England Green Infrastructure Mapping Database. Version 1.2 Method Statement.

July 2023

Natural England Evidence Project Report RP2972

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NATURAL ENGLAND

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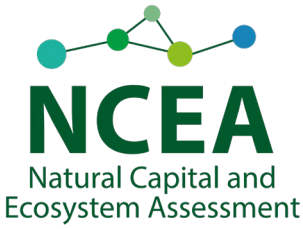
Westcountry Rivers Ltd

Natural Capital and Ecosystems Assessment Programme.



England Green Infrastructure Standards Project. [Home (naturalengland.org.uk)]

Presentation of the mapping on the Green Infrastructure Standards website was done by Exegesis, and Idox PLC Company.

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Contents

Executive summary

Version 1.2 of the England Green Infrastructure mapping database was published online in January 2023.

This method statement for version 1.2 of the "England Green Infrastructure Mapping Database" sets out the approaches and methods used for all the content (combined V 1.1 and 1.2) produced by spatial assessment of combined source data. The individual maps or layers in the mapping are described in detail in the User Guide on the Green Infrastructure Standards website.

- Section 1 explains the approach to using Green Infrastructure typologies in the mapping.
- Section 2 explains the approach to how the public accessibility of green spaces was determined in order to produce the "Accessible Green Infrastructure" map.
- Section 3 explains the approach taken to determining access to woodlands.
- Section 4 explains how a "greenness" grid was created for all England.
- Section 5 explains how the full accessible natural green space (ANGSt) assessment for England was undertaken (in future this will more simply be referred to as the "Accessible Green Space Standards Assessment". The descriptions and titles used in the mapping relating to "Natural Green Spaces" will be brought into line with the documentation for the "England Green Infrastructure Standards Framework" in due course).
- Section 6 explains the approach to undertaking accessible natural green space inequalities assessments. These include assessments using the Index of Multiple Deprivation (IMD) and population density data. There is a specific "Nature Close to Home" assessment focussed on children up to 16 years old and people 65 years old. In addition, there is an assessment of combined inequalities for green space and linear access.
- Section 7 explains how the "Blue Infrastructure" network mapping was undertaken for water bodies and water courses.
- Section 8 explains how the access to waterside assessment was done.
- Section 9 explains how a focussed assessment of access to waterside in urban areas only was done.
- Section 10 explains how the grid density maps for "Public Rights of Way" were undertaken.
- Section 11 explains how the "Public Rights of Way Experiential Terrain" mapping was done to provide information on the landscape experience of all routes in the network.

Section 1. England Green Infrastructure mapping approach to use of typologies.

A system of Green Infrastructure typologies was devised to enable the integration of a range of spatial datasets that sometimes describe the same physical spaces in different ways. In devising the typology system effort was taken to mimic the descriptions in the source data as closely as possible.

Typologies are currently grounded into five “families.

1. Public and community spaces.
2. Access Land.
3. Woodland.
4. Water features.
5. Functional green spaces (usually dedicated to a specific activity or use).

The system of Green Infrastructure typologies is set out in table 1.

Table 1. England Green Infrastructure mapping version 1.2 system of spatial typologies. Look up table for system of Green Infrastructure typologies used in version 1.2 of the mapping. The typologies are grouped in “families” and given unique numeric codes and titles.

Typology family	Typology code	Typology title
Public and community spaces (Family code 1)	1.1	Public Park (general)
Public and Community Spaces (Family code 1)	1.2	Public Park (Country Park)
Public and Community Spaces (Family code 1)	1.3	Millennium or Doorstep Green
Public and Community Spaces (Family code 1)	1.4	Local Nature Reserve
Public and Community Spaces (Family code 1)	1.5	National Nature Reserve
Public and Community Spaces (Family code 1)	1.6	Playing Fields

Typology family	Typology code	Typology title
Public and Community Spaces (Family code 1)	1.7	Other Sports Facilities
Access Land (Family code 2)	2.1	Section 15 and Section 16 Access Land
Woodland (Family code 3)	3.1	Woodland
Water Features (Family code 4)	4.1	Water courses and surface water features
Functional green spaces (Family code 5)	5.1	Allotments and community growing spaces
Functional green spaces (Family code 5)	5.2	Activity spaces provision (including bowling greens and tennis courts)
Functional green spaces (Family code 5)	5.3	Cemeteries and religious grounds
Functional green spaces (Family code 5)	5.4	Golf Courses
Functional green spaces (Family code 5)	5.5	Play space provision

Green Infrastructure typologies were identified from a range of source data. Several categories from the source data were brought together into one Green Infrastructure typology to create the “Combined Green and Blue Infrastructure” map.

The relationship between source data categories for mapped polygons and the Green Infrastructure typology to which they were assigned is set out in Table 2.

Table 2. Look up table for attribution of source data to respective Green Infrastructure typologies. The table identifies which datasets (and any data attributes) were assigned to which Green Infrastructure typology (by title and numeric code) to create the "Combined Green and Blue Infrastructure" map.

Dataset	Attribute	License	V 1.2 Typology Code	V 1.2 Typology title
OS Greenspace	Allotments or Community Growing Spaces	OGL	5.1	Allotment and Community Growing Spaces
OS Greenspace	Bowling Green	OGL	5.2	Activity Spaces Provision
OS Greenspace	Cemetery	OGL	5.3	Cemeteries and Religious Grounds
OS Greenspace	Golf Course	OGL	5.4	Golf Course
OS Greenspace	Other Sports Facility	OGL	1.7	Other Sports Facility
OS Greenspace	Play Space	OGL	5.5	Play Space Provision
OS Greenspace	Playing Field	OGL	1.6	Playing Fields
OS Greenspace	Public Park or Garden	OGL	1.1	Public Park – General
OS Greenspace	Religious Grounds	OGL	5.3	Cemeteries and Religious Grounds
OS Greenspace	Tennis Court	OGL	5.2	Activity Spaces Provision
Local Nature Reserve	None	OGL	1.4	Local Nature Reserve
National Nature Reserve	None	OGL	1.5	National Nature Reserve
Natural England open access data	None	OGL	2.1	Access Land (CRoW)
Natural England open access S15	None	OGL	2.1	Access Land (CRoW)
Millennium Greens	None	OGL	1.3	Millennium or Doorstep Green
Country Parks	None	OGL	1.2	Public Park - Country Park
Doorstep Greens	None	OGL	1.3	Millennium or Doorstep Green
OS Woodland	None	OGL	3.1	Woodland

Dataset	Attribute	License	V 1.2 Typology Code	V 1.2 Typology title
OS Surface Water	None	OGL	4.1	Water Courses and Surface Water Features
National Forest Inventory	None	OGL	3.1	Woodland
Ancient Woodland	None	OGL	3.1	Woodland
OS Open Rivers	canal	OGL	4.1	Water Courses and Surface Water Features
OS Open Rivers	inlandRiver	OGL	4.1	Water Courses and Surface Water Features
OS Open Rivers	lake	OGL	4.1	Water Courses and Surface Water Features
OS Open Rivers	tidalRiver	OGL	4.1	Water Courses and Surface Water Features

The combined Green and Blue Infrastructure layer is a collection of open data that is combined to identify the Green and Blue Infrastructure polygons. This map is not a comprehensive map of all green and blue land cover in England and the map has areas for which no data is presented. It is intended that the coverage of this map may expand over time to become more comprehensive as further data are added.

Data used to create the Combined Green and Blue Infrastructure layer may have overlapping geographical extents. This means that there can be multiple overlapping polygons in an area which relate to the same physical space on the ground, and which may therefore have different attributes due to different data sources. In addition, the specific polygon boundaries for the same on the ground site may have cartographic mis-alignments. No attempt has been made to rationalise polygon boundaries or attributes so that data integrity with the source is retained.

All polygons on the “Combined Green and Blue Infrastructure map” were assigned key attributes. These attributes are utilised to assist with spatial analysis for other maps in the database.

The key attributes used on the “Combined Green and Blue Infrastructure” map are listed below.

- Dataset. Identifies the dataset from which the polygon is derived
- Accessible. An attribute flag to identify whether the greenspace is treated as accessible to the public.
- Accessible Natural Green Space. An attribute flag to determine if the greenspace is included in the Accessible Natural Greenspace Standards (ANGSt) assessment.
- Naturalness. An attribute assigned to each polygon as level 1 to 3 with 1 being most natural.
- Typology Code. The Green Infrastructure typology code assigned to each polygon.
- Typology Title. The name of the Green Infrastructure typology assigned to each polygon.

- Manmade area. The percentage of the polygon that is not vegetation, water, or soils. This attribute is derived from the Ordnance Survey MasterMap Topography (non-open) data).

Note on the treatment of “Playing Fields”.

The Town and Country Planning (Development Management Procedure) (England) Order 2015 defines “Playing Fields” as.

“The whole of a site which encompasses at least one playing pitch”

In addition, “playing pitches” are described as.

“a delineated area which, together with any run-off area, is of 0.2 hectares or more, and which is used for association football, American football, rugby, cricket, hockey, lacrosse, rounders, baseball, softball, Australian football, Gaelic football, shinty, hurling, polo or cycle polo”.

In the Green Infrastructure Mapping version 1.2 source data from the Ordnance Survey “Open Green Space” data has been used to identify both “Playing Fields” and “Other Sports Facilities” which are defined in the Ordnance Survey technical specification as follows.

- Playing Fields - Large, flat areas of grass or specially designed surfaces, generally with marked pitches, used primarily for outdoor sports, i.e., football, rugby, cricket.
- Other Sports Facilities – Land used for sports not specifically described by other categories. This typology includes those facilities where participation in sport is the primary use of the area.

Please note that “Other Sports Facilities” may substantially include or be made up wholly of buildings (identifiable using the “percent manmade surface” attribute).

The Ordnance Survey depictions of “Playing Fields” may thus not be entirely in accordance with the Town and Country Planning Act definition and the Green Infrastructure mapping has used the data as provided by the Ordnance Survey source. The use of typology descriptions “Playing Fields” or “Other Sports Facilities” in the mapping is purely for the purposes of typological differentiation of spaces and in the event of any discrepancy, the depiction of “Playing Fields” and/or “Sports Facility” in the mapping does not override the definition in the TCPA (Development Management Procedure) 2015 or that used in the National Planning Policy Framework which should be followed in any formal, policy or legal consideration of “Playing Fields”.

For Version 1.2, in an attempt to provide some clarification on outdoor activity spaces; some limited data from the Sport England “Active Places” database has been used to supplement the information derived from the OS. The Sport England data focusses on the provision of facilities for outdoor sports and activities and does not include data on any indoor facilities. In addition, the Sport England data is “point data” that may provide either

more detailed content to OS polygons or locate facilities that are missing from the OS data.

Approach to the determination of “Accessible Green Infrastructure”.

All polygons in the mapping with a greenspace “accessible” attribute flag were merged using “ArcMap GIS” into a single national vector.

Accessibility was determined primarily from the typology of the GI. The approach to assigning accessibility by typology is set out in Table 3.

For the Green Infrastructure mapping, a simple hierarchy of accessibility was used based on the formality of access provision. The hierarchy has three levels.

1. Publicly accessible. To be considered publicly accessible, a type of Green Infrastructure had to be regarded as likely to be open to the general public, free of charge and provided as a space where the public would expect to be able to access at least during daylight hours. This could either be via a formal public right of access (such as by designation as access land but not purely by the existence of a Public Right of Way over any land) or it being a space provided for public access as a core land use purpose and likely to be providing opportunity for a broad range of activities requiring public access (including for example public parks but also places such as cemeteries or public playing fields).
2. Accessible to the public. Land to which public access is permitted by the landowner, usually free of charge (although some areas may be pay to access). Such access may be restricted in extents, times of day or year and may be subject to closure at short notice or may come with conditions.
3. Accessed by the public. Land that is accessed by the public but over which no right or permissive access arrangements are known. Such access may be tolerated by the landowner, be locally accessible by tradition, be incidental in nature or be actual trespass.

A judgement was made based on a review of the source data typologies as to whether an identified space was likely to be publicly accessible as set out in the access hierarchy. Sites identified as “publicly accessible” were done on the basis of a judgement of the usual probability. This means that some sites identified as accessible may in fact be not accessible to the public (for example, some cemeteries are private). The detailed determination of public accessibility can only be done locally.

Table 3. Typological assignment of accessibility of Green Infrastructure. Look up table showing how datasets and relevant attributes were assigned typologically to define Green Infrastructure accessibility and further refined to identify those that were used in the England Accessible Natural Green Space Standards (ANGSt) assessment. Sites identified as “accessible” are done so on a usual probability basis and some sites may in fact be not accessible to the public.

Database	Attribute	Classed as accessible	Used in the ANGSt Assessment
OS Greenspace	Allotments or Community Growing Spaces	No	No
OS Greenspace	Bowling Green	No	No
OS Greenspace	Cemetery	Yes	No
OS Greenspace	Golf Course	No	No
OS Greenspace	Other Sports Facility	No	No
OS Greenspace	Play Space	Yes	No
OS Greenspace	Playing Field	Yes	Buffer_200 only
OS Greenspace	Public Park or Garden	Yes	Yes
OS Greenspace	Religious Grounds	Yes	No
OS Greenspace	Tennis Court	No	No
Local Nature Reserve	None	Yes	Yes
National Nature Reserve (see note)	None	No	No
Natural England open access data (including section 15)	None	Yes	Yes
Millennium Greens	None	Yes	Yes
Country Parks	None	Yes	Yes
Doorstep Greens	None	Yes	Yes
OS Woodland	None	No	No
OS Surface Water	None	No	No

Database	Attribute	Classed as accessible	Used in the ANGSt Assessment
National Forest Inventory	None	No	No
Ancient Woodland	None	No	No
OS Open Rivers	canal	No	No
OS Open Rivers	inlandRiver	No	No
OS Open Rivers	lake	No	No
OS Open Rivers	tidalRiver	No	No

Note on exceptions.

Some typologies deemed normally not accessible were included as accessible if they formed part of a wider typology deemed accessible. For example, woodland has been classed as usually not accessible but included as accessible if it forms part of a public park. Likewise, Tennis Courts and Bowling Greens (which on their own are deemed not accessible but their extents are treated as accessible if within the confines of a public park).

The Ordnance Survey Open Green Space data typology of “Other Sports Facilities” was not considered accessible as they may be buildings or spaces normally providing restricted and/or private access and facilities (including pay to access).

Likewise, Golf Courses were deemed not accessible because they are usually private or have restricted access to club members or may be “pay to play” businesses.

Spaces that are usually private, pay to access, or usually accessible by permissive agreement only, were not included in the assessment of “Accessible Green Infrastructure”. However, it is possible that some outdoor sport facilities within Public Parks may have restricted access or even be pay to use. If within a broader publicly accessible space, these have nonetheless been included as accessible for simplicity.

In Version 1.2 of the mapping; new data on sites offering permissive access to the public (on a general basis and usually free to access) has been included. The “Permissive access” layer is based on data provided to Natural England by land owning organisations that have identified the parts of their estate to which they permit some form of public access. Such access may be restricted in extents, times of day and possibly times of year but is usually free to access (although there may be charges for parts of the site or facilities such as car parking). Data gathered so far is only for a few organisations, but more data will be added over time to build a more comprehensive dataset of sites offering permissive access to the public and are thus access hierarchy class “accessible to the public”.

In addition, for Version 1.2 of the mapping, OS Open Green Space data on sports, activity and play spaces (Active Places) has been collated into one layer. The sites identified may or may not be open to the public. In addition, some sports facilities may be buildings or 100 percent “manmade surface” (that is not vegetation, water or soils). However, some sites may include significant green areas and may offer limited or significant accessibility to the public. Sport England “Active Places” data has also been used to supplement and expand on that provided from the Ordnance Survey Open Green Space data. The Sport England data gives information on those sites that provide some form of public accessibility although this may be subject to some restrictions or require payment to use.

Determination of Accessible Natural Green Space (ANGSt) attribution.

A sub-set of “Accessible Green Infrastructure” typologies was used for the England Accessible Natural Green Space Standards (ANGSt) assessment.

The ANGSt approach aims to address differences in access to the natural environment across the country through local green spaces by setting a range of accessibility benchmarks for sites of “higher level” naturalness and areas within easy reach of people’s homes.

Once those typologies that were judged publicly accessible had been identified, a subsequent judgement process reviewed each typology to consider its likely “naturalness score” (The approach used to “naturalness” determination is set out below).

Those with a naturalness score of 1 or 2 (likely to be of a more natural character or of a mixed character) were then further considered to generate a sub-set of typologies that would be identified as “Accessible Natural Green Spaces”. This was done on an “on balance of probability” basis seeking to identify those spaces that were likely to be of a more “natural” character but would also generally be considered as publicly accessible green spaces.

An exception was made for “Playing Fields” (Naturalness 3) which in some datasets are identified as “recreation grounds” and in others as provision for formal sporting activities. Playing Fields were included in the ANGSt assessments if they are an integral part of a wider public open green space (Parks and Gardens) but only in the ‘Doorstep’ ANGSt analysis. In the Doorstep ANGSt assessment, Playing Fields were assigned a buffer of 200 m alongside those green spaces that had been included as “natural” for the purposes of the overall ANGSt assessment. In this case it was judged that whilst their naturalness factor is likely to be 3 because they are likely to be quite highly managed for formal sport and recreation, they nonetheless are likely to be important green space resources at this very local level.

Formal “Sports Facilities” were completely excluded from the ANGSt analysis as they are likely to be highly managed functional spaces and may be 100% man made. However, some spaces that have been identified as Sports Facilities may in fact be Playing Fields and vice versa.

Facilities such as play spaces, tennis courts or bowling greens were included only if they formed part of a larger “Public Park” with Naturalness Rank 2 (as this rank covers the fact that such sites are likely to be variable in character).

Approach to the determination of “Naturalness” attribute.

The ‘Naturalness’ attribute was determined using the Green Infrastructure typology as a proxy. A system based on that set out in Nature Nearby was devised to fit with the mapping requirements.

Find out more about the system in Nature Nearby

Find out more about the system in Nature Nearby.

Typologies were assigned a naturalness rating based on judgement as to the average rating a particular typology was likely to attain. The meaning of “naturalness” for V 1.2 is set out below.

- Level 1 (likely to be most natural – lowest apparent levels of land management intensity).
- Level 2 (Likely to have mixed attributes – likely to be a mosaic of areas of low and high intensity land management)
- Level 3 (Likely to be highly or intensively managed spaces – may contain an element of less intensively managed areas).

Table 4. Assignment of “naturalness factor” to source data typologies. Look up table relating source data and any relevant attributes to an assigned “naturalness factor” of between 1 (Likely to be most natural) and 3 (Likely to be least natural).

Dataset	Attribute (sub-title in the data where relevant)	Assigned naturalness factor
OS Greenspace	Allotments or Community Growing Spaces	3
OS Greenspace	Bowling Green	3
OS Greenspace	Cemetery	3
OS Greenspace	Golf Course	3
OS Greenspace	Other Sports Facility	3
OS Greenspace	Play Space	3
OS Greenspace	Playing Field	3
OS Greenspace	Public Park or Garden	2
OS Greenspace	Religious Grounds	3
OS Greenspace	Tennis Court	3
Local Nature Reserve	None	1
National Nature Reserve	None	1
Natural England open access data (including S15)	None	1
Millennium Greens	None	2
Country Parks	None	2
Doorstep Greens	None	2

Dataset	Attribute (sub-title in the data where relevant)	Assigned naturalness factor
OS Woodland	None	1
OS Surface Water	None	1
National Forest Inventory	None	1
Ancient Woodland	None	1
OS Open Rivers	canal	1
OS Open Rivers	inlandRiver	1
OS Open Rivers	lake	1
OS Open Rivers	tidalRiver	1

The naturalness rank assignments will be full of exceptions and should only be considered as a loose fit. For example, some Golf Courses (rank 3) contain significant natural space that is not picked up whilst some cemeteries (rank 2) will be more or less intensively managed than others meaning they could rank 1 or 3. Likewise, the management regimes for public parks are likely to be highly varied but they have been given a general rank of 2. In addition, all watercourses and bodies were assigned a rank of 1, but some will be highly engineered reservoirs, formal water features and canals with a substantial man made character.

Further work on Naturalness is planned to improve on the way in which this attribute is used in future mapping.

Approach to the determination of the "Percent Manmade Surface" attribution.

The "Percent manmade surface" attribution shows the percentage of the total area of each Green Infrastructure polygon or "Greenness Grid" square that is covered by a manmade surface (not vegetation, water, or soils). It is intended as a companion indicator to naturalness and can indicate some Green Infrastructure areas which were mapped in this process as Green Infrastructure but are in fact substantially or even entirely manmade.

For example, some sport facilities which appear in this dataset as Green Infrastructure may be buildings and indoor sports areas, and this can be determined using the percentage manmade area. The manmade area was calculated using a manmade surface dataset for the whole of England which was extracted from the Topography Layer from the Ordnance Survey's (OS) 'MasterMap' data. The data presented in V 1.2 is thus a derived product as the source data is not available under OGL terms.

In addition, the greenness grid registers the existence of Green Infrastructure that does not appear in the mapping because the data relating to it is not open, cannot be shown in the OGL mapping or has no specific typological attribution due to a lack of land use data. Greenness is therefore a broad measure of the total amount of aggregated "green cover" both accessible and non-accessible.

The Greenness data does not however include any tree canopy data. The impact of trees (as opposed to woods) on local greenness will therefore not be taken account of in the Greenness Grid.

Section 2. The assessment of publicly accessible Green Infrastructure.

The “Accessible Green Infrastructure” layer was generated by creating a subset of polygons from the “Combined Green and Blue Infrastructure” layer.

Polygons from the “Combined Green and Blue Infrastructure” layer were retained based on the accessibility flag attribute. This means that private greenspaces such as golf courses, allotments, private sports facilities, gardens etc are not included in the Accessible Green Infrastructure layer.

To be flagged as “Publicly Accessible” a typology had to be (on the basis of usual probability), formally open to the general public (at least during daylight hours), free to access and available for at least informal recreation and visiting (although many accessible spaces will provide for a range of formal and informal recreation and activities).

All polygons flagged as accessible were dissolved to create a single vector dataset and each were assigned the following attributes.

- Shape area = area of the polygon in hectares.
- Percent manmade = percent of the polygon area that is not plants, water, or soils.

The process of dissolving the polygons into one vector dataset removes the problem of overlapping polygons from different datasets seen in the “Combined Green and Blue Infrastructure” layer. This is because it joins adjacent green space polygons and creates a single, larger polygon where two or more polygons intersect. Finally, the polygons created by this process were intersected with the manmade surface dataset and a percentage of each greenspace area that is manmade surface (not vegetation, water, or soils) was calculated based on this intersection.

A look up table matching dataset typologies with their treatment as “accessible” and whether used in the Accessible Natural Green Space Assessment is set out in Table 3 above.

Some typologies deemed normally not accessible were included as accessible if they formed part of a wider typology deemed itself accessible. For example, woodland has been classed as usually not accessible but included as accessible if it forms part of a place such as a public park. Likewise, Tennis Courts and Bowling Greens, which on their own are deemed not accessible but are treated as accessible if within a wider context such as a public park or greenspace.

Section 3. Woodlands and access.

There has been limited incorporation of woodlands data into Version 1.2 of the Green Infrastructure Database. This has involved bringing together OS Open Data with National Forest Inventory and Ancient Woodland Inventory data.

It has not proved possible to yet include data on urban trees or "Trees Outside of Woods". It is still planned to incorporate tree data in a future iteration of the mapping.

In addition, the assessment of access to woods has been limited and high level and the resulting "Woodlands and Access" map should be regarded as a limited initial product only. Current work being undertaken by Forest Research on woodlands and access will expand data in due course.

Woodland access standards have not been incorporated into V 1.2, however; a limited "Woodlands and Access" assessment was undertaken to identify those woods that are either.

1. Accessible because they fall within a publicly accessible green infrastructure polygon.
2. Are partially accessible because of the existence of a Public Right of Way either within or along the edge of a woodland which creates a linear route with a woodland character. The route of the Public Right of Way is depicted as a linear corridor of 20m width.
3. Are not part of a publicly accessible green infrastructure polygon and are not crossed by a Public Right of Way and are thus for the purposes of this exercise deemed as "not accessible". However, some woods deemed in this way may offer some form of permissive access and thus be "accessible to the public" in the access hierarchy.

No data relating to permissive access or incidental access to woodlands is however included in this analysis.

Data for the "Woodlands and access" map was extracted from the "Combined Green and Blue Infrastructure map. Polygons were extracted if they were classed as having woodland typology code. Woodland polygons were dissolved to create a single vector dataset, and each were assigned the attributes detailed in below.

- Access class = Accessible, linear access or non-accessible.
- Percent manmade = percent of woodland area that is not plants, water, or soil.

The percentage of manmade area was calculated based on an intersection with the manmade surface dataset.

There are gaps in the Public Rights of Way network layer where data could not be sourced for inclusion in V 1.2. Where this is the case, woodlands with a Public Right of Way through or adjacent to them will not be identified as "linear accessible".

Public Rights of way within or adjacent to woodlands are identified using an indicative 20m wide corridor to highlight the corridor within which the Public Right of Way exists. The

existence of a Public Right of Way within or adjacent to a woodland does not give any rights of access except along the route of the right of way itself.

Section 4. The Greenness Grid.

Greenness is mapped with respect to the percentage of a polygon/area that is not vegetation, water, or soils. Greenness is expressed as a "percentage manmade surface" in the mapping but can be expressed as the inverse proportion statistically.

Greenness is used to permit two things.

1. At a site level (for each polygon), greenness is a means of understanding the amount of any given space mapped as Green Infrastructure that is actually man-made surface.
2. On an area basis (each Greenness Grid square), a simple measure of general environmental quality as derived from understanding how much of an area is manmade surface as opposed to vegetation, water, or soils.

The manmade area was calculated using the "manmade surface" dataset for the whole of England which was extracted from the "topography layer" from Ordnance Survey's (OS) 'MasterMap' data.

The percent manmade surface and Greenness Grid data presented in V1.2 is a derived product because OS MasterMap Topography Layer is not open data and not available under Open Government License.

Approach to the use of greenness in the "Combined Green and Blue Infrastructure" map.

Within the Combined Green and Blue Infrastructure layer, Greenness exists as an attribute attached to each mapped Green Infrastructure polygon.

The attribute field shows the percentage of the total area of each green infrastructure polygon that is covered by manmade surface (not vegetation, water, or soils). It is intended as a companion indicator of naturalness and can indicate those areas mapped as green infrastructure in the data in fact being entirely or mostly buildings and other manmade surfaces. For example, some sport facilities which appear in this dataset may be indoor sport areas and this can be determined using the percentage manmade area.

Approach to the creation of the "Greenness Grid" map.

There is also a specific "Greenness Grid" map which shows the percentage of land surface that is manmade as opposed to vegetation, water or soils using a 250 metre square grid (aligned with the OS Grid).

This national map purely shows the estimated amount (derived from the source data) of surface within a grid square that is not vegetation, water, or soils. A 250m square grid was chosen as it strikes a balance between detailed geographical area coverage, processing requirements to create the data and overall size of the data.

Section 5. England Accessible Natural Green Space Standards Assessment (ANGSt).

The Accessible Natural Green Space Standards assessment is the first England scale ANGSt assessment and the first to use an updated system of 6 ANGSt Standards that now form the structure of the England Green Infrastructure Standards for accessible green space (see table below).

In future this will more simply be referred to as the “Accessible Green Space Standards Assessment”. The descriptions and titles used in the mapping relating to “Natural Green Spaces” will be brought into line with the documentation for the “England Green Infrastructure Standards Framework” in due course (this will include the access inequalities mapping modules).

The purpose of the assessment was to determine the baseline (current situation) for access to natural green space across England and for each standard.

For the purpose of this exercise, a system of 6 standards was used.

The England ANGSt assessment was undertaken using a subset of the data for the “Accessible Green Infrastructure” layer (see table 3) and utilised a system of ANGSt criteria as set out in table 5.

Table 5. Table setting out the parameters for the system of Accessible Natural Green Space Standards (ANGSt) used in the England ANGSt assessment. Each Accessible Natural Green Space Standard is set out with the threshold values for minimum green space size, and it’s associated width of proximity buffer. Information on generalised time estimates for walking and cycling to undertake a journey of distance equivalent to the respective buffer width is also given.

Name of ANGSt Standard	Size and distance criteria
Doorstep Green Space	At least 0.5 ha within 200 metres Less than 5 mins walk
Local Natural Green Space	At least 2 ha within 300 m 5-10 mins walk, 1-2 mins cycle

Name of ANGSt Standard	Size and distance criteria
Neighbourhood Natural Green Space	10 ha within 1 km 15-20 mins walk, 3-4 mins cycle
Wider Neighbourhood Natural Green Space	At least 20ha within 2km 35 mins walk, 6-8min cycle
District Natural Green Space	100 ha within 5 km 15-20 mins cycle
Sub-regional Natural Green Space	500 ha within 10 km 30-40 mins cycle
Local Nature Reserves	LNRs of at least 1 ha per 1000 population

Note on distance and walking times.

The Chartered Institution for Highways and Transportation reports that average walking speed is approximately 60 metres per minute. 90 metres per minute is fast and 30-40 metres is slow. On the basis of 60 metres a minute the following distances can be achieved in bands of increasing time:

- 5 mins is 300 metres
- 10 mins is 600 metres
- 15 mins is 900 metres
- 20 mins is 1200 met
- 35 mins is 2 km

Note on cycling times.

The Department for Transport (Local Transport Note 2/08) reports that the average speed of cyclists on a level surface is around 12 mph.

Transport for London assume an average cycle speed of 15 kilometres per hour.

Approach to establishing ANGSt buffers (Straight line versus network approaches).

The V 1.2 ANGSt assessment uses a “straight line” method to creating buffers around those green spaces that meet the minimum threshold size for each ANGSt standard.

A buffer of the respective distance was generated around all polygons (that meet the size thresholds) in the “Accessible Green Infrastructure” map.

Because the “straight line” method assumes an “as the Crow flies” distance measurement, actual distances walked are likely to be longer. Comparison with assessments using network analysis suggest that actual walking distances may be up to 50% longer than the straight-line distance due to barriers within the route network between journey origin (usually home) and destination (green space). Such barriers may be railways, rivers, and roads. In addition, the position of access points to greenspace will affect workable routes and thus actual distances traversed.

Best practice is to measure actual walking routes in applying the ANGSt standards (at least for the 200m, 300m and 1km buffers). Such approaches are often called “network analysis”. But there are data size and comprehensiveness issues (especially for access points) that have meant that an England level network style of analysis has not been attempted for this version of the mapping. This means that the “straight line buffer” method was used for this assessment.

In the context of the England ANGSt assessment, “accessibility” thus in practice refers to the creation of distance buffers around publicly accessible green spaces. The buffer thus more correctly creates a “zone of proximity” to the relevant spaces. However, the ability of people to physically access the space will be affected by a range of factors including physical barriers and those created through personal circumstances such as personal health issues. Proximity to a space may thus not directly lead to an ability to easily physically access it.

In the England ANGSt assessment, straight line buffers have been used with no corrections to understand the impact of major barriers (such as motorways, railways, or rivers etc) on local buffers. Such corrections can be applied locally.

However, in Version 1.2 of the mapping new layers of information that may help understand major features that could affect routes and thus distances have been included.

There are new layers showing.

- Major barriers (for V 1.2 these are all railways and motorways although potential barriers created by rivers and water bodies can also be seen when combining this layer with the “Blue Infrastructure Network” map to identify water courses that may also be physical barriers).

- Access Points. This new layer incorporates access points derived from OS Open Greenspace data but has also identified access points where the edge of an accessible greenspace intersects a Public Right of Way (see PRoW Network layer) where it is assumed that there will be an access point. Where PRoW data is missing, access points will not have been identified. In addition, any access points that occur where the PRoW or other track/road etc are in parallel with the Access Land may not have been picked up.

Selection of polygons to include in the England Accessible Natural Green Space assessment.

The Accessible Natural Green Space (ANGSt) approach aims to aid the understanding of differences in access to the local green spaces across the country.

Accessible green infrastructure polygons with a "naturalness" score of 1 or 2 were used in the England ANGSt assessment. These typologies and their source data are set out in table 3.

An exception was made for "Playing Fields" (Naturalness 3) which were included in the ANGSt assessments if they were an integral part of a wider public open green space.

In addition, Playing Fields were included within the new 'Doorstep' ANGSt standard buffer of 200m. This was because it was judged that whilst their Naturalness factor is 3 (likely to be highly managed for formal sport and recreation) they nonetheless are likely to be important green space resources at this very local level.

Formal "Sports Facilities" were completely excluded from the ANGSt analysis as they are likely to be highly managed functional spaces and may be 100% man made.

Polygons identified as activity spaces (such as tennis courts and bowling greens etc) were included if they were part of a wider public green space (given a Naturalness rank of 2) but not if standalone facilities.

All features flagged to be included in the ANGSt assessment were dissolved to create a single feature where individual layers overlapped. The area of each of the spatially isolated polygons was calculated to determine the size of the buffer that was created around them based on the standards set out in table 5.

Note on the difference of approach for the "Doorstep" ANGSt criterion.

For the Doorstep standard, a different approach was taken by including Playing Fields (Naturalness 3) in the assessment. This means that the Doorstep Standard is actually a measure of wider access to green space rather than the narrower "Natural Green Space" that underpins the assessments for the other standards in the system.

This was because the Doorstep standard includes spaces down to 0.5 ha where it may be difficult to determine a robust view of what "Natural" means at such a small scale. In addition, the rationale for this standard relates to the provision of very local green space

assets and more formal spaces are likely to be valued resources at community level irrespective of actual Naturalness qualities.

Note on the generation of the “ANGSt Profile” map.

Maps were generated to show overlaps of the different buffers (combined buffers map) to create an “ANGSt Profile” for each area. The ANGSt profile identifies each of the buffers that are present at any given location of the map. The list of specific buffers present creates the ANGSt profile.

Note on the generation of the “ANGSt” population data.

In order to estimate the population that is within the ANGSt buffer “zone of proximity”, the percentage and area of each LSOA that was covered by the zones meeting each of the ANGSt size and distance criteria was multiplied by the population density in that output area. This analysis had to assume that the population is evenly spread within each LSOA (this will not be the case for all LSOA, especially those of a more rural or dispersed character).

The population within the “zones of proximity” to a greenspace was then aggregated to the larger administrative regions and expressed as a percentage of the total population in those regions.

Specific data at an individual LSOA level may be at variance with the situation on the ground due the methodological assumptions that were made for the calculation. Aggregated data at larger scales is likely to smooth out any variances.

Note on the use of “straight line” and “Network” approaches to ANGSt buffer generation.

The England ANGSt assessment uses a simple “straight line” or “as the crow flies” method to generate the ANGSt buffers around greenspaces.

This has the advantage of being relatively simple and generates lower amounts of data than using more complex “Network Analysis”. In addition, it does not require comprehensive access point data (without which Network Analysis cannot effectively be undertaken).

However, the use of straight-line buffering will likely over-estimate the number of people who are within the distance element of the respective ANGSt standard because it assumes everyone can access the green space in a straight line. In reality, access will be along local networks of routes (paths, streets, and roads etc) and usually to the nearest access point.

Full network analysis could not be carried out for the V 1.2 ANGSt due to the complex and sizable nature of the data processing task to cover all England.

However, to develop some indication of the different results that straight line and network approaches would deliver, a test was undertaken during the preparation of V 1.1 using the Cambridgeshire area comparing the outputs from the ANGSt Straight Line assessment with a bespoke Network Analysis approach undertaken for the test area.

Network analysis buffers were created using the ESRI ArcGIS tool 'Generate Service Areas'. The tool creates buffers to a specified distance along a linear network which is held by ESRI. The linear network appears to correlate well with OS open road and available Public Rights of Way open datasets. It was decided to use the centroid points of ANGSt polygons as input for the 'generate service areas' tool.

Impact of different buffer methods on percent population within the buffer statistics.

A comparative assessment was under-taken for Cambridgeshire that examined the impact of the area covered by the ANGSt buffers (as generated from straight line and network styles of analysis) and population figures. The results are set out in table 6.

These statistics used an early version of the GI mapping and take no account of subsequent changes in the source data that was used for later versions of the mapping. They are provided here purely to illustrate the potential impact of network analysis on results obtained from applying a straight-line method versus a network analysis method (as both approaches were applied using the same source maps). The specific numbers cannot be considered accurate or useable outside of this specific comparative analysis.

Table 6. Buffer comparison for the Cambridge test area. Table showing comparison figures for straight line (SL) versus network (Net) analysis methods of calculating area covered by ANGSt buffers and population within the buffers. In this exercise the 1km buffer was not used as it had not at the time been incorporated into the ANGSt system. Overall, the average impact on the estimated population within the ANGSt buffers showed a 58.78% reduction with a range between a minimum 42% reduction and maximum 73% reduction.

ANGSt Buffer	Area (ha) within Buffer – straight line analysis.	Area (ha within buffer – network analysis.	Percent of trial area – straight line analysis.	Percent of trial area – network analysis.	Number of people within buffer – straight line analysis.	Number of people within buffer – network analysis.	Percent population within buffer (assumes even spread across LSOA).	Percent population within buffer (assumes even spread across LSOA).	Percent change in population within buffer figures (Straight line divided by network).
Left blank	SL	Net	SL	Net	SL	Net	SL	Net	Left blank
200 m	26,398	10,291	7.8	3.0	205,481	117,209	25.5	14.6	42.1
300 m	23,934	6,324	7.0	1.9	196,134	70,032	24.4	8.7	64.4
2 km	86,077	24,125	25.4	7.1	396,276	184,074	49.2	22.9	53.5
5km	103,135	27,831	30.4	8.2	363,648	98,593	45.2	12.3	72.8
10km	13,408	5,247	4.0	1.5	14,126	5,311	1.8	0.7	61.1

A major issue with comparing the two ANGSt buffering methods was that the 'generate service areas' tool requires point data as an input for the buffering process. Due to a lack of comprehensive access point data, green space centroids were used as the assessment points. The resulting networks generated by the ESRI tool showed some parts of networks were within the actual green space polygon (especially larger ones). This means that the buffer areas for the network element of the assessment may have been significantly smaller than those generated by the straight line method as some of the distance travelled along the network was within the area of the greenspace itself and some buffers were entirely within the green space in question or only extended a small distance.

This means that the estimates for reductions in percent population within the buffers may be significantly over-estimated by an unknown margin. The figures should therefore be considered with caution and regarded as maximum impact levels.

The use of access points (not available in the mapping at the time this comparison was done) might well have resulted in an overall reduction in the differences between method populations covered estimates.

In addition, the situation for Cambridgeshire is not likely to be representative across all England. Results would likely vary considerably depending on local levels of accessible natural green space provision and the range of site sizes.

However, the analysis does suggest that the use of network analysis across England might possibly impact on the figures derived resulting in significant reductions in number of people within the buffers compared with those included in V 1.2 of the mapping. The straight-line ANGSt assessment figures should therefore be regarding as upper limit estimates.

Note on barriers affecting people movement across buffers.

No account of the impact of major barriers has been attempted in the mapping.

However, for Version 1.2 a new layer in the mapping has been included showing the presence of major barriers in the form of the rail network and motorways. When used in conjunction with the "ANGSt Buffers" layers it is possible to detect where substantial barriers within the buffers are likely to create a network interruption. Potential crossing points are not included in the mapping and other more local barriers are not mapped. Such information can be generated locally and incorporated as required.

In addition to motorways and railways, the "Blue Infrastructure Network" map can also be used to identify potential barriers created by water courses or water bodies. Again, crossing points are not included in the mapping, although some may be identifiable on the "Public Rights of Way Network" map which includes bridges that form part of a Public Right of Way.

Section 6. Accessible Natural Green Space Inequalities Mapping.

The original assessment of natural green space inequalities for Version 1.1 was undertaken using two approaches.

- A nature close to home (Nature Close2Home) assessment was undertaken for selected age cohorts of population using a unique 300m buffer that incorporates all green spaces with a naturalness factor of 1 or 2 and above 0.5 ha in size.
- Accessible Natural Green Space Inequalities maps were created for LSOAs comparing levels of accessibility with other socio-economic variables.

For Version 1.2 an additional assessment of access inequalities was undertaken that identifies the range of scenarios relating to the provision of accessible greenspace compared with the density of the Public Rights of Way network.

Version 1.2 of the mapping thus provides information on.

- The potential variation of the supply of “more natural” green spaces with respect to the population cohorts for people of ages under 16 (children) or 65 and over (older people) at LSOA level.
- The relative provision of accessible green space compared to either the Index of Multiple Derivation (IMD) or population density at Lower Super Output Area (LSOA) level.
- The relative variation in the combined provision of access infrastructure (measured as amounts of accessible green space and density of the Public Rights of Way network) using a 5km grid square.

Nature rich spaces close to home. The “Close2Home” assessment.

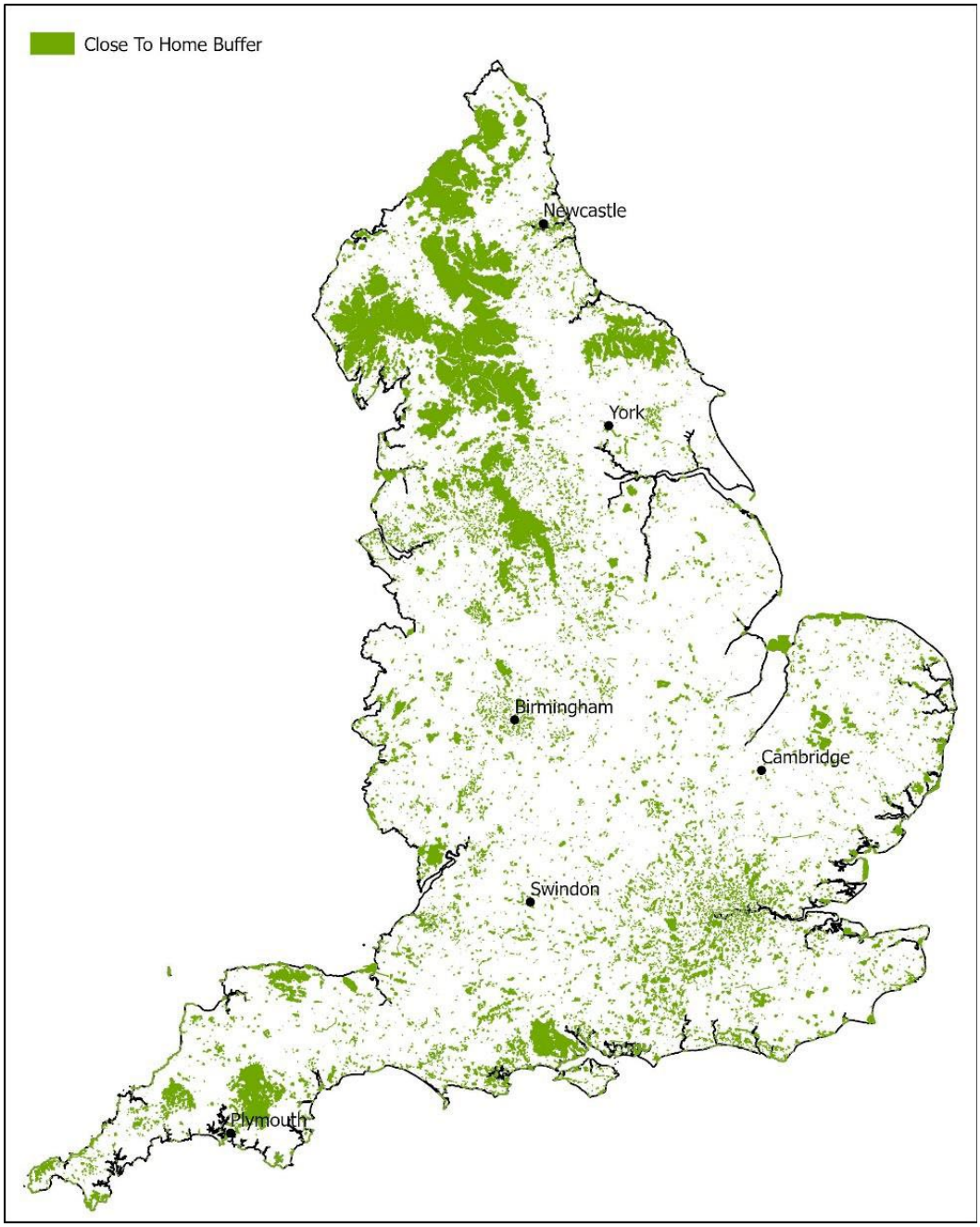
The “Nature Close to Home” assessment aims to understand the supply of publicly accessible green spaces that are likely to be moderate to high in terms of providing opportunity for “contact with nature” (wildlife) on a regular, daily, and local basis.

The assessment focusses on the supply of green spaces of at least 0.5 ha size and with a naturalness rank of either 1 or 2. However, this is a general approach to assessing naturalness which means some of the level 1 or 2 spaces may not be that “nature rich” at current time, although many may have potential for biodiversity enhancement.

To assess the supply of “nature rich” spaces close to home, a new 300m “Close2Home” buffer was created around all green spaces with a minimum 0.5 ha size and naturalness rank 1 or 2. This excludes “Playing Fields” and is thus different to both the Doorstep and Local ANGSt buffers.

The spaces included are thus those that are likely to be currently offering the most local opportunity to have contact with nature on a regular or routine daily basis.

Figure 1. A map of England showing the "nature close to home" 300m buffer (highlighted in green) across England. The map shows concentrations of buffer in the north of England, especially upland areas with large contiguous areas. There are lesser concentrations in the West of England (especially Devon and Cornwall) with more dispersed concentrations in Hampshire and across Surrey and around Greater London.



The “Nature Close to Home” assessment has focussed on two key groups for the purposes of Version 1.2 these are.

- Children and young people (under 16).
- Older people (65 and older).

Population data from ONS (2011 census) was gathered which provides a breakdown of population for all different age cohorts (0-5, 5-10, 10-15, 65-75 and 75+). Relevant cohort populations were summed together to define new “children” and “older people” population groups.

The new “Close to Home” buffer was intersected with LSOA to calculate the percentage area of LSOA within at least 300 m of a “Close to Home” natural greenspace”. This percentage area was then used to calculate the percentage of total population and percentage of Children (ages 15 and under) and older people (Age 65 plus) which were within this “Close to Home” buffer.

This calculation assumes population is evenly distributed across LSOA which is probably true for some, but not for all. This assumption introduces a level of distortion into the statistics and maps at an individual LSOA level.

The age cohort data was then be used to create maps of greenspace provision for different age cohorts showing area in hectares of accessible greenspace per head of population for Children and Older people at County, District, MSOA and LSOA level. Maps were colour coded after sorting into 10 equal sized bands (deciles) based on area of greenspace per head for each cohort.

Accessible Natural Green Space Inequalities Mapping.

The “Accessible Natural Green Space Inequalities” mapping looks at the relative disparity between LSOA when it comes to levels of access to “Natural Green Space”. The measure of accessibility used is “percent of output area covered by selected ANGSt Standard Green Space and attendant buffer”. This measure of accessibility is then compared using bivariate analysis with another key indicator of interest.

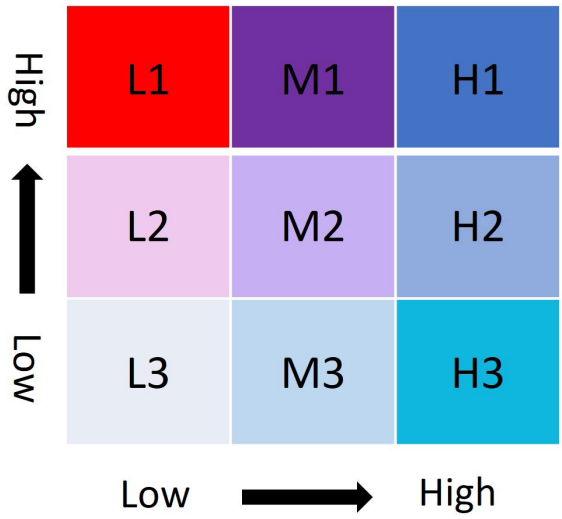
For Version 1.1 of the GI Database two comparator variables were selected for analysis. They were.

- Index of Multiple Deprivation (IMD) by decile.
- Population Density (by square km).

The resulting maps give an overview of LSOA across England showing the differential between the greenspace “demand factors” of IMD and population density against a proxy supply factor of “% LSOA covered by the ANGSt buffer including the associated green space”. The assessment was undertaken for the full set of 6 ANGSt Standards.

A method of bivariate colour mapping was used to assign Access Inequalities codes to LSOA. Bivariate analysis is where 2 factors are identified and mapped at the same time, with different colour gradients. Overall, this gives a spatial measure of relative accessible natural green space inequalities between different places.

Figure 2. Graphic showing how a bivariate analysis is built up. Each axis is from low to high. This creates an analysis box containing 9 compartments in a grid. A system of alphanumeric codes is used to define the 9 accessible natural green space inequalities classes. Unique alphanumeric codes are assigned to each sector of the grid. In this system, the assessment classes represent the different scenarios as defined by the mix of variables to create an "Access Inequalities Class" ranging from L1 to H3. Each assessment class is colour coded for the purposes of mapping but has its' individual alpha-numeric code attached as an attribute.



In this system the letters L, M and H represent Low, Medium, and High for "Percent ANGSt Buffer Coverage".

In addition, the numbers 1, 2 and 3 represent High, Medium, and Low for level of deprivation or Population Density.

This creates a range of Access Inequalities Classes with.

- L1 = Being the Least Favourable Scenario (i.e.: lowest buffer coverage and highest level of IMD/Population Density.
- H3 = Being the Most Favourable Scenario (i.e.: highest buffer coverage and lowest level of IMD/Population density).

Please note that these are relative not absolute measures and that H3 as a scenario does not mean that the situation on the ground necessarily fulfils local green space requirements.

In addition, the assessment can take no account of the quality of green spaces.

To run the analysis, band widths were selected to allow the two variables to be co-mapped. The band widths of the variables are not equal. This is to simplify the outputs of the analysis and permit a focus on those places considered to be in the “least favourable scenario”.

The selected approach to band widths is set out in figures 3 and 4 below.

Figure 3. Band width selection incorporating IMD Deciles. Bivariate analysis box for percent ANGSt buffer coverage along the horizontal axis and IMD decile along the vertical. Band widths for ANGSt buffer coverage (from low to high) are 0 to 5%, 5% to 50% and 50 to 100%. The percent ANGSt buffer coverage is the percentage of the area covered by both the accessible green space and its attendant buffer. Band widths for IMD deciles are inverted so that the highest IMD deciles (least deprived) are presented as low. Therefore, band widths are IMD deciles 1 and 2 (most deprived) are highest, 9 and 10 (least deprived) are lowest.

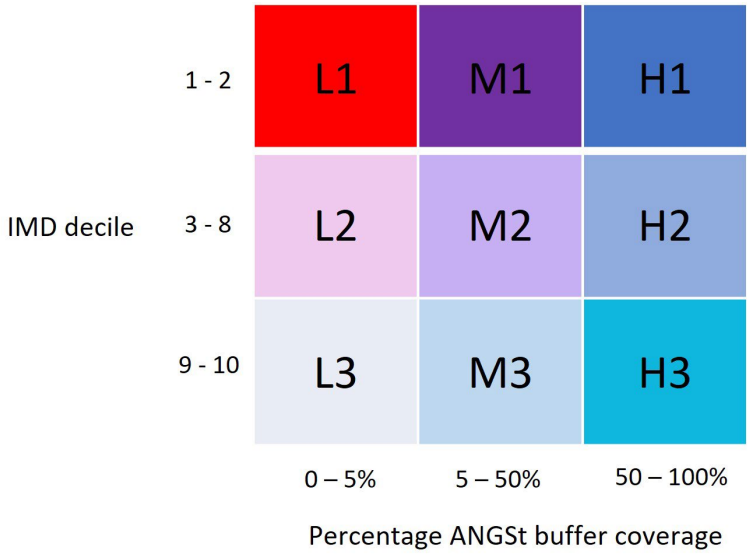
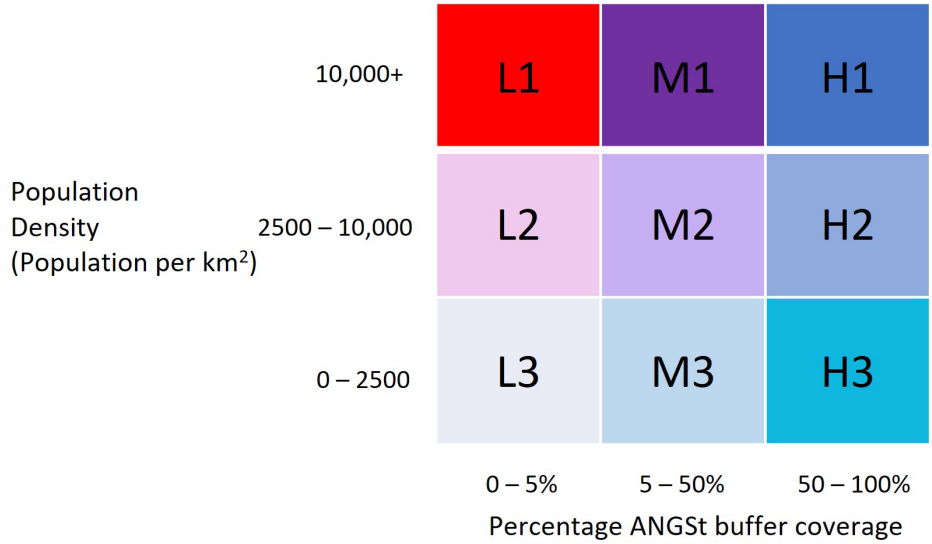


Figure 4. Band width selection incorporating population density. Bivariate analysis box for percent ANGSt buffer coverage along the horizontal axis and population density along the vertical. Band widths for ANGSt buffer coverage (from low to high) are 0 to 5%, 5% to 50% and 50 to 100%. The percent ANGSt buffer coverage is the percentage of the area covered by both the accessible green space and its attendant buffer. Band widths for population density (from low to high) are 0 to 2500, 2500 to 10,000 and 10,000 and above people per square kilometre.



The assessment of accessible green space inequalities was undertaken at an LSOA scale and each LSOA assigned its respective Access Inequalities Code based on the respective data for "percent of LSOA covered by the greenspace and associated buffer for each ANGSt Standard and IMD Decile or level of population density.

Access inequalities for combined green space and Public Rights of Way access infrastructure.

A new assessment for Version 1.2 looked at the relative disparity between total greenspace area (ha) compared to the total length of Public Rights of Way (PRoW) (m) across England. As total area and length values have been used the results are displayed in 5 km grid squares across England and not by LSOA or other geographic area as the variable size of these areas would affect the amounts of each variable they contain thus creating outputs that could not be easily compared across boundaries.

Again, the method of bivariate colour mapping was used. This is where 2 factors are identified and mapped at the same time, with different colour gradients. To run the analysis, band widths were selected to allow the two variables to be co-mapped. In this instance the 'Natural Breaks' method of classification was used to generate the different band widths.

"Natural Breaks" (also known as "Jenks Natural Breaks") is a data clustering method of data classification that partitions data based on natural groups in the data distribution. The

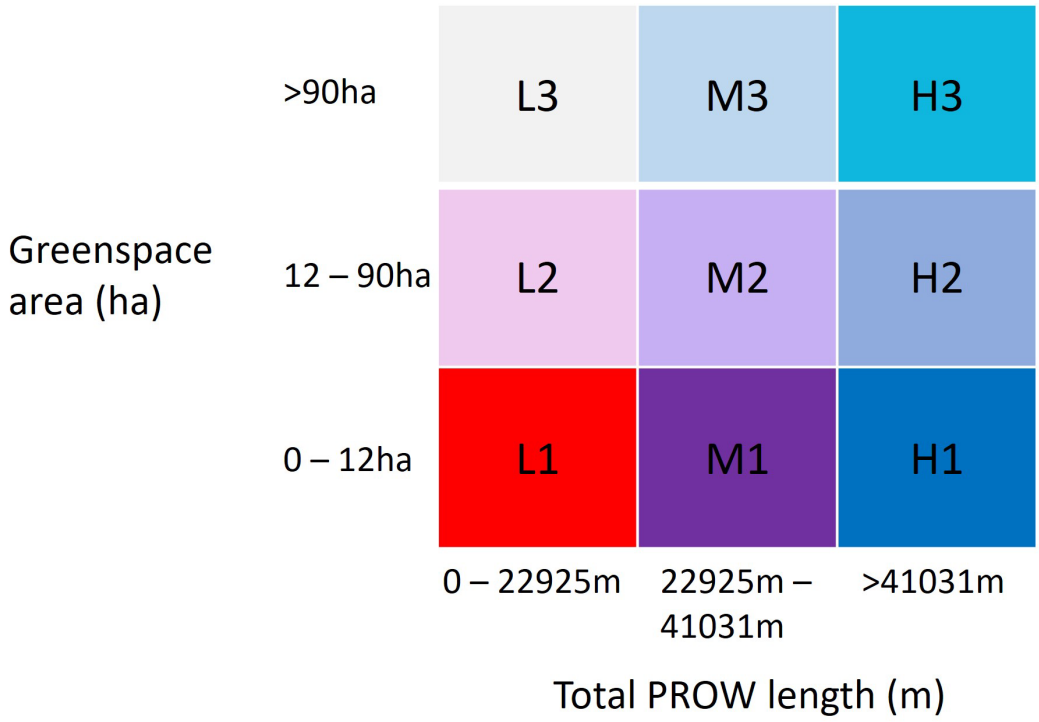
method is considered particularly suitable for use with data that has high ranges. Natural Breaks aims to normalise data in the most accurate way by minimising average deviation from the class mean while maximising the deviation from the means of other groups within the data. This creates classes with different numbers of observations within each class.

“Natural Breaks” splits up ranges to create like areas that are grouped together. The method minimizes the variation within each range, so that areas within each range are as close as possible in value to each other.

The assessment has thus used thresholds that are not even and based on specific numbers that may not look intuitive. This is because of the high range in the “amounts” for each variable and the heavy skewing or bunching in the data that is seen across that range.

Figure six shows the bivariate analysis box for total greenspace area and total PRoW length. To aid the display and assessment of the inequalities between greenspace and PRoW each sector of the grid has an alphanumeric code. The values for both greenspace area and total PRoW length for each 5 km grid square in England were then assessed together and assigned an alphanumeric code. The classes and codes can be seen in figure 6.

Figure 5. The bivariate colour grid used in the access inequalities for combined greenspace and PRoW access infrastructure. Unique alphanumeric codes are assigned to each sector. In this system, the assessment classes represent the different scenarios as defined by the mix of variables to create an "Access Inequalities Class" ranging from L1 to H3. Each assessment class is colour coded for the purposes of mapping but has its' individual alpha-numeric code attached as an attribute.



In this system the letters L, M and H represent Low, Medium, and High for 'total PRoW length (m)'.

In addition, the numbers 1, 2 and 3 represent Low, Medium and High for Green Space area (ha)

This Creates a range of Access Inequalities Classes with:

- L1 = Being the Least Favourable Scenario (i.e., Lowest PRoW length and lowest Greenspace Area)
- H3 = Being the Most Favourable Scenario (i.e., Highest PRoW length and Highest Greenspace Area)

Thresholds used were;

For Greenspace, L = up to 12 ha, M = between 12 and 90 ha and H = over 90 ha.

For Public Rights of Way, L = up to 22925 m, M = between 22925 and 41031 m and H = over 41031 m.

Section 7. Blue Infrastructure Network Map.

In Version 1.2 of the England Green Infrastructure Mapping Database, the term “Blue Infrastructure” is used as a general description for those elements of the wider Green Infrastructure that are water dominated (water courses and water bodies). The Blue Infrastructure Network brings together data to identify and highlight the water courses, water bodies and tidal water elements of the overall Green Infrastructure.

The Combined Green and Blue Infrastructure layer includes some Blue Infrastructure data on inland water courses and bodies. However, the Blue Infrastructure Network layer is more detailed. It is intended that the Blue Infrastructure Network layer will be imported into the Combined Green and Blue Infrastructure map for version 2.1 or the mapping. This translation has not been done for V 1.2 in order to retain consistency between V 1.1 and V 1.2 overall.

To create a more detailed Blue Infrastructure Network (Open) map, a range of data options were reviewed.

It was decided that the Ordnance Survey (OS) OpenMap Local Surface Water Area dataset (already utilised in the Combined Green and Blue Infrastructure map) was the most suitable dataset for mapping inland water in terms of balancing spatial resolution and data accessibility.

The spatial resolution of this dataset is not too dissimilar from OS MasterMap Topographic Area - Surface Water (the most detailed dataset that exists) but has the advantage of being openly accessible. It includes rivers, canals, lakes, and reservoirs.

However, this polygon dataset omits smaller streams and therefore for the Blue Infrastructure Network map it was decided to also include the equivalent polyline dataset of OS OpenMap Local Surface Water Line.

Furthermore, tidal sections of rivers are not included in the two aforementioned datasets, therefore the equivalent tidal water dataset was also included, being OS OpenMap Local Tidal Water.

The resulting map represents a comprehensive collation of Blue Infrastructure data but will nonetheless omit the smallest of water bodies and courses.

Section 8. Access to waterside assessment.

Please note that this assessment uses the Public Rights of Way network data for V 1.1 of the mapping and takes no account of the subsequent addition of data undertaken for V 1.2. This means that in affected Local Authority areas, Access to Waterside will not be identified by Public Rights of Way proximity (due to it not being in the V 1.1 data) and will thus be an overall underestimate.

The “Access to Waterside” assessment aims to map the level of (probable) public access to the side of water courses and bodies across England. Limitations in the mapping method mean that the depiction on the map of accessible waterside is only indicative. Waterside mapped as accessible may in fact not be and that mapped as not accessible may also in fact be accessible. Local inspection is required to confirm the access to waterside data and the depiction in the mapping is only intended to be broadly indicative.

The inclusion of waterside in the mapping as accessible does not create any right or provision of access.

Likewise, the mapping of waterside as not accessible does not affect the existence of any rights or provision of access.

The assessment focussed on access on foot only, to inland water bodies.

The results are displayed at different administrative scales (Upper and Lower Tier Local Authority, MSOA and LSOA) to be able to sit alongside the access to green space assessments.

The access to waterside assessment only maps the likelihood that the edges of water bodies and course are accessible. The accessibility is created purely by proximity of water edge to publicly accessible green infrastructure and/or a Public Right of Way.

The access to waterside maps do not consider any access to the actual water body itself and the existence of accessible waterside does not create or imply any such rights of access to the water for any purpose.

No attempt has been made to create standards relating to access to waterside.

The approach uses the V 1.1 “Public Rights of Way Network” (PRoW) dataset that was compiled using data made openly accessible by Local Authorities across England. However, there are some gaps. PRoW data for Version 1.1 of the PRoW Network map was unavailable for 54 local authorities. The lack of data for these areas is highlighted on the resulting maps. Whilst updating of the PRoW Network map was undertaken for version 1.2, the Access to Waterside Analysis was not updated and remains that included in Version 1.1.

Access to waterside was assessed using proximity buffers which may contain local barriers not picked up in the assessment. Not all of the waterside mapped as accessible may therefore be physically accessible on site.

Other potential access infrastructure includes footpaths that are not designated as PRoW and small/quiet roads that are suitable for walking. In addition, access infrastructure in urban areas is more likely to be dominated by streets and paths and these have not been included in this assessment. This is likely to result in a marked underestimation of access to waterside in built up areas. Footpaths that are not designated as PRoW may also be locally used viable access routes. Unfortunately, these are not mapped for most of the country and the conditions of access (assuming it is by some form of permissive agreement) are also unknown.

Waterside access created by permissive agreement or other non-statutory access behaviour, or informal arrangements are thus not included in this assessment.

Approach to mapping access to waterside.

The “Blue Infrastructure Network” map was used to create a map of all watersides around water bodies and along water courses.

However, the smaller water courses are mapped as lines with unknown widths, meaning the water’s edge cannot be accurately delineated. This causes complications when considering how close a person can get to the water’s edge.

The access to waterside assessment does not include any factors describing the physical condition or aesthetic qualities of the watercourse or suitability of the waterside for access.

The assessment also presumes that the surface water bodies are visible; underground rivers and culverts are not included in the dataset.

Note on access criteria used to identify accessible waterside.

The analysis considered access to waterside on foot only.

Access to waterside was deemed to be possible (and therefore likely) if the edge of a water body/course was within 10 metres of a Public Right of Way or adjacent to, or within 1 metre of an area of accessible green space.

Mapping access by proximity to PRoW was affected by a lack of data for 54 Local Authorities which creates gaps on the maps.

The accessible green infrastructure typologies used to generate the 1m buffer were.

- Cemeteries.
- Playing fields
- Public parks and gardens.
- Religious grounds.

- Local Nature Reserves
- Open Access Land
- Millennium and Doorstep Greens.
- Country Parks

Footpaths that are not designated as PRoW potentially provide access to waterside. However, many of these are not consistently mapped for most of the country and they are not included in this assessment.

Spatial analysis approach used to identify accessible waterside.

The Access to waterside assessment looked at the likelihood of PRoW and accessible green spaces providing direct access to waterside only. No attempt has been made to map any form of access to the water bodies themselves.

For PRoW, access to waterside was deemed probable if the route of the PRoW (as depicted on the Public Rights of Way Network map) was within a 10m buffer created around the edges of all water bodies and courses in the Blue Infrastructure Network Layer.

Note that any changes to the routes of Public Rights of Way after April 2021 (or the date of the appropriate Highway Authority published PRoW data used as source) will not have been picked up by the Version 1.1 of the PRoW Network map. This may introduce a source of local error.

A 10m buffer was used because a distance allowance had to be made for four reasons.

1. There may be a gap between the water and the path.

2. The width of the path may vary.

3. The width of the riverbank zone (e.g., mudbanks, vegetation etc) may vary.

4. The potential for there being a low spatial resolution of the PRoW data.

A buffer of less than 10m was thought to exclude a large number of genuine waterside paths, while more than 10m has greater potential to include paths that have no access to the waterside itself (e.g., there could be buildings between the path and water body, especially in urban or developed areas).

For accessible green spaces, access to waterside was deemed probable if the edge of the water body and the edge of the accessible green infrastructure were within 1 m of each other (i.e., effectively contiguous).

For accessible green space, we considered any edge of a water body located within such a space to be accessible. A 1m buffer on the accessible natural space was used in order to capture the edge of water bodies (e.g., rivers) that border the natural space; where differences in spatial resolution and/or mapping depiction may cause them to slightly

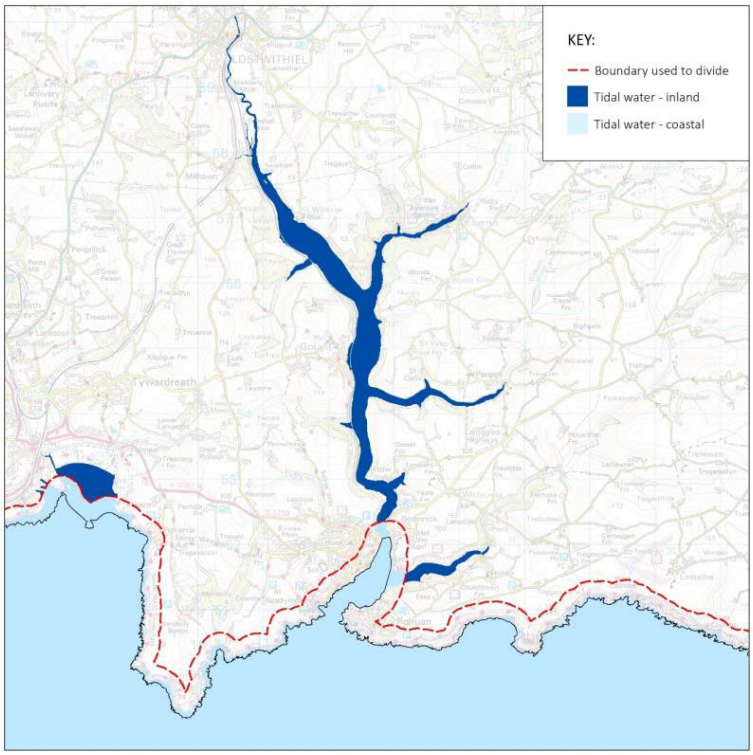
misalign. However, some waterside thus identified may in practice be fenced off or be otherwise inaccessible.

Modification used for tidal waters.

Some rivers are tidal for a long distance inland and therefore much of this tidal stretch of river should be included in the inland access to waterside analysis (using a 10m buffer). The tidal water dataset (OS OpenMap Local Tidal Water) includes these sections of river but also includes coastal waters (water on the seaward side of the mouth of the river and along the coastline). These seaward polygons were removed from the ‘inland water’ analysis, in order to focus on inland waters.

To do this, the tidal waters dataset was clipped by the GB boundary (OS BoundaryLine – GB region) with a 250m landward buffer to remove coastal waters. The landward buffer was used to exclude numerous tidal water polygons/slivers along the coast. This generally worked well, splitting the tidal rivers at the river mouth (retaining tidal rivers but excluding coastal waters), but it does retain some additional coastal polygons. This is a limitation of the method. If a PRoW comes within 10m of one of these coastal polygons, they will be included in the ‘inland surface water’ statistics for each administrative scale.

Figure 6. Use of landward cut off to exclude coastal waters. Map showing example of tidal waters 'inland' and 'offshore', with 250m cut-off boundary highlighted. Dark blue = tidal water inland. Light blue = tidal waters offshore. Red dotted line – cut off boundary used to differentiate in the mapping.



Note on access criteria used to identify accessible waterside.

The main statistics calculated from the assessment are related to the length of accessible waterside**,** not the area or length of the water body itself. Water bodies that were mapped as polygons were converted to lines (i.e., lines delineating their perimeter) in order to measure the length of the waters' edge.

This approach has four main benefits.

1. The inclusion of both sides of a river if a PRoW is present on both sides.
2. A clearer statistic for water bodies (e.g., lakes) that are only partially within an accessible area.
3. A more accurate measurement of water's edge (as opposed to river centrelines).
4. A singular statistic type (length) as opposed to a mixture of area and lengths for the different water body types and dataset shapes.

However, this method has limitations. For example, when a PRoW is within close proximity of a narrow river/stream, both sides of the river fall within the 10m buffer zone skewing any "length of waterside" analyses. It was decided that both sides of the river should be counted when a PRoW is present on both sides. However, there may be stretches of waterside that are depicted as accessible because of the narrowness of the water body. This introduces some over-estimation of accessible waterside.

When a PRoW crosses a river, a 10m stretch of waterside is selected (5m upstream and 5m downstream) for both sides of the river. Furthermore, the smaller streams that were mapped as lines from the start (centreline of stream as opposed to a polygon) produce statistics describing the length of the river only, not the length of individual banks.

These sources of error may distort local statistics.

Section 9. Access to urban waterside assessment.

Please note that this assessment uses the Public Rights of Way network data for V 1.1 of the mapping and takes no account of the subsequent addition of data undertaken for V 1.2.

An access to urban waterside assessment was undertaken as a part of the version 1.2 development process. This new assessment expands on work previously done for version 1.1 that sought to identify lengths of waterside that are likely to be accessible due to their inclusion in publicly accessible greenspace, or proximity to Public Rights of Way.

The version 1.1 approach to mapping accessible waterside had several limitations, especially in terms of its application to the urban environment. In particular, the relative lack of Public Rights of Way in urban areas limited the identification of potentially accessible waterside. In the urban environment, roads, paths, and public realm are or greater significance as access infrastructure relative to Public Rights of Way.

Work for version 1.2 reviewed the access to waterside mapping approach in version 1.1 and explored solutions to the urban limitations. It tested the accuracy of modified mapping methods, including the use of different distance thresholds between access infrastructure and waterside, as well as including additional datasets. It then applied a modified approach to the urban domain in England.

The main difference from the version 1.1 mapping approach was the addition of the "OS MasterMap Highways – Paths" dataset to the access infrastructure. Summarised statistics were then produced at the LSOA scale and additional analyses were also carried out describing distance to accessible waterside and length of accessible waterside per 1000 people.

In addition, data validation was undertaken through 120 field validation surveys at 7 different locations (Bristol, Cheltenham, Exeter, Reading, Salisbury, Dartmoor, and

Cornwall) to assess the accuracy of the “Access to Waterside” analysis both in urban and rural areas.

When present, the length of over-estimation and under-estimation was recorded by field survey, as well as the suspected causes of error.

Whilst the field validation exercise has limitations due to the survey locations being located mostly in the South-West of England, nonetheless it provides some evidence of the margins for error in the data.

Field validation found that overall, 64% of the sites were described as having ‘high’ overall accuracy, 27% as ‘medium’ accuracy and 9% as ‘low’ accuracy.

Overall, the field validation identified that the length of accessible waterside was over-estimated by 3.8% in parts and under-estimated by 4.6% in parts, the net result being a 0.8% under-estimation. However, the results showed that there was a high level of variability in accuracy rates from location to location. This means that at local scales, the actual accessibility of the waterside should be subject to ground truthing.

Geographical scope of the access to urban waterside mapping. Defining the urban domain.

There are a number of spatial datasets that describe the extent and distribution of the urban domain in England. Each differs in its method, level of detail and the size of urban areas mapped. Datasets that were considered for the access to urban waterside mapping were:

1. OS Strategic Urban Regions (includes very small towns and villages, as well as cities)
2. ONS Built-Up Areas (includes small towns, as well as cities)
3. ONS Urban Audit Core Cities (includes medium to large cities)
4. ONS Rural-Urban classifications for different administrative scales (e.g., Output Areas, LSOAs, MSOAs, Local Authorities, counties)

It was decided to use the LSOA rural-urban classification dataset (Census 2011) for consistency with existing content in the national Green Infrastructure database.

All urban LSOAs were extracted from the national dataset and dissolved to show the outer boundary of urban areas. LSOA were considered urban if they had one of the following RUC 2011 LSOA classifications.

- Urban Major Conurbation.
- Urban Minor Conurbation.
- Urban City and Town.

This created an “Urban Mapping Domain” of about 25,000 square kilometres across England (approximately 20% of the country). The edges of the “Urban Mapping Domain”

were then buffered by 200m before carrying out the mapping analysis in order to include waterside that lies adjacent to the boundary (the large buffer distance ensured all tidal waters were included, allowing for inconsistencies between the LSOA and the tidal water boundaries). Despite these efforts to include tidal waters in the mapping analysis, in the end they were not fully captured in the LSOA summary statistics due to complexities in the mapping method and boundary inconsistencies. There is therefore some under-representation in affected LSOA.

Detailed mapping methodology.

The method set out below was applied to the developed England "Urban Mapping Domain". The spatial analyses focus was on the length of accessible urban waterside.

The Blue Infrastructure (BI), for which access is measured, comprises rivers, lakes, canals, reservoirs, and inland tidal waters.

The access infrastructure includes Public Rights of Way (PRoW), urban paths and accessible green infrastructure.

A seven step process for undertaking the mapping was developed as set out below.

Step 1. Data collation.

The datasets used were.

- Inland Waterside. (Note, this is based on OS OpenMap Local Surface Water Area (polygon), Surface Water Line (line) and Tidal Waters (polygon), where the polygons are converted to lines and the tidal waters are clipped to exclude coastal waters).
- Public Rights of Way (PRoW).
- Accessible Green Infrastructure.

- OS MasterMap Highways – Paths. (Obtained by extracting and merging the *PathLink* feature classes).

Step 2. Creation of "Urban Mapping Domain".

LSOA boundaries (ONS Lower Super Output Areas 2011) and urban-rural classification data (ONS LSOA Urban-Rural Classification 2011) were obtained. The urban-rural data was joined with the LSOA boundaries and urban LSOAs were extracted (Urban LSOAs as defined above). All identified "Urban LSOA" were then dissolved to produce the outer extent of urban areas (the 'urban domain') and buffer by 200m.

Step 3. Data clipping.

The selected datasets were clipped to the buffered urban domain.

Step 4. Linear access infrastructure buffering.

Linear routes in the “Public Rights of Way” (PRoW) and “OS Paths” datasets were buffered by 10m and the “accessible green infrastructure” dataset by 1m.

Step 5. Accessible waterside lines generation.

The PRoW, OS Paths and accessible green infrastructure buffers were merged and then intersected with the inland waterside dataset to identify accessible waterside.

Step 6. Generation of map attributes.

Attribute fields were added to the urban LSOA dataset to record the accessible waterside statistics, namely:

- Area of LSOA in hectares.
- Total length of Public Rights of Way (all classes).
- Total length of “paths” (OS Paths data).
- Total area of accessible green infrastructure in hectares.
- Total length of waterside.
- Total length of waterside accessible by PRoW proximity in metres.
- Total length of waterside accessible by proximity to “paths” in metres.
- Total length of waterside accessible by adjacency or inclusion within an accessible green infrastructure in metres.
- Total length of waterside accessible (PRoW, OS Paths, and accessible green infrastructure).
- Percentage of waterside within the LSOA accessible by the above access infrastructure types.

Step 7. Statistics generation.

Statistics were calculated for the LSOA boundary dataset.

Note on the use of the “OS Paths” data to increase access infrastructure data used in the accessible urban waterside assessment.

This analysis extracted from the “OS Highways – Paths” dataset, the location of paths suitable for pedestrians (using the *PathLink* feature class). These paths are defined as “linear features that represent the general alignment of a route used by pedestrians”. That is, they show urban pedestrian routes, such as footpaths and alleys, that Local Authorities have captured in their “Local Street Gazetteer” (excluding single paved footpaths along roads). Upon clarification of their public accessibility, the OS stated that it can be assumed these paths are mostly publicly accessible. Some paths may be private, but most will be owned by the Local Authority they sit within. It has therefore been assumed for this exercise that pedestrians will have access to these paths. However, some may in practice be private.

The source data for urban paths is not open. The vector data lines of the paths themselves cannot be published in the mapping. However, metrics describing their length have been included in summarised maps using administrative boundaries.

As well as paths, some other datasets were considered for inclusion in the refined urban analysis. They focused on expanding the access infrastructure to include more types of urban public walkways. These included: small lanes, pavements, bridges, and cycle routes.

It is possible to map all these features in some way. However, a number of reasons meant that these datasets were less suitable for the national analysis (but maybe practicable to include in more local assessments).

Firstly, small lanes can be mapped using different OS data products (e.g., OpenMap Local or MasterMap Highways); however, it is not possible to know which small lanes are suitable for walking or unsuitable due to the presence of road related hazards.

Pavements can be mapped fairly accurately using OS MasterMap Topographic Layer (roadside, manmade); however, in addition to pavements this method identifies numerous other types of manmade roadside, which would not be suitable for walking, including slivers of land between motorway cross sections.

Also, the data processing requirements for including all pavements (detailed polygons) across all urban areas in England would be considerable.

Road bridges can be mapped quite accurately by intersecting roads with surface water (various OS datasets). However, once mapped, it is necessary to identify which bridges are suitable for pedestrians. Mapping pavements on bridges would have the same issue as already stated. Foot bridges are generally included when a PRoW or path (*OS Paths*) crosses a water body, and these datasets are included in the analysis. Other bridges are not included.

Local cycle routes can also be important access routes; however, they are not mapped consistently across the country. Some information is included in the *OS MasterMap Highways* dataset and some Local Authorities have mapped these routes, but the data is not comprehensive and has not been collated at England level. Cycleways have thus not been specifically included in the access infrastructure for the urban waterside accessibility mapping.

In addition, consideration was given to the inclusion of non-green open spaces (e.g., public realm and open areas or spaces such as shopping precincts) which can sometimes include waterside access. There is a persuasive argument that these areas should be included and could potentially have a significant impact on the overall length of waterside that is deemed accessible in some places. However, these areas are not consistently mapped across the country and therefore could not be included in the analysis at this time. Many Local Authorities have published ‘Open Spaces’ data meaning that such data may be available locally.

Note on methodological limitations.

The main statistics produced from these analyses describe the length of waterside that is likely to be accessible within the “urban domain” LSOA.

However, there are a number of limitations which introduce some uncertainty. This means that some waterside identified as accessible may in fact not be whilst other sections identified as non-accessible may, in reality; be accessible. The depiction of waterside as either accessible or not accessible should only be considered as indicative. Local confirmation of the actual access is required to confirm the position on the ground. The depiction of waterside in the mapping does not create, extinguish, or affect the status of any existing access (or lack of) in reality.

There are four main sources of mapping error in the assessment that need to be taken account of when considering the map outputs at a local level.

1. Small streams error. Small streams are mapped as centrelines, not polygons. This can lead to an under-estimation of the length of accessible waterside in areas where these small streams are accessed from both sides. This is because only one length of the watercourse is being counted as opposed to the length of each bank, which is the case for larger rivers.
2. Opposite bank error. In places, the bank of a watercourse may be erroneously mapped as accessible when the river or water body polygon is narrow. This can lead to an over-estimation of the length of accessible waterside.
3. Data missing error. There are gaps in the PRoW network dataset for some urban areas. Data gaps are highlighted on the maps. This lack of access infrastructure data may lead to an under-estimation of accessible waterside in affected urban areas.
4. Mapping method error. The mapping method can introduce complexities with regards to waterside that falls outside, but adjacent to, the LSOA boundary. When summarising the results at LSOA scale, only waterside that falls within each LSOA boundary is counted. It does not include lengths of waterside that lie outside the LSOA border, even if they are accessed from a path within the LSOA. This length of accessible waterside is counted within the neighbouring LSOA. This approach is logical and straightforward to calculate, but complications can occur in the tidal regions. The LSOA boundaries are drawn to exclude tidal waters leading to a spatial misalignment between the LSOA and tidal water boundary lines. This means that many stretches of accessible tidal waterside are not included in the LSOA statistics.

Limitations of the distance to nearest waterside assessment.

For urban LSOAs that had no detectable accessible waterside present, the distance to nearest accessible waterside was calculated. Note, if an LSOA contains accessible waterside then this value is zero.

Furthermore, the length of waterside per 1000 people was calculated using the 2018 population estimate for LSOAs provided by ONS and not the 2011 population data used in the broader Green Infrastructure mapping. This is the only element of Version 1.2 of the Green Infrastructure mapping that uses population data other than Census 2011 outputs.

The distance to nearest waterside calculation has some limitations, including the fact that the value describes the shortest distance between any point on the edge of the LSOA and the surrounding accessible waterside, not the distance from households within the LSOA. Therefore, residents that live at the opposite end of the LSOA would have to travel further to the identified accessible waterside or may in fact be closer to a different accessible water body. Furthermore, it currently only includes urban accessible waterside, not rural accessible waterside. Therefore, if no accessible waterside is present in the entire urban area the distance to the accessible waterside in the next urban area is calculated, which can be very large in some cases. Further refinement of the method in future may resolve these issues.

Field data verification exercise.

A field data verification exercise was undertaken to provide information on the data confidence of the accessible waterside data.

Seven locations in England were selected for field data verification, each measuring approximately 20 square kilometres. Each location had multiple sites that covered all the waterside mapped as accessible (divided into 300m stretches of manageable lengths to survey). A surveyor spent a day at each location, surveying as many of the sites as possible (ranged between 11 and 26 sites). After a training session, each surveyor was provided with an overview map; a list of site coordinates; individual site maps showing the accessible waterside and the access infrastructure. At each site, the surveyor walked the length of the accessible waterside, making notes on the paper maps and taking photos as required, then completed a survey on a mobile app (ArcGIS Survey123).

Of the seven locations, five were urban and two were rural. While the main focus was to validate the urban mapping method, the opportunity was taken to gain some understanding of the accuracy of the rural method also.

A key limitation to note, is that the surveys focus on waterside that is mapped as accessible, identifying whether it is truly accessible or whether the map over-estimates or under-estimates the length that is accessible. The surveys do not actively assess waterside that is mapped as inaccessible (though many stretches are present within the surveyed sites). Therefore, if a stretch of waterside has been wrongly mapped as inaccessible (and is not adjacent to waterside mapped as accessible) it was not actively surveyed. The survey form had the option to record notes about these sites if the surveyor came across them; however, they were captured in a much more ad-hoc way than the waterside mapped as accessible. This was due to time constraints and impracticalities. In an ideal situation, the surveys would capture information about all the waterside present across the location. However, inaccessible waterside is often very difficult to validate because it is exactly that; inaccessible. To be certain that inaccessible waterside is truly inaccessible, the surveyor would have to explore all possible access routes to the site. Sometimes, on the ground, this can be difficult due to obstructions or uncertainty about whether land/paths are public or private, etc.

Field data verification locations.

In order to thoroughly assess the accuracy of the method, locations were selected to represent a range of settings with different types of Blue Infrastructure (BI) and means of accessing it. However, logistical practicalities also had to be considered and therefore the selected locations cover a wide area but were to be reachable by a team of surveyors based in SW England. There were thus no field verifications sites in the north, East, Southeast of midlands.

The locations where surveys took place were:

Urban areas.

- Exeter (smaller city; tidal)
- Bristol (large mixture)
- Cheltenham (small historic town)
- Salisbury (chalk rivers)
- Reading (large river through a city centre)

Rural areas.

- Dartmoor (access land)
- Cornwall (a coastal stream)

For each of these locations, a 20 square kilometre portion of land was selected, usually focusing on the city centre and/or areas with considerable waterside mapped as accessible. All surveys took place between February and April 2022, by six different surveyors.

Table 7. Table of field verification survey contexts, locations, survey dates and number of sample locations.

Urban or rural	Location name	Date surveyed	Number of sites surveyed
Urban	Bristol	04/03/2022	26
Urban	Cheltenham	25/02/2022	11
Urban	Exeter	30/04/2022	25
Urban	Reading	11/03/2022	15
Urban	Salisbury	07/03/2022	15
Rural	Dartmoor	19/03/2022	18
Rural	Cornwall	23/03/2022	10
Total sites surveyed	Left blank	Left blank	120

Out of the 120 sites surveyed, 77 were described as having 'high' overall accuracy (64%), 32 as 'medium' accuracy (27%) and 11 as 'low' accuracy (9%). Though it should be noted that despite 77 sites described as having high overall accuracy, 32 of these still recorded a minor level of over-estimation and/or under-estimation in the length of accessible waterside mapped.

Over estimation of accessible waterside.

Out of the 120 sites surveyed, 37 sites (31%) recorded an over-estimation of accessible waterside at part or all of the site. That is, the waterside mapped as accessible was not deemed to be accessible in reality. Of these sites, the length of over-estimation ranged between 10m and 300m. As the length of accessible waterside varies from site to site, it is more meaningful to use the percentage of mapped accessible waterside that is deemed to be inaccurate. At sites where over-estimation was recorded, this ranged from 1% to 100%, with an average of 20%.

However, the impact of over-estimation on the length of accessible waterside across all sites (including those where no over-estimation was recorded) was relatively low; with only 3.8% of the mapped accessible waterside regarded as inaccessible in reality.

Under estimation of accessible waterside.

50 out of the 120 sites surveyed (42%) recorded an under-estimation of accessible waterside at part or all of the site. That is, accessible waterside existed in reality but was not included on the map. Note, that surveyors could record both over-estimation and under-estimation at a site, if different parts of the site could be described as such. Of these 50 sites, the length of under-estimation ranged between 10m and 400m. When comparing

these lengths with the waterside that was already mapped as accessible at each site, the under-estimation varied between 1% and 400% of the mapped accessible waterside (with an average of 26%).

However, the impact of under-estimation on the length of accessible waterside across all sites (i.e., including those where no under-estimation was recorded) was relatively low; with the mapped accessible waterside underestimated by an overall 4.6%.

The surveys show that under-estimation appears to be marginally more wide-spread and impacting on mapped accuracy of accessible waterside than over-estimation. With the results showing that, overall, the length of accessible waterside is over-estimated by 3.8% in parts and under-estimated by 4.6% in parts, the net result being a 0.8% under-estimation.

There are caveats with generalising the figures in this way. An important one being that the surveys focused on sites where waterside was mapped as accessible. Sites where waterside was mapped as inaccessible were not actively surveyed (except the segments that fell within or adjacent to accessible waterside).

Table 8. Variations in survey results of under and over estimation of accessible waterside by survey location. Table showing field data survey locations giving statistics for levels of over and under estimation of accessible waterside. The figures show the range of variation of both over and under-estimation and the estimated overall impact on net accuracy. Overall net accuracy in the field assessment was a 0.8% under-estimation with a range between 11.2% under-estimation to 10.5% over estimation.

Field location	Urban or rural	Number of sites surveyed	Percent of accessible waterside over estimated	Percent of accessible waterside underestimated	Difference (Positive numbers = under-estimation. Negative numbers = over-estimation.
Bristol	Urban	26	4.4	14.9	10.5
Cheltenham	Urban	11	17.1	5.9	-11.2
Exeter	Urban	25	3.7	4.0	0.3
Reading	Urban	15	0.3	1.6	1.3
Salisbury	Urban	15	1.1	0.2	-0.9
Dartmoor	Rural	18	3.6	0.0	-3.6
Cornwall	Rural	10	4.2	0.4	-3.8

Field location	Urban or rural	Number of sites surveyed	Percent of accessible waterside over estimated	Percent of accessible waterside underestimated	Difference (Positive numbers = under-estimation. Negative numbers = over-estimation.
All	Mix	120	3.8	4.6	0.8

Section 10. Public Rights of Way Density mapping.

All Public Rights of Way.

Public Rights of Way density is mapped using a 1 km grid covering the whole of England. The 1 km grid is in alignment with the 250 m grid used in the “Greenness Gird” of the GI database.

Calculations were made for total length within the grid square for all PRoW and each PRoW type (footpath, bridleway, byways, and restricted byway).

A ‘Data_Available’ field was added to the 1 km grid dataset and, where no PRoW data was available within a grid square; the grid square was assigned ‘no’ in this field and each length field was left as ‘null’. This was done in order to distinguish those grid squares where data is available but there is 0m of PRoW within that grid square from those without available data. The areas of Highway Authorities for which no data could be included in V 1.2 have been cut out of the map. This cuts across and truncates some grid squares and will affect the accuracy of the statistics (as the lengths do not cover the whole of the truncated square).

There are a total of 134,486 1km grid squares. There are 4,055 grid squares where no PRoW data was available (3%).

Higher Public Rights of Way only.

A separate Public Rights of Way density mapping exercise was conducted for routes that are more than Public Footpaths. These routes are sometimes referred to as “higher rights” and include Bridleways, Byways Open to all Traffic and Restricted Byways.

For the “higher rights” density mapping, a 5 km square grid was used as the overall route density is usually significantly lower than for “all rights”.

Section 11. Public Rights of Way Experiential Terrain mapping.

The “Public Rights of Way (PRoW) Experiential Terrain” mapping aims to give a broad indication of the physical environment (landscape terrain) and likely “underfoot” land surface that the route of a PRoW exhibits. These two factors are designed to give an indication of the likely physical experience that might be encountered along the route.

The England PRoW network map data was buffered by 10m either side of the right of way. This distance was deemed to be wide enough to provide a good overall indication of the experience of the environment through which the PRoW passes. This buffered PRoW network was then intersected with two further datasets to provide contextual information about the areas which intersect the PRoW.

Use of Living England Map data.

The first of these datasets was the Living England Phase 4 England habitat map. The Living England habitat map is a satellite-derived national habitat layer in support of the Environment Land Management (ELM) system and the Natural Capital and Ecosystem Assessment (NCEA) Pilot - Living England Phase 4 Habitat Map. Living England is a habitat probability map created using machine learning. The habitat probability map displays modelled likely broad habitat classifications trained on earth observation data from 2021 as well as historic data layers. Thus, Living England should be seen as an indicative probability based map and is not a definitive habitat survey.

The habitat probability map has some known under mapping (under representation) of urban areas, with major roads, airports, car parks and dockland areas being classified under a number of other habitat types. This mainly affects habitat predictions around urban areas for the following broad habitat types: Broadleaved, Mixed and Yew Woodland; Coastal Sand Dunes; Bare Sand; Dwarf Shrub Heath; Acid, Calcareous and Neutral Grasslands. The Living England Technical User Guide and Confusion Matrices can be found here - Find out more about Living England.

Prior to intersection with the buffered PRoW network the Living England habitat classifications were aggregated to create a simplified system of experiential classes. The Moorland Line dataset was used to differentiate between upland and lowland Heathland, Grasslands and Wetlands. The aggregation classes create the mapped “Experiential Terrain Classes” and are set out in table 9.

Find out more about the Moorland Line on Magic.

Table 9: Aggregated "Living England" habitat probability classes. Look up table mapping "Experiential Terrain Classes" used in the Public Rights of Way Experiential Terrain Mapping and their constituent "Living England" habitat probability classes.

Experiential Terrain Class	Constituent Living England Class
Grasslands	Acid, calcareous and acid grassland, or improved grassland.
Woodland and scrub	Broadleaf, mixed and Yew woods, coniferous woods, scrub, or bracken.
Arable	Arable and horticultural.
Urban	Built up and gardens.
Wetlands	Bog, Fen, Marsh, and Swamp.
Heath	Dwarf shrub heath.
Coastal	Coastal salt marsh and coastal sand dunes.
Water	Water.
Bare ground	Bare ground and bare sand.
Upland grasslands	Acid, calcareous and acid grassland, or improved grassland above the Moorland Line.
Upland wetlands	Bog, Fen, Marsh, and Swamp above the Moorland line.
Upland heath	Dwarf shrub heath above the Moorland line.

Use of Landscape Description Units (LDU) data.

The second dataset that was intersected with the buffered PRoW network was the Landscape Descriptor Unit dataset. This is a non-open data product from which broad geological and landscape feature information was derived to add contextual information relating to the physical character of the landscape of the Experiential Terrain Corridors. However, the LDU data is not always comprehensive in this respect so that some corridors lack specific physical character information and provide basic geological information only.

The PRoW type attribute was retained alongside the new Experiential Terrain Corridor and LDU derived dataset attributes.

List of abbreviations.

ANGSt. Accessible Natural Green Space Standards.

ESRI. American multinational geographic information system software company.

GB. Great Britain.

GI. Green Infrastructure.

GIS. Geographic Information System.

IMD. Index of Multiple Deprivation.

LDU. Landscape Description Unit.

LSOA. Lower Super Output Area.

MSOA. Middle Super Output Area.

OGL. Open Government License.

ONS. Office for National Statistics.

OS. Ordnance Survey.

PRoW. Public Right of Way.

Glossary.

Access Land. The Countryside and Rights of Way Act 2000 (CROW Act) normally gives a public right of access to land mapped as ‘open country’ (mountain, moor, heath and down) or registered common land. These areas are known as ‘open access land’. You can find out if the public has a right of access to land under the CROW Act using the online maps.

Accessible Natural Green Space Standards. The ANGSt approach aims to address differences in access to the natural environment across the country through local green spaces by setting a range of accessibility benchmarks for sites of “higher level” naturalness and areas within easy reach of people’s homes.

Green Infrastructure. There are many definitions of Green Infrastructure. The England Green Infrastructure Framework uses the definition in the National Planning Policy Framework:

“A network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity”.

Index of Multiple Deprivation. The English indices of deprivation measure relative deprivation in small areas in England called lower-layer super output areas.

Landscape Description Units. Areas of landscape that share broadly similar physical characteristics.

Output Areas are the lowest level of geographical area for census statistics. Output areas usually comprise between 40 and 200 households and between 100 and 625 usually resident persons.

Lower layer Super Output Areas (LSOAs) are made up of groups of Output Areas, usually four or five. They comprise between 400 and 1,200 households and have a usually resident population between 1,000 and 3,000 persons.

Middle layer Super Output Areas (MSOAs) are made up of groups of LSOAs, usually four or five. They comprise between 2,000 and 6,000 households and have a usually resident population between 5,000 and 15,000 persons. MSOAs fit within local authorities.

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Public Right of Way. A public right of way is a right by which the public can pass along linear routes over land at all times. Public rights of way are all highways in law, but the term ‘public rights of way’ is generally used to cover more minor highways. Actual mode of transport rights differ by class. PRoW are defined as Public Footpaths, Bridleways, Restricted Byways and Byways Open to All Traffic

Rural-Urban Classification. The Rural-Urban Classification is a typological system of administrative units based on physical settlement and related characteristics.

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