

Using GIS to Estimate Non-standard Area Population

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WA Health Department



Western Australia's public health system aims:

- To ensure healthier, longer and better lives for all Western Australians
- To protect the health of our community by providing a safe, high quality, accountable and sustainable health care system



Epidemiology Branch Department of Health Western Australia

Our Aim:

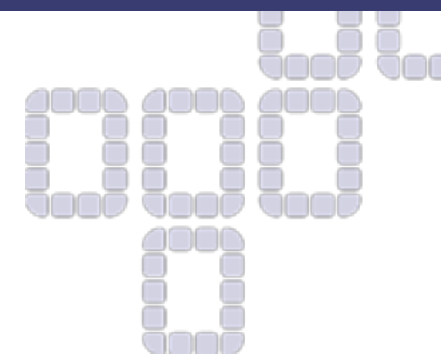
To monitor, assess and report on health profiles and service utilisation for the WA population.

We provide information to:

- ∅ Guide policy development
- ∅ Identify emerging issues
- ∅ Prioritise service delivery
- ∅ Evaluate health system performance

For more info visit: <http://www.public.health.wa.gov.au>

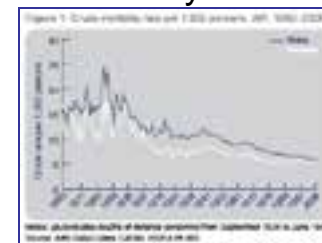
Email: epi@health.wa.gov.au



GIS



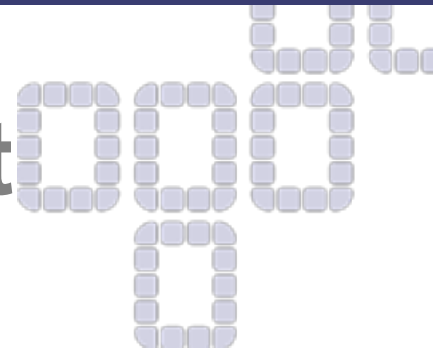
Epidemiological
Analysis



Health Surveys



GIS in WA Health Department

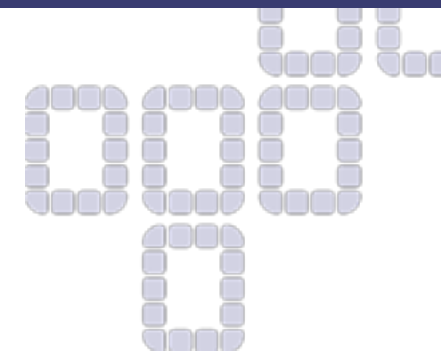


- Epidemiology Branch within Public Health and Clinical Services Division
- 3 FTE + 0.4 contractor positions
- Historically MapInfo domain, changed to ESRI suite due to increased spatial analysis requirement



USA

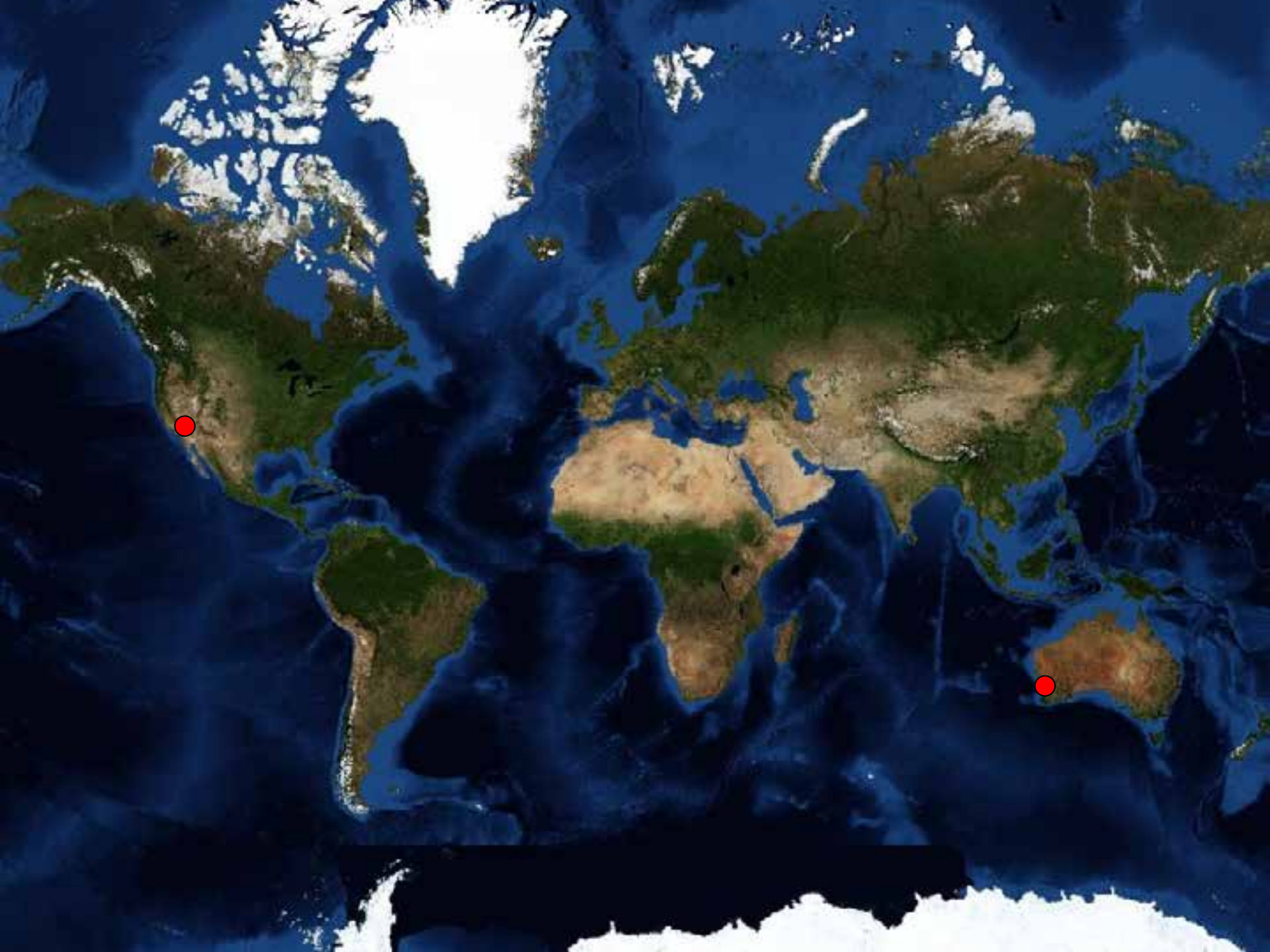
- ~3,790,000sq mi
- 313,900,000 people
- ~82 ppl/sq mi
- Spend 13.5% GDP on Health
- Life expectancy ~78

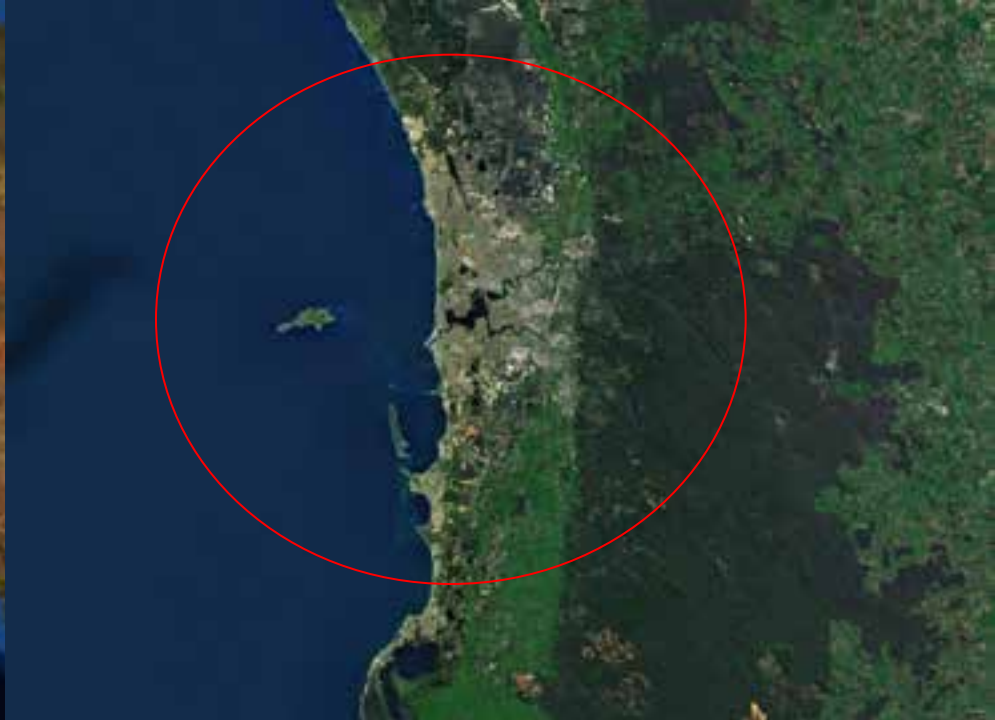


Australia

- ~3,000,000 sq mi
- 23,500,000 people
- ~7 ppl/sq mi
- Spend 8.5% of GDP on Health
- Life expectancy ~82



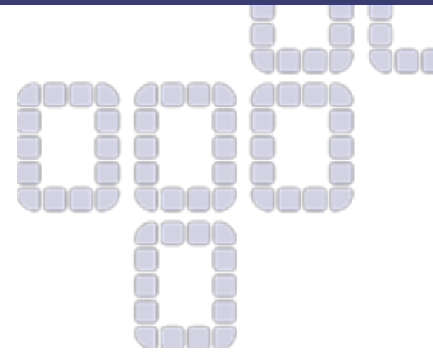




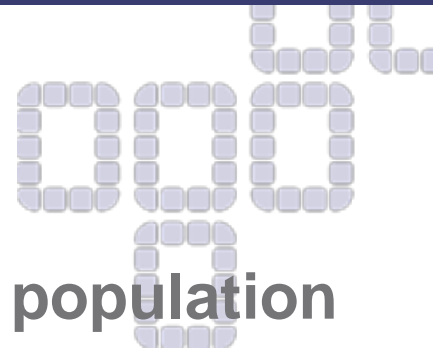


Overview

- **Background**
- **Population Estimate**
- **Concordance files**
- **Evaluation**



Background



Measuring the size and distribution of human population and projection is fundamental to services

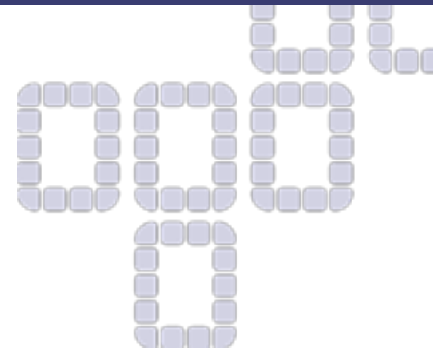
- Health, education, political, transportation and urban planning

Users - government and non-government agencies

- Areal levels population (Suburbs and Postcode)
- Administrative boundaries (Health District, Health Regions & Service Areas) for reporting and funding allocating purposes
- Detailed demography information, such as ethnic groups, age and gender, family income, structure etc



Background



Australian Bureau of Statistics (ABS)

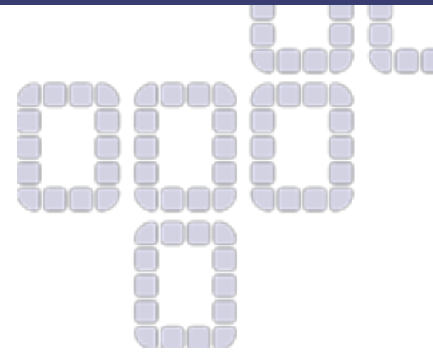
- Census every 5 years
- Population projection for whole state and major capital cities (Greater Perth Area)
- ABS standard geography
 - Mash Block, SA1 – SA4, Yearly population estimate by SA2
 - Preserve the confidentiality of original respondents
 - Administrative convenience

WA Department of Planning (Planning)

- Population projection every 5 years by Local Government Areas (LGA)
- ABS Statistic Area 2 for Health Department



Background



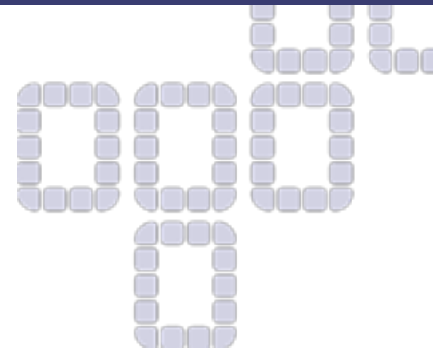
Aboriginal Population

- 3% population are Aboriginal and Torres Strait Islanders
- Most disadvantaged and poor health
- Life expectancy at the end of last year:

	Life expectancy (years)
Aboriginal and Torres Strait Islander - Male	69.1
Non-Indigenous - Male	79.7
Aboriginal and Torres Strait Islander - Female	73.7
Non-Indigenous - Female	83.1



Background



Aboriginal Population

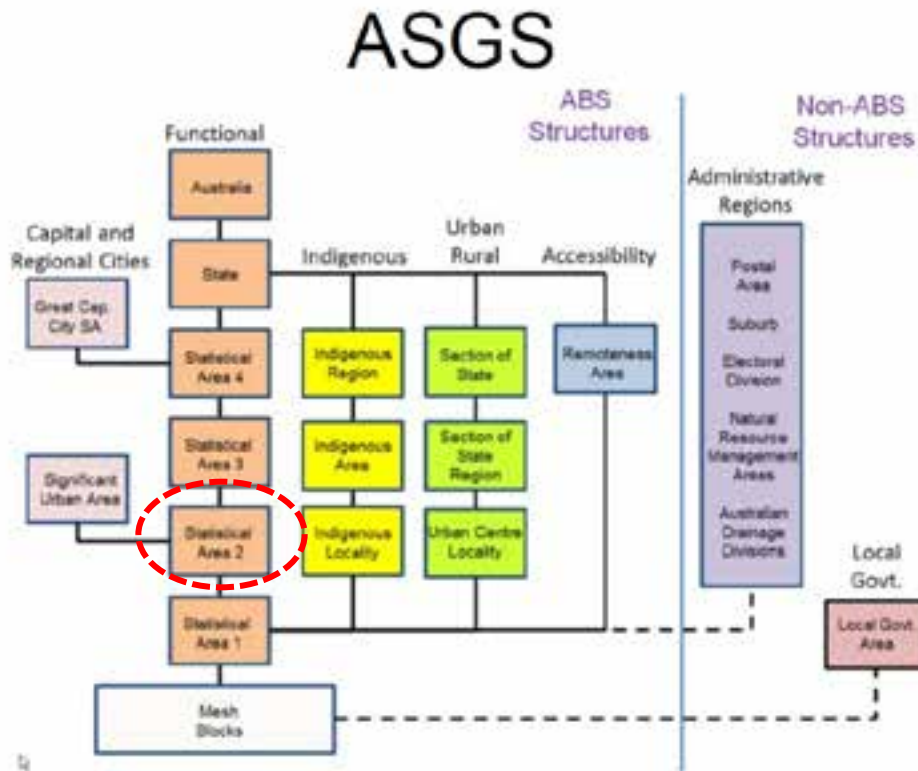
- “Closing the gap” strategies
- Accurate population is needed at all geographical levels for evidence to inform health service planning and delivery
- But due to the privacy issues, ABS only releases age-sex population at state level and total population at SA2 level

So there is a strong demand to develop a methodology to estimate non-standard area (postcode or suburb) population and SA2 level Aboriginal population, and also to assess the estimation errors



Population Estimate Method

- Non – standard area population
 - ABS SA2 population as the base



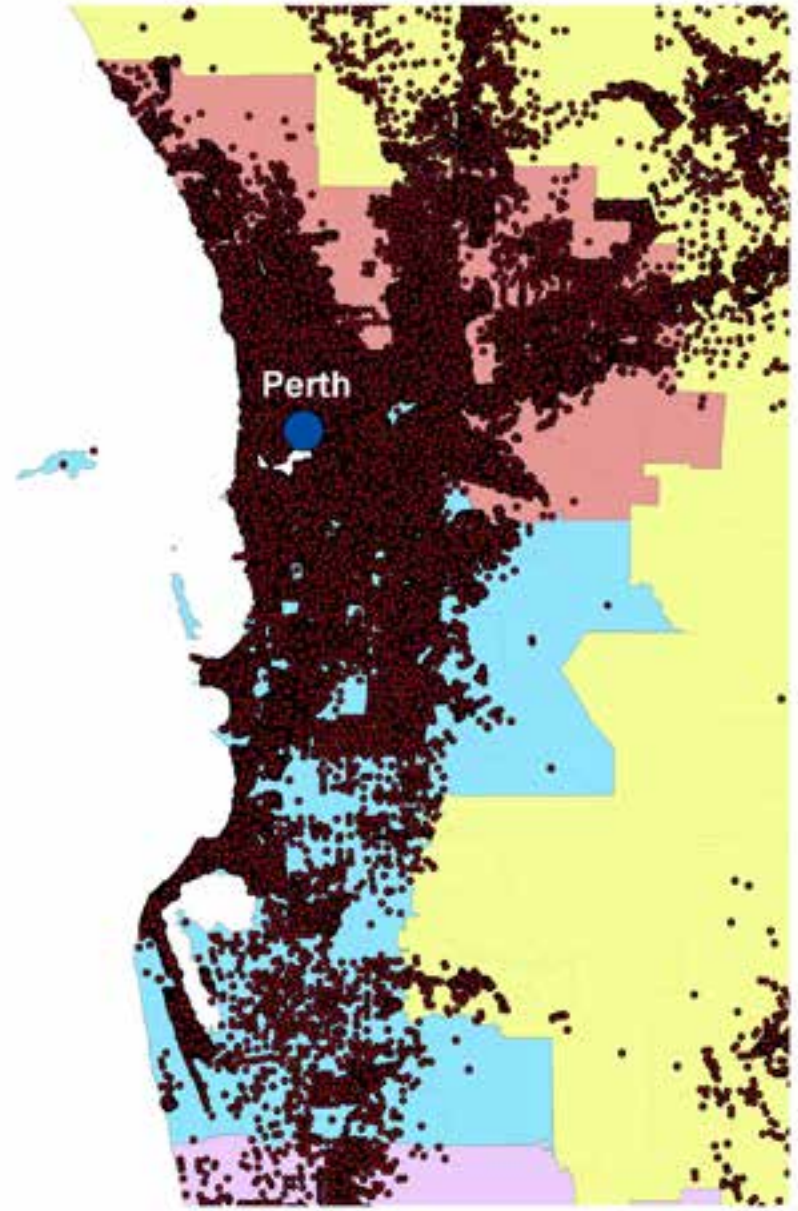
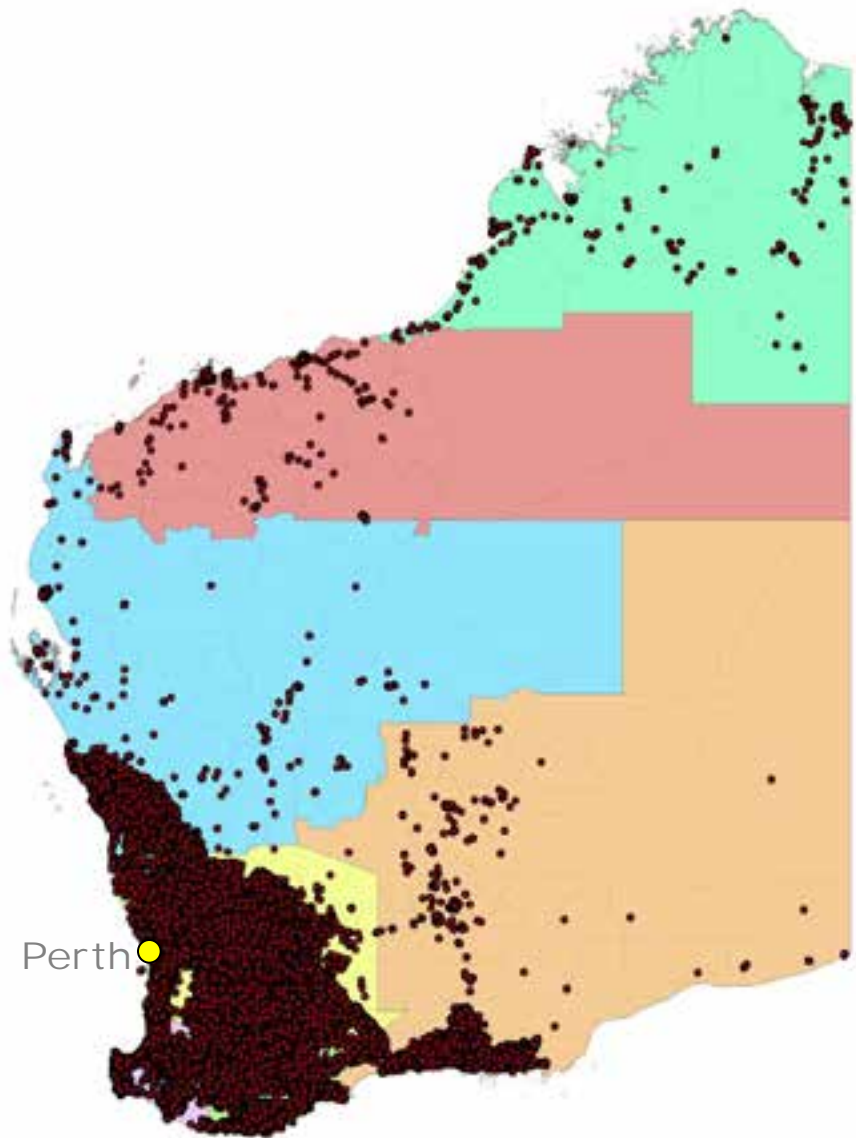
- Optimised for demographic data (ERP) – freely available yearly
- Census and non-census data available
- Based on gazetted suburb/locality
- Average population 10,000
- Optimal range 3,000 – 25,000



Population Estimate Method

- **Non – standard area population**
 - ABS SA2 population as the base
 - Use Property Street Address (PSA) as the weight
 - PSA spatial data from Western Australia Landgate (authority dataset)
 - Update daily with new building approval and subdivision info
 - Over 1.2 millions records, 96% are houses
 - Good indicator of where people are



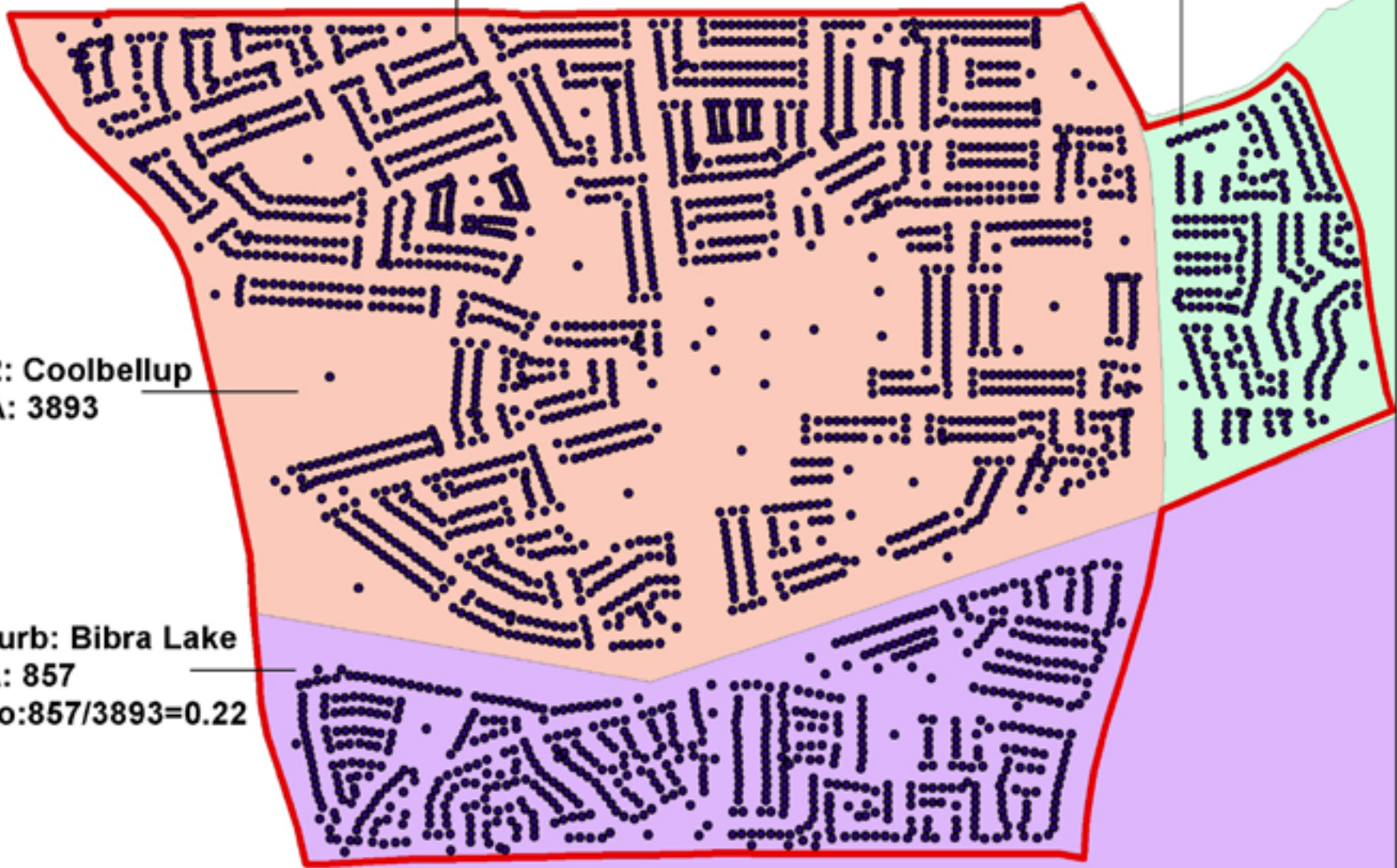


Suburb: Coolbellup
PSA: 2746
Ratio: $2746/3893=0.705$

Suburb: North Lake
PSA: 290
Ratio: $290/3893=0.075$

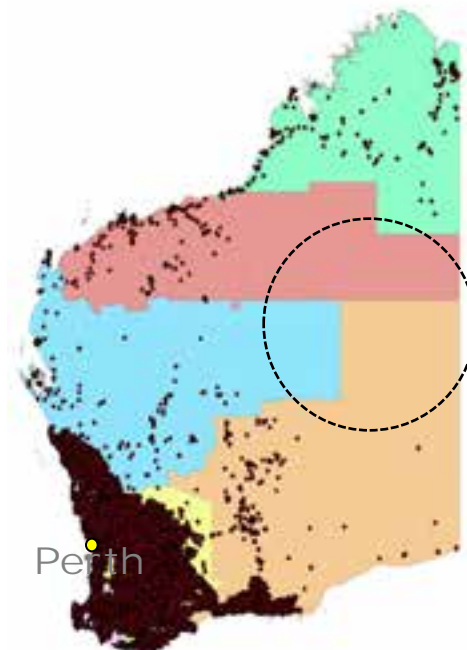
SA2: Coolbellup
PSA: 3893

Suburb: Bibra Lake
PSA: 857
Ratio: $857/3893=0.22$



Population Estimate Method

- Non – standard area population
 - ABS SA2 population as the base
 - Use Property Street Address (PSA) as the weight
 - If no PSA in the area, using the area split



SLA: Ngaanyatjarraku (S)

PSA: 0

Area:156,177km²

2011 Population: 1,544

Suburb: Gibson Desert South

PSA: 0

Area:92,114

Ratio: $92114/156177=0.59$

Population (2011):911

Suburb: Warburton

PSA: 0

Area:2,726

Ratio: $2726/156177=0.02$

Population (2011):27

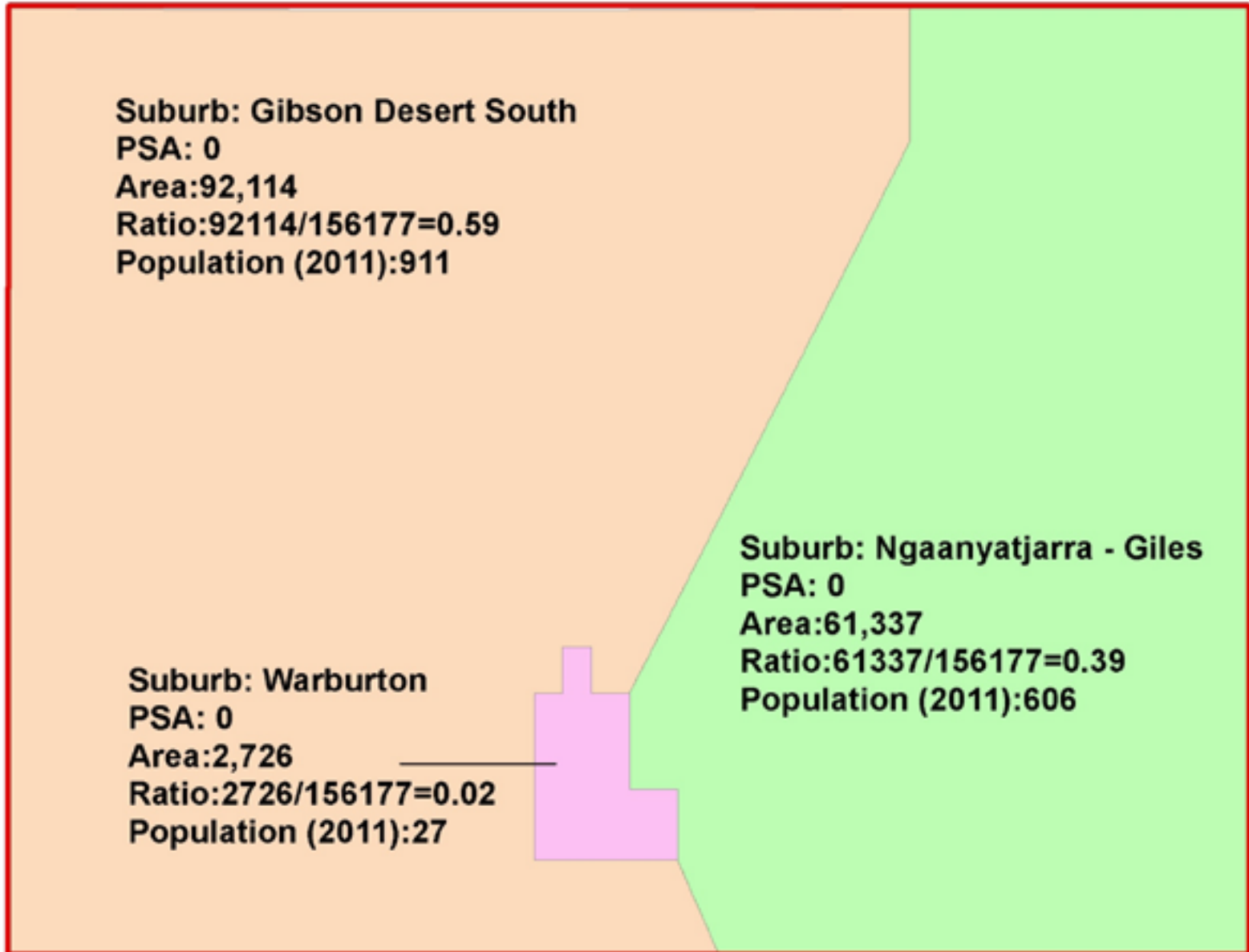
Suburb: Ngaanyatjarra - Giles

PSA: 0

Area:61,337

Ratio: $61337/156177=0.39$

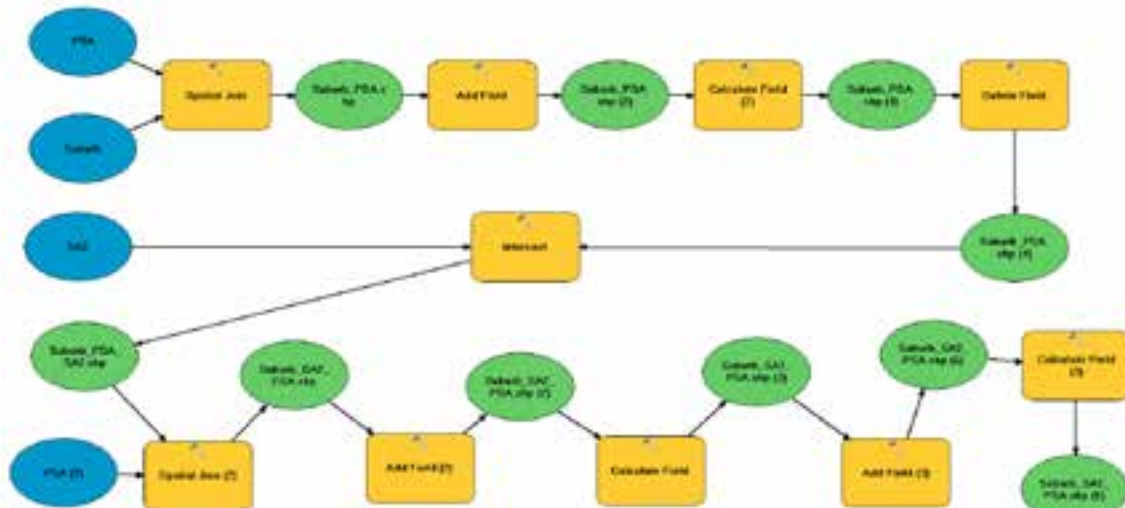
Population (2011):606



Population Estimate Method

- Non – standard area population

- ABS SA2 population as the base
- Use Property Street Address (PSA) as the weight
- If no PSA in the area, using the area split
- Use ArcGIS Model Builder



Population Estimate Method

- **Non – standard area population continue**
 - Use the ratio to calculate the suburb or postcode area population for the census year
 - Adjust the rounding errors
 - Assess / validate the results to the ABS census State Suburb (SSC) or Postal Area (POA)
 - If the two datasets are similar (most of the cases), then use the derived ratio to produce spatially explicit population for subsequent suburb or postcode area for the year using the relevant SA2 data
 - The method can be used to estimate population at all geographic levels



Population Estimate Method

- **Concordance file between Suburb, postcode or any user defined geography to ABS SA2s**
 - ABS SA2 population as the base
 - Use Property Street Address (PSA) as the weight
 - If no PSA in the area, using the area split
 - Use ArcGIS Model Builder
 - Can produce the split ratios if there is/are split(s) or
 - Assign the area to the SA2 has most PSA (one to many relationship)



POSTCODE	SA2_CODE	SA2_NAME	PERCENTAGE	HEALTH DISTRICT	HEALTH REGION	HEALTH SERVICE	METRO_COUNTRY
0872	508061219	East Pilbara	24.2479	East Pilbara	Pilbara	Northern and Remote Country Health Service	Country
0872	508031203	Leinster - Leonora	75.7521	Northern Goldfields	Goldfields	Northern and Remote Country Health Service	Country
6000	503021037	Kings Park (WA)	0.3497	City	North Metro	North Metro Health Service	Metro
6000	503021041	Perth City	99.6503	City	North Metro	North Metro Health Service	Metro
6003	503021041	Perth City	100	City	North Metro	North Metro Health Service	Metro
6004	503021041	Perth City	100	City	North Metro	North Metro Health Service	Metro
6005	503021037	Kings Park (WA)	0.0191	City	North Metro	North Metro Health Service	Metro
6005	503021038	Mount Hawthorn - Leederville	0.1661	City	North Metro	North Metro Health Service	Metro
6005	503021042	Subiaco - Shenton Park	1.3263	Lower West	North Metro	North Metro Health Service	Metro
6005	503021041	Perth City	98.4886	City	North Metro	North Metro Health Service	Metro
6006	503021038	Mount Hawthorn - Leederville	0.1303	City	North Metro	North Metro Health Service	Metro
6006	503021040	North Perth	99.8697	City	North Metro	North Metro Health Service	Metro
6007	503021038	Mount Hawthorn - Leederville	44.8235	City	North Metro	North Metro Health Service	Metro
6007	503021043	Wembley - West Leederville - Glendalough	55.1765	Lower West	North Metro	North Metro Health Service	Metro
6008	503021043	Wembley - West Leederville - Glendalough	0.9142	Lower West	North Metro	North Metro Health Service	Metro
6008	503021042	Subiaco - Shenton Park	99.0858	Lower West	North Metro	North Metro Health Service	Metro
6009	503011035	Nedlands - Dalkeith - Crawley	100	Lower West	North Metro	North Metro Health Service	Metro
6010	503011031	Claremont (WA)	49.0569	Lower West	North Metro	North Metro Health Service	Metro
6010	503011036	Swanbourne - Mount Claremont	50.9431	Lower West	North Metro	North Metro Health Service	Metro
6011	503011034	Mosman Park - Peppermint Grove	17.3035	Lower West	North Metro	North Metro Health Service	Metro
6011	503011032	Cottesloe	82.6965	Lower West	North Metro	North Metro Health Service	Metro
6012	503011034	Mosman Park - Peppermint Grove	100	Lower West	North Metro	North Metro Health Service	Metro
6014	505021096	Wembley Downs - Churchlands - Woodlands	0.1140	Central	North Metro	North Metro Health Service	Metro
6014	503021042	Subiaco - Shenton Park	6.8455	Lower West	North Metro	North Metro Health Service	Metro
6014	503011033	Floreat	37.5632	Lower West	North Metro	North Metro Health Service	Metro
6014	503021043	Wembley - West Leederville - Glendalough	55.4773	Lower West	North Metro	North Metro Health Service	Metro
6015	505021096	Wembley Downs - Churchlands - Woodlands	0.000008	Central	North Metro	North Metro Health Service	Metro
6015	505021092	Scarborough	0.0629	Central	North Metro	North Metro Health Service	Metro
6015	503011033	Floreat	0.1808	Lower West	North Metro	North Metro Health Service	Metro
6015	503011030	City Beach	99.7562	Lower West	North Metro	North Metro Health Service	Metro

POSTCODE	SA2_CODE	SA2_NAME	SPLIT	HEALTH DISTRICT	HEALTH REGION	HEALTH SERVICE	METRO_COUNTRY
0872	508031203	Leinster - Leonora	Yes	Northern Goldfields	Goldfields	Northern and Remote Country Health Service	Country
6000	503021041	Perth City	Yes	City	North Metro	North Metro Health Service	Metro
6003	503021041	Perth City	No	City	North Metro	North Metro Health Service	Metro
6004	503021041	Perth City	No	City	North Metro	North Metro Health Service	Metro
6005	503021041	Perth City	Yes	City	North Metro	North Metro Health Service	Metro
6006	503021040	North Perth	Yes	City	North Metro	North Metro Health Service	Metro
6007	503021043	Wembley - West Leederville - Glendalough	Yes	Lower West	North Metro	North Metro Health Service	Metro
6008	503021042	Subiaco - Shenton Park	Yes	Lower West	North Metro	North Metro Health Service	Metro
6009	503011035	Nedlands - Dalkeith - Crawley	No	Lower West	North Metro	North Metro Health Service	Metro
6010	503011036	Swanbourne - Mount Claremont	Yes	Lower West	North Metro	North Metro Health Service	Metro
6011	503011032	Cottesloe	Yes	Lower West	North Metro	North Metro Health Service	Metro
6012	503011034	Mosman Park - Peppermint Grove	No	Lower West	North Metro	North Metro Health Service	Metro
6014	503021043	Wembley - West Leederville - Glendalough	Yes	Lower West	North Metro	North Metro Health Service	Metro
6015	503011030	City Beach	Yes	Lower West	North Metro	North Metro Health Service	Metro



Aboriginal Population Estimate

- Estimate aboriginal population from Health District to SA2

Data available

- ABS SA2 total aboriginal population for the census year
- Commissioned ABS to provide age/sex aboriginal population by Health District
- Use Health District population to derive the ratio for age and sex for that district
- Apply the ratio to SA2 total in the district to get the estimate of the SA2 population by age/sex
- Round and check the errors



Aboriginal Population Estimate

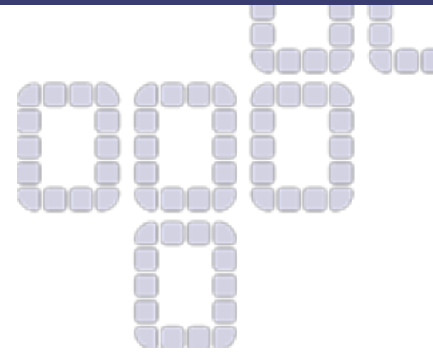
- Check and make sure the SA2 aboriginal population for any age group is less than total population
- Assess and validate the results with the Department of Indigenous community population
- This is only for census year aboriginal population
- This forms the base, then use the standard cohort method to derive the future years population after census. That is add births, subtract deaths and assume zero migration and age population one year.



Evaluation

- Use the PSA as the weight for non-standard area population estimate is reliable
- Use the PSA as the weight for creating concordance file between ABS standard geography to any administration boundary is accurate and reliable
- The method for aboriginal population estimate is the only way for us to get the results needed
- **It is not an absolutely accurate estimation, but best available for Health planning and delivery**





Thankyou and questions

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Government of Western Australia
Department of Health