AECOM

Renewable Energy Study

Solar PV and Wind Turbine Potential

Rutland County Council

Rev 4

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Quality information

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Abbreviations

Abbreviation	Definition
ALC	Agricultural Land Classification
BMV	Best and Most Versatile
BNG	Biodiversity Net Gain
BSP	Bulk Supply Point
DESNZ	Department for Energy Security and Net Zero
DFES	Distributed Future Energy Scenarios
DLUHC	Department for Levelling-Up, Housing and Communities
DNO	Distribution Network Operator
DPD	Development Plan Documents
GBI	Green and Blue Infrastructure
GHI	Global Horizontal Index
GIS	Geographic Information System
GWh	Gigawatt hours
ha	Hectare
Hz	Hertz
kV	Kilovolts
kWh/m²	Kilowatt-Hours per Square Meter
kWh/ha/yr	Kilowatt-Hours per Hectare per Year
LCA	Landscape Character Assessment
LNR	Local Nature Reserves
LNRS	Local Nature Recovery Strategies
LTDS	Long Term Development Statement
LWS	Local Wildlife Sites
m	Metres
m/s	Metres per Second
MW	Megawatt
MWh	Megawatt Hour
MWh/yr	Megawatt Hour per Year
MWp	Megawatt peak
MWp/Ha	Megawatt peak per Hectare
NDP	Network Development Plan
NGED	National Grid Electricity Distribution
NNR	National Nature Reserves
NPPF	National Planning Policy Framework
PV	Photovoltaics
POWER	Prediction of Worldwide Energy Resource
RA	Recreation Area
RAG	Red, Amber, Green
RCC	Rutland County Council

Abbreviation	Definition
RWA	Rutland Water Area
SAC	Special Areas of Conservation
SPA	Special Protection Areas
SPD	Supplementary Planning Document
SSSI	Sites of Special Scientific Interest
WTG	Wind Turbine Generator

Executive Summary

Rutland County Council (RCC) have formally acknowledged the climate crisis and, as part of their climate change action motion, committed to achieving 100% clean energy across their full range of functions by 2050 or earlier as well as considering other actions that could be implemented, such as renewable energy generation. To support this, AECOM were appointed to undertake an assessment to identify areas of opportunity for potential solar PV and wind turbine generator (WTG) developments, following a constraints-based approach and to provide an overview of planning policies relevant to the development of renewable energy infrastructure.

Various environmental constraints were identified across RCC, including the Rutland Water Ramsar Site and Special Sites of Scientific Interest (SSSI). Slope / terrain, Agricultural Land Classification (ALC), and historical constraints were also identified. For the purpose of this study, all environmental and historical constraints were avoided, development on Grade 1 and 2 ALC was ruled out, as were parcels of land with greater than 5-degree ground slope.

Renewable energy resource was identified on average to be between 994 and 1,008 kWh/m^2 for Global Horizontal Index and between 7.5 and 9.5 m/s for mean wind speed. The greatest opportunity identified from renewable energy was ground mounted solar PV. The combination of ground mounted solar PV, both within and outside of flood zones 2 and 3, could potentially produce an annual generation of c. 633 GWh. The second largest opportunity is from WTGs, with an annual generation potential of c. 598 GWh.

This study focusses on utility scale projects therefore the potential contribution from small-scale generators of these technology types, as well as other renewable energy sources (e.g., biomass, hydropower, geothermal), is likely to be significant, but their investigation was outside the scope of this study.

Generally, the electrical infrastructure surrounding RCC seems to be relatively unconstrained; however, the forecast generation headroom for these substations reduces as 2050 is approached. Early engagement with NGED is recommended to secure connections before available headroom is allocated.

There is sufficient capacity forecast between 2023 and 2027 to connect over 30 wind turbines, 270 hectares of ground mounted solar, or 140 hectares of carport PV to the 13 primary substations located inside of – and within 5km of – the RCC boundary.

It is recommended that RCC develop a renewable energy strategy to map out how the required energy can be deployed in the available timeframe. Individual opportunities should be further developed to determine which best align with RCC's aspirations.

1. Introduction

In January 2021, Rutland County Council (RCC) formally acknowledged the climate crisis and set out a series of actions to ensure Council activities are net zero by the year 2050[1].

RCC, as part of their climate change action motion, committed to achieving 100% clean energy across their full range of functions by 2050 or earlier as well as considering other actions that could be implemented, such as: renewable energy generation and storage, providing electric vehicle infrastructure, encouraging alternatives to fossil fuelled private car use, increasing the efficiency of buildings, tree planting on council land, addressing fuel poverty, proactively using local planning powers to accelerate the delivery of net carbon new developments and communities, coordinating a series of information and training events to raise awareness and share good practice[1].

To support the net zero carbon 2050 transition, RCC have instructed AECOM to quantify renewable energy potential within their boundary. This study is intended to help inform the RCC Local Plan, which is an opportunity to shape policies and roll out measures aimed at carbon reduction, while making sure the county is resilient to the effects of climate change and supporting RCC's wider climate crisis goals[2].

The aim of the study is to identify areas of opportunity for potential developments following a constraints-based approach and to provide an overview of planning policies relevant to the development of renewable energy infrastructure. Technologies investigated include solar photovoltaics (PV) and wind turbine generators (WTGs).

This study focusses on utility scale projects therefore the potential contribution from small-scale generators[3] of these technology types is excluded.

This study is desktop based; therefore, no site visits have been carried out to review the feasibility of any of the opportunities discussed.

1.1 Energy Consumption

Details of the energy consumption within the RCC are provided here to provide context to the estimated renewable generation yields.

In 2020, the total consumption of all fuels (including gas, electricity, coal, petroleum, bioenergy, manufactured fuels) in RCC equated to 2,727 GWh; of which 324 GWh was delivered as electrical power (see Figure 1-1). It can be assumed that electricity use will increase as sectors, such as heating and transport, are electrified. RCC will need to meet demand for this growth, for example, increased usage of electric vehicles will require more electrical power. To achieve 100% clean energy across the RCC's functions by 2050, electricity will need to be produced from renewable sources, such as wind and solar, rather than by natural gas and coal.

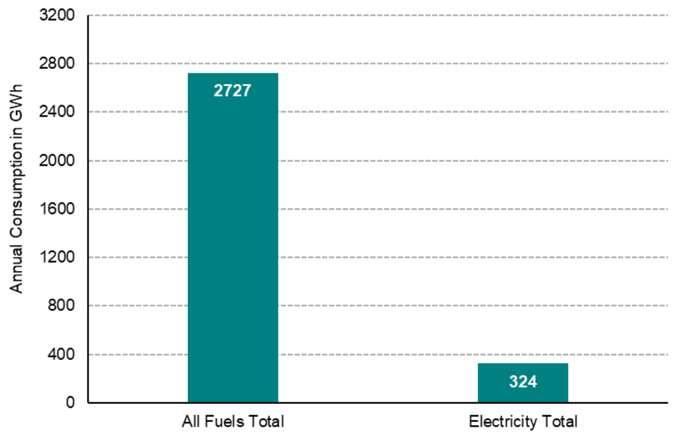


Figure 1-1. Rutland Total Fuel and Electricity Consumption, 2020[4]

[1] RCC, (n.d.) *Climate Change Action Motion*. Available at: https://rutlandcounty.moderngov.co.uk/documents/s16474/Draft%20Motion%20on%20Climate%20Change%20Final%20Draft.pdf
[2] RCC (2022) *Local Plan FAQs*. Available at: https://www.rutland.gov.uk/planning-building-control/local-plan/new-local-plan/local-plan-faqs
[3] Small-scale is defined as the generation of energy (heat and electricity) by individuals, small business and communities to meet their own needs.
[4] Department for Energy Security and Net Zero (DESNZ, 2022) *Total final energy consumption at regional and local authority level: 2005 to 2020*. Available at: https://www.gov.uk/government/statistics/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2020

1.2 Methodology

The renewable energy study was conducted in line with the steps set out in the following methodology:

1. Definition of mapping criteria used to build the GIS model.
    - The GIS model was developed using Esri ArcGIS desktop. Datasets were compiled into a file geodatabase, supplied with appropriate metadata from Global Solar Atlas[5] and Global Wind Atlas[6]. Layers of spatial data include:
        - Planning and environmental constraints;
        - Existing infrastructure (buildings, roads, overhead power lines, railways etc.);
        - Watercourses and flood risk;
        - Topography;
        - Mean wind speed; and
        - Irradiance as Global Horizontal Index (GHI).
2. The GIS model was then used to identify areas of constraint and allowed for a high-level measurement of land areas with opportunity for development of solar PV or WTGs.
3. A high-level assessment of generation capacity was carried out for the land areas identified in step 2. Solar PV yield was calculated using PV GIS software and wind energy yield was simulated using HOMER software.

    Publicly available data was used to assess the available generation capacity ("generation headroom") and fault level capacity at each primary substation and BSP[7].

    Each primary substation or BSP was assessed to determine if it was a suitable point of connection for connection of embedded generation. The number of wind turbines or hectares of PV a primary substation or BSP could supply was used for Red, Amber Green (RAG) analysis:

    - Forecast headroom does not allow for the connection of any wind turbines or can support less than 10 hectares of PV in 2023 with all headroom used prior to 2050 – Red.
    - There is headroom available to connect both wind turbines and more than 10 hectares of PV in 2023; however, all headroom is used up prior to 2050 – Amber.
    - There is sufficient headroom to connect both the wind turbines and there is available headroom to connect PV until 2050 – Green.

    RAG analysis for fault level at each substation and BSP was conducted based on the current fault level headroom.

    - More than 100% of fault level headroom used – Red.
    - Between 50-100% of fault level headroom used – Amber.
    - <50% of fault level headroom used – Green.

    The following acceptance criteria was followed:

    - Only existing substations inside of – and within 5km of – the Rutland County Council boundary were considered as potential points of connection.
    - The connection voltage for embedded generation was 11kV or 33kV.
    - RAG analysis was assessed assuming 50% and 100% utilisation of available headroom.

The methodology above identified the opportunities for renewable energy in the RCC area and provided the estimation of their scale in terms of capacity and energy yield.

A high-level planning and policy review was also undertaken to understand the relevant national and local planning policies relevant to renewable energy infrastructure development.

[5] Global Solar Atlas (n.d.) Map and data downloads. Available at: https://globalsolaratlas.info/download
[6] Global Wind Atlas (n.d.) GIS files & API access. Available at: https://globalwindatlas.info/en/download/gis-files
[7] National Grid Electricity Distribution (2023) *Network capacity map*. Available at: https://www.nationalgrid.co.uk/our-network/network-capacity-map-application

2. Planning Policy Context

A review of national and local planning policies relevant to renewable energy infrastructure development was undertaken to feed into the constraints mapping process.

A summary of the policies reviewed is provided below for context and information purposes. Not all of the policies reviewed are relevant for this early feasibility stage of analysis. However, should RCC progress any opportunities, these policies may have significant impact on the site at a later stage of development.

2.1 National Planning Policy

The National Planning Policy Framework[8] (NPPF), published in March 2012 and updated in July 2021, states that local planning authorities should design their policies to maximise renewable and low carbon energy development, while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts.

The NPPF also states that local planning authorities should follow the approach set out in the National Policy Statement for Renewable Energy Infrastructure EN-3[9], published in July 2011, along with the Overarching Statement for Energy Infrastructure EN-1[10], also published in July 2011. This approach looks at assessing the likely impacts of potential wind energy developments, in identifying suitable areas and in determining planning applications for such development.

At the time of writing, the Department for Energy Security and Net Zero (DESNZ) is consulting on a suite of draft national policy statements for new energy infrastructure, which includes a revised EN-1 and EN-3 that will include specific policies relating to solar PV and battery storage. However, these remain in draft and are not yet adopted policy.

In the Net Zero Strategy[11], published in October 2021, government committed to action so that all our electricity will come from low carbon sources by 2035, subject to security of supply, whilst meeting a 40- 60% increase in demand. This document is supported by Powering Up Britain: The Net Zero Growth Plan[12], published in March 2023.

2.2 Local Planning Policy

The Adopted Local Plan sets out the planning policies for RCC up to 2026. The adopted Local Plan is made up of three development plan documents (DPD):

- The Core Strategy Development Plan Document (DPD), adopted in July 2011;
- The Site Allocations and Policies DPD, adopted in October 2014; and
- The Minerals Core Strategy and Development Control Policies DPD, adopted in October 2010.

Core Strategy Policy CS20 (Energy efficiency and low carbon energy developments) sets out the overall approach to wind turbines and other low carbon energy generating developments in Rutland. These will be supported where environmental, economic, and social impacts can be addressed satisfactorily, and where they address the following issues:

- Landscape and visual impact, informed by the Rutland Landscape Character Assessment (LCA) and the Rutland Historic LCA;
- Effects on the natural and cultural environment including any potential impacts on the internationally designated nature conservation area of Rutland Water;
- Effects on the built environment, public and residential amenity, including noise intrusion;
- The number and size of wind turbines and their cumulative impact; and

[8] Department for Levelling Up, Housing and Communities (DLUHC, 2021), *National Planning Policy Framework*, Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf
[9] DESNZ (2011*), National Policy Statement for Renewable Energy Infrastructure (EN-3)*, Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment__data/file/37048/1940-nps-renewable-energy-en3.pdf
[10] DESNZ (2011), *Overarching National Policy Statement for Energy (EN-1),* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
[11] DESNZ (2021), *Net Zero Strategy: Build Back Greener*, Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf
[12] DESNZ (2023), *Powering Up Britain – The Net Zero Growth Plan*, Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147457/powering-up-britain-net-zero-growth-plan.pdf

- The contribution to national and international environmental objectives on climate change and national renewable energy targets.

Site Allocations and Polices DPD Policy SP18 (Wind turbines and low carbon energy developments) states that proposals for wind turbines and other low carbon energy developments will be supported where environmental, economic, and social impacts can be addressed satisfactorily, in accordance with Core Strategy Policy CS20 (Energy efficiency and low carbon energy developments). With regard to other low carbon energy generating developments, proposals will be supported where they are found acceptable in terms of:

- Impact on residential amenity;
- Landscape and visual effects;
- The natural environment;
- The historic and cultural environment;
- Noise;
- Emissions to ground, watercourses and air;
- Odour;
- Vehicular access and traffic;
- Proximity of generating plants to the renewable energy source;
- Grid connection;
- Form and siting;
- Mitigation; and
- The decommissioning of the development and reinstatement of land at the end of its operational life.

Site Allocations and Polices DPD Policy SP7 (Non-residential development in the countryside), clause (c) states sustainable development in the countryside will be supported where essential investment in infrastructure including utilities, renewable energy, and roadside services is required for public safety purposes.

2.3 Evidence Base Documents

In November 2012, RCC published a Supplementary Planning Document (SPD) for WTGs developments[13]. This document and the Landscape Sensitivity and Capacity Study for WTGs is to be used by Planning Officers at RCC to inform planning policy development and enable them to make informed judgements on the suitability of WTGs. It will also be available to landowners, developers, applicants, and local interest groups to provide guidance on what is expected from planning applications and to identify areas and circumstances where WTGs are unlikely to be acceptable, due to potential landscape and visual impacts.

The Rutland LCA[14], published in May 2003, sets out what landscape character is and how it is assessed. It describes the five main landscape character types in the RCC area:

- High Rutland;
- The Welland Valley;
- The Vale of Catmose;
- Rutland Water Basin; and,
- The Rutland Plateau.

The report is intended to help RCC, and all other stakeholders involved in development, and land use change in the countryside.

The Landscape Sensitivity and Capacity Study[15], published in May 2010, contains detailed fieldwork on the edges of Oakham, Uppingham and Stamford has been undertaken to provide a finer grain of assessment than the county wide landscape character assessment undertaken in 2003. This was required to provide a greater level of understanding of the landscape and settlement character sensitivity of each of the specified sites.

The Landscape Review of the Rutland Water Area[16] (RWA), published in August 2019, provides more recent evidence to underpin the identification of the RWA and its boundaries, and the defined Recreation Areas (RAs)

[13] RCC (2012), *Wind Turbine Developments Supplementary Planning Document*, Available at: https://www.rutland.gov.uk/sites/default/files/2022-12/Wind%20Turbines%20SPD%20%282012%29.pdf
[14] RCC (2003), *Rutland Landscape Character Assessment*, Available at: https://www.rutland.gov.uk/sites/default/files/2022-09/Landscape%20Character%20Assessment%20of%20Rutland%20%282003%29.pdf
[15] David Tyldesley And Associates (2010), *Rutland County Council Landscape Sensitivity And Capacity Study,* Available at: https://www.rutland.gov.uk/sites/default/files/2022-09/Landscape%20Sensitivity%20and%20Capacity%20Study%20%28May%202010%29.pdf
[16] Bayou Bluenvironment Limited (2019), *Landscape Review of the Rutland Water Area*, Available at: https://www.rutland.gov.uk/sites/default/files/2022-10/ENV2%20-%20Landscape%20Review%20of%20Rutland%20Water%20Area%20%28Aug%202019%29.pdf

inset within it, as required by the NPPF. Section 3 of the report sets put the findings of a desk study review highlighting the landscape characteristics, features and special qualities of the RWA.

RCC is currently undertaking a review of the Adopted Local Plan for Rutland. The emerging Rutland Local Plan will replace the Adopted Local Plan.

The new Local Plan, which will cover the period up to 2041, will be the key planning policy document for Rutland and will guide decisions on the use and development of land. The proposed timetable is set out in the revised Local Development Scheme (April 2022). An 'Issues and Options' consultation will be undertaken in June 2022 (under Regulation 18 of the Local Plan Regulations). This will be followed by consultation on a 'Preferred Options' Local Plan (also under Regulation 18 of the Local Plan Regulations) during autumn 2023 and a statutory consultation on a Pre-submission Local Plan (under Regulation 19 of the Local Plan Regulations) in autumn 2024. The timetable will be kept under review, as the production of the Local Plan progresses. Further information is available on the Council's webpages[17].

2.4 Emerging Local Plan Evidence Base

The following documents are, at the time of writing, in draft stage and are yet to be published.

The upcoming RCC LCA updates the 2003 LCA, by considering several documents and other information. Appropriate landscape management objectives for each landscape type are described to conserve, enhance, restore and re-create landscape and settlement character. Areas and landscape features with significant landscape sensitivity to new developments, including renewable energy proposals, are identified, together with those considered to have the ability to absorb new developments. Paired with this is the Landscape Sensitivity Study, the purpose of which is to assist RCC in making an informed choice of suitable site allocations for housing, employment and renewable energy development in the emerging Rutland Local Plan.

The RCC Open Space Assessment, prepared by TEP, comprises an assessment of the quantity, accessibility, quality and value of open spaces within RCC and for each of its 15 constituent sub-areas. The report states there are 656 sites designated as open space, totalling 2438.99 hectares. Outdoor Sports Facilities accounts for 51.46% of the County's open space provision at 1255.11 ha. The total open space within the RCC area equates to 60.26 ha per 1,000 population.

The upcoming Biodiversity Study, prepared by Johns Associates Ltd, provides a robust evidence base for the preparation of biodiversity and natural environment policies and proposals in the new Local Plan as well as informing a diverse range of other policy requirements such as Biodiversity Net Gain (BNG) Local Nature Recovery Strategies (LNRS), Green Infrastructure and climate change.

The upcoming Green and Blue Infrastructure (GBI) Strategy will guide the protection, enhancement, creation, and maintenance of GBI across the county. The report states the county covers 39,375 ha of which 95% is GBI. RCC has a rural character with an undulating topography and the extensive Rutland Water (reservoir) is in the centre. Over 5% of the county is designated for international and national biodiversity and much of this is associated with Rutland Water. Agriculture is the predominant land use (over 75% of the county), with a woodland cover of about 7%.

[17] RCC (2023), *The New Local Plan*, Available at: https://www.rutland.gov.uk/planning-building-control/local-plan/new-local-plan

3. Constraints Overview

This section provides an overview of the RCC boundary area and the main limitations to developing renewable energy. Development of large-scale renewables generally requires extensive open land areas. All figures referenced with a prefix of "A" can be found in the Appendices.

Figure 6-2 , in Appendix A, highlights the main constraints on renewable energy development in the RCC area.

Environmental constraints that have been avoided within the RCC boundary include Local Wildlife Sites (LWS), Ancient Woodland, Country Parks, Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Priority Habitat, as shown in Figure 6-3. The main environmental constraints identified are summarised below:

- Rutland Water Ramsar site: A large, artificial freshwater reservoir which is home to a number of habitats. Rutland Water is also a SSSI and a SPA.
- There are numerous other SSSIs across the RCC area:
  - Burley and Rushpit Woods;
  - Greetham Meadows;
  - Clipsham Old Quarry;
  - Pickworth Great Wood;
  - Newell Wood;
  - Ryhall Pasture and Little Warren verges;
  - East Wood Great Casterton;
  - Tolethorpe Road Verges;
  - Bloody Oaks Quarry;
  - Tickencote Marsh;
  - Empingham Marshy Meadows;
  - Shacklewell Hollow;
  - Ketton Quarries;
  - North Luffenham Quarry;
  - Wing Water Treatment Works;
  - Seaton Meadows; Prior's Coppice; and
  - Eye Brook Reservoir, with half of the SSSI inside and half outside the RCC boundary.
- RCC is within a Nitrate Vulnerable Zone, from the River Welland.
- There are 28 Scheduled Monuments within the RCC area and numerous listed buildings ranging from Grade I to Grade II*.
- There are two Registered Parks and Gardens in the RCC area, Burley on the Hill and Exton Park.
- There are also areas of Ancient and Semi-natural Woodland throughout RCC which are protected.

Figure 6-4 shows flood zones within the RCC boundary. Flood zones were identified as a constraint, although it is technically possible to develop ground mounted solar PV and WTGs in flood zone areas with suitable engineering solutions. These areas are therefore included in this assessment as a soft constraint and their potential for installation of WTGs and solar PV are analysed separately to the other potential areas.

Figure 6-5 shows the Agricultural Land Classification (ALC) within the county. ALC uses a grading system to allow for assessment and comparison of the quality of agricultural land; it utilises a graded system from 1 to 5 with the best and most versatile (BMV) agricultural land graded 1 to 3a. It is typical to assume that development should generally avoid unnecessary loss of BMV land however, it is known that some sites on Grade 3 land have been granted permission for solar PV by other councils. Renewable energy development on Grade 1 and 2 was ruled out as part of this assessment.

Slope / terrain is the final constraint considered in this section of the report and can be seen in Figure 6-6. For ground mounted solar PV installations, the land should ideally be either flat or on a gentle south-facing slope. The slope of a site can impact the energy output of a site due to the shade cover from the surrounding, elevated solar panels or land; similar to the impact of surrounding trees. Land developers should seek large, open, flat pieces of land for their solar sites to avoid these impacts on energy production. In the event flat land is not available, land with a five-degree slope or less can be used for the site. When working with a sloped site, south facing rows of solar panels should be built for optimal energy production. Similarly, WTGs are tall, and their construction requires a sturdy and relatively flat terrain for a crane to be stable during construction and decommissioning. Generally, slopes below 10% (5.71 degrees) are acceptable to support access tracks to WTGs. Land where slope exceeded 5 degrees was deemed not suitable for development in this study.

It is noted that Mineral Safeguarding Areas (MSAs) have been identified within the RCC boundary.

Figure 6-12. Mineral resources are concentrated almost exclusively in the eastern half of the county and consist mainly of Lincolnshire Limestone and clays, including siliceous clay from the Rutland formation and fireclay. Some isolated pockets of glacial, sub-alluvial and river terrace sand and gravel deposits exist around the edge of the county, particularly in the Welland Valley. Control over built development within the safeguarding area is dealt with by Development Control Policy MDC10[18] which states:

"Planning Permission will not be granted for any form of development within the Mineral Safeguarding Area that is incompatible with safeguarding the mineral and significant infrastructure such as rail linked facilities unless: The applicant can demonstrate to the satisfaction of the Mineral Planning Authority that the mineral concerned is no longer of any value or potential value or that significant deposits of a similar quality exist elsewhere in the County; or The mineral can be extracted satisfactorily prior to the development taking place; or The incompatible development is of a temporary nature and can be completed and the site restored to a condition that does not inhibit extraction within the timescale that the mineral is likely to be needed; or There is an overriding need for the development; or The development is of a minor nature which would not inhibit extraction of the mineral resource; or The development is, or forms part of, a specific site allocation in the Development Plan."*

As part of this study, MSAs are highlighted and their potential limitations to any solar PV and WTG developments are noted however, for this assessment, they have not been considered a limiting constraint.

3.1 Renewable Resource Overview

By reviewing the solar and wind resource maps, it is clear that the RCC area has potential renewable energy resource. Figure 6-7 illustrates that Global Horizontal Irradiance (GHI) (the total solar radiation on a horizontal surface) is varied across the RCC area which is an important factor when analysing the potential energy generation from solar PV.

There is a decreasing trend in annual insolation from east to west within the RCC boundary. The minimum annual insolation is 994 kWh/m², which is identified in the area surrounding Rutland Water and to the western edge of the RCC boundary, near Belton-in-Rutland. The area to the east of Rutland Water experiences higher annual insolation and exceeds 1,000 kWh/m² in most areas and the maximum annual insolation is 1,008 kWh/m^2. It should be clarified that these values assume no shading objects. For comparison, Sheffield is the town deemed to represent the average solar resource in the UK with approximately 950 kWh/m² thus the RCC area has a comparably high GHI.

Figure 6-8 shows the mean wind speed at 100 m above ground across RCC. A height of 100 m is used as this represents the typical hub height of large onshore WTGs. Mean wind speed across the RCC area varies between 7.7 m/s and 9.5 m/s; as a general rule, 6 m/s is a minimum requirement for economically viable WTG development. The greater wind speed per m/s is found in areas to the west of RCC and centrally around Rutland Water, due to the areas of slightly elevated position. Areas to the east receive lower wind speeds between 7 and 8.5 m/s on average. Wind speeds in areas selected for analysis in this study are between 8.5 and 9.5 m/s.

[18] RCC (2010) Local Development Framework. Minerals Core Strategy & Development Control Policies. Available at: https://www.rutland.gov.uk/sites/default/files/2022-10/LP14%20-%20Minerals%20Core%20Strategy%20and%20Development%20Control%20Policies%20DPD%20%28October%202010%29.pdf

4. The Renewable Energy Technology Type

Within the scope of this study the renewable energy technologies include solar PV and WTGs. Options investigated are tailored specifically to the opportunities within the RCC boundary and include ground mounted solar PV, car-port solar PV, and horizontal axis wind turbines.

4.1 Ground Mounted Solar PV

To develop ground mounted solar PV installations, typically large areas of relatively flat open land is required, with few obstructions from trees and structures. PV modules are attached to array tables which are fixed to the ground either with a screw or pile foundation, or ballast where ground conditions do not allow the former option. The layout can be tailored to maximise capacity from individual shapes of land parcels and the approach is modular so can be scaled to almost any size. A clear and preferably short route should be available to connect the solar PV plant either to the grid or to a local off-taker such as a hospital or industrial site.

4.1.1 Potential Ground Mounted Solar PV Locations

The majority of open land areas within the RCC boundary are constrained by flood zones, environmental designations, or by slope. A maximum slope of 5 degrees has been assumed for this study. Figure 6-9 shows the locations with solar PV potential within the RCC area that are not constrained by these factors.

Technically, it is possible to develop ground mounted solar PV in flood zone areas with suitable engineering solutions. Array tables can be sited on higher mounting structures and electrical equipment and connections raised and designed with appropriate water ingress protection. However, there are potential planning issues around rainwater runoff and ecology. Assuming that these engineering and planning challenges can be overcome, the area available for potential ground mounted solar PV would increase. Figure 6-10 shows the potential opportunities in RCC area for solar PV which are in flood zone 2 and 3 areas.

4.1.2 Estimated Ground Mounted Solar PV Generation

Generation potential for ground mounted solar PV has been broken down into areas that are outside a flood zone and within flood zone 2 and 3.

Ground Mounted Solar PV
Table 4-1 shows that the total size of the 53 areas identified in Figure 6-9 is 1,622 Ha. Assuming a solar PV density of 0.5 MWp/Ha and a land usability factor of 0.8; to account for hedgerows and shading, the estimated solar PV capacity is 649 MWp.

Table 4-1. Generation potential from ground mounted solar PV

Total Area (Ha)	Capacity (MWp)	Year 1 yield (MWh)	Yield estimates over 30-year lifespan (MWh)
1,622	649	632,624	17,917,967

The year one yield was simulated in PV GIS which results in an expected annual generation of approximately 633 GWh. The average house in the UK uses approximately 2.9 MWh/yr[19], therefore the solar PV can generate energy for around 218,146 houses per year. Lifetime yields includes expected module degradation over a 30-year period.

Inside Flood Zone
In Table 4-2, we can see that the area with potential for solar PV development inside the flood zone area is 195 Ha. This includes all areas highlighted in Figure 6-10. The total potential solar PV capacity within this area is 78 MWp, which has a simulated year 1 yield of approximately 76 GWh. This can generate energy for 26,206 houses per year.

Table 4-2. Generation potential from ground mounted Solar PV inside Flood Zone

Total Area (Ha)	Capacity (MWp)	Year 1 yield (MWh)	Yield estimates over 30-year lifespan (MWh)
195	78	75,896	2,149,609

[19]Skills Training Group (n.d.), *Average Annual Electricity Usage per Household UK: Essential Facts and Insights*, Available at: https://www.skillstg.co.uk/blog/average-annual-electricity-usage-per-household-uk-essential-facts-and-insights/#:~:text=According%20to%20Ofgem%2C%20the%20typical,significantly%20impact%20total%20energy%20consumption.

The following assumptions were made in the calculating generation potential from ground mounted solar PV:

- 0.4% annual degradation of solar PV modules.
- No shading losses were calculated.
- 0.5 MW solar PV capacity / hectare.
- 14% system energy losses (due to cell temperature rise, electrical losses).
- 20% reduction on deployable land / hectares.
- 30 year expected system lifespan.
- For the purpose of this report, a generic specific yield of 975 MWh/MWp for the RCC area was used.

4.2 Solar PV Carport

A solar PV carport is a shelter for one or more vehicles that incorporates solar PV modules. The roof cover material of these structures consists of solar PV modules (if integrated), mounted onto steel or wooden structures as seen in Figure 4-1. Wood has the advantage of being a lower embodied carbon building material than steel (depending on lifecycle), although this type of frame is more commonly seen in smaller installations. The foundations tend to be screw piles, concrete piles or concrete pads. Solar PV carports are a more costly method for installing solar PV, but on balance with the constraints within the RCC boundary, it may be a good opportunity to utilise additional land in these areas as well as installing generation near to demand.

Figure 4-1. Example of a solar PV carport with steel support structure

4.2.1 Potential Solar PV Carport Locations

Car park size and location data was provided by RCC. AECOM understands that this data may not be exhaustive of all car parks in the RCC boundary. RCC have some direct control over 14 council owned car parks, increasing the potential renewable capacity of this type.

4.2.2 Estimated Solar PV Carport Generation

Table 4-3 shows that estimated total solar PV carport capacity of the car parks provided by RCC. Within these car parks there is the potential for 2.1 MWp of carport PV capacity, with estimated total annual generation of 1,905 MWh.

Table 4-3. Generation potential from solar PV carport

Car Park Area (Ha)	Capacity (MWp)	Year 1 yield (MWh)	Yield estimates over 30-year lifespan (MWh)
2.2	2.1	1,905	53,961

The following assumptions were made in calculating generation potential from carport PV:

- 25-degree inclination of solar PV modules.
- 45-degree average orientation of solar PV modules.
- 0.4% annual degradation of solar PV modules.
- No shading losses were calculated.
- 950 kWp installed per hectare.
- 14% system energy losses.
- 30 year expected system lifespan.

It should be noted that while the density of installed capacity (kWp/ha) of solar PV can be higher than that of ground mounted, the generation density (kWh/ha/yr) of carports is likely to be lower due to higher shading losses, limitations on orientation (relative to the south) and sub-optimal tilt angles.

4.3 Wind Turbine Generators

WTGs exist in various forms and sizes. The two main types are horizontal axis and vertical axis wind turbines, both of which can be installed at the domestic and commercial levels, or at grid-scale. The assessment of potential from domestic and commercial sites is outside the scope of this study, instead the focus is on large grid-scale deployment of horizontal axis WTGs, illustrated in Figure 4-2. This turbine type is preferable due to higher energy conversion efficiencies.

Figure 4-2. Example of a wind farm consisting of horizontal axis wind turbines

For development of WTGs and for the benefit of maximising wind potential, land should ideally be flat or elevated terrain and free from obstructions to the wind flow. Obstructions cause the wind flow to become turbulent which increases the wear on equipment. The main adverse effect on local residents is the sound created by air passing over the turbine blades. Therefore, the following constraints have also been considered for WTGs, in addition to the previous constraints.

Residential Buffer

"Practice Guidance – Planning Implications of Renewable and Low Carbon Energy" (2013)[20] indicates that careful consideration of the siting and layout design of individual turbines / wind farms is important to ensure that increases in ambient noise levels around noise-sensitive development (i.e., residential properties) are kept to acceptable levels in relation to existing background noise. Effects from increases in noise levels can be minimised by ensuring that there is sufficient distance between the turbines and residential properties.

"The existing Wind Energy Development Guidelines"[21] published in 2006 do not have a prescribed setback distance but do indicate that a 500 m setback distance should be sufficient to prevent any significant noise impact arising from the operations of wind turbines.

The 2019 Draft Wind Energy Development Guidelines[22] propose a "visual amenity setback of 4 times the turbine height between a wind turbine and the nearest residential property, subject to a mandatory minimum distance of 500 metres".

For this study, a typical buffer of 500 m between WTGs and residential dwellings has been implemented to mitigate noise, amenity, and safety issues.

National Air Traffic Services (NATS) Consultation Zone

National Air Traffic Services (NATS) provide air traffic control services for flights in the UK. As wind turbines are at risk of communications interference, NATS must be consulted if a development is proposed within the consultation zone. A Consultation Zone of 10,000m for air-ground-air communications stations and navigation aids should be provided and 27,780 m for secondary surveillance radar[23].

At this stage of the assessment, the NATS Consultation Zone has been considered a soft constraint as it may restrict the tip height and location of the WTGs prior to more detailed assessments being undertaken. However, with the information currently available it is not considered to be a prevention of development. The airfields within the area would be a statutory consultee and would require engagement should WTGs be further explored in the Rutland Country area.

Slope

WTGs are tall, and their construction requires a sturdy and relatively flat terrain for a crane. Generally, slopes below 10% (5.71 degrees) are acceptable to support access tracks to WTGs. As part of this assessment, potential WTGs are identified on areas where slope at the proposed location and immediately adjacent was below 5 degrees. Access tracks were not considered at this stage.

Shadow Flicker

Shadow flicker is the effect of the sun (low on the horizon) shining through the rotating blades of a WTG, casting a moving shadow. It will be perceived as a "flicker" due to the rotating blades repeatedly casting the shadow. Although, in many cases shadow flicker occurs only a few hours in a year, it can potentially create a nuisance for homeowners in close proximity to turbines.

The magnitude of shadow flicker effects varies both spatially and temporally, and depends on a number of environmental conditions coinciding at a particular point in time, which include:

- time of day and year,
- wind direction (rotor orientation),
- height of wind turbine and blade length,
- position of the sun in the sky,
- weather conditions,

[20] Department for Communities and Local Government (2013) *Planning practise guidance for renewable and low carbon energy.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf

[21] Department of Housing, Local Government and Heritage (2006) *Wind Energy Development Guidelines*. Available at: https://www.gov.ie/en/publication/f449e-wind-energy-development-guidelines-2006/

[22] Department of Housing, Local Government and Heritage (2019) *Draft Wind Energy Development Guidelines*. Available at: https://www.gov.ie/en/publication/9d0f66-draft-revised-wind-energy-development-guidelines-december-2019/

[23] National Air Traffic Services (NATS) *Self-assessment maps*. Available at: https://www.nats.aero/services-products/catalogue/n/wind-farms-self-assessment-maps/#:~:text=For%20each%20of%20the%2054,nautical%20miles%20(nm)%20for%20the

- proportion of daylight hours in which the WTG operate,
- type and frequency of use of the affected space, and
- distance and direction of the wind turbine from the receptor.

There is no applicable legislation that directly deals with the assessment or control of shadow flicker. “Planning for Renewable Energy – A Companion Guide to PPS22 Office of the Deputy Prime Minister “(2004)[24] makes the following Statements:

- Shadow flicker only occurs inside buildings where the flicker appears through a narrow window opening.
- Only properties within 130 degrees either side of north of the turbines can be affected at UK latitudes.
- Shadow flicker has been proven to occur only within ten rotor diameters of a turbine position.
- Less than 5% of photo-sensitive epileptics are sensitive to the lowest frequencies of 2.5-3 Hz; the remainder being sensitive to higher frequencies.
- A fast-moving three-bladed wind turbine will give rise to the highest levels of flicker frequency of well below 2 Hz. The new generation of wind turbines is known to operate at levels below 1 Hz.

Computer models can accurately predict when, where, and to what degree this problem will occur, so wind project developers can mitigate this impact during the site selection process. However, this affect has not been looked at as part of this initial feasibility study.

4.3.1 Potential Wind Turbine Locations

Areas with the highest wind speeds in the RCC area are constrained by slope; a maximum slope of 5.0 degrees has been assumed for this study.

Figure 6-11 illustrates the locations in the RCC area which may be suitable for WTGs; the locations are marked by blue circles with a radius of 72.5 m each to demonstrate the rotor diameter of a Siemens 3.6 MW turbine (typical for the UK). For this study, a nominal minimum distance of 500 m has been kept between WTG locations to reduce yield loss from wake effects (blocking of wind flow by upstream WTGs). It is noted that for a Siemens 3.6 MW turbine that this distance may need to be increased to 720 m in the prevailing wind direction. Further analysis of topography and wind class will be required in a future study, to determine the exact separation distance to prevent ellipses from overlapping on a WTG-to-WTG basis. Proximity to electrical transmission lines is also kept to 300 m. The final separation distance from turbines to each other and other constraints will be determined by the final turbine size and prevailing wind direction.

4.3.2 Estimated Generation from Wind Turbines

Potential wind energy yield was simulated in the energy modelling software HOMER[25], which is used to simulate wind turbines to find the most optimal configuration and power output. HOMER software was used as it is the global standard for optimising microgrid design in all sectors.

For this exercise, a single Siemens 3.6 MW turbine with hub height of 100 m was selected. The wind climate and temperature were based on the NASA Prediction of Worldwide Energy Resource (POWER) database, monthly average wind speed at 50 m above earth’s surface, spanning a 30-year period. An industry standard power law equation was applied to scale up the wind speeds realised at 100 m. The location of the data source is latitude 52.75, longitude -0.75, which is within the ‘red’ wind resource zone just outside of the RCC boundary, approximately 4.5 km northwest of the most northern wind turbine locations in Figure 6-11. Therefore, the resulting yield is generally most accurate for the WTGs positioned in Figure 6-11.

Table 4-4 shows the yield estimates for a single 3.6 MW turbine and scaled up to 49 which could potentially be sited within the RCC boundary. It is assumed that the WTG’s would derate in capacity by 0.3% per year and have a lifespan of 25 years. The estimated capacity factor[26] is 38.7%, which is above average for existing onshore wind turbines in southern England. The result is due to high recorded resource data on which the simulation was based. The annual maximum annual yield from WTGs in the RCC area is estimated to be 598 GWh. This can generate energy for 206,206 houses per year.

[24] Office of the Deputy Prime Minister (2004) *Planning for Renewable Energy – A Companion Guide to PPS22*. Available at: https://cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/17716/17720/17723/42130145839.PDF
[25] HOMER Pro Available at: https://www.homerenergy.com/
[26] The estimated capacity factor of a wind turbine equals to the actual power generation divided by optimal power generation.

Table 4-4. Generation potential from wind turbines

Wind Turbines	Total Capacity (MW)	Year 1 Yield (MWh)	Yield estimates over 25-year lifespan (MWh)
1	3.6	12,196	294,170
49	176.4	597,609	14,414,558

The following assumptions were made in the calculating generation potential from wind turbines:

- 100 m hub height.
- 500 m min distance to domestic buildings.
- 500 m min distance between individual WTGs.
- Weibull k factor[27] 2.0.
- Power law exponent[28] 0.14.
- 0.3% annual derating of capacity.
- No wake losses were modelled.
- 25-year wind turbine lifespan.

[27] Weibull k factor is a parameter that reflects the breadth of a distribution of wind speeds. The k value refers to the shape of that distribution.
[28] Power law exponent is used to determine wind speeds at different heights.

5. Grid Connection Capacity

National Grid Electricity Distribution (NGED) – formerly Western Power Distribution – is the Distribution Network Operator (DNO) responsible for supplying power to RCC, specifically located within NGED East Midlands region.

There are thirteen primary substations and three bulk supply points (BSP) located inside of – and within 5km of – the RCC boundary which could potentially be a suitable point of connection for the embedded generation options proposed in the previous sections. The location of these substations is available in the appendices, Figure A-14.

The suitability of each primary substation and BSP was assessed using the following NGED reports:

- Network Development Plan (NDP)[29] – outlines network development information under the Distribution Future Energy Scenarios (DFES) to 2050.
- Distributed Future Energy Scenarios (DFES)[30] – outlines credible energy futures to support the development of the energy system.
- Long-Term Development Statement (LTDS)[31] – a compiled list of current and future users of NGED's network and assets.

To assess the suitability of each primary substation and BSP for connection of embedded generation we will consider the available generation headroom and fault level headroom.

5.1 Generation Headroom

NGED's DFES has 4 forecasting categories: Falling Short, Consumer Transformation, System Transformation, and Leading the Way. Each of these categories represents a different path to net zero with Falling Short the most pessimistic and Leading the Way the most optimistic forecast.

This assessment uses the data forecast under System Transformation as one of the two available moderate forecasts. System Transformation was selected over Consumer Transformation as the current plan for achieving net zero seems to focus on infrastructure upgrades and behaviour changes to a lesser extent. The generation headroom for the relevant primary substations is shown in Table 5-1.

Table 5-1 Primary substation generation headroom (MW)

Substation	2023	2024	2025	2030	2035	2040	2045	2050
CORBY CENTRAL 33 11kV	14.7	14.7	14.7	15.7	16.4	16.6	16.3	15.9
CORBY No2 11kV	21.7	21.5	21.3	20.0	16.8	16.9	13.1	7.9
EARLSTREES 33 11kV	16.6	16.5	16.4	16.8	16.6	16.4	15.4	14.2
EMPINGHAM 33 11kV	11.7	11.7	11.6	11.5	11.1	10.8	10.3	9.8
EXTON 33kV	3.6	3.6	3.5	3.4	3.3	3.1	2.9	2.6
HAZELWOOD 33 11kV	7.4	7.3	7.2	5.4	2.4	0.4	-2.0	-4.8
MARKET OVERTON 33 11kV	4.9	4.8	4.8	2.5	-3.2	-5.3	-8.1	-11.5
MELTON MOWBRAY 11KV	12.6	12.5	12.2	2.7	-18.9	-28.5	-42.3	-58.5
OAKHAM 11kV	14.8	14.7	14.5	11.4	3.1	-0.1	-5.2	-11.4
STAMFORD 11kV	16.1	15.9	15.6	11.8	4.1	0.2	-5.9	-12.8
TINWELL ROAD KETTON 33 11kV	5.0	5.0	4.9	4.2	2.4	1.7	0.7	-0.5
UPPINGHAM 33 11kV	4.1	4.1	4.0	1.8	-5.6	-8.1	-12.4	-16.9
WITTERING 33 11kV	6.5	6.5	6.4	2.7	-0.8	-2.0	-3.6	-5.6

8 of the 13 primary substations, shown in amber, do not have available generation headroom in 2050 and are therefore likely to become constrained. Early engagement with NGED is recommendation to secure a connection at these substations.

[29] National Grid (2022) *Network development plan*. Available at: National Grid - Network capacity map
[30] National Grid (2021) *Distribution Future Energy Scenarios*. Available at: National Grid - Distribution Future Energy Scenarios Map
[31] National Grid (2022) *Long Term Development Statement*. Available at: National Grid - Long term development statement

7 of the 8 constrained primary substations are identified by NGED as being thermally constrained. A thermal constraint occurs when the loading of a component is approaching or has exceeded its rating i.e., current exceeding the rated ampacity of a cable.

The Hazelwood 33 11kV substation is identified as having a fault level constraint. A fault level constraint occurs when the fault current exceeds the capacity of the substation equipment.

Both types of constraints can be resolved by upgrading the associated infrastructure.

Table 5-2 shows generation headroom for the relevant BSP.

Table 5-2 BSP generation headroom (MW)

BSP	2023	2024	2025	2030	2035	2040	2045	2050
Corby	95.3	94.8	94.1	89.1	74.7	69.8	56.3	39.9
Oakham	42.08	41.82	41.35	33.49	11.69	3.46	-9.59	-24.37
Stamford	52.8	52.3	51.3	36.8	11.8	0.0	-18.2	-38.8

The Oakham BSP and Stamford BSP, shown in amber, do not have available generation headroom in 2050 are therefore likely to become constrained. Early engagement with NGED is recommendation to secure a connection at these BSP.

Installation of embedded generation at the constrained primary substations and BSP may be possible with an Active Network Management system or network reinforcement. Engagement with NGED would allow for an estimate of the costs associated with reinforcement works necessary for connection at a constrained primary substation or BSP.

An Active Network Management system may allow for connection at a constrained primary substation or BSP but may require generation to be curtailed during periods specified by NGED.

A direct connection to the BSP is possible for sites with a larger generation capacity; however, the location of the site relative to the BSP would be important. When considering the point of connection, it is important to consider the distance which would impact cable costs, any potential routing obstructions, and other connection issues.

The definition of the absolute spare capacity illustrated above should be considered as indicative only. The available spare capacity is highly impacted by large developments, growth of low carbon technologies, etc…

5.1.1 Wind Generation

The capacity for wind generation within RCC has been assessed by determining the number of 3.6MW WTG that could be connected to each primary substation and BSP.

Table 5-3 and Table 5-4 shows the number of WTG that can be installed at each primary substation and BSP using 100% and 50% of generation headroom, respectively.

Connections that do not use 100% of available capacity will increase – but not guarantee – the likelihood of an early connection without the need for reinforcement works.

Table 5-3 Number of 3.6MW wind turbines connected at each substation (100% headroom utilisation)

Substation / BSP	2023	2024	2025	2030	2035	2040	2045	2050
CORBY	26	26	26	24	20	19	15	11
CORBY CENTRAL 33 11KV	4	4	4	4	4	4	4	4
CORBY NO2 11KV	6	5	5	5	4	4	3	2
EARLSTREES 33 11KV	4	4	4	4	4	4	4	3
EMPINGHAM 33 11KV	3	3	3	3	3	2	2	2
EXTON 22KV	0	0	0	0	0	0	0	0
HAZELWOOD 33 11KV	2	2	2	1	0	0	0	0
MARKET OVERTON 33 11KV	1	1	1	0	0	0	0	0
MELTON MOWBRAY 11KV	3	3	3	0	0	0	0	0
OAKHAM	11	11	11	9	3	0	0	0
OAKHAM 11KV	4	4	4	3	0	0	0	0
STAMFORD	14	14	14	10	3	0	0	0
STAMFORD 11KV	4	4	4	3	1	0	0	0
TINWELL ROAD KETTON 33 11KV	1	1	1	1	0	0	0	0
UPPINGHAM 33 11KV	1	1	1	0	0	0	0	0
WITTERING 33 11KV	1	1	1	0	0	0	0	0

4 of the 13 primary substations and Corby BSP, shown in green, are forecast to have sufficient capacity to support the installation of between 3 – 26 WGT in 2023 and 2 – 11 WGT in 2050.

8 of the 13 primary substations, the Oakham BSP, and the Stamford BSP, shown in amber, are forecast to have sufficient capacity to support the installation of between 1 – 14 WGT in 2023; however, this capacity is forecast to be unavailable by 2050. For connection to any of these substations' early engagement with NGED is recommended.

There is not sufficient headroom available to allow for the connection of any 3.6MW WTG to the Exton primary substation, shown in red. For the purposes of this analysis, the Exton primary substation is therefore constrained.

As this analysis assumes that all the available capacity is used the likelihood of required reinforcement works or an Active Network Management system are increased, especially for the primary substations and BSP highlighted in amber and red.

If planning to use all the available capacity, it is recommended to engagement with NGED as early as possible.

Table 5-4 Number of 3.6MW wind turbines connected at each substation (50% headroom utilisation)

Substation / BSP	2023	2024	2025	2030	2035	2040	2045	2050
Corby	13	13	13	12	10	9	7	5
CORBY CENTRAL 33 11kV	2	2	2	2	2	2	2	2
CORBY No2 11kV	3	2	2	2	2	2	1	1
EARLSTREES 33 11kV	2	2	2	2	2	2	2	1
EMPINGHAM 33 11kV	1	1	1	1	1	1	1	1
EXTON 33kV	0	0	0	0	0	0	0	0
HAZELWOOD 33 11kV	1	1	1	0	0	0	0	0
MARKET OVERTON 33 11kV	0	0	0	0	0	0	0	0
MELTON MOWBRAY 11KV	1	1	1	0	0	0	0	0
Oakham	5	5	5	4	1	0	0	0
OAKHAM 11kV	2	2	2	1	0	0	0	0
Stamford	7	7	7	5	1	0	0	0
STAMFORD 11kV	2	2	2	1	0	0	0	0
TINWELL ROAD KETTON 33 11kV	0	0	0	0	0	0	0	0
UPPINGHAM 33 11k	0	0	0	0	0	0	0	0
WITTERING 33 11kV	0	0	0	0	0	0	0	0

By using only 50% of available headroom, 4 of the 13 primary substations and Corby BSP are forecast to have sufficient capacity to support the installation of between 1 – 13 WGT in 2023 and 1 – 5 WGT in 2050.

4 of the 13 primary substations, the Oakham BSP, and the Stamford BSP are forecast to have sufficient capacity to support the installation of between 1 – 7 WGT in 2023; this capacity is forecast to be unavailable by 2050. For connection to any of these substations' early engagement with NGED is recommended.

5 of the 13 primary substations do not have sufficient headroom to support the installation of any WTG and are therefore constrained. Reinforcement works would be required to facilitate a connection at these substations.

As this analysis assumes that only 50% of the available capacity is used, the likelihood of requiring reinforcement works or an Active Network Management system is reduced, especially for those substations highlighted in green and amber.

5.1.2 Ground Mounted PV

The capacity for ground mounted PV within RCC has been assessed by determining the number of hectares of PV could be connected to each primary substation and BSP. It has been assumed that one hectare of PV will generate 0.5MW power.

Table 5-5 and

Table 5-6 shows how many hectares of PV that can be installed at each primary substation and BSP utilising 100% and 50% of generation headroom, respectively.

Connections that do not use 100% of available capacity will increase – but not guarantee – the likelihood of an early connection without the need for reinforcement works.

Table 5-5 Hectares of PV at each substation (100% headroom utilisation)

Substation / BSP	2023	2024	2025	2030	2035	2040	2045	2050
CORBY	190.6	189.5	188.1	178.1	149.4	139.6	112.5	79.8
CORBY CENTRAL 33 11KV	29.4	29.3	29.3	31.3	32.7	33.2	32.6	31.8
CORBY NO2 11KV	43.3	42.9	42.6	40.0	33.6	33.8	26.1	15.7
EARLSTREES 33 11KV	33.2	33.0	32.8	33.6	33.1	32.7	30.7	28.4
EMPINGHAM 33 11KV	23.4	23.3	23.2	22.9	22.1	21.5	20.5	19.6
EXTON 22KV	7.1	7.1	7.0	6.7	6.5	6.2	5.7	5.2
HAZELWOOD 33 11KV	14.7	14.6	14.4	10.8	4.7	0.8	0.0	0.0
MARKET OVERTON 33 11KV	9.7	9.6	9.5	4.9	0.0	0.0	0.0	0.0
MELTON MOWBRAY 11KV	25.1	24.9	24.3	5.4	0.0	0.0	0.0	0.0
Oakham	84.2	83.6	82.7	67.0	23.4	6.9	0.0	0.0
OAKHAM 11KV	29.6	29.4	29.0	22.8	6.2	0.0	0.0	0.0
STAMFORD	105.6	104.6	102.6	73.5	23.5	0.0	0.0	0.0
STAMFORD 11KV	32.1	31.8	31.2	23.5	8.2	0.3	0.0	0.0
TINWELL ROAD KETTON 33 11KV	10.0	10.0	9.8	8.3	4.8	3.4	1.3	0.0
UPPINGHAM 33 11KV	8.2	8.1	7.9	3.5	0.0	0.0	0.0	0.0
WITTERING 33 11KV	12.9	12.9	12.8	5.3	0.0	0.0	0.0	0.0

5 of the 13 primary substations and Corby BSP, shown in green, are forecast to have sufficient capacity to support the installation of ground mounted PV between now and 2050. The hectares of PV possible at each substation ranges from 7.1 – 190.6 in 2023 to 5.2 – 79.8 in 2050. These substations are considered unconstrained.

6 of the 13 primary substations, the Oakham BSP, and the Stamford BSP, shown in amber, are forecast to have sufficient capacity to support the installation of ground mounted PV; however, this capacity is forecast to used prior 2050. The hectares of PV possible at each substation ranges from 10 – 105.6 in 2023 to 0 in 2050. For connection to any of these substations' early engagement with NGED is recommended.

2 of the 13 primary substations, shown in red, have capacity to support less than 10 hectares of ground mounted PV (less than 5MW) with this capacity becoming unavailable prior 2050. The hectares of PV possible at each substation ranges from 8.2 to 9.7 in 2023 to 0 in 2050.

As this analysis assumes that all the available capacity is used the likelihood of required reinforcement works or an Active Network Management system are increased, especially for the primary substations and BSP highlighted in amber and red.

If planning to use all the available capacity, it is recommended to engagement with NGED as early as possible.

Table 5-6 Hectares of PV at each substation (50% headroom utilisation)

Substation / BSP	2023	2024	2025	2030	2035	2040	2045	2050
Corby	95.3	94.7	94.0	89.0	74.7	69.8	56.2	39.9
CORBY CENTRAL 33 11kV	14.7	14.6	14.6	15.6	16.3	16.6	16.3	15.9
CORBY No2 11kV	21.6	21.4	21.3	20.0	16.8	16.9	13.0	7.8
EARLSTREES 33 11kV	16.6	16.5	16.4	16.8	16.5	16.3	15.3	14.2
EMPINGHAM 33 11kV	11.7	11.6	11.6	11.4	11.0	10.7	10.2	9.8
EXTON 22kV	3.5	3.5	3.5	3.3	3.2	3.1	2.8	2.6
HAZELWOOD 33 11kV	7.3	7.3	7.2	5.4	2.3	0.4	0.0	0.0
MARKET OVERTON 33 11kV	4.8	4.8	4.7	2.4	0.0	0.0	0.0	0.0
MELTON MOWBRAY 11KV	12.5	12.4	12.1	2.7	0.0	0.0	0.0	0.0
Oakham	42.1	41.8	41.4	33.5	11.7	3.5	0.0	0.0
OAKHAM 11kV	14.8	14.7	14.5	11.4	3.1	0.0	0.0	0.0
Stamford	52.8	52.3	51.3	36.7	11.7	0.0	0.0	0.0
STAMFORD 11kV	16.0	15.9	15.6	11.7	4.1	0.1	0.0	0.0
TINWELL ROAD KETTON 33 11kV	5.0	5.0	4.9	4.1	2.4	1.7	0.6	0.0
UPPINGHAM 33 11kV	4.1	4.0	3.9	1.7	0.0	0.0	0.0	0.0
WITTERING 33 11kV	6.4	6.4	6.4	2.6	0.0	0.0	0.0	0.0

By using only 50% of available headroom, 5 of the 13 primary substations and Corby BSP, shown in green, are forecast to have sufficient capacity to support the installation of ground mounted PV between now and 2050. The hectares of PV possible at each substation ranges from 3.5 – 95.3 in 2023 to 2.6 – 39.9 in 2050. These substations are considered unconstrained.

3 of the 13 primary substations, the Oakham BSP, and the Stamford BSP, shown in amber, are forecast to have sufficient capacity to support the installation of ground mounted PV; however, this capacity is forecast to used prior 2050. The hectares of PV possible at each substation ranges from 12.5 – 52.8 in 2023 to 0 in 2050. For connection to any of these substations' early engagement with NGED is recommended.

5 of the 13 primary substations, shown in red, have capacity to support less than 10 hectares of ground mounted PV (less than 5MW) with this capacity used prior 2050. The hectares of PV ranges from 4.1 – 7.3 in 2023 to 0 in 2050.

As this analysis assumes that only 50% of the available capacity is used, this will reduce the likelihood of required reinforcement works or an Active Network Management system, especially for those substations highlighted in green and amber.

5.1.3 Solar PV Carport

The capacity for Carport PV within Rutland County has been assessed by determining the number of hectares of PV could be connected to each primary substation and BSP. It has been assumed that one hectare of PV from a carport will generate 0.95MW power.

Table 5-7 and Table 5-7 shows how many hectares of PV that can be installed at each primary substation and BSP using 100% and 50% of generation headroom, respectively.

Connections that do not use 100% of available capacity will increase – but not guarantee – the likelihood of an early connection without the need for reinforcement works.

Table 5-7 Hectares of Carport PV at each substation (100% headroom utilisation)

Substation / BSP	2023	2024	2025	2030	2035	2040	2045	2050
Corby	100.3	99.7	99.0	93.7	78.6	73.5	59.2	42.0
CORBY CENTRAL 33 11kV	15.4	15.4	15.4	16.4	17.2	17.4	17.1	16.7
CORBY No2 11kV	22.7	22.5	22.4	21.0	17.6	17.8	13.7	8.2
EARLSTREES 33 11kV	17.4	17.4	17.3	17.6	17.4	17.2	16.2	14.9
EMPINGHAM 33 11kV	12.3	12.2	12.2	12.0	11.6	11.3	10.8	10.3
EXTON 22kV	3.7	3.7	3.6	3.5	3.4	3.3	3.0	2.7
HAZELWOOD 33 11kV	7.7	7.6	7.5	5.6	2.5	0.4	0.0	0.0
MARKET OVERTON 33 11kV	5.1	5.0	5.0	2.6	0.0	0.0	0.0	0.0
MELTON MOWBRAY 11KV	13.2	13.1	12.8	2.8	0.0	0.0	0.0	0.0
Oakham	44.2	44.0	43.5	35.2	12.3	3.6	0.0	0.0
OAKHAM 11kV	15.5	15.4	15.2	12.0	3.2	0.0	0.0	0.0
Stamford	55.5	55.0	54.0	38.7	12.3	0.0	0.0	0.0
STAMFORD 11kV	16.9	16.7	16.4	12.3	4.3	0.1	0.0	0.0
TINWELL ROAD KETTON 33 11kV	5.2	5.2	5.1	4.3	2.5	1.8	0.7	0.0
UPPINGHAM 33 11kV	4.3	4.2	4.2	1.8	0.0	0.0	0.0	0.0
WITTERING 33 11kV	6.8	6.8	6.7	2.8	0.0	0.0	0.0	0.0

5 of the 13 primary substations and Corby BSP, shown in green, are forecast to have sufficient capacity to support the installation of carport PV between now and 2050. The hectares of PV possible at each substation ranges from 3.7 – 100.3 in 2023 to 2.7 – 42 in 2050. These substations are considered unconstrained.

3 of the 13 primary substations, the Oakham BSP, and the Stamford BSP, shown in amber, are forecast to have sufficient capacity to support the installation of carport PV; however, this capacity is forecast to used prior 2050. The hectares of PV possible at each substation ranges from 13.2 – 55.5 in 2023 to 0 in 2050. For connection to any of these substations' early engagement with NGED is recommended.

5 of the 13 primary substations, shown in red, have capacity to support less than 10 hectares of carport PV (less than 5MW) with this capacity forecast to be used prior 2050. The hectares of PV possible at each substation ranges from 4.3 – 7.7 in 2023 to 0 in 2050.

As this analysis assumes that all the available capacity is used the likelihood of required reinforcement works or an Active Network Management system are increased, especially for the primary substations and BSP highlighted in amber and red.

If planning to use all the available capacity, it is recommended to engagement with NGED as early as possible.

Table 5-8 Hectares of Carport PV at each substation (50% headroom utilisation)

Substation / BSP	2023	2024	2025	2030	2035	2040	2045	2050
CORBY	75.2	74.8	74.2	70.3	58.9	55.1	44.4	31.5
CORBY CENTRAL 33 11KV	7.7	7.7	7.7	8.2	8.6	8.7	8.5	8.3
CORBY NO2 11KV	11.3	11.2	11.2	10.5	8.8	8.9	6.8	4.1
EARLSTREES 33 11KV	8.7	8.7	8.6	8.8	8.7	8.6	8.1	7.4
EMPINGHAM 33 11KV	6.1	6.1	6.1	6.0	5.8	5.6	5.4	5.1
EXTON 22KV	1.8	1.8	1.8	1.7	1.7	1.6	1.5	1.3
HAZELWOOD 33 11KV	3.8	3.8	3.7	2.8	1.2	0.2	0.0	0.0
MARKET OVERTON 33 11KV	2.5	2.5	2.5	1.3	0.0	0.0	0.0	0.0
MELTON MOWBRAY 11KV	6.6	6.5	6.4	1.4	0.0	0.0	0.0	0.0
Oakham	33.2	33.0	32.6	26.4	9.2	2.7	0.0	0.0
OAKHAM 11KV	7.7	7.7	7.6	6.0	1.6	0.0	0.0	0.0
STAMFORD	41.6	41.2	40.5	29.0	9.2	0.0	0.0	0.0
STAMFORD 11KV	8.4	8.3	8.2	6.1	2.1	0.0	0.0	0.0
TINWELL ROAD KETTON 33 11KV	2.6	2.6	2.5	2.1	1.2	0.9	0.3	0.0
UPPINGHAM 33 11KV	2.1	2.1	2.1	0.9	0.0	0.0	0.0	0.0
WITTERING 33 11KV	3.4	3.4	3.3	1.4	0.0	0.0	0.0	0.0

5 of the 13 primary substations and Corby BSP, shown in green, are forecast to have sufficient capacity to support the installation of carport PV between now and 2050. The hectares of PV possible at each substation ranges from 1.8 - 75.2 in 2023 to 1.3 - 31.5 in 2050. These substations are considered unconstrained.

The Oakham BSP and Stamford BSP, shown in amber, are forecast to have sufficient capacity to support the installation of carport PV; however, this capacity is forecast to used prior 2050. The hectares of PV possible at each substation ranges from 33.2 - 41.6 in 2023 to 0 in 2050. For connection to Oakham BSP or Stamford BSP early engagement with NGED is recommended.

8 of the 13 primary substations, shown in red, have capacity to support less than 10 hectares of ground mounted PV (less than 5MW) with this capacity used prior 2050. The hectares of PV possible at each substation ranges from 2.1 - 8.4 in 2023 to 0 in 2050.

As this analysis assumes that only 50% of the available capacity is used, this will reduce the likelihood of required reinforcement works or an Active Network Management system, especially for those substations highlighted in green and amber.

5.2 Fault Level Capacity

The LTDS provides the three phase fault currents at each primary substation as well as the rated make and breaking currents of the relevant switchgear. Assessment of this data may provide insight into the likelihood of additional embedded generation requiring reinforcement works.

Table 5-9 shows that fault currents, ratings, and fault level percentage capacity for each primary substation and BSP.

Table 5-9 Primary substation and BSP 3-phase fault currents and ratings

Substation/BSP	Peak Make (kA)	RMS Breaking (kA)	Peak Make Rating (kA)	RMS Breaking Rating (kA)	Peak Make (%)	RMS Breaking (%)
Corby	58.8	34.9	50.0	26.2	117.6	132.9
CORBY CENTRAL 33 11kV	33.1	17.5	80.0	26.2	41.4	66.6
CORBY NO2 11kV	30.5	16.7	32.8	13.1	93.0	127.2
EARLSTREES 33 11kV	23.6	11.5	32.8	13.1	71.9	88.0
EMPINGHAM 33 11kV	19.2	8.5	43.7	17.5	43.8	48.4
EXTON 33kV	14.3	6.4	43.7	17.5	32.7	36.5
HAZELWOOD 33 11kV	27.6	14.4	32.8	13.1	84.2	109.6
MARKET OVERTON 33 11kV	7.1	3.1	46.9	18.4	15.1	17.1
MELTON MOWBRAY 11KV	19.9	9.4	43.7	17.5	45.4	53.7
Oakham	30.8	13.8	32.8	31.5	94.0	44.0
OAKHAM 11kV	22.3	11.3	45.9	18.4	48.6	61.5
Stamford	28.0	12.7	43.8	17.5	63.9	72.6
STAMFORD 11kV	20.7	10.4	32.8	13.1	63.0	79.3
TINWELL ROAD KETTON 33 11kV	13.6	6.4	32.8	13.1	41.3	48.8
UPPINGHAM 33 11kV	8.4	4.3	-	-	-	-
WITTERING 33 11kV	8.92	3.94	32.8	13.1	27.2	30.1

5 of the 13 primary substations, shown in green, can withstand their respective fault currents. The three-phase fault current at each substation is less than 50% of the switchgear rated make and breaking currents. These substations are therefore unconstrained.

5 of the 13 primary substations, the Oakham BSP, and the Stamford BSP, shown in amber, can also withstand their respective fault currents; however, the three-phase fault current at each substation and BSP ranges between 50-100% of the switchgear rated make and breaking currents. For connection to any of these substations' early engagement with NGED is recommended.

3 of the 13 primary substations and the Corby BSP, shown in red, exceed their respective fault currents or have no available data. These substations may have reinforcement works scheduled or have Active Network Management systems in place as the three-phase fault currents exceed 100% of the of the switchgear rated make and breaking currents. If so, connections to these substations may be delayed until any reinforcements work are completed.

The fault level capacity is provided for indicative purposes only. The transition to net zero will naturally cause a reduction in the fault level contribution as converter connected generation (WTG, PV, etc…) contribute significantly less fault current than conventional generators.

5.2.1 Limitations

NGED also provide a tool for network analysis in the form of their Network Capacity Map[32] which uses data from the LTDS and quotation statistics to provide RAG analysis for demand headroom, generation headroom, and fault level headroom.

There are instances where the fault level and generation headroom RAG analysis extracted from the Network Capacity Map contradicted the data taken from the LTDS and DFES.

[32] National Grid (2023) *Network Capacity Map. Available at:* National Grid - Network capacity map

NGED suggest the following limitations for their generation and fault level headroom analysis[33]:

- The Network Capacity Map tool is unable to differentiate between multiple offers for the same site.
- Impacts of planned reinforcements, contracted flexibility, and load management schemes are not included in the headroom report.
- Fault level analysis only considers the additional fault infeed from generation connected at each primary substation. It does not account for wider network changes that would affect upstream fault infeed due to the connection of additional distributed generation, removal of generation (particularly synchronous plant) and changes in network topology.

Fault level assessment assumes that new demand and generation would connect directly to the 11 kV or 6.6 kV bar of the Primary substation. As a result, this is a worst-case assumption as no additional impedance assumptions have been made for the connection of new demand and generation.

At the feasibility stage, the grid connection should be assessed on a site-by-site basis, as the electrical infrastructure local to the generating equipment must withstand the additional power. Where this is not the case, the installation project bears the costs associated with the required reinforcement works. Grid connection costs can vary vastly so early engagement with the DNO is recommended.

It should also be noted that connection of embedded generation at a primary substation may reduce the available headroom at the associated BSP.

[33] National Grid (2022) *Network Headroom Report*

6. Summary

An assessment of renewable energy potential in RCC has been carried out. The technologies assessed include ground mounted solar PV, solar PV carports and WTGs. A GIS model was constructed and used to map constraints to allow for the identification and measurement of areas of opportunity. A summary of these opportunities is shown in Table 6-1.

Table 6-1. Generation potential from all identified opportunities

Technology type	Total capacity (MWp)	Year 1 yield (MWh)	Yield estimate over lifespan (MWh)
Ground mounted solar PV (inc. flood zones 2 & 3)	649 (78 inside flood zone)	632,624 (75,896 inside flood zone)	17,917,967 (2,149,609 inside flood zone)
Solar PV Carport	2	1,905	53,961
WTGs	176	597,609	14,414,558
Total	**827**	**1,232,138**	**32,386,486**

As can be seen above, the greatest opportunity is from ground mounted solar PV when all zones are considered including within flood zones 2 and 3, which in combination produce an annual yield generation potential of c. 633 GWh. The second largest opportunity is from WTGs with a yearly generation potential of c. 598 GWh. When reviewing these figures, it should also be considered that wind energy has a different seasonal profile to solar PV with winter months typically being the strongest and generation also at night-time. The energy transition requires a mix of technologies and resources to reduce strain on the electricity networks and decrease required energy storage capacities.

A comparison can be drawn between the energy consumption figure shown in section 2 of this report and the estimated renewable energy generation potential. The total demand for all fuels in 2020 was 2,727 GWh[34], if all the opportunities in Table 6-1 were implemented, they have the potential to provide energy equivalent to 45% of the total demand. This would generate energy for c. 424,875 houses, as illustrated by Figure 6-1. That is not to say that RCC should aim to become energy independent, but it does highlight the scale of deployment required to meet energy demand.

To be noted is that the renewables yield includes generation from utility-scale WTGs; and commercial, and utility-scale solar PV. The potential contribution from large numbers of small-scale generators of these technology types, as well as other renewable energy sources (e.g., biomass, hydropower, geothermal), is likely to be significant, but their investigation was outside the scope of this study.

Generally, the electrical infrastructure surrounding RCC seems to be relatively unconstrained; however, the forecast generation headroom for these substations reduces as 2050 is approached, early engagement with NGED is recommended to secure connections.

The grid capacity in the county has sufficient headroom forecast between 2023 and 2027 to connect over 30 wind turbines, 270 hectares of ground mounted solar, or 140 hectares of carport PV to the 13 primary substations located inside of – and within 5km of – the RCC boundary. This is not great enough to allow for the connection of all identified opportunities, however in reality it is likely that not all opportunities would be viable for construction due to site-specific planning, engineering or financial constraints that were out with the scope of this initial assessment. Additionally, an energy mix is required to provide grid resilience and therefore a variety of generation technologies will be required to reduce the energy related emissions of the County while still meeting demand.

The definitions of the absolute spare capacity illustrated above should be considered as indicative only. The available spare capacity is highly impacted by large developments, growth of low carbon technologies, etc... As such, the grid connection should be assessed on a site-by-site basis for any connections taken onto the feasibility stage.

There are important details that the figures presented here do not consider. For example, there is no analysis of generation vs demand, which becomes an important factor in net zero carbon scenarios, as differences between

[34] BEIS (2022) *Total final energy consumption at regional and local authority level: 2005 to 2020.* Available at: https://www.gov.uk/government/statistics/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2020

peak demand and peak generation must be met via other energy sources or energy storage. Where fossil fuel generators are still used in the short term, carbon offset may be required to achieve Net Zero.

It is recommended that RCC develop a renewable energy strategy to map out how the required energy can be deployed in the available timeframe. Individual opportunities could be further developed and ranked. RCC could then directly or indirectly progress installation of schemes which best align with their requirement. Connection by private wire has typically been seen used by other councils to connect renewable energy generators to either industrial sites or in one case a hospital.

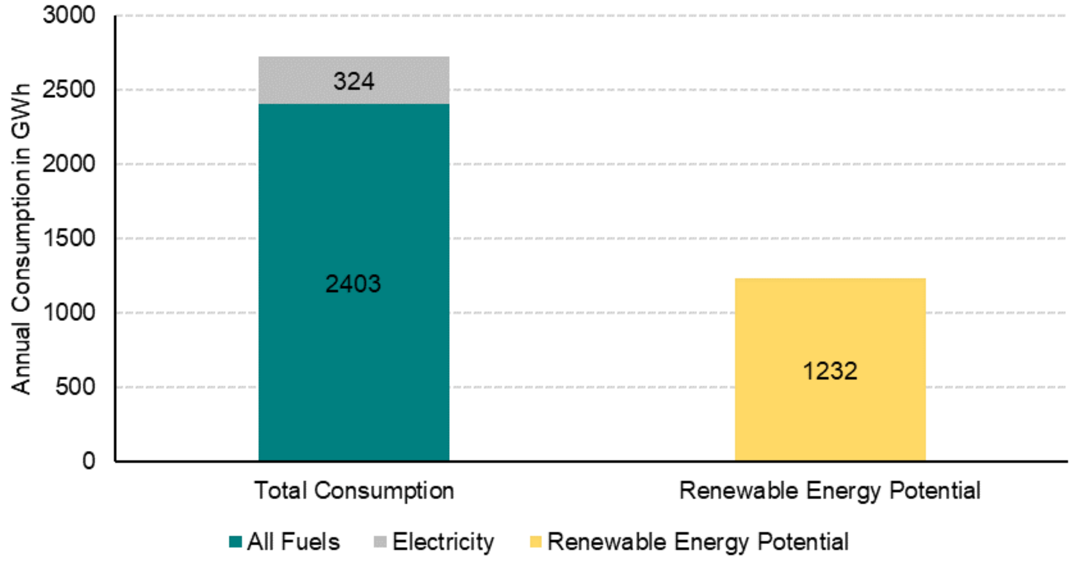
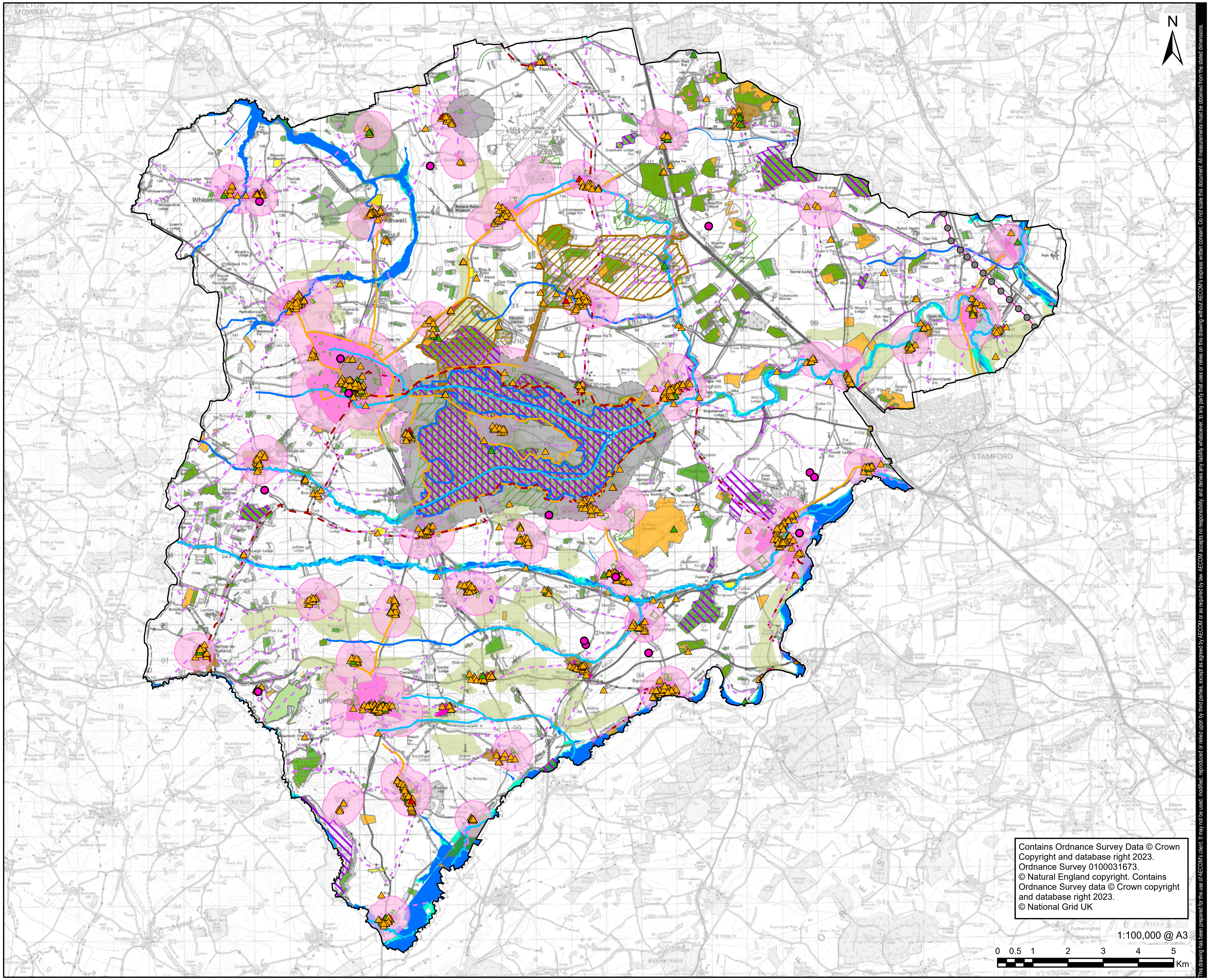


Figure 6-1. Rutland total fuel and electricity consumption in 2020 against estimated renewable energy potential.

Appendix A Figures

Please see the following figures in this appendix:

Revision: 0 Drawn: AC Checked: LL Approved: AR Date: 2023-07-06



AECOM

PROJECT

Rutland

CLIENT

Rutland County Council

CONSULTANT

AECOM Limited
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4 Bedford Park
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LEGEND

- Rutland County Boundary
- Turbine Location
- PRoW
- Walking Route
- Statutory Main River
- Waterbody
- Cycle Routes
- RAMSAR
- Registered Parks and Gardens
- Open Green Space
- SSSI
- SPA
- Parks and Gardens (500m)
- Amenity (500m)
- Planned Limits of Development
- RIGS
- Priority Habitat
- National Park
- LWS
- Ancient Woodland
- SAC
- LNR
- Scheduled Monument
- Conservation Area
- Flood Zone 3
- Flood Zone 2

Listed Building

- Grade I
- Grade II*
- Grade II

Utility

- Utility Tower
- Utility Cable
- Overhead Cable

Agricultural Land Classification

- Grade 1
- Grade 2

ISSUE PURPOSE

For Information

PROJECT NUMBER

60696507

FIGURE TITLE

Constraints

FIGURE NUMBER

Figure 1

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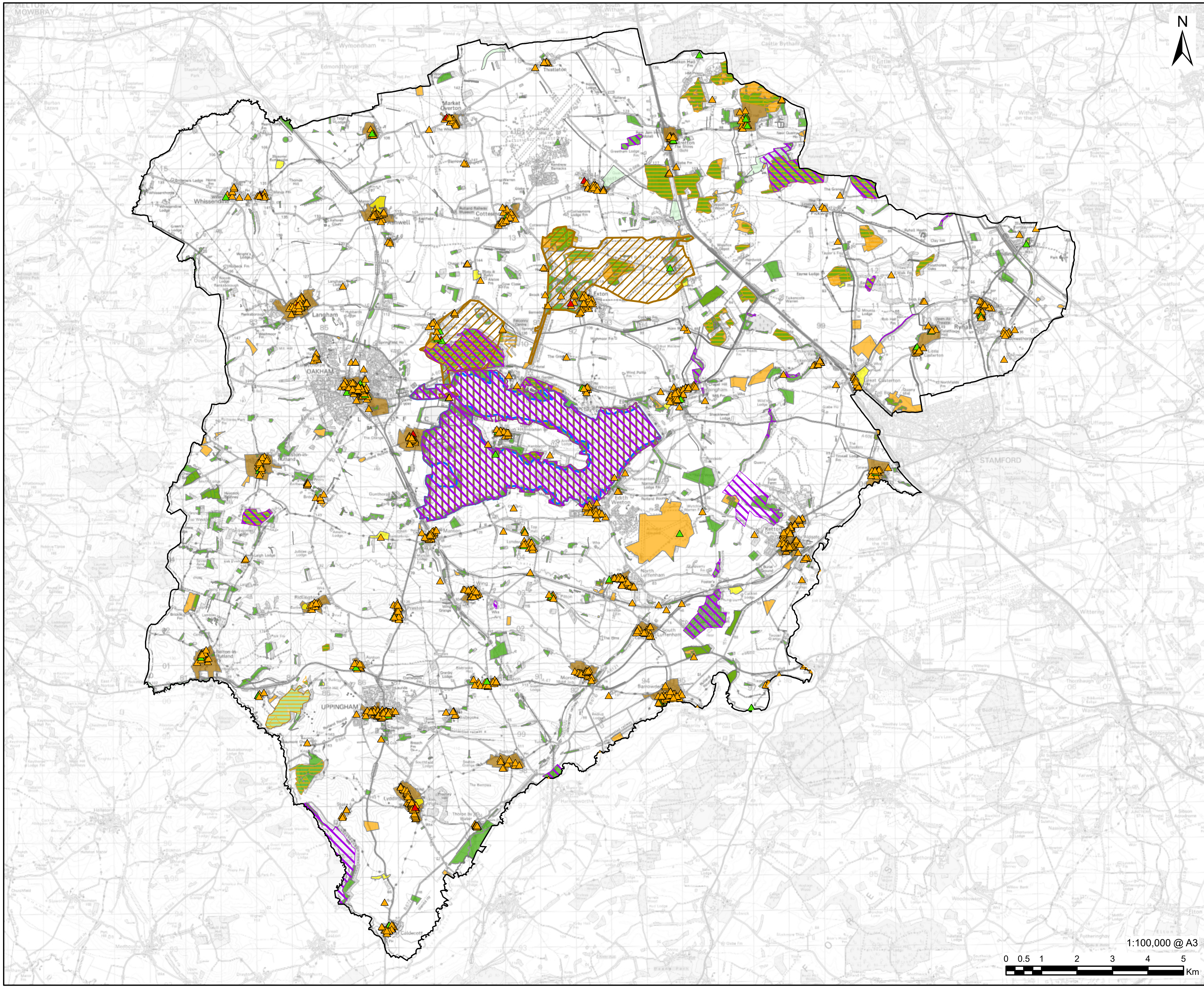
Revision: 0 Drawn: AC Checked: LL Approved: AR Date: 2023-07-06



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LEGEND

- Rutland County Boundary
- SSSI
- SPA
- Registered Parks and Gardens
- RAMSAR
- Ancient Woodland
- RIGS
- Priority Habitat
- National Park
- LWS
- SAC
- LNR
- Scheduled Monument
- Conservation Area

Listed Building

- Grade I
- Grade II*
- Grade II

NOTES

ISSUE PURPOSE

For Information

PROJECT NUMBER

60696507

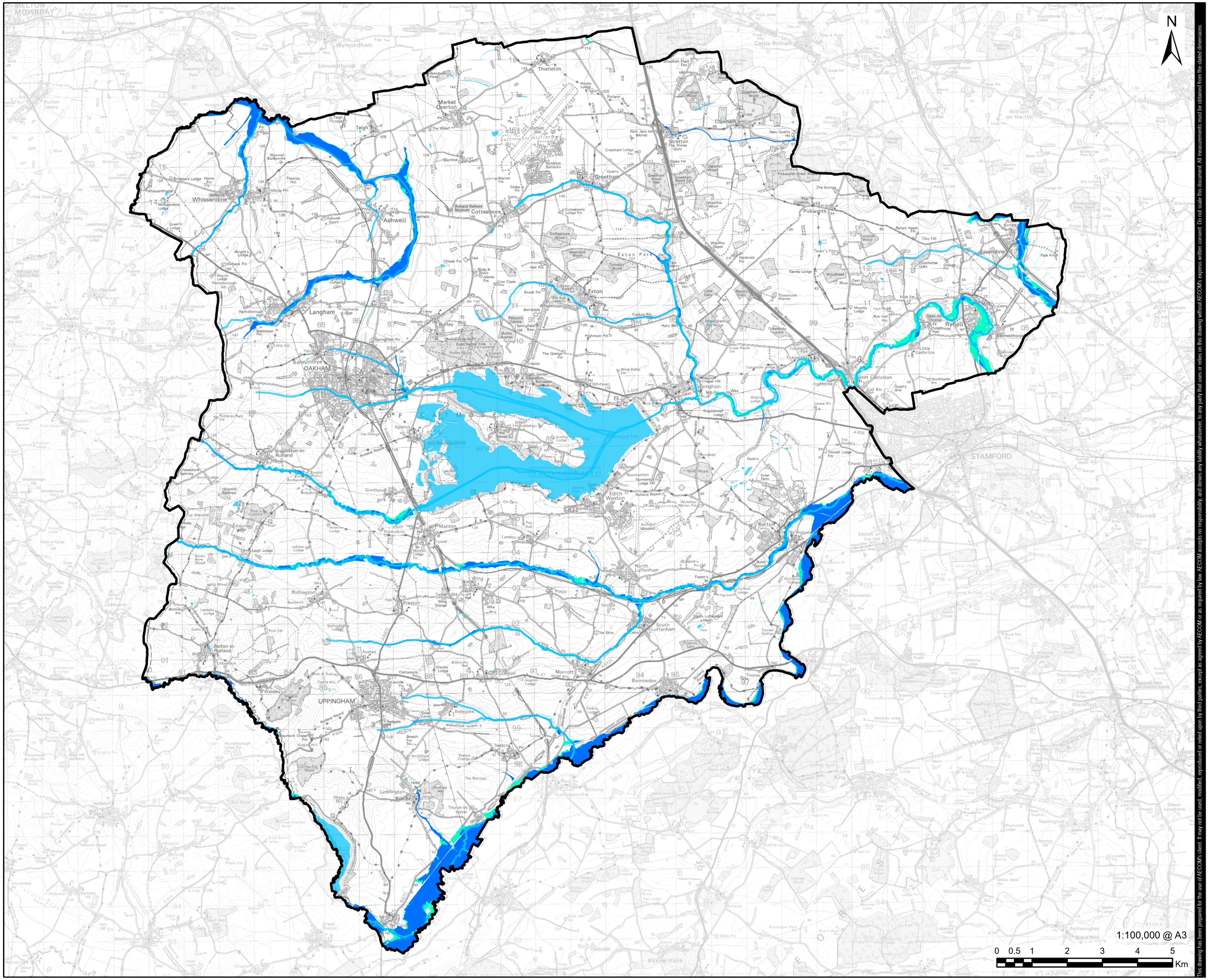
FIGURE TITLE

Environmental and Historical Constraints

FIGURE NUMBER

Figure 2

Revision: 0 Drawn: AC Checked: LL Approved: AR Date: 2023-07-03



Filename: W:\Rutland\Layout\Rutland_Constraints.aprx

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LEGEND

- Rutland County Boundary
- Waterbody
- Flood Zone 3
- Flood Zone 2

NOTES

ISSUE PURPOSE

For Information

PROJECT NUMBER

60696507

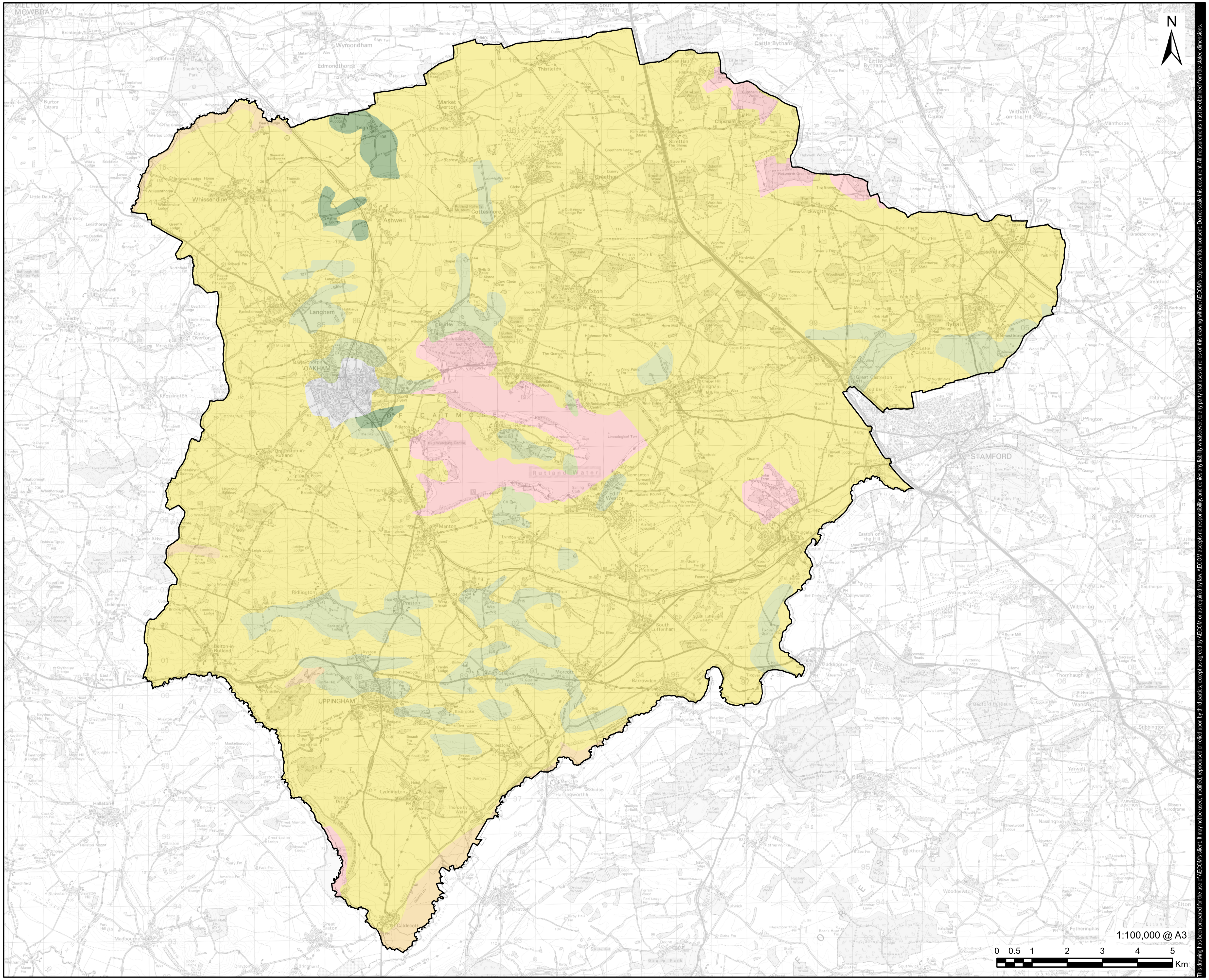
FIGURE TITLE

Flood Zones and Waterbodies

FIGURE NUMBER

Figure 3

Revision: 0 Drawn: AC Checked: LL Approved: AR Date: 2023-06-29



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LEGEND

Rutland County Boundary

Agricultural Land Classification

- Exclusion
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban

NOTES

ISSUE PURPOSE

For Information

PROJECT NUMBER

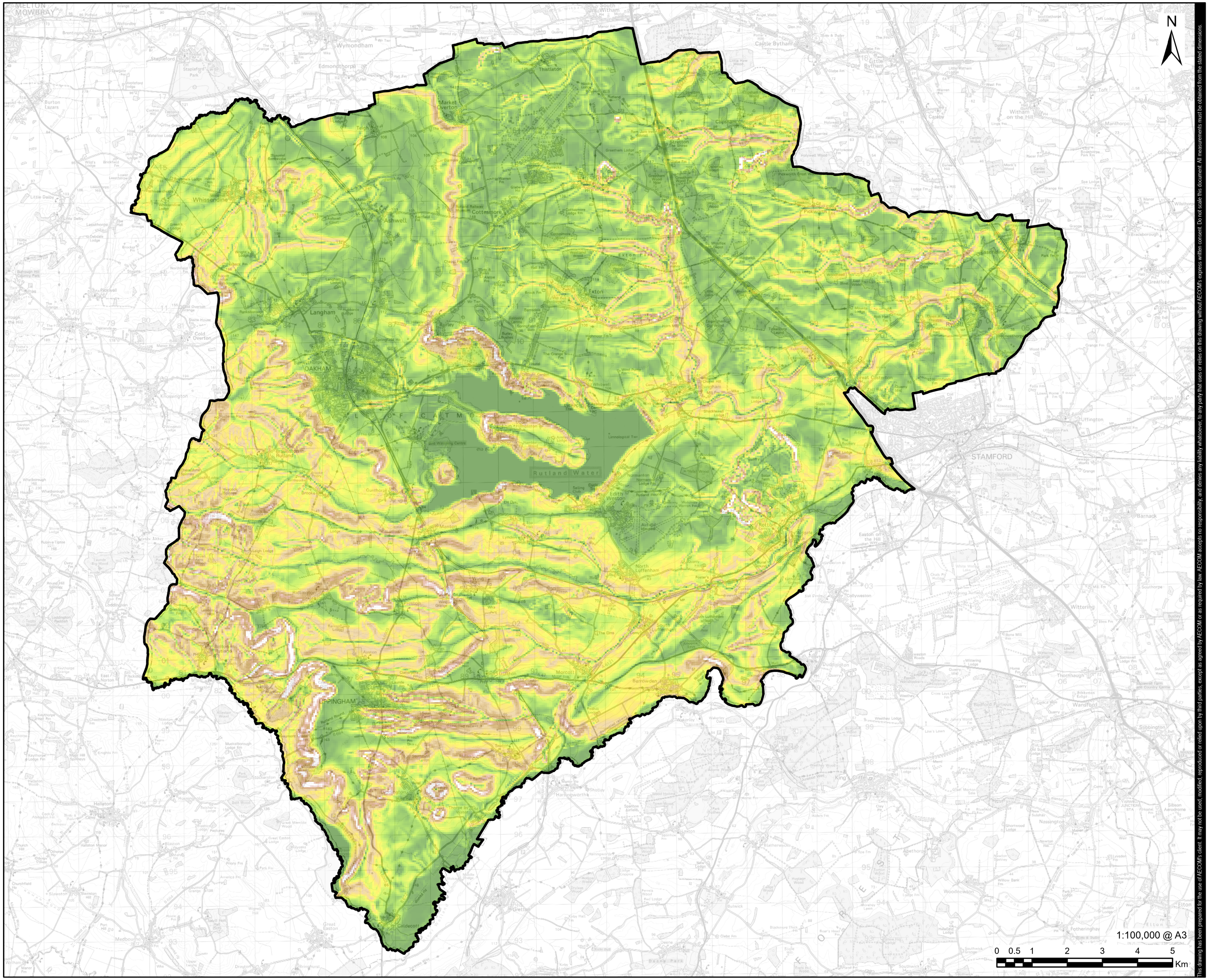
60696507

FIGURE TITLE

Agricultural Land Classification

FIGURE NUMBER

Figure 4



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LEGEND

Rutland County Boundary

Slope (m)

25.55

0

NOTES

ISSUE PURPOSE

For Information

PROJECT NUMBER

60696507

FIGURE TITLE

Slope

FIGURE NUMBER

Figure 5

Revision: 0 Drawn: AC Checked: LL Approved: AR Date: 2023-06-29

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