

Census 2021: Cambridgeshire County Council's Business Intelligence Research Team's Output Area lookup methodology

Output Areas (OA) are a statistical geography used to publish data from Census 2001 onwards. They are the lowest geographic level for Census data, and contain between:

- 40 and 250 households
- 100 and 625 usual residents

The boundaries for OAs are set by the Office for National Statistics (ONS). The underlying principle is that stability is maintained in OA boundaries over time as much as possible to allow for consistent comparison over time. The output areas are reviewed at each Census, but the ONS endeavours to keep changes to a minimum.

OAs are used as small area building blocks and can be grouped together to produce Census data for other administrative boundaries, such as wards and parishes. However, OA boundaries do not perfectly match administrative boundaries and as such OAs may overlap with two or more wards or parishes. Therefore, to group OAs into wards and parishes a best fit lookup is required.

Cambridgeshire County Council's Business Intelligence Research Team's best fit lookup

The Cambridgeshire County Council's Business Intelligence Research Team (CCC) produce an OA best fit lookup that assigns each OA from Census 2011 and 2021 to a ward and parish based on the count of postal addresses. Using these lookups allows for comparison between data from Census 2011 and Census 2021 based on a consistent methodology. It also allows this change over time analysis to be done on ward boundaries in place at May 2022, as at the time of producing this lookup an ONS OA 2011 to ward 2022 lookup was not available.

For the Census 2021 lookup, postal addresses were sourced from Ordnance Survey's AddressBase Premium dated from May 2022. For the Census 2011 lookup, postal addresses were sourced from AddressBase Premium from June 2012 for Cambridgeshire, and AddressPoint from January 2011 for Peterborough (the closest in time source data still available).

The method for producing the lookup is as follows:

1. Each individual postal address is matched to the OA that it is located within.
2. The number of addresses located in the overlaps between the OA boundary and ward / parish boundary are counted.
3. The OA lookup assigns the OA to the ward or parish with the highest address count in the overlap area.

Map 1 and Table 1 below show the example of OA E00091807 in Huntingdonshire, which overlaps three different wards. In the example below the best fit OA lookup would assign E00091807 to the Warboys ward, as it has the highest number of addresses that overlap.

Map 1: OA E00091807 and postal addresses compared to Huntingdonshire ward boundaries

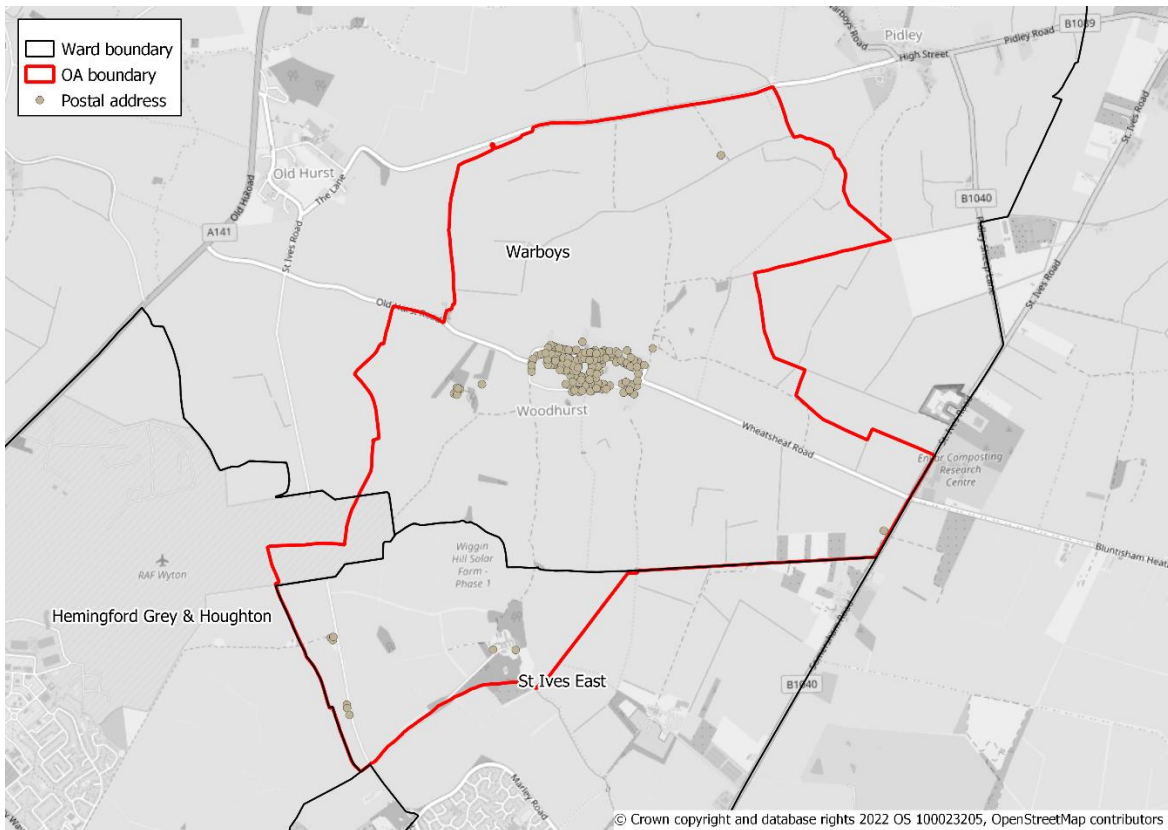


Table 1: address count for overlap between OA E00091807 and ward boundaries

OA	Ward	Address count
E00091807	Warboys	160
E00091807	St Ives East	8
E00091807	Hemingford Grey & Houghton	0

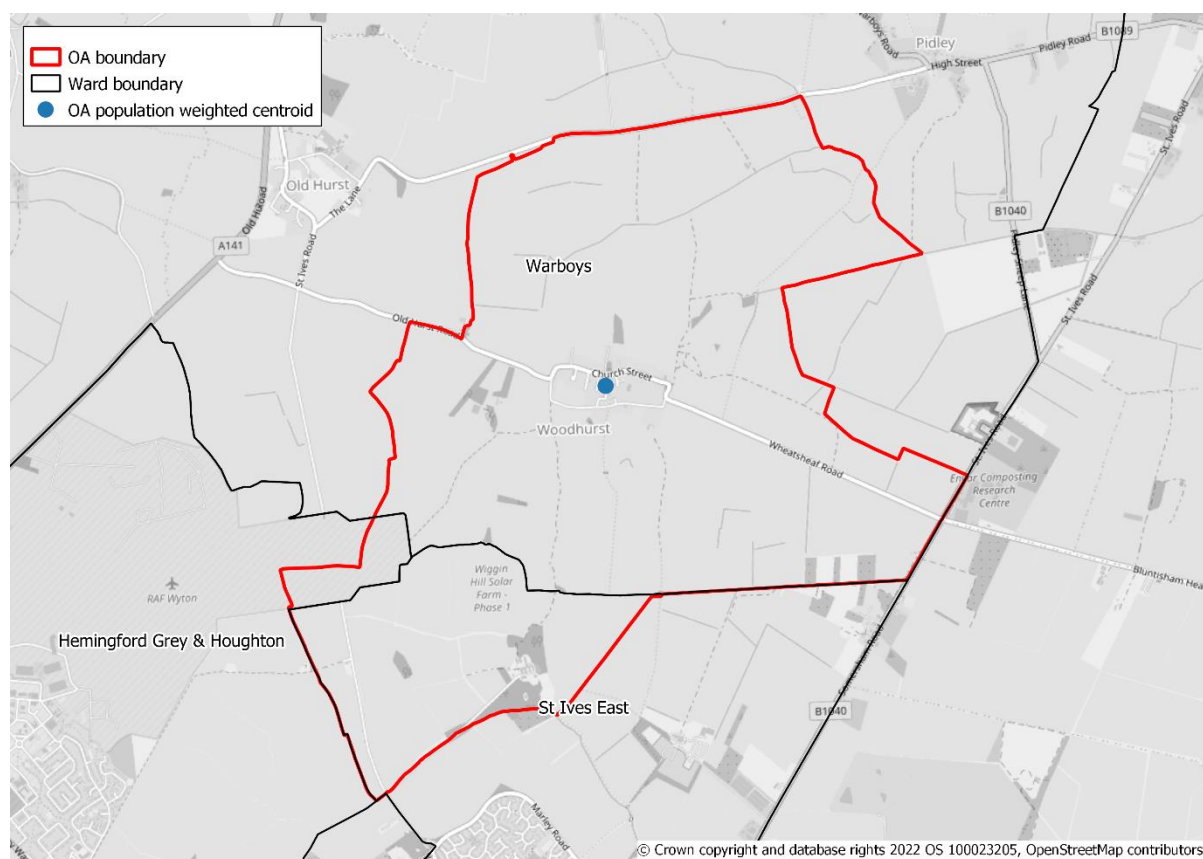
Office for National Statistics best fit lookup

The ONS use groups of OAs as the basis for publishing all Census data for various administrative geographies, such as wards, parishes and health areas. The ONS produce and [publish best fit OA lookups](#) used to aggregate Census 2011 and 2021 data to these different geographies.

The ONS best fit lookup is produced by creating a population weighted centroid for each OA. The centroid represents the spatial distribution of the population in each OA as a single summary reference point on the ground – this point is therefore weighted towards where more people are located within the OA. The ONS best fit lookup assigns the OA to the ward and parish in which the population weighted centroid is located.

Map 2 uses OA E00091807 again to demonstrate this. In this example, the population weighted centroid has been weighted towards where the ONS population centroid methodology estimates people are living in this OA, which is the village of Woodhurst. The population weighted centroid is located in the Warboys ward, so this OA is assigned to this ward in the ONS OA lookup.

Map 2: OA E00091807 and Census 2021 population weighted centroid compared to Huntingdonshire ward boundaries



As illustrated in the examples above, in most cases the CCC OA lookup and the ONS lookup agree. However, there are some circumstances where the two do not agree, and assign an OA to a different ward (or parish). These differences have been reviewed, and in some cases the CCC lookup has been adjusted and in some cases they have not. This is covered in the following sections.

Adjustments to CCC OA lookups

Table 2 and table 3 show the adjustments that have been made to the CCC OA lookups for Census 2011 and Census 2021, to alter which ward or parish the OA is assigned to. The reasoning for each adjustment is explained in the table.

Table 2: adjustments made to CCC OA 2021 lookup

OA 2021	Original boundary	Adjusted boundary	Reason for adjustment
E00167076	Castle (ward)	West Chesterton (ward)	The ONS population weighted centroid places this OA in West Chesterton. University of Cambridge Colleges are located in this OA, so it is possible the CCC lookup methodology is not accounting for the student population in this OA.
E00079145	Hargate and Hempsted (ward), non parished area (parish)	Fletton and Woodston (ward), Orton Longueville (parish)	Further analysis shows that the only residential addresses in this OA are located in the intersection with Fletton and Woodston ward and Orton Longueville parish.

Table 3: adjustments made to CCC OA 2011 lookup

OA 2011	Original boundary	Adjusted boundary	Reason for adjustment
E00167075	Castle (ward)	Newnham (ward)	The ONS population weighted centroid places this OA in Newnham. University of Cambridge Colleges are located in this intersection, so it is possible the CCC lookup methodology is not accounting for the student population in this OA.
E00167076	Castle (ward)	Newnham (ward)	The ONS population weighted centroid places this OA in Newnham. University of Cambridge Colleges are located in this intersection, so it is possible the CCC lookup methodology is not accounting for the student population in this OA.

OA 2011	Original boundary	Adjusted boundary	Reason for adjustment
E00079145	Hargate and Hempsted (ward), non parished area (parish)	Fletton and Woodston (ward), Orton Longueville (parish)	Further analysis shows that the only residential addresses in this OA are located in the intersection with Fletton and Woodston ward and Orton Longueville parish.

Differences between CCC and ONS OA lookups

The CCC OA lookups for Census 2021 and 2011 differ from the ONS population weighted centroid OA lookups for the OAs listed in tables 4 and 5. These differences have occurred where the CCC lookup methodology finds a higher count of addresses in the intersection of a ward compared to the ward that overlaps with the ONS population weighted centroid.

Table 4: ward and parish differences between CCC OA 2021 lookup and ONS OA 2021 lookup

OA 2021	CCC lookup boundary	ONS lookup boundary
E00090618	Coleridge (ward)	Queen Edith's (ward)
E00090685	Arbury (ward)	King's Hedges (ward)
E00091133	Bassenhally (ward)	Stonald (ward)
E00091318	Stonald (ward)	St Andrews (ward)
E00187670	Caldecote (ward), Bourn (parish)	Cambourne (ward), Cambourne (parish)
E00092183	Knapwell (parish)	Elsworth (parish)
E00187737	Longstanton (parish)	Northstowe (parish)
E00079114	Orton Longueville (ward)	Orton Waterville (ward)
E00079252	Stanground South (ward)	Fletton and Stanground (ward)
E00187847	Gunthorpe (ward)	Paston and Walton (ward)
E00187736	Non parished area (parish)	Hampton Hargate and Vale (parish)

Table 5: ward and parish differences between CCC OA 2011 lookup and population weighted centroid OA 2011 lookup [Note 1]

OA 2011	CCC lookup boundary	ONS lookup boundary
E00090618	Coleridge (ward)	Queen Edith's (ward)
E00090685	Arbury (ward)	King's Hedges (ward)
E00091133	Bassenhally (ward)	Stonald (ward)
E00091318	Stonald (ward)	St Andrews (ward)
E00092183	Knapwell (parish)	Elsworth (parish)
E00079114	Orton Longueville (ward)	Orton Waterville (ward)
E00079252	Stanground South (ward)	Fletton and Stanground (ward)

[Note 1] At the time of producing this lookup, an ONS OA 2011 to ward or parish 2022 best fit lookup was not available. Instead, CCC used the Census 2011 population weighted centroids to produce a version for Cambridgeshire and Peterborough.

Comparison between CCC and ONS OA lookups

Tables 6 and 7 compare the differences between the adjusted CCC OA 2021 lookup and ONS OA 2021 lookup. There are only a small number of differences for wards and parishes.

Table 6: comparison between CCC and ONS OA 2021 lookups by number of matching and different wards

District	OAs with same ward	OAs with different ward
Cambridge	424	2
East Cambridgeshire	269	0
Fenland	301	2
Huntingdonshire	581	0
South Cambridgeshire	505	1
Peterborough	653	3

Table 7: comparison between CCC and ONS OA 2021 lookups by number of matching and different parishes [Note 2]

District	OAs with same parish	OAs with different parish
Cambridge	Non parished area	Non parished area
East Cambridgeshire	269	0
Fenland	303	0
Huntingdonshire	581	0
South Cambridgeshire	503	3
Peterborough	655	1

[Note 2] Part of Peterborough unitary authority is a non parished area. Where both the CCC and OA lookup place an OA in this non parished area, this is counted in the comparison as being the same parish.

Tables 8 and 9 show the population estimates at ward and parish level that the two different lookup methodologies result in.

Table 8: comparison between CCC and ONS Census 2021 ward population estimates (data rounded to nearest 10)

District	Ward	CCC Census 2021 population	ONS Census 2021 population
Cambridge	Arbury	10,140	9,880
Cambridge	Coleridge	10,820	10,500
Cambridge	King's Hedges	10,840	11,100
Cambridge	Queen Edith's	11,930	12,250
Fenland	Bassenhally	5,850	5,530
Fenland	St Andrews	2,670	2,960
Fenland	Stonald	2,870	2,900
South Cambridgeshire	Caldecote	4,110	3,490

District	Ward	CCC Census 2021 population	ONS Census 2021 population
South Cambridgeshire	Cambourne	11,730	12,350
Peterborough	Fletton & Stanground	10,710	10,990
Peterborough	Gunthorpe	9,530	9,400
Peterborough	Orton Longueville	11,390	11,160
Peterborough	Orton Waterville	9,570	9,800
Peterborough	Paston & Walton	10,960	11,090
Peterborough	Stanground South	10,930	10,650

Table 9: comparison between CCC and ONS Census 2021 parish population estimates (data rounded to nearest 10)

District	Parish	CCC Census 2021 population	ONS Census 2021 population
South Cambridgeshire	Bourn	1,320	700
South Cambridgeshire	Cambourne	11,730	12,350
South Cambridgeshire	Elsworth	620	780
South Cambridgeshire	Knapwell	160	No OA in lookup
South Cambridgeshire	Longstanton	3,300	3,060
South Cambridgeshire	Northstowe	2,400	2,640
Peterborough	Hampton Hargate and Vale	12,850	13,330
Peterborough	Non Parished Area	142,630	142,150

Methodology limitations

Using a best fit OA lookup to produce estimates at ward and parish level has its limitations. As the lookup is the best fit to the boundary, rather than an exact fit, this means that an OA

may be assigned to a ward even though that OA actually contains some residents that live in a different ward. This can have a greater impact for data at smaller geographies, in particular data aggregated to parish level.

This issue can be particularly apparent for OAs that cover a large area of a small settlement, but also can make a notable difference where the OA covers a small area of a much larger settlement that may be in the process of expanding through housebuilding. If the OA is assigned to the ward/parish of the smaller settlement, this may cause an overestimation of its population. However, if it is instead assigned to the ward/parish of the larger settlement, this may cause an underestimation of the smaller settlement's population (and vice versa).

While producing the Census 2011 and Census 2021 ward level estimates, CCC has noted two OAs that demonstrate this issue:

E00187670 – Cambourne and Caldecote wards

OA E00187670 overlaps both Cambourne and Caldecote wards, and Cambourne and Bourn parishes. The address count for this OA shows a higher number of postal addresses for Caldecote ward and Bourn parish (165) compared to Cambourne ward and parish (112). The CCC lookup places this OA into Caldecote ward and Bourn parish, whereas the ONS lookup places it in Cambourne ward and parish.

This OA has a large population, with 622 residents at Census 2021. This therefore has an impact on the population and household estimates for whichever ward it is and is not assigned to. This issue is even more acute for Bourn parish due to its small size, as shown in the difference between the CCC Census 2021 population estimate of 1,320 and the ONS estimate of 700 for this parish.

E00173821 – St Neots East and Great Paxton wards

OA E00173821 overlaps both St Neots East and Great Paxton wards, and St Neots and Abbotsley parishes. The address count for this OA shows a higher number of postal addresses for St Neots East ward and St Neots parish (132) compared to Great Paxton ward and Abbotsley parish (79). The CCC and ONS lookups place this OA into the St Neots East ward and St Neots parish.

This OA has a population of 365 residents at Census 2021. This therefore has an impact on the population and household estimates for whichever ward it is and is not assigned to. This issue is even more acute for Abbotsley parish due to its small size, with a Census 2021 population of 422 residents when following the CCC and ONS OA best fit lookups.