



NCEconomics

# Paradise Dam Improvement Project: Economic Impact Assessment

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## EXECUTIVE SUMMARY

The Bundaberg Local Government Area (LGA) is experiencing a major structural shift, with irrigated agriculture expanding and transforming to higher value crops. This includes significant investment from southern Australian States and internationally as the regions' competitive advantages are realised (including reliable water allocations).

This analysis has used an Input-Output (I-O) economic modelling approach to estimate the impacts on the economy attributable to the Paradise Dam Improvement Project including the first proposed tranche of the distribution system augmentation, specifically it assesses:

- The impacts of the construction phase (Dam improvement and distribution system), based on an average annual spend across the construction phase.
- A series of impact assessments for 2030, 2040 and 2050 as representative years for the operational phase of the project. This modelling assesses the impact of the expansion and changed crop mix for irrigated agriculture on the Bundaberg economy. For each year, two demand projections are assessed – the P50 (more likely) demand and the P90 (higher end) demand.<sup>1</sup>

### Construction phase impacts

A substantial economic stimulus impact during the construction phase for the Dam Improvement Works and raising the spillway back to the previous full supply level is expected. Due to the location of the actual Dam, the largest stimulus is estimated for the neighbouring North Burnett LGA, where gains of around \$70M in GRP are expected. Bundaberg is estimated to benefit from the works on the distribution system (around \$5M per annum), while significant expenditure on inputs such as technical design and project management will ultimately benefit regions such as Brisbane (where the specialist inputs are located). The construction phase is expected to be a significant direct and indirect employment generator for the duration of the construction phase. This will provide significant opportunities for workers in the broader North Burnett and Bundaberg regions as well as for providers of labour inputs from outside the region.

### Operational phase impacts

The operational economic impacts reflect the growth of water use and the change in the irrigated crop mix over the long-term. Higher levels of demand for the Paradise Dam's water as a result of larger increases in the area of irrigated agricultural land are within the forecast range of future water demand. The direct impacts and much of the indirect impacts of the operational phase will be captured within the Bundaberg economy. Based on projected changes in land use and water demand, it is expected that by 2050:

- Direct impacts on Gross Regional Product (GRP) are estimated to be between \$108 and \$182 million for the P50 (more likely) and P90 (higher end) demand estimates respectively. Including indirect impacts, GRP is estimated to be between \$238 and \$402 million for the P50 and P90 demand estimates respectively – 5.6 to 9.4% higher than the most recent available estimate.
- The corresponding impact on total full time equivalent employment by 2050 is an increase of between 6.2% and 10.6% over current total employment in the Bundaberg LGA.

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<sup>1</sup> P50 means that 50% of all estimates are less than that volume. P90 means that 90% of all estimates are less than that volume.

This growth will occur over the next 30 years as the region's competitive advantages are realised. In addition, the community will benefit from the dam safety improvements as soon as that work is finalised.

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# 1 CONTEXT AND PURPOSE

## 1.1 Current economic context

The Bundaberg Local Government Area (LGA) is experiencing a major structural shift, with irrigated agriculture expanding and transforming to higher value crops. This includes significant investment from southern Australian States and internationally as the regions' competitive advantages are realised (including reliable water allocations).

Investor interest is focussed on areas in the broader region already serviced by irrigation services such as Bundaberg and Lower Mary where incremental expansions to services are possible. However, interest is also increasing in regions that are currently not serviced by major infrastructure such as the Coalstoun Lakes area.

The analysis in the report focusses on the economic impacts of development directly related to the Paradise Dam Project.

The agricultural and manufacturing industries in the Bundaberg Regional Council (BRC) region play significant economic roles. In 2018/2019, agricultural output accounted for \$1,022m, worth 13% of the entire output value for the BRC region<sup>2</sup>.

For context, the same sector contributed 3% of Queensland's output. Within the manufacturing sector, which has a total value of \$1,082m, 46% of the output value in the BRC region was derived from food product manufacturing (predominantly sugar mills), compared to 30% across Queensland. The economic value-add for those two industries stood at \$440m and \$348m respectively, representing 12% and 10% of total value-add for the BRC region.

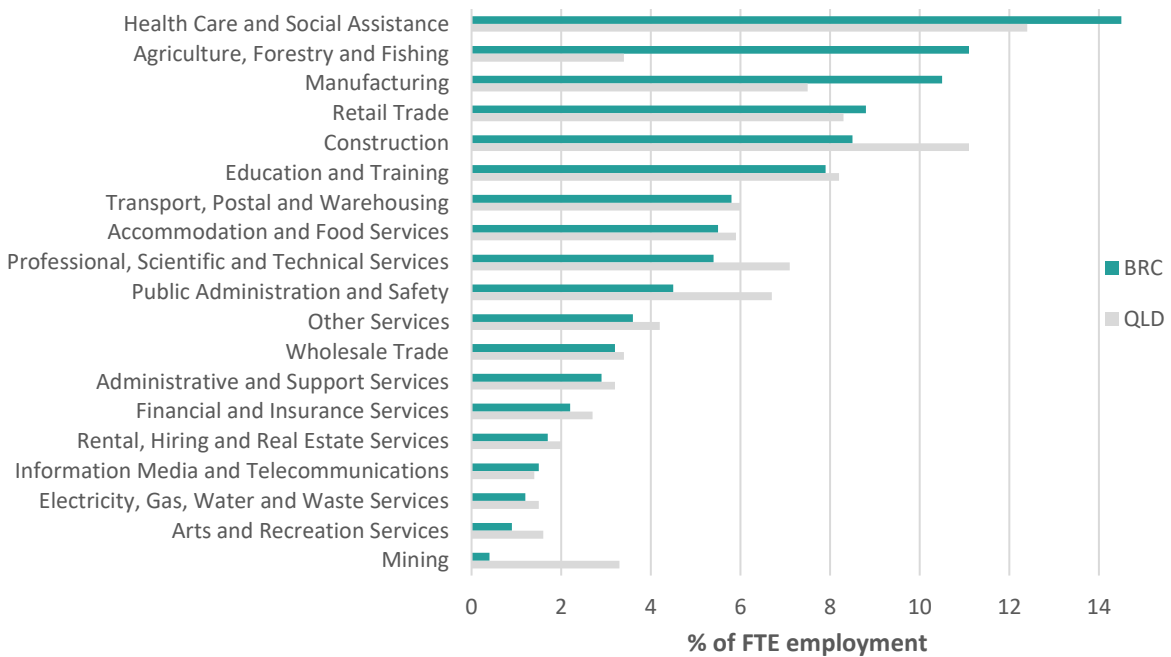
The relative proportion of full-time equivalent (FTE) employment in key sectors in the BRC and Queensland are shown below. The data indicates that the economy in BRC is significantly more concentrated towards agriculture and associated economic activity than the State as a whole.

Of the estimated 36,500 employed in the BRC LGA, 12% are employed in agriculture (which is largely irrigated), forestry, and fishing, and a further 11% employed in manufacturing (a sector dominated by food processing). These employment figures are higher than the State level (agriculture – 3%, manufacturing – 8%). This industrial concentration can also be described by the number of businesses in the region. Agriculture, forestry and fishing constitute 21% of all businesses in the BRC region, compared to 9% across Queensland.

Given that the local economy in the BRC LGA is highly reliant on the irrigated agricultural industry, ensuring consistent irrigation is essential for long-term economic prosperity and employment in the region.

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<sup>2</sup> National Institute of Economic and Industry Research (NIEIR) 2019. Compiled and presented in economy.id by .id informed decisions. Data are based on a 2016-17 price base for all years. NIEIR-ID data are inflation adjusted each year to allow direct comparison, and annual data releases adjust previous years' figures to a new base year.



**Figure 1. Structure of economy based on employment by industry (BRC vs. Queensland)**

Source: National Institute of Economic and Industry Research (NIEIR) 2019

**Key point**

Irrigated agriculture is a major contributor to the Bundaberg economy. The sector is expanding, and the crop mix is changing to higher value crops, as domestic and international investors recognise the region’s competitive advantages, including reliable water resources.

**1.2 Report purpose**

A detailed demand assessment has been completed for the Paradise Dam Project including projections for the demand for water from Paradise Dam out to 2050, including a range of estimates for Medium Priority (MP) and High Priority (HP) allocation requirements over the forecast period. Building on this information, a cost-benefit analysis (CBA) was undertaken to inform the decision on future works on the Dam as part of the Business Case.

An Economic Impact Assessment (EIA) complements the CBA by providing valuable information on the broader economic impacts of the project that may not be fully captured in a CBA. The EIA undertaken for the Paradise Dam Project considers the economic impacts of the infrastructure works (Paradise Dam Option 1 plus the first tranche of the distribution channel upgrades) and the expanded irrigation production (based on the demand projections used in the business case).

The purpose of this report is to provide estimates of the economic impacts out to 2050 of projected changes in land use and water demand supported by the Paradise Dam capital works, including output and employment impacts in the BRC. The economic impacts are estimated using input-output (I-O) analysis, which provides an estimate of the flow-on effects arising from the additional spending expected in the regional economy as a consequence of the project. This includes the initial spending on the capital works and ongoing increases in spending arising from increased activity in irrigated agricultural enterprises supplied with the extra water made available by the capital works.

**Key point**

This EIA provides estimates of the economic impacts of the Paradise Dam Project using an Input-Output modelling approach.

## 2 APPROACH

An Economic Impact Assessment (EIA) can complement the cost-benefit analysis (CBA) undertaken for the Business Case. Although not a substitute for the rigorous CBA, it still provides valuable information on the broader economic impacts of the project, which can assist decision-makers. An EIA was undertaken for the Project. This assessment considers the economic impacts of the infrastructure works (Paradise Dam Option 1 plus the first tranche of the distribution channel upgrades) and the expanded irrigation production (based on the demand projections used in the business case).

The approach to the economic impact assessment (EIA) is to conduct an input-output (I-O) analysis of the dam works and supporting water delivery infrastructure upgrades. I-O analysis provides an approach to estimate how economic impacts of a specific project can flow through an economy ("flow-on effects"). The approach involves the estimation of a model of a regional economy in which transactions between industry sectors, the household sectors, and the economy outside of the region are summarised in a matrix. An I-O analysis typically estimates economic impacts in terms of changes in employment, expenditure and incomes. This provides an initial indication of the potential size of impacts and their distribution between sectors of the economy.

The approach taken to assess the economic impact of the proposed Paradise Dam works draws on a national accounting approach, scaled down to the regional level, to estimate the economic impacts of the developments on the region's Gross Regional Product (GRP) and employment (both direct and indirect). GRP is calculated as the value of output less the cost of goods and services used in producing the output (or as the sum of all incomes earned in wages by households, gross operating surplus earned by firms and taxes earned by the government). The I-O model used for this analysis was the AURIN Economic Impact Tool<sup>3</sup>. As with most I-O models, the AURIN model is static (single year). The approach adopted was to estimate the economic impacts for a series of representative years across the project cycle, specifically:

- A representative year for the construction phase. This was based on the cost estimates outlined in the business case. For the construction phase, the expenditure would occur primarily across three LGAs, North Burnett (Dam site), Bundaberg (distribution system augmentations) and Brisbane (many of the professional inputs such as design and management, etc.).
- A series of years for the operational phase of the project, specifically 2030, 2040, 2050. This was based on the water demand, irrigated production volumes and associated economic data used for the business case. Given the uncertainty in demand estimates, estimates for the P50 (more likely demand) and P90 (more optimistic) water demand were assessed. For simplicity, this was all assumed to occur in the Bundaberg LGA as that is the location of the irrigation activity.
- There are a number of limitations associated with the AURIN model and the I-O approach more generally, which influence the interpretation of the results. These limitations were discussed by the Productivity Commission (2013) and the degree to which they apply to the current situation are summarised in terms of the following five aspects of the I-O approach<sup>4</sup>:
  - Lack of supply-side constraints – it was assumed that extra output can be produced in one area of activity, such as irrigated agriculture, without taking away resources (e.g., labour) from other activities. Actual impacts would be dependent on the availability of appropriate labour and capital and other productive inputs, which depends on factors

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<sup>3</sup> The Economic Impact Analysis Tool (EIAT) is available here: <http://eiat.aurin.org.au/#/eiat/home>

<sup>4</sup> Gretton, P. (2013) On input-output tables: uses and abuses, Staff Research Note, Productivity Commission, Canberra.



such as the unemployment rate in regions that could potentially supply those inputs. In this regard, it can be noted that unemployment has increased over the past year in the BRC, and that substantial underemployment exists there. Many local workers have low levels of formal qualifications but could successfully contribute to the agricultural sector, potentially increasing the impact of infrastructure investments such as the Paradise Dam works.

- Fixed prices – it was assumed that the effects of relative price changes played no role in the allocation of scarce resources between activities. Actual impacts would be affected by relative price changes due to constraints on the availability of labour, capital and other inputs and policy changes. This is a limitation of I-O modelling in general, particularly as the model parameters are generated using data that may not reflect current prices of inputs in key sectors.
- Fixed ratios between intermediate inputs to production and outputs from production – it was assumed that these ratios will not change when output increases in response to the infrastructure investment. This excludes consideration of potential changes in these ratios compared with statewide averages arising from case-specific factors including the production technology used and the degree to which capital is imported into the region (e.g. specialist earth moving equipment). Actual impacts could be affected by changes in production technologies such as more efficient irrigation technologies. This could result in the flow-on benefits being overestimated.
- No allowance for household purchasers' marginal responses to changes in their income and the relative prices they face in making purchasing decisions. In particular, it was assumed that households do not change the share of their budgets allocated to different goods and services when household income and relative prices change. In practice, the level and composition of household purchases would potentially be affected by income and relative price changes.
- Absence of budget constraints – it was assumed that changes in household or government consumption occur without reducing demand elsewhere. In practice, the level of consumption expenditure by households and government would be budget-constrained.

These limitations have no influence on the estimated direct economic impacts of the establishment and operational phases. However, they mean that the **estimates of flow-on benefits should be treated with caution as they are potentially over-estimated.**

#### **Key point**

The I-O modelling provides an initial estimate of the impact of project expenditures on employment and the value of output in other sectors of the regional economies most affected by the investment.

## 3 ECONOMIC IMPACT ASSESSMENT

This section provides estimates of impacts of the proposed Paradise Dam Project, focusing on changes to Gross Regional Product (GRP) and employment impacts. Two distinctly different sets of impacts were modelled:

- The impacts of the construction phase (Dam improvement and distribution system), based on an average annual spend across the construction phase.
- A series of impact assessments for 2030, 2040 and 2050 as representative years for the operational phase of the project. This modelling assesses the impact of the expansion and changed crop mix for irrigated agriculture on the Bundaberg economy.

### 3.1 Impact of construction phase

Impacts of the construction phase were based on the capital expenditures estimated for the business case. While the cashflow profiles would change significantly for each year of the construction phase, as would the nature and location of expenditures, we modelled a representative year for the construction phase for simplicity. This was based on a line-by-line assessment of expenditure, where expenditure was allocated to LGAs and sectors based on the likely location and expenditure type for each line item – specifically Bundaberg (construction sector), North Burnett (construction sector) and Brisbane (professional, scientific and technical services sector). This was then averaged across the six years to establish a representative year of construction. The resulting assumed average expenditures for Bundaberg, North Burnett and Brisbane LGAs were \$5 million, \$119 million and \$72 million respectively. It should be noted that actual expenditure patterns would differ significantly, depending on the contracted source of inputs and contract design. The key points to note are:

- Depending on contract design and the provision of local inputs, the impacts could be greatest in the North Burnett LGA, potentially increasing GRP by \$70 million per annum for the construction period, if local inputs are maximised and economic leakage is minimised. This is potentially a significant overestimate as much of the inputs for the construction phase will likely be sourced from outside the North Burnett LGA due to the scale of the project and the limited ability of local contractors to meet the demand of the project.
- With the exception of the distribution system upgrades, direct impacts in Bundaberg could be relatively low (around \$5 million per annum). However, to the extent that labour and other inputs are sourced from the region, significant indirect benefits may be captured in Bundaberg.
- Most of the technical design, technical assessments and management is expected to largely benefit Brisbane as that is the most likely location of the required expertise.

While employment impacts were an output of the I-O modelling, due to many of the limitations of the approach outlined above, they were not particularly reliable for such large projects in such small economies. Therefore, they have not been presented here. However, the project will generate significant employment across the region and in Brisbane during the construction period.

#### **Key points**

The economic impacts of the construction phase will be highly dependent on the construction contract design and the location of inputs used. It is anticipated that impacts will be concentrated in the North Burnett LGA where the Dam is located, in Bundaberg (distribution system augmentations) and Brisbane where many of the professional inputs and services will be sourced.

The construction phase will provide significant opportunities for workers in the broader North Burnett and Bundaberg regions as well as for providers of labour inputs from outside the region.

### 3.2 Impact of operational phase

The economic impacts of the operational phase are significantly more important to the regional economy as they are ongoing, compared to a short stimulus from the construction phase. To estimate the impacts on the operational phase, three representative years were modelled – 2030, 2040 and 2050. In addition, for each representative year, two water demand and use scenarios were modelled – P50 (more likely volume) and P90 (higher end volume) from the business case. The economic impacts during the operational phase of the project largely related to the change in output from irrigation, investment in that year for new on-farm irrigation infrastructure, and additional expenditure by Sunwater on operations and maintenance. Changes in irrigation output and on-farm irrigation were modelled as an impact to the agriculture, forestry and fisheries sector, while changes to Sunwater’s operations and maintenance expenditure were modelled as an impact on the electricity, gas, water and waste services sector.

The input to the I-O modelling was estimated based on data used in the business case modelling, as per Table 1.

**Table 1. Estimated change in expenditure (\$ million) – used as inputs to the I-O modelling**

Year and water use scenario	2030 (P50)	2030 (P90)	2040 (P50)	2040 (P90)	2050 (P50)	2050 (P90)
Agriculture, Forestry and Fishing	27	54	43	217	232	415
Electricity, Gas, Water and Waste Services	1	1	2	12	15	20

Source: NCEconomics estimate

Using the I-O model it is possible to estimate the direct and indirect impact on GRP. For each of the scenarios, this is shown in Table 2. This has also been benchmarked against the current estimate for BRC’s GRP<sup>5</sup>.

**Table 2. Estimated impact on GRP - \$million (operational phase)**

Year and water use scenario	2030 (P50)	2030 (P90)	2040 (P50)	2040 (P90)	2050 (P50)	2050 (P90)
Direct	12	24	20	100	108	182
Flow-on	15	29	24	121	131	220
Total change	27	53	43	221	238	402
% of 2021 GRP	0.6%	1.2%	1.0%	5.2%	5.6%	9.4%

Source: NCEconomics estimates

The key points to note are:

- By 2030, GRP is expected to be marginally higher than the 2021 GRP as land use change and output increases soon after the commissioning of the dam improvements. Direct impacts are estimated to be between \$12 and \$24 million for the P50 and P90 demand estimates respectively. Including indirect (flow-on) impacts, GRP is estimated to be between \$27 and \$53 million for the P50 and P90 demand estimates respectively – 0.6% to 1.2% higher than the most recent available estimate. The corresponding impact on total full time equivalent employment is an increase of between 0.7% and 1.4%.
- By 2040, the impacts are significantly greater as development would have been underway for several years. GRP is expected to be significantly higher. Direct impacts are estimated to be

<sup>5</sup> Currently around \$4.29 billion.

between \$20 and \$100 million for the P50 and P90 demand estimates respectively. Including indirect impacts, GRP is estimated to be between \$43 and \$221 million for the P50 and P90 demand estimates respectively – 1.0% to 5.2% higher than the most recent available estimate. The corresponding impact on total full time equivalent employment is an increase of between 1.1% and 5.7%.

- By 2050, the impacts are very substantial under both demand scenario. Direct impacts are estimated to be between \$108 and \$182 million for the P50 and P90 demand estimates respectively. Including indirect impacts, GRP is estimated to be between \$238 and \$402 million for the P50 and P90 demand estimates respectively – 5.6 to 9.4% higher than the most recent available estimate. The corresponding impact on total full time equivalent employment is an increase of between 6.2% and 10.6%.

A detailed breakdown of the distribution of the economic impacts across sectors in the Bundaberg economy is shown in the table below. This is sorted from the sector that benefits the most, to the sector that benefits the least.

**Table 3. GRP. Impacts by industry sector (direct and indirect) under two water demand scenarios in 2030 and 2050**

Sector	GRP impacts 2030 (\$M)	GRP impacts 2030 (\$M)	GRP impacts 2050 (\$M)	GRP impacts 2050 (\$M)
	P50 demand	P90 demand	P50 demand	P90 demand
Agriculture, Forestry and Fishing	15.2	30.1	130.0	232.8
Manufacturing	1.7	3.4	15.0	25.7
Rental, Hiring and Real Estate Services	1.7	3.3	15.0	25.3
Financial and Insurance Services	1.3	2.6	13.2	19.6
Electricity, Gas, Water and Waste Services	1.2	2.0	11.7	15.0
Wholesale Trade	1.0	1.9	8.7	14.5
Retail Trade	1.0	1.8	8.6	12.9
Transport, Postal and Warehousing	0.9	1.7	7.5	8.4
Professional, Scientific and Technical Services	0.5	1.0	4.6	7.8
Other Services	0.5	1.0	4.3	7.3
Accommodation and Food Services	0.4	0.8	3.8	6.4
Construction	0.4	0.8	3.5	5.7
Health Care and Social Assistance	0.4	0.7	3.4	5.5
Education and Training	0.3	0.6	2.9	4.9
Administrative and Support Services	0.3	0.6	2.5	4.3
Information Media and Telecommunications	0.2	0.4	1.7	2.9
Mining	0.1	0.2	0.9	1.2
Public Administration and Safety	0.1	0.2	0.7	1.1
Arts and Recreation Services	0.0	0.1	0.4	0.7
Total	27.2	53.2	238.4	402.0

Source: NCEconomics estimates

As would be expected, the bulk of the impacts occur in the agriculture sector (around 55% of total impacts). However, other sectors that provide inputs and services to the agriculture sector will also

benefit through increases turnover. This includes sectors including manufacturing (6%), wholesale and retail trade (8% combined), rental and real estate (6%), and financial and insurance services (5%).

### Key point

Based on projected changes in land use and water demand, it is expected that by 2050 direct impacts on Gross Regional Product (GRP) are estimated to be between \$108 and \$182 million for the P50 (more likely) and P90 (higher end) demand estimates respectively. Including indirect impacts, GRP is estimated to be between \$238 and \$402 million for the P50 and P90 demand estimates respectively – 5.6 to 9.4% higher than the most recent available estimate.

The estimated current number of employed in the Bundaberg LGA is 36,500. The additional economic activity attributable to the increase in irrigated agriculture will also create opportunities for employment. Direct and indirect employment impacts on full time equivalent (FTE) employment from the I-O modelling are shown in the table below. The key points to note from the modelling are:

- By 2030, direct plus indirect employment is modelled to be 260 to 510 FTE jobs (or 0.7% and 1.4% higher than the current estimate of employment) attributable to development from the P50 and P90 water demand projections.
- By 2040, direct plus indirect employment is modelled to be 413 to 2097 FTE jobs (or 1.1% and 5.7% higher than the current estimate of employment).
- By 2050, direct plus indirect employment is modelled to be 2,250 to 3,890 FTE jobs (or 6.2% and 10.5% higher than the current estimate of employment).

**Table 4. Estimated impact on employment (full time equivalent jobs)**

Year and water use scenario	2030 (P50)	2030 (P90)	2040 (P50)	2040 (P90)	2050 (P50)	2050 (P90)
Direct	133	262	211	1,069	1,145	2,005
Flow-on	127	248	202	1,028	1,105	1,885
Total change	260	510	413	2,097	2,250	3,890
% of current employment	0.7%	1.4%	1.1%	5.7%	6.2%	10.6%

Source: NCEconomics estimate

The distribution of impacts across sectors is dominated by opportunities in the agricultural sector (around 65% of total jobs created). However, jobs will also be created in manufacturing (around 6% of total), and wholesale and retail trade.

These employment gains can be viewed against the background of characteristic local unemployment and under-employment rates in the Bundaberg region. Over a quarter of the local labour force works less than 25 hours per week and unemployment rates have been between 10 and 11% for over a year.<sup>6</sup>

Employment opportunities expected to result from the expansion in irrigated agriculture are likely to be well matched with the unemployed and under-employed local labour force. This partly reflects that many of the jobs in the agriculture sector and other benefits sectors (e.g. manufacturing) do not require levels of education and training that exceed the qualifications held by significant numbers of the local workforce in the BRC (i.e. completion of high school or a trade).<sup>7</sup>

<sup>6</sup> <https://economy.id.com.au/bundaberg/hours-worked>

<sup>7</sup> <https://economy.id.com.au/bundaberg/workers-level-of-qualifications>

**Key points**

By 2050, direct plus indirect employment is modelled to be 2,250 to 3,890 FTE jobs (or 6.2% and 10.5% higher than the current estimate of employment).

The vast majority of the employment opportunities created during the operational phase are aligned with the current capacity (e.g. skills and training) of the local labour force.