Measuring Auckland's Population Density

Version 1.2
26 May 2014

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Executive Summary

Population density refers to the relationship between people and land or space. Population density is a factor in understanding how city areas function and it is linked population related topics such as health, economics and sustainability.

In Auckland, population density can be measured for a number of spatial areas, including the region as a whole (the Auckland Council territorial area) and for sub-regional areas such as the urbanised area and even local boards or smaller.

The methodology used to calculate densities and the geographic areas used for density calculations are outlined in this report.

In summary, the key population density results are as follows:

- The population density for the Auckland region is 3.1 people per hectare (when using 2013 population estimates).
- The population density for the Auckland urbanised area is 24.9 people per hectare (when using 2013 census population counts).

While comparisons are required to be made between Auckland and other cities and districts within New Zealand and overseas locations, not all comparisons are equal, and care should be taken when comparing.

Maps and tables of densities for Auckland and other areas are included in the appendices of this report.

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1.0 Introduction

Population density refers to the relationship between people and land or space. Population density is a factor in understanding how city areas (and other places) function and it is linked to population related topics such as health, economics and sustainability.

Modern urban planning rose as a response to the poor living conditions experienced by the growing population that flocked to British cities for work during the Industrial Revolution. At this time high population density was synonymous with cramped and overcrowded living conditions, poor sanitation, high death rates from communicable diseases and other public health issues (Hall and Tewdwr-Jones, 2011). Over the centuries since the Industrial Revolution, modern cities have taken a different form, expanding outwards from their traditionally compact core, as a response to development and changes in transportation, economic and cultural priorities, with parts of the many modern cities now being dominated by lower-density residential suburbs (Newman and Kenworthy, 1999).

In more recent times the lower density of cities has been associated with increased greenhouse gas emissions (partially through an increased use of private motor vehicles and commuting) (Norman et al., 2006). Coupled with this is the requirement of more land rural to accommodate urban development, and the encroachment into traditionally rural areas (Curran-Cournane et al., 2014). Interestingly at the same time higher population density in urban areas has been linked to better public transport systems (Cervero, 2002), improved access to essential services and, preservation of rural land around urbanised areas.

It is for these reasons that having an understanding of population density and, how the population interacts with its environment is essential to inform our knowledge of how a city works.

2.0 Calculating Population Density

Calculating population density is done using the following simple formula where population is the numerator; the area in which the population is located is the denominator:

$$population\ density = \left(\frac{population}{size\ of\ area}\right)$$

The following sections (2.1 and 2.2) detail the population and areas used to generate population density figures for Auckland.

2.1 Population

The first component of the population density equation required is the population of an area. Statistics New Zealand (SNZ) collects and reports population counts across the country, both at a national and sub-national level. Population is tracked in three ways: the Census, population estimates and population projections. There are outlined below:

- New Zealand Census of Population and Dwellings: Usual resident population count
    - The census provides a usually resident population count, which includes people who were in New Zealand on census day and who usually reside in New Zealand. This count excludes visitors from overseas. It also excludes NZ residents who are temporarily overseas on census night and others who are simply missed by the census (net census undercount).
    - Residents who were away from their usual address on census night, but who were in New Zealand, are allocated back to the dwelling where they usually live and form part of the census usually resident population count of that area.
    - Think about the 2013 census usually resident population count as a ‘snapshot in time’.
- Population estimates
    - Population estimates are produced annually (as at 30 June), and are derived from census usually resident population counts (see above). Estimates also take into account net census undercount and those who were out of the country on census night, and are updated for births, deaths and net migration each year.
    - Census counts are not directly comparable with SNZ's regularly published population estimates.
    - The estimated resident population is often higher than the census usually resident population count because the estimates make an allowance for net census undercount and residents who are temporarily overseas at the time of the census.
    - Auckland’s estimated population at 30 June 2013 was 1,529,300.
- Population projections

- Population projections use population estimates as a starting point, and are an indication of future demographic change, based on assumptions about future demographic behaviour. They are derived from an assessment of historical, current and likely future trends in births, deaths and migration – the three components of population change.
- They are released as a series of low, medium and high projections at five year increments, and are updated every three to five years.
- Population projections are not predictions, but are a series of possibilities.

Population estimates are not generated by SNZ for all geographies; they are produced for New Zealand, the regions and for territorial authority areas. Census counts are released at these three geographies, plus smaller areas, such census area unit and meshblock. Meshblock is the smallest geographic level at which SNZ releases population information. In urban areas, meshblocks are sufficiently sized (small enough) to allow aggregation or concordance to many of the areas that we wish to measure population density for, but for which there are statistics available.

Where possible, population estimates are used for density calculations as they provide the best estimate of a population. Unfortunately estimates are only available for a limited number of geographies and as such cannot be used in some cases; where it is not available the population count from the census is used instead.

All population counts and estimates used in the analysis reported in this document are sourced from Statistics New Zealand.

2.2 Area

The second component needed to calculate population density is the size of the area in which the population we are measuring is located. These areas can be any geographic definition.

Calculating the population density for the Auckland region is simple as the area of Auckland is clearly defined and a population count of the exact area is readily available. Sometimes using the population density for the entire region is not the most suitable, especially when trying to understand how the urban part of our city functions, or compares, to other locations. It is for this reason that several geographic areas should be considered when considering the population density for Auckland. Both Bryan et al. (2007) and Newman and Kenworthy (1989) note that there can be issues in creating and comparing geographic definitions of cities, with both indicating that there can be multiple definitions of a single 'city' and within that city multiple sub-locations. This is no different in the Auckland context.

For this study, we have chosen to use the following geographic definitions in order to calculate density:

- The Auckland region
    - These are the boundaries of the Auckland Council jurisdictional area. The boundaries of the Auckland region were established on the 1st of November 2010 when the Auckland Council was established through the Local Government

(Auckland Council) Act (2009). The boundaries of the region were determined after investigations by the Local Government Commission (2010) which saw the northern boundary of the region remain the same and changes made to the location of the region's southern boundary.

- The metropolitan urban area
    - The metropolitan urban area is defined through the Metropolitan Urban Limits (MUL), as defined in the Auckland Regional Policy Statement (RPS)[1]. The MUL defines the extent to which the urbanised area of Auckland can develop up to; the MUL acts as a dividing line between urban and rural (Fredrickson, 2013). It should be noted that when the RPS section to the PAUP comes into effect the MUL will no longer have effect and will be replaced by a Rural Urban Boundary (RUB).
- The area within the Rural Urban Boundary (RUB)
    - The RUB is defined through the RPS section of the PAUP, and is the boundary which defines the maximum extent of urban development to 2040 in the form of a permanent rural urban interface (Auckland Council, 2013). The RUB, unlike the MUL, which only encompassed the main urban areas of the region, also surrounds the satellite towns of Pukekohe and Warkworth and other rural towns[2].
- The statistical urban area
    - The statistical urban area is defined by Statistics New Zealand and is reviewed annually. The areas are statistically defined and are without administrative or legal basis, and are divided into three classifications main, secondary and minor; Auckland's statistical urban area is classed as a 'main urban area'. Main urban areas are very large urban areas centred on a city or major urban centre, with a minimum population of 30,000 (Statistics New Zealand, 2013).
- The urbanised area
    - An urbanised area is defined by Newman and Kenworthy (1989) as being “all land presently developed for residential, commercial, industrial and special urban purposes (schools etc.), including all streets and roads”. The Research Investigations and Monitoring Unit (RIMU) of Auckland Council capture digitally the urbanised area of the region through time as part of its monitoring programme. The Auckland urbanised area is based on the extent of development as exhibited in ortho-rectified aerial imagery (and other data sources), as per the methodology documented in Fredrickson (2014). For analysis in this report the urbanised area

[1] The MUL can, and has been, moved over time through changes to the RPS. The MUL used in this analysis is that set by the RPS (as at April 2014), this included those changes made through Change 13 which became effective on 10 May 2013.

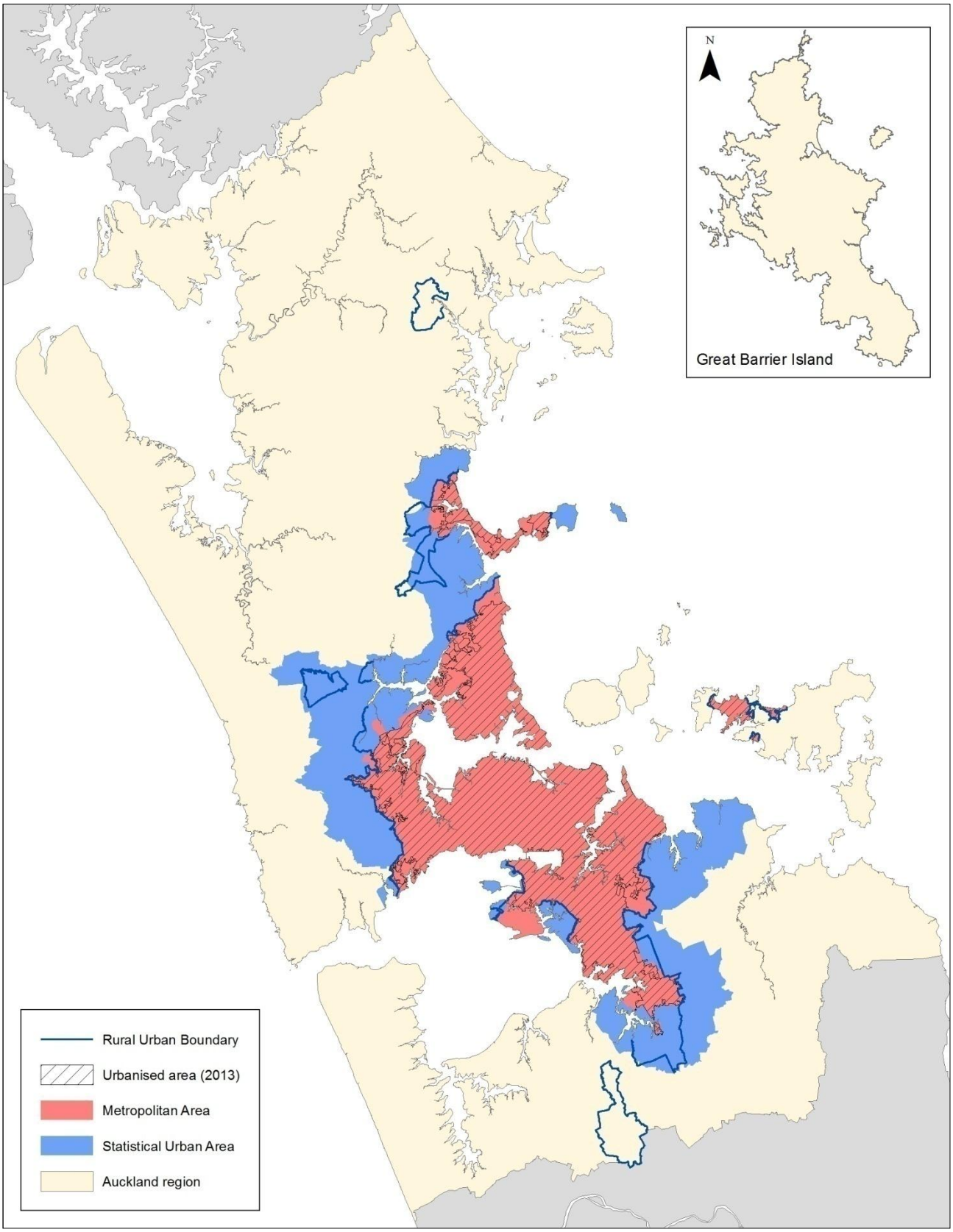
[2] Currently the RUB included in the notified PAUP has not been defined around rural and coastal towns and serviced villages, and the Unitary Plan (UP) will need to be changed to define these are a later date AUCKLAND COUNCIL 2013. *Proposed Auckland Unitary Plan,* Auckland, New Zealand, Auckland Council.. The RUB used in this analysis is as published in the notified PAUP (30 September 2013).

refers to the core urban area and excludes satellite and rural towns located within the region.

The geographical areas of the areas detailed above are shown below in Figure 1.

Other densities for sub-regional areas of Auckland can also be calculated and visualised, including at local board level (refer section 3.4: Population density of Auckland's local boards) and census area unit (refer Appendix 7: Population density map of Auckland by Census Area Unit).

Figure 1: Geographical boundary definitions for the Auckland region (2013)



3.0 Auckland's population density

3.1 Auckland's 2013 population densities

For the Auckland region, the population density calculated using 2013 population estimates can be seen in Table 1 below.

Table 1: Land area, population (2013 population estimate) and densities for Auckland region

Area name	Population (2013 estimate)	Area (ha)	Population per ha	Area (km2)	Population per km^2
Auckland region	1,529,300	489,362	3.1	4,893	312

As mentioned in Section 2.0, as well as a population density for the entire region, it can also be calculated for sub-regional areas, some of which may be more useful when referencing Auckland's population density. The results for these calculations can be seen below in Table 2. It should be noted that the population used in these calculations are based on the population counts from the 2013 census.

Table 2: Land areas, population (2013 census) and densities for Auckland

Area name	Population (2013 census)	Area (ha)	Population per ha	Area (km2)	Population per km^2
Region	1,415,550	489,362	2.9	4,893	289
Statistical urban area	1,308,537	109,263	12.0	1,092	1,198
Area within the Rural Urban Boundary	1,297,377	71,201	18.2	712	1,822
Metropolitan urban area	1,259,832	57,768	21.8	577	2,183
Urbanised area	1,240,782	49,784	24.9	498	2,492

3.2 Which density figure should be used?

Since there is more than one population density figure for Auckland, which one should be used? This very much dependent on what you are looking at, or trying to compare. If you are specifically looking at the population density of the 'city' part of the region, then perhaps the best density to use is that noted above for the urbanised area. If you want to compare to other NZ council areas the density for Auckland region (as shown in Table 1) is likely the best option.

For help, or more information on population densities, please feel free to contact the Research Investigation and Monitoring Unit.

3.3 Comparing Auckland's population density over time

The population density of Auckland's urbanised area has varied greatly; from humble beginnings as a small port town on the reaches of the Waitemata Harbour, to a bustling metropolitan city. The population density of the urbanised area over time, at intervals between 1842 and 2013 is shown below in Table 3.

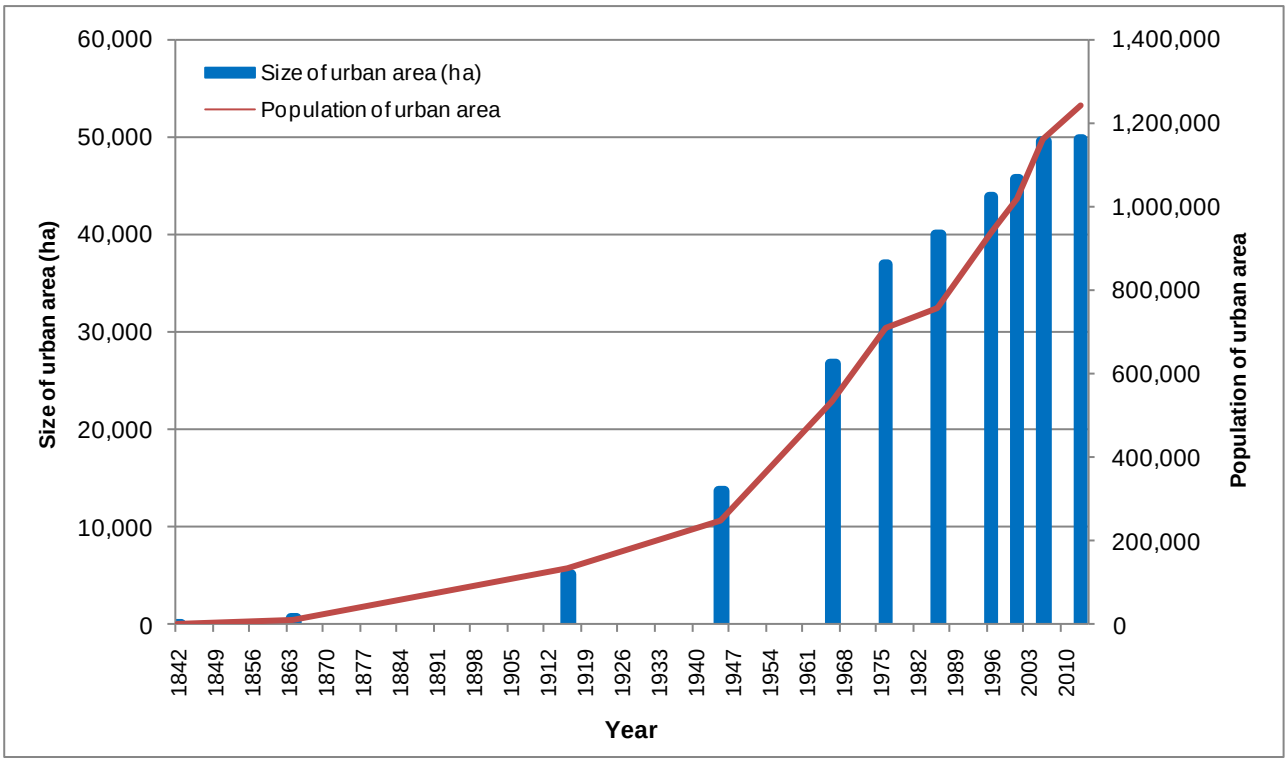
Table 3: Population densities of Auckland's urban area 1842 to 2013

Year	Population	Built up (urbanised) area (ha)	Population per hectare
1842	2,895	33	87
1864	12,423	565	22
1916	133,712	5,039	27
1945	251,667	13,642	18
1966	535,167	26,793	20
1976	707,607	37,000	19
1986	754,845	40,022	19
1996	937,305	43,984	21
2001	1,019,589	45,659	22
2006	1,160,100	49,520	23
2013	1,240,782	49,784	25

Source: Auckland Regional Council (2010) for all years except 1996, 2001 and 2013

A map illustrating the extents of the urbanised areas as listed above in Table 3 can be found in Appendix 1 (Extent of Auckland's urbanised area 1842 to 2013). Figure 2 shows that in the period between 1916 and 1986 the size of Auckland's urban area grew at a faster rate than that of population growth; as a result population density decreased, falling to 19 persons per hectare in 1976 and 1986. In more recent times population growth has been greater than that of urban expansion, leading to higher densities, with population density sitting at 25 persons per hectare in 2013.

Figure 2: Graph - Population densities of Auckland's urban area 1842 to 2013



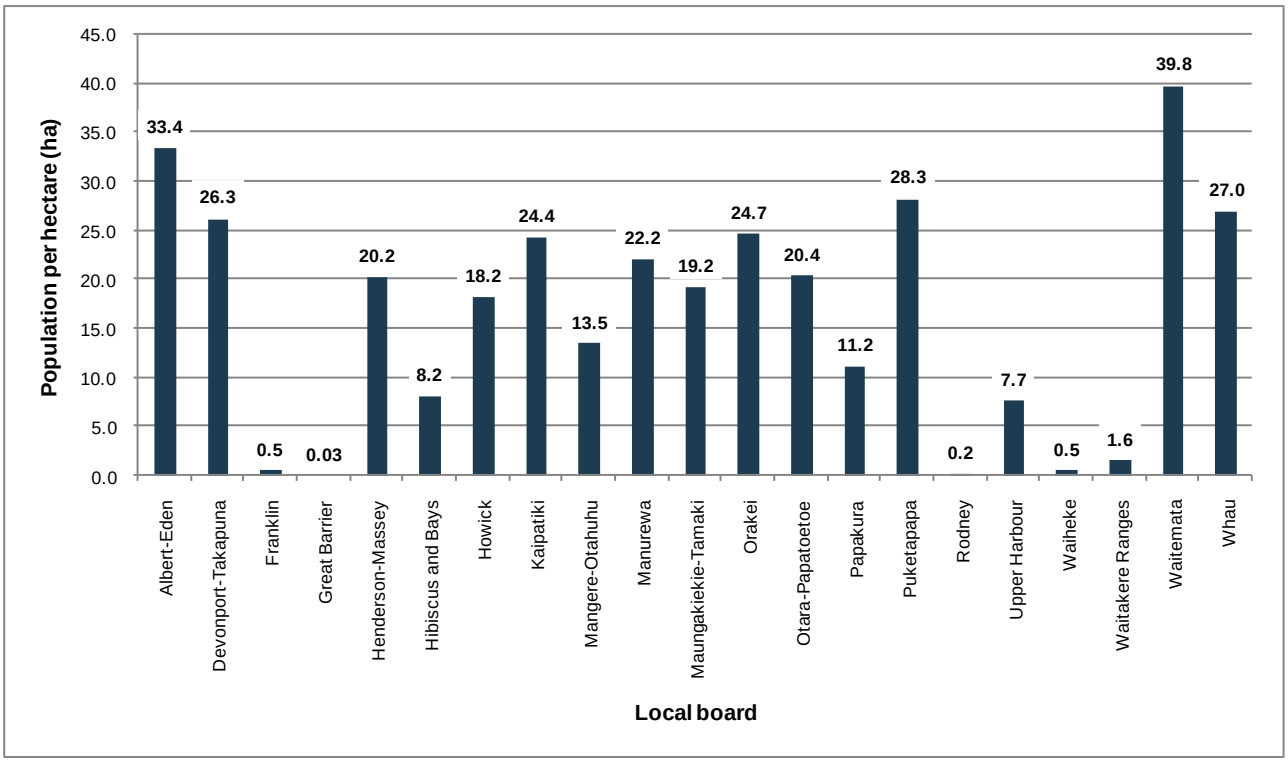
It is important to note that the boundaries of what we call 'Auckland' have changed twice over the last few decades, with the boundaries of the Auckland region moving in 1989, and again in 2010 when the 'super city' was formed. This change in area should be noted when making comparisons for the region over time. Some information on how the Auckland regional boundary has changed over time can be found in Appendix 2: Changes to the Auckland region boundary in 1989 and 2010.

3.4 Population density of Auckland's local boards

Population density can also be measured for other sub-regional areas, including for local boards.

Density is highest in the Waitemata local board area. Density is likely to be higher here due to the Central Business District being within its boundaries, in which a large number of apartments are located. The Albert-Eden Local board also exhibits a higher population density than other local boards. This local board, much like Waitemata, contains many of the central isthmus suburbs. These suburbs (such as Grey Lynn and Ponsonby) tend to older or historic and in many cases have a higher dwelling density than more recently developed areas, In addition to more recent higher-density developments that include terraced housing and apartment buildings, all contributing to increased population densities. At the other end of the scale the Great Barrier local board area has a population density close to zero (0.03 persons per hectare) - this is due to its large size and very small population. Many of the local boards that have a reasonable proportion of rural land within their boundaries also have relatively low population densities, with Rodney, Franklin and Waiheke being the primary examples. This is also the case for Upper Harbour and Hibiscus and Bays local boards.

Figure 3: Graph - Population densities (people her hectare) of Auckland's local boards (2013 census)



A table and map showing the population, area and densities of Auckland's local board areas can be found at the end of this report in Appendix 3: Population densities for Auckland's local boards.

3.5 Comparing Auckland's density to other cities and regions

Auckland is a unitary authority[3], as such its population density for the entire Auckland area can be compared with both territorial authorities (cities and districts) and regions across New Zealand. When comparing population density between cities, districts and regions the population estimates should be used primarily.

Comparing the urban areas of cities and other urbanised areas is more difficult. There is no standard definition of what constitutes an urbanised area, and data capture of urbanised areas is not done by a national body (such as LINZ) that would ensure a consistent capture and methodological approach across New Zealand. Auckland Council has an established methodological approach for capturing the city's urbanised area on a semi-regular basis, which is primarily based on aerial photography, but in more recent times has also incorporated other data sources to help track development. More information on this process can be found in the report titled *Measuring Auckland's Urban Extents: Background and Methodology*.

[3] A unitary authority is a territorial authority that has the responsibilities, duties and powers of a regional council conferred on it DEPARTMENT OF INTERNAL AFFAIRS. 2014. *Local Government in New Zealand - Local Councils: Glossary* [Online]. Wellington, New Zealand: Department of Internal Affairs. Available: http://www.localcouncils.govt.nz/lgip.nsf/wpgurl/Resources-Glossary-Index [Accessed 30 April 2014]..

3.5.1 Comparing Auckland's population density with that of other New Zealand cities, districts and regions

The population density of Auckland can be easily compared with all other territorial authority areas (city and district council areas). A table listing the population densities for all of the territorial authority areas in New Zealand can be found in Appendix 4: Population densities for New Zealand's territorial authorities. Included in the appendix is a map illustrating these densities.

Making comparisons between the areas can be problematic though, with some districts and cities covering very large areas with their populations concentrated in small pockets — giving a possible misrepresentation of population density. Comparing population density of urbanised areas across New Zealand is no different. Because there is no national standard to measure what is urbanised and what is not, comparisons cannot be directly made. Despite this I have attempted to show an example of a comparison below through an assessment of Hamilton City. In order to make this comparison, the urbanised area of the territorial authority (Hamilton City) was captured using the same method undertaken for Auckland, based on aerial photography (2013) and parcel data (2014) both sourced from LINZ's Data Service website.

Hamilton City has the highest population density of any territorial area, with 13.6 people per hectare (based on the 2013 population estimate), compared to Auckland's territorial area authority with a density of just 3.1 people per hectare. Despite this, Table 4 shows, when comparing like-with-like, in this case only the urbanised areas of the two territorial areas we can see that Auckland has a higher urban density of 25 people per hectare compared to Hamilton's urban density of 19 people per hectare.

Table 4: Comparison of Auckland and Hamilton's population density

City	Area type	Population (2013 census)	Area (ha)	Population per hectare
Auckland	Territorial authority area	1,415,550	489,362	2.9
	Urban area	1,240,782	49,784	25
Hamilton	Territorial authority area	141,612	11,077	13
	Urban area	138,855	7,207	19

3.5.2 Comparing Auckland's density figures with overseas cities and regions

Often there is a desire to compare Auckland (and other New Zealand cities and urban areas) with international comparators. While it is possible to compare Auckland to any major urban area in the world, some comparisons are perhaps more useful than others. Population size, urban area size as well as development history should all be considered. As noted by Newman and Kenworthy (1989, 1999) different cities and indeed, different parts of cities, have different development histories, thus producing different densities. Their work notes that cities or areas of cities that developed significantly in the post-World War II period (when the use of private motor vehicles was becoming more prevalent) have overall lower densities than those cities and areas that developed in earlier periods.

Similar to there being no national standard for data capture on city or urban areas, international comparisons can be as difficult. While the city of Auckland is now contained within one council area, others such as Wellington still span many council areas; this is the same for many international examples, including Sydney and Melbourne in Australia, London in the United Kingdom and even New York in the United States. Despite this, comparisons can be made in some cases. Below in Table 4 Auckland's Statistical Urban Area has been compared with and the Significant Urban Area for a selection of major Australian cities.

Table 5: Comparison of Auckland, Sydney, Melbourne, Brisbane and Perth's population density

Area	Population	Area (ha)	Population per hectare
Auckland*	1,308,537	109,263	12.0
Sydney**	4,373,433	406,367	10.8
Melbourne**	4,181,021	567,930	7.4
Brisbane**	2,143,121	506,513	4.2
Perth**	1,901,582	336,710	5.6

* Statistical Urban Area, as defined by Statistics New Zealand. Population from 2013 census.

** Significant Urban Areas, as defined by the Australian Bureau of Statistics. Population 2013 estimate.

Perhaps the most well-known international comparison of urban area size, population and population density is undertaken by the US based Demographia[4]. Demographia produces a global assessment of the largest urban areas with a population over 500,000. While their comparison study is useful in many respects it should be noted that the urban area size and population information is captured in different ways and from many different sources between cities, meaning that often what is being compared is not the same. An example of this is that Demographia have used aerial photography of Auckland to estimate the size of the urban area (most likely similar to the process used by Auckland Council) while for Australian cities they use the area and population for the Australian Bureau of Statistics 'Significant Urban Areas', which are vastly different from each other.

3.6 Visualising population density

Population density can be illustrated visually and spatially using mapping software, and can be a useful tool in identifying areas of greater or lesser density across wider areas at a glance.

Included in the appendices are several maps that illustrate population density at different geographic levels. Included are maps of densities for New Zealand's regions and territorial authority areas, Auckland's local board areas and lastly population density for census areas units located in Auckland.

[4] Demographia and its website is a product of the US based Wendell Cox Consultancy.

3.7 Population density 'heat maps'

Included in Appendix 8: Population density 'heat maps', are a series of maps that illustrate relative population density. While not showing a true density (population divided by area), they provide an excellent visual aid as to locations within the Auckland region that have a relatively higher density that other locations. These ‘heat’ maps show locations where population is higher compared to other locations, or are more concentrated.

Appendix 8: Population density 'heat maps', contains maps for the following topics:

- Total population 'density' - at the time of the 2006 and 2013 censuses.
- Ethnicity population 'density' — for the five main ethnicity categories (SNZ Level 1 ethnicity) at the time of the 2013 census.
- Age population 'density' — for three age groups 1) children (ages 0 to 14), young people (ages 15 to 24) and, elderly (ages 65 and over).

These maps have been created so that each within a topic group can be compared with the other, with the scale of the 'heat' maps showing their density relative to each other. For example, all the ethnicity maps are shown using the same colouring scale, this allows you to see that densities for the European group are higher than those for the other categories.

3.8 Other densities

While population density is widely used as an indicator, other types of density may also be suitable or a more appropriate measure, depending on the situation. Dwelling density, for instance can be used to indicate the type of built form prevalent in an area, and ethnic density can be used to identify areas of interest for community engagement. These densities can be calculated in the using the same method as population density.

For more information please contact the Research Investigations and Monitoring Unit (rimu@aucklandcouncilgovt.nz).

4.0 References

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5.0 Appendices

Appendix 1 Extent of Auckland's urbanised area 1842 to 2013

For more information on the source of information presented in this map and how it was captured, please refer to the report "Measuring Auckland's Urban Extents: Background and Methodology", available from the Research, Investigations & Monitoring Unit.

Historic Urbanisation in the Auckland Region: 1842 - 2013

Metropolitan Limits
Motorway
Rail

1842	1945	1987	2008
1871	1959	1996	2010/2011
1915	1964	2001	2013
1940	1975	2006	

Map Produced by
Research, Investigations &
Monitoring Unit,
Auckland Strategy & Research,
Auckland Council

Auckland Council
Te Kaunihera o Tāmaki Makaurau

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Appendix 2 Changes to the Auckland region boundary in 1989 and 2010

The Auckland regional boundary has changed several times over the past few decades, with relocation of the regional boundary occurring twice; first during the nation-wide local government reorganisation of 1989, and again in 2010 when the city, district and regional councils within Auckland were amalgamated to form the "super city" and Auckland Council.

In 1989, the Auckland region was reduced in size with the loss of 56,028 hectares. The area lost was predominately in the south, with the area transferring to the Waikato region. A small area in the north including the southern spit of the Mangawhai Heads was transferred to the Northland Region. These areas of loss can be seen on the map on the following page.

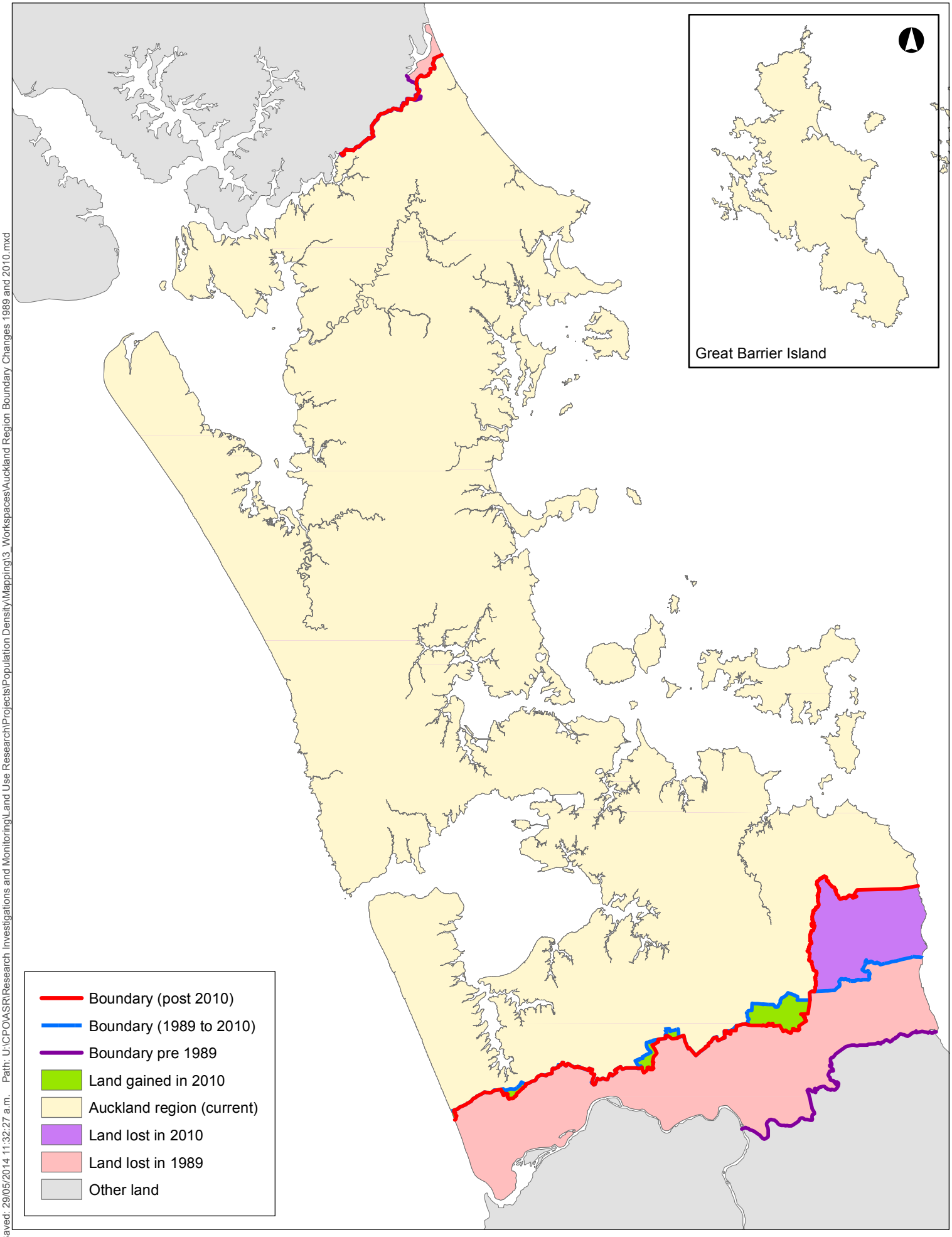
The land area of the Auckland region before and after boundary changes can be seen in Table 6 below. This table includes the area post the 2010 boundary shifts. The boundary shifts on the 1st of November 2010 included the loss of land to the Waikato Region around the Hunua Ranges and the gain of some area from the Waikato Region around the rural towns of Pukekohe and Waiuku. These changes again can be seen in the map on the following page.

Table 6: Land area of the Auckland region: pre 1989, 1989 to 2010, and post 2010 (current)

Year	Area (ha)	Area (km^2)
Pre 1989	555,916	5,5590
1989 to 2010	499,888	4,998
Post 2010 (current)	489,362	4,893

At the time of the 2013 census, the net population change to the Auckland region from the 2010 boundary shift was 2,337. This was made up from the gain of 2664 people in the areas gained around Pukekohe and Waiuku and the loss of 327 people in the Hunua Ranges area. It is important to note the changing land area, and the corresponding population loss or gain when comparing longitudinal population density for the Auckland region.

As mentioned earlier, a map illustrating the changes in the boundary of the Auckland region can be found on the following page.



Regional boundary changes for Auckland in 1989 and 2010

Map Produced by
Research, Investigations
& Monitoring, Regional Strategy,
Auckland Council

Auckland Council
Te Kaunihera o Tāmaki Makaurau

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Appendix 3 Population densities for Auckland's local boards

Table 7: Population densities for Auckland's local boards

Local board	Population (2013 census)	Area (ha)	People per hectare
Rodney	54,879	227,495	0.2
Hibiscus and Bays	89,829	11,006	8.2
Upper Harbour	53,670	6,973	7.7
Kaipatiki	82,494	3,384	24.4
Devonport-Takapuna	55,470	2,113	26.3
Henderson-Massey	107,685	5,321	20.2
Waitakere Ranges	48,396	30,403	1.6
Great Barrier	939	32,066	0.0
Waiheke	8,337	15,476	0.5
Waitemata	77,136	1,939	39.8
Whau	72,594	2,685	27.0
Albert-Eden	94,695	2,834	33.4
Puketapapa	52,938	1,872	28.3
Orakei	79,536	3,225	24.7
Maungakiekie-Tamaki	70,005	3,642	19.2
Howick	127,125	6,969	18.2
Mangere-Otahuhu	70,959	5,247	13.5
Otara-Papatoetoe	75,663	3,706	20.4
Manurewa	82,239	3,712	22.2
Papakura	45,636	4,072	11.2
Franklin	65,319	119,752	0.5

Rodney

Great Barrier Island

Hibiscus and Bays

Upper Harbour

Upper Harbour

Devonport - Takapuna

Kaipatiki

Waiheke

Henderson - Massey

Waitemata

Albert - Eden

Orakei

Whau

Puketapapa

Maungakiekie - Tamaki

Howick

Waitakere Ranges

Mangere - Otahuhu

Otara - Papatoetoe

Howick

Franklin

Manurewa

Papakura

Franklin

Franklin

People per hectare

- 5.00 or less
- 5.01 - 10.00
- 10.01 - 15.00
- 15.01 - 20.00
- 20.01 - 25.00
- 25.01 or more

2013 Census
Number of People per Hectare, by Local Board, in Auckland

Source: Statistics New Zealand, 2013 Census

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Produced by Research, Investigations & Monitoring

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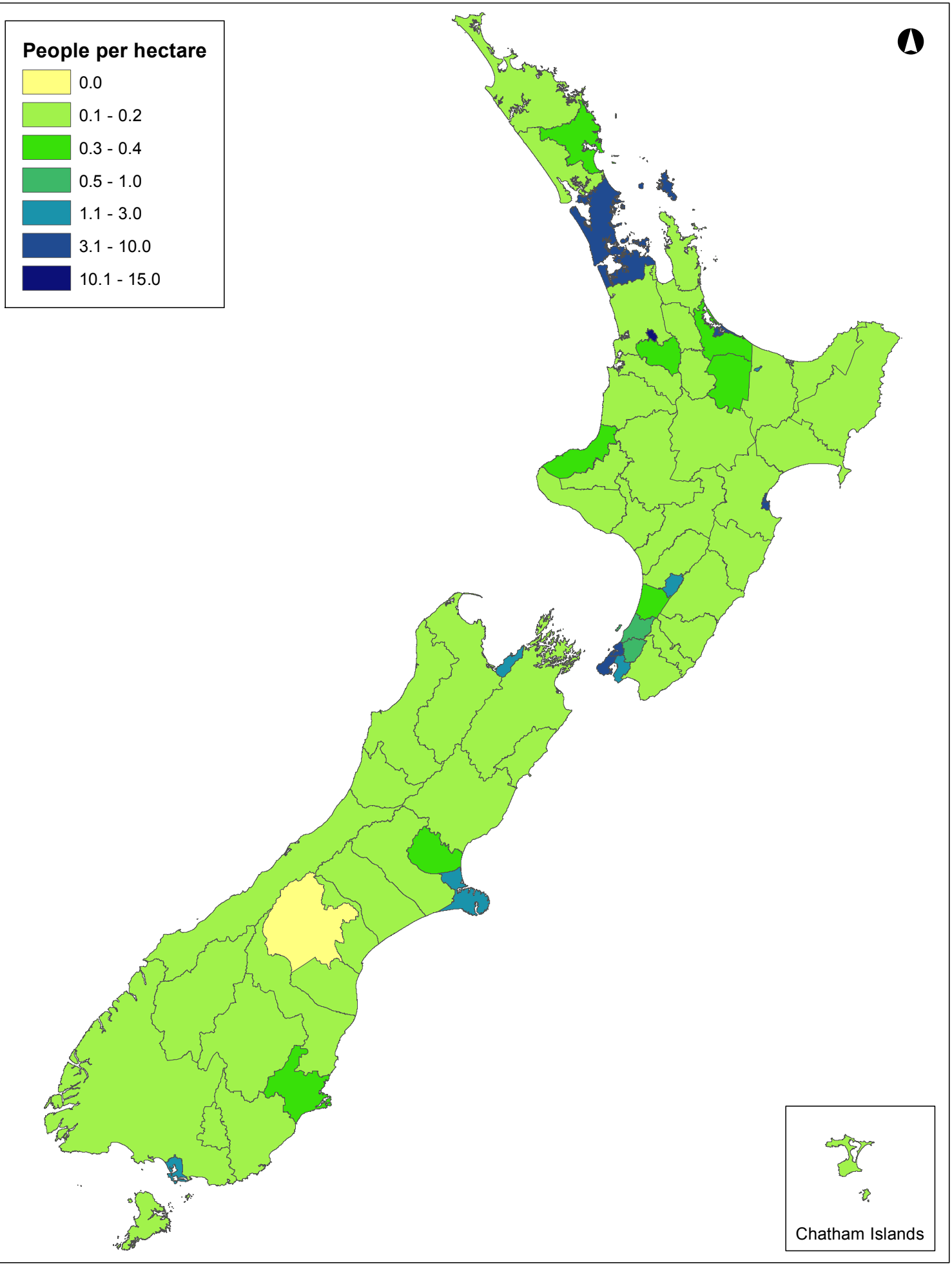
Appendix 4 Population densities for New Zealand's territorial authorities

Table 8: Population densities for New Zealand's territorial authorities

Territorial authority	Population (2013 estimate)	Area (ha)	People per hectare
Far North district	58,300	667,706	0.09
Whangarei district	81,300	269,975	0.30
Kaipara district	19,050	310,571	0.06
Auckland	1,529,300	489,251	3.13
Thames-Coromandel district	27,100	217,258	0.12
Hauraki district	18,750	127,024	0.15
Waikato district	64,900	445,166	0.15
Matamata-Piako district	32,200	175,517	0.18
Hamilton city	150,200	11,073	13.56
Waipa district	46,400	147,026	0.32
Otorohanga district	9,330	199,790	0.05
South Waikato district	22,500	181,919	0.12
Waitomo district	9,410	353,484	0.03
Taupo district	34,400	696,373	0.05
Western Bay of Plenty district	45,800	194,578	0.24
Tauranga city	117,600	13,447	8.75
Rotorua district	68,600	261,919	0.26
Whakatane district	34,200	444,926	0.08
Kawerau district	6,720	2,364	2.84
Opotiki district	8,590	308,913	0.03
Gisborne district	46,700	838,737	0.06
Wairoa district	8,050	412,944	0.02
Hastings district	75,700	522,718	0.14
Napier city	57,800	10,593	5.46
Central Hawke's Bay district	13,300	333,313	0.04
New Plymouth district	74,700	220,534	0.34

Territorial authority	Population (2013 estimate)	Area (ha)	People per hectare
Stratford district	9,200	216,388	0.04
South Taranaki district	26,800	357,578	0.07
Ruapehu district	13,050	673,365	0.02
Wanganui district	43,100	237,409	0.18
Rangitikei district	14,650	448,376	0.03
Manawatu district	27,900	256,740	0.11
Palmerston North city	85,900	39,469	2.18
Tararua district	17,400	436,462	0.04
Horowhenua district	30,600	106,430	0.29
Kapiti Coast district	50,000	71,199	0.70
Porirua city	53,300	17,290	3.08
Upper Hutt city	41,700	54,007	0.77
Lower Hutt city	102,900	37,647	2.73
Wellington city	204,000	29,039	7.02
Masterton district	23,400	230,055	0.10
Carterton district	7,820	118,016	0.07
South Wairarapa district	9,430	245,796	0.04
Tasman district	48,600	963,129	0.05
Nelson city	46,800	42,398	1.10
Marlborough district	45,900	1,044,692	0.04
Kaikoura district	3,770	204,789	0.02
Buller district	10,050	794,176	0.01
Grey district	13,650	351,579	0.04
Westland district	8,950	1,186,180	0.01
Hurunui district	11,650	865,524	0.01
Waimakariri district	50,700	221,732	0.23
Christchurch city	366,000	148,450	2.47
Selwyn district	44,200	655,222	0.07
Ashburton district	31,100	618,957	0.05
Timaru district	45,200	273,356	0.17

Territorial authority	Population (2013 estimate)	Area (ha)	People per hectare
Mackenzie district	4,070	744,226	0.01
Waimate district	7,730	358,228	0.02
Chatham Islands territory	610	80,830	0.01
Waitaki district	21,000	721,698	0.03
Central Otago district	18,850	996,878	0.02
Queenstown-Lakes district	30,200	937,468	0.03
Dunedin city	127,500	328,677	0.39
Clutha district	17,350	636,299	0.03
Southland district	29,800	3,013,351	0.01
Gore district	12,200	125,355	0.10
Invercargill city	52,900	38,781	1.36



Population density of New Zealand's Territorial Authorities (2013 population estimate)

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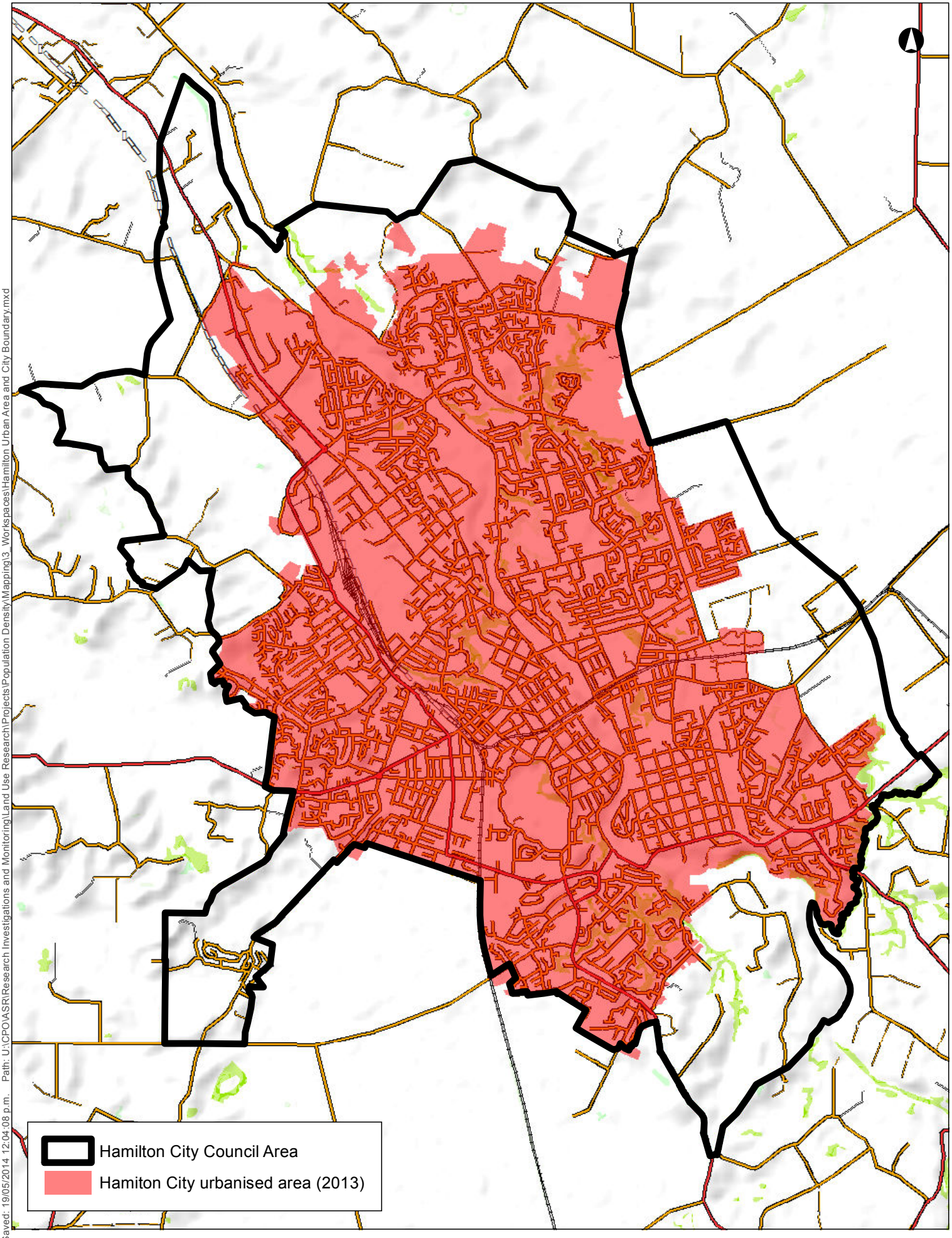
Appendix 5 Map illustrating the boundaries of Hamilton City and its urbanised area



Hamilton City Council territorial area and urbanised area comparison (2013)

Map Produced by
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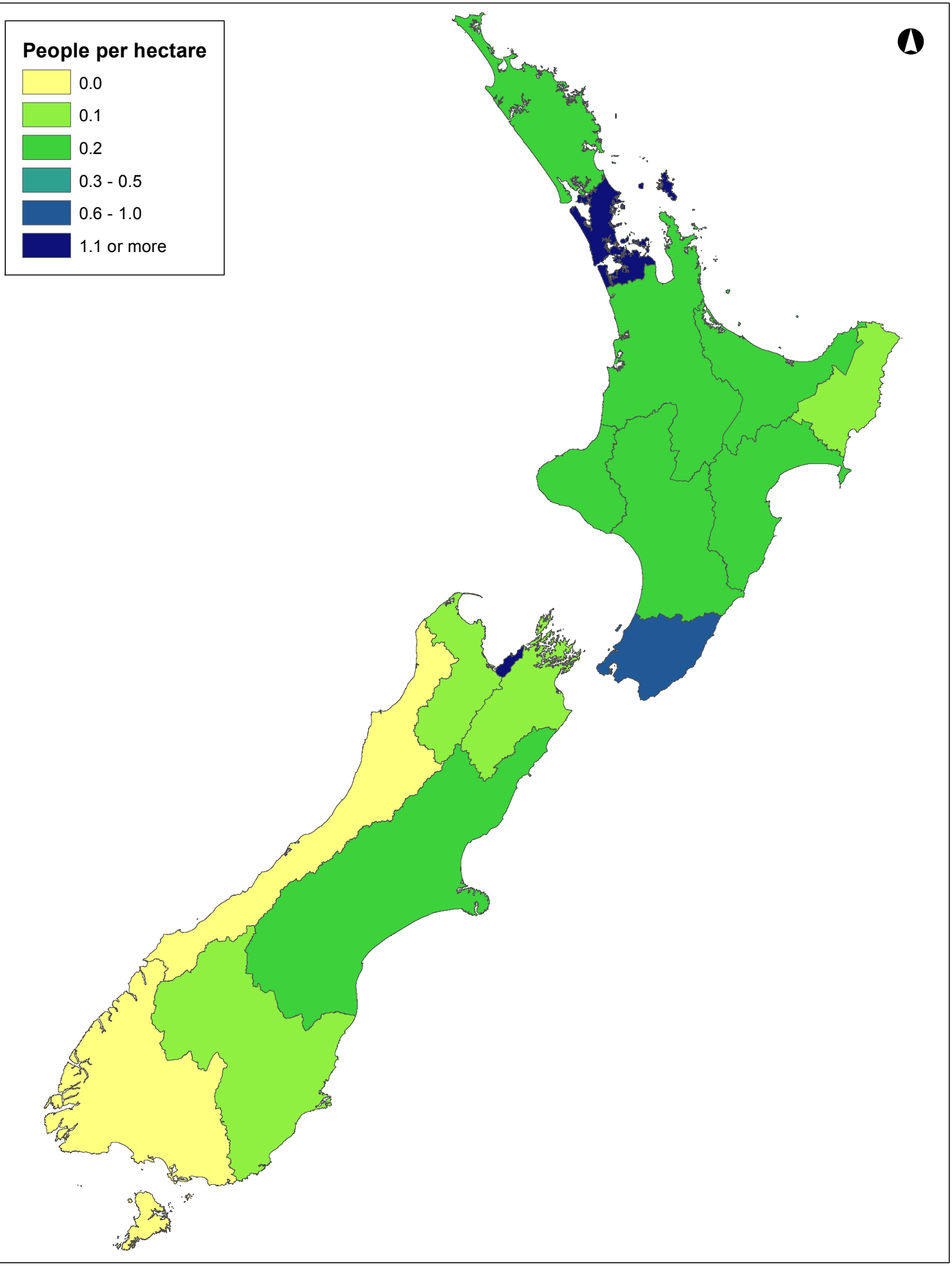
Appendix 6 Population densities for New Zealand's regions

Table 9: Population densities for New Zealand's regions

Region	Population (2013 estimate)	Area (ha)	People per hectare
Northland region	158,700	1,248,253	0.13
Auckland region	1,529,300	489,235	3.13
Waikato region	418,500	2,454,363	0.17
Bay of Plenty region	278,100	1,224,953	0.23
Gisborne region	46,700	838,737	0.06
Hawke's Bay region	155,000	1,419,229	0.11
Taranaki region	110,500	725,521	0.15
Manawatu-Wanganui region	232,700	2,222,176	0.10
Wellington region	492,500	809,939	0.61
Tasman region	48,600	963,094	0.05
Nelson region	46,800	42,398	1.10
Marlborough region	45,900	1,044,648	0.04
West Coast region	32,700	2,331,949	0.01
Canterbury region	566,000	4,520,914	0.13
Otago region	213,200	3,190,650	0.07
Southland region	94,800	3,177,489	0.03



Population density of New Zealand's Regions (2013 population estimate)

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Appendix 7 Population density map of Auckland by Census Area Unit

Great Barrier Island

People per hectare

- 5.00 or less
- 5.01 - 10.00
- 10.01 - 20.00
- 20.01 - 30.00
- 30.01 - 40.00
- 40.01 - 50.00
- 50.01 or more

2013 Census
Number of People per Hectare, by Census Area Unit (CAU), in Auckland

Source: Statistics New Zealand, 2013 Census

Produced by Research, Investigations & Monitoring

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Whangaparoa

Waiheke Island

People per hectare

- 5.00 or less
- 5.01 - 10.00
- 10.01 - 20.00
- 20.01 - 30.00
- 30.01 - 40.00
- 40.01 - 50.00
- 50.01 or more

2013 Census
Number of People per Hectare, by Census Area Unit (CAU), in Auckland's Urban Area

Source: Statistics New Zealand, 2013 Census

Auckland Council
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Appendix 8 Population density 'heat maps'

Metropolitan Limits

Motorway

Arterial

Population Density

High

Low

2013 Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population Density

High

Low

2006 Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population density

High

Low

2013 Population Density Heat Map of Children (ages 0 to 14 years) for Auckland's Urban Area

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population density

High

Low

2013 Population Density Heat Map of Young People (ages 15 to 24 years) for Auckland's Urban Area

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population density

High

Low

2013 Population Density Heat Map of Elderly (ages 65 and over) for Auckland's Urban Area

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population Density

High

Low

2013 European Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population Density

High

Low

2013 Maori Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population Density

High

Low

2013 Pacific Peoples Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits
Motorway
Arterial
Population Density
High
Low

2013 Asian Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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Metropolitan Limits

Motorway

Arterial

Population Density

High

Low

2013 MELAA Population Density Heat Map for Auckland's Urban Core

Density calaculations undertaken using 2013 census meshblock centroids and population counts sourced from Statistics NZ.

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