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# ECONOMIC SIGNIFICANCE OF THE LIVESTOCK INDUSTRY TO CENTRAL AND WESTERN QUEENSLAND

REGIONAL DEVELOPMENT AUSTRALIA  
CENTRAL AND WESTERN QUEENSLAND

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## EXECUTIVE SUMMARY

### BACKGROUND

Indonesia is experiencing an outbreak of the highly transmissible and deadly Foot-and-Mouth Disease (FMD). As a near neighbour, a major tourism destination and significant trading partner with Australia, there is potential for the disease to be introduced to Australia and then potentially the Central and Western Queensland region.

The introduction of FMD to Australia is expected to have a catastrophic impact to the livestock industry – not just on herd health and size, but also on market access. Impacts of FMD are expected to be felt beyond the agricultural industry, but also to the food manufacturing and road transport industries that rely on continued success of the livestock industry.

The aim of this report is to assist RDA Central and Western Queensland understand and communicate the magnitude of the economic impact FMD could have on the Central and Western Queensland regions.

### KEY FINDINGS

An outbreak of FMD amongst the region's livestock would have a considerable impact to the region's economy, in both in terms of Gross Regional Product (GRP) and employment in both the livestock and food manufacturing sectors.

The impact to GRP is estimated to be \$1.1 billion which is 5.2% of the region's economy. Sub-regions including Western Queensland and Banana would have catastrophic impacts to their GRP, with losses of \$318.4 million (37.3% of the Western Queensland economy) and \$218.5 million (10.1% of the Banana economy) respectively. Summarised GRP impacts of the regions are displayed in Table E.S. 1 .

**Table E.S. 1. Total GRP Impact to the Economy**

Region	GRP (\$M) Impact	Proportion of Economy Impacted
Western Queensland	\$318.4	37.3%
Banana	\$218.5	10.1%
Rockhampton	\$214.4	3.9%
Central Highlands & Woorabinda	\$166.0	3.0%
Livingstone	\$121.8	8.6%
Gladstone	\$64.1	1.2%
<b>Central and Western Queensland</b>	<b>\$1,102.7</b>	<b>5.2%</b>

Source: AEC

The impact to jobs is estimated to be 33,726 FTE jobs which is 7.6% of all jobs in the region. Sub-regions including Rockhampton and Banana would have serious impacts to their employment numbers with losses of 7,034 FTE jobs (4.9% of all Rockhampton jobs) and 6,530 FTE jobs (19.6% of the Banana economy) respectively. Over 30% of all jobs in Western Queensland would be impacted (6,094 FTE jobs). Summarised employment impacts of the regions are displayed in Table E.S. 2.

**Table E.S. 2. Employment Impacts to the Economy**

Region	Employment (FTEs) Impact	Proportion of Jobs Impacted
Rockhampton	7,034	4.9%
Banana	6,530	19.6%
Western Queensland	6,094	30.4%
Central Highlands & Woorabinda	5,423	8.5%
Livingstone	3,960	10.2%
Gladstone	2,343	1.6%
<b>Central and Western Queensland</b>	<b>33,726</b>	<b>7.6%</b>

Source: AEC

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# 1. INTRODUCTION

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## 1.1 BACKGROUND

Indonesia is experiencing an outbreak of the highly transmissible and deadly Foot-and-Mouth Disease (FMD). As a near neighbour, a major tourism destination and significant trading partner with Australia, there is potential for the disease to be introduced to Australia and then potentially the Central and Western Queensland region.

The introduction of FMD to Australia is expected to have a catastrophic impact to the livestock industry – not just on herd health and size, but also on market access. Impacts of FMD are expected to be felt beyond the agricultural industry, but also to the food manufacturing and road transport industries that rely on continued success of the livestock industry.

## 1.2 PURPOSE OF THIS REPORT

The aim of this report is to assist RDA Central and Western Queensland understand and communicate the magnitude of the economic impact FMD could have on the Central and Western Queensland regions.

## 2. SIGNIFICANCE ASSESSMENT

### 2.1 MODEL DRIVERS

This section establishes the approach to quantifying the potential economic impact of a FMD outbreak on the livestock industry in Central and Western Queensland. More detail on the AEC Significance Assessment methodology and GRP and Employment Models is included in Appendix A and B.

#### 2.1.1 Industries Impacted

For the purposes of this report, it is assumed that an outbreak of FMD in Central and Western Queensland would result in a 100% reduction in output from both the livestock and meat processing industries. Non-livestock agricultural industries (such as broadacre farming) have been excluded from this analysis.

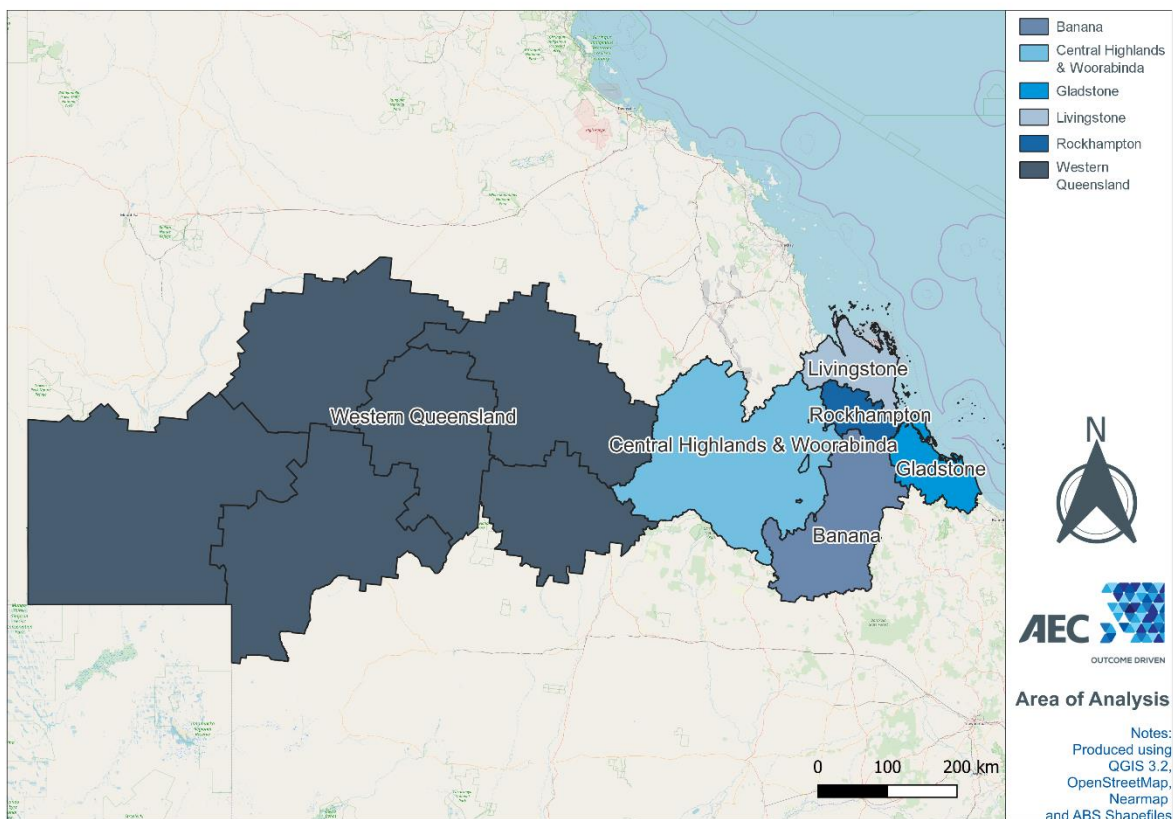
AEC utilised its in-house Input-Output model to calculate the economic flow-on impacts, which included:

- **Production induced impacts:** Supply of services to the livestock and meat processing industries (such as transport, energy, wholesale trade etc)
- **Household consumption impacts:** Spend of salaries earned in the economy (such as retail, food and beverage, health, and education services)

#### 2.1.2 Geographies Assessed

The analysis conducted includes the economic impacts to the Central and Western Queensland region as well as the six sub-regions that make up Central and Western Queensland. Figure 2.1 displays the sub-regions of Central and Western Queensland that have been assessed.

**Figure 2.1. Geographies Assessed in Central and Western Queensland**



Source: AEC

## 2.2 CENTRAL AND WESTERN QUEENSLAND

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Central and Western Queensland economy in 2020-21 (detailed breakdown provided in Table 2.1):

- \$1,102.7 million contribution to GRP (including \$845.3 million through initial impacts)
- 33,726 FTE jobs (including 25,502 FTE jobs through initial impacts), paying a total of \$750.6 million in wages and salaries (including \$576.4 million through initial impacts).

**Table 2.1. Estimated Economic Contribution of the Livestock Industry to the Central and Western Queensland Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$2,503.3	\$845.3	\$576.4	25,502
Production Induced Impacts	\$350.1	\$138.9	\$91.1	4,220
Household Consumption Impacts	\$231.1	\$118.5	\$83.1	4,004
<b>Total</b>	<b>\$3,084.5</b>	<b>\$1,102.7</b>	<b>\$750.6</b>	<b>33,726</b>
<b>% of economy</b>	<b>5.3%</b>	<b>5.2%</b>	<b>7.5%</b>	<b>7.6%</b>

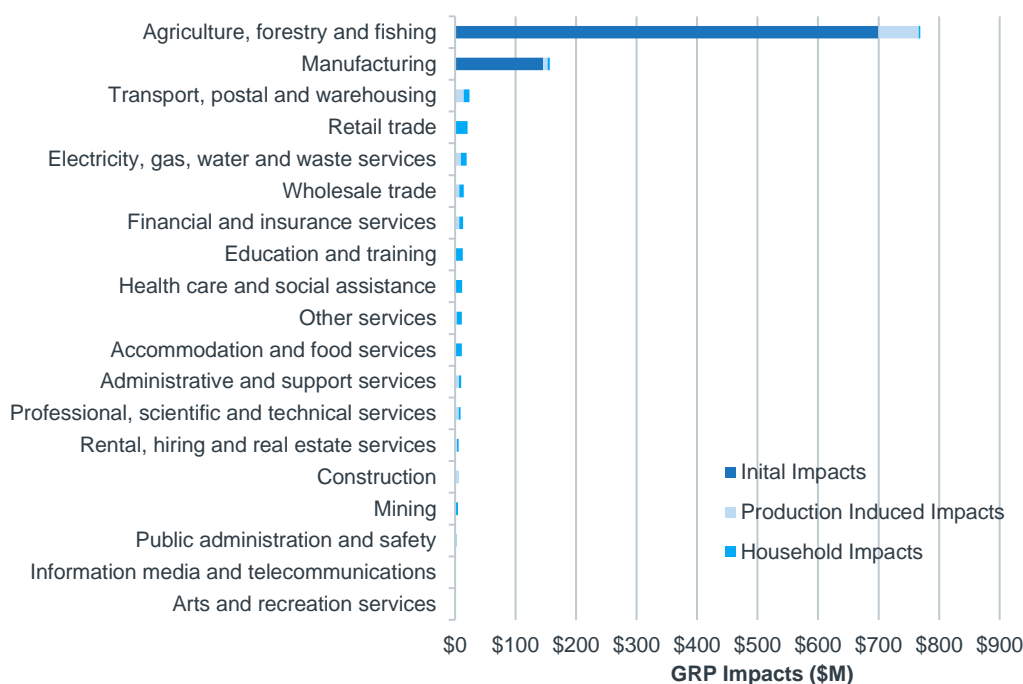
Note: Totals may not sum due to rounding.  
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Central and Western Queensland economy can be seen in Figure 2.2. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Central and Western Queensland with:

- Agriculture GRP expected to be impacted by \$769.1 million.
- Manufacturing GRP expected to be impacted by \$156.7 million.

**Figure 2.2. GRP Impact by Industry, Initial and Flow-On to Central and Western Queensland**



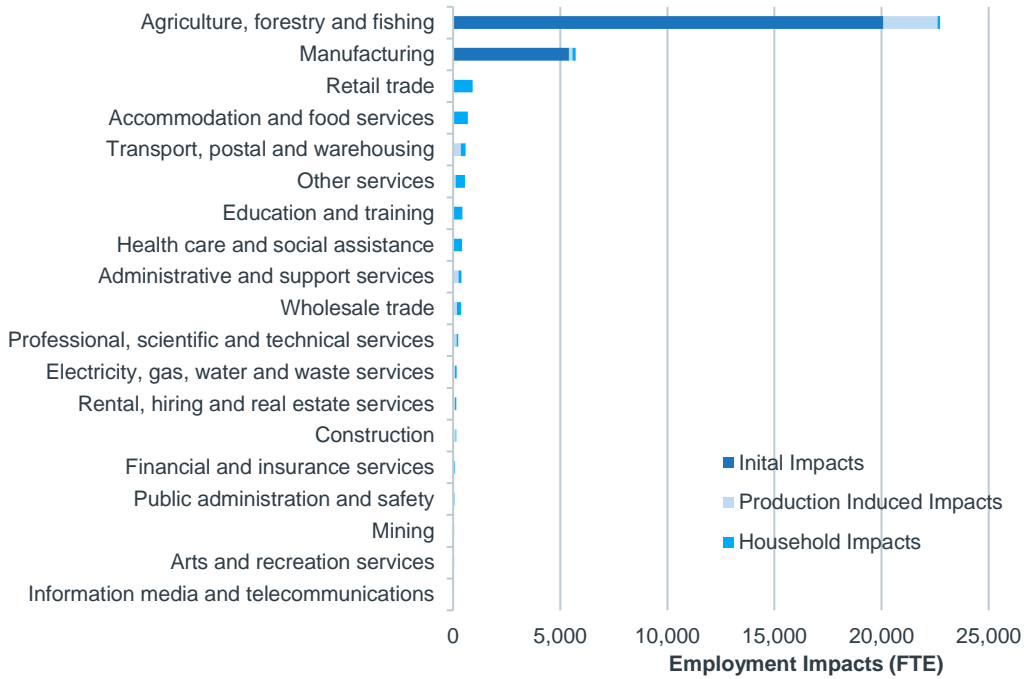
Source: AEC.

**Impact on Employment**

A breakdown of the initial and flow-on impacts to employment to the Central and Western Queensland economy can be seen in Figure 2.3. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Central and Western Queensland with:

- Agricultural employment expected to be impacted by 22,726 FTEs.
- Manufacturing employment expected to be impacted by 5,714 FTEs.

**Figure 2.3. Employment Impact by Industry, Initial and Flow-On to Central and Western Queensland**



Source: AEC.



## 2.3 WESTERN QUEENSLAND

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Western Queensland economy in 2020-21 (detailed breakdown provided in Table 2.2):

- \$318.4 million contribution to GRP (including \$302.1 million through initial impacts)
- 6,094 FTE jobs (including 5,586 FTE jobs through initial impacts), paying a total of \$216.8 million in wages and salaries (including \$205.3 million through initial impacts).

**Table 2.2. Estimated Economic Contribution of the Livestock Industry to the Western Queensland Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$773.6	\$302.1	\$205.3	5,586
Production Induced Impacts	\$11.7	\$4.3	\$2.9	118
Household Consumption Impacts	\$22.2	\$12.0	\$8.6	389
<b>Total</b>	<b>\$807.5</b>	<b>\$318.4</b>	<b>\$216.8</b>	<b>6,094</b>
<b>% of Economy</b>	<b>33.6%</b>	<b>37.3%</b>	<b>37.5%</b>	<b>30.4%</b>

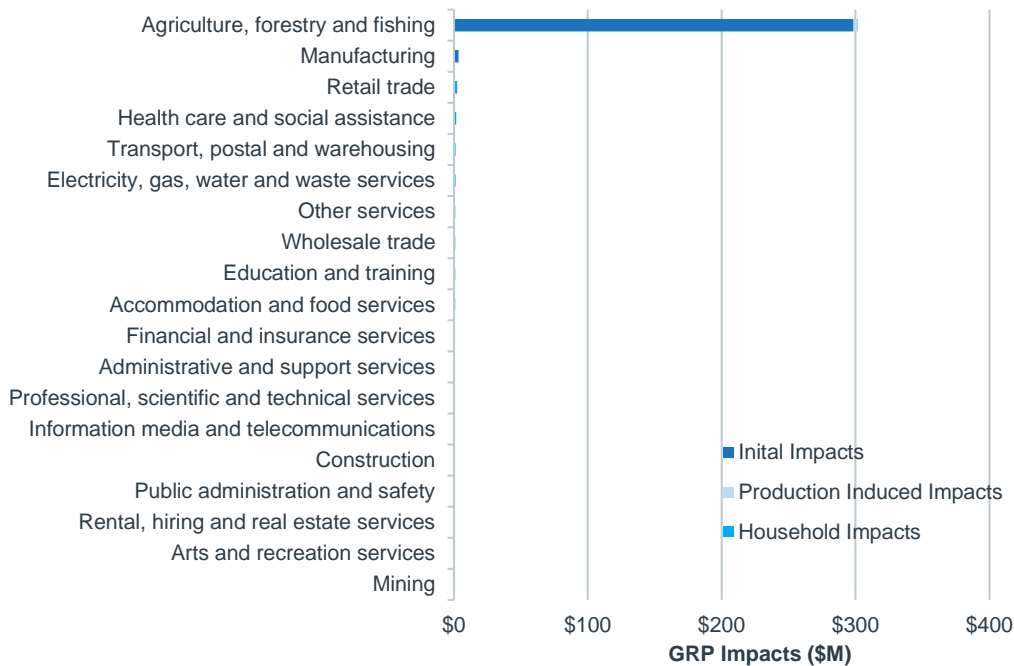
Note: Totals may not sum due to rounding.  
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Western Queensland economy can be seen in Figure 2.4. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Western Queensland with:

- Agriculture GRP expected to be impacted by \$301.6 million.
- Manufacturing GRP expected to be impacted by \$3.7 million.

**Figure 2.4. GRP Impact by Industry, Initial and Flow-On to Western Queensland**



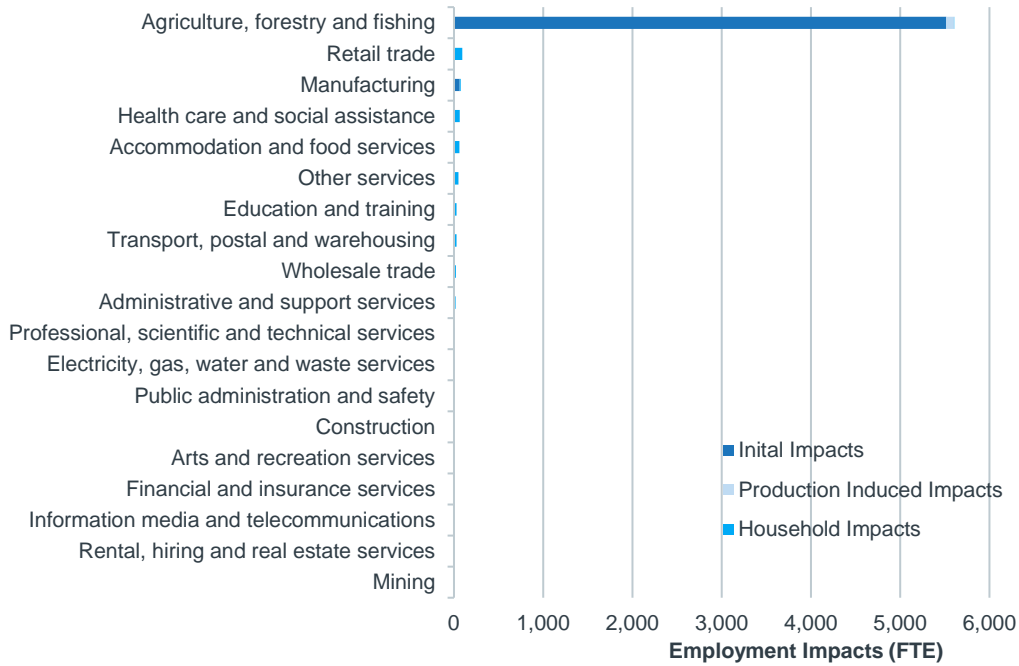
Source: AEC.

**Impact on Employment**

A breakdown of the initial and flow-on impacts to employment to the Western Queensland economy can be seen in Figure 2.5. The 1-digit industries of agriculture, forestry and fishing and retail trade are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Central and Western Queensland with:

- Agricultural employment expected to be impacted by 5,605 FTEs.
- Retail employment expected to be impacted by 96 FTEs.

**Figure 2.5. Employment Impact by Industry, Initial and Flow-On to Western Queensland**



Source: AEC.

## 2.4 BANANA SHIRE

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Banana economy in 2020-21 (detailed breakdown provided in Table 2.3):

- \$201.1 million contribution to GRP (including \$173.1 million through initial impacts)
- 6,530 FTE jobs (including 5,634 FTE jobs through initial impacts), paying a total of \$136.1 million in wages and salaries (including \$118.1 million through initial impacts).

**Table 2.3. Estimated Economic Contribution of the Livestock Industry to the Banana Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$525.1	\$173.1	\$118.1	5,634
Production Induced Impacts	\$39.1	\$15.6	\$10.3	523
Household Consumption Impacts	\$24.0	\$12.3	\$7.7	373
<b>Total</b>	<b>\$588.2</b>	<b>\$201.1</b>	<b>\$136.1</b>	<b>6,530</b>
<b>% of Economy</b>	<b>11.9%</b>	<b>9.2%</b>	<b>18.2%</b>	<b>19.6%</b>

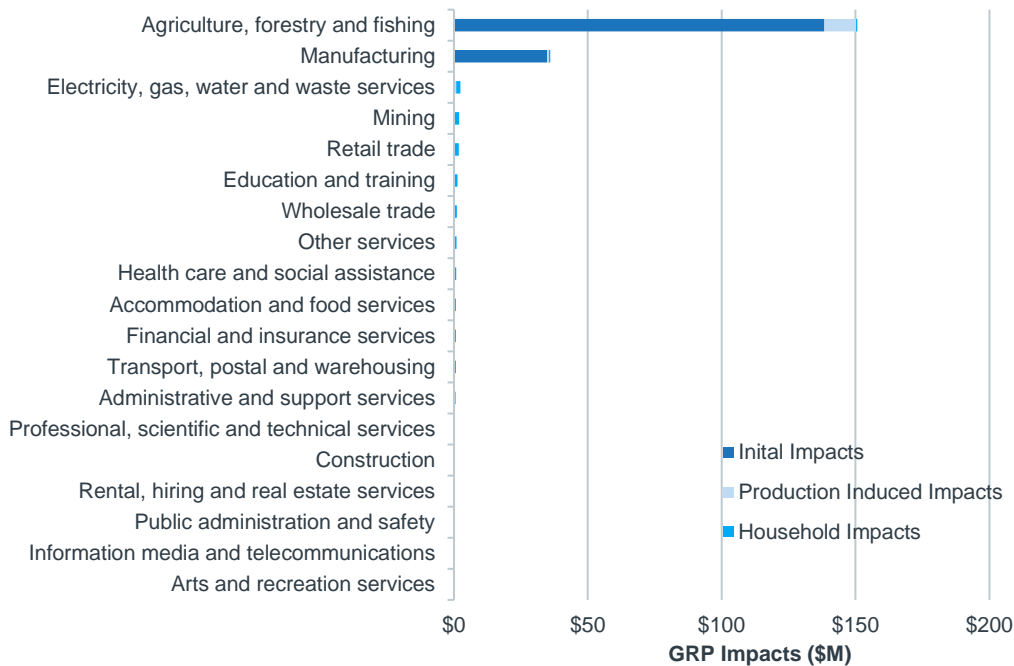
Note: Totals may not sum due to rounding.  
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Banana economy can be seen in Figure 2.6. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock industry from foot-and-mouth disease in Banana Regional Queensland with:

- Agriculture GRP expected to be impacted by \$ 150.7 million
- Manufacturing GRP expected to be impacted by \$36.0 million

**Figure 2.6. GRP Impact by Industry, Initial and Flow-On to Banana Queensland**



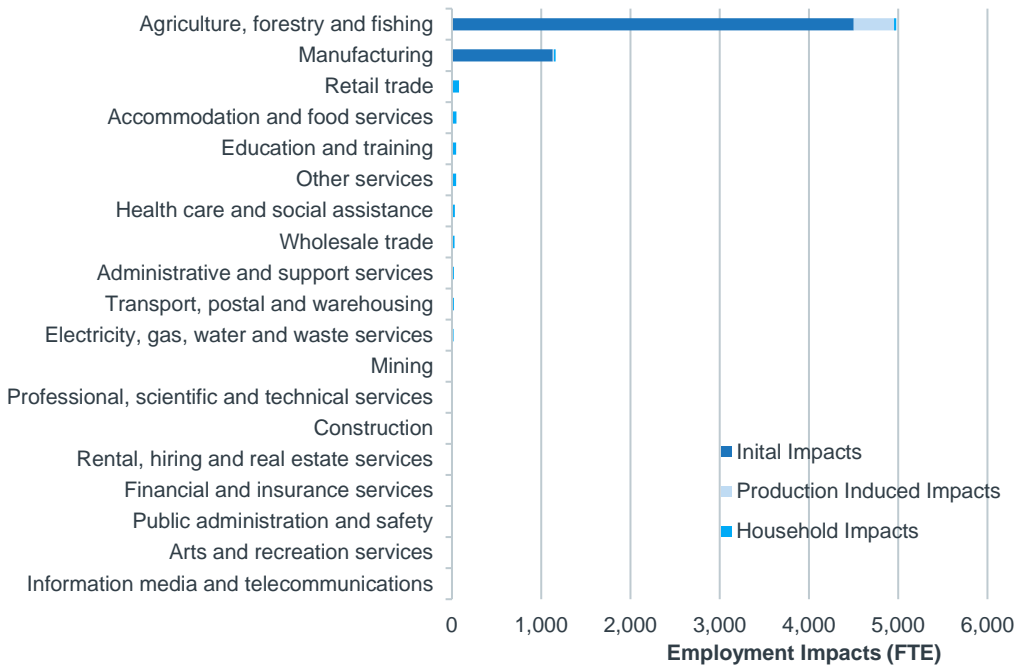
Source: AEC.

**Impact on Employment**

A breakdown of the initial and flow-on impacts to employment to the Banana economy can be seen in Figure 2.7. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock industry from foot-and-mouth disease in the Banana Region with:

- Agricultural employment is expected to be impacted by 4,979 FTE.
- Manufacturing employment expected to be impacted by 1,161 FTE.

**Figure 2.7 Employment Impact by Industry, Initial and Flow-On to Banana Queensland**



Source: AEC.

## 2.6 ROCKHAMPTON

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Rockhampton economy in 2020-21 (detailed breakdown provided in Table 2.4):

- \$214.4 million contribution to GRP (including \$150.2 million through initial impacts)
- 7,034 FTE jobs (including 5,027 FTE jobs through initial impacts), paying a total of \$146.9 million in wages and salaries (including \$103.2 million through initial impacts).

**Table 2.4. Estimated Economic Contribution of the Livestock Industry to the Rockhampton Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$599.7	\$150.2	\$103.2	5,027
Production Induced Impacts	\$70.6	\$27.9	\$17.8	794
Household Consumption Impacts	\$71.1	\$36.3	\$25.9	1,213
<b>Total</b>	<b>\$741.5</b>	<b>\$214.4</b>	<b>\$146.9</b>	<b>7,034</b>
<b>% of Economy</b>	<b>4.8%</b>	<b>3.9%</b>	<b>3.9%</b>	<b>4.9%</b>

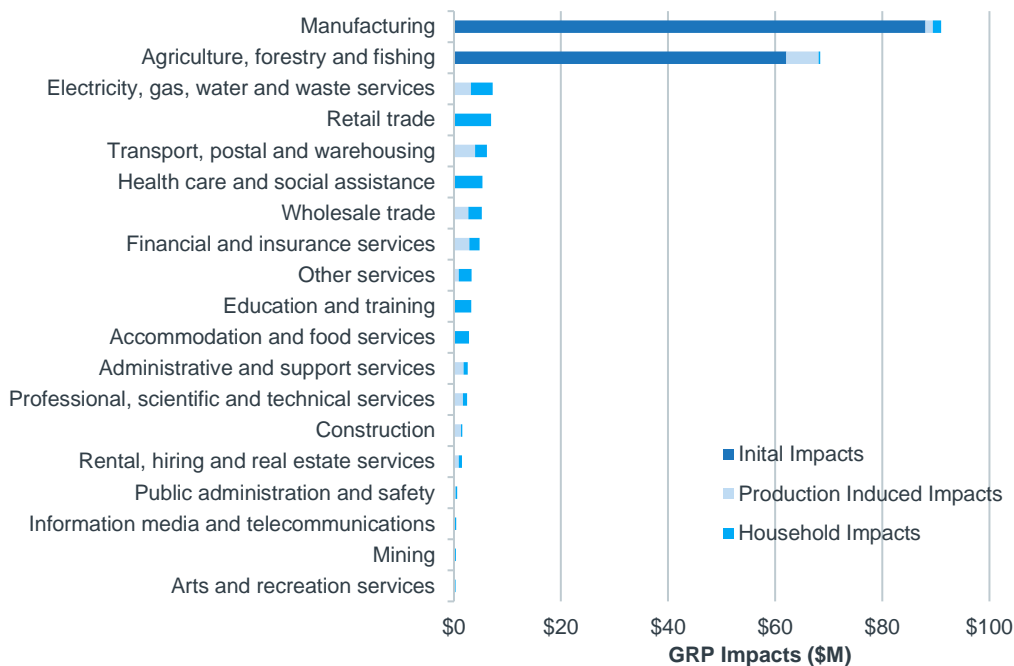
Note: Totals may not sum due to rounding.  
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Rockhampton economy can be seen in Figure 2.8. The 1-digit industries of manufacturing and agriculture, forestry and fishing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Rockhampton with:

- Manufacturing GRP expected to be impacted by \$91.0 million.
- Agriculture GRP expected to be impacted by \$68.4 million.

**Figure 2.8. GRP Impact by Industry, Initial and Flow-On to Rockhampton**



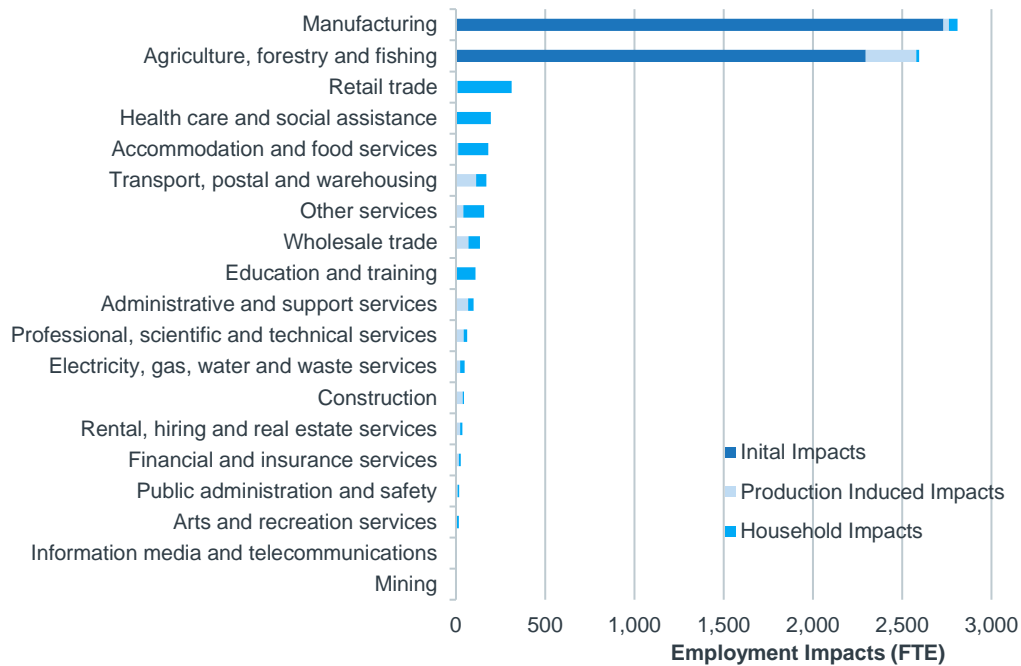
Source: AEC.

### Impact on Employment

A breakdown of the initial and flow-on impacts to employment to the Rockhampton economy can be seen in Figure 2.9. The 1-digit industries of manufacturing and agriculture, forestry and fishing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Rockhampton with:

- Manufacturing employment expected to be impacted by 2,811 FTEs.
- Agricultural employment expected to be impacted by 2,597 FTEs.

**Figure 2.9. Employment Impact by Industry, Initial and Flow-On to Rockhampton**



Source: AEC.

## 2.7 CENTRAL HIGHLANDS & WOORABINDA

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Central Highlands and Woorabinda economy in 2020-21 (detailed breakdown provided in Table 2.5):

- \$166.0 million contribution to GRP (including \$143.4 million through initial impacts)
- 5,423 FTE jobs (including 4,594 FTE jobs through initial impacts), paying a total of \$113.0 million in wages and salaries (including \$97.4 million through initial impacts).

**Table 2.5. Estimated Economic Contribution of the Livestock Industry to the Central Highlands & Woorabinda Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$367.1	\$143.4	\$97.4	4,594
Production Induced Impacts	\$32.3	\$12.9	\$8.7	486
Household Consumption Impacts	\$18.0	\$9.8	\$6.9	343
<b>Total</b>	<b>\$417.4</b>	<b>\$166.0</b>	<b>\$113.0</b>	<b>5,423</b>
<b>% of Economy</b>	<b>4.0%</b>	<b>3.0%</b>	<b>7.1%</b>	<b>8.5%</b>

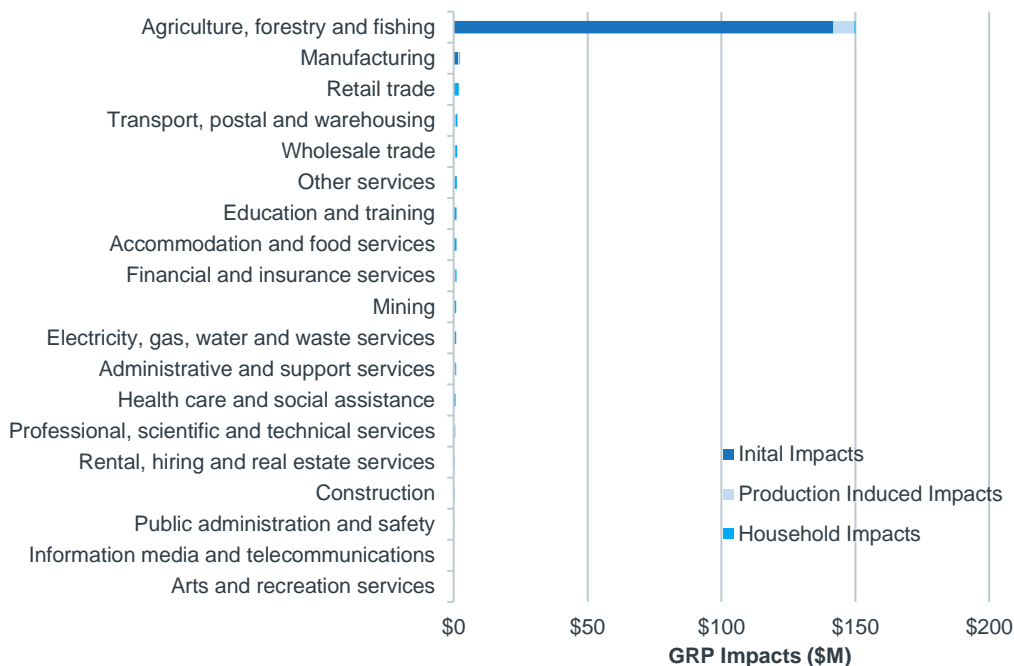
Note: Totals may not sum due to rounding.  
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Central Highlands and Woorabinda economy can be seen in Figure 2.10. The 1-digit industries of agriculture, forestry and fishing and transport, postal and warehousing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Gladstone with:

- Agriculture GRP expected to be impacted by \$150.1 million.
- Manufacturing GRP expected to be impacted by \$2.3 million.

**Figure 2.10. GRP Impact by Industry, Initial and Flow-On to Central Highlands & Woorabinda**



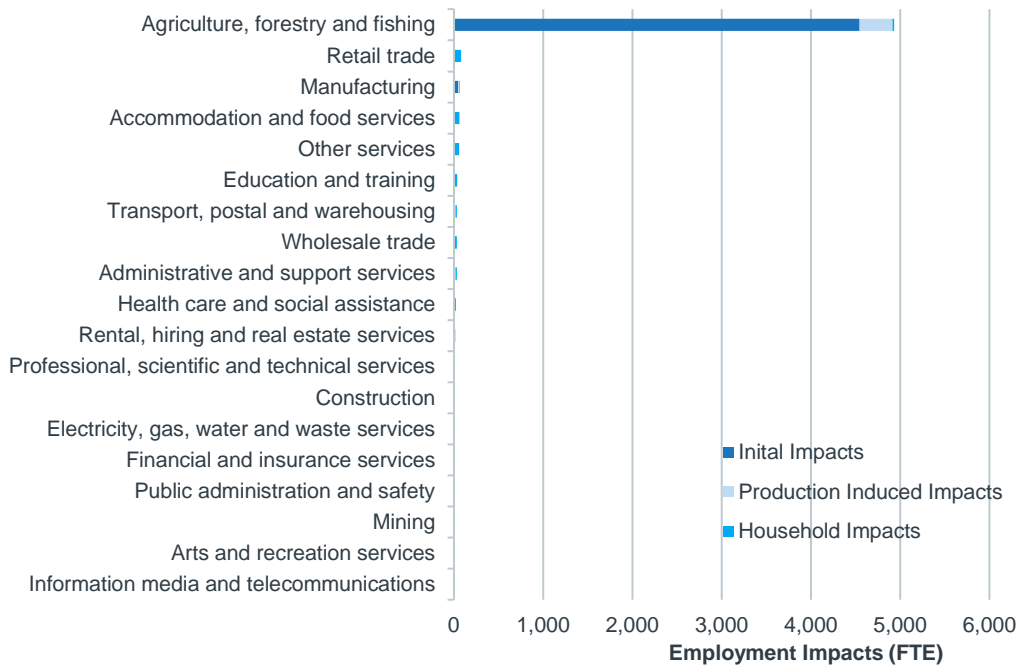
Source: AEC.

### Impact on Employment

A breakdown of the initial and flow-on impacts to employment to the Central Highlands and Woorabinda economy can be seen in Figure 2.11. The 1-digit industries of agriculture, forestry and fishing and retail trade are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Livingstone with:

- Agricultural employment expected to be impacted by 4,934 FTEs.
- Retail employment expected to be impacted by 81 FTEs.

**Figure 2.11. Employment Impact by Industry, Initial and Flow-On to Central Highlands & Woorabinda**



Source: AEC.



## 2.8 LIVINGSTONE

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Livingstone economy in 2020-21 (detailed breakdown provided in Table 2.6):

- \$121.8 million contribution to GRP (including \$98.7 million through initial impacts)
- 3,960 FTE jobs (including 3,059 FTE jobs through initial impacts), paying a total of \$85.1 million in wages and salaries (including \$67.7 million through initial impacts).

**Table 2.6. Estimated Economic Contribution of the Livestock Industry to the Livingstone Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$364.2	\$98.7	\$67.7	3,059
Production Induced Impacts	\$25.6	\$10.9	\$8.0	409
Household Consumption Impacts	\$22.9	\$12.2	\$9.5	492
<b>Total</b>	<b>\$412.7</b>	<b>\$121.8</b>	<b>\$85.1</b>	<b>3,960</b>
<b>% of Economy</b>	<b>9.4%</b>	<b>8.6%</b>	<b>8.2%</b>	<b>10.2%</b>

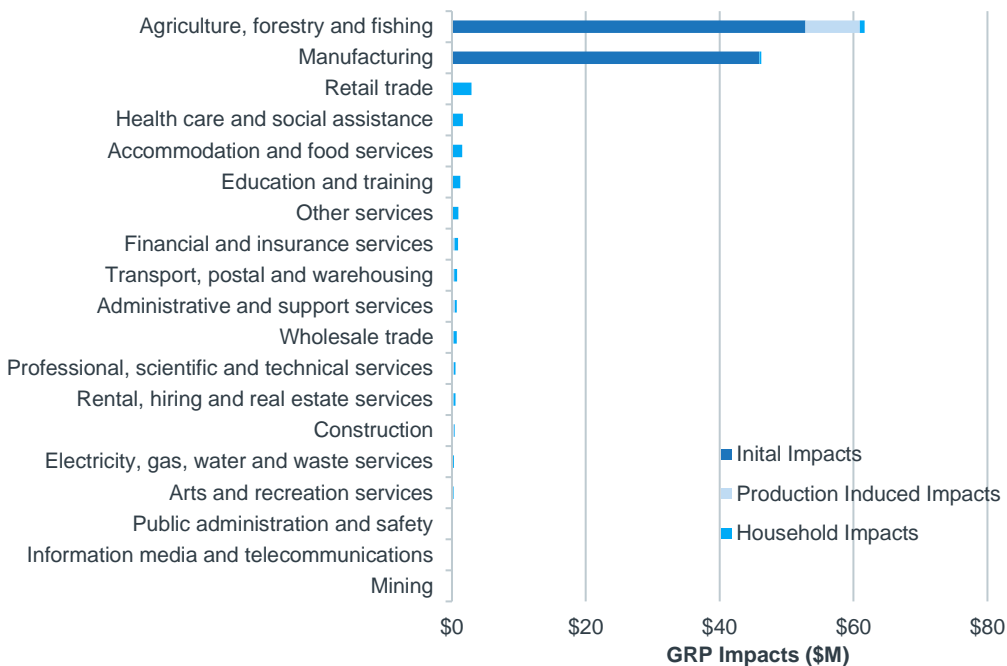
Note: Totals may not sum due to rounding.  
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Livingstone economy can be seen in Figure 2.12. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Livingstone with:

- Agriculture GRP expected to be impacted by \$61.7 million.
- Manufacturing GRP expected to be impacted by \$46.2 million.

**Figure 2.12. GRP Impact by Industry, Initial and Flow-On to Livingstone**



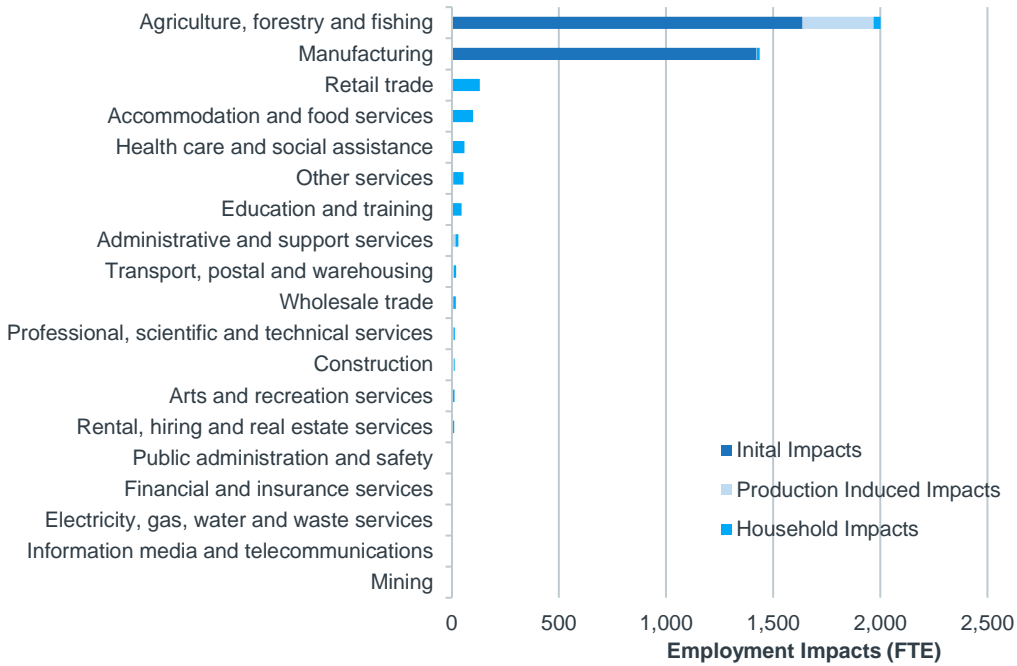
Source: AEC.

**Impact on Employment**

A breakdown of the initial and flow-on impacts to employment to the Livingstone economy can be seen in Figure 2.13. The 1-digit industries of agriculture, forestry and fishing and manufacturing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Livingstone with:

- Agricultural employment expected to be impacted by 2,002 FTEs.
- Manufacturing employment expected to be impacted by 1,437 FTEs.

**Figure 2.13. Employment Impact by Industry, Initial and Flow-On to Livingstone**



Source: AEC.

## 2.9 GLADSTONE

### Summary

The livestock and meat processing industry is estimated to have contributed (through direct and flow-on activities) to the Gladstone economy in 2020-21 (detailed breakdown provided in Table 2.7):

- \$64.1 million contribution to GRP (including \$42.0 million through initial impacts)
- 2,343 FTE jobs (including 1,677 FTE jobs through initial impacts), paying a total of \$42.5 million in wages and salaries (including \$28.6 million through initial impacts).

**Table 2.7. Estimated Economic Contribution of the Livestock Industry to the Gladstone Economy, 2020-21**

Impact	Output (\$M)	Gross Regional Product (\$M)	Incomes (\$M)	Employment (FTEs)
Initial Stimulus	\$107.2	\$42.0	\$28.6	1,677
Production Induced Impacts	\$48.4	\$17.6	\$10.8	511
Household Consumption Impacts	\$9.0	\$4.5	\$3.1	156
<b>Total</b>	<b>\$164.6</b>	<b>\$64.1</b>	<b>\$42.5</b>	<b>2,343</b>
<b>% of Economy</b>	<b>0.7%</b>	<b>1.2%</b>	<b>1.5%</b>	<b>1.6%</b>

Note: Totals may not sum due to rounding.

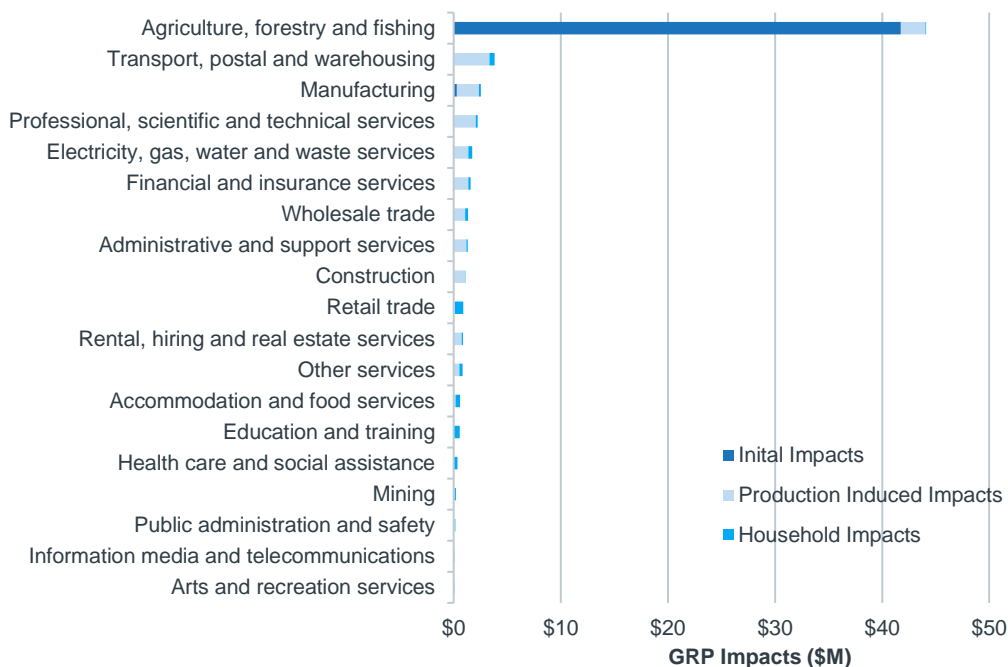
Source: AEC.

### Impact on Gross Regional Product

A breakdown of the initial and flow-on impacts to GRP to the Gladstone economy can be seen in Figure 2.14. The 1-digit industries of agriculture, forestry and fishing and transport, postal and warehousing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Gladstone with:

- Agriculture GRP expected to be impacted by \$44.1 million.
- Transport GRP expected to be impacted by \$3.8 million.

**Figure 2.14. GRP Impact by Industry, Initial and Flow-On to Gladstone**



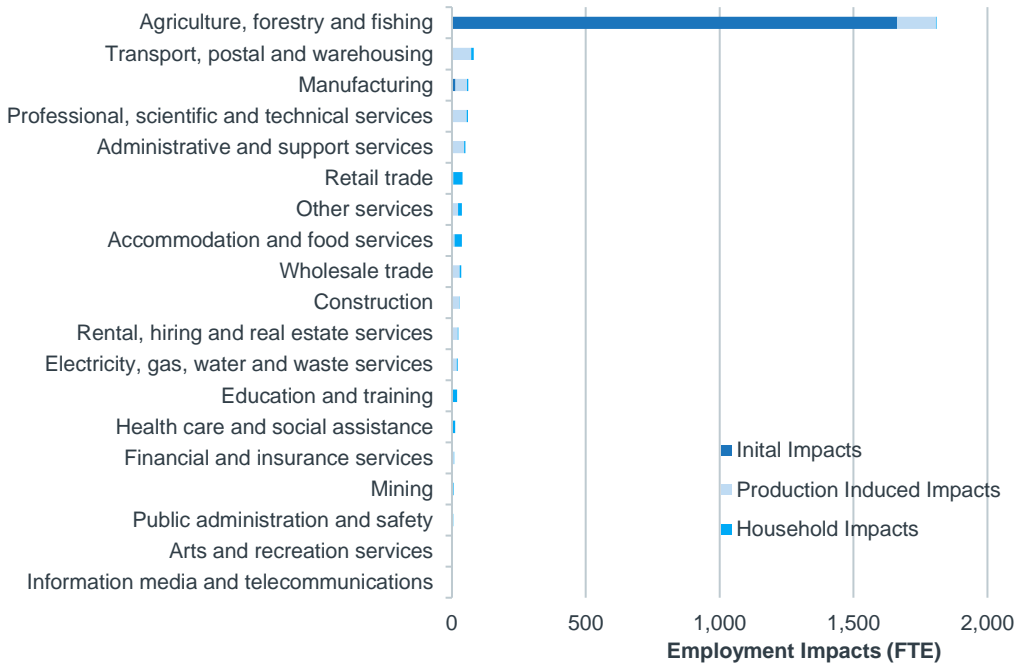
Source: AEC.

**Impact on Employment**

A breakdown of the initial and flow-on impacts to employment to the Gladstone economy can be seen in Figure 2.15. The 1-digit industries of agriculture, forestry and fishing and transport, postal and warehousing are expected to have the most detrimental impacts from the loss of a livestock and meat processing industry from foot-and-mouth disease in Gladstone with:

- Agricultural employment expected to be impacted by 1,811 FTEs.
- Transport employment expected to be impacted by 81 FTEs.

**Figure 2.15. Employment Impact by Industry, Initial and Flow-On to Gladstone**



Source: AEC.

## APPENDIX A: SIGNIFIANCE ASSESSMENT METHODOLOGY

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The economic significance estimates in this report are produced using Input-Output transaction tables and models developed by AEC for the purposes of this assessment, combined with data from a range of sources, including State and National Accounts data and various industry specific data from the ABS. The Input-Output models were used to produce estimates of the direct and flow-on contribution of the livestock industry to the Central and Western Queensland (CWQ) economy in terms of output, gross product, employment and income (i.e., wages and salaries).

### OVERVIEW OF INPUT-OUTPUT MODELLING

Input-Output analysis demonstrates inter-industry relationships in an economy, depicting how the output of one industry is purchased by other industries, households, the government, and external parties (i.e., exports), as well as expenditure on other factors of production such as labour, capital, and imports. Input-Output analysis shows the direct and indirect (flow-on) effects of one sector on other sectors and the general economy. As such, Input-Output modelling can be used to demonstrate the economic contribution of a sector on the overall economy and how much the economy relies on this sector or to examine a change in final demand of any one sector and the resultant change in activity of its supporting sectors.

The economic contribution can be traced through the economic system via:

- **Initial stimulus (direct) impacts**, which represent the economic activity of the industry directly experiencing the stimulus.
- **Flow-on impacts**, which are disaggregated to:
  - **Production induced effects (type I flow-on)**, which comprise the effects from:
    - Expenditure on goods and services by the industry experiencing the stimulus (direct suppliers to the industry), known as the first round or direct requirements effects.
    - The second and subsequent round effects of increased purchases by suppliers in response to increased sales, known as the industry support effects.
  - **Household consumption effects (type II flow-on)**, which represent the consumption induced activity from additional household expenditure on goods and services resulting from additional wages and salaries being paid within the economic system.

These effects can be identified through the examination of four types of impacts:

- **Output:** Refers to the gross value of goods and services transacted, including the costs of goods and services used in the development and provision of the final product. Output typically overstates the economic impacts as it counts all goods and services used in one stage of production as an input to later stages of production, hence counting their contribution more than once.
- **Gross product:** Refers to the value of output after deducting the cost of goods and services inputs in the production process. Gross product (e.g., Gross Regional Product) defines a true net economic contribution and is subsequently the preferred measure for assessing economic impacts.
- **Income:** Measures the level of wages and salaries paid to employees of the industry under consideration and to other industries benefiting from the project.
- **Employment:** Refers to the part-time and full-time employment positions generated by the economic shock, both directly and indirectly through flow-on activity, and is expressed in terms of full time equivalent (FTE) positions.

Input-Output multipliers can be derived from open (Type I) Input-Output models or closed (Type II) models. Open models show the direct effects of spending in a particular industry as well as the indirect or flow-on (industrial

support) effects of additional activities undertaken by industries increasing their activity in response to the direct spending.

Closed models re-circulate the labour income earned as a result of the initial spending through other industry and commodity groups to estimate consumption induced effects (or impacts from increased household consumption).

## SIGNIFICANCE ASSESSMENT VERSUS IMPACT ASSESSMENT

In undertaking the analysis, an economic significance assessment framework was applied.

The framework employed in significance assessment differs from that employed in traditional economic impact analysis in that economic significance assessment primarily seeks the contribution of an existing industry or activity as opposed to the impact of a “stimulus” (or expansion) in a particular industry or in several industries (West, 1993). The usual approach of comparing what the economy would be with and without the industries whose contributions are to be assessed does not work because the inter-relationship between industries means whether or not the industries to be assessed exist, there will still be demand for their outputs (e.g., a complete vehicle needs tyres so that whether or not the entire tyre manufacturer is closed down, the car manufacturer’s demand for tyres still exists). From a modelling stance, this problem is solved by assuming that demand for outputs of the industries to be assessed will instead be met by imports.

In practical terms this is achieved in the model by splitting each of the 114 industries represented in the Input-Output transaction tables into the livestock industry components based on information available regarding activities in the specified LGA and attributing these to their most relevant industry in the transaction tables. These splits are outlined in Chapter 2.

Importantly, a key benefit of the significance assessment approach is it ensures the economic contribution related to the activities or industries being examined never exceeds the total economic activity of the region being examined. All estimates are tied back to the total economy size, and by extracting the livestock industry’s related inputs from the other inputs ensures the livestock industry related inputs are not double counted through flow-on impacts.

## MODEL DEVELOPMENT

The models used in this assessment are derived from sub-regional transaction tables developed specifically for this project for the CWQ LGAs. The process of developing a sub-regional transaction table involves developing regional estimates of gross production and purchasing patterns based on a parent table, in this case the 2018-19 Australian transaction table (ABS, 2020a).

Indicative estimates of gross production (by industry) in the CWQ region were developed based on the percent contribution to employment (by place of work) of the study areas to the Australian economy for the base model year of 2021-20. This is based on AEC’s annual employment estimates by industry by small area (AEC, unpublished b) applied to Australian gross output identified in the 2021-20 Australian table. Modelled indicative estimates for 2021-20 activity in CWQ were then re-based to actual estimates of activity using a range of data sets, including:

- GRP from AEC’s in-house estimates of GRP by small area (AEC, unpublished a), as well as Gross State Product and Gross Domestic Product (ABS, 2020g).
  - An exception to this approach was construction-based industries, which used data regarding the change in total value of construction work done by State for buildings (ABS, 2020h) and engineering construction activity (ABS, 2020i).
- 2021-20 employment by industry estimates from AEC’s in-house employment by industry by small area model (AEC, unpublished b).

Additional details regarding AEC’s in-house GRP and employment estimates models are provided in Appendix D.

Industry purchasing patterns within study areas were estimated using a process of cross industry location quotients and demand-supply pool production functions as described in West (1993). These were then adjusted based on

differences in industry value added activity per employee between the State/ region and Australia, as estimated using AEC's GRP and employment estimates models.

## INPUT-OUTPUT LIMITATIONS

The key assumptions and limitations of IO analysis include:

- **Lack of supply-side constraints:** The most significant limitation of economic impact analysis using IO multipliers is the implicit assumption that the economy has no supply-side constraints so the supply of each good is perfectly elastic. That is, it is assumed that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts. The actual impact is likely to be dependent on the extent to which the economy is operating at or near capacity.
- **Fixed prices:** Constraints on the availability of inputs, such as skilled labour, require prices to act as a rationing device. In assessments using IO multipliers, where factors of production are assumed to be limitless, this rationing response is assumed not to occur. The system is in equilibrium at given prices, and prices are assumed to be unaffected by policy and any crowding out effects are not captured. This is not the case in an economic system subject to external influences.
- **Fixed ratios for intermediate inputs and production (linear production function):** Economic impact analysis using IO multipliers implicitly assumes that there is a fixed input structure in each industry and fixed ratios for production. That is, the input function is generally assumed linear and homogenous of degree one (which implies constant returns to scale and no substitution between inputs). As such, impact analysis using IO multipliers can be seen to describe average effects, not marginal effects. For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount. Further, it is assumed each commodity (or group of commodities) is supplied by a single industry or sector of production. This implies there is only one method used to produce each commodity and that each sector has only one primary output.
- **No allowance for economies of scope:** The total effect of carrying on several types of production is the sum of the separate effects. This rules out external economies and diseconomies and is known simply as the "additivity assumption". This generally does not reflect real world operations.
- **No allowance for purchasers' marginal responses to change:** Economic impact analysis using multipliers assumes that households consume goods and services in exact proportions to their initial budget shares. For example, the household budget share of some goods might increase as household income increases. This equally applies to industrial consumption of intermediate inputs and factors of production.
- **Absence of budget constraints:** Assessments of economic impacts using multipliers that consider consumption induced effects (type two multipliers) implicitly assume that household and government consumption is not subject to budget constraints.

Despite these limitations, IO techniques provide a solid approach for taking account of the inter-relationships between the various sectors of the economy in the short-term and provide useful insight into the quantum of final demand for goods and services, both directly and indirectly, likely to be generated by a project.

In addition to the general limitations of Input-Output analysis, there are two other factors that need to be considered when assessing the outputs of sub-regional transaction tables:

- It is assumed the sub-region has similar technology and demand/ consumption patterns as the parent (Australia) table (e.g., the ratio of employee compensation to employees for each industry is held constant).
- Intra-regional cross-industry purchasing patterns for a given sector vary from the national tables depending on the prominence of the sector in the regional economy compared to its input sectors. Typically, sectors that are more prominent in the region (compared to the national economy) will be assessed as purchasing a higher proportion of imports from input sectors than at the national level, and vice versa.

To assist in accounting for these limitations, AEC's approach has applied results from our internal GRP and employment models to the Input-Output models to reflect the differences more appropriately in production functions between the region examined and the national economy.

## SIGNIFICANCE ASSESSMENT APPROACH

Input-Output transaction tables utilise an aggregated system of industry classifications based on the ANZSIC system. In total, the 2018-19 Input-Output tables produced by the ABS (2020a) define 114 distinct industries. Specified LGA's activities represent a sub-set of some of these 114 industries in the Input-Output tables, and in undertaking the significance assessment modelling it is necessary to separate the LGA's direct activity component from the "non-LGA" direct activity component in the related Input-Output industry.

The separation of the LGA's from "non-LGA" related activity has been developed based on total output and employment (by year and industry) of the LGA activity as outlined in **Error! Reference source not found.**, which was subtracted from the total output and employment for each industry in the selected LGA in the CWQ region (as estimated above).

These shares are then utilised to expand the original Input-Output table to separate these industries into their LGA related and "non-LGA" related components to facilitate the economic significance assessment of the LGA's the livestock industry in isolation for CWQ. Once the transaction table is complete, the significance model is developed through the development of coefficients as per West (1993).

The significance assessment is initially undertaken for the 2019-20 financial year to be consistent with the Input-Output transaction tables utilised. These estimates are then "rebased" to 2021-20 values using:

- Data from the National and State Accounts (ABS, 2020g) and AEC's in-house estimates of Gross Regional Product by small area (AEC, unpublished<sup>a</sup>) to identify growth in output and gross product between 2017-18 and other years examined for each industry of the economy.
- Data on the value of building work done (ABS, 2020h) and the value of engineering construction work done (ABS, 2020i) to estimate the proportion of overall construction sector growth attributable to building construction versus engineering.
- Data on total employment change by industry using AEC's in-house estimates of employment by industry by small area (AEC, unpublished<sup>b</sup>) to identify changes in productivity per employee for each industry between 2019-20 and 2021-20. These estimates were then applied to annual production (estimated above) to identify employment for each industry in each year.
- Estimates of incomes in each year were obtained assuming that the relationship between income and output in 2021-20 remains constant, which is consistent with the stylised fact of cost shares of output being close to constant over the long-term.

Estimates of the flow-on effects of CWQ activities in 2021-20 are obtained assuming constant proportion between individual industries' flow-on effects and the initial (LGA activity) effects (output, gross product, income and employment) in 2021-20. The relationship between industries is likely to have changed over this period, so the estimates produced are indicative only. In the absence of a more recent Input-Output transaction table, which forms the basis to quantify the inter-relationships between industries, the estimates produced represent the flow-on effects of the specified LGA's activities in the livestock industry assuming no significant structural changes in the relationship between industries.

All model results were rebalanced to estimates of total industry value added and employment by industry to ensure model outputs remained within the bounds of the selected LGA of CWQ's total economy size.



## APPENDIX B: AEC GRP & EMPLOYMENT MODELS

Every year AEC produces annual estimates of Gross Regional Product and employment by industry for small areas across Australia (Statistical Area 2 (SA2) and Local Government Area (LGA)). This appendix provides an overview of the approach used in modelling GRP and employment by industry.

### GROSS REGIONAL PRODUCT

#### Background

Gross Domestic Product (GDP) and Gross State Product (GSP) figures are produced on a regular basis and published by the Australian Bureau of Statistics and the relevant State and Territory Government departments. However, regular official estimates of production for sub-State regions do not exist (Gross Regional Product, GRP<sup>1</sup>).

The Australian Bureau of Statistics (ABS) use three approaches to calculate GDP/ GSP (Australian Bureau of Statistics, 2000):

- **Value added approach (or Production approach):** represents the difference between taking the market value of the goods and services produced by an industry (gross output) and deducting the cost of goods and services used up by the industry in the productive process (intermediate consumption).
- **Income approach:** calculates the cost of producing GRP by summing the incomes accruing from domestic production. These income components can be viewed as the market costs of production consisting of the compensation of employees (wages, salaries, and supplements), provision for the consumption of fixed capital (depreciation), net operating surplus, and net indirect taxes; and
- **Expenditure approach:** sums all final expenditures (ignoring expenditure on intermediate consumption) on goods and services, add on the contribution of exports and deduct the value of imports. Final expenditures are known as final demand and include final consumption expenditure by households, gross fixed capital expenditure by producers (i.e., durable assets), investment stocks and exports to the rest of the world.

Due to data limitations, it is not possible to calculate GRP using the same approach as national or State values. AEC estimates of GRP at factor cost use an indirect method to disaggregate official State GSP totals. As such, all GRP estimates will be subject to a combination of any errors in the State GSP estimates as well as those introduced by the methodology and data limitations used to allocate GSP to the constituent regions.

#### AEC Approach

AEC's GRP model utilises the ABS's national Input-Output (IO) transaction tables (ABS, 2020a) to develop GRP estimates by 114 industries for each LGA and SA2 in Australia for the latest IO release year at time of development (for the 2021-20 GRP estimates used in this study, the 2019-20 IO transaction tables were used). Development of LGA and SA2 estimates is based on AEC's IO model regionalisation process, as described in the "General Overview" of the "Model Development" section of Appendix A. The estimates are aggregated to the 19 industry classifications listed in ANZSIC, plus ownership of dwellings, and rebased to State Accounts estimates of value add by industry (ABS, 2020c).

Estimates of GRP for other years are developed based on industry growth in GVA at the State level, disaggregated to an LGA/ SA2 level primarily based on AEC's employment by industry estimates (described separately below). Key exceptions to this are:

- Agriculture, forestry, and fishing, which is based on small area commodity production value data from the ABS (2019).

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<sup>1</sup> GRP at factor cost is that part of the cost of producing the gross regional product which consists of gross payments to factors of production (labour, land, capital, and enterprise). It represents the value added by these factors in the process of production and is equivalent to gross regional product less indirect taxes plus subsidies.

- Ownership of dwellings, which uses data on the number of rented properties and average rental value for each small area based on Census of Population and Housing Data (ABS, 2017).

Adjustments are also made to the mining industry to allocate a greater value per employee to where resources are located (versus office-based employment) based on occupation groupings.

## EMPLOYMENT BY INDUSTRY

### Background

Data outlining employment by industry by place of work (i.e., where the jobs are located) for small areas is only available every five years from the Census of Population and Housing. While other data sets exist providing more regular and up-to-date estimates of employment, these typically suffer from some combination of the following:

- Are not available for small areas.
- Are based on place of usual residence rather than place of work.
- Do not provide a breakdown of employment across industry.

Economic activity in a region is typically based on where jobs are located. To assist in providing more relevant and up-to-date statistics and analysis of economic activity at small regional levels, AEC has sought to address these data limitations by developing in-house estimates of annual employment by industry for LGA and SA2 geographies across Australia.

### AEC Approach

AEC's approach to modelling employment by place of work uses 2011 and 2016 Census of Population and Housing employment by industry by place of work data as a starting point (ABS, 2012 and ABS, 2017). Modelling for other years is, in the first instance, undertaken at a Statistical Area 4 (SA4) geographic level using data from the ABS quarterly Labour Force Survey (LFS) (ABS, 2020b), using regression techniques to smooth this data. Smoothed estimates are converted from place of usual residence to place of work estimates using Census differences for each SA4 between place of usual residence and place of work in 2011 and 2016 (straight line change assumed). Annual changes in the LFS are then applied to Census place of work data for the SA4s.

Small area (SA2) data from the Census as well as Department of Employment, Small Business and Training (DoESB&T, 2020) is then used to assist in splitting SA4 estimates to constituent SA2s across years, based on Census year shares and annual total employment change by SA2.

All estimates are rebalanced to ensure internal consistency between SA2s, SA4s, States and Australian totals. Estimates by LGA are developed using correspondence files between SA2s and LGAs



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