APPENDIX 3: TECHNICAL APPENDIX

1.0 Introduction

This appendix lists the datasets used in the generation of the report and some of the specific methodologies used by Ethos in the analysis to ensure that it is robust and repeatable.

It covers the following sections:

- GIS data used in the study
- Licensing
- Tree canopy mapping
- Access buffers
- Multifunctionality assessment maps (by individual function)
- Bivariate maps

2.0 GIS data used in study

Layer	Data Owner	Data Format	Year
Mastermap Topography	Ordnance Survey	GML	2022
Mastermap Greenspace	Ordnance Survey	GML	2022
OpenMap Local	Ordnance Survey	ESRI Shapefile	2022
Wards (December 2021) GB BFC	Office for National Statistics	https://services1.arcgis.com/ESMARspQHYMw9BZ9/arcgis/rest/services/Wards_December_2021_GB_BFC/FeatureServer	2022
LSOA (December 2011)	Office for National Statistics	https://services1.arcgis.com/ESMARspQHYMw9BZ9/arcgis/rest/services/Lower_Layer_Super_Output_Areas_December_2011_Boundaries_EW_BFC_V2/FeatureServer	2020
MSOA (December 2011)	Office for National Statistics	https://services1.arcgis.com/ESMARspQHYMw9BZ9/arcgis/rest/services/Middle_Layer_Super_Output_Areas_December_2011_EW_BFC_V2/FeatureServer	2021
LSOA population density (Mid-2020 estimates)	Office for National Statistics	https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/lowersuperoutputareapopulationdensity	2021
Access to Garden Space (April 2020)	Office for National Statistics	https://www.ons.gov.uk/economy/environmentalaccounts/datasets/accesstogardensandpublicgreenspaceingreatbritain	2020
IMD 2019	Ministry of Housing, Communities and Local Government	https://services3.arcgis.com/ivmBBrHfQfDnDf8Q/arcgis/rest/services/Lower_Super_Output_Area_(LSOA)_IMD_2019__(OSGB1936)/FeatureServer	2019

Layer	Data Owner	Data Format	Year
Green Belt (2020-21)	Ministry of Housing, Communities and Local Government	https://www.data.gov.uk/dataset/ccb505e0-67a8-4ace-b294-19a3cbff4861/english-local-authority-green-belt-dataset	2021
Green Spaces Strategy (2013-2027)	Oxford City Council	ESRI Shapefile	2022
HELAA (2019)	Oxford City Council	ESRI Shapefile	2022
GI Network (Policy G1)	Oxford City Council	ESRI Shapefile	2022
Local Wildlife Sites	Oxford City Council	ESRI Shapefile	2022
Allotments (Policy G4)	Oxford City Council	ESRI Shapefile	2022
Outdoor Sports (Policy G5)	Oxford City Council	ESRI Shapefile	2022
Air Quality Annual Status Report 2021	Oxford City Council	Excel	2021
HadUK-Grid Gridded Climate Observations on a 1km grid over the UK, v1.1.0.0 (1836-2021)	Met Office	https://catalogue.ceda.ac.uk/uuid/bbca3267dc7d4219af484976734c9527	2022
Emission Map Data for Nitrogen oxides in 2019	National Atmospheric Emissions Inventory	ASCII	2021
Carbon Storage (best available Ecosystem Services data raster)	OxCAM LNCP	https://www.oxcamlncp.org/s/PaidData_Carbon.zip	2020
Conservation Areas	Historic England	https://historicengland.org.uk/listing/the-list/data-downloads/	2022
Historic Parks and Gardens	Historic England	https://historicengland.org.uk/listing/the-list/data-downloads/	2022
Scheduled Ancient Monuments	Historic England	https://historicengland.org.uk/listing/the-list/data-downloads/	2022
Ancient Woodland	Natural England	https://services.arcgis.com/JJzESW51TqeY9uat/arcgis/rest/services/Ancient_Woodland_England/FeatureServer	2022
SSSI	Natural England	https://services.arcgis.com/JJzESW51TqeY9uat/arcgis/rest/services/SSSI_England/FeatureServer	2022
Special Areas of Conservation	Natural England	https://services.arcgis.com/JJzESW51TqeY9uat/arcgis/rest/services/Special_Areas_of_Conservation_England/FeatureServer	2022
Local Nature Reserves	Natural England	https://services.arcgis.com/JJzESW51TqeY9uat/arcgis/rest/services/Local_Nature_Reserves_England/FeatureServer	2022

Layer	Data Owner	Data Format	Year
Priority Habitats Inventory (central)	Natural England	https://services.arcgis.com/JJzESW51TqeY9uat/arcgis/rest/services/Priority_Habitat_Inventory_England_Central/FeatureServer	2022
Habitat Networks (Combined Habitats)	Natural England	https://services.arcgis.com/JJzESW51TqeY9uat/arcgis/rest/services/National_Habitat_Networks_England/FeatureServer	2021
Flood Map for Planning (Rivers and Sea) Zone 2	Environment Agency	https://environment.data.gov.uk/arcgis/rest/services/EA/FloodMapForPlanningRiversAndSeaFloodZone2/FeatureServer	2022
Flood Map for Planning (Rivers and Sea) Zone 3	Environment Agency	https://environment.data.gov.uk/arcgis/rest/services/EA/FloodMapForPlanningRiversAndSeaFloodZone3/FeatureServer	2022
Risk of flooding from Surface Water Extent 0.1%	Environment Agency	https://environment.data.gov.uk/arcgis/rest/services/EA/RiskOfFloodingFromSurfaceWaterBasic/MapServer	2020
WFD Groundwater Body Classifications (2019)	The Rivers Trust	https://environment.data.gov.uk/arcgis/rest/services/EA/WFDGroundwaterBodiesCycle22019/MapServer/0	2021
WFD River, Canal and SWT Waterbody Classifications (2019)	The Rivers Trust	https://environment.data.gov.uk/arcgis/rest/services/EA/WFDRiverCanalAndSWTWaterBodiesCycle22019/MapServer/0	2021
Land Use Landcover (2020)	OpenStreetMap	https://osmlanduse.org/#12/8.7/49.4/0/	2020
Leisure Areas for Europe	OpenStreetMap	https://services-eu1.arcgis.com/zci5bUiJ8olAal7N/arcgis/rest/services/OSM_Leisure_EU/FeatureServer	2020
Amenities for Europe	OpenStreetMap	https://services-eu1.arcgis.com/zci5bUiJ8olAal7N/arcgis/rest/services/OSM_Amenities_EU/FeatureServer	2020
Highways for Europe	OpenStreetMap	https://services-eu1.arcgis.com/zci5bUiJ8olAal7N/arcgis/rest/services/OSM_Highways_EU/FeatureServer	2021
Outdoor Recreation Valuation Tool Version 2.0	LEEP	https://www.leep.exeter.ac.uk/orval/	2018
Draft Oxfordshire Nature Recovery Network	TVERC	Shapefile	2019

3.0 Licensing

Ordnance Survey premium datasets used under subcontractor license:

OxCAM carbon storage raster (used in the multifunctionality assessment (Section 6.2 of main report) requires the following accreditations on any outputs produced from the data:

4.0 Tree Canopy Mapping

The Ethos methodology for producing the spatial canopy cover dataset (see Figure 7 in main report, Section 4.3.2) is set out below.

To extract the tree canopy data, the most recent imagery (summer 2020) was used under subcontractor license from Aerial Photography for Great Britain (APGB). The Digital Surface Model (DSM) (2m resolution) minus Digital Terrain Model (DTM) (5m resolution) gave a raster dataset showing all buildings and vegetation – this was refined to only cover those features over 2m or 3m in height. In order to further refine that dataset to only show vegetation/trees, the data had everything defined as 'manmade' by Ordnance Survey Mastermap clipped from it.

5.0 Access buffers (open space and district/city analysis)

Open space access buffers (Section 6.3 of main report)

The buffers for all typologies are created from access points – derived where a path or road from OpenStreetMap intersects with a site boundary. In the few cases that sites have no paths or roads into them from this dataset, a centroid is used instead as the buffer feature. The walking buffers are generated using ESRI's service area tool a standard 5kph walking speed and detailed isochrone output. The tool follows paths and roads that allow pedestrian traffic (as specified by Esri which uses Here mapping data), and therefore takes account of physical barriers to access such as rivers and railway lines - the buffer will follow bridges/tunnels/crossing points.

The more basic straight line buffer access analysis approach is used for the ANGSt standards, in line with Natural England guidance.

The straight-line walking distances do not take into account roads or barriers to access, and so the actual route walked (the pedestrian route) is generally further i.e. straight line distances are around 60% of actual distances. The standard walk time and straight line/pedestrian route distances are shown in the table below:

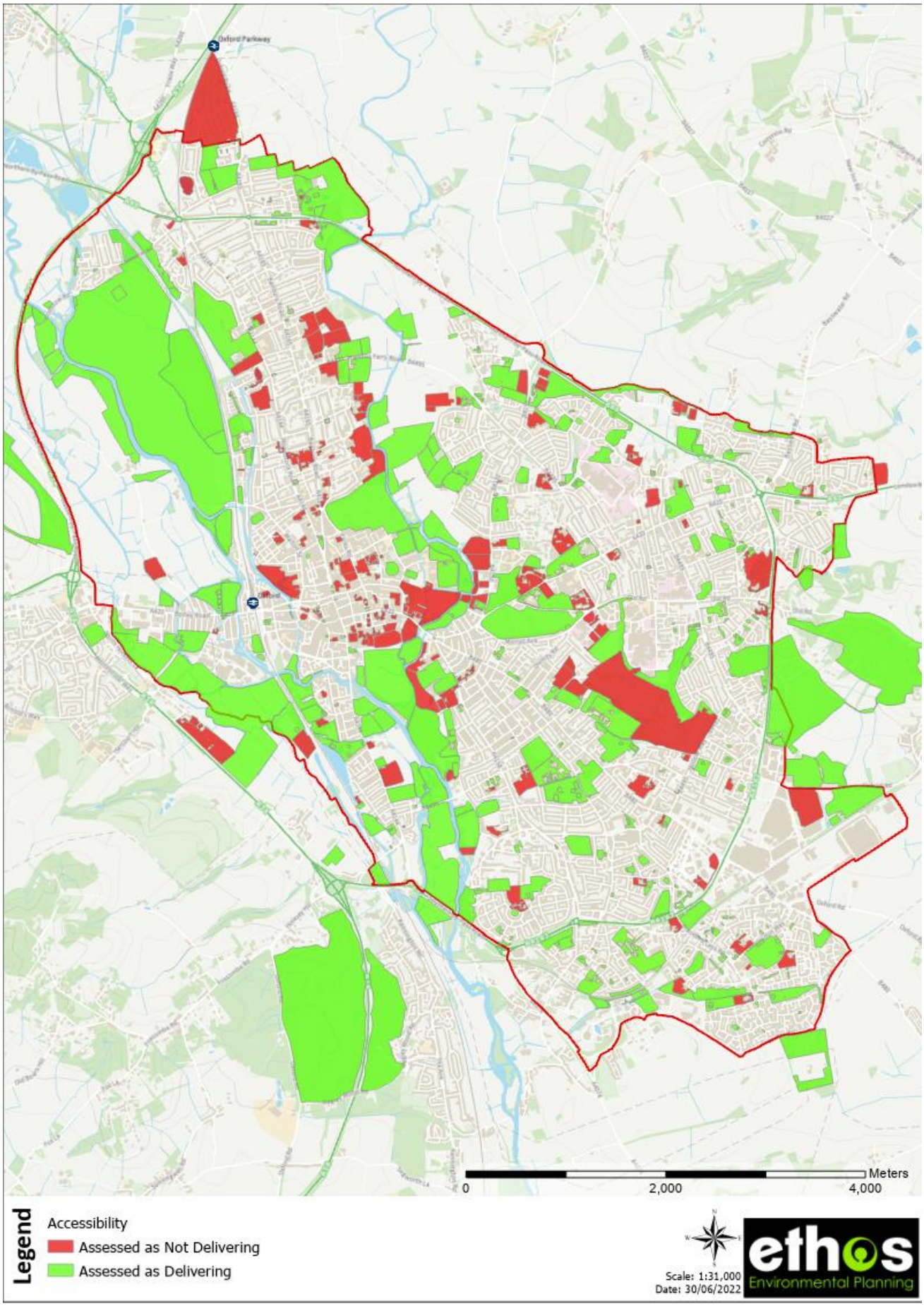
walk time (minutes)	Pedestrian Route (metres)	Straight line (metres)
1	100	60
2	160	96
3	240	144
4	320	192
5	400	240
6	480	288
7	560	336
8	640	384
9	720	432
10	800	480
11	880	528
12	960	576
13	1040	624
14	1120	672
15	1200	720
16	1280	768
17	1360	816
18	1440	864
19	1520	912
20	1600	960
21	1680	1008
22	1760	1056
23	1840	1104
24	1920	1152
25	2000	1200

15 minute city buffers (Section 4.3.7 of main report)

The same ESRI network analysis tool was used to generate the 15 walking buffers for district centres and the city centre. Each boundary was buffered from multiple points around their perimeter to ensure that accurate 15 minute walking buffers were generated (to buffer the central point of a district centre would not represent access to the full extent of the area).

6.0 Multifunctionality assessment maps (by individual function)

The following maps show the results of the multifunctionality assessment for each individual function assessed, using the criteria set out in Table 11 of the Main Report (Section 6.2).


Oxford Parkway
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2,000
4,000
Meters
Legend
Accessibility
Assessed as Not Delivering
Assessed as Delivering
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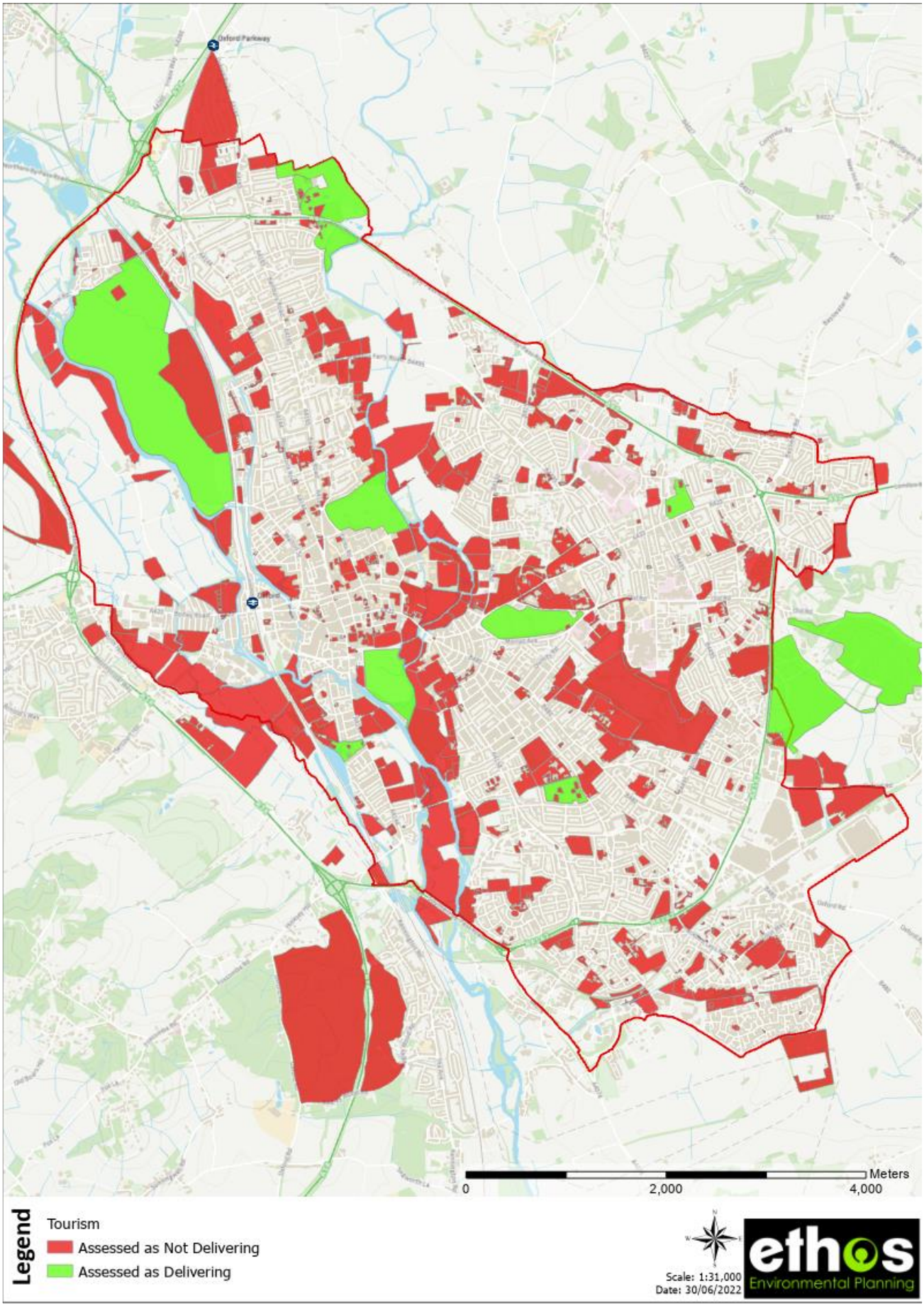
Date: 30/06/2022
ethos
Environmental Planning


Oxford Parkway
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4,000
Meters
Legend
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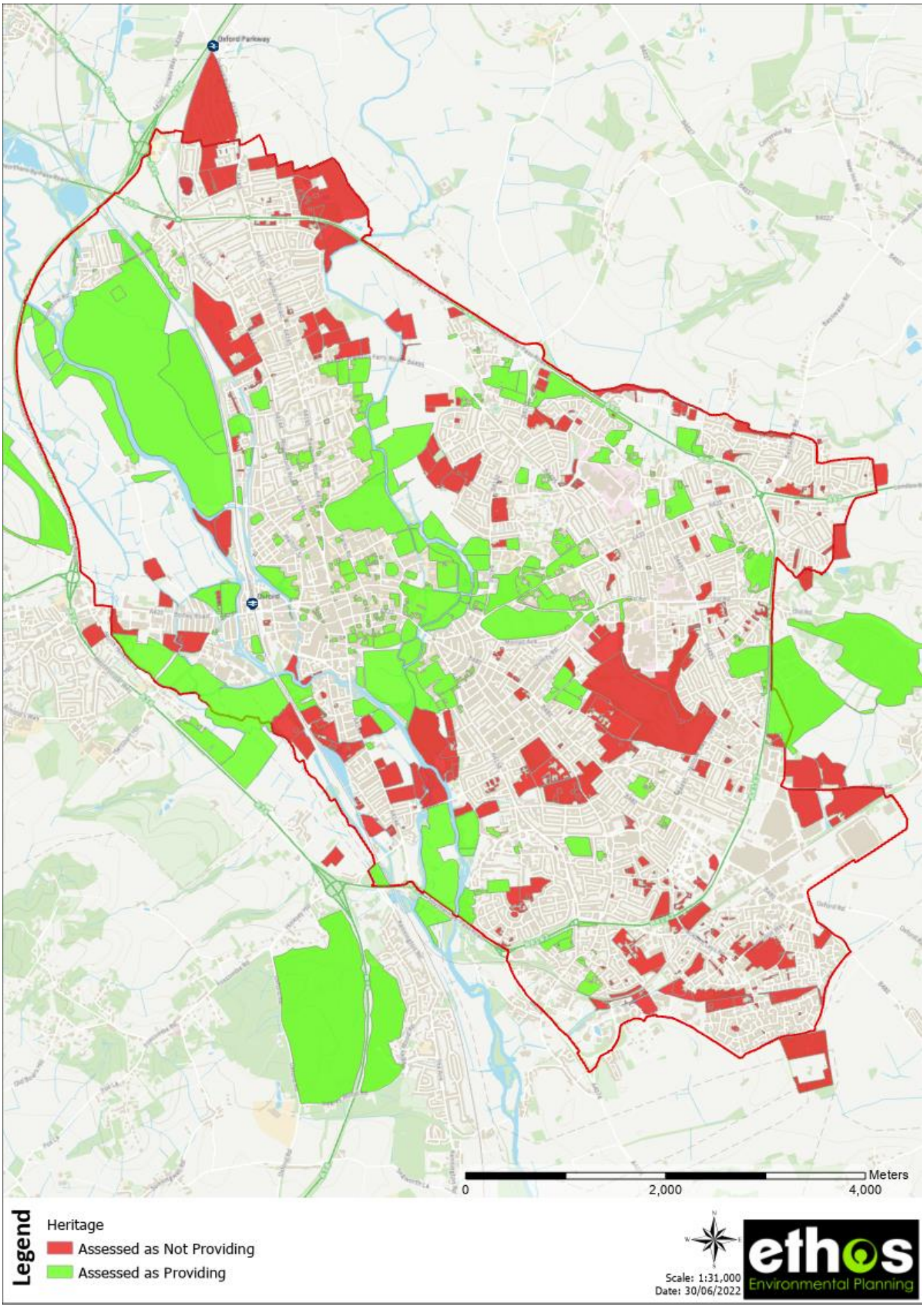
ethos
Environmental Planning


Oxford Parkway
Oxford
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2,000
4,000
Meters
Legend
Heritage
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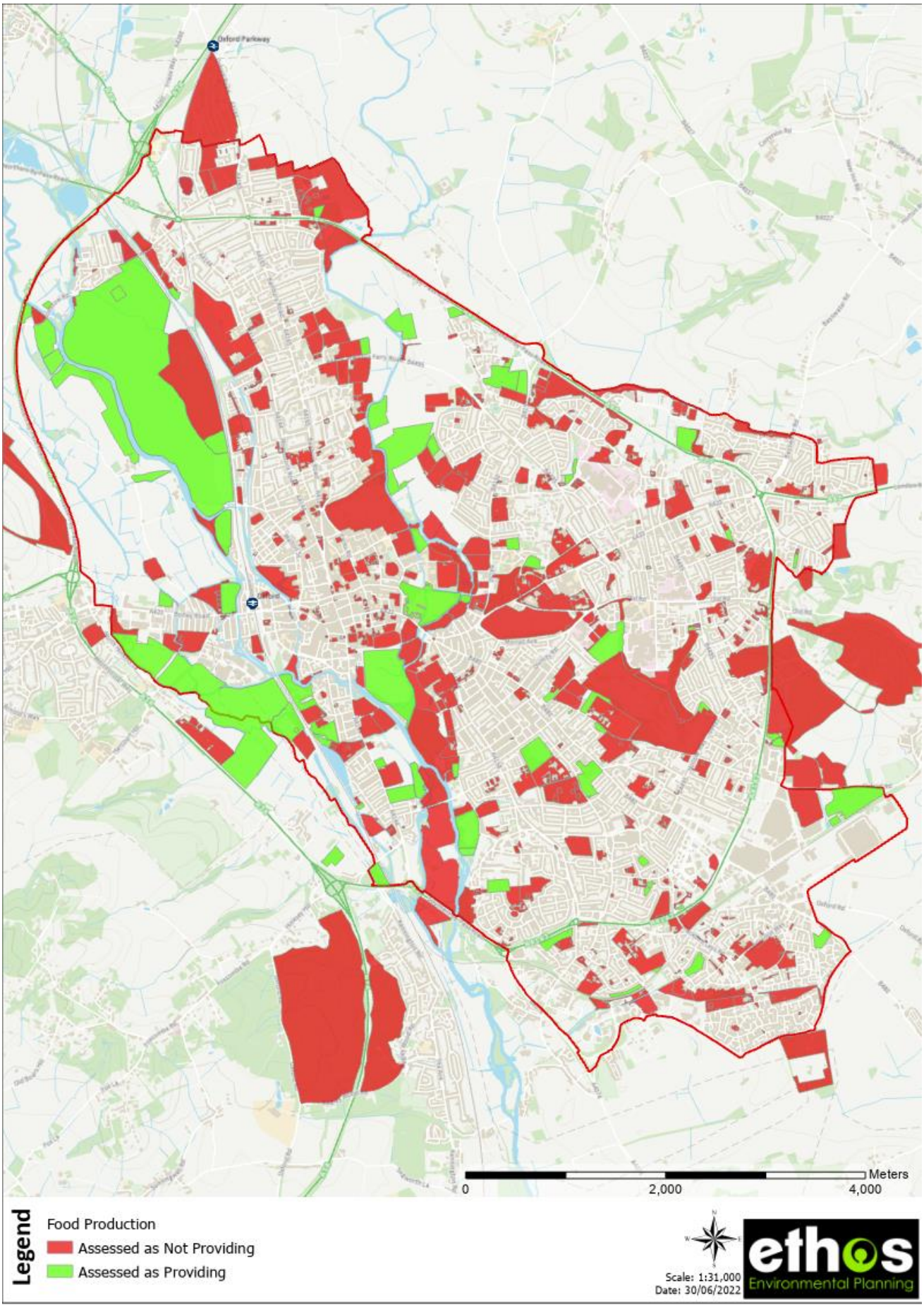
Date: 30/06/2022
ethos
Environmental Planning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2,000
4,000
Meters
Legend
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Assessed as Providing
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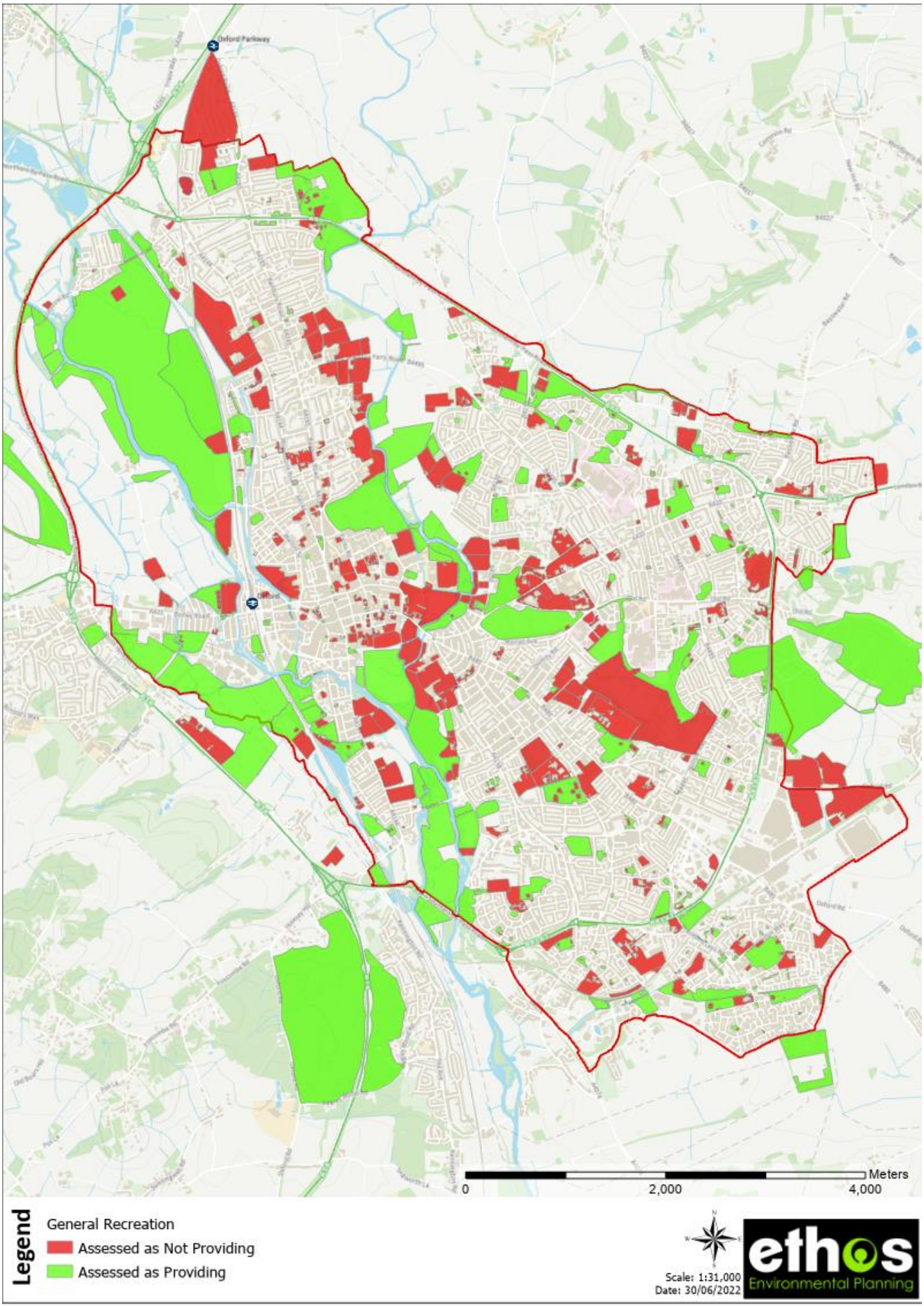
Date: 30/06/2022
ethos
Environmental Planning


Oxford Parkway
Meters
0
2,000
4,000
Legend
General Recreation
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Assessed as Providing
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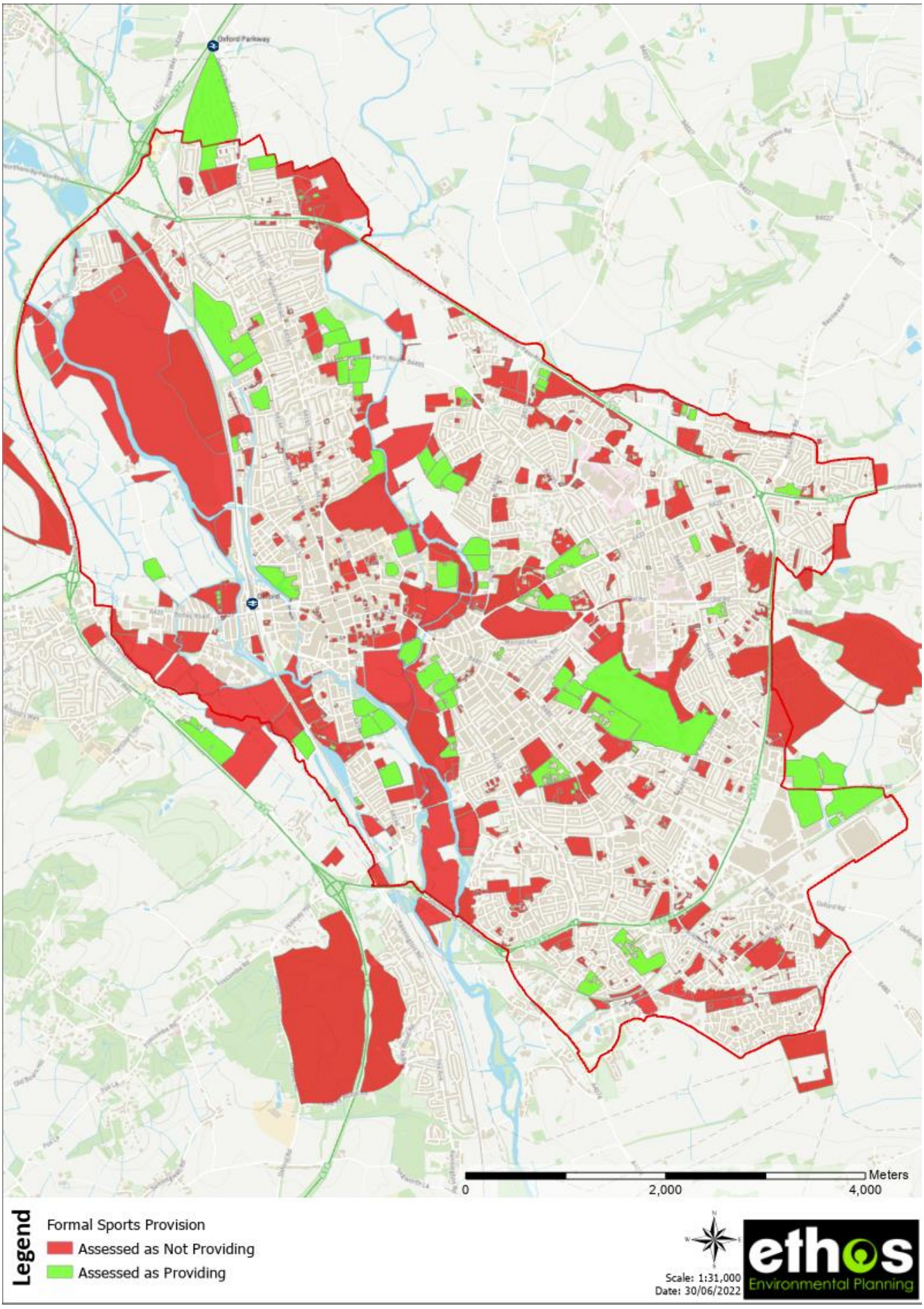
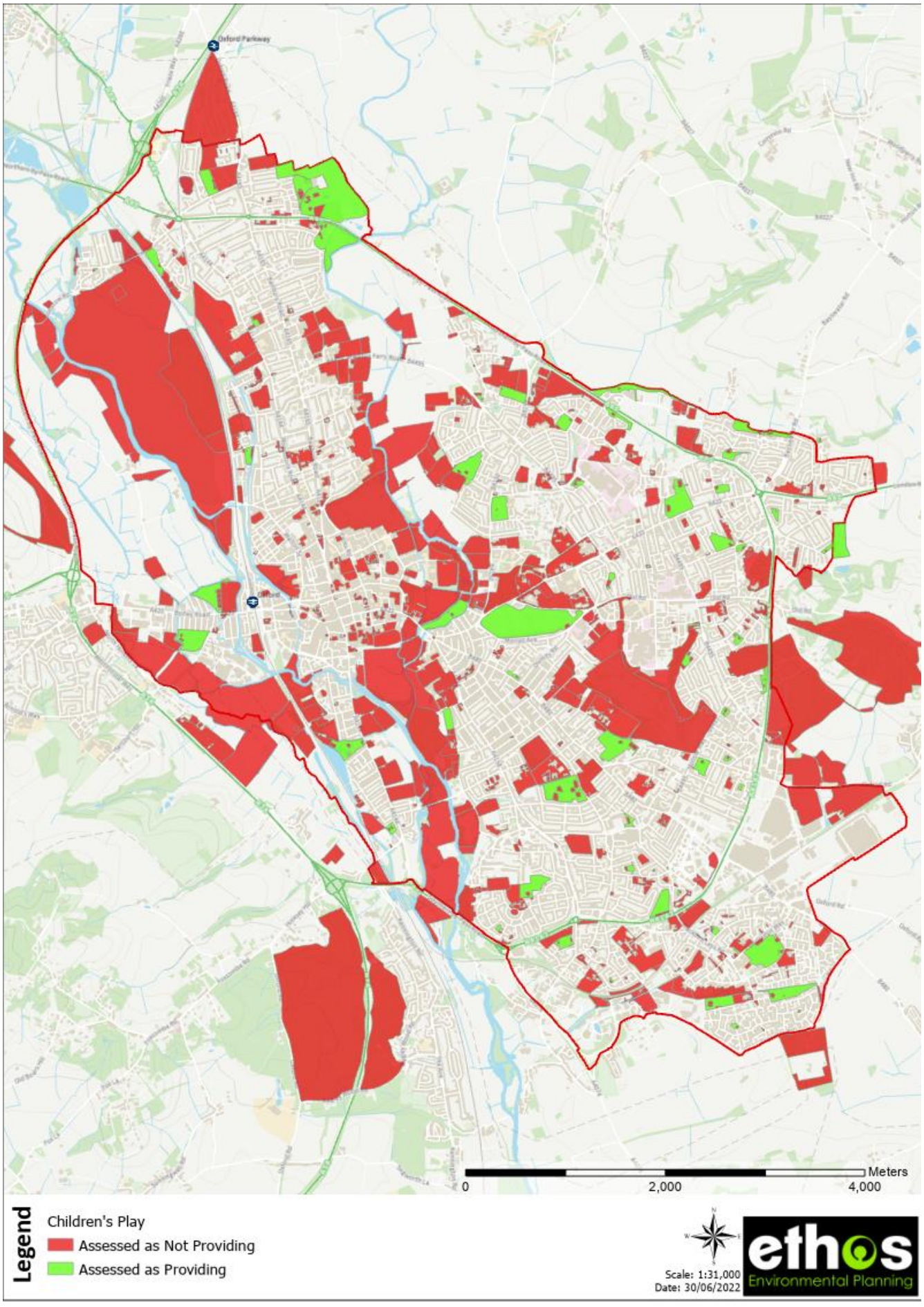
Date: 30/06/2022
ethos
Environmental Planning


Oxford Parkway
Meters
0
2,000
4,000
Legend
Formal Sports Provision
Assessed as Not Providing
Assessed as Providing
Scale: 1:31,000
Date: 30/06/2022
ethos
Environmental Planning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4,000
Meters
Legend
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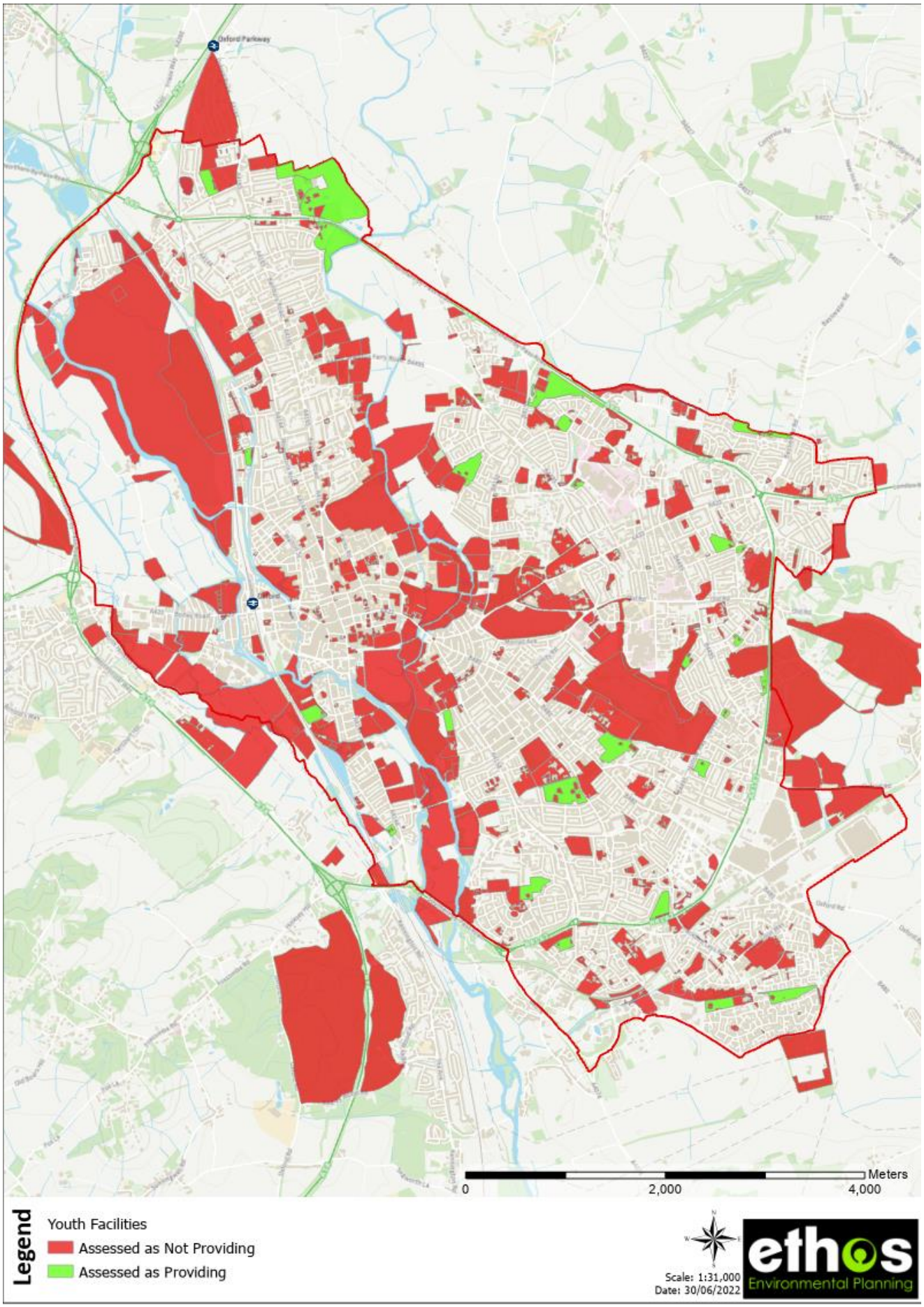
Assessed as Providing
Scale: 1:31,000
Date: 30/06/2022
ethos
Environmental Planning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Meters
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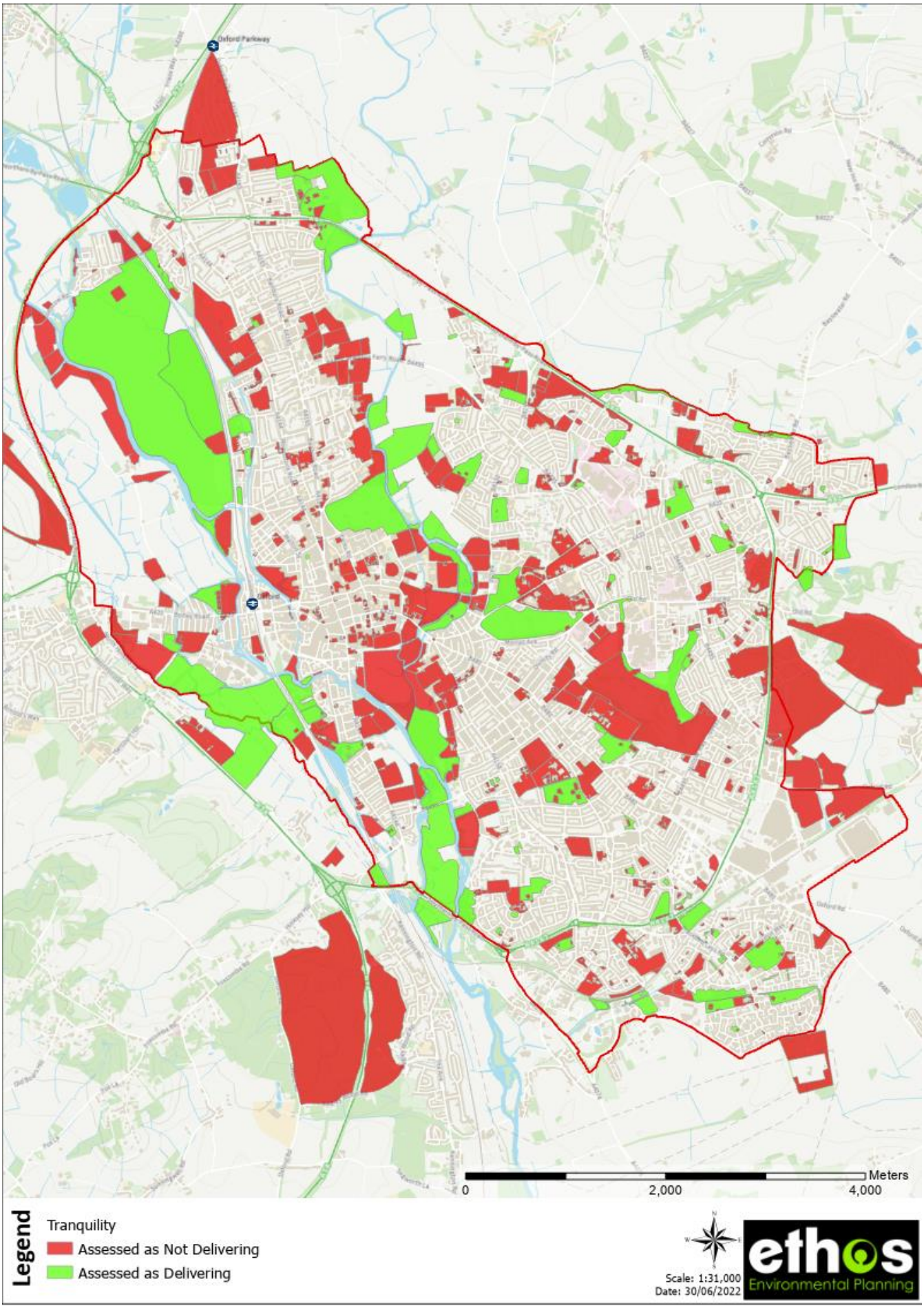
Assessed as Providing
Scale: 1:31,000
Date: 30/06/2022
ethos
Environmental Planning


Oxford Parkway
0
2,000
4,000
Meters
Legend
Tranquility
Assessed as Not Delivering
Assessed as Delivering
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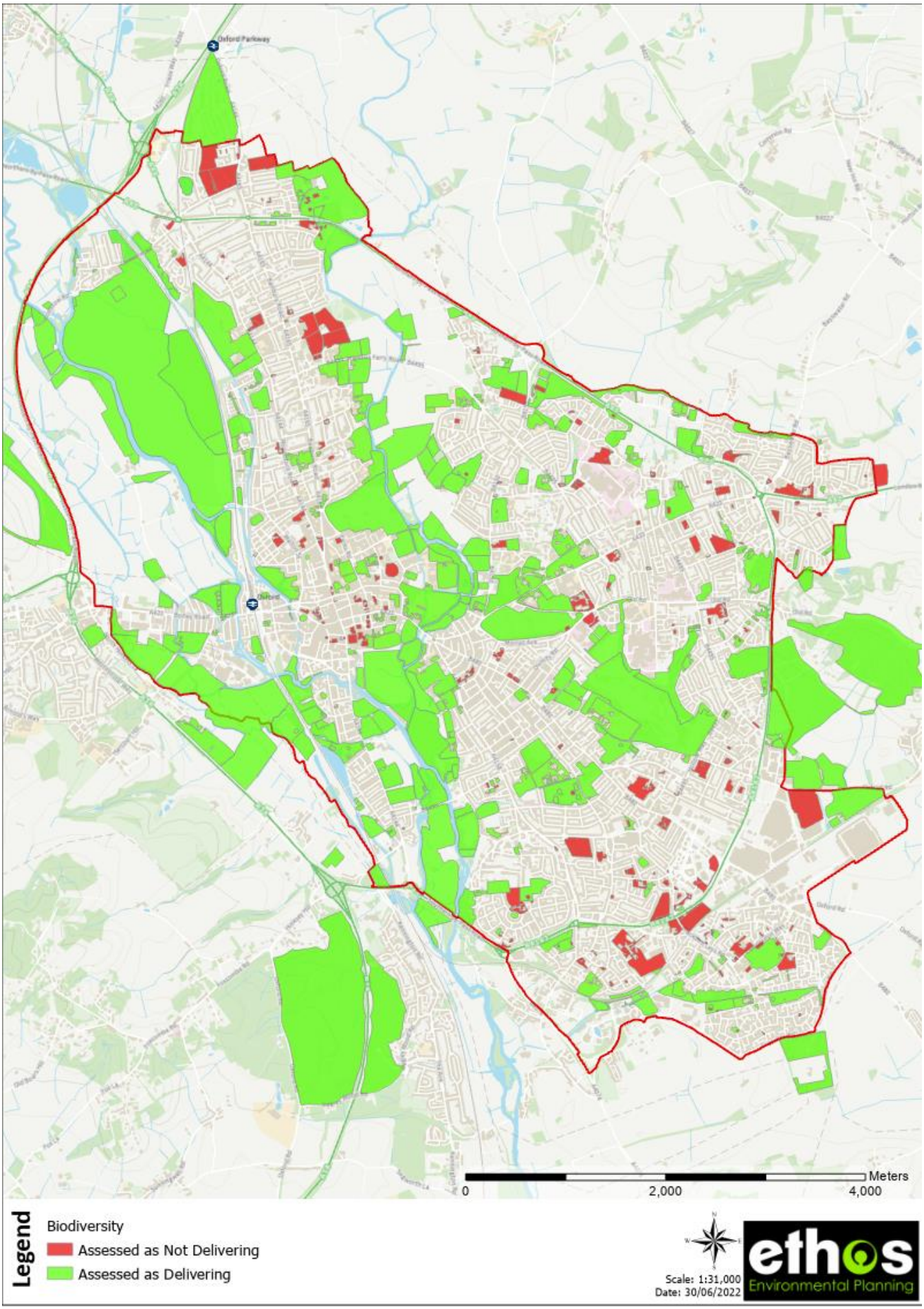
Date: 30/06/2022
ethos
Environmental Planning


Oxford Parkway
Oxford
0
2,000
4,000
Meters
Legend
Biodiversity
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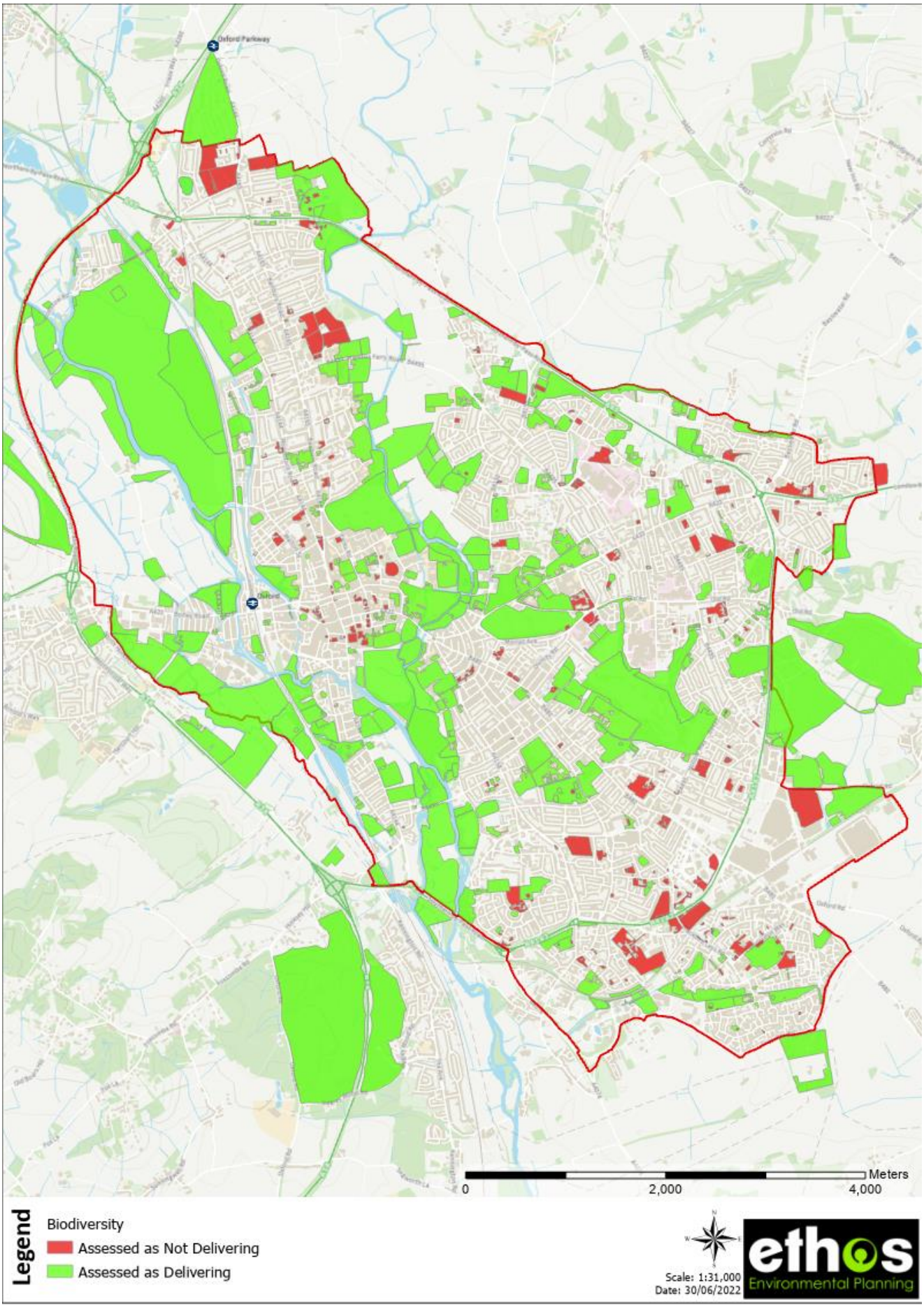
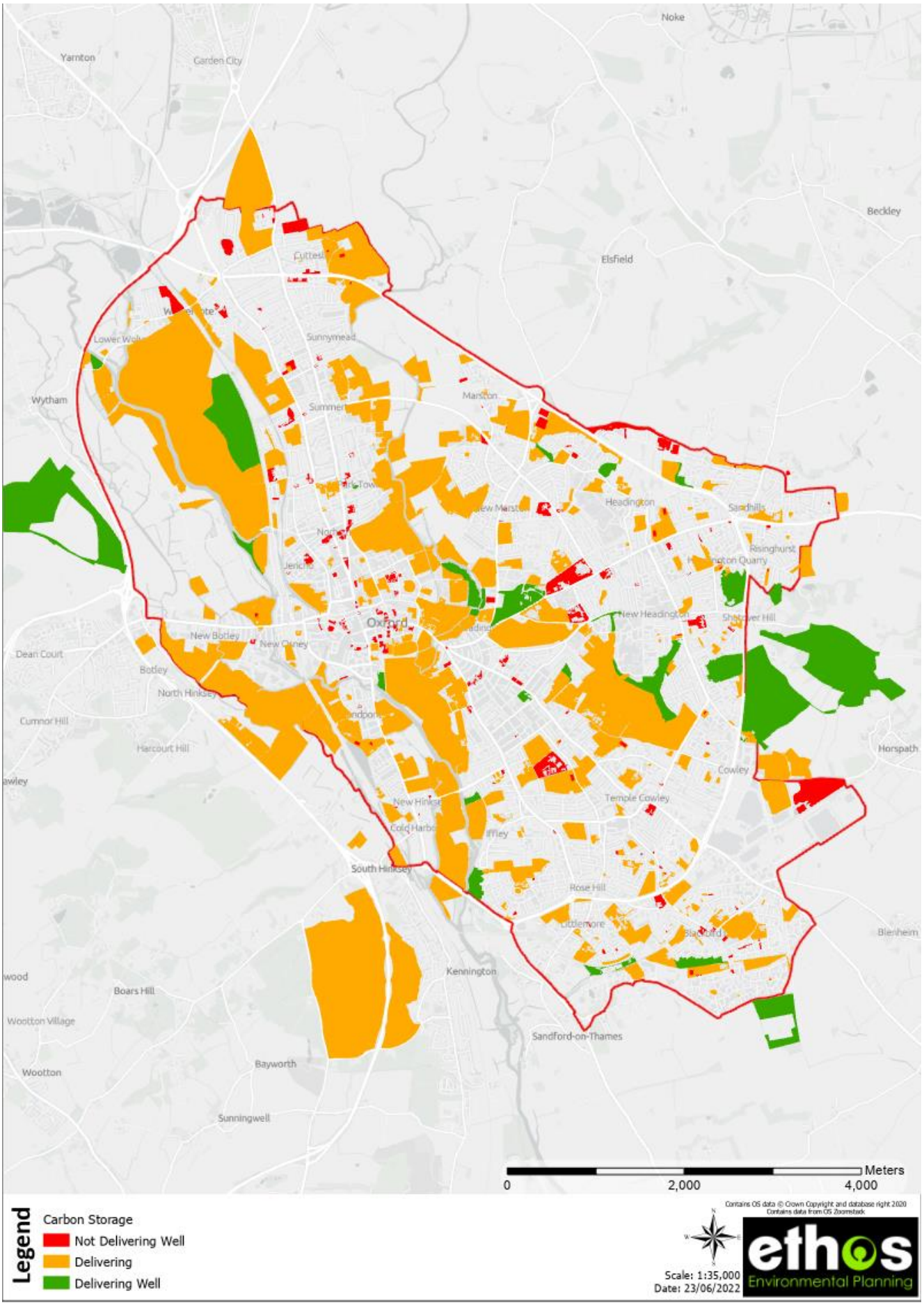
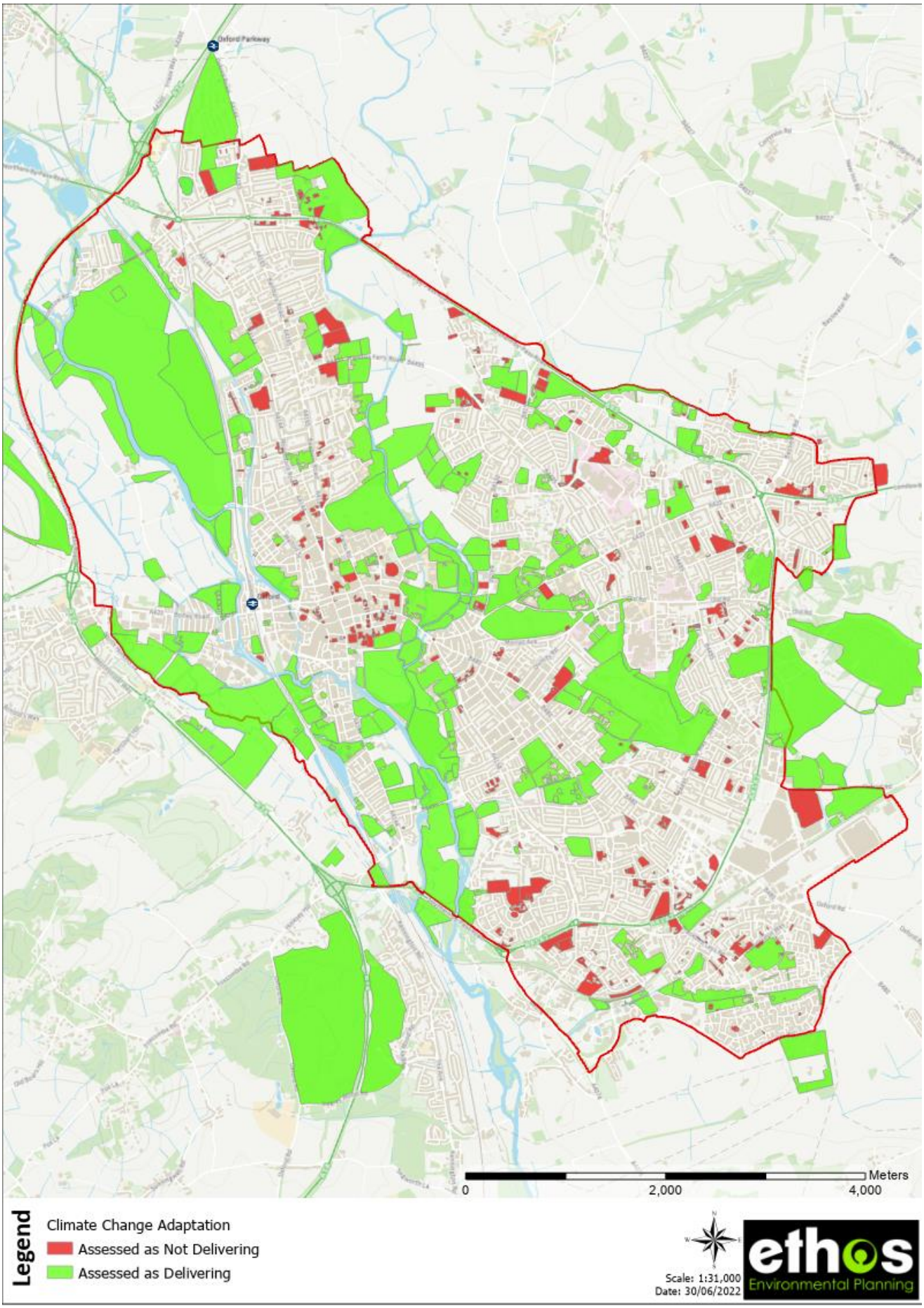
Assessed as Delivering
Scale: 1:31,000
Date: 30/06/2022
ethos
Environmental Planning


Oxford Parkway
Oxford
0
2,000
4,000
Meters
Legend
Biodiversity
Assessed as Not Delivering
Assessed as Delivering
Scale: 1:31,000
Date: 30/06/2022
ethos
Environmental Planning


Noke
Yarnton
Garden City
Beckley
Elsfield
Cutteslowe
Sunnymead
Lower Wolvercote
Wytham
Marston
Summertown
New Marston
Headington
Sandhills
Risinghurst
Jericho
Oxford
New Headington
Shotover Hill
New Botley
New Osney
Dean Court
Botley
North Hinksey
Cumnor Hill
Harcourt Hill
Horspath
Cowley
Temple Cowley
New Hinksey
Cold Harbour
Iffley
South Hinksey
Rose Hill
Littlemore
Blenheim
Kennington
Boars Hill
Wootton Village
Sandford-on-Thames
Bayworth
Wootton
Sunningwell
Meters
0
2,000
4,000
Legend
Carbon Storage
Not Delivering Well
Delivering
Delivering Well
Contains OS data © Crown Copyright and database right 2020
Contains data from OS Zoomstack
Scale: 1:35,000
Date: 23/06/2022
ethos
Environmental Planning


Oxford Parkway
Meters
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2,000
4,000
Legend
Climate Change Adaptation
Assessed as Not Delivering
Assessed as Delivering
Scale: 1:31,000
Date: 30/06/2022
ethos
Environmental Planning

7.0 Bivariate maps

Bivariate maps are useful for illustrating the relationship between two variables. The following maps are provided below:

- Canopy cover (Ethos analysis 2m+ vegetation height) and IMD
- Population density and IMD
- Percentage of publicly accessible open space and IMD
- Percentage of publicly accessible open space and percentage of homes with gardens

These maps have been used to identify priority areas for enhancing GI provision within Section 4.3.3 – 4.3.6 of the main report.

Comparing canopy cover with IMD

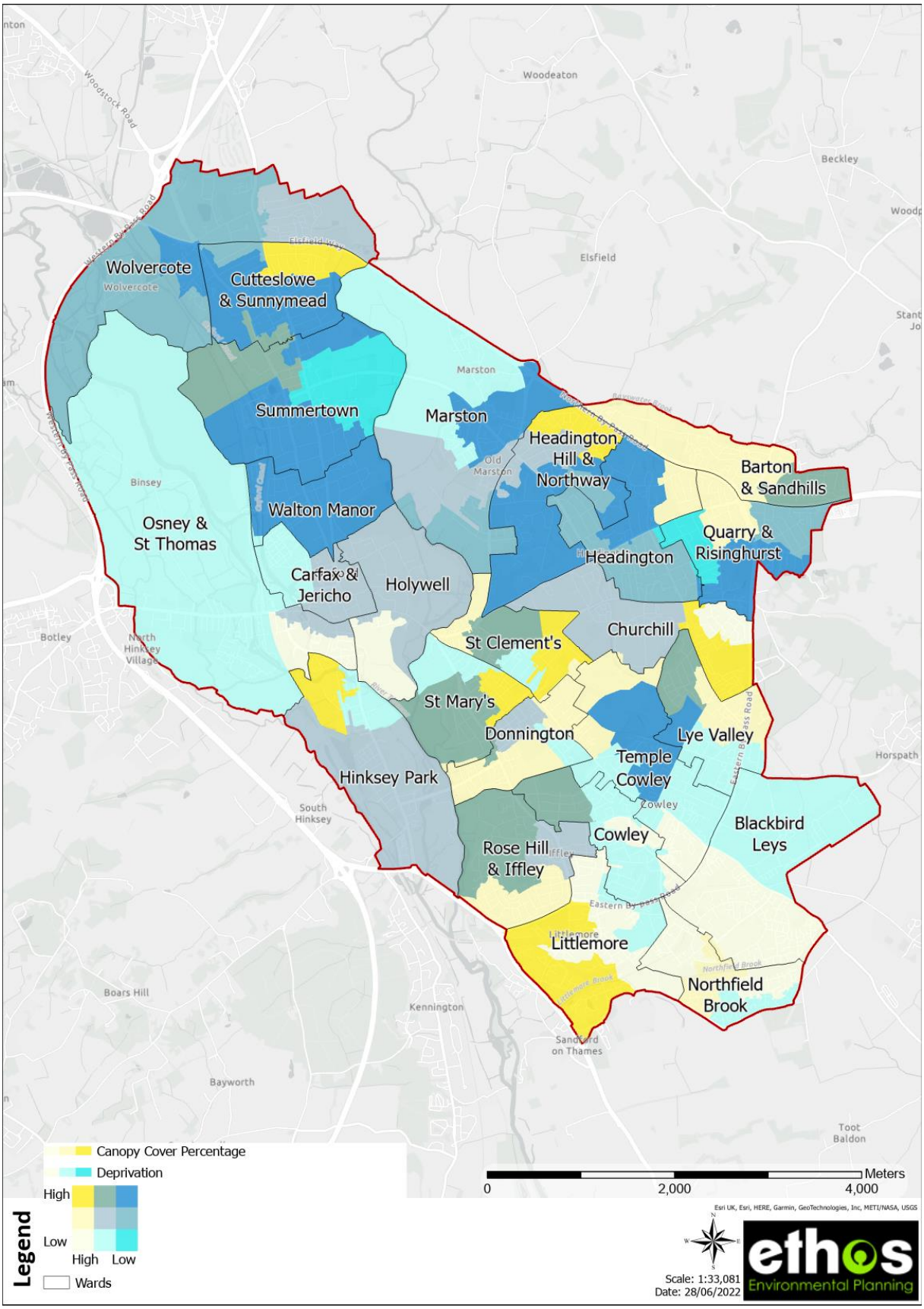

Figure 1 Bivariate map comparing percentage canopy cover and IMD

Those areas of lowest relative tree canopy cover and highest levels of deprivation are pale yellow/cream.

Comparing population density with IMD

The figure below shows that the areas with the highest population density and highest deprivation (deep yellow) tend to fall in the south, east and central parts of the city. Conversely, the northern and western areas of Oxford tend to be low in both population density and deprivation (such as Wolvercote). However, this correlation between population density and deprivation does not apply throughout the city - there areas with low population density and high deprivation (white) in the south and east and areas with high population density and low deprivation (dark areas) in the city centre.

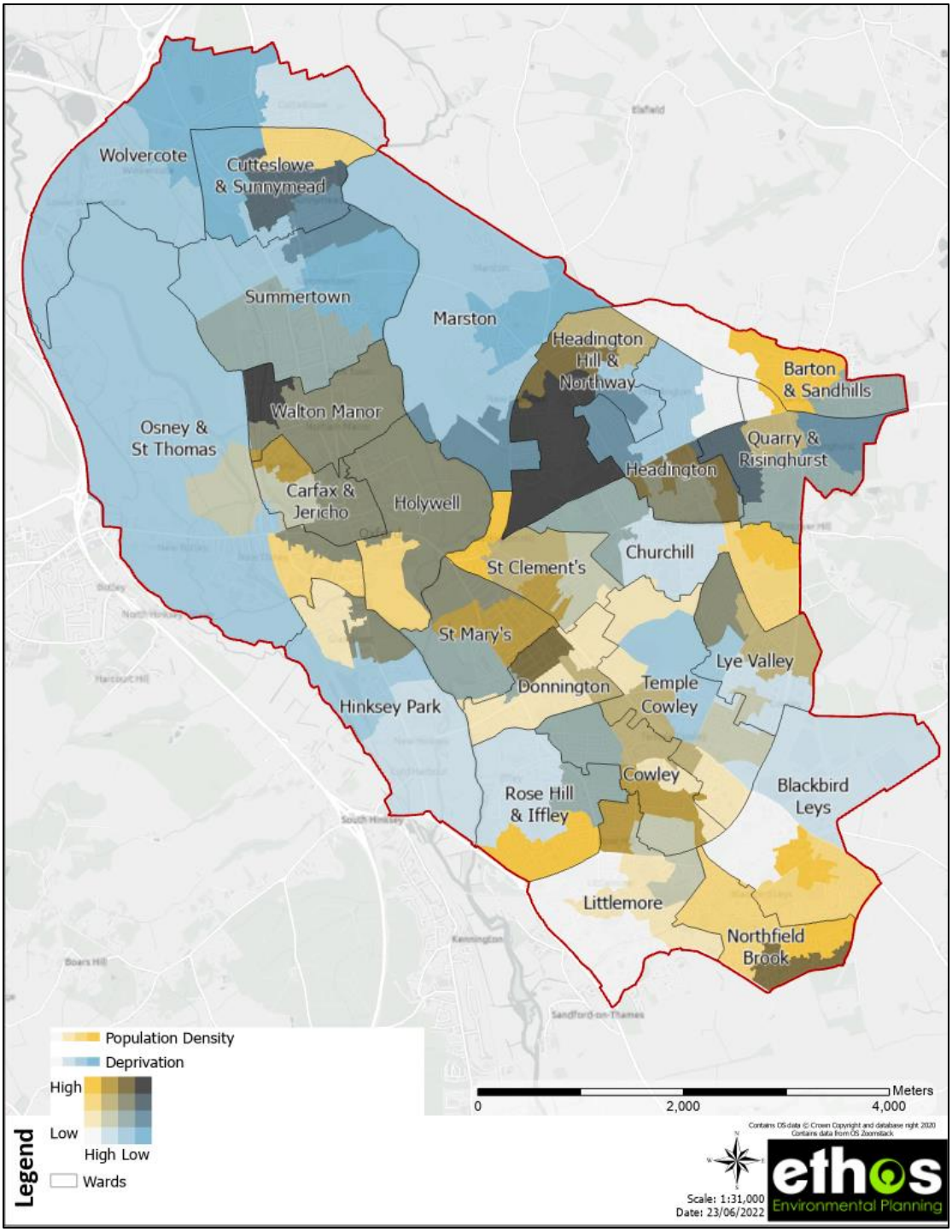

Figure 2 Bivariate map comparing population density with IMD

Comparing percentage of open space with IMD

Those areas of the city with the lowest relative proportion of open space and highest levels of deprivation (white) are restricted to small areas within the wards of St Clement's, Littlemore, Cowley and Barton and Sandhills. The turquoise areas to the North and East indicate areas with relatively low proportions of open space and low levels of deprivation. The open space access analysis (Section 6.3) also needs to be taken into consideration as even if an LSOA has a relatively low percentage of open space, there may be good access to open space in the surrounding areas.

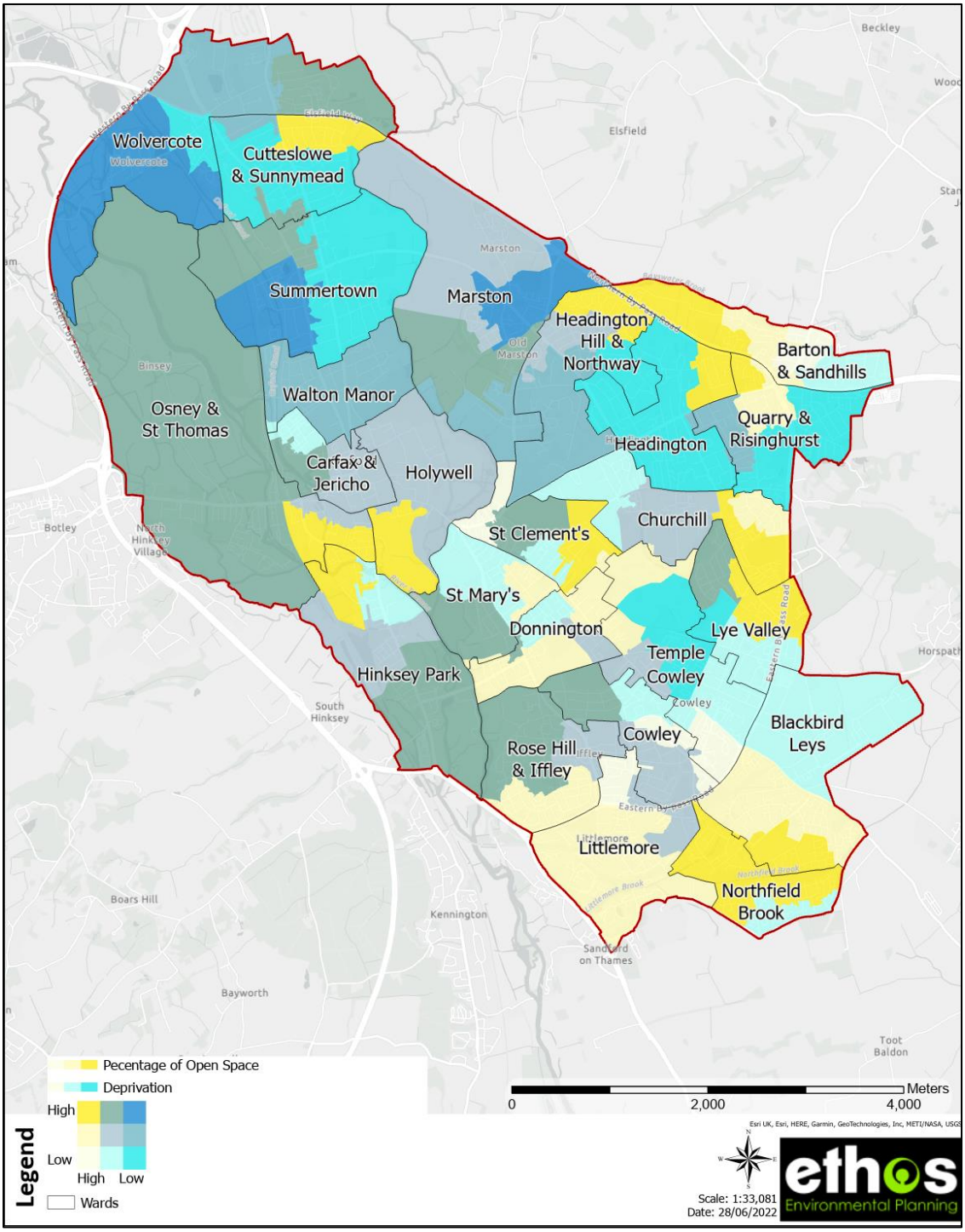

Figure 3 Bivariate map comparing percentage open space with IMD

Comparing percentage of open space with percentage of homes with gardens

The paler areas in the East of the city and of Summertown Ward show those areas with the lowest proportion of both open space and access to private gardens. These areas could be prioritised for new open space or improvement of existing open space.

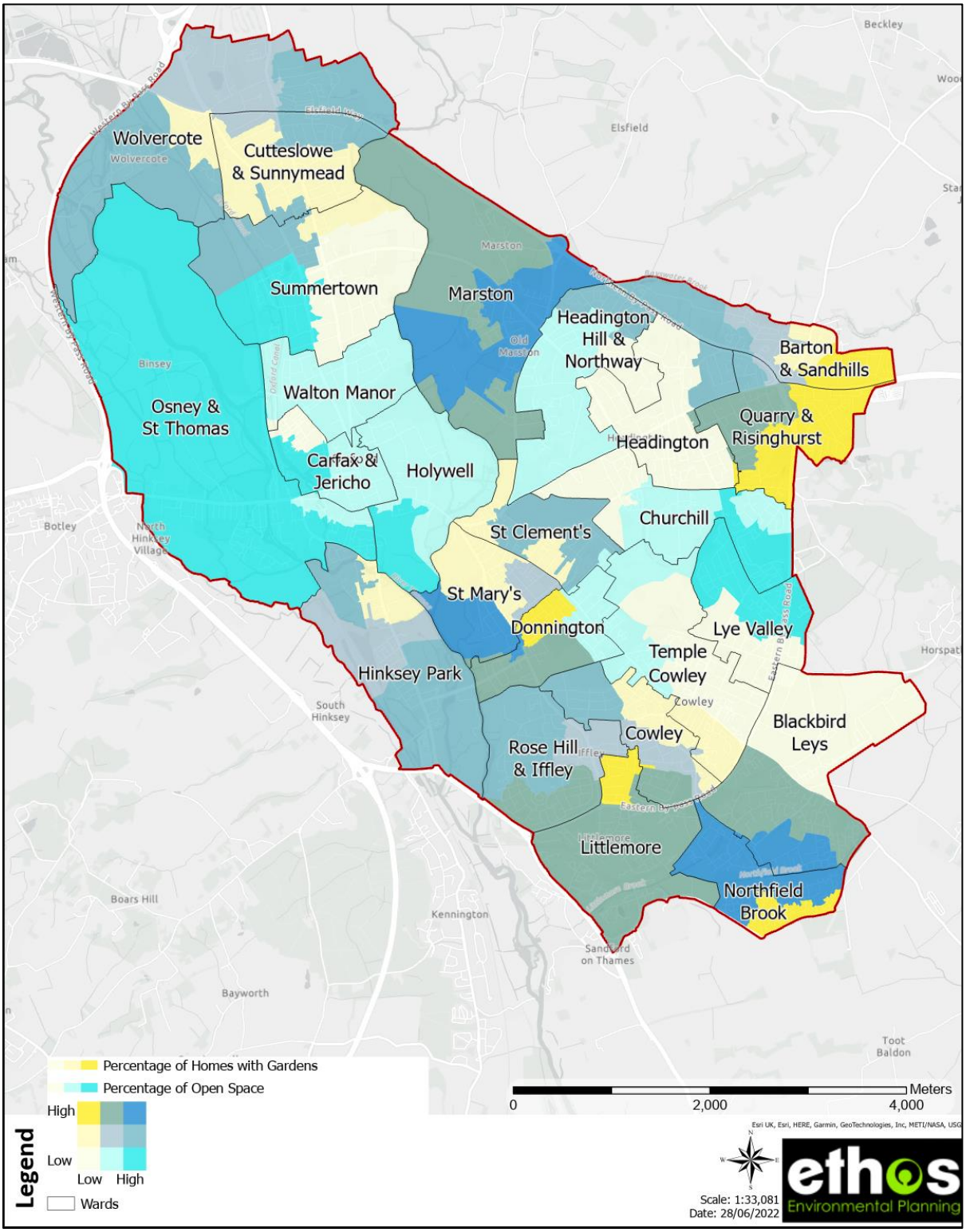

Figure 4 Bivariate map comparing percentage of open space with percentage of homes with gardens