



Economic Options for the Gove Peninsula

Prepared for Developing East Arnhem Limited
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Geografia



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Executive Summary

Introduction

- Developing East Arnhem Limited (DEAL) and the Northern Territory Government commissioned this study to investigate the economic prospects for the Gove Peninsula¹. It outlines the potential population, employment and economic prospects for the Gove Peninsula to 2036. The 'Study Area' extends beyond the town of Nhulunbuy
- The 2017 Gove Peninsula Economic Options report documented findings from an analysis of the economic impact of 22 project investment proposals, as well as other research into the economic and demographic changes likely to occur in the region. This update summarises the results of new modelling that has incorporated new information on project investment proposals (now at 23 individual projects), as well as data from the 2016 ABS Census, which was not available at the time of the earlier report².

Scenario results

- Three different scenarios have been modelled for the Peninsula. They are based on the likelihood of 23 different projects occurring over the next decade. These scenarios are:
 - **Scenario 1 (BaU)** – models the effect on the economy of the closure of the Rio Tinto mine, as well as the impact of investments already confirmed and committed (a total of nine projects with an average project probability of 95%).
 - **Scenario 2 (Steady Growth)** – some additional investment is expected across a range of sectors, including health, mining, agribusiness, transport and logistics, tourism and road construction (a total of 16 projects with an average project probability of 84%).
 - **Scenario 3 (High Growth)** – as for Steady Growth, as well as additional investment in fishing and aquaculture, tourism (specifically new tourism accommodation), horticulture and defence (all 23 projects are included with an average project probability of 75%)
- A key assumption for these scenarios is that most of the jobs generated, will be located in Gove Peninsula. This assumes, for example, that there is limited remote servicing and that business and household escape expenditure (e.g. via travel for purchasing goods, and/or online sales) is relatively low. These assumptions have yet to be tested through data analysis of expenditure flows.

Population and jobs

- The mean job and population growth estimates (in 2036) are summarised in Figure A, along with the breakdown in net new population servicing and export-oriented jobs.

¹ The Gove Peninsula is the Study Area and is illustrated in Figure 1.

² To streamline this report, additional information (e.g. on modelling method) can be found in the earlier document.





Figure A: Mean Population and Job Change (2036)

Source: Geografia, 2018

- Under all scenarios, population growth is dominated by Indigenous residents.
- Net job growth is dominated by population servicing activity (e.g. public administration and safety, education and training and health care), although in all three scenarios, there is an overall, net job loss by 2036.
- The net job loss is primarily due to the loss in export-oriented jobs. However, there is some expected job growth (stimulated by several of the 23 projects) that are ‘export-oriented, specifically in tourism (between 10-20 FTEs, with a mean of 16) and fishing (up to 20 FTEs), but also the Equatorial Launch Australia project (around 15 FTEs).
- For all scenarios, the ratio of new jobs to new residents in the Study Area drops below zero around 2022 and stays there. That is, less than one new job is created for every new working age resident.
- Figure B shows the mean estimated total job supply gap by 2036. It compares:
 - the estimated change in the size of the labour force (the working age population expected to be in the labour force, based on recent labour force participation rates);
 - the net change in total jobs due to the 23 projects investigated; and
 - the resulting gap in total job demand. That is, the job deficit.

The implication is that, under the current scenarios (i.e. the 23 projects) post 2026 the number of jobs available for people who are seeking a job is expected to decline.

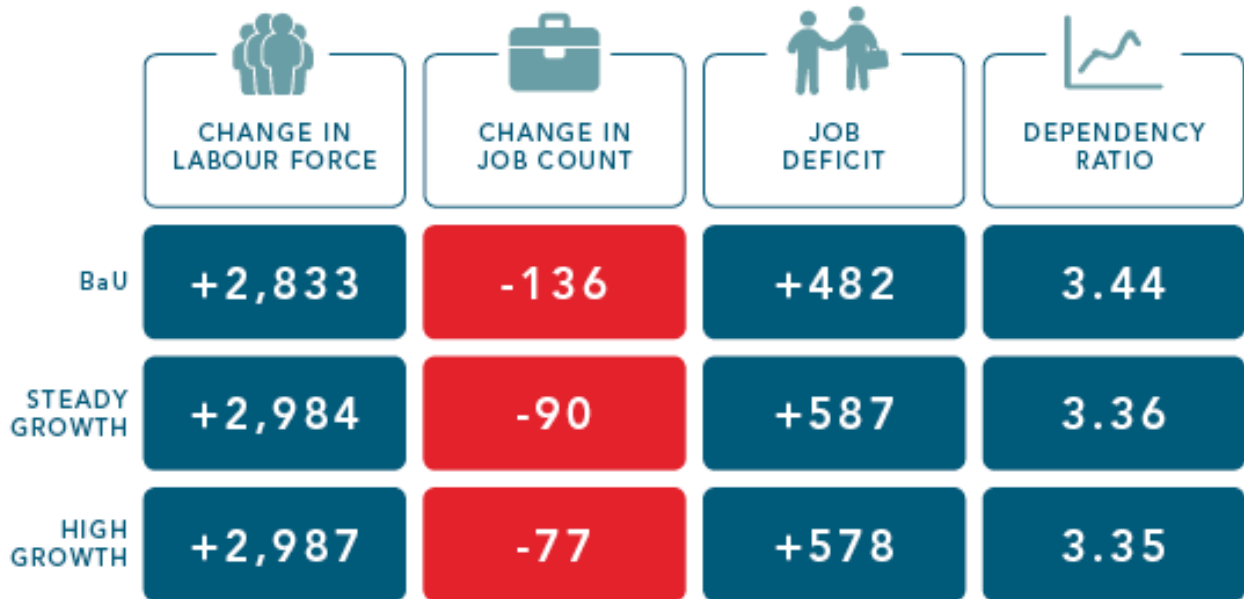


Figure B: Mean Change in Labour Force, Job Count, Job Deficit and Dependency Ratio

This shows that, counterintuitively, the gap between the labour force size and the available jobs (the jobs deficit) is highest under the High Growth scenario. However, this is due to the higher number of working age residents expected in the population due to the investment in all 23 projects. The dependency ratio (the ratio of working residents to non-working residents) is slightly larger under BaU, although, given the uncertainty in these estimates, the difference is arguably negligible. Source: Geografia, 2018

GRP

- Figure C summarises GRP changes by 2036. They refer to net changes to these values for the economy of East Arnhem Land (that is, not just for the Gove Peninsula).

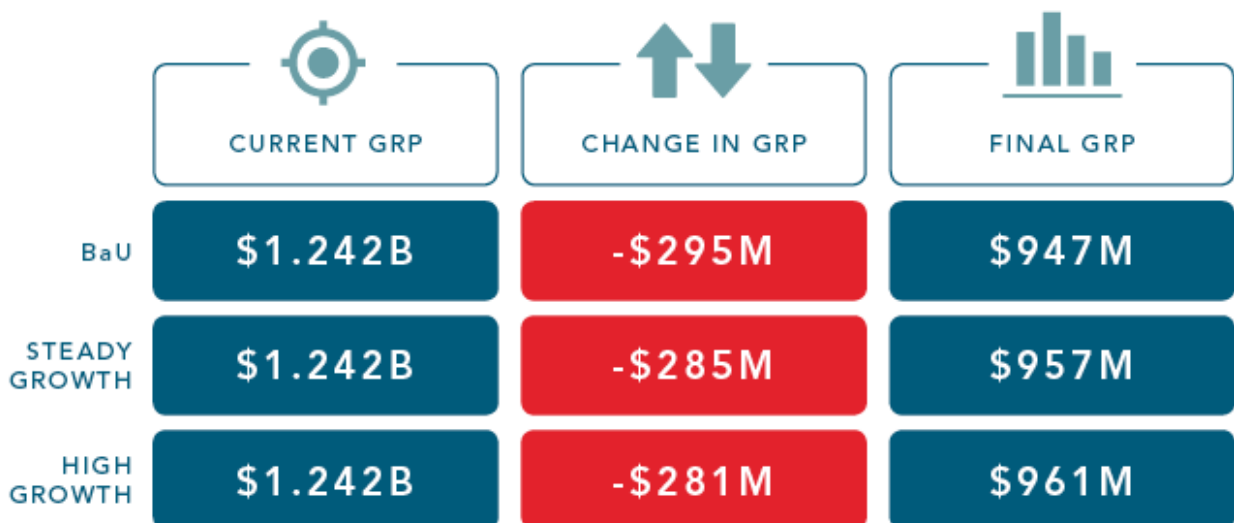


Figure C: GRP Impact (2036)

Source: Geografia, 2018



Floorspace

- The floorspace demand implications are summarised in Figure D. They are based on the application of the mean job change values from Figure A.
- Most of the additional demand is derived from industrial activity (which includes construction, transport and wholesale trade), followed by health, then offices, and retail.
- Demand for floorspace from tourism activity is embedded across Retail and Other floorspace types.

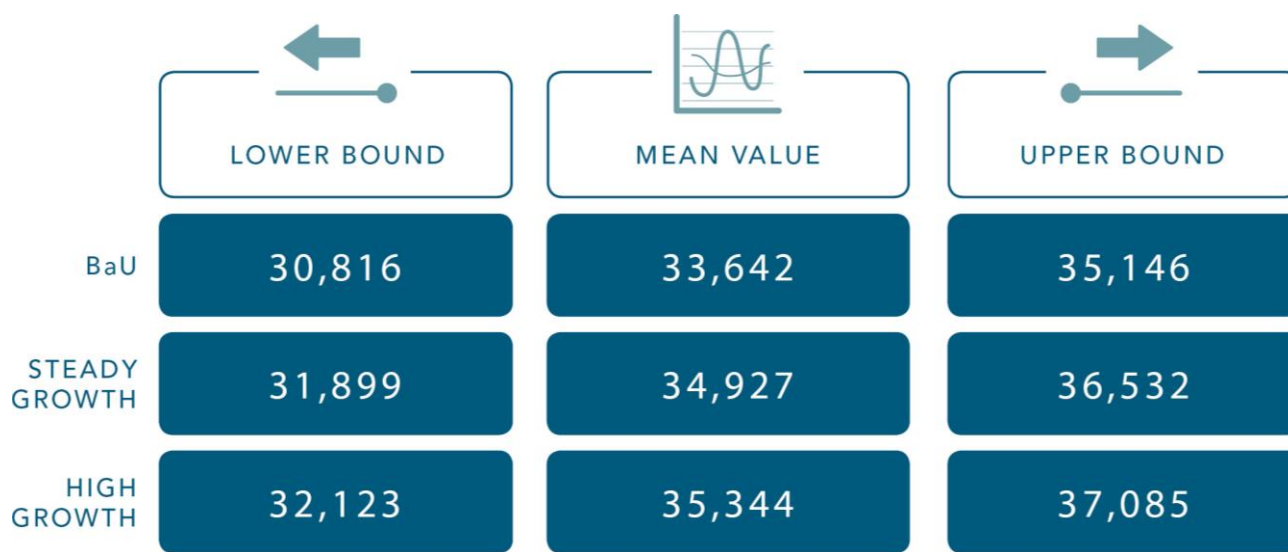


Figure D: New Floorspace by Scenario (2036)

There is a high degree of variability in the floorspace estimates, and so the lower and upper bound of the estimations are included here. Source: Geografia, 2018

Housing demand

- An estimate of future housing demand suggests a broadly similar demand profile for each scenario, which is in the order of 689 new dwellings in total by 2036 in the Study Area (i.e. Nhulunbuy and beyond). This assumes there is a one-to-one correlation between households formed (e.g. families, singles, groups) and dwellings required (see Figure 14 for the demand profile).
- Average annual new dwelling demand is estimated at 35 per year, although there is some volatility due to peaks and troughs in major project activity (see Figure 13).
- There is a risk that access to housing may become a bottleneck for Gove from now until at least 2025 and, so, some attention will need to be paid to ensuring secure housing.

Health service thresholds

- Table A summarises the ratios for optimal health service worker and bed count per 1,000 residents and the population thresholds at which these numbers can change (up or down).



Table A: Health Worker and Bed Count (Ratios & Thresholds)

Service	Current optimal	Scenario 1	Scenario 2	Scenario 3
ATSI health practitioner	7.8-9.4	+1.9-2.3	+1.9-2.4	+1.9-2.4
Dentist	3.7-4.4	+0.8-1.1	+0.8-1.1	+0.8-1.1
Medical practitioner	48.3-50.4	+10.7-12.9	+10.8-13.2	+11.0-13.2
Optometrist	1.4-1.6	+0.3-0.4	+0.3-0.4	+0.3-0.4
Pharmacist	6.8-8.1	+1.7-2.0	+1.7-2.0	+1.7-2.0
Physiotherapist	5.6-6.6	+1.3-1.6	+1.3-1.6	+1.3-1.6
Podiatrist	0.5-0.9	+0.1-0.2	+0.1-0.2	+0.1-0.2
Psychologist	7.6-8.6	+1.9-2.0	+1.9-2.0	+1.9-2.0
Midwife	7.5-25.4	+1.5-3.1	+1.6-3.2	+1.6-3.2
Registered nurse	143.5-156.3	+32.2-41.7	+32.9-42.2	+33.3-42.3
Hospital beds	29-32	+6.8-8.1	+6.9-8.2	+6.9-8.2

Source: AIHW, 2018; Geografia, 2018

- Figure E shows the change in demand for key health services, assuming average (NT) levels of service provision are optimal as per the Australian Institute of Health and Welfare provision standards data. It shows that, by 2036:
 - The total optimal count of health service workers increases by 52-69 FTEs.
 - The total optimal count of hospital beds increases by 6.8-8.2.

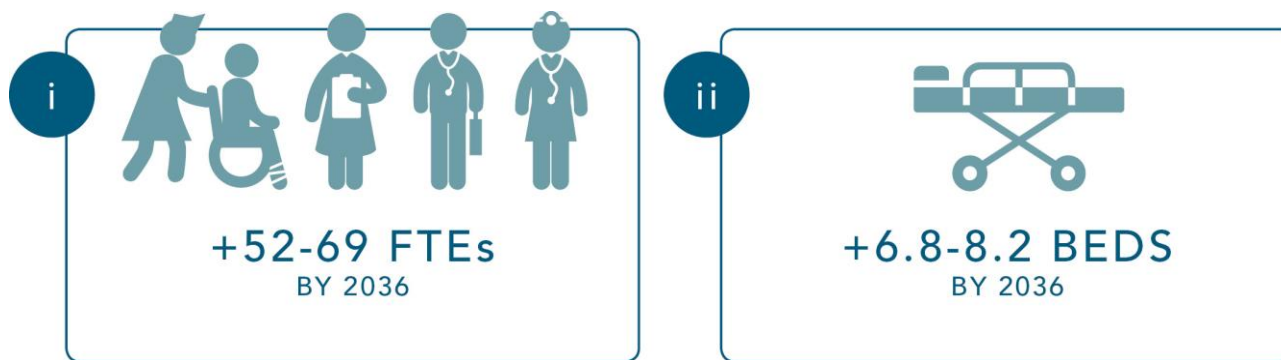


Figure E: Change in Optimal Provision of Key Health Services

Source: Geografia, 2018

Implications

In the previous report, six implications of the impact of the (then) 22 projects and the underlying population forecasts were identified and discussed. These have been revisited and revised in light of the new information and modelling results. They have been summarised into four key issues.



1. A return to a pre-closure population size

Already we have seen quite a strong bounce-back in population size after a significant decline post the refinery closure. This is expected to continue through a combination of natural increase and project investments. At least for the next decade or so, and assuming the 23 projects proceed (using the probabilities included here), the population should continue to grow slowly increasing by a further 2-3,000.

2. Staying export oriented

As was concluded in the previous report, it is still considered critical that strategies are implemented to ensure the Peninsula retains some export-oriented activity. This will attract the investment (and therefore jobs) necessary to sustainably support the population beyond 2036 and ensure amenities and services are maintained to a standard high enough to retain residents. For example, population servicing activities are always at risk of being delivered remotely, or having service provision levels lowered.

3. Education, training, innovation and collaboration

As the share of total resident population made up by the Indigenous community increases and new industries are needed to replace the current ones, there will be a greater need to invest in education and training specific to the new industry prospects. This includes everything from hospitality training, to health services and manufacturing.

4. Remote versus local

Further analysis is needed to quantify the potential effects of critical servicing and staffing policies (such as FIFO) and business, government and household expenditure escape rates (which, based on bank transaction data reviewed during this study, are relatively high). Future employment self-containment ratios will be sensitive to these factors.

As part of this, and mindful of any existing local, or Territory policy obligations, it may be worth investigating the costs and benefits of a local procurement policy.

Concluding statement

Given the expected closure of the Rio mine operations, time is of the essence. There is also imminent major project activity that may place short-term pressure on existing services and facilities. Both of these 'shocks' need to be planned for so that the Study Area's economy can manage the challenges ahead, and benefit from the opportunities presented by the 23 projects.



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1.0 Introduction

Developing East Arnhem Limited (DEAL) and the Northern Territory Government commissioned economic development scenarios for the Gove Peninsula, and a study into the implications of these scenarios. This was reported in the 2017 Gove Peninsula Economic Options Report. Newly available data (on project investment proposals and from the 2016 ABS Census) has been used to update the economic modelling that formed a key part of the original study. This report documents the new model results.

1.1 The study

This study estimates the impact of different investments and initiatives on the economy and population of Gove Peninsula to 2036. Figure 1 illustrates the project study area and its catchment area.

1.2 This report

This updated report focuses on changes in the information available to inform economic modelling. The key changes have been:

1. Confirmation that the Rio Mine will close.
2. The recognition of several new project investment proposals in the region, including, for example, new road construction projects and a new mine.
3. Changes in the scale and timing of the original set of projects, as well as revised probabilities for these projects occurring.

All other elements of the previous report remain the same³. This report only addresses the updated modelling results and analysis. Readers are referred to the earlier report for

information relating to model methods, underlying population shifts and so forth.

1.3 Projects and scenarios

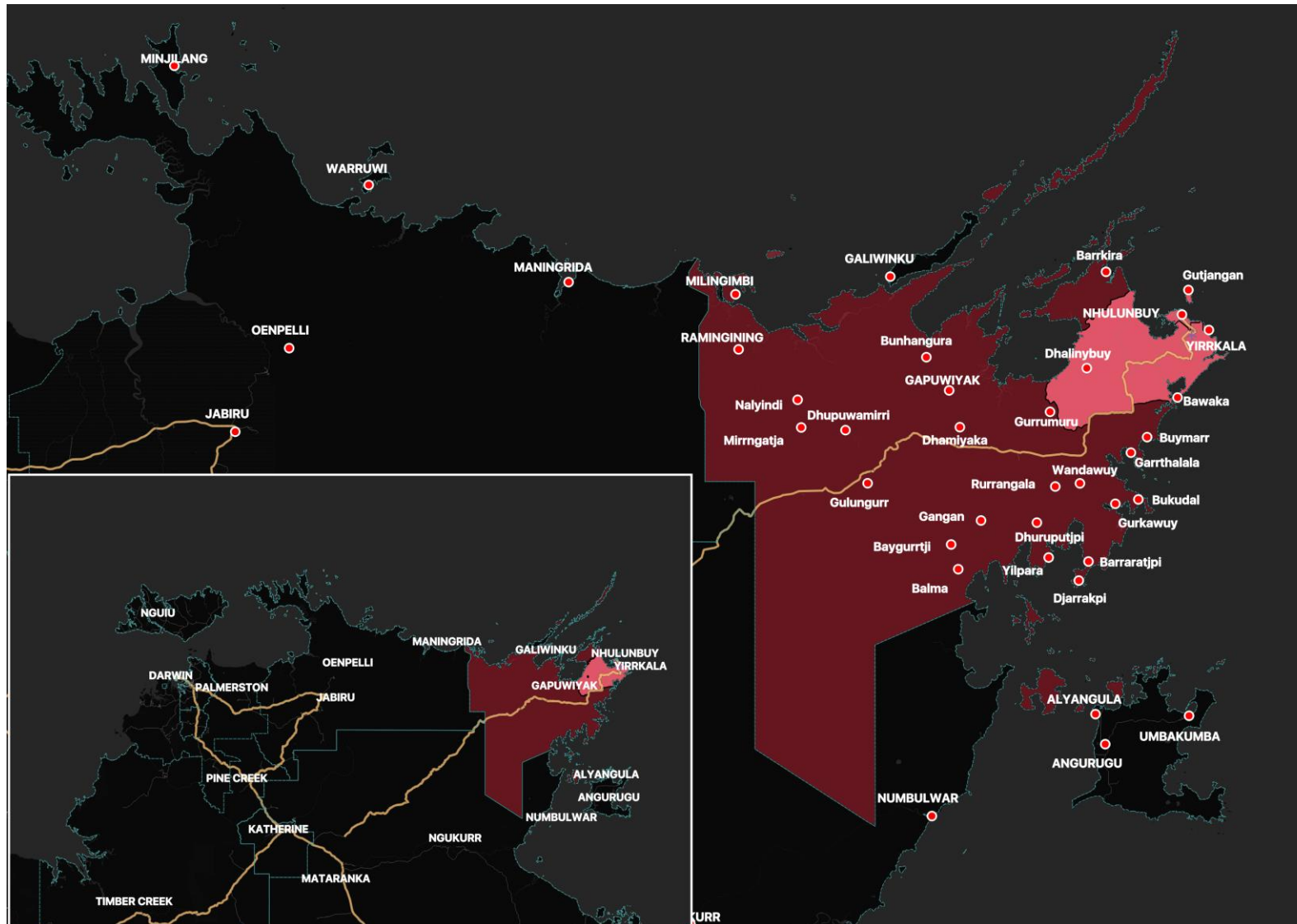
This analysis examined the potential impact of 23 projects across different industry sectors. The projects were assigned different input values, including the probability of each occurring, timeframe and investment amount. The 23 projects were assessed under three scenarios:

1. A **Business-as-Usual** scenario in which only those projects or events that are committed will occur. Nine of the 23 project proposals (see Section 2.0) occur under all scenarios including this one.
2. A **Steady Growth** scenario that included additional investments.
3. A **High Growth** scenario in which all proposed investments were considered, including those with a low (or currently uncertain) probability.

The projects, scenarios and key input assumptions are shown in Figure 2.

³ For example, the 'baseline' population estimate for Gove (see Section 2.1). These were derived from up-to-date information sourced directly from the ABS, which have not been officially revised since then.





The Gove Peninsula study area boundary uses ABS SA1 geographies (lighter pink on the map). It includes 13 SA1s and is referred to in this report as 'Gove', 'Gove Peninsula', or 'Study Area'. It encompasses the towns of Nhulunbuy and Yirrkala, some homelands, and extends a little over 90km from Nhulunbuy along the Central Arnhem Road.

A larger 'hinterland' effectively includes the rest of the local government area, excluding Groote Eylandt and Elcho Island. This is the catchment area used to estimate demand for services and facilities in the modelling.

Figure 1: Study Area

Source: Geografia, 2018



PROJECT NAME	Probability	Construction Start	Construction End	Operational Start	Construction Jobs or \$	Operational Jobs or \$	Scenarios
New Boarding House Stage 1	100%	2016	2017	2017	N/A	N/A	All
Education Project 2	90%	2022	2023	2023	\$1,500,000	\$8,000,000	All
Equatorial Launch Australia (Phase 1- Sounding Rockets)	90%	2019	2020	2020	25	15	All
Equatorial Launch Australia (Phase 2- Orbital Rockets)	10%	2027	2029	2029	0	4-5	2&3
In Confidence Project 1	40%	2025	2026	2026	\$5,000,000	\$10,000,000	3
Aged Care Facility	100%	2019	2020	2020	\$15,000,000	\$2,000,000	All
NDIS - increased servicing in line with projections	100%	N/A	N/A	2019	N/A	\$5,000,000-\$30,000,000	All
Increase Health Servicing & Regional Health Delivery	70%	N/A	N/A	2019	N/A	7	2&3
Minerals/Energy Exploration	70%	N/A	N/A	2023	N/A	10	2&3
New Resource Project 1	100%	2020	2021	2021	7	8	2&3
Decommissioning of RTA Mine	100%	2022	2030	2030	N/A	Peaking in 2025 at 250 FTEs	All
Rehabilitation of Mine Site							
Horticulture Enterprises	50%	2018	2018	2020	N/A	4	3
Major Fishery Project 1	90%	2021	2022	2022	N/A	20	2&3
Northern Prawn Fishery attracted to Gove Port	50%	2022	2023	2023	\$10,000,000	N/A	3
Fishing Processing Plant	50%	2025	2026	2026	\$10,000,000-\$15,000,000	3	3
Aquaculture Enterprise	50%	2021	2023	2023	5-10	3	3
Freight Distribution Hub	70%	2021	2022	2022	2-4	2-3	2&3
Central Arnhem Road (CAR) Upgrades (phase 1 - 2019-2024)	100%	2019	2024	2024	40-50	N/A	All
Central Arnhem Road Upgrades (phase 2 - 2024-2029)	80%	2025	2029	2029	N/A	N/A	2&3
Associated Arterial Road Upgrades to Ramingining and Gapuwiyak	80%	2023	2029	2029	N/A	N/A	3
Arts Trail	90%	2019	2020	2020	\$10,000,000	10	All
Indigenous Owned Ec Lodge	65%	2023	2025	2025	\$15,000,000	7	3
Nhulunbuy Accommodation Project	85%	2019	2020	2019	\$500,000	3	All

Figure 2: Projects and Scenarios

These are the 23 projects, key input assumptions and the scenarios in which they occur. N/A relates to either projects that are already completed (e.g. Stage 1 of the Boarding House development), for which there is no construction phase, or in cases where the data is confidential.



2.0 Scenario Results

The 23 projects and three scenarios have substantially different outcomes for Gove. Each of these outcomes builds on an underlying (baseline) population trajectory.

2.1 Baseline trajectory

Underlying all three scenarios is a baseline population estimate for Gove. This baseline population is derived from natural growth and the feedback effect of some increase in population servicing activity. Figure 3 illustrates this baseline trajectory. There is some degree of uncertainty around the kick off year population estimate, and the likelihood of local population needs being met locally, or remotely. Note the steep decline from 2011 to 2016 post the refinery closure.

In summary, then, the underlying population scenario (which assumes any economic changes do not affect population growth) is for a population of around 12,600 by 2036, an increase of some 2,200 from the last Census. Of this, the Indigenous population is expected to increase to around 85% of the total estimated resident population (ERP) and the non-Indigenous population ultimately decline in both relative and absolute terms.

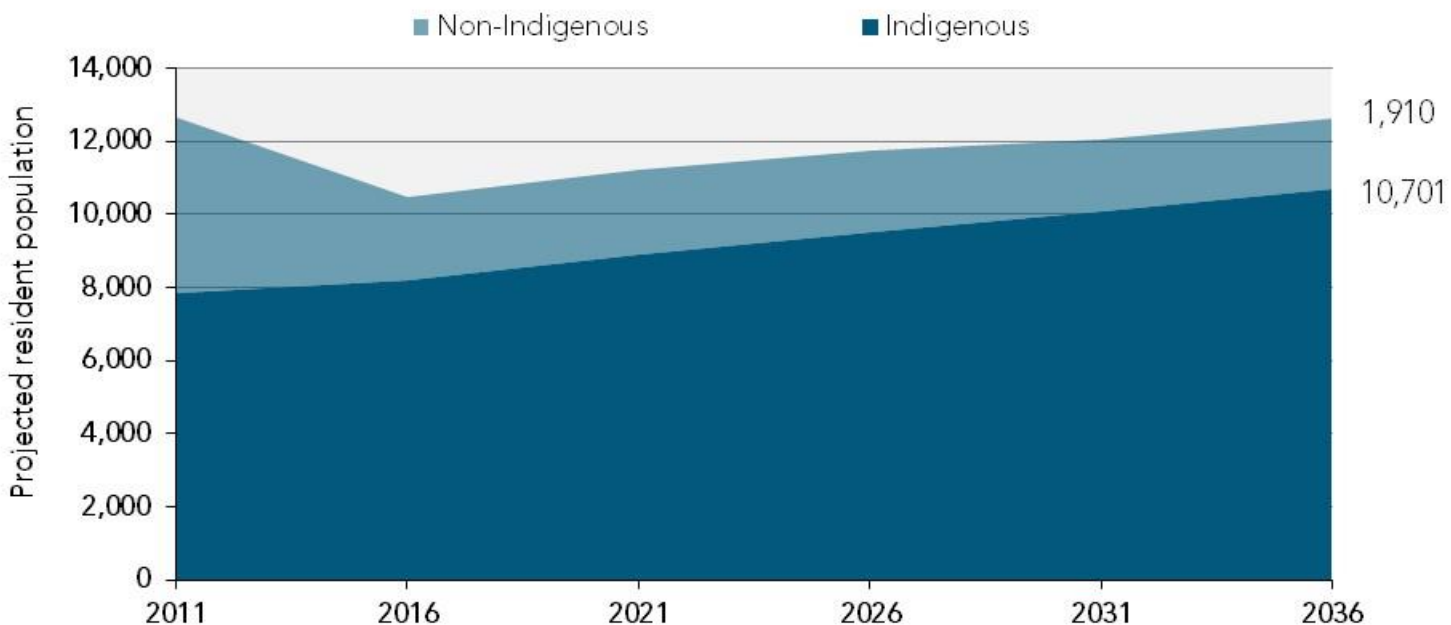


Figure 3: **Business as Usual Population Projection (Gove, 2011-2036)**

Assuming no major economic investment/disinvestment, the Gove Peninsula’s overall population is expected to rebound from its recent, dramatic decline, primarily from natural increase (reflecting a relatively high fertility rate and a declining mortality rate in the Indigenous population). Note that this population estimate includes only mainland populations within the Study Area. Source: Advanced Demographic Modelling, 2018, Geografia, 2018



As noted in Figure 1, the Study Area extends well beyond the geography of the town of Nhulunbuy. Table 1 shows key data inputs (from 2016) to illustrate the difference.

Table 1: Study Area and Nhulunbuy Baseline Data

Variable	Nhulunbuy (Town)	Study Area
Total population	3,710	10,475
Labour force	1,751	2,486
Dwelling count	1,504	3,241

Source: ABS, 2016

In simple terms, the Study Area encompasses around 2.8 times the population of the town of Nhulunbuy, 1.5 times the workforce and 2.2 times the dwelling count.

2.2 Three growth scenarios for the Study Area

Three growth scenarios have been modelled for the Study Area, each of which assumes a different combination of the 23 projects occurring. These scenarios are:

1. **Business as usual** – the primary feature of this scenario is that all currently confirmed/committed investments or disinvestments will occur. This includes the closure and remediation of the Rio Tinto mine, but also the Boarding House construction projects, phase 1 of the Equatorial Launch Area (ELA) project (sounding rockets), and the NDIS rollout. A total of nine of the 23 projects are included in this Scenario. It can be considered a do-nothing trajectory as it assumes no other efforts are made to attract new investment beyond these nine. Note, though, that not all nine projects are 100% certain to occur. Even under this scenario, there are projects at 90% and even 85% certainty. Overall project probability for this scenario is

95%. That is, we are 95% confident that all nine projects will occur.

2. **Steady Growth** – in addition to confirmed (or already underway) investments, a further seven projects occur. This includes phase 2 of the ELA project, and further investment in mining, agriculture, freight infrastructure, road construction and tourism. As per Figure 2 there is a variable degree of confidence that these additional projects will occur and overall, mean project probability is 84%, although the mean probability of the additional seven projects is 70%.
3. **High Growth** – all 23 projects are included in this scenario. In addition to all of the Steady Growth scenario projects, it includes a further seven projects in defence and road infrastructure, fishing industry investments and tourism. Overall, mean project probability is 75%, although the mean probability for the additional seven projects is 55%.

For all scenarios, the Rio mine closes and, as a consequence, the non-Indigenous population declines, in both absolute terms and as a share of the total population (See Appendix 1 for population data on this).

2.3 Modelling the scenarios

Overview

As with the first study, the scenarios are modelled using a Monte Carlo simulation. This assumes a uniformly distributed range around the probability of each project occurring, multiplied by the expected impact of each project. The impact is measured in local jobs (Full Time Equivalent) and Gross Regional Product (GRP).

So, for example, a 90% chance of a project generating 100 jobs, results in a mean job impact of 90 jobs (90% * 100). In addition,



multipliers have been applied to the initial job impact. These were sourced from the DEAL economic impact model.

The model also accounts for timing of both construction (if one exists for a particular project) and operational phases. This means there will be delays, lags and growth/decline stages for most projects. The modelling also assumes there are no constraints on filling jobs or providing the necessary infrastructure to accommodate the jobs (e.g. office space).

Population servicing feedback

Also carried over from the first study is the way feedback effects are managed. The model includes a feedback effect by:

1. Assuming a proportion of each project will attract new residents to the Peninsula⁴.
2. Escalating the number of new residents to account for other household members. This is based on 2016 Census household structure by industry of employment data, which provides us with a way to estimate the probable number of dependents per new worker.
3. Applying service ratios to these new residents. So, for example, NT Government data shows an average of one medical practitioner per 440 residents. Each new resident (and their dependents) increases demand for various services and these ratios are applied to estimate the change in demand for population servicing FTEs⁵.
4. Using the 2016 Census estimate of employment self-containment by industry of employment to estimate how many of these population servicing jobs will be local.
5. Using the NIEIR data to estimate how many of these new jobs need to be filled

by new residents, rather than existing residents.

6. Adding new residents in population servicing roles to the total population estimate.

This feedback effect iterates until there is a negligible effect on population growth. Then overall job, GRP, floorspace and new housing demand estimates are derived.

Estimating job and GRP impacts

To estimate total jobs under each scenario, as noted earlier, a multiplier effect is applied to the initial project impact. This ensures that the additional jobs created by the increased activity are captured in the model. The impact of this on population growth and subsequent population service demand is then included via the feedback effect (i.e. the population growth-induced job creation).

Each job growth scenario has a mean value and an uncertainty band derived from:

1. Variability in projected population growth, as illustrated above.
2. The variability in project job impact (as shown in Figure 2). Additionally, an error value has been added to the population-job ratio (based on Census data from similar regions).
3. Uncertainty about whether each of the 23 investments will be made, and the timing of it (using the probability estimates from Figure 2).

Jobs are reported by industry of employment (ANZSIC 1 division) and categorised as either population servicing (non-tradeable) or export-oriented (tradeable). Gross Regional

⁴ A specified proportion of new jobs are assumed to be taken up by existing residents. The assumptions are from the NIEIR estimates from the Developing East Arnhem Land economic profile service.

⁵ Note that, where possible, a distinction is made between Indigenous and non-Indigenous service demand. Similar distinctions are made (where possible) with respect to fertility rates, labour force participation rates and so forth.



Product has been estimated from this using an input output model.

Estimating floorspace demand

Floorspace demand based on the job growth scenarios has been calculated using standard floorspace-job ratios for different types of use (Table 2). These are:

- **Office**, comprising information media and telecommunications; finance and insurance; professional, scientific and technical services; administrative support; public administration and a share of unknown;
- **Retail**, comprising retail; accommodation and hospitality; rental, hiring and real estate services; and a share of other services and unknown;
- **Industrial**, comprising manufacturing; construction; utilities; wholesale trade; transport, postal and warehousing; and a share of other services and unknown (mining and agriculture are excluded from floorspace calculations);
- **Education**, made up solely of education and training;
- **Health**, made up of health care and social assistance; and
- **Other**, including arts and recreation and a share of unknown.

Table 2: Floorspace-Job Ratios

Use	Ratio (sqm/job)
Office	20 ±0.4
Retail	30 ±0.6
Industrial	100 ±2
Education	80 ±1.6
Health	80 ±1.6
Other	80 ±1.6

Estimating housing demand

New housing demand is based on the estimate of new residents (i.e. that proportion

of new jobs not filled by locals). It is calculated using household structure assumptions from the last three Censuses. Each new household is assumed to require a new dwelling, with household size based on the last three Census averages for both Indigenous and non-Indigenous residents.

As there is currently no reliable estimate of available vacant stock, no assumption is made about how the new dwelling demand is met. That is, whether it requires a new build, or existing stock. However, stakeholder comments suggest there is little to no available housing and so, it is reasonable to assume the derived estimates are for new dwellings. Given the relatively permanent nature of the expected population growth, and based on experience elsewhere in the Territory, one of the key barriers to providing this new stock may be tenure. That is, the capacity for the local housing market to supply stock with a suitable tenure.

Estimating health service demand

Population change will impact on health service demand. Health jobs estimates are included in the results in Section 2.4. These figures are the estimated number of health sector workers one would expect given the size of the population and the historical industry proportions in the Study Area.

However, we also need to estimate *demand* for health services based on average provision ratios. This uses population growth (and change) to estimate demand for specific health services using NT Government provision ratios as the standard. **This is not an estimation of actual jobs expected, but of staff required to service the expected population. It is the ideal outcome for health services.**

To calculate this, NT Government health service worker/resident ratios are used, with



data sourced from the Australian Institute of Health & Welfare. This includes:

- Counts of workers, by 10 different occupations, for the Northern Territory from 2009 to 2015⁶; and
- Average count of beds per 1,000 residents for the Northern Territory from 2012-13 to 2016-17⁷.

These are assumed to be acceptable service provision ratios for NT communities; measured as FTEs or beds per 1,000 residents (Table 3). The ratios have been converted to thresholds. For example, for ATSI health practitioners, for every 1,000 Indigenous residents, we can expect to find 0.82 ± 0.06 practitioners. This means that if the population were to grow by $1,220 \pm 90$ Indigenous residents, we would gain (or lose) one ATSI health practitioner. This is the number of residents who need to leave or arrive before one new FTE would leave or arrive or one bed added or removed such that we maintain the average provision ratios.

As the FTE and bed provision data show no notable trend, the average and standard deviation of the available time series (from 2009-10 to 2016-17) have been used for the provision ratios and subsequent thresholds. For example, data for NT bed counts per 1,000 residents showed a range from 2.9 in 2009-10 to 2.51 in 2016-17. This equates to 2.8 ± 0.12 beds per 1,000 residents and a threshold of 360 ± 15 .

Table 3: Health Worker and Bed Count Ratios

Service	FTEs or beds/1,000	Popn/1 FTE
ATSI health practitioner	0.82 ± 0.06	$1,220 \pm 90$
Dentist	0.38 ± 0.02	$2,581 \pm 150$
Medical Practitioner	4.7 ± 0.08	212 ± 8
Optometrist	0.14 ± 0.01	$7,011 \pm 515$
Pharmacist	0.71 ± 0.05	$1,413 \pm 99$
Physiotherapist	0.58 ± 0.3	$1,724 \pm 116$
Podiatrist	0.07 ± 0.01	$15,133 \pm 3,333$
Psychologist	0.77 ± 0.03	$1,295 \pm 62$
Midwife	1.57 ± 0.66	705 ± 199
Registered Nurse	14.3 ± 0.45	70 ± 2.2
Hospital Bed	2.8 ± 0.12	360 ± 15

Source: AIHW, 2017; Geografia, 2018

2.4 Scenario results

Population scenarios

Table 4 shows the estimated population increase to 2036 for the three scenarios. Figure 4 to Figure 6 illustrate these as trajectories from 2016. The lowest estimate across the three scenarios (under BaU) is for 11,757 residents by 2036. This is essentially equivalent to the estimated resident population under the baseline projection from Figure 3. It means little long-term additional impact on population growth from economic growth catalysed by new project investment under this scenario.

By contrast, gains from 'export-oriented' activity will be small simply because of the modest size of the mooted projects. They will, however, be important for attracting new investment and stimulating GRP growth.

⁶ Data has not been updated since 2015.

⁷ Hospital Resources 2016-17, AIHW.



Table 4: Population Growth Estimates

Scenario	Population 2036	Change	Mean value
1. BaU	11,757-13,599	+1,283-2,866	+2,122
2. Steady Growth	12,280-13,649	+1,805-3,174	+2,521
3. High Growth	12,290-13,658	+1,816-3,184	+2,532

Source: Geografia, 2018

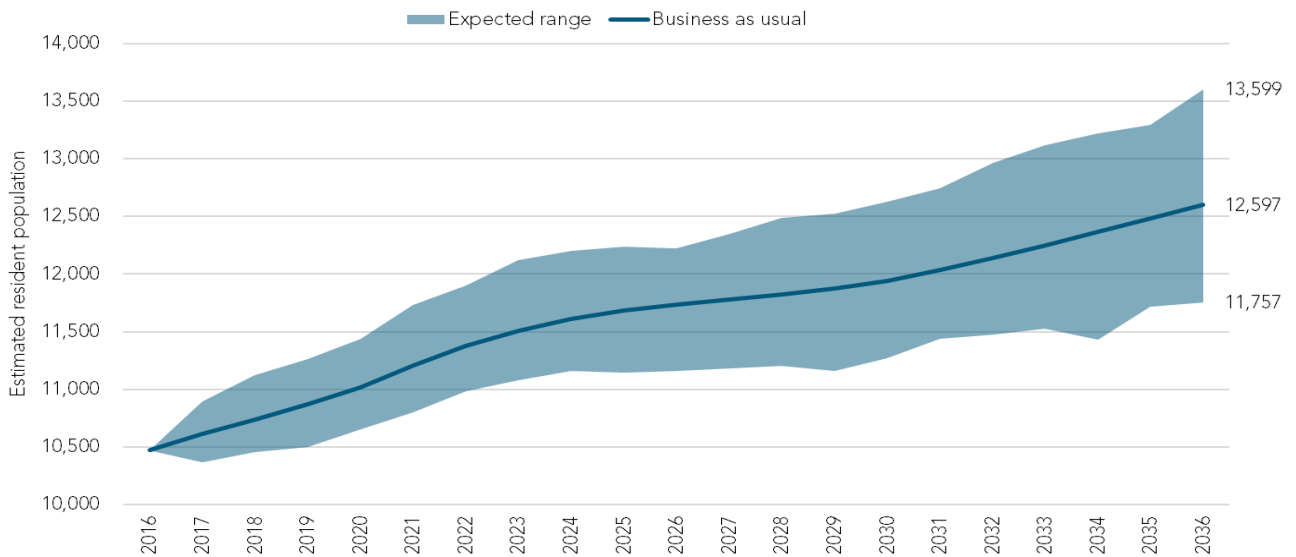


Figure 4: Study Area Population, Business as usual Scenario (2016-2036)

Source: ABS, 2017; Geografia, 2018

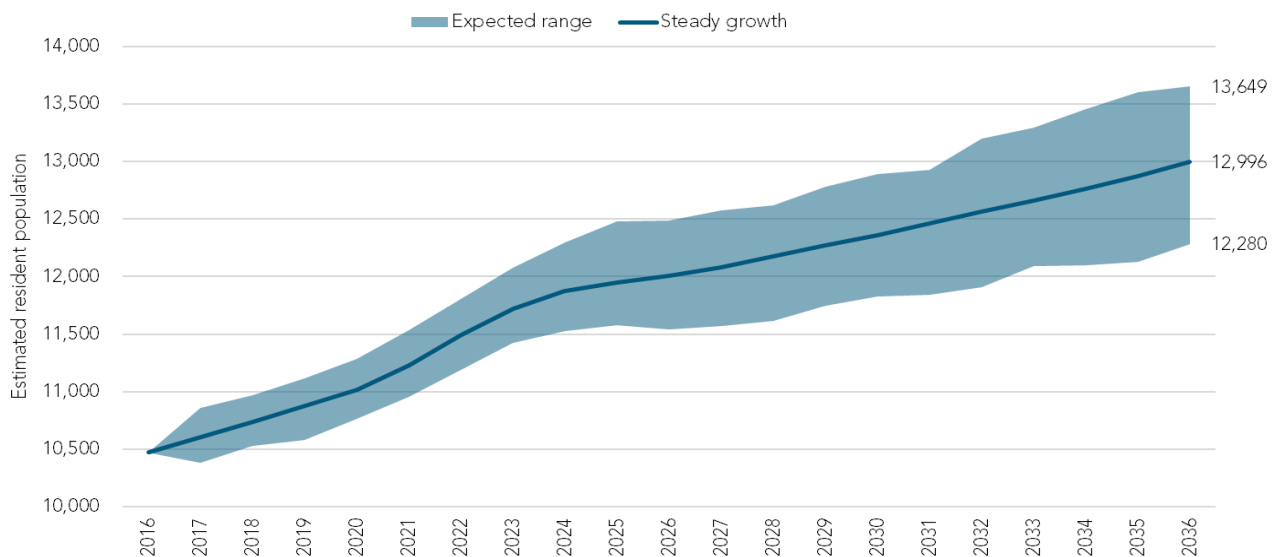


Figure 5: Study Area Population, Steady Growth Scenario (2016-2036)

Source: ABS, 2017; Geografia, 2018



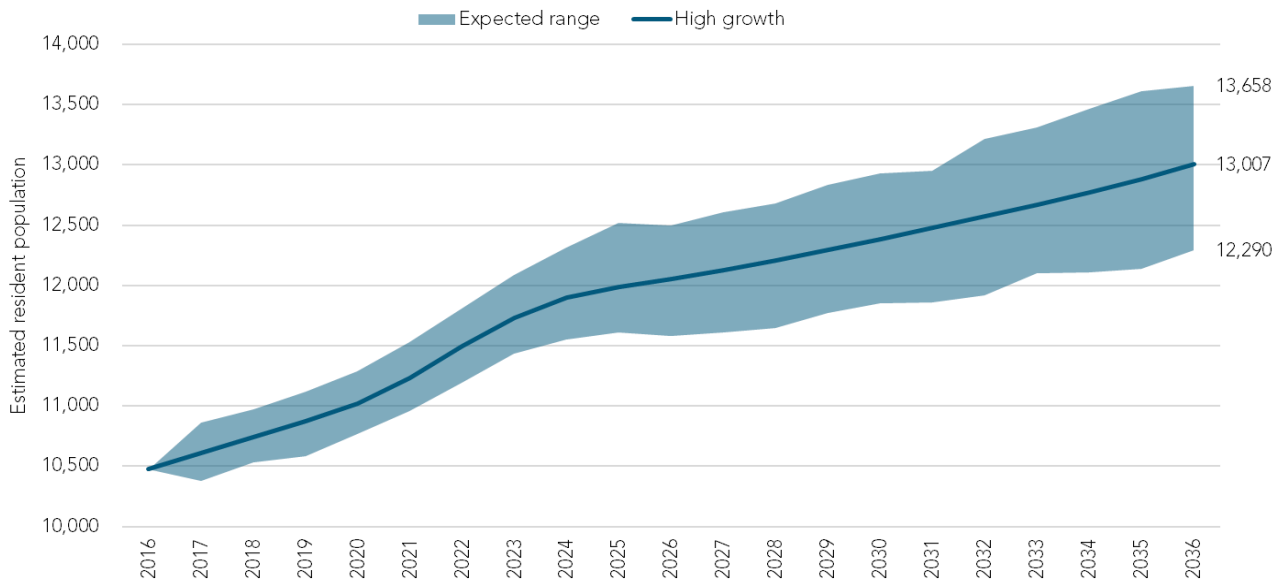


Figure 6: Study Area Population, High Growth Scenario (2016-2036)
 Source: ABS, 2017; Geografia, 2018

Job scenarios

Table 5 summarises the total job estimates for each scenario. The range runs from a loss of close to 210 jobs (Scenario 1, lower bound) and a gain of 34 jobs (Scenario 3, upper bound).

This job loss (or, at best, modest job increase) is the net result by the end of the 20-year period. More revealing is the trajectory of job growth from now until 2036, illustrated in Figure 7 to Figure 9. This shows:

- How the major project investments will drive a significant, albeit temporary, increase in job numbers over the next decade;
- At the peak (which lasts in the order of 2-4 years), the projections suggest somewhere between 600 and 700 additional jobs in the Study Area;
- From now until at least 2031-2, all three scenarios show a net increase in jobs; and
- From 2031-2, the projections indicate the number of jobs in the Study Area will be less than the current number.

Table 6 summarises the mean (net) job growth to 2036 by ANZSIC industry sector. The shading shows losses (red) or gains (blue). The greatest losses for all scenarios are in Mining and Manufacturing (as well as jobs 'inadequately described') and the greatest gains are in population servicing industries like Retail, Health, Education and Other Services, as well as Construction (which is responding to demand from both the local population and the major construction projects expected).



Table 5: Total New Jobs by Scenario (2036)

Scenario	New Jobs	Mean Value	Propn Popn Servicing Growth
1. Business as Usual	-210 to -34	-136	100%
2. Steady Growth	-170 to 17	-90	100%
3. High Growth	-158 to 34	-77	100%

The figures here are the net increase in jobs from 2016-2036; showing the 90% confidence interval for the range; the mean value for the estimate; and the proportion of these jobs that can be considered population servicing. As with the first iteration of this study, most of the job losses are in export-oriented jobs, but more of the gains in the higher growth scenarios are in population servicing activities. Source: Geografia, 2018

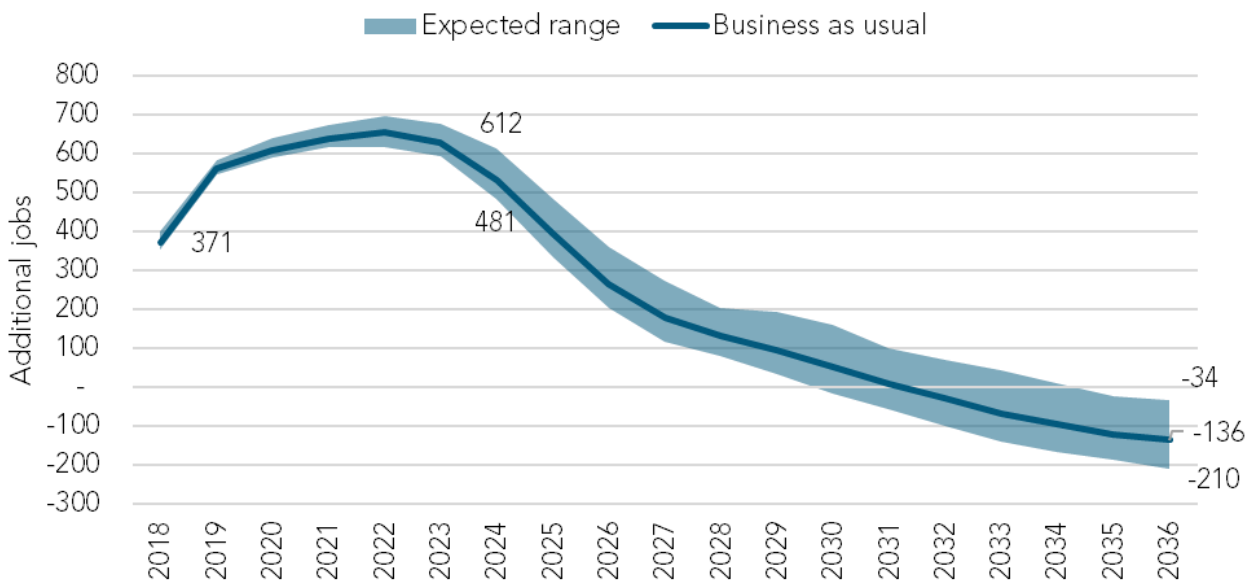


Figure 7: Study Area New Jobs, Business as Usual Scenario (2018-2036)

Source: Geografia, 2018

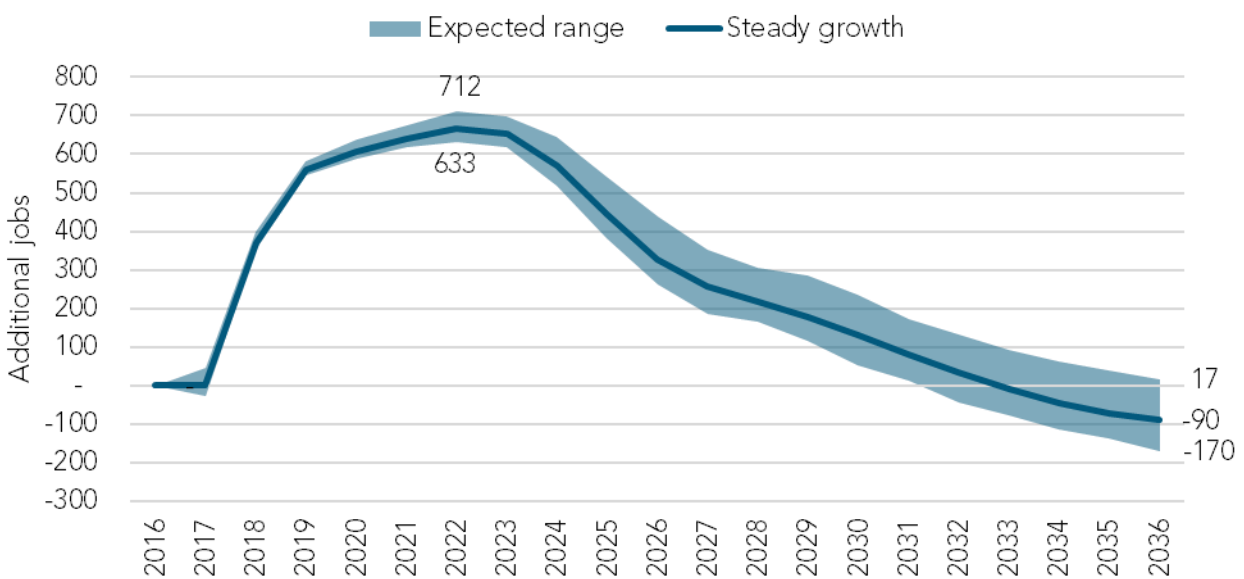


Figure 8: Study Area New Jobs, Steady Growth Scenario (2016-2036)

Source: Geografia, 2018



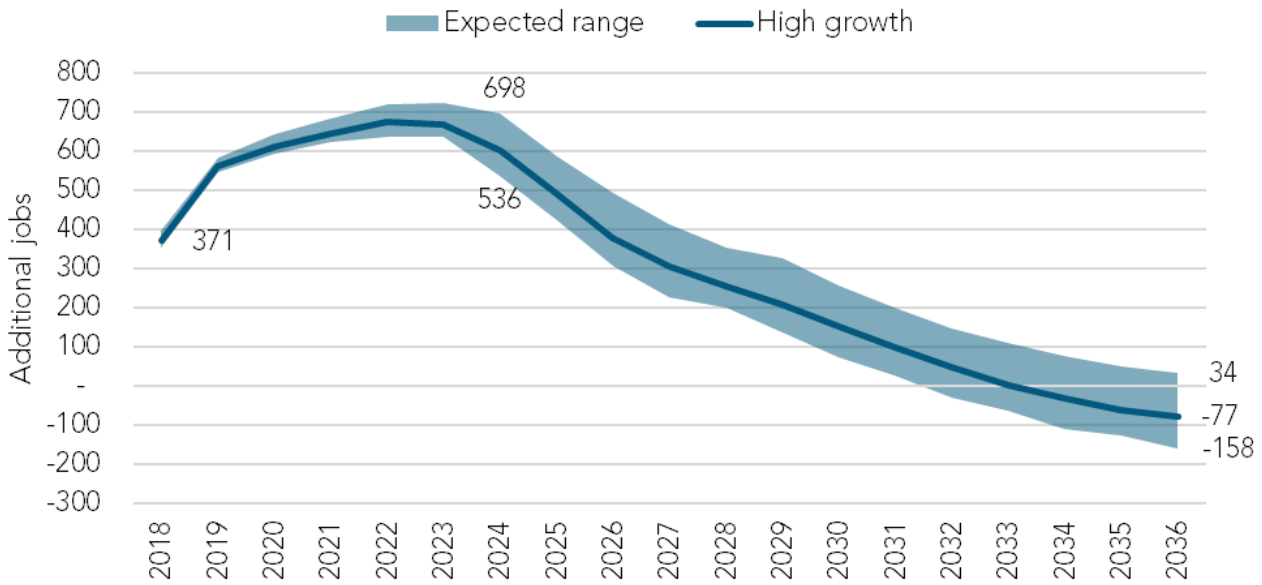


Figure 9: Study Area New Jobs, High Growth Scenario (2016-2036)

Source: Geografia, 2018

Table 6: Mean Additional Jobs by Scenario and Industry (2036)

Industry of Employment	1. BAU	2. Steady	3. High
Agriculture, Forestry and Fishing	-4	3	7
Mining	-598	-583	-583
Manufacturing	-28	-25	-24
Electricity, Gas, Water and Waste Services	-3	-3	-3
Construction	146	150	151
Wholesale Trade	-3	-2	-2
Retail Trade	96	96	96
Accommodation and Food Services	-9	-9	-7
Transport, Postal and Warehousing	17	19	19
Information Media and Telecommunications	8	8	8
Financial and Insurance Services	-13	-12	-12
Rental, Hiring and Real Estate Services	25	26	26
Professional, Scientific and Technical Services	-16	-14	-14
Administrative and Support Services	-12	-11	-11
Public Administration and Safety	-13	-13	-13
Education and Training	20	20	20
Health Care and Social Assistance	133	135	135
Arts and Recreation Services	-2	-2	-2
Other Services	197	197	198
Inadequately described	-77	-69	-67
TOTAL	-136	-90	-77

Red shading highlights the lowest growth (or decline) in count of jobs by industry, yellow/green a mid-range change and blue, increases in employment by industry. Positive numbers are bolded. Note that due to rounding errors, the total of the mean estimates by industry do not match those of the mean estimates by scenario as per Table 4. Source: Geografia, 2018



Jobs by type

As noted earlier, much of the decline in job numbers is likely to come from a decline in export-oriented activity (primarily mining). The most stable growth is expected from population servicing activity (such as health and education), although agriculture and defence and temporary construction works are also expected to have a notable impact.

In net terms, by 2036, population servicing activity accounts for 100% of new jobs under all three scenarios. (Figure 10). However, during the period to 2036, export-oriented job losses are expected in most sectors, but particularly Construction, Mining, Retail and Other Services. This net job loss conceals some small gains expected in some export-oriented project investments, including in tourism and fishing.

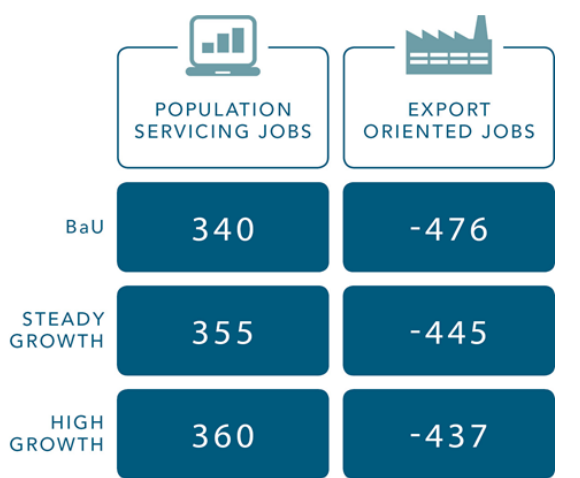


Figure 10: New Jobs by Type (2036)

This shows the net gain (or loss) in total jobs by 2036 for each scenario and split by population servicing and export-oriented jobs. Source: Geografia, 2018

The growing jobs deficit⁸

To compare the population and job growth scenarios, the ratio of the absolute annual increase in jobs and in population for each year has been plotted in Figure 11. It means that after around 2022, the rate of population growth starts to exceed the rate of new job growth. By the end of the 20-year period, this returns to zero (that is, there are as many new jobs per year as there are new residents – both of which are growing at a very low rate by this stage). This comparison, of course, presumes no new investment projects (beyond the 23) occur over this period.

A job-population ratio below 1.0 indicates a move towards a higher dependency ratio (that is, more people not working, than working)⁹

Assuming the labour force participation rate stays fixed, the gap between job demand and job supply increases under all three scenarios and the job deficit grows. Figure 12 compares the estimated new job range and the estimated range of prospective new workers¹⁰ for 2036 based on the 2016 estimated baseline. In all three scenarios, there is greater potential demand for jobs than there are jobs available and, so, the job deficit increases.

Table 7 shows the size of the expected job deficit by 2036 for each scenario. It means that, by 2036, there will be an undersupply of jobs of between 482 and 578, relative to the current status of jobs per labour force participant. Obviously (given the trajectories seen in Figure 7 to Figure 9), there is an oversupply of jobs relative to resident workforce size during the peak mid-2020s period.

⁸ In this analysis, it is measured as the total new residents minus the total new jobs.

⁹ This is the ratio of working to non-working residents.

¹⁰ This factors in the current labour force participation rate for Indigenous and non-Indigenous residents based on the average participation rates for the 2016 Census.



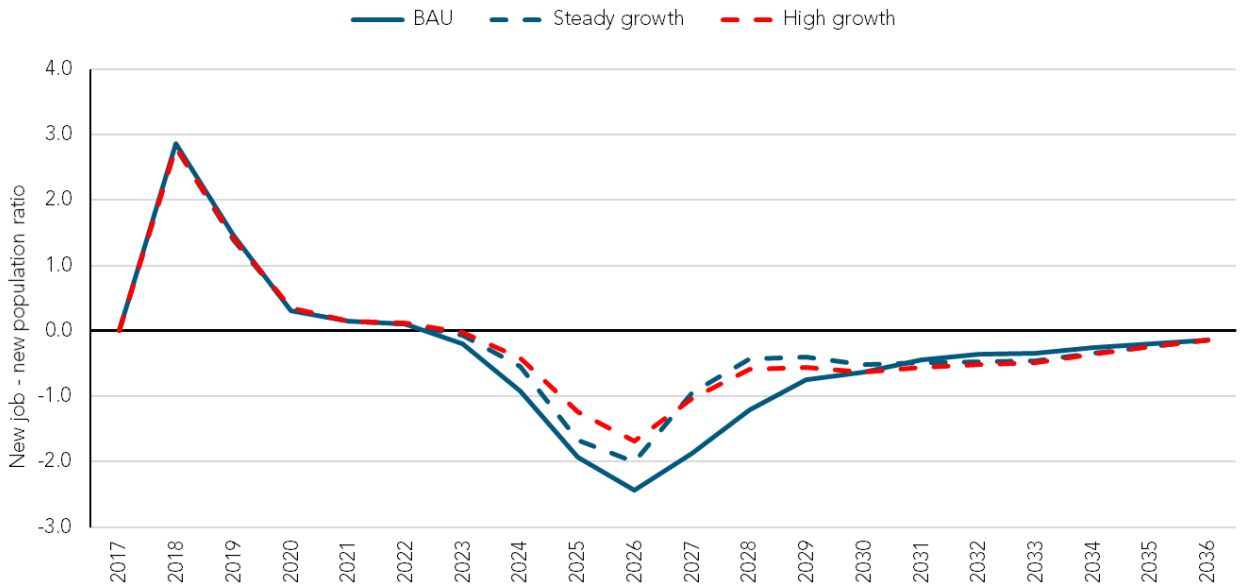


Figure 11: Comparing Job and Population Growth by Scenario (2016-2036)

This shows the new job-population ratio for 2016 to 2036. That is, how many new jobs there are for each new resident. It shows that, for most scenarios, the ratio of jobs to population declines post 2022. This shows that, for example, in 2026, the rate at which the gap between jobs and residents is growing, is at its fastest and there are fewer workers compared with non-workers. In fundamental terms, the higher the line above zero, the better for the economy. This gap reaches its maximum extent in 2036 when the pace of the growth in the gap has slowed down. Source: Geografia, 2018

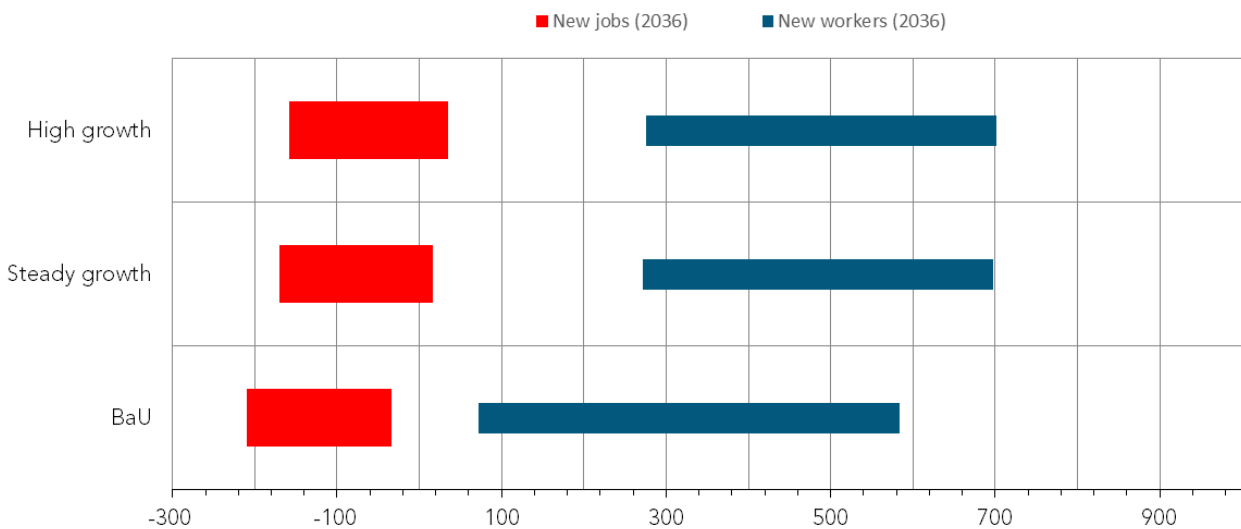


Figure 12: Mean New Workers and New Jobs (2036)

This shows the estimated number of new jobs and new prospective resident workers in 2036 (the baseline is 2016). No scenario decreases the job deficit in the Study Area. This shows that, for example, under BaU, there may be somewhere between 71 and 512 new workers, but somewhere between -34 and -177 fewer jobs. Source: Geografia, 2018



Table 7: Mean Change in Labour Force, Job Count, Job Deficit and Dependency Ratio

Scenario	Change in Labour Force	Change in Job Count	Job Deficit	Dependency Ratio
1. BaU	+2,833	-136	+482	3.44
2. Steady Growth	+2,984	-90	+587	3.36
3. High Growth	+2,987	-77	+578	3.35

This shows that, counterintuitively, the gap between the labour force size and the available jobs (the jobs deficit) is highest under the High Growth scenario. However, this is due to the higher number of working age residents in the population. The dependency ratio (the ratio of working residents to non-working residents) is slightly larger under BaU, although, given the uncertainty in these estimates, the difference is negligible.

Source: Geografia, 2018

Automation and participation

The estimated job deficit for 2036 has been calculated using fixed labour force participation rates for the Indigenous and Non-Indigenous populations, adjusting for the slight change in the age profile expected during this period. However, job automation has not been included in these calculations.

Research suggests an average of around 20-25% of all current job will simply not exist in 20 years. However, given there is still insufficient evidence to be certain whether other (particularly personal service and high skilled) jobs may emerge to replace those lost to automation, we cannot yet confidently state what this may mean for the job-population ratio.

GRP impacts

In addition to job growth, the 23 projects will also have an impact on Gross Regional Product (GRP): both short-term (from construction) and longer term (from the operational phase).

Running the net job growth impacts through a regional inter-industry model composed at Shire level, produces estimates for the impact on GRP from each scenario.

Table 8 shows the net change in GRP for the entire East Arnhem economy based on the mean job impacts for each scenario¹¹.

Under all three scenarios, GRP declines by around 22-23%.

Table 8: GRP Impact (2036)

Scenario	Current GRP	Change in GRP	GRP (2036)
1. BaU	\$1.242b	-\$295m (-23.7%)	\$947m
2. Steady Growth	\$1.242b	-\$285m (-22.9%)	\$957m
3. High Growth	\$1.242b	-\$281m (-22.6%)	\$961m

The figures here are the mean estimates for change in GRP from 2016 to 2036 based on the mean job change estimates from the scenario modelling. All values are real prices. Source: Geografia, 2018, NIEIR, 2018

¹¹ The current figures from the DEAL economic profile data is used as the baseline figures. An inter-industry impact model is used to estimate change based on change in job figures. Note these types of models are static, in that they only estimate the immediate impact of a change in investment, rather than long-term change. The figures should be considered indicative only.



Floorspace demand

Based on the ratios from Table 2 and the job estimate ranges from the three scenarios, total ranged estimates for change in floorspace demand has been calculated. These are changes to the current provision.

As Table 9 shows, total additional floorspace demand ranges from around 30-35,000 sqm.

Table 10 breaks down the floorspace demand by use. The greatest demand, not surprisingly, is for industrial land/floorspace

(which includes Construction, Manufacturing and a portion of Other Services).

Health, Education and Retail floorspace demand is consistently positive across all scenarios (reflecting the growing population). Other (which includes Arts & Recreation Services and 'Inadequately Described') and Office floorspace (which includes most commercial service sector activity excluding Retail) are projected to see a decline in demand¹².

Table 9: Total New Floorspace by Scenario (sqm)

Scenario	Lower Bound	Upper Bound	Mean Value
1. BaU	+30,816	+35,146	+33,642
2. Steady Growth	+31,899	+36,532	+34,927
3. High Growth	+32,123	+37,085	+35,344

Source: Geografia, 2018

Table 10: Mean New Floorspace by Scenario and use (sqm, 2036)

Type	1. BaU	2. Steady Growth	3. High Growth
Office	-1,298	-1,189	-1,153
Retail	5,743	5,840	5,938
Industrial	21,289	22,133	22,381
Education	1,181	1,174	1,175
Health	7,998	8,126	8,126
Other	-1,272	-1,156	-1,122
TOTAL	+33,642	+34,927	+35,344

Source: Geografia, 2018

¹² Note that Floorspace/FTE ratios are kept fixed for these calculations. It is, though, reasonable to conclude that, as some jobs are automated, these ratios will change.



Housing demand impacts

As noted earlier, housing demand is based on the estimates of population growth, using assumptions about household size and formation. It is presented in terms of the net demand for new dwellings, and assumes there is currently no available housing stock. That is, the baseline is zero. It also assumes a one-to-one correlation between households and dwellings.

Table 11 shows the range of expected new dwelling unit demand by scenario. The scenarios are similar in demand profile. This is due to most of the permanent population growth coming from natural increase of the

Indigenous population, which is mostly independent of the 23 projects.

Figure 13 shows the volatility of change in demand by year. The spikes are slightly in advance of the major project development timelines. Average yearly demand is around 34 new dwelling units per annum.

Figure 14 shows the cumulative demand to 2036. Figures for the High Growth scenario are included as labels, although there is very little difference between scenarios.

This dwelling demand growth trajectory assumes there is a one-to-one correlation between households formed (e.g. families, singles, groups) and dwellings required

Table 11: Total New Dwelling Unit Demand (2036)

Scenario	Lower Bound	Upper Bound	Mean Value
1. BaU	+597	+757	+657
2. Steady Growth	+599	+760	+679
3. High Growth	+612	+774	+689

Source: Geografia, 2018

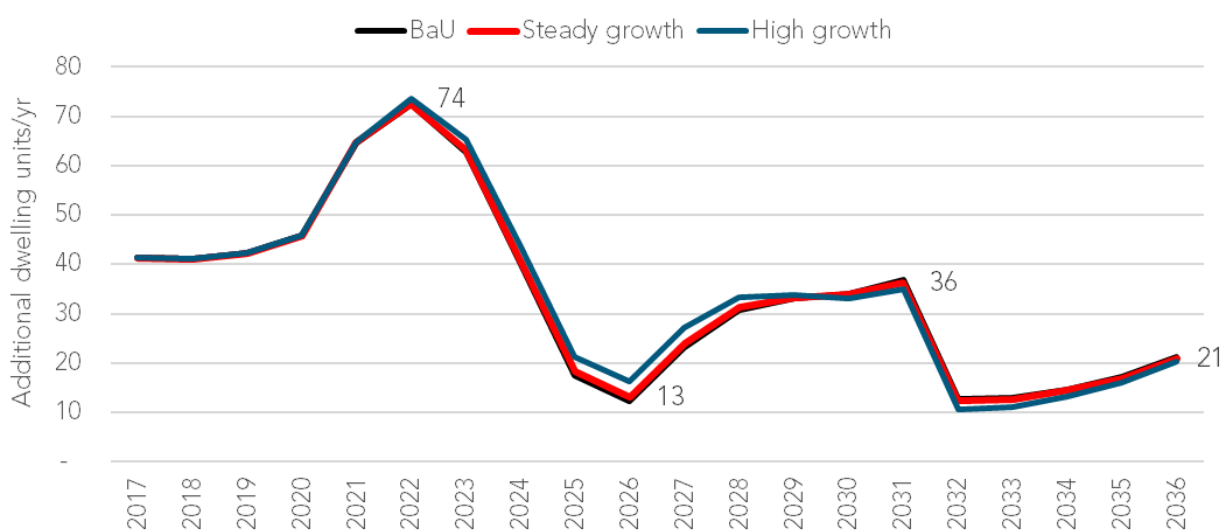


Figure 13: Annual Demand for New Dwelling Units (2017-2036)

Source: Geografia, 2018



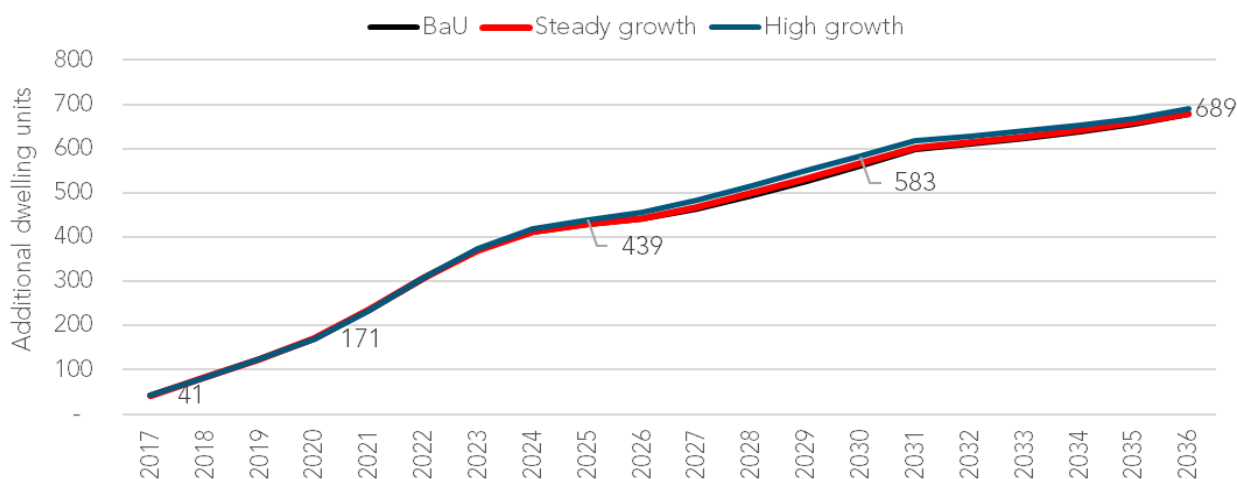


Figure 14: Cumulative Demand for New Dwelling Units (2017-2036)

Source: Geografia, 2018

Health service provisions and thresholds

According to the latest Census count, there are some 443 health workers in the region. Assuming it is still an undersupply as was reported by stakeholders in the 2017 report, and in view of the growing Indigenous population, it is very likely that the gap between supply and demand will grow.

Based on the thresholds outlined in Table 3, and the population forecasts, estimates have been calculated for the change in the number of FTEs by occupation and bed count that

would ensure optimal provision levels for 2036 (Table 12).

Under all scenarios, optimal provision levels increase for all the health occupations modelled, as well as for bed count (which increases from around 30 to between 36 and 40, depending on the population scenario – recall the current hospital bed count is 30).

Table 12: Change in Health Worker and Bed Optimal Provision

Service	Current optimal	Scenario 1	Scenario 2	Scenario 3
ATSI health practitioner	7.8-9.4	+1.9-2.3	+1.9-2.4	+1.9-2.4
Dentist	3.7-4.4	+0.8-1.1	+0.8-1.1	+0.8-1.1
Medical Practitioner	48.3-50.4	+10.7-12.9	+10.8-13.2	+11.0-13.2
Optometrist	1.4-1.6	+0.3-0.4	+0.3-0.4	+0.3-0.4
Pharmacist	6.8-8.1	+1.7-2.0	+1.7-2.0	+1.7-2.0
Physiotherapist	5.6-6.6	+1.3-1.6	+1.3-1.6	+1.3-1.6
Podiatrist	0.5-0.9	+0.1-0.2	+0.1-0.2	+0.1-0.2
Psychologist	7.6-8.6	+1.9-2.0	+1.9-2.0	+1.9-2.0
Midwife	7.5-25.4	+1.5-3.1	+1.6-3.2	+1.6-3.2
Registered Nurse	143.5-156.3	+32.2-41.7	+32.9-42.2	+33.3-42.3
Hospital Beds	29-32	+6.8-8.1	+6.9-8.2	+6.9-8.2

Source: Geografia, 2018



3.0 Implications

Since the last report (in which three key changes were flagged), there are now only two major drivers of the future population and economic prospects for Gove: 1) the projected natural increase in the Indigenous population; and 2) the 23 prospective project investments. Given some of the larger of the 23 projects are expected for all three scenarios (e.g. the Rio mine closure and remediation), it means the difference between them is now much smaller. In all three scenarios, we can expect modest growth over the long-term with some medium term (i.e. over the next 10 years) spikes in activity, service and facility demand. In all three cases, though, any growth is contingent on population servicing activity being delivered locally and not remotely and on acting now to ensure there are no bottlenecks that undermine the opportunities emerging from the 23 projects.

3.1 Summary of projections

Population

- The estimated resident population of the region is expected to grow under all three scenarios and, at a minimum, return to its pre-refinery closure population (2011 Census) by 2036;
- The Indigenous population is expected to account for almost all the population growth and, consequently, make up a much larger share of the total population by 2036 (from under 80% to around 85% of the resident population);

Jobs

- Overall, all three scenarios show a net loss in jobs compared with a 2016 baseline. However, in the short to medium-term, there will be significant spikes (of some 3-5 years' duration) in the order of 600-700 additional jobs;
- Population servicing jobs (e.g. in health, education, administration and retail) are expected to grow by around 350 net new jobs, but export-oriented jobs will decline by around 450 net jobs;

GRP

- GRP is expected to decline by around 22-23% or \$281-295m (based on a measure for the entire Shire);

Floorspace

- Floorspace demand will be largely driven by industrial space requirements, varying around 33-35,000 sqm of additional requirements, of which, 21-22,000 sqm (one third) is industrial and 8,000 sqm demand for additional health services floorspace;

Housing market trends

- Demand for additional dwelling units is expected to result in a net total demand of around 689 new dwellings by 2036, averaging 34 new dwelling units required per annum (although with some volatility);

Health service provision levels

- Underlying population growth, including an increase in the Indigenous population, is expected to increase demand for health service workers



(between 52-69 new health service workers) and hospital beds (between 6.8 and 8.2 beds – not accounting for any current undersupply); that is

- The population is not expected to drop below any thresholds that might see a loss in total service provision (as measured by optimal FTE and bed count).

3.2 Implications

In the previous report, six implications of the impact of the (then) 22 projects and the underlying population forecasts were identified and discussed. These have been revisited and revised in light of new information and modelling results. Where the implications are still valid, they are described below (with some minor amendments).

5. *A return to a pre-closure population size*

Already we have seen quite a strong bounce-back in population size after a significant decline post the refinery closure. This is expected to continue through a combination of natural increase and project investments. At least for the next decade or so, and assuming the 23 projects proceed (using the probabilities included here), the population should continue to grow slowly increasing by a further 2-3,000.

6. *Staying export oriented*

As was concluded in the previous report, it is still considered critical that strategies are implemented to ensure the Peninsula retains some export-oriented activity. This will attract the investment (and therefore jobs) necessary to sustainably support the population beyond 2036 and ensure amenities and services are maintained to a standard high enough to retain residents. For example, population servicing activities are always at risk of being

delivered remotely, or having service provision levels lowered.

7. *Education, training, innovation and collaboration*

As the share of total resident population made up by the Indigenous community increases and new industries are needed to replace the current ones, there will be a greater need to invest in education and training specific to the new industry prospects. This includes everything from hospitality training, to health services and manufacturing.

8. *Remote versus local*

Further analysis is needed to quantify the potential effects of critical servicing and staffing policies (such as FIFO) and business, government and household expenditure escape rates (which, based on bank transaction data reviewed during this study, are relatively high). Future employment self-containment ratios will be sensitive to these factors.

As part of this, and mindful of any existing local, or Territory policy obligations, it may be worth investigating the costs and benefits of a local procurement policy.

3.3 Concluding statement

Given the expected closure of the Rio mine operations, time is of the essence. There is also imminent major project activity that may place short-term pressure on existing services and facilities. Both of these 'shocks' need to be planned for so that Gove's economy can manage the challenges ahead, and benefit from the opportunities presented by the 23 projects.



4.0 Appendix 1

The following additional data is provided for information. It shows the mean estimated population for each scenario broken down by Indigenous and non-Indigenous residents. Also included are:

- The lower bound of the BaU Scenario, which represents the lowest estimated population trajectory; and
- The upper bound for the High Growth (HG) Scenario, which is the highest estimated population trajectory.

Table 13: Indigenous and non-Indigenous Estimated Resident Population (2016-2036)

Estimate	2016	2021	2026	2031	2036
BaU					
Mean	10,475	11,207	11,736	12,033	12,597
<i>Indigenous</i>	8,204	8,897	9,563	10,168	10,821
<i>Non-Indigenous</i>	2,271	2,310	2,173	1,866	1,776
Steady Growth					
Mean	10,475	11,233	12,007	12,463	12,996
<i>Indigenous</i>	8,204	8,899	9,579	10,188	10,834
<i>Non-Indigenous</i>	2,271	2,336	2,428	2,276	2,162
High Growth					
Mean	10,475	11,234	12,052	12,480	13,007
<i>Indigenous</i>	8,204	8,905	9,592	10,193	10,897
<i>Non-Indigenous</i>	2,271	2,337	2,459	2,287	2,170
Range					
Lower Bound (BaU)	10,475	10,798	11,157	11,442	11,757
<i>Indigenous</i>	8,100	8,727	9,345	9,887	10,461
<i>Non-Indigenous</i>	2,374	2,070	1,812	1,555	1,296
Upper Bound (HG)	10,475	11,533	12,497	12,953	13,658
<i>Indigenous</i>	8,311	9,061	9,855	10,500	11,216
<i>Non-Indigenous</i>	2,163	2,471	2,642	2,453	2,442

Source: Geografia, 2018

