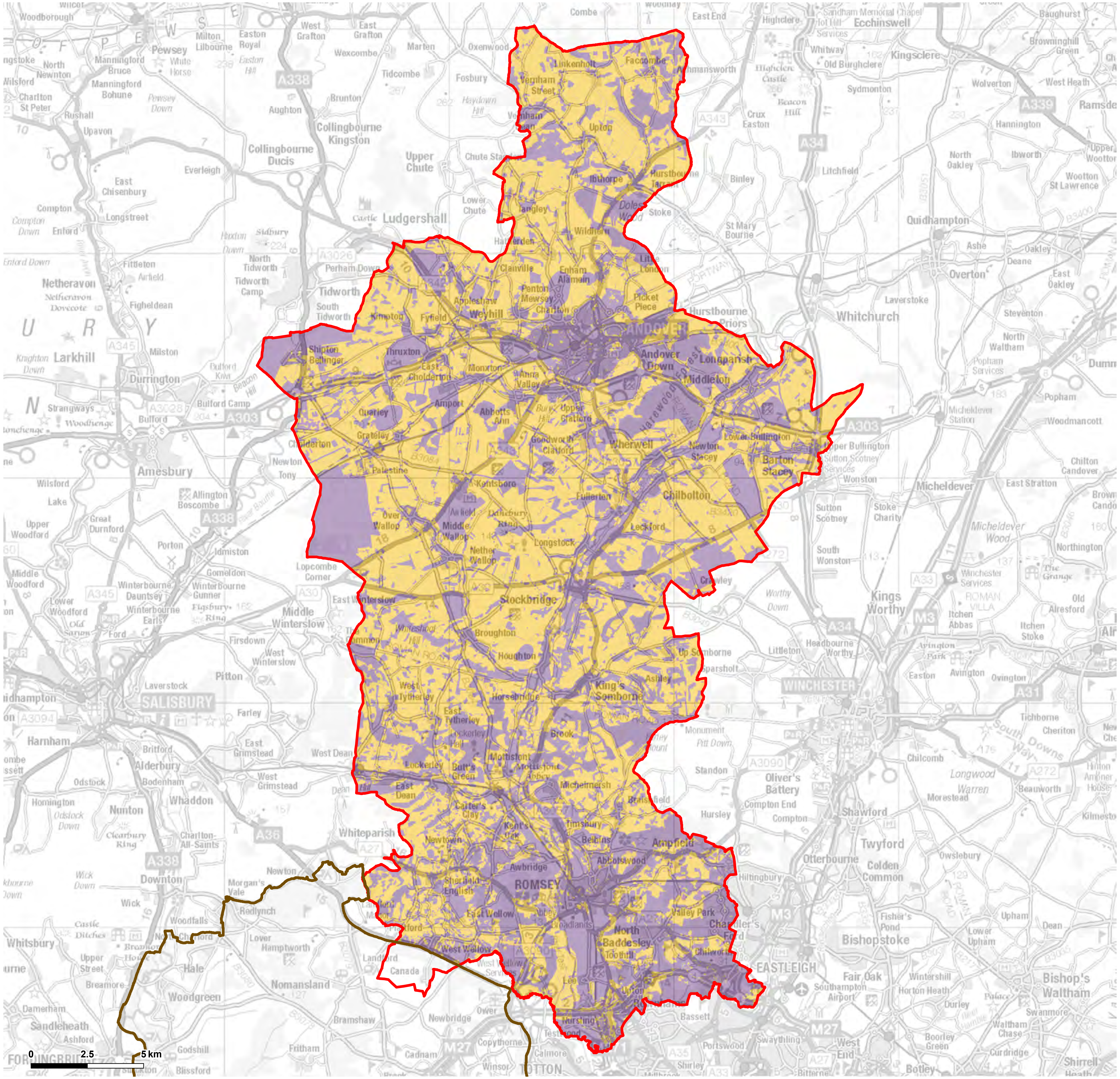
MOD land is not included within this map due to the sensitive nature of this information

Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigC2_10953_r0_Solar_Physical_Landuse_Infra 10/12/2020
Source: Natural England, Test Valley Borough Council, Hampshire and Isle of Wight Wildlife Trust, RSPB, Historic England, Ordnance Survey

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure C-3: Opportunities and Constraints: solar development



- Test Valley Borough Council boundary
- New Forest National Park
- Suitable areas for solar development
- Constrained area for solar development

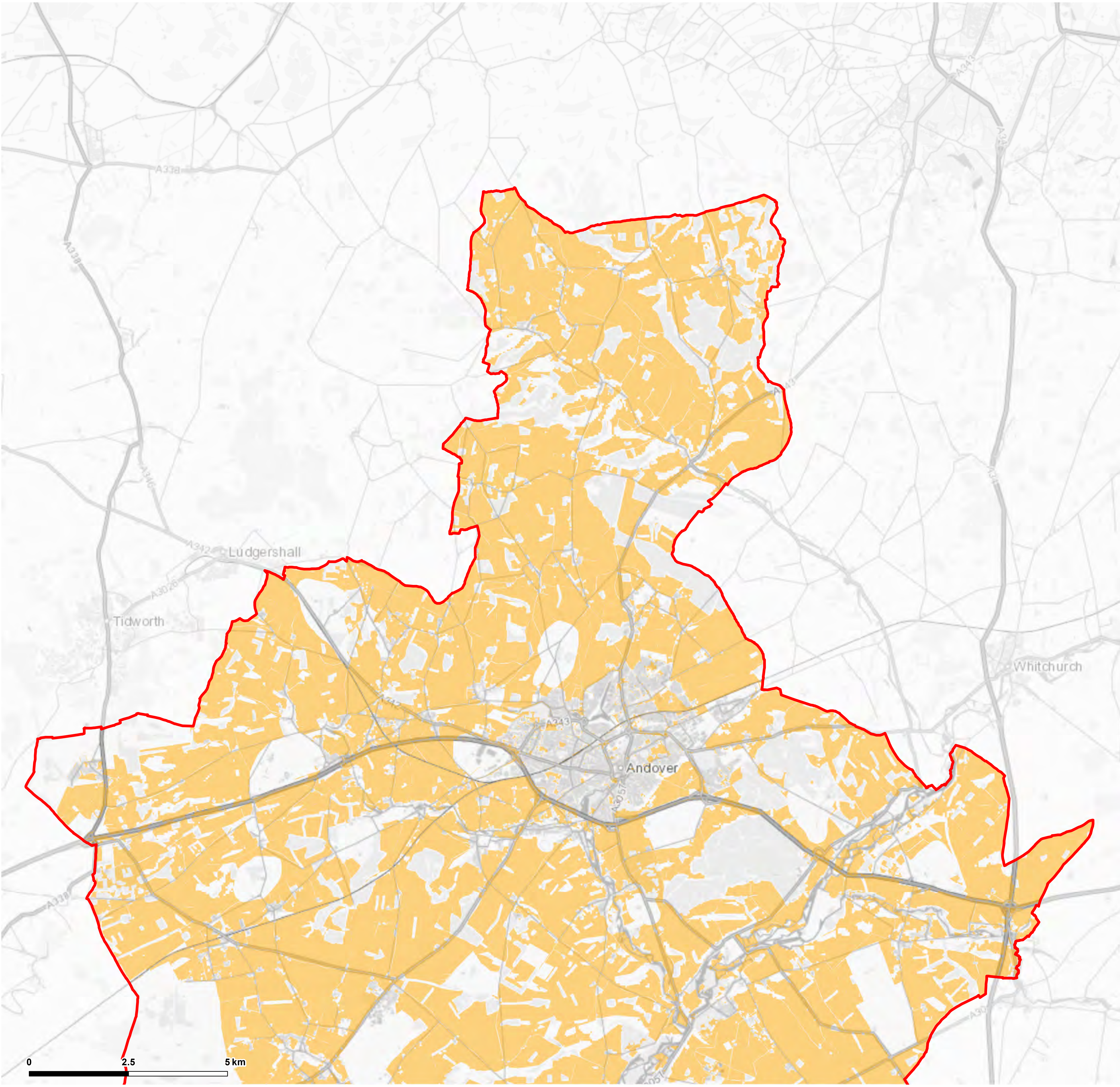
Map scale
1:175,000 @ A3

CB:BP EB:Packham_B LUC FigC3_10953_r0_Opportunities_and_Constraints_Solar 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure C-4a: Opportunities for Solar Development (North)

Test Valley Borough Council boundary
Areas of potential for solar development

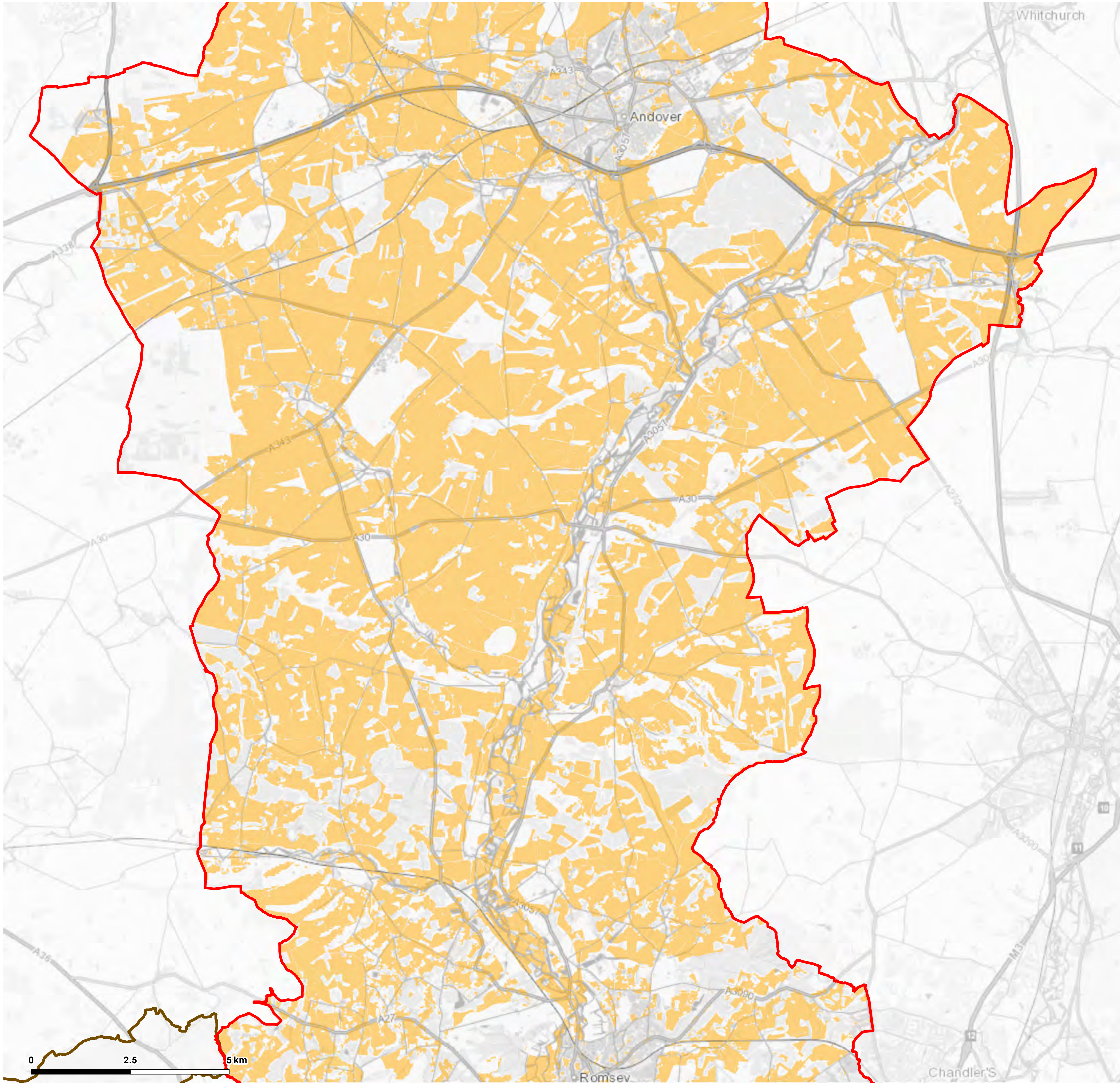


Map scale
1:100,000 @ A3

CB:BP EB:Packham_B LUC FigC4_10953_r0_Opportunities_for_Solar_Developmen 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure C-4b: Opportunities for Solar Development (Central)



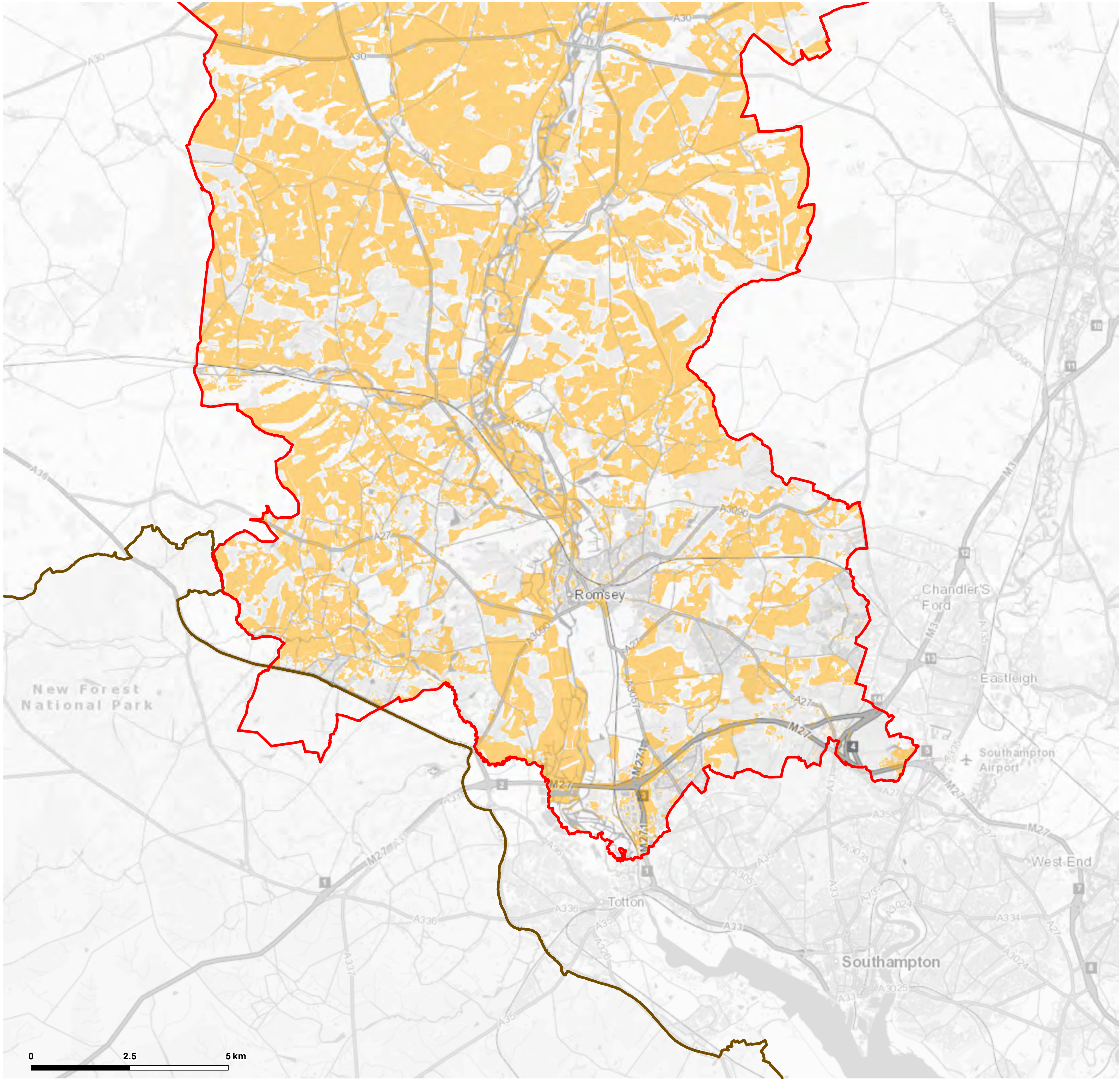
Test Valley Borough Council boundary
New Forest National Park
Areas of potential for solar development

Map scale
1:100,000 @ A3

CB:BP EB:Packham_B LUC FigC4_10953_r0_Opportunities_for_Solar_Developmen 07/10/2020
Source: Test Valley Borough Council

Renewable and Low Carbon Energy Study
Test Valley Borough Council

Figure C-4c: Opportunities for Solar Development (South)



CB:BP EB:Packham_B LUC FigC4_10953_r0_Opportunities_for_Solar_Developmen 07/10/2020
Source: Test Valley Borough Council

Appendix D
Data Index

The table overleaf lists the data and data sources used within this study.

GIS layer	Source	Notes
Study boundary	OS Boundaries	
Land Registry parcels	Land Registry (Inspire)	To identify land boundaries containing consented and operational renewable energy installations
Base maps		
Ordnance Survey Mastermap	Test Valley Borough Council	
Ordnance Survey Vector Map Local	Test Valley Borough Council	
Ordnance Survey 25K	Test Valley Borough Council	
OS Terrain 50	Ordnance Survey	
Local authority boundaries	OS Boundaries	OS Boundary Line dataset
Aerial imagery	ESRI	
Ordnance Survey Vector Map District	Ordnance Survey	
Ordnance Survey 1:250k	Ordnance Survey	
Landscape		
Landscape character types / areas	Test Valley Borough Council	
Areas of Outstanding Natural Beauty	Natural England	
Agricultural Land Classifications	Natural England	
National Parks	Natural England	New Forest excluded from study area
Hydrology		
Watercourses / bodies	Ordnance Survey	OS Rivers and OS VectorMap District

GIS layer	Source	Notes
		OS Survey VectorMap District surface water data includes waterways of approximately a minimum of 2m width. OS Rivers data is line data, and so a 1m buffer was applied to approximate a footprint of smaller waterways.
Historic Environment[129]		
Conservation areas	Test Valley Borough Council	
Listed buildings Polygons	Test Valley Borough Council	
Registered parks and gardens	Historic England	
Scheduled monuments	Historic England	
Ecological Environment		
Sites of Importance for Nature Conservation (SINCs)	Test Valley Borough Council	
Hampshire and Isle of Wight Wildlife Trust Reserves	Test Valley Borough Council/Hampshire and Isle of Wight Wildlife Trust	
Local Nature Reserves (LNR)	Natural England	
Special Areas of Conservation (SAC)[130]	Natural England	
Special Areas of Conservation (SAC) Bat foraging zone	Test Valley Borough Council	LUC has information relating to the bat foraging zone associated with the Mottisfont bat SAC. On the basis of this information, it was concluded that site-specific bat surveys for development may result in the identification of unacceptable impacts on the SAC population in individual cases, but that it is not appropriate to apply the foraging zone as an unconditional constraint to all wind development in this area for the purposes of the present assessment. As in relation to wind, it was not considered appropriate to exclude the foraging zone associated with the Mottisfont bat SAC from the assessment of solar potential an absolute constraint. TVBC confirmed that solar schemes have already been granted permission within this zone.

[129] There are no World Heritage Sites or Registered Battlefields located within Test Valley Borough.
[130] There are no candidate SACs within Test Valley Borough.

GIS layer	Source	Notes
Special Protection Areas (SPA)[131]	Natural England	
Ramsar sites	Natural England	
Sites of Special Scientific Interest (SSSI)	Natural England	
RSPB reserves	RSPB	
Ancient Woodland Inventory (AWI)	Natural England	
National Forest Inventory (NFI)	Forestry Commission	Any data classed as 'Non-Woodland' under 'Category' field removed
Access and Recreation[132]		
Local cycle routes	Test Valley Borough Council	Buffered by 3m to form polygon
Public Rights of Way (PRoW)	Test Valley Borough Council	Buffered by 3m to form polygon
Public Open Space	Test Valley Borough Council	TVBC Public Open Space Audit: all supplied data categories of 'Allotments', 'Children and Teenagers', 'Informal', 'Outdoor Sports' and 'Parks and Public Gardens'
Green Space OS	OS	This was combined with TVBC data and use to check against it. OS Green Space: 'Cemetery' and 'Religious Grounds' data categories
National and Regional Cycle Routes	Sustrans	Buffered by 3m to form polygon
Common Land	Natural England	
Planning		
Planning permissions and live planning applications for one or more new dwellings or non-residential buildings	Test Valley Borough Council	Planning permissions from January 2015 to June 2020. Live planning applications as at August 2020.

[131] There are no potential SPAs within Test Valley Borough.
[132] There are no National Trails located within Test Valley Borough.

GIS layer	Source	Notes
Site allocations	Test Valley Borough Council	Strategic site allocations from adopted Test Valley Local Plan (2016).
Infrastructure		
Local land and property gazetteer	Test Valley Borough Council	Residential and commercial classes defined
Allocated Minerals and Waste Sites	Test Valley Borough Council/Hampshire County Council	It was agreed with TVBC that there are in fact no relevant waste allocation sites to include in the assessment, as Squabb Wood landfill site will be restored for the majority of the Local Plan period.
Operational Mineral and Waste Sites	Test Valley Borough Council/Hampshire County Council	Categories are: ▪ Active with planning permission or a certificate of lawful use ▪ Aftercare (active) ▪ In Aftercare ▪ In Restoration (active) ▪ Inactive with planning permission or a certificate of lawful use ▪ Lapsed permission ▪ Planning Application ▪ Site completed/restored/permission expired
Renewable Energy Developments (operational and consented)	Test Valley Borough Council/BEIS	Data from 2010 until present, categorized by technology and application status. Data includes all applications, not just consented/operational. Data use for assessment: ▪ Join by location to Inspire land registry polygons.
MOD Land	Test Valley Borough Council/OS Mapping	MOD land is not included within mapping of individual constraints due to the sensitive nature of this information
Transmission lines	Ordnance Survey/National Grid	OS Vector Mapping
Airports and Airfields	Ordnance Survey	Extracted from OS VectorMap Local Functional Site layer with the theme ‘Air Transport’

GIS layer	Source	Notes
Buildings	Ordnance Survey	OS OpenMap Local for buildings adjacent to the Test Valley Borough Boundary and (for solar) buildings within Test Valley Borough Boundary
Railways	Ordnance Survey	OS VectorMap District dataset Buffered by 15m to form polygon
Road network	Ordnance Survey	OS VectorMap District dataset Unique values separated by Form of Way field and buffered to form polygon: ■ Single Carriageway with 10m buffer ■ Double Carriageway with 20m buffer ■ Motorway with 30m buffer
Renewable Energy Resource		
Wind Speed at 50m above ground level	Global Wind Atlas/Vortex	The majority of Test Valley Borough Council meets and exceeds the minimum requirement of 5m/s.
Solar Irradiance	Global Solar Atlas	All of Test Valley considered suitable for Solar installations