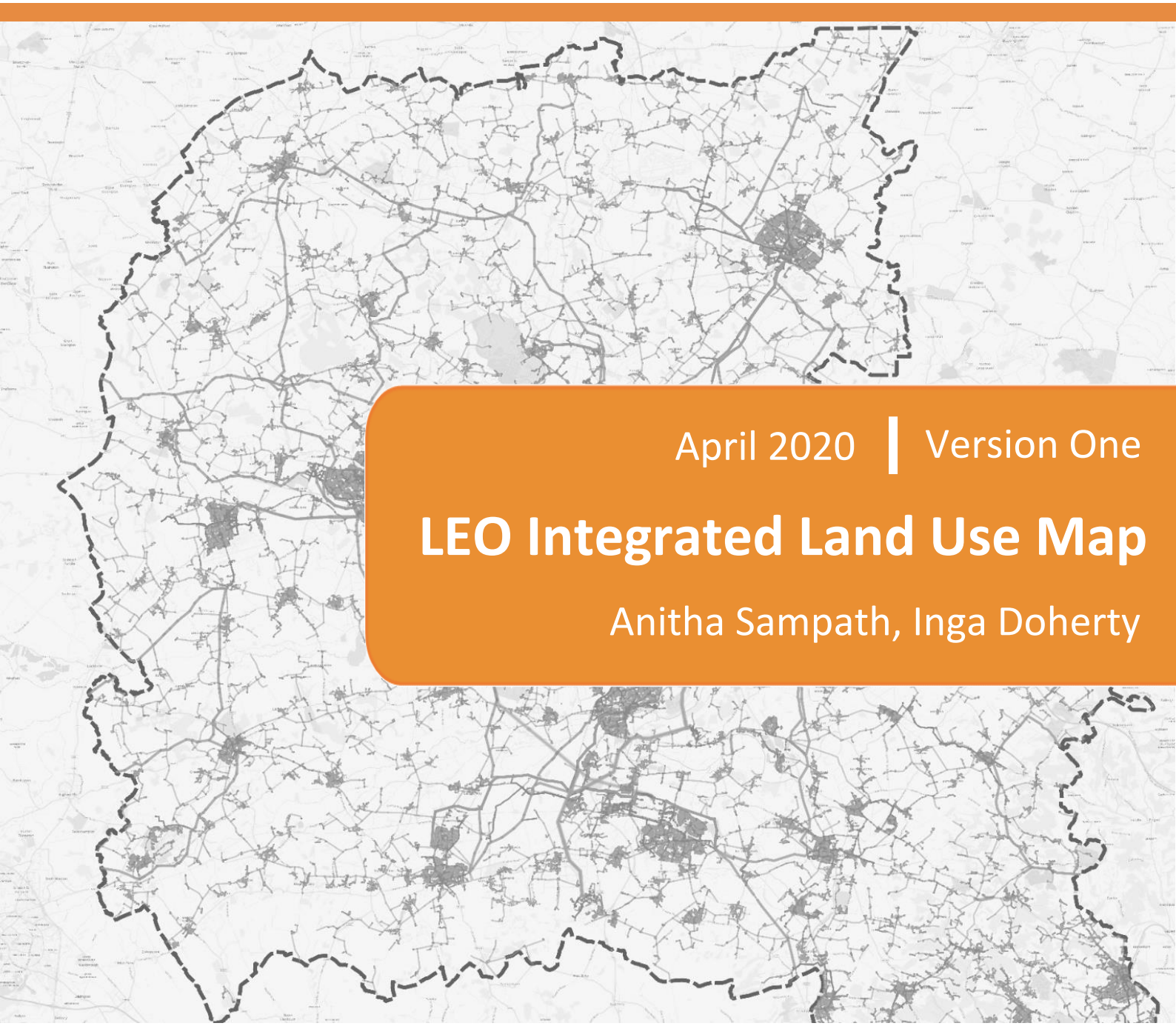
Local Energy Oxfordshire



April 2020 | Version One

LEO Integrated Land Use Map

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Industrial Strategy

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Context

The UK Government has legislated to reduce its carbon emissions to net zero by 2050. Meeting this target will require significant decarbonisation and an increased demand upon the electricity network. Traditionally an increase in demand on the network would require network reinforcement. However, technology and the ability to balance demand on the system at different periods provides opportunities for new markets to be created, and new demand to be accommodated through a smarter, secure and more flexible network.

The future energy market offers the opportunity to create a decentralised energy system, supporting local renewable energy sources, and new markets that everyone can benefit from through providing flexibility services. To accommodate this change, Distribution Network Operators (DNOs) are changing to become Distribution System Operators (DSOs).

Project Local Energy Oxfordshire (LEO) is an important step in understanding how new markets can work and improving customer engagement. Project LEO is part funded via the Industrial Strategy Challenge Fund (ISCF) who set up a fund in 2018 of £102.5m for UK industry and research to develop systems that can support the global move to renewable energy called: Prospering From the Energy Revolution (PFER).

Project LEO is one of the most ambitious, wide-ranging, innovative, and holistic smart grid trials ever conducted in the UK. LEO will improve our understanding of how opportunities can be maximised and unlocked from the transition to a smarter, flexible electricity system and how households, businesses and communities can realise the benefits. The increase in small-scale renewables and low-carbon technologies is creating opportunities for consumers to generate and sell electricity, store electricity using batteries, and even for electric vehicles (EVs) to alleviate demand on the electricity system. To ensure the benefits of this are realised, Distribution Network Operators (DNO) like Scottish and Southern Electricity Networks (SSEN) are becoming Distribution System Operators (DSO).

Project LEO seeks to create the conditions that replicate the electricity system of the future to better understand these relationships and grow an evidence base that can inform how we manage the transition to a smarter electricity system. It will inform how DSOs function in the future, show how markets can be unlocked and supported, create new investment models for community engagement, and support the development of a skilled community positioned to thrive and benefit from a smarter, responsive and flexible electricity network.

Project LEO brings together an exceptional group of stakeholders as Partners to deliver a common goal of creating a sustainable local energy system. This partnership represents the entire energy value chain in a compact and focused consortium and is further enhanced through global leading energy systems research brought by the University of Oxford and Oxford Brookes University consolidating multiple data sources and analysis tools to deliver a model for future local energy system mapping across all energy vectors.

Table of Contents

Executive Summary 4

1 Introduction 5

2 Background and Context 5

3 Purpose of the map 6

4 Methodology 6

4.1 Participants 6

4.2 Process 7

5 Layer List and Explanations 11

5.1 Planning and environmental constraints 11

5.2 Aerial Photography 16

6 Renewable Generation Potential 17

7 Web Application 21

7.1 Developing the web application 21

7.2 Review and feedback on the land use map web application 22

7.3 Accessing the web application 22

7.4 Using the map 23

8 Future Developments 23

Appendices 24

A: User Guide for Integrated Land Use Web Application 24

List of Figures and Tables

Figure 1: Process for developing the Integrated Land Use Map 7

Figure 2: Oxfordshire County boundary including constituent Local Authorities 12

Figure 3: Example of planning constraint layers 13

Figure 4: Sample Aerial Photography for Oxford City 16

Figure 5: Assessment of ground mount solar suitability across Oxfordshire 19

Table 1 Boundaries 11

Table 2 Planning Layers 13

Table 3 Environment Layers 14

Table 4 Archaeology Layers 15

Table 5 Specification for solar suitability assessment 18

Table 6 Specification for estimating wind energy suitability 18

Table 7 Timeline of web application development 21

Table 8 Review of initial web application 22

Executive Summary

The LEO Integrated Land Use map has been developed by Oxfordshire County Council (OCC) as the first deliverable of Work Package 4.1. The map, delivered to partners as an ArcGIS web application, aims to provide an accessible overview of land use designations and energy assets within the Oxfordshire county area to inform energy system planning in the consolidation phase of Project LEO. In addition, the map will provide evidence to support delivery of the Oxfordshire Countywide Energy Strategy.

The process for developing the map was set out as an MVS (Minimum Viable System) in line with the approach being taken across Project LEO. The content of the map was informed by consultation with LEO partners and external stakeholders. As well as drawing on existing land use data held by OCC and available through national databases (including planned housing and employment growth, planning constraints, aerial photography), the map includes new data on the potential for solar PV and wind generation across the county created for LEO by Energeo Limited.

To make the map accessible to LEO partners, the mapping layers were added to an ArcGIS web application created by the council's GIS team. The web application development included multiple iterations based on comments received internally within OCC and from WP4.1 partner, Oxford Brookes University. Data in the map is shared under the Public Sector Geospatial Agreement. A user guide to accompany the online map is included here as Appendix 1.

The LEO Integrated Land Use Map will continue to be developed by updating and adding new data and functionality over the course of the LEO project.

1 Introduction

The LEO Integrated Land Use Map has been developed by Oxfordshire County Council (OCC) as the first deliverable of Work Package 4.1. The map aims to provide an accessible overview of land use designations and energy assets within the Oxfordshire county area to inform energy system planning in the consolidation phase of Project LEO. The map will also provide evidence to support delivery of the Oxfordshire Energy Strategy (Section 2).

This report outlines the development and key features of the map and identifies next steps and opportunities for further development. A separate user guide has been prepared to accompany the online map and is included here as Appendix 1.

2 Background and Context

Work Package 4 focuses on Future Energy System Planning. It has three components:

4.1 Spatial Mapping – led by Oxfordshire County Council and Oxford Brookes University
4.2 Temporal mapping – led by University of Oxford
4.3 Insights – led by University of Oxford

Oxfordshire County Council (OCC) is working alongside Oxford Brookes University (OBU) in **Work Package 4.1** to provide spatial energy mapping intelligence to:

- aid identification of locations for smart grid and capacity testing
- support decisions to optimise use of existing infrastructure
- aid identification of location and potential capacity for low carbon energy generation
- identify communities and households for targeted energy efficiency programmes to reduce energy demand.

As well as supporting decisions in LEO the spatial mapping intelligence will provide evidence to support the Oxfordshire Plan 2050 (the county's Joint Statutory Spatial Plan)[1] and delivery of the Oxfordshire Energy Strategy[2]. Owned by the Oxfordshire Local Enterprise Partnership and developed in partnership with the county's local authorities, the University of Oxford, Low Carbon Hub, SSEN and with input from a wide range of local stakeholders, the Energy Strategy provides the framework to support clean growth and meet public commitments to reduce countywide carbon emissions by 50% between 2008 and 2030 and set a pathway to net zero carbon by 2050.

Delivery of the Energy Strategy to meet this objective – and the county's ambitious plans for housing and economic growth - will be through many avenues and organisations and will require significant interventions across all sectors. For example, emissions modelling commissioned to inform the

[1] https://oxfordshireplan.org/
[2] Oxfordshire Energy Strategy, 2019. https://www.oxfordshirelep.com/energystrategy

Strategy[3] indicates that renewable generation will need to provide more than 50% of the county's power and 40% of heat by 2030 to meet this objective, an estimated additional 2000 GWh. This will require delivery of new generation at dwelling, community and strategic scale. Developing a countywide energy plan based on sound evidence and data on the county's energy resources, demand and opportunities will be critical.

3 Purpose of the map

The integrated land use map for Oxfordshire is the first step in providing the spatial intelligence to support energy systems planning in LEO and strategic planning for delivery of the Oxfordshire Energy Strategy.

The map draws together a wide range of information on land use, including environmental and landscape designations, agricultural grade, flood risk zones, planned housing and employment growth and energy assets (including the location and installed capacity of existing renewables), primarily shown through geographical placemarks and polygons. It also includes a new data set created for LEO by Energeo Limited indicating areas across the county which may be suitable for installation of additional renewables at a variety of scales, including potential strategic sites which may be considered through the Oxfordshire Plan 2050. Further details of the Renewable Energy Potential dataset are provided in section 6 of this report.

Presenting land use layers together in a single map, will make it easier for LEO partners in the first instance and then for a wider group of stakeholders to identify areas of opportunity for growth of renewable energy to inform strategic decision making.

Development of the map will continue over the coming year with the addition of further datasets and functionality informed by the needs of project partners and other key stakeholders.

4 Methodology

The process for developing the Integrated Land Use Map was set out as MVSB1.1 in line with the approach being taken across Project LEO[4]. Details are set out below and summarised in Figure 1.

4.1 Participants

i. MVS leads

The map has been developed by the Energy Insights team at Oxfordshire County Council (Anitha Sampath and Inga Doherty), working in conjunction with the council's GIS and digital data team. Oxford Brookes University (Professor Rajat Gupta and Dr Angelines Donastorg Sosa) provided support and reviewed the map prior to its release to all LEO partners[5].

[3] Aether, 2008. Oxfordshire Greenhouse Gas Projections. 2018 update for Oxfordshire County Council
[4] Land Use Mapping MVS (Available on LEO SharePoint)
[5] Integrated Land Use Map Review (Available on LEO SharePoint)

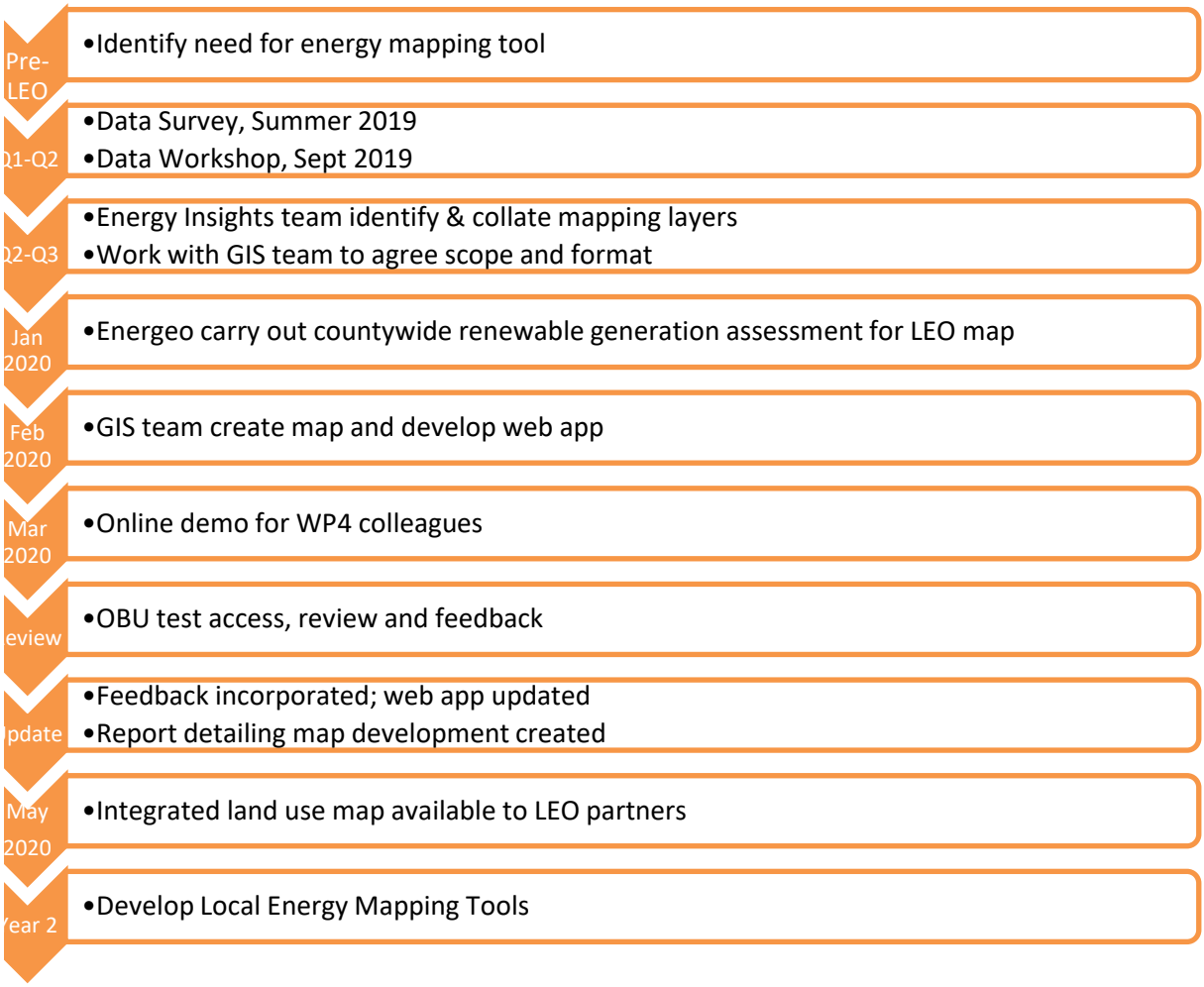
ii. Data providers

Data for the land use layers has been provided by Oxfordshire County Council and Energeo.

iii. Data Users will be Oxford Brookes University, the University of Oxford, Low Carbon Hub, District Councils.

4.2 Process

Figure 1: Process for developing the Integrated Land Use Map



i. Identification of need

OCC holds a wide range of geospatial data used to inform service planning and delivery. The value in drawing together key aspects of this data into an integrated land use map to inform county-wide energy planning was identified by OCC and partners developing the Countywide Energy Strategy and included in Project LEO under Work Package 4 (future system learning). Consultation with LEO partners and external stakeholders, in particular the County Energy Officers' Network, helped define the purpose and requirements for the map.

ii. Identifying data

A data survey was conducted by Oxford Brookes University and University of Oxford in Summer 2019 to determine data availability, data owners and access. The survey results identified many of the data layers relevant for the mapping project and showed that the majority were held by OCC. [6]

Following the initial survey, the Council's LEO Insights Officer identified and consulted further with teams across Oxfordshire County Council (OCC) that generate and/or manage a variety of land use data.

- Environment Strategy Team works on natural environment issues, promoting environmental quality and maintaining partnerships with environmental groups across Oxfordshire. They maintain various spatial data sets relevant to energy planning which can be included in the LEO map: county ecology; landscape management; nature conservation areas; biodiversity. In addition, the team is close to finalising a project mapping county wide natural capital which can be a future addition to the land use map.

- Strategic Planning Team works closely with the District and City Councils (the Local Planning Authorities) on Local Plans and the Oxfordshire Plan. To enable a countywide overview of planned housing and employment growth, the team have collated data from each Local Planning Authority. This information was agreed as essential data for the land use map.

- Thames Valley Environmental Records Centre (TVERC), part funded by OCC, provides comprehensive species and habitat data to support scientific research and planning decisions. TVERC has provided GIS data for Local Wildlife and Geological Sites, NERC Act S41 Habitats of Principal Importance (previously called UK Biodiversity Action Plan (BAP)

[6] Report on Data Survey, August 2019 (Available on LEO SharePoint)

habitats) and Ecological Networks (Conservation Target Areas and Biodiversity Opportunity Areas).

- OCC's Digital and GIS Team maintain and deliver a wide range of spatial datasets for use within the county council as well as for an external audience. The team made available the following data (identified in the data survey): Ordinance Survey base map, administrative and statistical boundaries within the county, Environmental Agency flood zone classification layers and Aerial Imagery.

iii. Agree data requirements with Stakeholders

- **LEO Partners** were consulted on uses and content of the mapping as part of the LEO Data Workshop held on 30 September 2019[7]. OCC and OBU presented the initial list of datasets gathered. Discussions highlighted additional data requirements and considered: how to link spatial data with temporal and metering data being used by the Technical MVS; ownership and replicability within a local authority remit; and business models for the long-term sustainability of an energy map or energy tool.

- **External stakeholders**

  The County Energy Officers' Network includes members from each of the six Oxfordshire local authorities and is a key stakeholder and potential user for the LEO map. While the first version of the integrated land use map is primarily for internal use by LEO partners, we envision that future iterations with additional functionality will be available to the District and City Councils. Ongoing discussions with the Energy Officers will keep them updated on the wider LEO project and gain their views and uses for the land use map.

- The **Greater South East Energy Hub** (GSEEH) is funded by the Department of Business, Energy and Industrial Strategy (BEIS) to support development of public sector energy projects. As part of their work, the GSEEH have been identifying current and recent energy mapping projects across the UK. To help develop the scope and specification of the LEO map, we had a number of discussions with GSEEH on mapping projects completed by other local authorities to understand what worked and what did not. Many of the issues focus on longevity of the project (ie how to keep it live beyond the funding period), others highlighted

[7] Data Workshop Report, September 2019 (Available on LEO SharePoint)

challenges in access to data, including feed in tariff data for property level renewables as well as grid constraint data.

iv. Data processing

Once the LEO team within OCC had finalised the list of layers required, the GIS team worked towards building the online version of the map on the ESRI platform. All layers included in the map are listed and described in Section 5, with further details on new data generated for the project explained in Section 6. A detailed description of the methodology used to develop the web application is presented in Section 7.

v. Feedback on the integrated land use map application

The web application, once created, was tested by OBU, who provided an impartial review of the integrated land use map in terms of user interface ease and layer positioning[8].

vi. Refinement of the integrated land use map

Recommendations made by OBU were used to refine the final iteration of the map before making it available to LEO partners.

vii. Sharing the Integrated land use map web application

OCC is able to share the online map through their Public Sector Geospatial Agreement (previously the Public Sector Mapping Agreement). All parties accessing the map were required to sign the Ordnance Survey PSGA data license and the APGB (Aerial Photography Great Britain) licensing agreement.

[8] Integrated Land Use Map Review (Available on LEO SharePoint)

5 Layer List and Explanations

In this section, we provide a brief description of each of the data layers identified for inclusion in the Integrated Land Use Map following discussions with stakeholders. The data has been organised into four categories:

i. Planning and environmental constraints – includes details on planned housing and employment growth and planning constraints (e.g. areas with nature conservation designations, flood risk zones)

ii. Electricity network

iii. Aerial photography

iv. Renewable generation potential.

The fourth category is a new data set created for the LEO project by Energeo Ltd. Full details are provided in Section 6. Details of each mapping layer are given in the following tables.

5.1 Planning and environmental constraints

Table 1 Boundaries

Layer	Description
District and City Council boundaries	Oxfordshire County is a 2-tier authority area. This layer provides the boundaries for the district areas.
Parish boundaries	Boundaries of 280 civil parishes within Oxfordshire county.
Ward boundaries	Boundaries of 112 wards in the county.
LSOAs	Boundaries of 404 LSOA in Oxfordshire. Lower Layer Super Output Area (LSOA) is a geospatial statistical unit created by the Office for National Statistics (ONS). Each LSOA has a minimum population of 1000 and the mean is 1500.
MSOAs	Boundaries of 86 MSOAs in Oxfordshire. Middle Layer Super Output Area (MSOA) is a geospatial statistical unit created by ONS with a population between 5000 and 7200

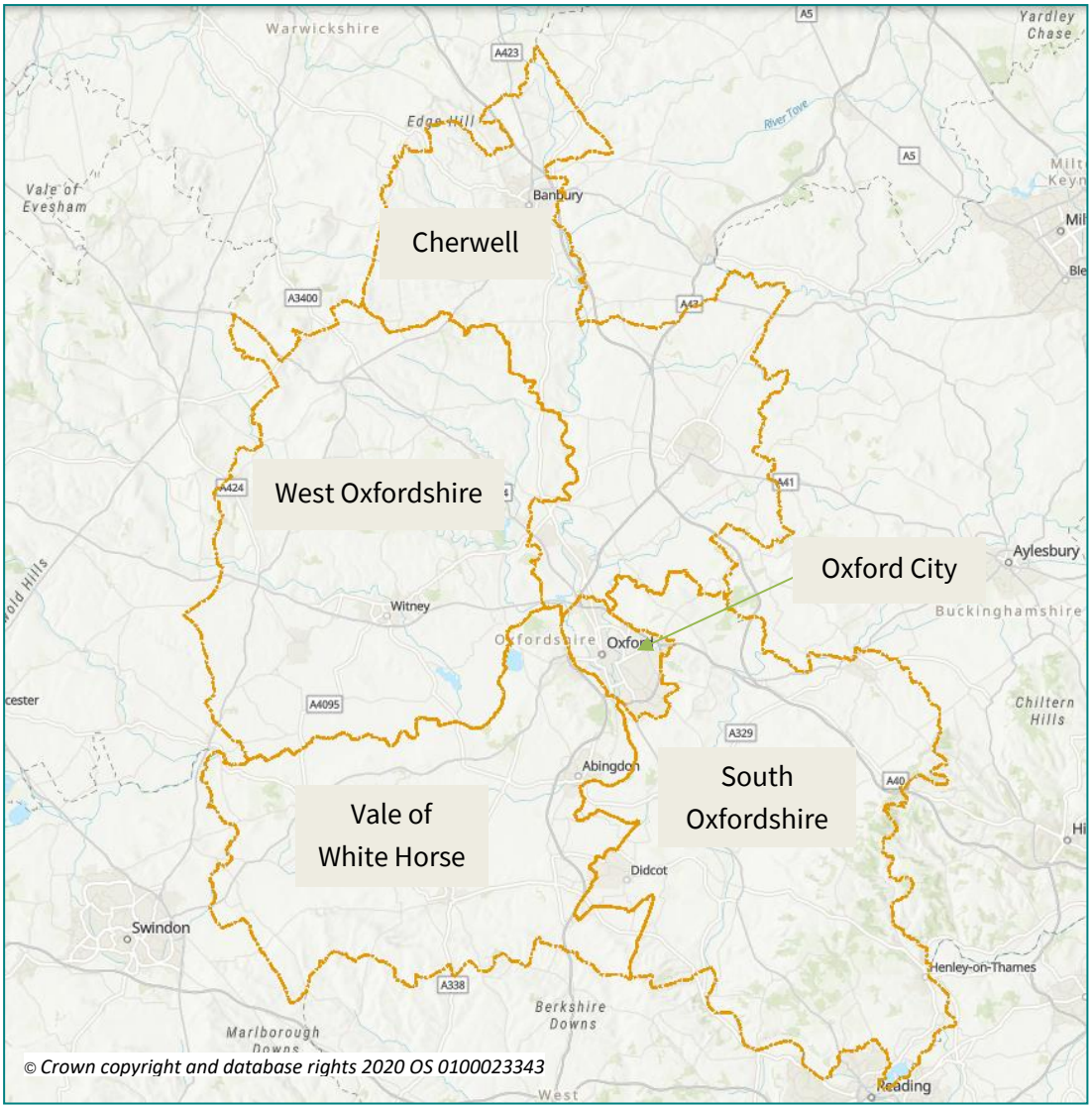


Figure 2: Oxfordshire County boundary including constituent Local Authorities [9]

[9] For this and all other maps in this report -- © Crown copyright and database rights 2020 OS 0100023343

Table 2 Planning Layers

Layer	Description
Oxfordshire adopted housing and mixed-use allocations	These are sites that have been allocated for housing and/or employment in adopted Local Plans.
Oxfordshire commitments and completions, May 2019	Development sites that have secured planning permission and are currently being built or already completed by May 2019 (latest data).
Oxfordshire emerging allocations	Areas being proposed for inclusion in future revisions of the Local Plans (those not adopted by May 2019).

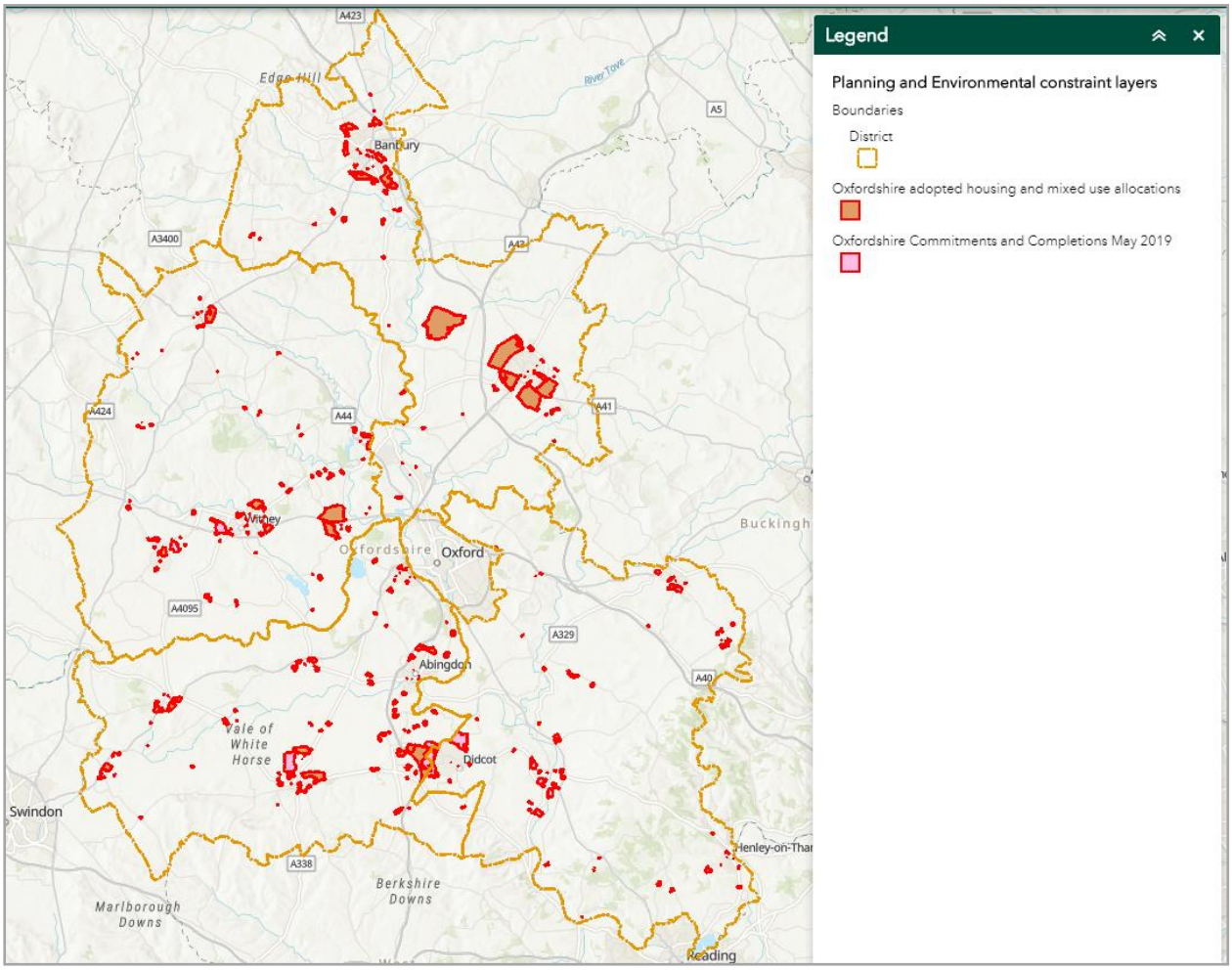


Figure 3: Example of planning constraint layers

Table 3 Environment Layers

Layer	Description
Areas of Outstanding Natural Beauty (AONBs)	Areas designated by Natural England to protect and manage the areas for conservation, visitors, and residents.
Green Belt 2018	Area of open countryside maintained through National Planning Policy to prevent urban sprawl
Ancient Woodland	Areas of woodland that have persisted since 1600 in England and Wales. They are unique and complex communities of plants, fungi, insects and other microorganisms.
Special Areas of Conservation (SAC)	Conservation areas of international importance and defined in the EU Habitats Directive (92/43/EEC), also known as the Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora.
Sites of Special Scientific Interest (SSSI)	A formal conservation designation used by Natural England for the finest sites for wildlife and natural features in England, supporting many characteristically rare and endangered species, habitats and natural features.
SSSI Impact Risk Zones (IRZ)	A GIS tool developed by Natural England to make rapid initial assessment of the potential risks posed by development proposals to SSSIs.
Conservation Target Areas, Oxfordshire (CTA Oxon)	Some of the most important areas for wildlife conservation in Oxfordshire, where targeted conservation action will have the greatest benefit.
CTA (Conservation Target Areas) Key link zones	The key link zones of CTA include surrounding land which can buffer and link areas thereby creating important larger and better-connected landscapes.
District Wildlife sites	Sites of importance within each district for wildlife which include important and rare habitats and species.
County Wildlife sites	Sites of importance at the county level for wildlife which include important and rare habitats and species.
National Nature Reserves	Sites designated by Natural England as key places for wildlife and natural features in England.
RSPB reserves England	The Royal Society for the Protection of Birds (RSPB) reserves serve to promote conservation and protection of birds and the wider environment through public awareness campaigns, petitions and through the operation of nature reserves throughout the United Kingdom.

Environment Agency (EA) layers	a. EA admin boundaries: Water Companies b. EA Admin boundaries: Water Management Companies c. EA detailed river network d. EA flood map defences e. EA Flood map areas benefit f. EA flood zones g. EA ground water vulnerability 100K h. EA ground water vulnerability drift 100K i. EA areas susceptible to groundwater flooding
Landscape Types	This data is an investigation of landscape character and biodiversity across the county.
Common Land	Land owned by a person (or persons) over which another person has certain rights, e.g. the 'right to roam'.
National Trust Land	Land owned and/or looked after by the National Trust including countryside and heritage landscapes.
Parks and gardens	Boundaries of parks and gardens within the county as registered on the Historic England list.
Public Rights of Way	Public rights of way allow the public to walk, or sometimes ride, cycle or drive, along specific routes over land which belongs to someone else – the land itself is often privately owned.
National Trails	Long distance footpaths and bridleways administered by Natural England.

Table 4 Archaeology Layers

Layer	**Description**
Listed buildings	Buildings with special historical or architectural importance and are of national interest.
Scheduled Monuments	The most important archaeological remains are designated as Scheduled Monuments by Historic England.

5.2 Electricity Network Layers

Layer	Description
Existing renewable energy sites	The Renewable Energy Planning Database (REPD) is managed by Eunomia Research and Consulting Ltd (Eunomia) on behalf of the Department for Business, Energy and Industrial Strategy (BEIS). The database tracks the progress of renewable energy projects (including those that can be used for combined heat and power (CHP)) though various stages such as – inception, planning, construction, operation, and decommissioning.
LEO Site Selection Primary Substations	12 primary substation areas selected for LEO flexibility trials.
Substation site	Location of electricity substations
Electricity pylons	Location of electricity pylons
Electricity Lines	Location of electricity lines

5.2 Aerial Photography

This layer includes the 25cm resolution aerial imagery captured by Blue Sky, part of the Aerial Photography Great Britain consortium and available under the Public Sector Geospatial Agreement of which the County Council is a member.

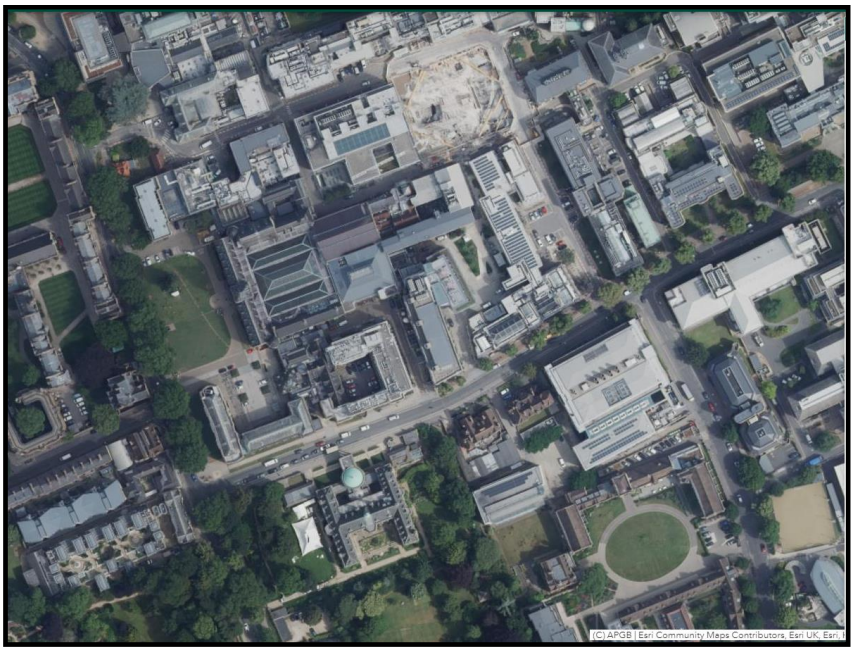


Figure 4: Sample Aerial Photography for Oxford City

5.4 Renewable generation potential layers

a) Solar suitable land and estimate of potential generation capacity
b) Wind suitable land and estimate of potential generation capacity.

Details of this dataset are provided in the following section.

6 Renewable Generation Potential

As well as including existing data on land use and planning constraints, the web application includes **new** data generated for the LEO spatial mapping project by Energeo Limited as set out below.

Energeo was identified as organisation offering new insights for energy planning through their use of geospatial Big Data and Machine Learning and was selected by Oxfordshire County Council (OCC) and the LEO consortium to undertake a detailed study into the potential to deploy a variety of low carbon technologies across the county.

In the first stage of this study, Energeo undertook a desk-based analysis to:

i. Assess all individual land areas across Oxfordshire of 0.5 hectares or more to identify areas suitable for solar and / or wind generation.
ii. For each suitable area identified, estimate the potential generation capacity of the installation.

Energeo used the criteria set out in Tables 5 and 6 to determine whether an area was potentially suitable for solar and/or wind generation.

Table 5 Specification for solar suitability assessment

Step	Specification for solar suitability
1	Not on Grade 1 or 2 agricultural land
2	Not in the green belt
3	Not in flood zones 2 or 3
4	Not in a SSSI, AONB, or other conservation zone
5	No buildings within field parcel
6	No woodland within field parcel
7	No water within field parcel
8	Pitch 0-10 degrees within the 90-270 (through south) aspect arc
9	Pitch 0-3 degrees within the 270-90 (through north) aspect arc
10	Minimum size 0.5 hectares
11	For sites that meet all the above criteria, estimate potential install **capacity**: Capacity: 1MW installed per hectare

Table 6 Specification for estimating wind energy suitability

Step	Specification for wind suitability
1	Not on Grade 1 or 2 agricultural land
2	Not in the green belt
3	Not in flood zones 2 or 3
4	Not in a SSSI, AONB, or other conservation zone
5	No buildings within field parcel or immediately adjacent parcels
6	No woodland within field parcel or immediately adjacent parcels
7	No water within field parcel or immediately adjacent parcels
8	Pitch 0-10 degrees within the 180-270-0 degree arc
9	Average wind speed 6 metres per second at 45m above ground level (AGL)
10	Minimum size 0.6 hectares
11	For sites that meet all the above criteria, estimate potential install **capacity** Capacity: 1MW installed per 0.3 hectare (estimation of potential installed capacity not energy generation)

Based on the above specifications, Energeo assessed 32,096 parcels of land across the county. Of these, 9,520 land parcels, a total area of approximately 46,095 hectares, were estimated to be suitable for solar generation (Figure 5); 517 land parcels over approximately 2,122 hectares of land were estimated suitable for wind generation (Figure 6).

The dataset is intended as an indicator of potential suitability only and may inform selection of areas for deeper investigation.

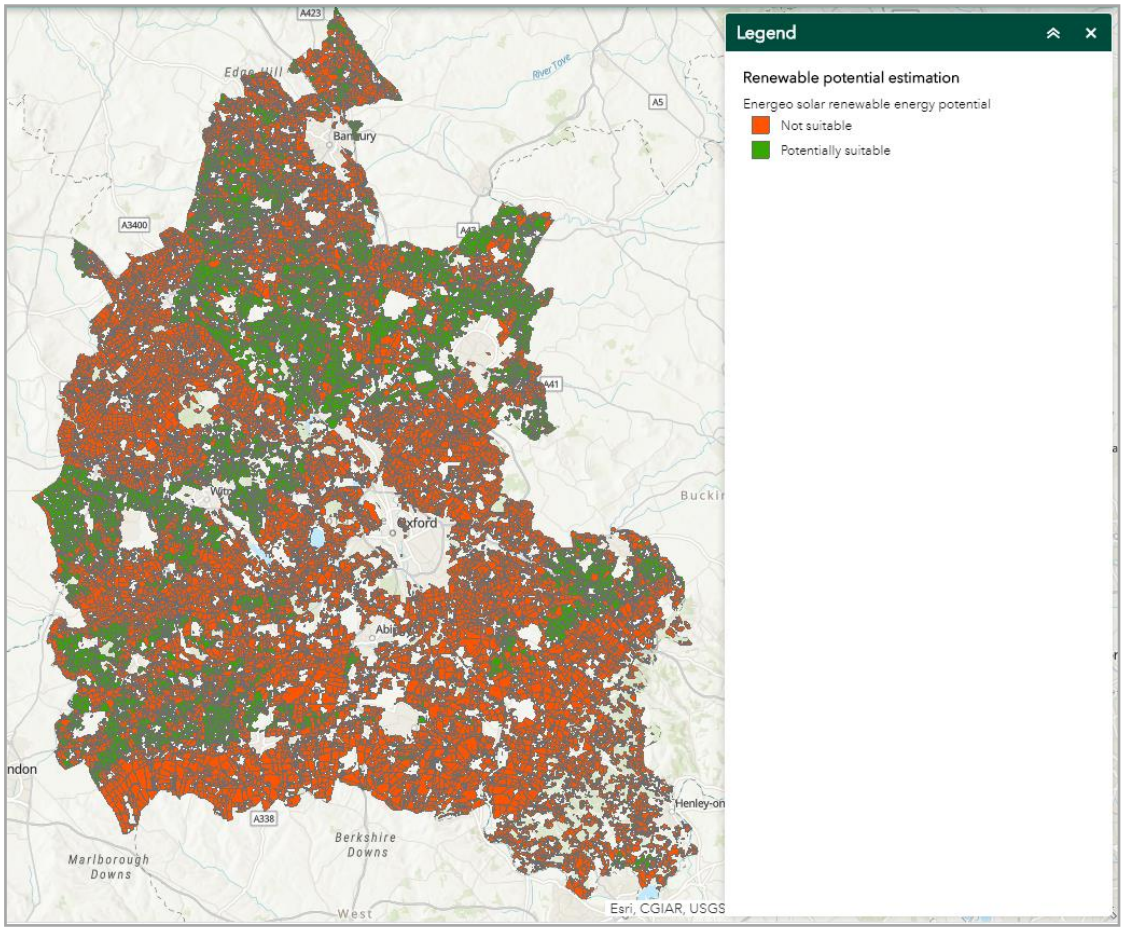


Figure 5: Assessment of ground mount solar suitability across Oxfordshire

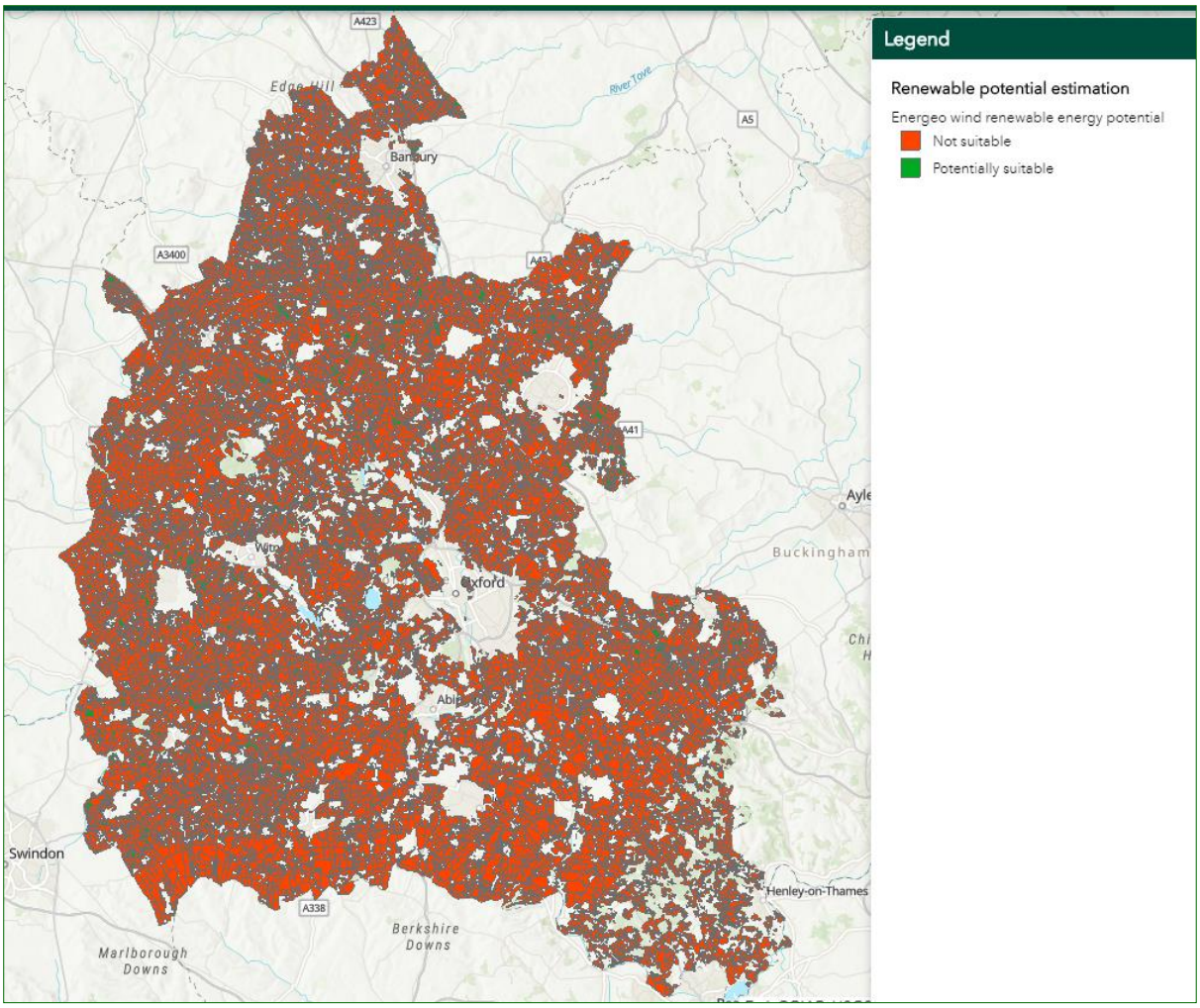


Figure 6: Assessment of wind generation suitability across Oxfordshire

The solar and wind generation estimates have been incorporated in the first iteration of the LEO web application. In future parts of this work, Energeo will digitally study over 110 square kilometres of urban conurbation and over 250,000 buildings in 10 market towns in Oxfordshire to determine their potential for low carbon technologies and the benefits of deployment.

7 Web Application

7.1 Developing the web application

It is vitally important that the digital data generated for the mapping can be readily accessed by the stakeholders that need it. **The data is therefore hosted by OCC and made available through a web application which will be accessible to LEO partners and to our district councils, and other key stakeholders as required.**

Once the LEO team within OCC had finalised the list of layers required, the GIS team developed the online version of the map on the ESRI platform. ESRI (Environmental Systems Research Institute) is an international supplier of geographic information system software, web GIS and geodatabase management applications. OCC has an enterprise partnership with ESRI which allows us to host our data on the ArcGIS web application through our Oxfordshire Online Map Portal. The steps to developing the web application are set out in Table 7 below.

Table 7 Timeline of web application development

Step	Activity	Time Line	Description
1	Initial Map Developed	Feb 2020	The OCC GIS team developed an initial map based on specifications and list of layers provided by the Energy Insights Team.
2	Feedback and re-work	26th Feb 2020	Based on internal feedback on the initial map, the GIS team exported an updated version onto the ArcGIS web portal
3	Demo to WP4 partners	5th Mar 2020	A demonstration of the initial map was done for WP4 partners from Oxford Brookes University. Along with the demonstration, OBU were provided access to the map on ArcGIS online.
4	Feedback from Oxford Brookes University (OBU)	1st Apr 2020	Oxford Brookes University provided feedback on the web app developed by OCC.
5	Updated App	May 2020	The GIS team updated the web app based on feedback received.
6	Data sharing licences agreed	May 2020	All partners who wish to view the map need to sign the Public Sector Geospatial Agreement and the licenses for Aerial Photography Great Britain.
6	Sharing with LEO partners	Jun 2020	The first version of the LEO integrated land use map will be shared with all LEO partners.

7.2 Review and feedback on the land use map web application

The feedback provided by OBU aided the creation of the final iteration of the land use map. Table 8 below provides a summary of the feedback provided by OBU.

Table 8 Review of initial web application

No.	Recommendations
1	Grouping the layers into 3 categories: (1) Existing (2) Potential (inferred using assumption/calculations) and (3) Aerial photos, would clarify the validity of the layers.
2	Percentage of the unsuitable and potentially suitable areas (for solar or wind energy potential) could be added.
3	Addition of a help button to provide information on what each button and feature does
4	Provision to download layer(s) can be added. This is subject to signing of the data sharing agreement.
5	Lowering the colour intensity of some layers and adding transparency to polygon layers.
6	Provision to see multiple pop-ups for the different layers.
7	Other energy vectors must be taken into account, information regarding heating, storage and transport vector should be added.

Where possible, the current iteration of the integrated land use map reflects these recommendations.

7.3 Accessing the web application

The data in the online Integrated Land Use map is shared through the Public Sector Geospatial Agreement (previously the Public Sector Mapping Agreement). This is a central government funded scheme which enables local authority members to access:

- Ordnance Survey premium chargeable digital spatial data,
- APGB Aerial Photography Great Britain Mapping Consortium imagery and digital terrain models, and
- GeoPlace and OS gazetteer data including Royal Mail postcode address files.

The terms of the agreement allow the council to share data with partners to deliver their core business. To do this and meet the requirements of the council's PSGA, all partners will be required to sign the Ordnance Survey PSGA data license and the APGB (Aerial Photography Great Britain) licensing agreement.

7.4 Using the map

A user guide has been compiled to accompany the current online map and is included here as Appendix 1.

8 Future Developments

The LEO integrated land use map will continue to be developed in Year 2 of the project, initially to include additional data, for example network constraints (other potential datasets are listed overleaf). Further development will create an energy mapping tools to provide descriptive and quantitative energy insights. The developments will be informed by consultation with stakeholders to identify user needs and requirements.

Datasets suggested for inclusion in the second phase:

1. Actual current and predicted electricity demand (from SSEN)
2. Domestic electricity (and gas) consumption by postcode and LSOA
3. Off gas areas
4. People's power station (Integration with Low Carbon Hub's map of installed community owned renewable energy projects)
5. Socio-economic indicators, including fuel poverty and indices of deprivation
6. Weather information i.e. Met. Office, Historical Information from the European Centre for Medium-Range Weather Forecasts (ECMWF)
7. River heights - to understand if there's capacity for hydro.
8. CORINE Land Cover data
9. Transport data (including electric vehicle charge points).

Appendices

A: User Guide for Integrated Land Use Web Application

Introduction

The LEO Integrated Land Use Map is an ArcGIS web application hosted by Oxfordshire County Council. This web application will help to identify locations across Oxfordshire which may be suitable for infrastructure related to the LEO project. It draws together a wide range of spatial data layers (full details are presented in the body of this report) which the user can switch on as required. This guide sets out how to use the web application.

The LEO Integrated Land Use Map

The LEO integrated Land Use Map opens to show the Oxfordshire county area displayed in Figure 1 below. The navigation and zoom functions appear on the top left corner of the map. The various features of the web application are shown as icons on the bar at the right of the screen. Each feature is explained in the following sections.

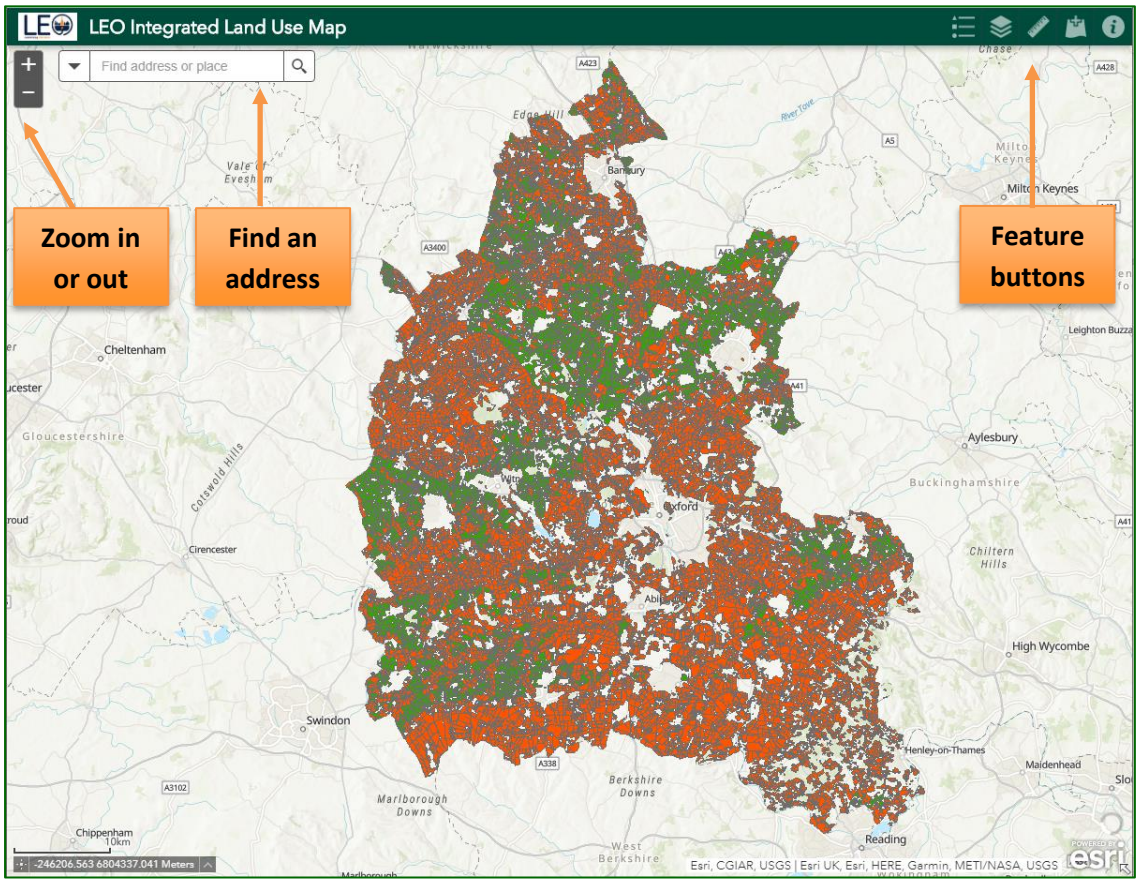


Figure 7: Landing page of LEO map[10]

[10] For this and all other maps in this report -- © Crown copyright and database rights 2020 OS 0100023343

Navigation

The LEO map uses an Ordnance Survey base map

- **Find your way round** by dragging your mouse across the map.
- **Zoom in and out** using the buttons on screen or by using your mouse.
- Enter an address or postcode to **zoom to an area** using the address finder widget.

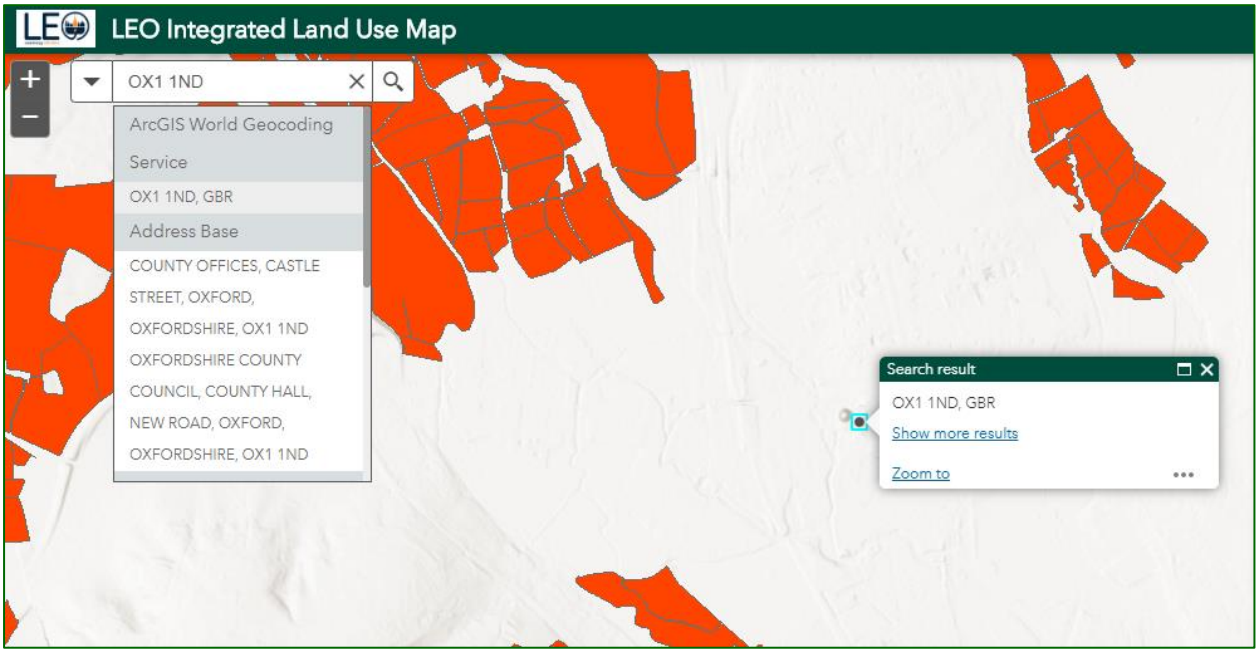


Figure 8: Navigating the map

Layers

When the App is launched it opens to display the countywide solar potential dataset created for Project LEO by Energeo. All other layers in the application are switched off by default to increase the speed at which the App launches.

To open the complete list of layers click on the layers button on the top right of the map as shown in figure 3 below.

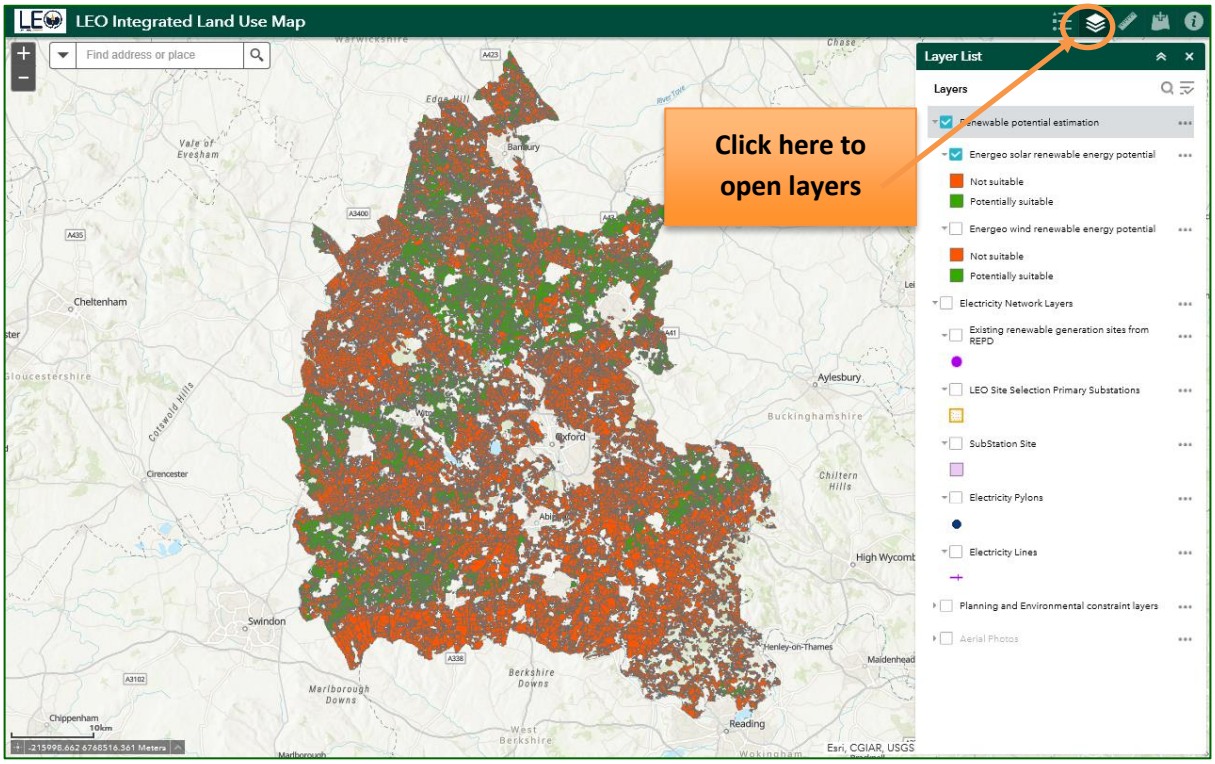


Figure 9: Viewing layers on the map

The data layers in the map are divided into four broad categories:

1. Renewable potential estimation
2. Electricity network layers
3. Planning and environmental constraint layers
4. Aerial imagery

The full list of layers and a short definition for each of the data sets is given in Appendix A.

To see the list of data layers under each grouping click the down arrow next to the category name as shown in the example in Figure 4. **To turn the layers on or off**, click the down arrow next to the layer name. Use the scroll bar to the right of the layer list to scroll down the complete list of layers in the map.

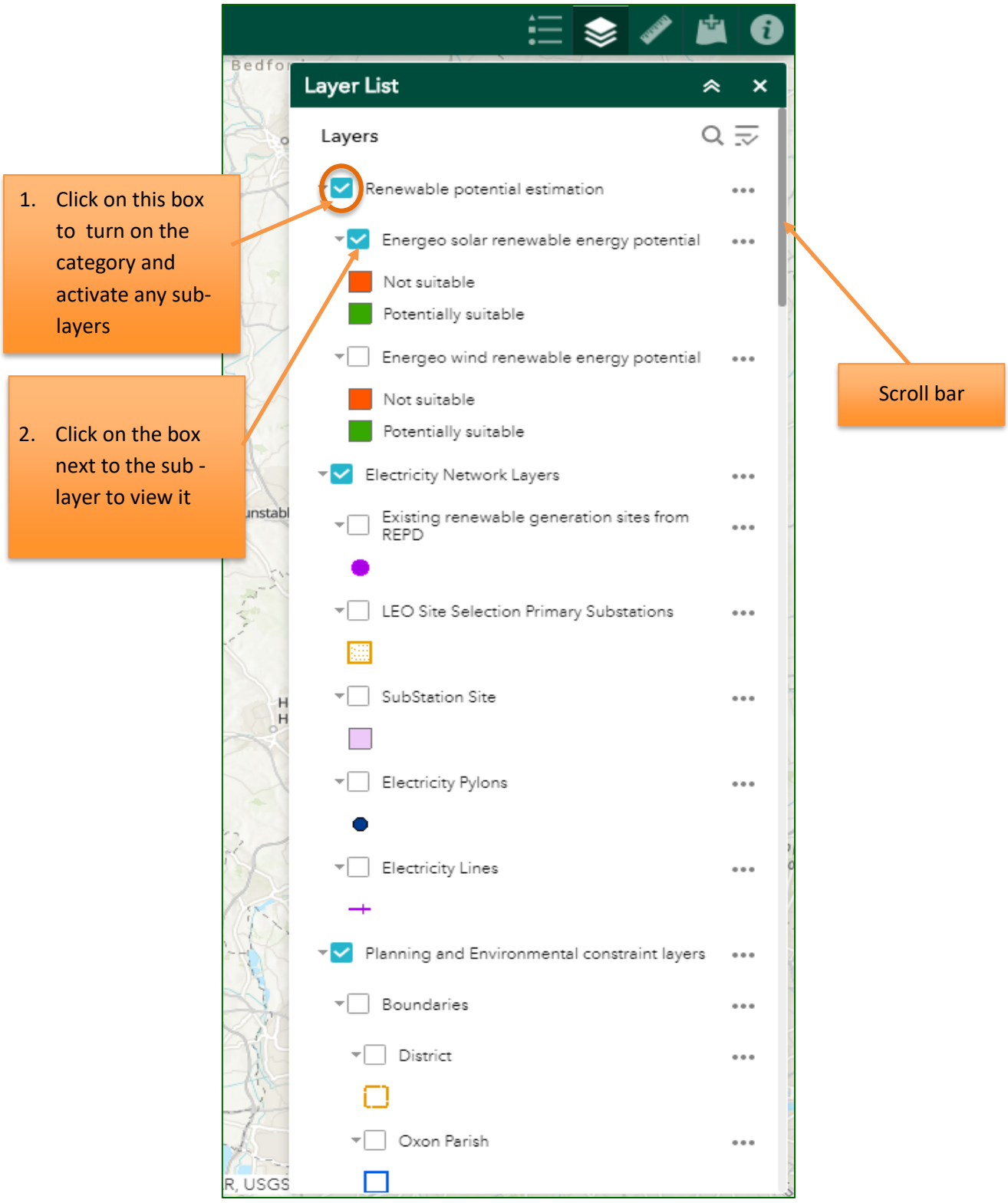


Figure 10: Selecting Layers and Sub-layers

Legend

To view the legend of the map, click on the legend button in the top right of the map (figure 5).

When you have multiple layers turned on, the legend displays the symbology for each of the associated layers as shown in figure 6.

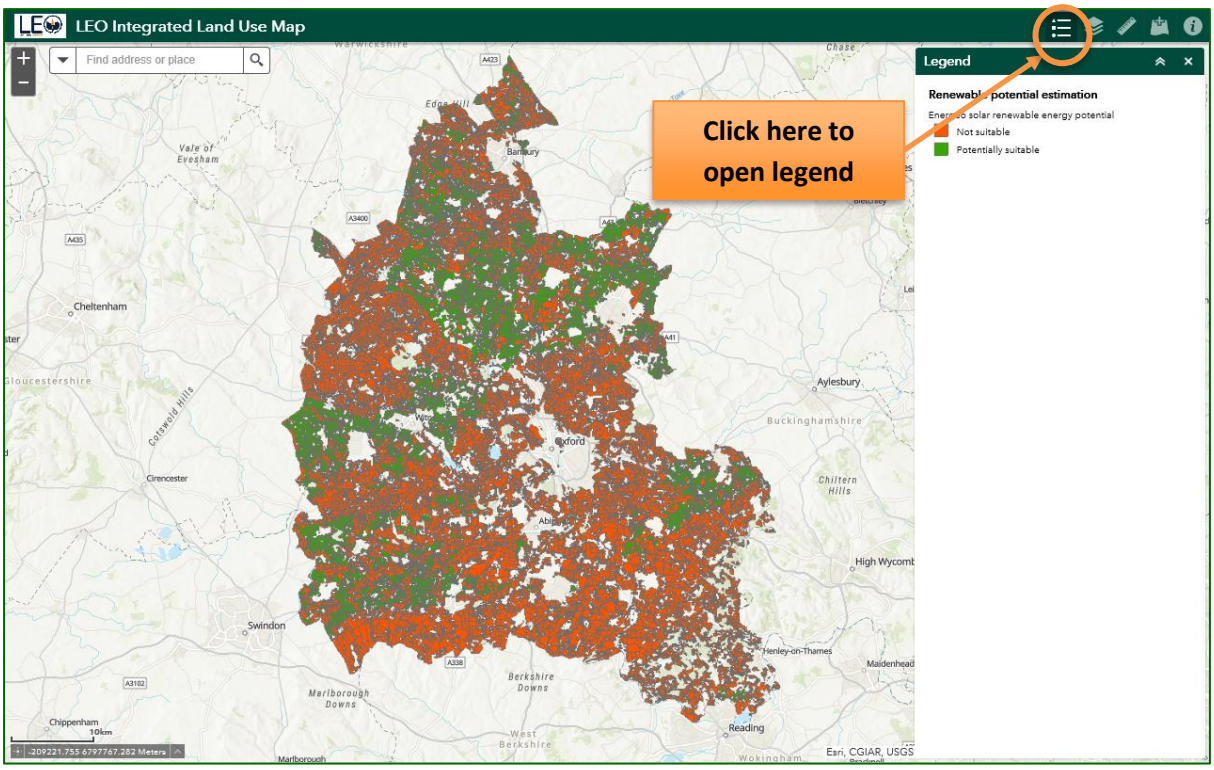


Figure 11: View the Legend for the map

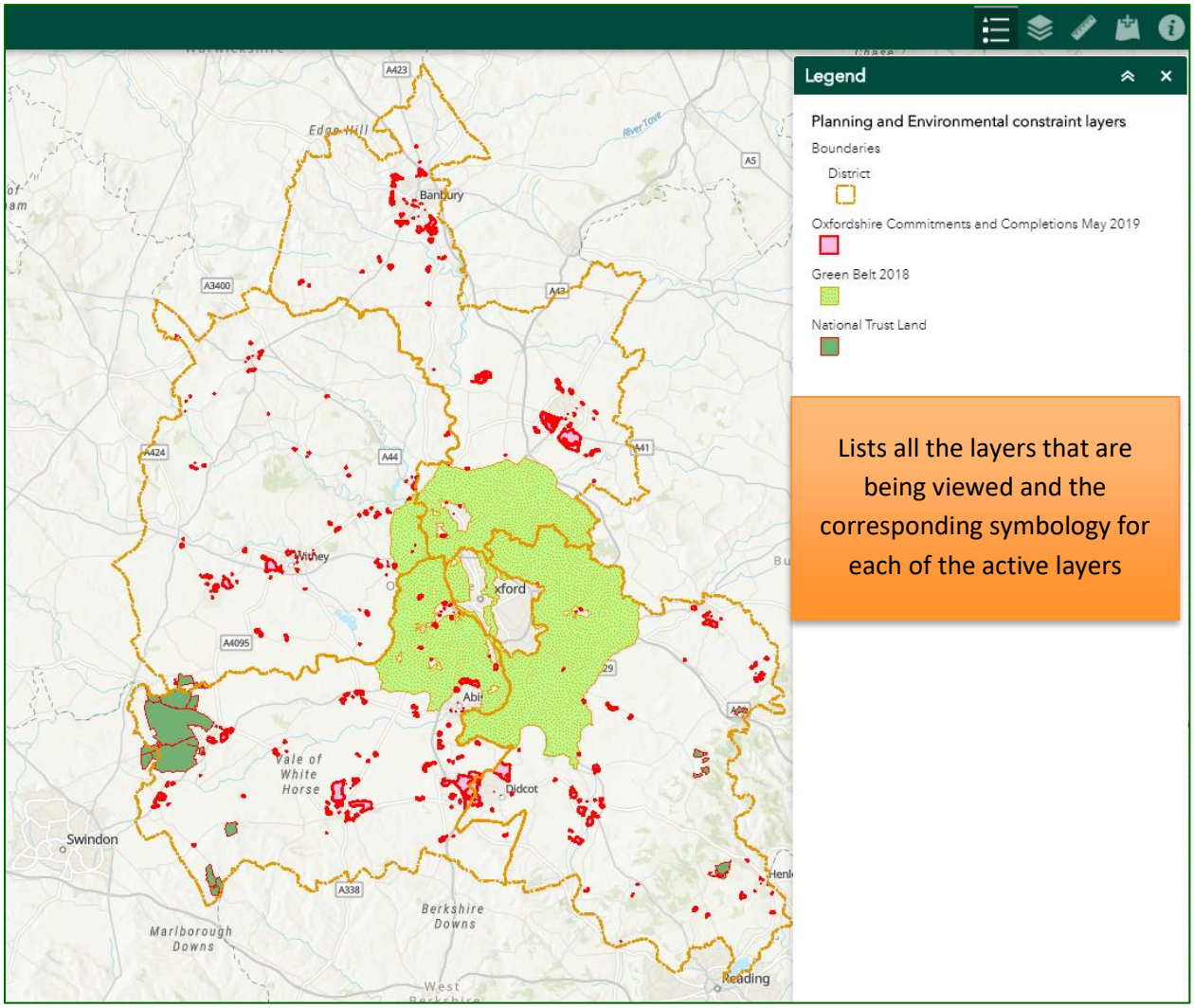


Figure 12: Legend when multiple layers are viewed at the same time

Attributes

Clicking on the map will bring up a text box showing the attributes for the selected mapping layers for that area as shown in figure 7.

If more than one layer is switched on for the same area, the pop up will show details for each; the example in figure 7 shows (2 of 2). Use the arrows in the top right of the pop-up box to view the attributes for each layer.

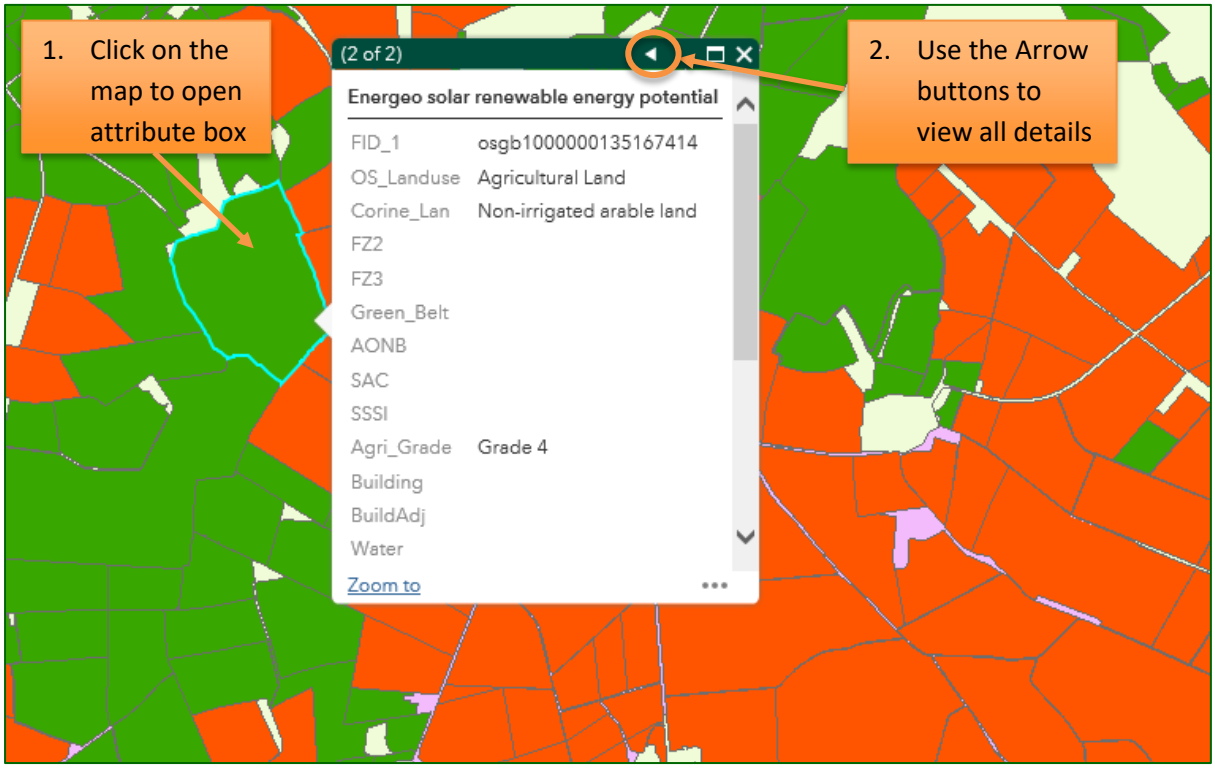


Figure 13: Attribute box and details for each associated feature

Transparency

It is possible to adjust the transparency for each of the four groups of layers. Click on the three dots next to each of the group of layers as shown below.

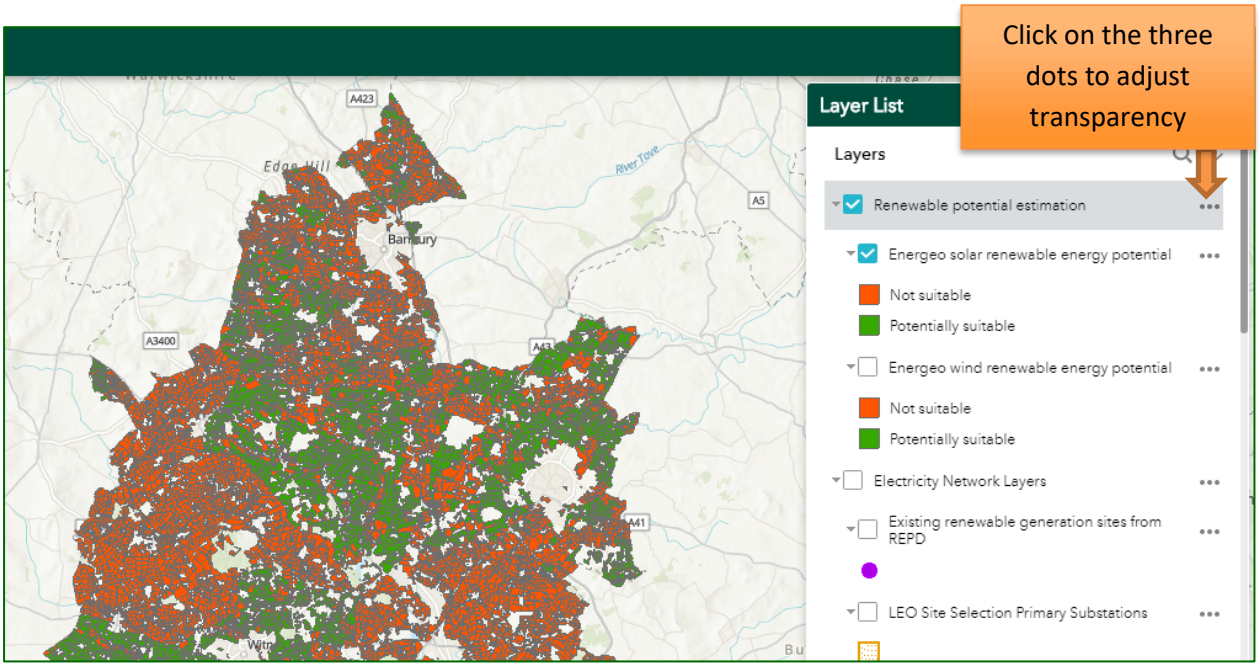


Figure 14: Adjusting transparency

This will provide you with the option to change the transparency of that group of layers.

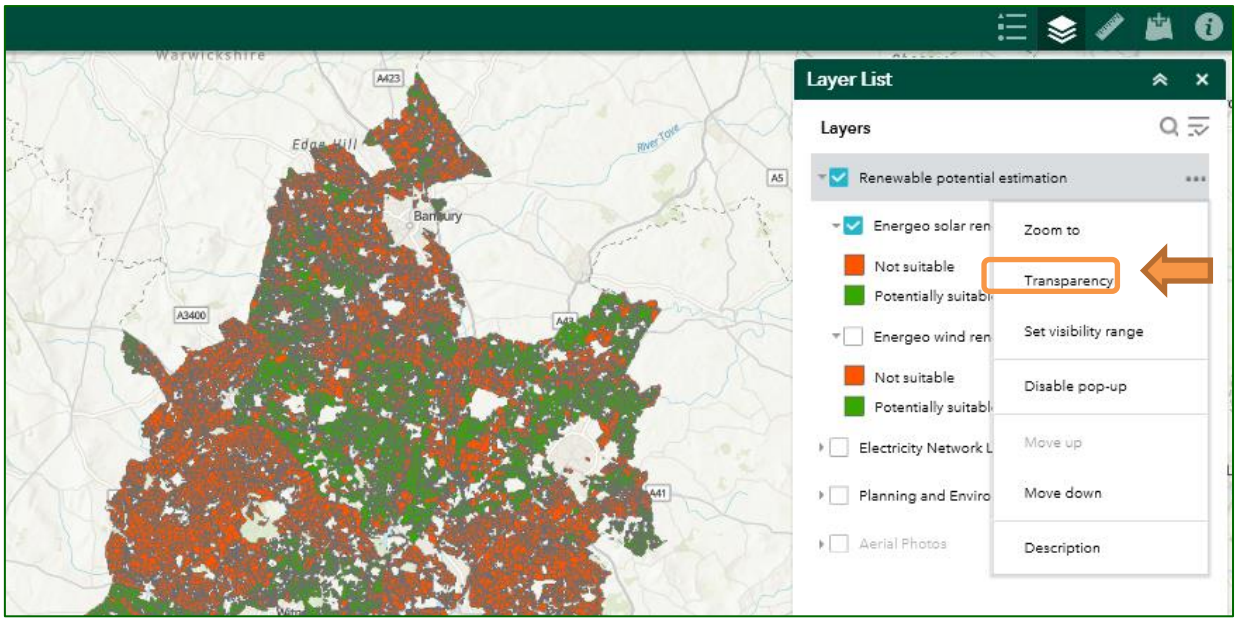


Figure 15: Transparency buttons

To adjust the transparency, click on the transparency option to open a moveable bar. Please note that transparency can only be adjusted at the main category level (discussed in the Layer section) but not for each individual layer**.**

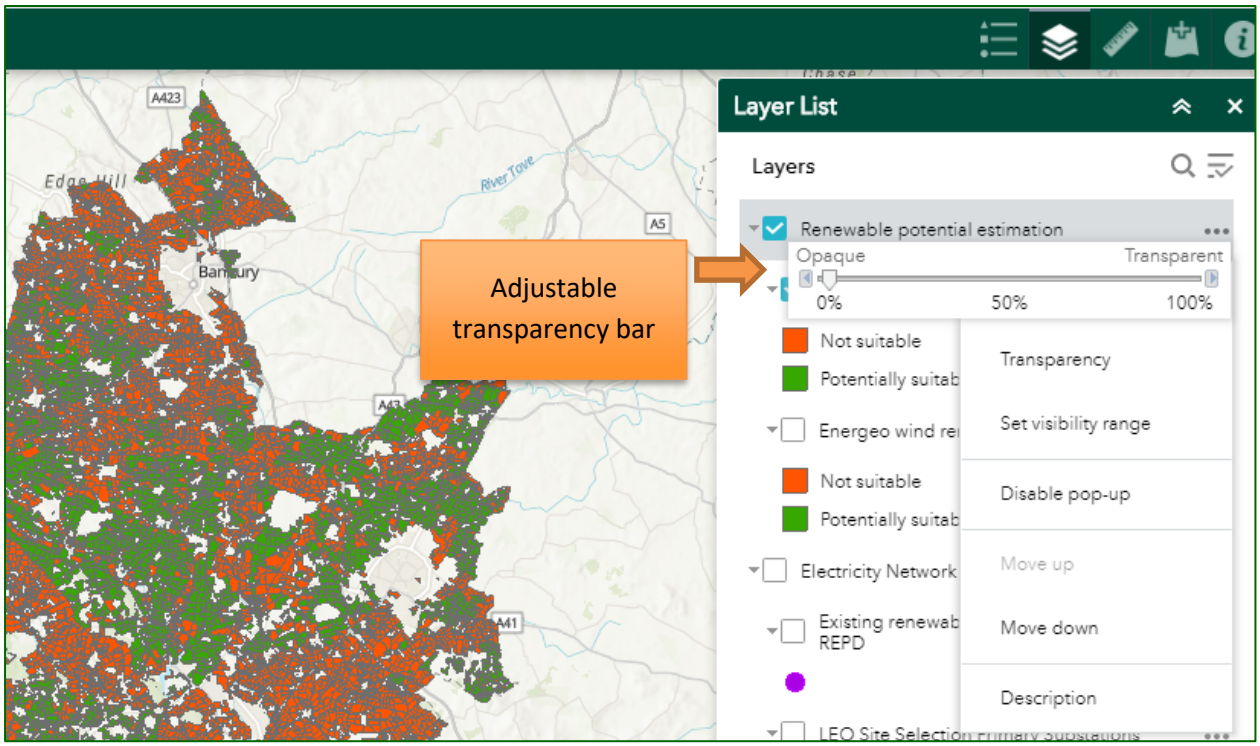


Figure 16: Adjusting transparency

Adding data

It is possible to add your own data to the map by using the **add data button**.

However, **please note that this data does not get saved into the online map**.

Click the 'add data' button to open a dialogue box. Drop (or browse for) your data file onto the box as shown in figure 11. This adds the data which can be used for analysis at that moment but once you close the map, it does not save the new data. The data can be added in any one of the following formats:

- Zipped shape file
- .csv file
- KML file
- GPX file
- Geo JSON

Please note that the web application has limitations in the extent of analysis that can be done online. For large scale data, it is best to conduct a desktop based analysis. Please contact us (details in section 10) if you wish to conduct any intensive analysis on this data.

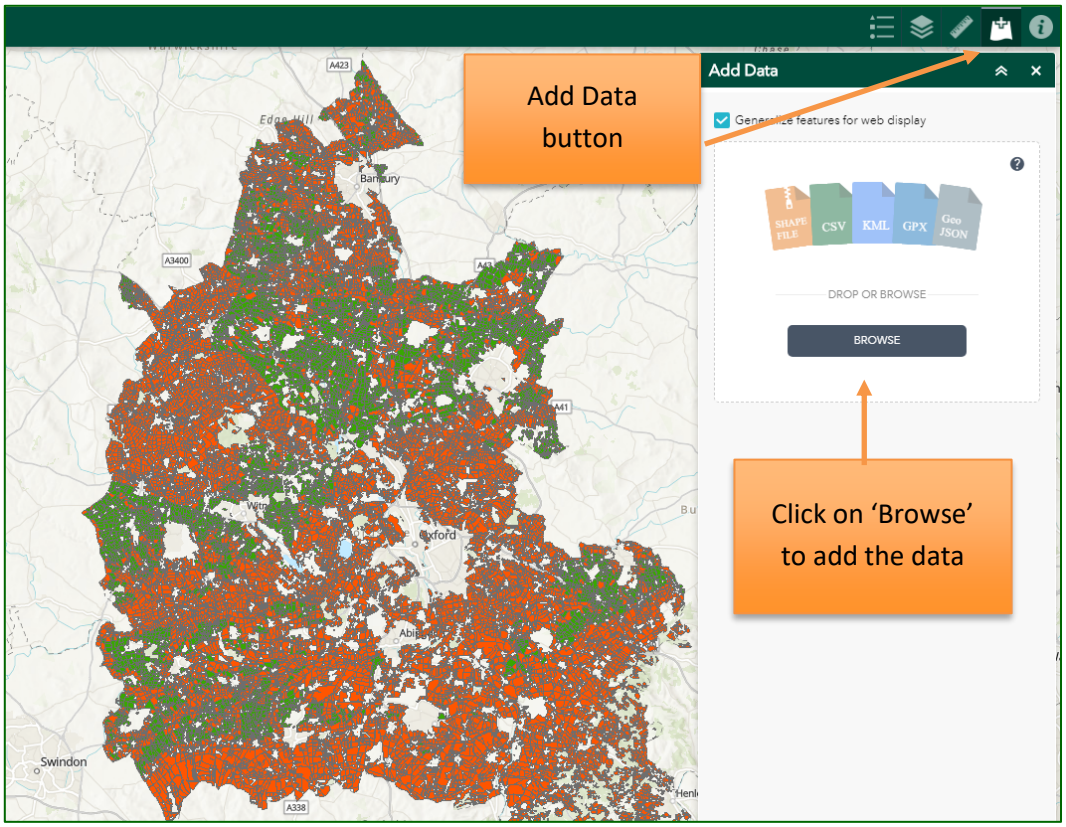


Figure 17: Adding data

Measurement Widget

Use the measurement widget to measure distances or areas within the map. The widget provides three options as shown in figure 12:

i. calculate area of a selected polygon

ii. calculate distance between two or more points on the map

iii. identify a location with the corresponding latitude and longitude

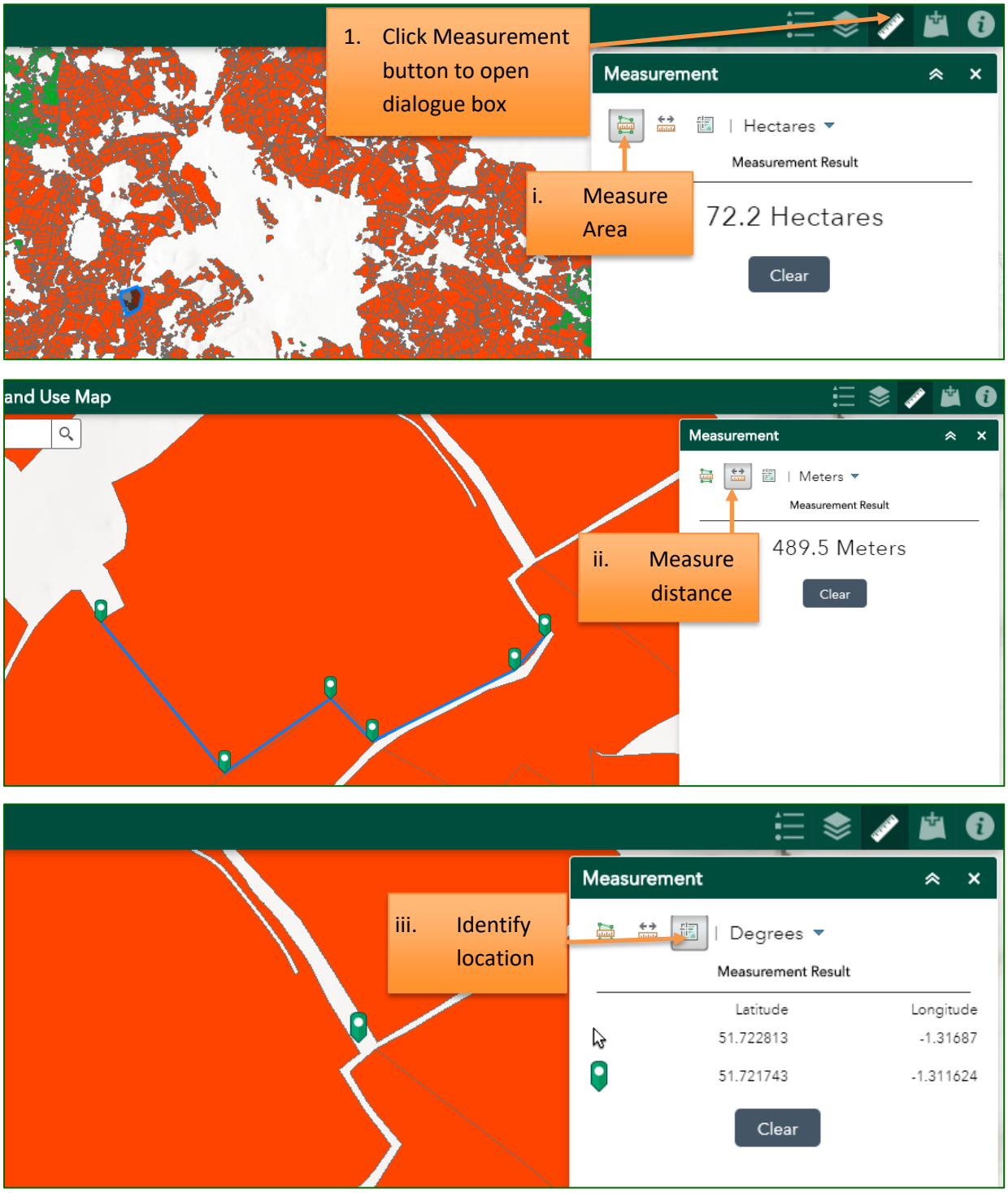


Figure 18: Measurement widget

About Button

Click on the **about button** on the top right corner of the screen to see a brief summary of the map as well as the link to this user guide.

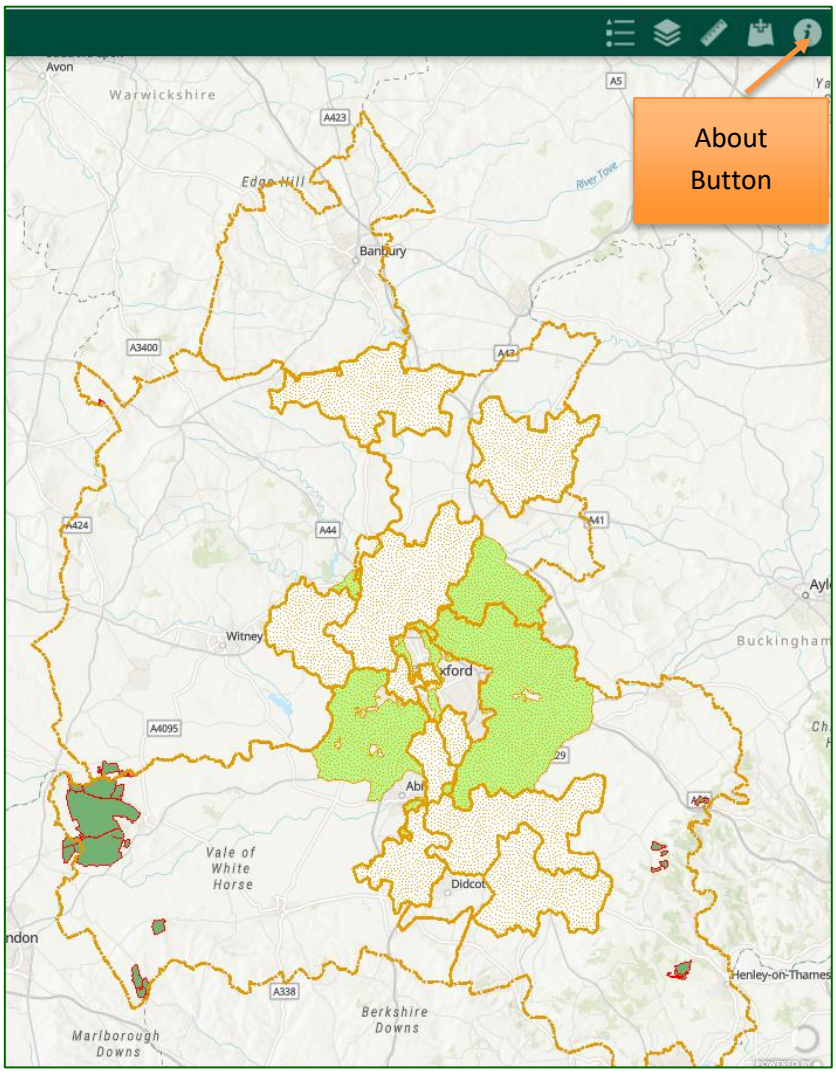


Figure 19: About Button

Support

If you have any questions about using the LEO Integrated Land Use Map, please contact anitha.sampath@oxfordshire.gov.uk