Regional Mining and Infrastructure Planning project - Eyre and Western Region

Contractor’s Report – November 2013

Prepared for the South Australian Department of Planning, Transport and Infrastructure and the Commonwealth Department of Infrastructure and Regional Development
Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glossary</td>
<td>1</td>
</tr>
<tr>
<td>Foreword</td>
<td>3</td>
</tr>
<tr>
<td>1. Purpose and intent</td>
<td>4</td>
</tr>
<tr>
<td>2. Approach</td>
<td>6</td>
</tr>
<tr>
<td>3. Regional background</td>
<td>9</td>
</tr>
<tr>
<td>4. Regional mining profile</td>
<td>17</td>
</tr>
<tr>
<td>5. Existing infrastructure profile</td>
<td>28</td>
</tr>
<tr>
<td>6. Future mining demand</td>
<td>39</td>
</tr>
<tr>
<td>7. Future infrastructure demands</td>
<td>46</td>
</tr>
<tr>
<td>8. Potential infrastructure solutions</td>
<td>53</td>
</tr>
<tr>
<td>9. Regional sustainable development</td>
<td>95</td>
</tr>
<tr>
<td>10. Infrastructure prioritisation</td>
<td>119</td>
</tr>
<tr>
<td>11. Findings</td>
<td>131</td>
</tr>
<tr>
<td>References</td>
<td>139</td>
</tr>
<tr>
<td>Appendix A - Approach</td>
<td>141</td>
</tr>
<tr>
<td>Appendix B – Eyre and Western environmental assets</td>
<td>148</td>
</tr>
<tr>
<td>Appendix C – Alignment of mines to DMITRE Pipeline</td>
<td>149</td>
</tr>
<tr>
<td>Appendix D – Infrastructure assessment benchmarks</td>
<td>151</td>
</tr>
<tr>
<td>Appendix E – Commodity price scenarios</td>
<td>153</td>
</tr>
<tr>
<td>Appendix F – The DAE-RGEM model</td>
<td>160</td>
</tr>
</tbody>
</table>

This final contractor report is one of three prepared for the Regional Mining and Infrastructure Planning project. As each report is intended to be a 'stand-alone' document there is some duplication between the three reports, particularly in Chapters 1, 2, 9, 10 and 11.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag</td>
<td>Silver</td>
</tr>
<tr>
<td>ARTC</td>
<td>Australian Rail Track Corporation</td>
</tr>
<tr>
<td>Au</td>
<td>Gold</td>
</tr>
<tr>
<td>Axle load</td>
<td>Weight felt by road or rail surface for all wheels connected to a given axle</td>
</tr>
<tr>
<td>Beneficiation</td>
<td>Processing of raw ore to increase mineral concentration prior to export</td>
</tr>
<tr>
<td>Bulk commodities</td>
<td>Commodities shipped unpackaged in large volumes</td>
</tr>
<tr>
<td>Concentrate</td>
<td>Processed ore with increased mineral concentration</td>
</tr>
<tr>
<td>Cu</td>
<td>Copper</td>
</tr>
<tr>
<td>DIRN</td>
<td>Defined Interstate Rail Network</td>
</tr>
<tr>
<td>DSO</td>
<td>Direct Shipping Ore</td>
</tr>
<tr>
<td>Easement</td>
<td>Right to use land for a specified purpose</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental impact statement</td>
</tr>
<tr>
<td>Fe</td>
<td>Iron</td>
</tr>
<tr>
<td>GL</td>
<td>Gigalitre</td>
</tr>
<tr>
<td>GWh</td>
<td>Gigawatt Hours</td>
</tr>
<tr>
<td>HM</td>
<td>Heavy mineral</td>
</tr>
<tr>
<td>HML</td>
<td>High Mass Load</td>
</tr>
<tr>
<td>IDS</td>
<td>Infrastructure Demand Study</td>
</tr>
<tr>
<td>ISR</td>
<td>In suit recovery process (for extracting uranium)</td>
</tr>
<tr>
<td>JORC</td>
<td>Joint Ore Reserves Committee</td>
</tr>
<tr>
<td>kW</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>MAPS</td>
<td>Moomba to Adelaide pipeline system</td>
</tr>
<tr>
<td>MCA</td>
<td>Multi-Criteria Analysis</td>
</tr>
<tr>
<td>Mtpta</td>
<td>Million Tonnes per annum</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>Ni</td>
<td>Nickel</td>
</tr>
<tr>
<td>Ore</td>
<td>A metal bearing mineral or rock</td>
</tr>
<tr>
<td>PACE</td>
<td>Plan for accelerating exploration</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead</td>
</tr>
<tr>
<td>PIP</td>
<td>Planning Improvement Process</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Potable</td>
<td>Water of quality to be safe for human consumption</td>
</tr>
<tr>
<td>Remnant vegetation</td>
<td>Areas of native trees, shrubs and grasses which have not been altered</td>
</tr>
<tr>
<td>RESIC</td>
<td>Resources and Energy Sector Infrastructure Council</td>
</tr>
<tr>
<td>REE</td>
<td>Rare Earth Elements</td>
</tr>
<tr>
<td>RMIP</td>
<td>Regional Mining and Infrastructure Planning</td>
</tr>
<tr>
<td>TJ</td>
<td>Terajoules</td>
</tr>
<tr>
<td>Transmission network</td>
<td>Network of high voltage electricity lines and transformer assets</td>
</tr>
<tr>
<td>U</td>
<td>Uranium</td>
</tr>
<tr>
<td>Zn</td>
<td>Zinc</td>
</tr>
</tbody>
</table>
Foreword

The South Australian Government has invested heavily to promote mining exploration and development over the past ten years. This investment is paying dividends in the form of an increase in minerals exploration and the number of mines in production.

The expansion in the mining industry presents a tremendous opportunity to further economic and social objectives in South Australia, particularly in regional centres.

The South Australian Government, miners and regional communities are, however, becoming increasingly concerned about the ability of existing infrastructure to service the future needs of the mining industry.

The South Australian Government has commissioned the Regional Mining and Infrastructure Planning (RMIP) project to consider the infrastructure which is best able to facilitate the development of the mining sector and to articulate the means of delivering this infrastructure. Three reports have been developed for the regions in which existing and potential mining operations are concentrated – Eyre and Western, Far North and Yorke and Mid-North/Braemar. Each of these reports are intended to be standalone documents, but will recognise the interdependencies between the regions.

Funding for the RMIP project has been provided by the Commonwealth Government through the Regional Infrastructure Fund.

This final report presents the findings of the RMIP project, including feedback received on the interim report during public consultation. The report consolidates analysis provided in the interim reports to identify the projects that have been assessed against a prioritisation framework as having the best ability to facilitate development of the mining sector. This analysis is extended to include consideration of the impediments to these infrastructure projects and how they might be resolved, along with the economic and social impacts which can be expected to result.
1. Purpose and intent

**Purpose and intent of the Regional Mining and Infrastructure Planning project**

The Regional Mining and Infrastructure Planning (RMIP) project has been tasked with articulating a plan for the delivery of infrastructure to support the development of mining in South Australia.

The objective of the RMIP project is to identify infrastructure solutions that maximise the net benefits to South Australia by improving connectivity from existing mines and by reducing infrastructure related risks for new mines.

The RMIP project delivers a roadmap, including the respective role of governments and the private sector in facilitating the delivery of long-term infrastructure solutions which are sensitive to the diverse economic, social and environmental requirements of all stakeholders in each of the regions.

This final report identifies the infrastructure requirements to support further development of existing mines and new mines located within the Eyre and Western region. This infrastructure is generally located in the Eyre and Western region, or may be located in one of the adjacent regions where there is better connectivity to support mine development. For this reason, RMIP reports have been developed concurrently for the Far North and Yorke and Mid-North/Braemar regions to provide an integrated approach to planning of mining developments across the State.

**Previous work undertaken**

The Resources and Energy Sector Infrastructure Council (RESIC) commissioned the 2011 Infrastructure Demand Study (IDS) which surveyed resource and energy project proponents in South Australia to develop a dataset of mining proponents’ expectations for future infrastructure requirements for their projects.

The RESIC commissioned study collated proponents’ infrastructure requirements in the event projects proceeded. The study assigned weights based on the likelihood projects would proceed, however this was not based on forecast economic conditions. The RESIC study identified a project weighted outbound resource task of 120 million tonnes per annum from 2017 and beyond.

Building upon the findings of the RESIC study, further information gathering from prospective miners and infrastructure proponents, industry experts and economic forecasts, the RMIP project has assessed the future infrastructure requirements of mining in South Australia. The assessment in this project considers the drivers and impediments to mining project development to develop realistic mining infrastructure demand scenarios, underpinned by key macroeconomic drivers.

The South Australian Government’s response to the RESIC IDS noted two actions which are to be included in the RMIP project:

- Consider the infrastructure requirements of the sector, including progressing the corridor and utility hub concepts. This will help planners and the private sector to determine their location, purpose and function
- Investigate the need for and location of Capesize port capability.
Purpose and intent of the final report

The purpose and intent of the final report is to consolidate the analysis in the interim report by incorporating the feedback received during consultations to form a list of prioritised infrastructure projects that will best facilitate the development of the mining sector. In doing so, the impediments to - and social and economic impacts of - the prioritised infrastructure projects are identified and analysed.

The final report presents our findings with respect to:

- The current state of mining and resultant infrastructure demand
- The forecast future state of mining and resultant infrastructure demand
- The state of current and committed infrastructure
- The gap between forecast infrastructure demand and provision
- The prioritised infrastructure projects and the rationale supporting the prioritisation process
- The impediments to prioritised infrastructure and the means by which these impediments can be overcome
- The social and economic outcomes resulting from the prioritised infrastructure.
2. Approach

Introduction
The approach adopted in the development of the RMIP project has been designed to ensure the comprehensive assessment of current and future infrastructure needs of mining and related industries across South Australia.

The RMIP project considers the requirements of three interrelated regions; as such, the plan for the Eyre and Western region has been prepared with consideration to each region to avoid duplication of infrastructure solutions. The approach adopted assesses the various infrastructure solutions and considers the feasibility, cost and delivery requirements of the infrastructure required.

Mining considered in this plan
There is a significant range of mining activity in South Australia including iron ore, copper, uranium, heavy mineral sands, silver, gold and zinc.

For the purposes of this project, the mining industry is taken to include the exploration and extraction of minerals with a significant or potentially significant demand for freight, water and power and/or gas infrastructure.

It is recognised that iron ore is the most infrastructure-intensive commodity in terms of power, water, freight and other infrastructure, and is therefore the primary focus of this project.

Energy projects, including coal, coal to liquids, geothermal, conventional and gas projects, have not been addressed in this study, however may be referenced from time to time where opportunities or impacts in relation to mineral projects are identified.

Infrastructure considered in this plan
Infrastructure is a broad term which refers to the basic physical and organisational structures required for business and community functions to operate. These structures include the network of roads, highways, railways and ports that underpin the transportation into, out of and within a region, the water and sewage systems that ensure an adequate supply of clean water as well as the disposal of waste, the power and gas grids that fuel enterprise, the networks that support communication and commercial exchange between parties and the structures and institutions that underpin the delivery of social services such as health, education and justice.
The infrastructure requirements of miners are considered in two dimensions; the extraction of the resources and the transportation of the resources. Subsequently, the infrastructure considered in this plan includes:

- Transport and logistics infrastructure, comprising:
  - Port facilities for import of goods required by mines and export of product produced by the mines. This includes landside port facilities as well as marine facilities
  - Freight route infrastructure between the mine site and the port. This comprises road, rail, conveyor systems and slurry pipelines or a combination of these
- Water infrastructure to collect, treat as necessary and transport water to mine sites
- Energy infrastructure to produce and/or supply gas and/or electricity to support mine site processes as well as processes for transport and water infrastructure above.

**Project governance**

A Steering Committee comprising government agencies has been established due to the relevance of the RMIP project to a range of government functions. The Steering Committee is led by the Department of Planning, Transport and Infrastructure and includes representatives from:

- Department of Manufacturing, Innovation, Trade, Resources and Energy
- Department of Primary Industries and Regions South Australia
- Department of the Premier and Cabinet
- Department of Treasury and Finance
- Regional Development Australia
- Commonwealth Department of Infrastructure and Regional Development.

The primary role of the Steering Committee is to ensure that the Government’s objectives on behalf of the South Australian community are considered in the development of the RMIP plans.

**Those who have contributed to the development of the final report**

The South Australian Government has established a team of deeply experienced contractors to support the RMIP project. This team brings a broad range of skills and expertise including:

- Minerals extraction and processing
- Freight and logistics
- Integrated infrastructure planning
- Public policy analysis
- Regional development
- Electricity generation and transmission
- Gas transmission
- Land transport
- Water supply and transmission
- Ports and shipping
- Cost estimation
• Community planning
• Economic impact assessment
• Environmental assessment.

The contractor team, government, industry and peak bodies have all been involved in planning workshops, one-on-one consultations and reviewing detailed analysis of the market forecasts, possible solutions and feedback from public consultation in order to inform the development of this final report.

**Methodology**

The methodology applied in the development of the RMIP report for the Eyre and Western region is discussed in detail in Appendix A.
3. Regional background

Mining has the ability to generate benefits for regional centres through its ability to create employment opportunities and support towns which underpin vibrant communities. The ability of regional communities to benefit from mining activity will in part be driven by the socio-demographic profile of the people in the region and in part by the ability of the region to attract and support skilled labour.

For context, this chapter provides an overview of the economic activity and demographic characteristics of the Eyre and Western region. The data contained in this chapter has underpinned the social and economic modelling undertaken as part of the prioritisation process described in Chapter 9.

The Eyre and Western region

The Eyre and Western region covers an area of 230,000 square kilometres from the regional centre of Whyalla on the north east coast of the Eyre Peninsula west to the State’s border with Western Australia.

Figure 3.1: Map of South Australian regions

The region has a population over 56,000 people comprising several major towns including Whyalla (22,000 residents) and Port Lincoln (15,000 residents). The Eyre and Western region also contains the Maralinga Tjarutja Lands, an Aboriginal local government area south of the Anangu Pitjantjatjara Yankunytjatara (APY) Lands. The regional economy is heavily invested in the industries of agriculture, tourism and mining.
A demographic profile and broader regional summary of the Eyre and Western region (compared to that of South Australia) is provided in Table 3.1 below.

**Table 3.1: Regional summary**

<table>
<thead>
<tr>
<th>Units</th>
<th>South Australia</th>
<th>Eyre and Western</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population no.</td>
<td>1,596,572</td>
<td>56,651</td>
</tr>
<tr>
<td>Population (0-15 years) % of population</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Population (15-64 years) % of population</td>
<td>66</td>
<td>64</td>
</tr>
<tr>
<td>Population (65 years+) % of population</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Population growth (2001-2011) %</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Average wage/salary income* $</td>
<td>41,896</td>
<td>40,628</td>
</tr>
<tr>
<td>Indigenous population % of population</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

**Education and employment**

<table>
<thead>
<tr>
<th>Units</th>
<th>South Australia</th>
<th>Eyre and Western</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of schools no.</td>
<td>785</td>
<td>73</td>
</tr>
<tr>
<td>School enrolment no.</td>
<td>258,991</td>
<td>10,138</td>
</tr>
<tr>
<td>Tertiary education % of population</td>
<td>42</td>
<td>32.5</td>
</tr>
<tr>
<td>Unemployment rate %</td>
<td>5.7</td>
<td>5.9</td>
</tr>
<tr>
<td>Labour force participation rate %</td>
<td>59.9</td>
<td>59.8</td>
</tr>
</tbody>
</table>

Regional Demographics

The Eyre and Western region has a relatively large proportion of children (aged 0-14 years) in its population compared to the State average – 21 per cent in the Eyre and Western region compared to 12 per cent statewide. Overall, the population distribution is similar to that of the State and Australia more broadly.

Figure 3.2: Eyre and Western population profile, 2011

Population projections

The table below presents forecasts of the population for the Regional Development Australia (RDA) Whyalla and Eyre region compared to South Australia. These forecasts refer to the RDA region which is equivalent to the Eyre and Western region considered in this study. It can be seen that population growth in the region over the coming decade is expected to be significantly lower than in the State more broadly, experiencing only 4.5 per cent growth in the coming decade.

Table 3.2: RDA population projections

<table>
<thead>
<tr>
<th>RDA region*</th>
<th>2016</th>
<th>2021</th>
<th>2026</th>
<th>% change 2011-2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whyalla and Eyre Peninsula</td>
<td>59,842</td>
<td>60,685</td>
<td>6,362</td>
<td>4.5%</td>
</tr>
<tr>
<td>South Australia</td>
<td>1,770,644</td>
<td>1,856,435</td>
<td>1,935,161</td>
<td>16.1%</td>
</tr>
</tbody>
</table>

*NB these regions approximately correspond to the study regions as discussed earlier in this report.
Source: Department of Planning and Local Government, cited in SA Centre for Economic Studies 2012

Economy

Agriculture, forestry and fishing (13 per cent) and health care and social assistance (also 13 per cent) are the two largest industries of employment for people in the Eyre and Western region. Other key industries of employment are manufacturing (12 per cent) and retail trade (12 per cent). Together, these four industries account for half of the employment in the region. In comparison, these four industries account for 34 per cent of employment at a State level.

The Eyre and Western region has a labour force profile that is similar to South Australia. The proportion of the labour force in full-time employment in the region (57 per cent) is the same as the proportion in South Australia. The proportion of part-time employment is also broadly similar in the Eyre and Western region (30 per cent) as in South Australia (32 per cent).
49 per cent of people in the Eyre and Western region have an income between $200 and $799 per week. The region also has a lower proportion of the population in the higher income brackets between $800-999 and $2000 or more. This strongly suggests that incomes are lower on average in Eyre and Western region. The median income ($400-$599) and modal income bracket ($400-599) in the region are the same as in South Australia.

Income support for residents in the region included 6.6 per cent of the population as recipients of unemployment benefits and a total of 29.6 per cent of the region’s population being Centrelink card holders.

**Figure 3.3: Total personal weekly income, Eyre and Western, 2011**

![Chart showing total personal weekly income for the Eyre and Western region in 2011.](chart)

Source: ABS Census 2011

**Education**

Like the other regions profiled, the Eyre and Western region has a significantly lower proportion of its working age population with a non-school qualification\(^1\) (32.5 per cent) when compared to the State average (42 per cent) or to Australia as a whole (44.9 per cent). This gap is seen across the board in all types of non-school qualifications, excluding certificate level qualifications held by 22 per cent of the working population in Eyre and Western region, but only 18.8 per cent for the State). The biggest gap in non-school qualifications is at the bachelor degree level, with 7 per cent of the working age population in Eyre and Western region holding this level of qualification compared to 11.6 per cent of the working age population in South Australia and 13.5 per cent nationally.

In the Eyre and Western region, 29 per cent of the population identified as being involved in study towards a non-school qualification. While some of the people in the ‘inadequately described/not stated/not applicable’ category may have held a non-school qualification, this can be assumed not to be the case for the majority.

This is in contrast to South Australia more broadly, where 83 per cent of the population reported a field of study in non-school qualifications. Similar to the State average and the other regions profiled in the RMIP project, engineering and related technologies was the most popular area of qualification (eight per cent of the Eyre and Western region), followed by management and commerce (four per cent).

---

\(^1\) This variable describes the level of education of the highest completed non-school qualification (e.g. bachelor degree, diploma).
The proportion of adults not currently undertaking any type of education in the Eyre and Western region (89.3 per cent) is significantly higher than in South Australia (71.3 per cent). This is driven by the low proportion of adults in the region undertaking full-time studies (0.5 per cent) and part-time studies (3.3 per cent).

### Table 3.3: Percentage of population aged 18 and above studying in the Eyre and Western region

<table>
<thead>
<tr>
<th>Education type</th>
<th>Eyre and Western</th>
<th>South Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not attending</td>
<td>89.3%</td>
<td>71.3%</td>
</tr>
<tr>
<td>Full-time student</td>
<td>0.5%</td>
<td>19.3%</td>
</tr>
<tr>
<td>Part-time student</td>
<td>3.3%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Institution stated, full-time/part-time status not stated</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Both institution and full-time/part-time status not stated</td>
<td>6.8%</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

Source: ABS Census 2011

### Social infrastructure

The Eyre and Western region has six local health services - each run by a local Health Advisory Council. Within the region, there are 11 hospitals. Major upgrades have already been undertaken or are planned at Ceduna Hospital (completed), Whyalla Hospital (which began in February 2013) and Port Lincoln Hospital (currently in planning).

Critical rural health services that operate in the Eyre and Western region include:

- Rural Primary Health Services
- Medical Specialist Outreach Assistance Program
- Royal Flying Doctor Service of Australia
- Rural Women’s GP Service
- Visiting Optometrist Scheme.
Of particular note is the fact that significant portions of the region are in areas considered ‘remote’ or ‘very remote’. This makes access to healthcare critically dependent on transport services. Future development and use of tele-health services including remote conferencing and consultation is set to grow as the rollout of the National Broadband Network (NBN) continues.

There are 27 preschools/kindergartens in the region, including five school-based preschools; this reflects the high proportion of young children in the region. As for school based education, there are 39 government schools in the region with a total enrolment of 7,734 students, as well as five non-governmental schools - all of which are Christian schools - with a total enrolment of 2,404 students.

School-age students also have access to two specialist schools that which specialise in farming and aquaculture, as well as the Eyre and Western Trade Training Centre Consortium, which includes 11 secondary and area schools and provides opportunities in primary industry and trades.

The University of South Australia has a campus at Whyalla. The Lincoln Marine Science Centre (LSMC) also operates in the area, allowing students to complete marine science related courses through TAFE SA and Flinders University.

TAFE SA Regional has three major campuses in the region at Whyalla, Port Lincoln and Ceduna, as well as sites at Wudinna, Cleve and Kimba.

There are 17 police stations in the Eyre and Western region which are predominantly located in more heavily populated areas, and thus hew closely to the major road network in the region.

Sports and recreation facilities in the region are commonly co-located; for example, the Streaky Bay Oval Precinct and Cummins Recreation Centre both have multi-purpose sporting facilities. The region also has a significant number of theatres and museums, including the Middle Back Theatre, Civic Hall Complex in Port Lincoln, D’Faces of Youth Arts hall as well as the Axel Stenross Maritime Museum, Whyalla Visitor Centre and Maritime Museum, Koppio Museum, Excell Blacksmith and Engineering Museum, Ceduna Historical Museum and Darling Terrace Gallery.

**Land use and the environment**

The Eyre and Western region is dominated by agricultural and pastoral land use. Other land uses in the region include conservation, defence (the Cultana Training Facility) and Indigenous lands (including the Maralinga Tjarutja lands). The known extent of remnant vegetation in the far west of the State is significant, whilst on the Eyre Peninsula itself, remnant vegetation is more patchy and is predominantly found in dedicated conservation areas and along roadside and rail reserves. This region also includes a significant number of national parks, including coastal, island and marine reserves which provide significant habitat, breeding and feeding resources for a variety of fauna and flora species.

A list of key environmental assets in the Eyre and Western region is provided in Appendix B; the figure overleaf shows the location of key environmental assets across South Australia. It is important to note this figure (and Appendix B) is intended to provide a high-level overview rather than a detailed assessment as would be required as part of the environmental impact assessment for any major project.
Figure 3.5: Key South Australian environmental assets
Implications of mining growth

The expansion of the mining sector is expected to have a significant impact on development and community dynamics in the Eyre and Western region. Along with the increased investment and commercial activity that would be expected, the increased mining activity will also result in an influx of temporary and permanent residents into the region.

As identified in Figure 4.6 on page 26 of this report, some mining clusters on the Eyre Peninsula (South Gawler, Central Eyre and Southern Eyre) are close to existing townships which are likely to provide workers to support mining activity. Local towns will play a central role in providing workers access to key social services such as health and education, social infrastructure such as housing, water and sewerage and broader community and recreational services such as pools, gymnasiums, cafes and retail facilities.

By contrast, operations in the Western Sands and Mount Christie clusters are not in close proximity to existing townships and are likely to rely heavily on labour sourced from outside the area. In this case, it is likely the remoteness of new operations will promote the development of company-built and operated towns to house the growing workforces and provide basic social services. The requirement to accommodate workers from outside the region may necessitate the investigation of new or expanded airports to service these clusters.

Identification of specific social infrastructure and community service needs (including airports) is provided in Chapter 9.
4. Regional mining profile

Mining in South Australia

Mining has played a key part in the development of South Australia from its foundation, providing not only an economic mainstay but encouraging waves of immigration and exploration. Australia’s first metal mine was established at Glen Osmond in 1841. Before 1850, virtually all of Australia’s metal mines were located in South Australia which, for a period, produced approximately 10 per cent of global copper supply. Many South Australian firms supplied mining machinery to other Australian colonies, and the economic benefits derived from mining made finance available for further mining developments around Australia.

The copper and gold rushes of the 1850s and 1860s and subsequent development of South Australia’s mining industry through the early 20th century fostered the development of infrastructure across the State, facilitating the exploration and settlement of the more remote areas of the State. Numerous towns were founded along or near the infrastructure corridors established to service the State’s burgeoning minerals export industries. Through the 20th century, the impact of mining on the State’s economy was overtaken by agricultural exports. However, the development of the Olympic Dam mine in the 1980s and a steady increase in minerals exploration through the 1990s have led to the importance of the minerals sector in South Australia beginning to increase once more.

The Plan for Accelerating Exploration (PACE) funding initiative was established by the South Australian Government in 2004 to promote minerals exploration in the State. PACE seeks to provide a robust, transparent and timely process to streamline the mining assessment and approval processes that are critical in determining the overall economic, environmental and social impact of a project.²

Initially a five year program, PACE is now funded through to 2014, with total funds in excess of $40 million. Due to the increased exploration over the last decade, facilitated by the PACE program and encouraged by increasing commodity prices, hundreds of new deposits have been identified and several new mines are now operating. From four operating mines in 2000, South Australia currently has 20 approved mines and over 130 developing projects and prospects. In the 2012 financial year, South Australia’s minerals exports exceeded $4 billion per year - more than one third of total state exports.

With existing operations and the potential evident from the number of significant mining projects currently in advanced development, the expansion of South Australia’s mining sector over the coming decades will place additional demand on existing infrastructure networks, support services and systems. Therefore, the expansion of South Australia’s power, water and transport infrastructure is a necessity in order to capitalise on the State’s mineral prospectivity and to support the expansion of mineral production and exports.

Mining in the Eyre and Western region

The Eyre Peninsula has a strong relationship with the mining sector dating back to the 1860s. Beginning with Iron Knob, iron ore has been mined in the Middleback Ranges since the 1890s, while BHP and Arrium (formerly OneSteel) have continued to expand extractive operations in the Middleback Ranges. The associated steelworks and shipyards at Whyalla were a long term economic mainstay in this region. There have also been numerous copper discoveries on the peninsula, including the Burrawing mine at Lipson near Tumby Bay. Other commodities mined on the Eyre Peninsula include gypsum, talc, kaolin, jade and graphite.

Current mining operations on or impacting the Eyre Peninsula include Arrium’s ongoing Middleback Ranges operations such as Iron Chieftain and Iron Duke and Iluka’s Jacinth and Ambrosia heavy mineral sands deposits. It should be noted these deposits are not located in the Eyre and Western region but are discussed in this context due to the interaction with infrastructure in the region. This is discussed further at the end of this chapter.

The exploration focus on the Eyre Peninsula is centred on a number of large iron ore deposits spread throughout the eastern and central parts of the peninsula. Several advanced magnetite projects have marked the Eyre Peninsula as a potential major new iron ore province in Australia. In addition, the identification of promising uranium, graphite and kaolin deposits and further heavy mineral sands discoveries have added to the diversity of commodities under investigation in the region.

Of the 21 major mines operating in South Australia, just three are located in the region. While Wilgerup is classified as a major mine due to its approval status, the mine is still to be constructed. A summary of the mining pipeline for the region is presented overleaf.

It should be noted the economic contribution of mining is a function of production volumes and price paid for the commodity (i.e. uranium is produced in relatively low volumes, but has a relatively high price per tonne).
In total, there are 15 mining projects recognised by the Department for Manufacturing, Innovation, Trade, Resources and Energy across the Eyre and Western region that have been assessed as part of the RMIP project. Mining activity in the Eyre and Western region has a focus on iron ore and heavy minerals (HM) projects, but also includes gold, uranium, graphite and kaolin prospects.

The analysis undertaken in the RMIP project has been limited to the mines recognised by DMITRE, however the prioritised projects identified as part of this project are likely to be able to support the development of other projects as they commence. The rationale for the selection of mining projects to be assessed as part of this project is presented in Appendix C.

---

3 Note that while Wilgerup is classified as a major mine it is not yet operational.

4 Although the Middleback Ranges project is located within the boundaries of the Far North region, it is included in considerations for the Eyre and Western region as its existing infrastructure solutions utilise Whyalla.
Table 4.1: Summary of Eyre and Western region mining activity by resource type (as at April 2013)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Iron</th>
<th>Cu</th>
<th>U (and associated)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of major mines</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1 (HM)</td>
</tr>
<tr>
<td>Number of developing projects</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3 (HM, Kaolin, Graphite)</td>
</tr>
<tr>
<td>Number of prospects</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total mining projects</td>
<td>15</td>
<td>9</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 4.2: Indicative annual production values for the major mines in the region (2012-13)

<table>
<thead>
<tr>
<th>Mine</th>
<th>Proponent</th>
<th>Mineral</th>
<th>Annual Production volume</th>
<th>Mine/ resource life (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacinth/ Ambrosia</td>
<td>Ilkua</td>
<td>Heavy minerals (e.g. zircon)</td>
<td>815,000 tonnes</td>
<td>8</td>
</tr>
<tr>
<td>Middleback Ranges (includes Iron Chieftain)</td>
<td>Arrium</td>
<td>Iron DSO</td>
<td>9.2 mtpa</td>
<td>10</td>
</tr>
</tbody>
</table>

Iron Projects

The defining characteristic of iron ore mining is whether the target ore body is haematite or magnetite; these two types of iron oxide deposits have vastly different mineral characteristics, which in turn have considerable impacts on the commercial considerations of mining.

Haematite

Haematite comprises the majority of Australia’s iron ore projects, including those in the Pilbara region of Western Australia. Haematite deposits are usually found with other iron minerals such as goethite and limonite and contain high levels of iron (usually around 60 per cent).

The higher proportion of iron in haematite deposits means mine production can be shipped to steelworks with little or no processing at the mine site. This practice of shipping ore in the state in which it is extracted is referred to as a direct shipping ore (DSO) operation.

The lack of processing required for DSO haematite operations means there is a significantly lower need for capital equipment at the mine site than for magnetite mines. Less capital equipment results in a lower capital cost of developing mines and lower operating cost as there is not as large a draw on power.

The relatively low capital and operating cost of haematite mines means they can be commercially viable at significantly lower production levels (as low as 1-2 mtpa) than magnetite mines.

Magnetite

Magnetite is a magnetic iron oxide often found in association with haematite deposits. Magnetite deposits have a lower iron content when mined (usually 25 per cent to 40 per cent) when compared to haematite, which means these deposits have lower overall yields.

The lower iron content found in magnetite deposits means the extracted ore needs to undergo more complex processing at the mine site to produce a magnetite concentrate. This beneficiation process requires capital equipment such as grinding mills, crushing plants and magnetic separators, which significantly increase the
capital and operating cost of magnetite mines. The greater fixed and operating cost of magnetite operations mean they must ship ore in larger volumes (around 5 mtpa) to be commercially viable.

However, as magnetite mines typically ship concentrate at 68 per cent to 70 per cent iron content, this higher quality product attracts a premium price from steel making customers, potentially offsetting the greater costs associated with processing.

**Iron deposits in the Eyre and Western region**

The geographic distribution of iron ore deposits in the Eyre and Western region is presented in the figure below.

*Figure 4.2: Map of the iron ore mining activity in the Eyre and Western region*

While there are no currently operating iron ore mines within the defined boundaries of the Eyre and Western region, there are several mines and prospects in the South Gawler cluster (see Figure 4.6) which straddles the boundary between the Eyre and Western and Far North regions. In addition to these projects, the Wilgerup project in the Eyre and Western region is in an advanced stage of development. The Eyre Peninsula is regarded as highly prospective region for magnetite, with a number of advanced projects in development. The table below details the iron ore projects assessed as part of the RMIP project.
### Table 4.3: Iron ore activity in the Eyre and Western region

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>DMITRE status</th>
<th>Mine Stage</th>
<th>Target Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middleback Ranges</td>
<td>Arrium Mining</td>
<td>Major Mine</td>
<td>Operating</td>
<td>Iron</td>
</tr>
<tr>
<td>[includes Iron Chieftain]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilgerup</td>
<td>Centrex Metals</td>
<td>Major Mine</td>
<td>Approved Mine - PEPR&lt;sup&gt;A&lt;/sup&gt; finalisation</td>
<td>Iron</td>
</tr>
<tr>
<td>Fusion</td>
<td>Eyre Iron</td>
<td>Developing Project</td>
<td>DFS commenced 2012</td>
<td>Iron</td>
</tr>
<tr>
<td>Central Eyre Iron Project</td>
<td>Iron Road</td>
<td>Developing Project</td>
<td>Bankable FS 2012, MLA 2013, DFS by Dec 2013</td>
<td>Iron</td>
</tr>
<tr>
<td>[Warramboo, Kopi]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gum Flat</td>
<td>Lincoln Minerals</td>
<td>Developing Project</td>
<td>Pre FS 2012</td>
<td>Iron</td>
</tr>
<tr>
<td>Bungalow + Minbrie</td>
<td>Centrex Metals</td>
<td>Prospect</td>
<td>Pre FS 2012</td>
<td>Iron</td>
</tr>
<tr>
<td>Carrow</td>
<td>Eyre Iron</td>
<td>Prospect</td>
<td>Pre FS 2012</td>
<td>Iron</td>
</tr>
<tr>
<td>Greenpatch</td>
<td>Eyre Iron</td>
<td>Prospect</td>
<td>Pre FS 2012</td>
<td>Iron</td>
</tr>
<tr>
<td>Bald Hill + Charlton Gully</td>
<td>Eyre Iron</td>
<td>Prospect</td>
<td>Exploration</td>
<td>Iron</td>
</tr>
</tbody>
</table>

<sup>A</sup> PEPR – Program for environment protection and rehabilitation

### Copper Projects

Many of the known South Australian copper deposits occur near the margins of the Gawler Craton, including several significant copper prospects on the margins of the Eyre and Western region.

The copper produced in South Australia is shipped either as a concentrate or as refined copper metal. The processing of copper has a significant power and water requirement per tonne – particularly in producing refined copper.

Copper deposits are often found in association with commercial reserves of iron ore, gold and uranium. Often the more valuable metals are obtained as by-products of iron ore processing.

### Copper deposits in the Eyre and Western region

The Eyre and Western region is not highly prospective for copper. Although uranium is the primary target of the Pundinya prospect, the deposit includes some copper resources, as shown in the table overleaf. The geographic distribution of copper deposits in the Eyre and Western region is presented in the figure overleaf.
Uranium Projects

Uranium mines typically undertake a significant amount of beneficiation at the mine site to produce a uranium oxide concentrate suitable for shipping. Although the volumes of concentrate produced are not large in comparison to bulk minerals such as iron ore, the processing requirements mean uranium mines have a relatively high power and water requirement per tonne of final product shipped.

Uranium deposits in South Australia are generally either hosted in breccia or sandstone geology.

Breccia hosted uranium

Breccia hosted uranium mines require the breccia in which the uranium is contained to be extracted by either open cut or underground mining for processing. The hardness of breccia means it is technically challenging to extract the material, as well as costly to crush sufficiently to enable further processing. Breccia hosted uranium deposits must normally be close to the surface if they are to be commercially viable.

Breccia hosted uranium is processed to derive uranium oxide above ground, with significant water and power requirements. In addition, considerable safety measures are required due to its radioactivity.
Sandstone hosted uranium

Due to the porous nature of the surrounding rock, sandstone hosted uranium can be extracted using the in-situ recovery (ISR) process. This process involves circulating local groundwater and chemical solutions through a network of wells through the host rock, which dissolves the uranium. The solution is then pumped to the surface and processed to produce uranium oxide concentrate suitable for shipping.

Because the ISR process is largely undertaken underground, this removes the need for much of the capital expenditure associated with traditional open cut or underground mining operations, such as crushing plants and smelters. Therefore, sandstone hosted uranium deposits require less power and water for extraction and processing than breccia hosted uranium, and produce fewer tailings.

Uranium deposits in the Eyre and Western region

The geographic distribution of uranium deposits in the Eyre and Western region is presented in the figure below.

Figure 4.4: Map of uranium related mining activity in the Eyre and Western region

![Map of uranium related mining activity in the Eyre and Western region](image)

The Pundinya project is the only uranium project in the Eyre and Western region assessed as part of the RMIP project.

Table 4.5: Uranium activity in the Eyre and Western region

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>DMITRE status</th>
<th>Target Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pundinya</td>
<td>Marmota Energy</td>
<td>Prospect</td>
<td>U, Cu, Ni</td>
</tr>
</tbody>
</table>

Regional mining profile
Other Projects (Heavy Minerals, Nickel, Graphite, Kaolin)

In addition to the minerals discussed above, the Eyre and Western region includes several prospects that target other commodities, including gold, silver and other metals.

Heavy minerals

Heavy Minerals, such as zircon, rutile and ilmenite, are generally found in sand deposits. The Jacinth/Ambrosia mine currently produces over 800,000 tonnes of heavy mineral concentrate annually, which is exported through the port of Thevenard. The heavy minerals deposits in the Eyre and Western region assessed as part of the RMIP project are detailed below.

Figure 4.5: Map of mining activity in the Eyre and Western region

Table 4.6: Other mineral activity in the Eyre and Western region

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>DMITRE status</th>
<th>Mine Stage</th>
<th>Target Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacinth/Ambrosia</td>
<td>Iluka</td>
<td>Major Mine</td>
<td>Operating Mine</td>
<td>HM</td>
</tr>
<tr>
<td>Tripitaka</td>
<td>Iluka</td>
<td>Developing Project</td>
<td>Exploration</td>
<td>HM</td>
</tr>
<tr>
<td>Atacama/ Typhoon/ Sonoran</td>
<td>Iluka</td>
<td>Prospect</td>
<td>Advanced Exploration</td>
<td>HM</td>
</tr>
<tr>
<td>Pundinya</td>
<td>Marmota</td>
<td>Prospect</td>
<td>Exploration</td>
<td>Ni, Cu, U</td>
</tr>
<tr>
<td>Paris</td>
<td>Investigator</td>
<td>Prospect</td>
<td>Exploration</td>
<td>Ag</td>
</tr>
<tr>
<td></td>
<td>Resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunkillia</td>
<td>Mungana Goldmines</td>
<td>Prospect</td>
<td>Exploration</td>
<td>Au, Ag</td>
</tr>
<tr>
<td>Uley</td>
<td>Strategic Graphite</td>
<td>Historical Mine</td>
<td>Project Development</td>
<td>Graphite</td>
</tr>
<tr>
<td>Mine</td>
<td>Operator</td>
<td>DMITRE status</td>
<td>Mine Stage</td>
<td>Target Commodity</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Carey’s Well (Poochera)</td>
<td>Mintoaur Exploration</td>
<td>Developing project</td>
<td>Advanced Exploration</td>
<td>Kaolin</td>
</tr>
</tbody>
</table>

**Graphite**

Graphite is a crystalline form of carbon, with numerous deposits of high quality graphite having been identified on the Eyre Peninsula. Whilst some of these are associated with historical graphite mining operations, the region has been the focus of considerable graphite exploration in recent years.

The RMIP project has only assessed the Uley project, which is associated with a historical mine that produced graphite up to 1993.

**Kaolin**

Kaolin is a clay mineral formed from the weathering of silica rich rock such as granite and gneiss, and is used in paints, ceramics, polymers and other industrial applications. The Carey’s Well project near Poochera has been included in the RMIP project assessment.

**Mining clusters**

To aid in the identification of concentrations of mining activity in South Australia and the associated requirement for supporting infrastructure, mineral deposits have been grouped into clusters of mines.

The intention of the development of clusters is to identify those operating and prospective mines which are likely to have similar infrastructure needs. Therefore, three factors determined whether or not mines would be clustered together:

- Common mineral being extracted (likely to reflect common freight need)
- Common extraction technique (likely to reflect common water and power needs)
- Geographic proximity (to reflect the location in which the infrastructure must be provided).

A key advantage of the development of clusters is the ability it provides to analyse infrastructure demand and facilitate solutions on an aggregated basis, as opposed to mine-by-mine solutions. Further, the consideration of clusters rather than individual mines means identified infrastructure demand, and thus the viability of solutions, is not reliant on circumstances impacting individual operations.

The mining clusters referred to for the remainder of this final report are presented in the figure overleaf.
Figure 4.6: Mining clusters in the Eyre and Western region
5. Existing infrastructure profile

Mining activity in the Eyre and Western region has increased significantly over the last decade. To date mining operators have fashioned composite bulk freight solutions utilising pre-existing infrastructure networks. This chapter reviews the nature and extent of infrastructure currently in place to support mining activity in the Eyre and Western region; specifically, its condition, capacity and capability to meet current infrastructure needs and any current infrastructure deficiencies that need to be addressed.

This chapter is divided into three sections:

- The first is a summary of the infrastructure solutions utilised by existing mines
- The second is an examination of the technical characteristics of infrastructure in the Eyre and Western region across the categories necessary to support current and future mining activity
- The third summarises the extent to which current infrastructure is supporting mining activity in the Eyre and Western region.

The information in this chapter is presented to give context and a point of comparison to the discussion of the expected future infrastructure needs of mining in the Eyre and Western region presented in Chapter 7.

Current infrastructure approach of major miners in the region

A summary of the major mines current output and infrastructure tasks is provided in the table below.

Table 5.1: Major mine infrastructure needs

<table>
<thead>
<tr>
<th>Mine</th>
<th>Annual Production volume (mtpa)</th>
<th>Transport to market</th>
<th>Utilities</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacinth/Ambrosia</td>
<td>0.82</td>
<td>Road to Thevenard</td>
<td>Onsite diesel power station, desalinated groundwater</td>
<td>n/a</td>
</tr>
<tr>
<td>Middleback Ranges (includes Iron Chieftain), Arrium Mining</td>
<td>9.2</td>
<td>Rail to Whyalla</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SMEC

Existing infrastructure profile

Ports

Currently, there are four ports within the Eyre and Western region:

1. Thevenard
2. Port Bonython
3. Port Lincoln
4. Whyalla

Further details for these ports are provided below.

**Figure 5.1: Overview of existing port facilities in the Eyre and Western region**

1. Thevenard

The port of Thevenard accounted for an export volume of approximately three million tonnes in 2011. The largest export commodity is Gypsum (1.7mtpa), followed by mineral sands (which varies in excess of 0.4mtpa) and grain (up to 0.4mtpa).

Thevenard is operated by Flinders Ports, and has a single cargo jetty approximately 200m in length and port water depth of 9.8 metres (although operations are constrained by the depth of the Yatala Channel at 8.2m).

The port precinct covers an area of approximately 95 hectares, and cargo storage at the site is limited. There is limited opportunity to expand the port precinct as it abuts residential areas to the north and recreation areas to the east.

The 2008 Eyre Peninsula Ports Master Plan proposed dredging the Yatala Channel to a depth of 10.7m as a key proposal to maintain or grow export volumes from the port of Thevenard. The 2011/12 annual report from RDA Whyalla and Eyre Peninsula identifies the need for upgraded capacity for loading operations as key to any expansion of the port. At this point, however, there is no commitment to funding or timing for these proposals.

There is a proposal to establish a marine offloading facility at Thevenard for the fishing fleet in the Western Eyre region. This project is aimed at separating fishing industry port activities from other commodities and has
been identified as a high priority project by RDA Whyalla and Eyre Peninsula. The District Council of Ceduna has submitted a Development Application for the project as Crown Development under Section 49 of the Development Act 1993. The Department of Planning, Transport and Infrastructure has endorsed the Development Application and the necessary funding is currently being sought through the Regional Development Australia fund.

2. Port Bonython

Port Bonython is owned by the South Australian Government and is currently solely operated by Santos as an export only facility, exporting approximately 250,000 tonnes per annum (approximately 30 ships per year), including naptha, crude oil, propane and butane. Port Bonython is subject to an indentured act of Parliament – the Stony Point (liquid projects) Ratification Act 1981.

The port uses a 2.4km jetty to access deep water (approximately 20m) to load ships of up to Capesize. Opportunities to use this port for other commodities are limited by the safety and practical implications of integrating with the existing uses.

Government approval exists for the construction of a diesel import, storage and distribution facility at the port, enabling the delivery of up to 1 billion litres of diesel annually to the region (although commitment to funding and timing for this development are not confirmed).

3. Port Lincoln

Port Lincoln is managed by Flinders Ports and typically exports 1-3 million tonnes of product, depending on the grain harvest.

Port Lincoln has natural deep water at the berths of up to 15.2m (with the minimum depth of the north channel being 14.6m), and currently caters for post-Panamax and small Capesize ships. Viterra own and operate two travelling bulk grain loaders at berths 4 and 5.

While the naturally deep water and port location itself are well suited to attracting increased throughput, the need to move product through the town is a significant constraint.

Centrex Metals received Development Approval in October 2009 to export 1.6 million tonnes of iron ore per annum through Port Lincoln for a maximum of 10 years, however a number of community concerns were raised with this proposal. As a result, this approval has now been in place for over 3 years and has not been enacted by Centrex; Centrex is instead progressing their Port Spencer proposal.

There are proposals for a new unloading facility for Port Lincoln’s fishing fleet at Proper Bay, which may provide the dual benefits of separating the fishing industry from other uses and freeing up additional port capacity. The timeframes for this development are not committed.

4. Whyalla

The Whyalla port is owned by the South Australian Government and operated by Arrium (formerly OneSteel) under an indentured Act of Parliament (the Whyalla Steel Act 1958).

The port operates using barges to two transhipment points (one for Panamax vessels and one for Capesize vessels) up to 12km from the port.

Whyalla is South Australia’s largest export facility, with Arrium recently undertaking an expansion of the port facilities to approximately double the capacity of the port (from 6mtpa to 12 mtpa).
There is opportunity to increase landside storage in alignment with the Whyalla structure planning process.

5. Other – Lucky Bay

In addition to the above defined ports, Lucky Bay harbour is used as the Eyre Peninsula terminal for the Wallaroo – Lucky Bay Ferry service operated by Sea Transport.

Rail

The rail network in this region is comprised of four distinct parts:

1. Narrow gauge lines between Kevin and Port Lincoln and between Buckleboo and Port Lincoln
2. Narrow gauge lines between Iron Knob, Iron Duke (via Iron Baron) and Whyalla
3. Standard gauge rail line between Port Augusta and Whyalla
4. Standard gauge rail line between Tarcoola and Western Australia (Adelaide – Perth corridor)

Further details for these lines are provided below.

Figure 5.2: Overview of existing rail lines in the Eyre and Western region

1. Narrow gauge network between Kevin and Port Lincoln and between Buckleboo and Port Lincoln.

This is an isolated network that is owned, operated and maintained (with the latter contracted to Transfield) by Genesee Wyoming Australia (GWA), and is principally used to carry grain to Port Lincoln and Gypsum to Thevenard.
This network typically carries 16 tonne axle loads at low operating speeds. The track is in ‘fit for purpose’ condition with a number of speed restrictions. The section between Cummins and Port Lincoln was upgraded in 2007.

There is some capacity to carry additional freight on these lines, however the 16 tonne axle limit and low operating speeds would need to apply, along with an increased maintenance input, unless substantial track upgrade works were undertaken.

Without the track upgrade works, volumes in the order of 1.0mtpa may be able to be carried over and above existing use, subject to train scheduling being able to coordinate train crossings at existing loop locations.

2. **Narrow gauge links between Iron Knob, Iron Duke (via Iron Baron) and Whyalla.**

These lines are owned by Arrium and are operated and maintained by GWA.

The corridor from Iron Duke through to Whyalla has been operating at a 23 tonne axle load to carry approximately 6mtpa. The section from Iron Knob has not operated in recent times following flood damage.

These corridors are currently being upgraded and will see the recommencement of services from Iron Knob, along with an increase in axle loads to 25 tonne to carry an estimated 9.4mtpa. A balloon loop is also being built at Whyalla and will enable both standard and narrow gauge access.

GWA advise that there is no available capacity for additional freight movements on these lines. Third party access to this track would have to be negotiated with Arrium.

3. **Standard gauge rail link between Port Augusta and Whyalla.**

This section of track links to the defined interstate rail network (DIRN) and is owned and operated by the Australian Rail Track Corporation (ARTC). This track is able to carry 1800m trains with 25 tonne axle loads with an 80km/h speed limit. Train control is via a verbal train order system although ARTC is proposing to roll-out a new ‘in-cab’ train control system in the next decade which will improve safety and operational efficiency on the line.

ARTC advise there is currently no spare capacity on this line.

4. **Standard gauge rail between Tarcoola and Western Australia (part of the Adelaide – Perth corridor).**

This is a part of the DIRN and is owned and operated by ARTC. This line operates at 23 tonne axle load at 80km/h.

There are no identified deficiencies in the condition of the track. As for the Port Augusta to Whyalla section, train control is via a verbal train order system, although ARTC is proposing to roll-out a new ‘in-cab’ train control system in the next decade.

There is currently some capacity for additional freight on this section which is broadly estimated at three train paths per week or 1.2mtpa, based on a number of assumptions.

**Road**

Roads throughout the Eyre and Western region are a combination of national highway (Eyre Highway), state arterial roads and local roads. Typical existing traffic volumes and percentage of freight vehicles are shown on the diagram overleaf.
The Eyre Highway is in fair condition, although is recognised as having aged pavement and shoulders that will require upgrade over time, particularly west of Penong.

The Lincoln Highway is generally in good condition - particularly the section between Port Augusta and Whyalla which was upgraded approximately four years ago. Other arterial roads are generally fit-for-purpose, however most roads will require shoulder upgrades and sealing if significant additional loads are to be accommodated. Additionally, many arterial roads will have insufficient pavement strength to carry significant additional loads, and pavement upgrade works are likely to be required.

DPTI also manages roads in the unincorporated areas in the far west of this region as part of a total 10,000km unsealed road network throughout the north and west of the State. Almost all of these roads would require pavement upgrade and sealing if significant additional loads were to be allocated. It should be noted, however, that sealing may not be the most cost efficient option for moderate load increases, as the maintenance costs of sealed roads may be higher than unsealed roads, particularly in areas prone to flooding. The approach for each road would need to be considered on a case-by-case basis.

The local network is a mixture of sealed and unsealed roads managed by 11 regional councils. The roads are generally fit for purpose, however almost all local roads would also require pavement upgrades, shoulder widening and sealing if significant further loads were to be added.
Many roads, as detailed in the DPTI online RAVNet system, are currently gazetted for a range of Restricted Access Vehicles, including:

- 32 and 36.5m road trains
- B-doubles
- B-triples
- Higher mass limit (HML) vehicles.

In addition, a number of roads are also used for over-dimension and over-mass freight movements.

In broad terms, there is spare capacity on most roads, however the following would need to be considered as part of a risk assessment process prior to any material change in volumes or type(s) of vehicles used in individual roads or sections of road:

- Pavement capability
- Road geometry (including intersection layouts)
- Safety, including interfaces with other users (e.g. rail) and crash history
- Impact on structures (culverts, bridges)
- Community impact (e.g. if a road passes through a town)
- Service level impacts (e.g. opportunities to overtake)
- Road upgrade costs and responsibility
- Road maintenance costs and responsibility.

It should be noted that ownership and responsibility for maintenance of national highways is with the Commonwealth Government, state roads with the South Australian Government and local roads with local councils.

**Electricity**

Electricity for the Eyre and Western region is provided from the South Australian electricity grid via the ElectraNet transmission network and the South Australian Power Networks (SAPN) distribution network.

The South Australian electricity grid receives power generated from coal fired power stations at Port Augusta (approximately 16 per cent), nine gas fired power stations (approximately 65 per cent) and a number of wind (17 per cent) and diesel (2 per cent) generation sites. In addition, the South Australian grid is connected to the National Electricity Market via two interconnector systems.

The peak demand for South Australia is at approximately 3,400MW, which occurs for approximately 80 to 100 hours per year. For over 90 per cent of the year, South Australia uses between 1,000 and 2,000 MW - well below the State’s peak demand.

The generation capability for South Australia, without reliance on the interconnectors, is approximately consistent with the current peak demand requirements.

For the Eyre and Western region of the State, transmission occurs via a 275kV network to Cultana and then via a 132kV radial supply to Yadnarie, Wudinna and Port Lincoln. In addition to that shown in Figure 5.4 overlaid, there are some local sections where transmission lines connect wind farms to the network and to the Iron Baron mine in the Middleback Ranges. Gas turbine generators (fuelled by distillate) provide up to 49MW of backup supply at Port Lincoln.
A summary of the electricity network in the region is presented in the diagram below.

**Figure 5.4: Overview of the existing electricity network in the Eyre and Western region**

![Diagram of the existing electricity network in the Eyre and Western region]

This system is currently able to supply approximately 100MW to the Eyre and Western region. This is used to near capacity at present, although demand has reduced slightly in recent years.

Accordingly, there is limited capacity to meet significant additional demand on this section of the network.

ElectraNet has advised that much of this system was originally built in 1967 and will need replacement/upgrades in the foreseeable future. ElectraNet has undertaken a Regulatory Investment Test (RIT-T) to establish whether or not a capacity upgrade of this network should be undertaken as a Regulatory project. While this has not been approved as a committed project, it has recently been approved as a 'contingent project', enabling a further RIT-T submission to be presented to the regulator (the Essential Services Commission of South Australia).

It is recognised that the Eyre Peninsula has significant opportunities for further renewable energy generation (particularly wind and wave), but also that this would require an upgrade of the transmission network capacity in order to allow this generation to feed back into the South Australian grid.

**Water**

South Australia uses just over 200GL of water per annum, with this water being sourced from:

- Surface water - 46.6 per cent
- River Murray - 45.6 per cent
- Ground water - 6 per cent
- Sea water - 1.8 per cent
For the Eyre and Western region, the current demand for water is approximately 27.7GL per annum, of which approximately 22 per cent is for residential use, 29 per cent for non-residential use, 27 per cent for livestock, 14 per cent for mining and 8 per cent for other uses.

The region’s water is provided by the following sources:

- River Murray - 39 per cent (of which the vast majority is used in Whyalla)
- Ground water - 37 per cent
- Farm dams – 7 per cent
- Recycled water - 11 per cent
- Farm dams - 6 per cent

Water supply sources for the Eyre and Western region are estimated to have a capacity of 28.6GL per annum according to the SA Water Demand and Supply statement for the region.

This is only marginally above the current demand estimates, indicating there is limited available capacity to accommodate any significant further demand. However, it should be noted that, similar to electricity, demand has reduced slightly in recent years.

In 2008, SA Water indicated an additional water source will be required in the next 25 years and identified a desalination plant in the south of the Eyre Peninsula as the preferred approach. Timing for this will be dependent on ongoing demand monitoring.

**Gas**

South Australia’s gas is supplied from two sources;

1. The Moomba to Adelaide pipeline system (MAPS), which links to the South West Queensland Pipeline System. This system is owned by Epic Energy (which is owned by QIC Global Infrastructure) and has a transmission capacity of 253 Terra Joules (TJ) per day.

2. The South East Australia (SEAGAS) pipeline system which links to the Victorian gas fields. This system is owned by SEAGAS (which is 50 per cent owned by APA Group) and has a transmission capacity of 303TJ per day.

The MAPS pipeline is shown in the figure overleaf.\(^5\)

\(^5\) The SEAGAS pipeline is not as it is not located within the study region.
Gas supply to South Australia is dependent on overall demands from the eastern states. At current demand rates, it is forecast that the existing supply basins have capacity for a further 50 years.

The current usage of the MAPS and SEAGAS transmission systems is generally well below the system capacity (although goes closer to capacity at times of peak demand), indicating that there is likely to be capacity for additional gas supply if required; this conclusion is consistent with feedback received during consultations suggesting that commitment to supply is much higher than ‘actual use’.

Gas supply to the Eyre and Western region is limited to a connection from the MAPS pipeline at Whyalla (as shown in Figure 5.5 above). This connection has a capacity of 24TJ/day, of which a large percentage is used within Whyalla. It is therefore expected that there is only limited capability to supply gas to the Eyre and Western region without significant capital expenditure.

Assessment of existing infrastructure

Existing Eyre and Western freight, power and water infrastructure have been assessed to ascertain their condition, capacity and capability to meet current mining demand. Current infrastructure demand refers to the aggregate requirements of the major mines. The scoring scale used for this assessment is outlined in the table overleaf.
Table 5.1: Infrastructure assessment scale

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
</table>
| 🟢      | Good   | - Infrastructure presents a low risk to mining operations/performance  
|         |        | - Infrastructure considered adequate to meet current requirements  
|         |        | - No immediate action required |
| 🟠      | Moderate | - Infrastructure presents a moderate risk to mining operations/performance  
|         |        | - Moderate risk that emerging issues will impact the ability of infrastructure to meet current requirement  
|         |        | - Short to medium term action likely |
| 🔴      | Poor   | - Infrastructure presents a high risk to operations, threatening overall performance  
|         |        | - Significant risk that infrastructure will be unable to meet current demand requirements  
|         |        | - Immediate action required |
| ⏰      | Not Applicable | - No infrastructure required, alternative infrastructure solution(s) are sufficient at this time  
|         |        | - No current mining demand in area requiring infrastructure  
|         |        | - No immediate action required |

The results of this assessment are summarised in the table below. This assessment was guided by the infrastructure benchmarks attached at Appendix D that outline the expected capacity, condition and capability standard of the alternate infrastructure.

Table 5.2: Assessment of infrastructure to meet current demand

<table>
<thead>
<tr>
<th>Mine Cluster</th>
<th>Ports</th>
<th>Rail</th>
<th>Roads</th>
<th>Power</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Condition</td>
<td>Capacity</td>
<td>Capability</td>
<td>Condition</td>
<td>Capacity</td>
</tr>
<tr>
<td>Central Eyre</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td>Mount Christie</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
</tr>
<tr>
<td>South Gawler</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
<td>🟠</td>
</tr>
<tr>
<td>Western Sands</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
</tr>
</tbody>
</table>

The assessment demonstrates that existing infrastructure can adequately accommodate the mining output currently being produced by major mines in the Eyre and Western region. The bulk freight solutions available (and adopted by operators) coupled with the low output profile for the region means the current infrastructure is in a strong position to meet current mining demand. While power and water have been identified as needing to be improved to support an expanded mining footprint, at this stage current demand requirements are being accommodated. The emerging power and water issues are discussed further in Chapter 7.
6. Future mining demand

Analysis presented in Chapter 5 demonstrates infrastructure in the Eyre and Western region is sufficient to support existing mining operations. This chapter presents forecasts of future mining activity and resultant infrastructure demands under low, medium and high global economic growth scenarios.

Chapter 7 presents our analysis of the extent to which the existing infrastructure examined in Chapter 5 is able to accommodate the future demands discussed in this chapter. Investigating ways to address the gap between the state of current infrastructure and demands of future mining is at the core of the RMIP project.

Future infrastructure needs will be driven by the mining production activity and freight and logistics task expected to take place in the region. Separate from the availability of infrastructure, the progression of mines from prospects to developments and developments to major mines will be based on the underlying profitability of each mine. Establishing an objective, transparent and robust forecast for this future mining activity is central to understanding what are and will be the pressing and emerging infrastructure needs for the region. This chapter presents the results of this mining demand forecast.

Demand modelling

A four step approach was undertaken to model the future mining demand for the Eyre and Western region. An overview of this approach is presented below. Data was collected on the nature and level of mining activity in the region during the preliminary stages of the project. Sources for this data included mining company annual reports, public statements by mining companies in relation to future mining plans, government databases and outputs from the previous RESIC survey. This material was augmented by private consultations with the leading mining companies, who assisted in validating and refining the information that had been collected.
This process underpinned the development of a mining project database which included the following detail:

Table 6.1: Project mine data collected

<table>
<thead>
<tr>
<th>Project</th>
<th>Resources</th>
<th>Demand estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Target metals</td>
<td>Base production rate</td>
</tr>
<tr>
<td>Phase</td>
<td>Total resource deposits</td>
<td>Export freight</td>
</tr>
<tr>
<td>DMITRE status</td>
<td>Grade of deposits</td>
<td>Import freight</td>
</tr>
<tr>
<td>Region</td>
<td>Beneficiation process</td>
<td>Peak power</td>
</tr>
<tr>
<td>Mine life</td>
<td>Main product</td>
<td>Electricity consumption</td>
</tr>
<tr>
<td>Estimated lead time</td>
<td>Ore mining rate</td>
<td>Water consumption</td>
</tr>
<tr>
<td>Logistics path(s)</td>
<td>Concentrate grade</td>
<td>Potential gas use</td>
</tr>
</tbody>
</table>

In parallel to this exercise, commodity price data was collected for iron ore, copper, uranium and gold, along with cost data for the respective mine operations and freight and logistics tasks.

Commodity price forecasts were drawn from Consensus Economics’ quarterly energy and metals forecasts, published December 2012. Consensus Economics develops forecasts using predictions submitted by more than 30 commodity forecasters (of which Deloitte Access Economics is one), including private sector consultancies and leading investment and commercial banks. The median of these forecasts is taken to be the most likely international economic scenario, while the highest and lowest forecasts are the high and low growth scenarios respectively.6

Using this data, estimates of costs and revenues per tonne for each mine were calculated, and then profitability of respective mines determined for high, medium and low global economic growth scenarios. Based on the mines profitability, a total resource output was determined and associated freight, power and water demand requirements forecast for the relevant mining clusters and region. The results of this analysis are presented in the following tables.7

Following consultations and a more detailed assessment of the potential infrastructure projects, operating costs for supporting infrastructure relevant to clusters of prospective mining projects have been refined. The impact on individual mine viability has been assessed and regional infrastructure demand cases restated through an iterative process to assess ideal regional common user infrastructure outcomes.

---

6 Refer to Appendix E for further details on these commodity price forecasts.
7 In assessing the path to market solutions for each region, we have included mining clusters from neighbouring regions where for some clusters appear multiple times (i.e. in more than one plan) and subsequently caution should be taken if aggregating the demand totals from the three plans.
**Low case scenario**

Demand and prices indicated under the low global growth scenario are unlikely to support significant investment in new mining projects in the Eyre and Western region.

Production from existing lower cost iron ore developments would be expected to continue over the effective life of existing projects; some low cost haematite DSO developments may be feasible, however investment in new large scale iron ore production would be unlikely.

Mineral sands production in the Western Sands cluster is under significant cost pressures at current market prices. Under a low global growth scenario, it would be anticipated that production would fall and new developments would be unlikely.

**Table 6.2: Low case forecast infrastructure demand**

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Annual Mineral/ Concentrate Production (Mt p.a.)</th>
<th>Bulk Freight Task (Mt p.a.)</th>
<th>Peak Power Demand (MW)</th>
<th>Energy Consumption (GWh p.a.)</th>
<th>Water Consumption (ML p.a.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Eyre</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Mount Christie</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>South Gawler</td>
<td>6.00</td>
<td>6.00</td>
<td>6.00</td>
<td>6.60</td>
<td>6.60</td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Western Sands</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Other</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>6.00</td>
<td>6.00</td>
<td>6.00</td>
<td>6.60</td>
<td>6.60</td>
</tr>
</tbody>
</table>

*Heavy mineral sands production is omitted from the low growth scenario in light of Iluka market announcement of 21 February 2013 regarding possible idling of Jacinth-Ambrosia.*

*Water demand driven by iron ore production.*

*Mining production volumes and requirement for infrastructure dominated by low cost Arrium haematite deposits.*
Medium case scenario

Demand and prices indicated under the medium (or base) case global growth scenario is expected to result in significant investment in new mining projects in the Eyre and Western region in the medium to long term.

Iron ore prices are expected to moderate as additional global supply comes on-line and growth in demand eases, however prices are expected to remain significantly above long term historic levels. Production from existing iron ore developments would be expected to continue over the effective life of existing projects, along with additional; projects that extend mine life, prices are also expected to be sufficient to support some larger scale magnetite developments in the Central Eyre region, as well as smaller DSO developments throughout the region.

Mineral sands production in the Western Sands cluster for existing developments is expected to continue however new developments would be unlikely while global demand remains soft.

Table 6.3: Medium case forecast infrastructure demand

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Annual Mineral/ Concentrate Production (Mt p.a.)</th>
<th>Bulk Freight Task (Mt p.a.)</th>
<th>Peak Power Demand (MW)</th>
<th>Energy Consumption (GWh p.a.)</th>
<th>Water Consumption (ML p.a.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Eyre</td>
<td>0.24</td>
<td>31.34</td>
<td>40.04</td>
<td>0.26</td>
<td>34.47</td>
</tr>
<tr>
<td>Mount Christie</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>South Gawler</td>
<td>6.00</td>
<td>9.00</td>
<td>11.00</td>
<td>6.60</td>
<td>9.90</td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>0.12</td>
<td>3.14</td>
<td>2.79</td>
<td>0.13</td>
<td>3.45</td>
</tr>
<tr>
<td>Western Sands</td>
<td>0.82</td>
<td>0.33</td>
<td>0.00</td>
<td>1.63</td>
<td>0.65</td>
</tr>
<tr>
<td>Other</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>7.18</td>
<td>43.81</td>
<td>53.83</td>
<td>8.63</td>
<td>48.48</td>
</tr>
</tbody>
</table>

Medium growth scenario prices anticipated to support multiple small-scale haematite DSO and magnetite projects
Central Eyre magnetite developments assumed to be commercially viable at medium case long-term prices scenario
Scale of Central Eyre magnetite mines drive power and water needs of Eyre Peninsula in this growth scenario
The cumulative development of Central Eyre and South Gawler magnetite mines would lead to considerable need for power and water per tonne shipped
Future mining demand
Current Western Sands projects is expected to continue operation, new deposits assumed not to be developed
South Gawler production expansion assumed to come from magnetite mines, considerably increase power, energy and water requirement
High case scenario

Demand and prices indicated under the high global growth scenario are expected to result in significant investment in new mining projects in the Eyre and Western region in the medium to long term.

Iron ore prices are expected to return to near historic highs, supporting new projects which extend existing mine life as well as new larger scale magnetite developments in the Central Eyre cluster and smaller DSO developments throughout the region.

Mineral sands production in the Western Sands cluster in expected to continue at an accelerated rate, and developments of new deposits would extend the use of existing processing and supporting infrastructure.

Table 6.4: High case forecast infrastructure demand

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Annual Mineral/ Concentrate Production (Mt p.a.)</th>
<th>Bulk Freight Task (Mt p.a.)</th>
<th>Peak Power Demand (MW)</th>
<th>Energy Consumption (GWh p.a.)</th>
<th>Water Consumption (ML p.a.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Eyre</td>
<td>0.68 38.12 45.04 8.75 41.93 49.54 6.6 365.8 431.2 27 1,767 2,118 576 47,188 58,007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mount Christie</td>
<td>0.00 0.00 0.00 0.00 0.00 0.00 0.0 0.5 1.2 0 13 33 0 12 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Gawler</td>
<td>8.34 10.65 11.00 9.17 11.80 12.20 66.4 76.0 59.8 89 224 301 5,181 8,416 9,927</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>0.12 4.16 7.83 0.13 4.60 8.64 0.1 25.6 87.2 10 313 522 144 5,436 16,856</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Sands</td>
<td>1.42 0.85 0.07 2.83 1.69 0.14 11.8 6.2 0.8 42 27 4 1,992 1,533 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.00 0.04 0.10 0.00 0.05 0.07 0.0 0.2 0.4 0 16 40 0 124 207</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10.56 53.82 64.03 12.88 60.07 70.59 85.0 474.2 580.7 168 2,361 3,018 7,893 62,709 85,043</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some small-scale Mount Christie magnetite production expected to be commercially viable in high growth scenario. Production peaks in second time period due to small deposits.

Investment in Western Mineral Sands production above medium growth scenario assumed. Production expected to tail-off as deposits reach end of commercial life.

Both haematite and magnetite projects expected to drive increase in production tonnage above medium growth scenario. Also, silver mining assumed to operate in the second time period, however production does not materially impact infrastructure needs.

Not a considerable increase in production in Central Eyre compared to medium growth scenario due to major developments in this cluster expected to proceed in medium growth scenario.

Central Eyre infrastructure needs increase considerably relative to the medium growth case, in line with increased.
The figure below presents a consolidated regional demand profile for bulk freight, power and water across the high, medium and low global growth scenarios.

Figure 6.2: Consolidated regional demand profile

Estimated Project Infrastructure Demand - Low Case

Estimated Project Infrastructure Demand - Medium Case

Estimated Project Infrastructure Demand - High Case
In the low growth scenario, little growth in the mining industry is expected above the level of activity already observed and mining production is not expected to exceed 10mtpa in any year.

The profile of expected growth in mining industry production is similar in the medium and high global growth scenarios. Little production above current level is expected until 2018 in the medium growth scenario and 2017 in the high growth scenario. From these years production (as distinct from the bulk freight task) increases rapidly to a peak of approximately 54mtpa in the medium growth scenario and just over 64mtpa in the high growth scenario for the period 2023-2032. Having reached these peaks, mining production in each of the scenarios declines slightly, but is largely stable over the period forecast. The rapid growth in mining production in the medium and high growth scenarios creates the need for investment in infrastructure over a relatively short time period, after production peaks have been reached the focus turns to operating and maintaining the infrastructure which has already been put in place.
7. Future infrastructure demands

This chapter consolidates the analysis presented in Chapters 5 and 6 to present an understanding of the extent to which existing infrastructure in the Eyre and Western region is able to meet the forecast needs of the mining industry. The difference between current infrastructure and future needs is the gap to be examined by the RMIP project.

Adequacy of existing infrastructure in meeting future demands

Infrastructure demand for this analysis is based on the medium global growth scenario, and is undertaken to identify the critical infrastructure deficiencies that are likely to hinder the development of South Australia’s mining sector in the region.

Analysis of the adequacy of current infrastructure in meeting forecast demand from mining is summarised in the tables overleaf, and is presented using the system of traffic lights and symbols depicted in the table below. Colours are used to indicate the rating of the ability of the infrastructure to meet the forecast demand over 0-5, 6-10 and 11-20 year time periods from 2013, while the symbols indicate how this adequacy changes between the periods.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Green Circle](image) | Good | • Infrastructure presents a low risk to mining operations/performance  
• Infrastructure considered adequate to meet current requirements  
• No immediate action required |
| ![Yellow Circle](image) | Moderate | • Infrastructure presents a moderate risk to mining operations/performance  
• Moderate risk that emerging issues will impact the ability of infrastructure to meet current requirement  
• Short to medium term action likely |
| ![Red Circle](image) | Poor | • Infrastructure presents a high risk to operations, threatening overall performance  
• Significant risk that infrastructure will be unable to meet current demand requirements  
• Immediate action required |
| ![Gray Circle](image) | Not Applicable | • No infrastructure required, alternative infrastructure solution(s) are sufficient at this time  
• No current mining demand in area requiring infrastructure  
• No immediate action required |
| ↑ | | • Adequacy of infrastructure to meet identified need improved compared to previous period |
The following tables summarise the assessment of the ability of existing infrastructure in meeting the forecast infrastructure demand from the mining industry. These assessments are presented for the 0-5, 6-10 and 11-20 year timeframes, beginning in 2013.

**Table 7.1: Assessment of existing infrastructure to meet 0-5 year demand**

<table>
<thead>
<tr>
<th>Mine Cluster</th>
<th>Ports</th>
<th>Rail</th>
<th>Roads</th>
<th>Power</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Eyre</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>*</td>
</tr>
<tr>
<td>Mount Christie</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>South Gawler</td>
<td>-</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>-</td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Western Sands</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Source: Deloitte and SMEC (2013)*

**Table 7.2: Assessment of existing infrastructure to meet 6-10 year demand**

<table>
<thead>
<tr>
<th>Mine Cluster</th>
<th>Ports</th>
<th>Rail</th>
<th>Roads</th>
<th>Power</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Eyre</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Mount Christie</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>South Gawler</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Western Sands</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Source: Deloitte and SMEC (2013)*

Future infrastructure demands
## Table 7.3: Assessment of existing infrastructure to meet 10 - 20 year demand

<table>
<thead>
<tr>
<th>Mine Cluster</th>
<th>Ports</th>
<th>Rail</th>
<th>Roads</th>
<th>Power</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Condition</td>
<td>Capacity</td>
<td>Capability</td>
<td>Condition</td>
<td>Capacity</td>
</tr>
<tr>
<td>Central Eyre</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mount Christie</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>South Gawler</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Southern Eyre</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Western Sands</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Deloitte and SMEC (2013)
Emerging infrastructure issues

The second half of this chapter distills identified infrastructure deficiencies into critical infrastructure issues which must be addressed to facilitate the development of the mining sector. Again, these issues are presented with reference to the time periods in which they manifest.

These key deficiencies in the current infrastructure which form impediments to the development of the mining sector are identified below.

**Issue A**

Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines

The volumes of ore assumed to be produced by mines in the South Gawler, Central Eyre and Southern Eyre clusters will require transportation to market by large bulk vessels to be commercially viable. This requires bulk commodities export facilities at which these vessels can be loaded.

There are multiple bulk commodity export ports (for both grain and minerals, and noting Port Bonython exports gas only) on the eastern side of the Eyre Peninsula; however, limitations in relation to the size of vessels which can be loaded at these ports limit their capability to service future mining demand. While Port Lincoln is able to load large vessels, landside infrastructure limitations represent considerable challenges.

South Gawler, Central Eyre and Southern Eyre mines will have no commercially viable access to markets for their product in the absence of access to a suitable bulk commodities export port.

**Issue B**

Inadequate electricity transmission links to South Gawler, Central Eyre and Southern Eyre mines

Mining activity requires considerable electricity for the extraction and processing aspects of operations. Much of the infrastructure that may be necessary to support mining activities, such as ports and desalination plants, also have significant electricity demands.

Existing electricity transmission infrastructure on the Eyre Peninsula is near capacity under existing loads and is close to the end of its economically useful life. Upgrades to the existing electricity infrastructure have been identified which would extend its economically useful life and provide some additional capacity, however these upgrades would not meet the significant demands of mining and associated infrastructure.

Many of the major mining projects in these clusters involve the extraction and processing of magnetite ores, which are particularly electricity-intensive. Provision of suitable access to electricity will be critical to the development of these large scale mining projects.
The ability of miners to safely and efficiently transport bulk commodities to ports for export is critical to miners’ ability to reach their markets.

The existing Eyre Peninsula rail network was designed in a previous era, predominantly to service the grain industry. This is a narrow gauge network with significant limitations in relation to load capacity, train length and maximum speeds. The location of the existing network is not well suited in relation to likely suitable bulk commodity export ports, and requires key townships to be traversed.

The existing road network on the Eyre Peninsula - while generally suitable to meet current needs - will not be able to handle the volume and load requirements of bulk mineral transport; this problem would be exacerbated if freight movements for grain were to increase as a result of a new port capable of handling grain being introduced in the region. Significant investment in developments such as town bypasses, road realignments and shoulder sealing would be required as a minimum for the existing road network to form part of the mine to port bulk transport task.

Mining projects have a range of water needs, including dust suppression, processing, slurry operation and potable water supply.

Parts of the Eyre Peninsula are connected to the SA Water supply network via the Mannum-Whyalla pipeline. The capacity of the existing pipeline is expected to be insufficient to meet the needs existing users of the reticulated supply networks on the Eyre Peninsula in the medium-term. Desalination has been proposed to supplement existing SA Water potable supply, however the scale of proposed infrastructure would be insufficient to meet mining demand.

There is also groundwater extraction in the region for human and agricultural use. There is insufficient information in relation to the groundwater resources in the Eyre Peninsula to accurately assess the adequacy in meeting mining demand and the associated impact this would have on the environment and existing extractors.

Alignment of emerging infrastructure issues

The four emerging infrastructure issues identified here constitute the four issues to be addressed by the prioritised projects identified by the RMIP project; they are at the core of the discussions of the potential and prioritised infrastructure projects in chapters 8 and 10.

The table overleaf summarises these key emerging issues as impediments to the development of the mining industry in the Eyre and Western region.
### Table 7.4: Key emerging mining infrastructure issues for the Eyre and Western region (2013 – 2032)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Lack of suitable bulk commodities export port accessible by South Gawler mines</td>
<td>Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines</td>
<td>Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines</td>
</tr>
<tr>
<td>B</td>
<td>Inadequate electricity transmission links to South Gawler mines</td>
<td>Inadequate electricity transmission links to South Gawler and Central Eyre mines</td>
<td>Inadequate electricity links to South Gawler, Central Eyre and Southern Eyre mines</td>
</tr>
<tr>
<td>C</td>
<td>Lack of mine to port bulk transport links for Central Eyre and Southern Eyre mines</td>
<td>Lack of mine to port bulk transport links for Central Eyre and Southern Eyre mines</td>
<td>Lack of mine to port bulk transport links for Central Eyre and Southern Eyre mines</td>
</tr>
<tr>
<td>D</td>
<td>No identified suitable source of water for South Gawler mines</td>
<td>No identified suitable source of water for Central Eyre and South Gawler mines</td>
<td>No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines</td>
</tr>
</tbody>
</table>

Each of the identified issues are represented geographically in the map of the Eyre and Western region provided overleaf.
Figure 7.1: Map of key emerging infrastructure issues for the Eyre and Western region
8. Potential infrastructure solutions

This chapter presents the infrastructure projects, and their associated groupings, which have been identified as having the potential to address the issues detailed in Chapter 7. A summary of each of the projects is presented to provide an understanding of their underlying technical attributes.

Projects identified

Projects with the potential to address the issues discussed in Chapter 7 have been identified through consultation with infrastructure proponents, mining proponents and peak bodies.

The table below summarises all the projects which were identified and considered. Through the course of our investigations, it was established that some of the identified projects would be unlikely to be able to meaningfully address issues identified in Chapter 7.

<table>
<thead>
<tr>
<th>Project</th>
<th>Issue addressed</th>
<th>Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path to market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whyalla port expansion</td>
<td>No – current expansion to 12mtpa is significant, and effective use of this transhipment option for significant volumes beyond this is considered unlikely.</td>
<td></td>
</tr>
<tr>
<td>Lucky Bay</td>
<td>No – does not address regional mining issues, would be a low volume solution only.</td>
<td></td>
</tr>
<tr>
<td>Expanded use of high mass load (HML) vehicles such as triple road trains</td>
<td>No – while this will assist some mining operations, including inbound freight, the magnitude of the benefits will not address the broader identified mining issues. Each potential change in road use needs individual assessment to determine the overall suitability of the proposal including associated road upgrade and/or maintenance requirements.</td>
<td></td>
</tr>
<tr>
<td>Specific road intersection upgrades</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Eyre Peninsula port base case</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Northern Eyre Peninsula port base case + new slurry link from Central Eyre cluster</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Northern Eyre Peninsula port base case + rail link from Eyre Peninsula</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Central Eyre Port Base case</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Central Eyre Port Base case + rail link from Central Eyre cluster</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Central Eyre Port Base case + upgrade of existing rail corridors</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Central Eyre Port Base case + slurry link to Central Eyre cluster</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>Potential infrastructure solutions</td>
<td>A and C</td>
<td>Yes</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------</td>
<td>-----</td>
</tr>
<tr>
<td>Port Lincoln port and upgraded rail links</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyre transmission upgrade</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Spencer Gulf undersea link</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Gas line to on-site generation from Whyalla branch line</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>On-site diesel generation</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Transmission link from Caltana</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>On-site LPG power station to service individual sites</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Renewable generation to support mining loads</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundwater investigation (Eyre Peninsula)</td>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>On-coast desalination plant and transmission to Central Eyre</td>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>On-coast desalination plant and transmission network</td>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>Southern on-coast desalination plant with SA Water integration</td>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>Transmission of raw seawater and on-site desalination plant(s)</td>
<td>D</td>
<td>Yes</td>
</tr>
<tr>
<td>Morgan-Whyalla pipeline to storage points</td>
<td>D</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Regional solutions

The figure below is provided to give an understanding of the geographic alignment of the identified infrastructure projects relative to sensitive environmental areas. More detailed summaries of the environmental assets and potential impacts in this region are provided in Appendix B and Chapter 9 respectively.
Paths to market

Identified freight projects have been grouped into paths to market, which integrate potential ports with land transport infrastructure that is able to deliver product to the port. It is necessary to group freight projects focused around a particular port because of the dependency between the port and landside infrastructure.

The “base case” for each port described in this section includes the port option and minimum land transport links necessary to provide sufficient throughput of bulk commodity for that port to be commercially viable. Land transport links proposed in addition to the base case for each port have the potential to service the port, but are not critical for commercial viability.

The eight paths to market which have been derived in response to issues identified in the Eyre and Western region are:

- PTM1: Far Northern Eyre Peninsula port base case
  - Far North region land transport links
  - Road upgrades from South Gawler to port
- PTM2: Northern Eyre Peninsula port base case + new slurry link from Central Eyre cluster
- PTM3: Northern Eyre Peninsula port base case + rail link from the Eyre Peninsula
- PTM4: Central Eyre port base case
- PTM5: Central Eyre port base case + rail link from Central Eyre cluster
- PTM6: Central Eyre port base case + upgrade of existing rail corridors
- PTM7: Central Eyre port base case + slurry link to Central Eyre cluster
- PTM8: Port Lincoln port and upgraded rail links
Potential infrastructure solutions

PTM1: Northern Eyre port links base case

*Project description:* A range of initiatives including rail connection to Whyalla, partial duplication and upgrade of rail to Wirrida, and road upgrades from the port to the South Gawler cluster.

*Issue addressed:*

A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines

C. Lack of mine to port bulk transport links for Central and Southern Eyre mines

*Capital cost:* Port; $750m - $900m

Rail; $500m - $600m

Road; $120m

*Capacity:* 20 mtpa

*Scalability of capacity and planned upgrades:* Port and rail connection to existing freight corridor initially established for 20mtpa and expandable to in excess of 50mtpa. Rail upgrades of existing corridors can be done in stages as demand requires. Road upgrades can be done in stages as demand requires.

*Lead time to operation:* 4 years

*Clusters and industries serviced:*

Clusters - Mount Woods, Tarcoola, Mount Christie, Braemar, South Gawler, Central Eyre

Supported Industries - Fuel, mining consumables, grain

Two port locations in this region have previously been identified by others;

- Port Bonython (adjacent to the existing Port Bonython jetty) has been identified due to its access to deep water and close proximity to road, rail and utility services. The Spencer Gulf Ports Link consortium has undertaken feasibility assessments and is currently conducting an environmental impact study (EIS) for the site.

- Port Nonowie, south of Whyalla, has been identified by the Alternative Ports Working Party as an alternate option to Port Bonython. To the best of our knowledge the site does not currently have a commercial proponent willing to back a project at the site. Detailed feasibility assessments are still to be completed for the site, introducing an element of commercial and technical uncertainty to its consideration.
Key technical and operational considerations for either site:

Ports

- Proximity to deep water. This will impact capital cost
- How sheltered the deep water is, from both weather and tidal impacts. This will impact capital and operating costs
- Shipping channel depths and capacity. The shipping channel to a Northern Eyre Peninsula Port has high levels of available capacity. It is noted that there are limited sections where the channel depth is less than the desirable 20m, however this not expected to be a significant constraint
- Proximity to road, rail and utility services. This will impact capital cost
- Community impacts – during construction and operation
- Environmental impacts (see chapter 9 for more detail)

Rail

- Geographic, hydrology and flooding – unknown levels
- Geotechnical conditions – existing terrain not investigated
- Rail corridor signalling system upgrade likely to be required to safely manage additional rail traffic volumes
- Much of the corridor has sufficient width for duplication but some land acquisition would be required where there is insufficient width or where corridor realignment is required
- Port Augusta triangle required (to enable trains to bypass Port Augusta going to/from Whyalla)
- Additional and busier level crossings; there are currently three, excluding Port Augusta

General comments, irrespective of where a northern Eyre Peninsula port is located:

Advantages

- Being centrally located, the port could support the Far North, Eyre and Western and Braemar regions of the State
- Good opportunity to connect to the main standard gauge freight rail network – maximises use of rail for freight
- Well positioned for road access from South Gawler cluster
- Well positioned for power and water connections to the port
- Opportunity for increased local employment across the port and rail developments during both construction and operations
- Rail upgrades may benefit broader rail users
- May be an efficient alternative port for grain export
- Area adjacent to port could be established as a rail hub for the exchange of freight to/from the Eyre Peninsula
- Port is well positioned for the import of mining consumables

Disadvantages

- A number of issues associated with increased rail use, particularly in relation to road crossings
- May not be the ‘most efficient’ option for Eyre and Western region and Braemar cluster
- Large central port may require additional land transport
- High capital cost
PTM2: Northern Eyre port links base case + new slurry link from Central Eyre

Project description: As for project PTM1 plus new slurry link from Central Eyre cluster.

Issue addressed:
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines
C. Lack of mine to port bulk transport links for Central and Southern Eyre mines

Capital cost: Slurry link from Central Eyre - $450m (excludes water supply)

Capacity: 20 mtpa

Scalability of capacity and planned upgrades: Pipe arrangement within the corridor can be structured to enable future expansion (i.e. install additional pipes). System can operate in 'batch mode' during lower capacity periods.

Lead time to operation: 2 years

Clusters and industries serviced:
Clusters – Central Eyre, South Gawler
Supported Industries – Nil

Key technical construction and operational risks:
- Requires suitable water (unlikely that seawater is suitable although product specific assessment is needed to confirm this). For 20mtpa, estimated water requirements are 13GL per annum
- Requires suitable power source for pumping. For 20mtpa, estimated power demand is 11 MW
- Requires suitable method of disposal of water from de-watering product OR method of recycling water at higher cost
- Management of risk of leaks
- Requires easement corridor for installation
- Geotechnical issues associated with construction

General comments:
Advantages
- As a result of the underground installation of the slurry pipe system, community impacts are minimised, e.g. no impact on road crossings or ongoing use of farming land following installation.
• Can consolidate impacts from several mines by using common corridor
• Is a long-life solution with limited maintenance requirement
• Can integrate water supply solution using seawater (desalinated as required)

Disadvantages
• Significant associated water and power supply requirements.
• Limited opportunity for this infrastructure to benefit other sectors, other than possibly associated with water and power supply solutions
• Suitability can be impacted by the nature of the product to be slurried
PTM3: Northern Eyre port links base case + rail link from the Eyre Peninsula

Project description: As for project PTM1 plus new rail link from Central Eyre cluster.

Issue addressed:
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines
C. Lack of mine to port bulk transport links for Central and Southern Eyre mines

Project description:

Capital cost: Rail link from Kimba; $500 - $750m
Rail link from Central Eyre Region to Kimba; $250 - $400m

Capacity: 20 mtpa

Scalability of capacity and planned upgrades: Initial rail corridor will cater for approx. 20mtpa. If sufficient corridor width is provided, additional capacity can be obtained via additional passing loops or duplication. There is opportunity to link into the existing narrow gauge corridors, although upgrade of these corridors will be required.

Lead time to operation: 3-4 years

Clusters and industries serviced:
Clusters – Central Eyre, South Gawler, possible expansion to include Southern Eyre
Supported Industries – Grain, mining consumables, fuel

Key technical construction and operational risks:
- Requires establishment of substantial new rail corridor – impacts on land owners and adjacent land use
- Road/rail interface issues
- Geotechnical and topography aspects may add to capital costs
- Environmental impacts (see Chapter 9 for more detail)
- Facilities for maintaining rolling stock may also need to be procured
- Alternate alignment suggested via Sinclair’s Gap into Kimba

General comments:
Advantages

Potential infrastructure solutions
• Versatile infrastructure with broader potential benefits for the region
• Efficient operating solution for a number of mines/precincts
• Employment during construction, operation and maintenance
• Provides the opportunity to also add a rail connection from the South Gawler cluster to join the rail link – possibly near Kimba

Disadvantages
• A number of issues associated with rail corridor, particularly in relation to road crossings and impacts on adjacent land use – includes potential issues for landowners whose property is severed by the alignment
• High capital cost
PTM4: Central Eyre port base case

Project description: Central Eyre Peninsula deep water port with road access.

Issue addressed:
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines
C. Lack of mine to port bulk transport links for Central and Southern Eyre mines

Capital cost: Port; $350 - $570m (varies depending on wharf length and land storage capacity)
Road upgrades; $110-$125m (will vary according to demand on individual roads)

Capacity: 5 - 20 mtpa

Scalability of capacity and planned upgrades: Wharf and landside storage can be designed for future capacity increases. Road upgrades can be undertaken as demand dictates.

Lead time to operation: 3-4 years

Clusters and industries serviced:
Clusters – Central Eyre, South Gawler, Southern Eyre
Supported Industries – Grain, mining consumables

Key technical construction and operational risks:
Two potential port locations have been identified by others;
- Port Spencer (Sheep Hill), north of Tumby Bay, has been proposed by Centrex Metals and Wuhan Iron and Steel Corporation. Conditional approval has been granted to establish a stage 1 facility to export 2 mtpa of haematite and 1 mtpa of grain
- Cape Hardy, between Port Neill and Tumby Bay, has been proposed by Iron Road Mining

Key technical and operational considerations are:
- Significant road freight increases will have an impact on other road users and adjacent property owners. Will require careful consideration of the extent of road upgrade. May be appropriate to provide purpose built routes in some instances
- Road freight is less efficient than rail or slurry for higher volumes over a long period
- Road upgrades likely to require some land acquisition, impacts on property owners and environment impacts (as discussed in...
Chapter 9)

- Tidal and weather exposure risks for port
- Remote nature of port may require additional pilots and tugs
- Electricity and water requirements for port

General comments:

**Advantages**
- Port is well positioned for Central Eyre cluster
- Provides a well-positioned alternative to Port Lincoln for Southern Eyre cluster
- Short wharf lengths (0.5km to 1.6km) to deep water for Capesize ships, meaning lower capital cost
- Versatile infrastructure with broader potential benefits for the region
- Flexible staging beneficial for start-up phases
- Good opportunity for large adjacent storage capacity
- Employment during construction, operation and maintenance

**Disadvantages**
- Managing tidal/weather exposure
- Managing impacts of significant road freight task
- If used for grain, impacts on broader grain export supply chain need to be considered. Also need to consider impacts of integrating grain and mineral facilities
- Detailed environmental assessments to be undertaken
**PTM5: Central Eyre port base case + rail link from Central Eyre cluster**

**Project description:** As for project PTM4 plus new rail link from Central Eyre cluster.

**Issue addressed:**
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines  
C. Lack of mine to port bulk transport links for Central and Southern Eyre mines

---

**Capital cost:** Rail - $780-$850m

**Capacity:** 20 mtpa

**Scalability of capacity and planned upgrades:** Limited scalability as a single rail line will have approximately 20mtpa capacity. Increased capacity can be added in the future via additional passing loops or duplication if sufficient corridor width is provided.

**Lead time to operation:** 3-4 years

**Clusters and industries serviced:**
- **Clusters** – Central Eyre
- **Supported Industries** – Grain, mining consumables

**Key technical construction and operational risks:**
- Requires establishment of substantial new rail corridor – impacts on land owners and adjacent land use
- Road/rail interface issues
- Geotechnical and topography aspects may add to capital costs
- Environmental interfaces
- Facilities for maintaining rolling stock may also need to be procured. May be opportunities to link to GWA network if a narrow gauge link is constructed

**General comments:**
- **Advantages**
  - Efficient operating solution for Central Eyre mines
  - Potential long-term benefits for the region including grain export option

---

**Potential infrastructure solutions**
• Removes large portion of road freight by comparison with option PTM4
• Employment during construction, operation and maintenance

Disadvantages
• A number of issues associated with rail corridor, particularly in relation to road crossings and impacts on adjacent land use. Includes potential issues for landowners whose property is severed by the alignment
• High capital cost
PTM6: Central Eyre port base case + rail link from Central Eyre cluster and upgrade of existing rail corridors

Project description: As for project PTM5 plus upgraded rail link from Buckleboo

Issue addressed:
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines
B. Lack of mine to port bulk transport links for Central and Southern Eyre mines

Capital cost: Upgraded rail link from Buckleboo - $550m

Capacity: 10 - 15mtpa

Scalability of capacity and planned upgrades: Corridor can be upgraded in stages.

Lead time to operation: 3-4 years

Clusters and industries serviced:
Clusters – South Gawler
Supported Industries – Grain, mining consumables

Key technical construction and operational risks:
- May require some geometric improvements to existing corridor to accommodate higher speeds if desired
- While this is an existing functional corridor and therefore currently manages level crossing issues, a significant increase in frequency/size/speed of trains may still generate substantial issues to be addressed in this regard
- Additional corridor width may be required in areas, particularly if additional passing loops are required
- Construction staging impact on current grain freight use
- Facilities for maintaining rolling stock may also need to be procured/expanded

General comments:
Advantages
- Versatile infrastructure with broader potential benefits for the region
- Efficient operating solution for mines in South Gawler cluster

Potential infrastructure solutions
• Removes further road freight traffic by comparison with projects PTM4 and 5
• Employment during construction, operation and maintenance

Disadvantages

• A number of issues associated with rail corridor, particularly in relation to road crossings and impacts on adjacent land use. Includes potential issues for landowners whose property is severed by the alignment
• High capital cost
PTM7: Central Eyre Port Base case + slurry link to Central Eyre cluster

Project description: As for project PTM4 plus new slurry pipeline link from Central Eyre cluster

Issue addressed:
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines
B. Lack of mine to port bulk transport links for Central and Southern Eyre mines

Capital cost: Slurry pipeline - $300m (excluding water supply)
Capacity: 20 mtpa

Scalability of capacity and planned upgrades: Pipe arrangement within the corridor can be structured to enable future expansion (i.e. install additional pipes). System can operate in 'batch mode' during lower capacity periods.

Lead time to operation: 3-4 years

Clusters and industries serviced:
Clusters – Central Eyre
Supported Industries – Nil

Key technical construction and operational risks:
- Requires suitable water (unlikely that seawater is suitable although product specific assessment is needed to confirm this). For 20mtpa, estimated water requirements are 13GL per annum
- Requires suitable power source for pumping. For 20mtpa, estimated power demand is 11 MW
- Requires suitable method of disposal of water from de-watering product OR method of recycling water at higher cost
- Management of risk of leaks
- Requires easement corridor for installation
- Geotechnical issues associated with construction

General comments:
Advantages
- As a result of the underground installation of the slurry pipe system, community impacts are minimised, e.g. no impact on road

Potential infrastructure solutions
crossings or ongoing use of farming land following installation

- Is a long-life solution with limited maintenance requirement
- Can integrate water supply solution using seawater (desalinated as required)

Disadvantages

- Significant associated water and power supply requirements.
- Limited opportunity for this infrastructure to benefit other sectors, other than possibly associated with water and power supply solutions
- Suitability can be impacted by the nature of the product to be slurried.
Project description: Upgrade rail corridors from Buckleboo to Cummins and from Wudinna to Cummins to Port Lincoln

Issue addressed:
A. Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines
C. Lack of mine to port bulk transport links for Central and Southern Eyre mines

Capital cost: Rail upgrades - $1.3b

Capacity: 10-15 mtpa

Scalability of capacity and planned upgrades: Rail corridor can be upgraded in stages.

Lead time to operation: 3-4 years

Clusters and industries serviced:
Clusters – Central Eyre, South Gawler
Supported Industries – Grain, mining consumables, fuel

Key technical construction and operational risks:
- May require some geometric improvements to existing corridor to accommodate higher speeds if desired
- While this is an existing functional corridor and therefore currently manages level crossing issues, a significant increase in frequency/size/speed of trains may still generate substantial issues to be addressed in this regard
- Additional corridor width may be required in areas, particularly if additional passing loops are required
- Construction staging impact on current grain freight use
- Facilities for maintaining additional rolling stock may also need to be procured/expanded
- Rail arrangements in Port Lincoln require several shunting movements through the town centre. Expansion of these movements will have a significant impact on Port Lincoln. It is likely a storage facility outside the town would be required with a covered conveyor system connecting to the port.
- Limited ability for the port in its current form to handle significant additional minerals volumes. Expansion would be required
- Integration of minerals port use with existing fishing and grain use is likely to result in a need for full separation of the handling
equipment and processes, requiring additional infrastructure

General comments:

Advantages

- Port Lincoln port has natural deep water (although not deep enough for loaded Capesize vessels)
- No need to construct greenfield port
- Existing rail corridor links to Port Lincoln simplify the establishment of rail connections from Central Eyre cluster
- Rail upgrade can provide benefits to other sectors, particularly grain

Disadvantages

- Number of issues associated with rail corridor, particularly in relation to road crossings and impacts on adjacent land use
- High capital cost of suitable rail upgrades
- Difficulty of moving significant mineral product through the city of Port Lincoln – efficiency issues plus likely to generate a number of community concerns
- Difficulty associated with integrating large volumes of mineral product with existing wharf use
- Overall capacity of Port Lincoln port
Energy

The seven energy projects have been derived in response to issues identified in the Eyre and Western region are:

- E1: Eyre transmission upgrade
- E2: Spencer Gulf undersea link
- E3: Gas line to on-site generation from Whyalla branch line
- E4: On-site diesel generation
- E5: Transmission link from Cultana
- E6: On-site LPG power station to service individual sites
- E7: Renewable generation to support mining loads

### E1: Eyre transmission upgrade

**Project description:** Upgrade of the Eyre Peninsula ElectraNet transmission network to a dual circuit 275kV system

**Issue addressed:**
B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

**Capital cost:** $ 910 million

**Capacity:** 600 MW @ 275kV

**Scalability of capacity and planned upgrades:**
Project can be staged by building the 275kV section between Cultana and Yadnarie and the 275kV to 132kV substation at Yadnarie first, with the remainder of the project works delayed until required.

**Lead time to operation:** 2-3 years (from the time a transmission agreement is signed)
Clusters and industries serviced:

Clusters - South Gawler, Central Eyre, and Southern Eyre

Supported Industries – renewable energy generation, community, water supply, ports

Key technical construction and operational risks:

- Alignment of these works with the regulatory processes or support as a non-regulated project
- Establishment of easement/corridor for the works
- Timeframes for construction, including long lead time equipment
- Capability of the upstream 275kV network between Cultana and Davenport. This has limited capacity
- Capability of the broader upstream transmission network to support the project, particularly in the context of possible works for the Far North and other regions. In conjunction with possible upgrades in other areas, there may be a need to strengthen the transmission network between Port Augusta and the main grid
- Capability of the ‘base load’ generation in the State. Again, in conjunction with possible upgrades in other areas there may be a need for additional Base Load generation to support the network as a whole. It is noted that the Playford and Northern power stations at Port Augusta currently shut down for 6 months of the year. The location(s) of additional generation are also an important consideration
- Need to manage the maximum load the network can handle in a single ‘electrical trip’. This may limit supply capacity initially or may result in constraints on the networks export load through InterConnectors

General comments:

- This project is consistent with the existing ElectraNet proposal for this region. ElectraNet have commenced the regulatory process, and the project has recently been accepted as a ‘contingent project’
- This project provides additional capacity in the Eyre and Western regional network to accommodate the forecast increase in mining loads.
- The existing 132kV transmission network on the Eyre Peninsula is relatively old and will require gradual upgrade/replacement over the next 10-15 years
- The Eyre Peninsula is recognised as having strong renewable energy potential (wind and wave), however the existing transmission network cannot support transmission of this generation back to the grid. This project provides capacity for the development of further energy assets in the region.
- The alignment of the corridor could take alternative paths to that shown. For example, the alignment could pass through the South Gawler cluster

Advantages:

- Improved electricity supply security to the region
- Replaces old asset with new
- Enables opportunity for additional renewable energy generation within the region

Disadvantages:

- High capital cost
- Impact on landowners associated with establishing suitable route/easements
E2: Spencer Gulf undersea link

Project description: Yorke Peninsula to Eyre Peninsula undersea transmission link and upgrade

Issue addressed:
B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

Capital cost: $800 million

Capacity: 600MW (assumes 2 circuits)

Scalability of capacity and planned upgrades: The project does not lend itself to being staged.

Lead time to operation: 4 years

Clusters and industries serviced:
Clusters - South Gawler, Central Eyre, Southern Eyre, and Yorke
Supported Industries – renewable energy generation, community

Key technical construction and operational risks:
- Alignment of these works with the regulatory processes or support as a non-regulated project
- Establishment of easement/corridor for the works
- Timeframes for construction, including long lead time equipment
- Installation of undersea cable
- Capability of the upstream 275kV network from Yorke Peninsula. This has limited capacity and will require associated upgrade
- Capability of the broader upstream transmission network to support the project, particularly in the context of possible works for the Far North and other regions. In conjunction with possible upgrades in other areas, there may be a need to strengthen the transmission network back to the main grid
- Capability of the ‘base load’ generation in the State. Again, in conjunction with possible upgrades in other areas there may be a need for additional base load generation to support the network as a whole. The location(s) of additional generation are also an important consideration

General comments:

Potential infrastructure solutions
• Direct supply to the high load areas on Eyre Peninsula would reduce/remove the demand to upgrade the Eyre Peninsula transmission network

Advantages:
• Additional capacity in the Eyre and Western regional and Yorke networks to accommodate the forecast increase in mining loads
• Better capacity for the connection of renewable energy assets in both the Eyre Peninsula and Yorke Peninsula regions
• Improved electricity supply security to both regions

Disadvantages:
• Limited flexibility for changes in scale
• High capital cost
• Does not improve condition of aged assets on Eyre Peninsula
E3: Gas line to on-site generation from Whyalla branch line

**Project description**: Install new gas supply line connected to existing Moomba-Adelaide branch line to Whyalla to South Gawler cluster and establish local gas generation plant

**Issue addressed**:

B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

**Capital cost**: $3 million (gas line), $84 million for onsite power generation

**Capacity**: 8 TJ per day (for generation of 40MW)

**Scalability of capacity and planned upgrades**: Generation capacity can be increased in a modular way in line with demand, providing initial gas supply pipe is sized to enable this.

**Lead time to operation**: 2 years

**Clusters and industries serviced**:

Clusters - South Gawler

Supported Industries – potential for other community gas/power supply

**Key technical construction and operational risks**:

- Unknown topography / geology – may encounter rock etc.
- Availability of gas from the Whyalla branch line would need to be confirmed. 8TJ represents approximately 30 per cent of this line’s capacity. If there is insufficient available capacity, this would require expansion back to the Moomba-Adelaide trunk main at significant additional cost
- Requires establishment of an easement – land owner interfaces, construction disruption etc.
- For power at more than one site, a localised distribution system will be required, or additional generation facilities at additional cost

**General comments**:

Advantages

- Lower cost electricity for significant volumes on a long-term basis, than on-site diesel generation
• Underground pipeline has minimal ongoing community impact and land use following construction
• Improved electricity and gas security to area

Disadvantages
• Risk of gas supply availability and/or need to augment Whyalla branch line capacity
• Higher cost option than transmission connection to Cultana
• Temporary disruption during construction
**Potential infrastructure solutions**

**E4: On-site diesel generation**

*Project description:* Provision of on-site diesel storage to fuel on-site power generation at localised site(s)

**Issue addressed:**

B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

**Capital cost:** $1.0 million per MW

**Capacity:** 2 – 300 MW

**Scalability of capacity and planned upgrades:** High flexibility - capacity can be added or removed in line with demand.

**Lead time to operation:** < 1 year

**Clusters and industries serviced:**

Clusters - All

Supported Industries - Nil

**Key technical construction and operational risks:**

- High operating cost for large demand

**General comments:**

- Solution already adopted at a number of existing mine sites – generally with relatively low power demand

**Advantages**

- High flexibility to ramp up or down with demand
- Short lead time to operation
- Low capital cost for low demands

**Disadvantages**

- Cost of transporting diesel
- Environmental impacts from diesel emissions
- Reliability of supply – backup generation may be appropriate in some circumstances
- High operating costs for larger demands

**Potential infrastructure solutions**
E5: Transmission link from Cultana

**Project description:** Installation of 275/132kV substation at Cultana and single circuit 132kV transmission line to South Gawler cluster

**Issue addressed:**

B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

---

**Capital cost:** Transmission line - $50 million; substation - $15 million

**Capacity:** 200MW

**Scalability of capacity and planned upgrades:** The project does not lend itself to being staged as the 132kV line is required in the first stage of the project. Cannot be scaled up without effectively replacing the system.

**Lead time to operation:** 2 years (from the time a transmission agreement is signed)

**Clusters and industries serviced:**

- **Clusters** - South Gawler
- **Supported Industries** – potential for other community power supply, may support renewable generation

**Key technical construction and operational risks:**

- Unknown topography/geology
- Requires establishment of easement

**General comments:**

**Advantages:**

- Common approach to provision of electricity supply
- Potential for use by others in the region – strengthens electricity supply security
- Potential to support renewable generation in the region

**Disadvantages:**

- Limited scalability options, therefore may be a high capital cost for initially low demand in order to protect higher use options later
E6: On-site LPG power station to service individual sites

**Project description:** Provision of on-site LPG storage to fuel on-site power generation at localised site(s)

**Issue addressed:**
B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

---

**Capital cost:** $2.1 million per MW

**Capacity:** 2 – 300 MW

**Scalability of capacity and planned upgrades:** Capacity can be added or removed in line with demand.

**Lead time to operation:** 1 year

**Clusters and industries serviced:**
- **Clusters** - All
- **Supported Industries** - Nil

**Key technical construction and operational risks:**
- Freight task for LPG
- High operating cost for larger demands

**General comments:**

**Advantages**
- Short lead time to operation
- High flexibility

**Disadvantages**
- High operating cost for larger/longer term demands
- Reliability of supply may warrant backup system
E7: Renewable generation to support mining loads

Project description: Renewable generation plant(s) as required to provide electricity supply to mining loads. Generation could be via solar (e.g. Solar Oasis), wind, wave, geothermal or hybrid technologies.

Issue addressed:
B. Inadequate power electricity links to South Gawler, Central Eyre and Southern Eyre mines

Capital cost: Solar; $7m - $10m per MW
Wind; $2 - $3m per MW
Geothermal; $5 - $10m per MW

Capacity: As required

Scalability of capacity and planned upgrades: Plants can be established in a ‘modular’ approach as demand requires.

Lead time to operation: 1-3 years

Clusters and industries serviced:
Clusters - All
Supported Industries – community if connected to transmission network grid, renewable energy sector

Key technical construction and operational risks:
- Often higher capital cost but lower operating cost
- Solar and wind are an intermittent sources and will require ‘backup’ supply. Backup supply could be via alternative on-site generation (such as diesel or gas generation), or via hybrid solutions (such as diesel/solar/batteries) or via connection to the transmission network
- Geothermal is a potential source of base load supply.
- New or establishing technology in some areas. Wind and solar are established commercial methods. Geothermal or wave are developing technologies. Large scale storage is a developing technology
- Proximity of suitable generation location may still require transmission to power demand point(s)
General comments:

Advantages

- Aligns with South Australian Renewable Energy plan and South Australian Strategic Plan
- Does not necessarily rely on network transmission upgrade
- Possible entitlement to ‘green energy’ funds

Disadvantages

- May be a higher up-front cost solution overall (depending on available options for funding support), particularly if two generation sources are required (i.e. backup supply); may be cost effective over a longer period of time due to low operating costs
- Proximity of available generation to demand – particularly for geothermal
- Potential community concerns, e.g. wind farms in some locations
- Possible requirements for land if facilities not able to be located on mine site
- Limited broader community benefits unless integrated with the transmission grid
Water
The six water projects have been derived in response to issues identified in the Eyre and Western region are:

- **W1**: Groundwater investigation (Eyre Peninsula)
- **W2**: On-coast desalination plant and transmission to Central Eyre
- **W3**: On-coast desalination plant and transmission network
- **W4**: Southern on-coast desalination plant with SA Water integration
- **W5**: Transmission of raw seawater and on-site desalination plant(s)
- **W6**: Morgan-Whyalla pipeline to storage points

### W1: Groundwater investigation

**Project description**: Undertake a high level overview analysis, building on existing knowledge bases, of the potential for further groundwater use in the Eyre Peninsula. Include consolidation of existing available data for easy and consistent access.

**Issue addressed**: D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

---

**Capital cost**: $2 - $5 million

**Capacity**: N/A

**Scalability of capacity and planned upgrades**: N/A

**Lead time to operation**: N/A

**Clusters and industries serviced**: 
- **Clusters** – Southern Eyre, Central Eyre, South Gawler
- **Supported Industries** – agriculture, tourism, community

Potential infrastructure solutions
Key technical construction and operational risks:

- Undertake in partnership with DEWNR and the Eyre Peninsula Natural Resources Management Board to ensure appropriate processes are followed and outcomes are maximised

General comments:

**Advantages**

- Improved early understanding of groundwater conditions will assist in early identification of environmentally sustainable solutions for planning and development
- Compliments existing research programs
- May improve overall levels of confidence of the understanding of environmental impacts of proposals
- Consolidated database may assist mining, farming and other community water supply planning by minimising the extent of investigation works required to establish confidence (or otherwise) in the feasibility of a water supply option
- May assist Government approval processes where water supply proposals can be demonstrated to be consistent with improved knowledge of groundwater availability and conditions

**Disadvantages**

- Capital cost
Potential infrastructure solutions

W2: On-coast desalination plant and transmission to Central Eyre

**Project description:** Desalination plant on coast to provide water to potable quality.

**Issue addressed:**
D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

**Project description:** Desalination plant on coast to provide water to potable quality.

**Issue addressed:**
D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

---

**Capital cost:** $600 million

**Capacity:** 12 GL/a

**Scalability of capacity and planned upgrades:** Limited scalability - initial intake/outlet sizing and transmission main should be sized for maximum forecast demand. Modular booster pumping can be incorporated.

**Lead time to operation:** 3 years

**Clusters and industries serviced:**
- **Clusters** – Central Eyre
- **Supported Industries** – agriculture, tourism, community

**Key technical construction and operational risks:**
- Environmental method of reusing/disposal of desalination process waste brine
- Transmission main route will require easement/construction disruption
- Power requirement for desalination plant and pumping (approximately 3-4 MW)

**General comments:**
- The desalination plant can be designed to desalinate seawater to different salinities to suit different end-uses. This option assumes desalination to the salinity level required for potable water but a re-mineralisation process is required to bring the mineral content of the desalination water to normal levels
- If desalination is undertaken to a lesser extent (e.g. suitable for mine processing, dust suppressant etc.), the ability to use this water for other sectors and the broader community is reduced without further subsequent desalination

**Advantages**
- Opportunities to supply other potential users from the transmission pipeline and increase water security for these users.
points could be provided at minimal additional cost. Outlet points could also be used for fire-fighting.

Disadvantages

- A centralised desalination point cannot produce water of varying quality for different users
- Power supply availability
- High capital cost
W3: On-coast desalination plant and transmission network

**Project description:** Desalination plant at coast to provide water to potable quality with transmission to key demand areas on the Eyre Peninsula.

**Issue addressed:**
D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

**Legend:**
- **DESLAL PLANT**
- **TRANSMISSION MAINS**
- **Mining Projects by Commodity**
  - Copper
  - Iron
  - Other
  - Uranium

**Capital cost:** $1.05 billion

**Capacity:** 15 GL/a

**Scalability of capacity and planned upgrades:** Limited scalability - initial intake/outlet sizing and transmission main should be sized for maximum forecast demand. Modular booster pumping can be incorporated.

**Lead time to operation:** 3 years

**Clusters and industries serviced:**
- **Clusters** – Southern Eyre, Central Eyre and South Gawler
- **Supported Industries** – agriculture, tourism, community

**Key technical construction and operational risks:**
- As for project W2

**General comments:**
- As for project W2

**Advantages**
- As for project W2
- Greater economies of scale benefit from the cost of a single larger desalination plant
- Well positioned to support largest forecast mining demand as well as supporting broader community

**Disadvantages**
- As for project W2
- Greater level of impact from easement/construction/operations perspective
- Higher capital cost

**Potential infrastructure solutions**
**W4: Southern on-site desalination plant with SA Water integration**

*Project description:* Desalination plant at coast to provide water to potable quality with transmission to key demand areas on Eyre Peninsula.

*Issue addressed:*
D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

*Capital cost:* $1.5b

*Capacity:* 15 GL/a

*Scalability of capacity and planned upgrades:* Greater level of scalability than options W1 and W3 as desalination plant can use existing SA Water mains initially with sections replaced or augmented as demand requires. Intake – Outlet for desalination plant should be sized to forecast maximum demand initially.

*Lead time to operation:* 3 years

*Clusters and industries serviced:*
- Clusters – Southern Eyre, Central Eyre, South Gawler
- Supported Industries – agriculture, tourism, community, renewable generation

*Key technical construction and operational risks:*
- Environmental method of reusing/disposal of desalination process waste brine
- Transmission main route can follow existing main route, although it is not known if there is sufficient room in the easement to install an additional pipe
- Power requirement for desalination plant and pumping – may be opportunity to connect directly to renewable generation

*General comments:*
- SA Water has previously investigated possible sites for a southern desalination plant. Larger desalination plant may require review of preferred location. Alternative sites on west coast of the Eyre Peninsula may be considered – although high cliffs likely to add to capital cost
- The desalination plant in this application would need to produce water to a potable standard as it integrates with existing community supply systems

*Advantages*
Potential infrastructure solutions

- Integrates mining water supply needs with water security for community
- The new water mains can be sized to replace the existing mains with new, providing a further ongoing benefit to the community
- Scalable transmission main upgrade/replacement may have cash flow benefits
- Option aligns with previous SA Water proposal for a southern desalination plant to strengthen the region’s water security

Disadvantages

- Risk of damage to existing mains and therefore disruption of supply during installation of adjacent mains
- Potential for higher quality of water to be provided for mining than is required
- Power supply
- High capital cost
W5: Transmission of raw seawater and on-site desalination plant(s)

Project description: Pump raw seawater via transmission mains to one or more sites where the required portion of water is desalinated locally.

Issue addressed:
D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

Capital cost: $400 million

Capacity: 13 GL/a

Scalability of capacity and planned upgrades: Limited scalability for raw seawater pump and transmission main - initial intake/outlet sizing and transmission main should be sized for maximum forecast demand. Modular booster pumping arrangements can be incorporated. Individual desalination plants can be applied or removed as demand dictates.

Lead time to operation: 3 years

Clusters and industries serviced:
Clusters – Central Eyre
Supported Industries - agriculture, tourism, community

Key technical construction and operational risks:
- Management of pipeline durability from saline water
- Management of risks of brine spills or leaks during operation. May require detection system, ‘sleeving’ or regular detention ponds
- Treatment/reuse/disposal of waste brine at individual desalination sites
- Transmission main route will require easement/construction disruption
- Power requirement for desalination at individual sites

General comments:
Advantages
- Product water quality can be tailored to suit each individual user’s requirements. An individual user can use raw seawater or desalinated water for different purposes

Potential infrastructure solutions
• Good flexibility for other users to use the pump and transmission pipeline system and apply their own desalination
• Construction phase employment

Disadvantages
• Management of the risk of seawater leaks
• Management/reuse/disposal of waste brine at individual sites
• Provision of power for desalination and transmission
**W6: Morgan – Whyalla pipeline to storage points**

*Project description:* Use existing mains water system to maximum capability by storing water in periods of low demand. This could also include use of existing dams (such as the Tod reservoir).

*Issue addressed:*

D. No identified suitable source of water for Central Eyre, Southern Eyre and South Gawler mines

---

- **Capital cost:** $20m
- **Capacity:** up to 1.0GL/a
- **Scalability of capacity and planned upgrades:** Storage tanks can be provided at individual sites based on demand
- **Lead time to operation:** < 1 year
- **Clusters and industries serviced:**
  - **Clusters:** South Gawler, Central Eyre, Southern Eyre
  - **Supported Industries:** Community
- **Key technical construction and operational risks:**
  - Reliability of available water supply
  - Maintaining quality of stored water
  - Salinity of dam water will require treatment to be used as potable water
- **General comments:**
  - This option may assist to meet a mines’ potable water demand and may therefore enable a lower water quality solution to be more viable for the majority of mine use
- **Advantages**
  - Low capital cost
  - Storage may assist fire fighting
- **Disadvantages**
  - Pushes existing system to maximum capability
• May not be a reliable supply
• May not be an adequate volume of supply
9. Regional sustainable development

In order to achieve the primary objective of the RMIP project – that is, to identify infrastructure solutions that maximise the net benefits to South Australia by improving connectivity from existing mines and reducing infrastructure-related risks for new mines – it is essential that the prioritised projects facilitate regional sustainable development. To achieve this regional sustainable development, prioritised infrastructure projects must be developed with consideration to the unique social and environmental features of the Eyre and Western region described in Chapter 3 and Appendix B respectively.

To ensure that the prioritised projects are capable of doing this, the RMIP project team has adopted a triple-bottom line approach in assessing the environmental, social and broader economic impacts of the infrastructure projects identified in Chapter 8. This approach has ensured that infrastructure projects have been prioritised (or not) on the basis of the full range of impacts that can be expected to result.

The specific methodology used to consider each type of impact has been adapted to suit the specific nature of that impact; however, all have been informed by the feedback received during public consultations on the interim reports.

Environmental impacts

In order to inform the prioritisation process described in Chapter 10, a high level review of the environmental impacts of the infrastructure projects has been undertaken. Rather than undertaking the detailed environmental impact assessment that would be required for the development of each infrastructure project, this review sought to outline the key potential environmental impacts posed by the infrastructure projects.

This high level review involved consultation with a range of conservation and environmental groups and working with technical experts to ensure potential environmental impacts were properly identified and considered. In undertaking this review, a range of factors were considered, with these summarised in the following sections. It should be noted that construction of all forms of infrastructure would be expected to have some degree of environmental impact. This review has not specifically identified particular environmental impacts arising from each individual proposed infrastructure projects at this point in time.

Assumptions

In undertaking this high level review, the following assumptions have been made:

- All infrastructure projects would comply with existing legislation and obtain all relevant approvals under existing local, State and Commonwealth frameworks. In broad terms, these frameworks (at a Commonwealth and State level) include those established under the following pieces of legislation:
  
  **Commonwealth**
  - Aboriginal and Torres Strait Islander Heritage Protection Act 1984
  - Australian Radiation Protection and Nuclear Safety Act 1998
  - Civil Aviation Act 1988
  - Customs Act 1901
  - Defence Act 1903 (for operations within the Woomera Prohibited Area and the Cultana Training Facility)
Regional sustainable development

- Environment Protection (Sea Dumping) Act 1981
- Environmental Protections and Biodiversity Conservation Act 1999 (EPBC Act)
- National Greenhouse and Energy Reporting Act 2007
- Native Title Act 1993
- Navigation Act 1912
- Nuclear non-Proliferation Safeguards Act 1997
- Work Health and Safety Act 2011

State

- Aboriginal Heritage Act 1988 and Aboriginal Heritage Act 1979
- Climate Change and Greenhouse Emissions Reduction Act 2007
- Crown Lands Act 1929
- Dangerous Substances Act 1979
- Development Act 1993
- Electricity Act 1996
- Environment Protection Act 1993
- Explosives Act 1936
- Gas Act 1997
- Harbors and Navigation Act 1993
- Heritage Places Act 1993
- Highways Act 1926
- Local Government Act 1999
- Marine Parks Act 2007
- Mines and Works Inspection Act 1920
- Mining Act 1971
- National Electricity (South Australia) Act 1996
- National Parks and Wildlife Act 1972
- Native Title (South Australia) Act 1994
- Native Vegetation Act 1991
- Natural Resources and Management Act 2004
- Pastoral Land Management and Conservation Act 1989
- Petroleum Act 2000
- Petroleum Products Regulation Act 1995
- Protection of Marine Waters (Prevention of Pollution from Ships) Act 1987
- Public and Environmental Health Act 1987
- Radiation Protection and Control Act 1982
- Rail Safety Act 2007
- Railways Act 1997
- Road Traffic Act 1961
- Roads Opening and Closing Act 1991
- Work Health and Safety Act 2012

- Vegetation clearance would be minimised wherever possible. This would include the clearance of roadside vegetation, which often comprises significant populations of remnant vegetation, as well as threatened species and ecological communities in some areas of South Australia where widespread clearing has taken place.

- Detailed identification and assessment of Matters of National Environmental Significance (as defined by the EPBC Act) would be undertaken on a project-by-project basis.

- Interruptions to existing land uses and existing access arrangements would be minimised wherever possible.

- Any extraction and/or reinjection of groundwater would comply with the requirements of the existing system of water licensing and Water Allocation Plans for Prescribed Wells Areas (e.g., the Far North PWA) and, where relevant, the Murray-Darling Basin Plan.
**Principles**

In implementing the prioritisation framework used to assess the infrastructure projects, a series of guiding principles have been used to inform the scoring of the projects against a number of strategic and deliverability criteria. These guiding principles have been developed for each type of infrastructure project considered in the RMIP project, and summarise the potential impacts which may need to be considered by the infrastructure proponents in further approval processes.

These guiding principles are summarised below.

**Ports**

Numerous ports proposals are able to meet the needs of the growing mining and minerals processing industries in South Australia, including the construction of new ports and the expansion of existing facilities. The types of ports considered include:

- Direct loading ports:
  - Product (e.g. ore or concentrate) is transported along a jetty to a bulk carrier moored in deep water at the end of the jetty
  - Containerised product is transported to a port where it is loaded directly onto bulk carriers at berth
- Transhipment:
  - Product is loaded into barges in shallow water ports and transported to an offshore transfer facility where the product is loaded onto a bulk carrier anchored in deep water
  - Product is slurried to an offshore vessel anchored in deep water, dewatered and transferred into a bulk carrier moored alongside.

Potential impacts associated with mineral export ports (and associated facilities) can include:

- Increased shipping traffic, dust generation from stockpiles (terrestrial impact) and ship loading (marine impact)
- Increased turbidity and sediment disturbance from dredging and propeller wash
- Impacts to existing land uses from establishment of stockpiles and associated landside facilities
- Soil erosion and subsequent sedimentation in coastal environments from construction of landside facilities
- Interruption to or restriction of existing land uses
- Impacts on visual amenity from the wharf, stockpiles, conveyors and other landside facilities
- Impacts on large marine fauna such as whales, dolphins and seals
- Impacts on coastal/shallow water species such as cuttlefish, fish and crustacean larvae that form important nursery and food populations for significant fisheries, and sedentary organisms such as coral, sponges and some shellfish
- Impacts on coastal vegetation such as mangroves, saltmarshes, estuaries and seagrass beds
- Disturbance of coastal acid sulphate soils during construction
- Impact on coastal processes such as interruption of longshore drift through construction of groynes, harbours and other structures
- Introduction of exotic marine species via discharge of ballast water or hulls of vessels
- Potential product loss (although the likelihood of this is generally perceived to be low).
Potential environmental benefits of establishing a high-volume port capable of servicing Capesize bulk carriers include:

- Consolidation of all environmental impacts to one location (including reduced emissions)
- Ability to service multiple industry sectors (e.g., agriculture) through the provision of a multi-commodity port could provide further consolidation of port infrastructure and associated environmental impacts
- Reduction of overall shipping traffic and transport emissions due to larger vessels with ability to ship greater volumes.

The establishment of ports and associated landside coastal developments will also need to consider the potential impacts of sea level rise.

**Rail**

Rail is often preferred over road transport for minerals export as rail can transport greater volumes with lower operating expense. The construction of new rail lines or upgrading of existing lines can pose potential environmental impacts such as:

- Vegetation clearance
- Impacts on terrestrial fauna from construction and operation of rail line
- Interruption of surface water drainage pathways which may affect the viability of remnant vegetation and fauna dependent on intermittent lakes and waterways
- Noise impacts to communities along the rail corridor
- Interruption to or restriction of existing land use or access arrangements
- Dust impacts along rail corridors.

Potential environmental benefits of providing additional rail infrastructure include:

- Transport by rail reduces the need for road traffic (providing road safety benefits and reduction in maintenance and upgrade requirements for existing roads)
- Lower transport emissions per tonne when compared to road transport
- Reduction of overall freight traffic due to higher volume parcels.

**Road**

The construction of new roads or upgrade of existing roads for the transport of mineral products is generally countenanced when production volumes are relatively low, short distances are involved or the capital expenditure required for the construction of new rail is seen to be prohibitive when considered in relation to factors such as production volumes, commodity value and anticipated mine life. Potential environmental impacts associated with road construction (new or upgraded) include:

- Vegetation clearance, including impacts on roadside vegetation during upgrades or widening of existing roadways
- Noise impacts to communities along the road corridor
- Interruption or restriction of existing land use or access arrangements
- Soil erosion during construction
- Traffic restrictions during construction
• Increased traffic volumes (particularly heavy vehicle movements) during operation.

**Slurry Pipelines**

The construction of slurry pipelines can pose a number of potential environmental impacts, including:

• Vegetation clearance
• Interruption to or restriction of existing land use or access arrangements
• Impacts to terrestrial fauna from construction of trenches
• Impacts to marine or terrestrial environments if water is discharged after dewatering slurried product/slurry is released due to pipeline rupture
• Soil erosion during construction
• Power use (and emissions generation) required for pump stations along pipeline route.

Environmental benefits of slurry pipelines relative to other infrastructure solutions include:

• Impacts to visual amenity, land use and access can be minimised; due to undergrounding of pipelines, existing aesthetics can be maintained, and existing land uses and access would undergo temporary interruption during construction, with minimal permanent restrictions
• Vegetation clearance can be minimised as the pipelines would be able to avoid significant stands of remnant vegetation (including those in road reserves)
• Traffic impacts reduced in comparison to road and rail solutions, freeing up capacity on existing freight networks for other commodities/sectors
• Use of fossil fuels and associated emissions can be reduced in comparison to road and rail solutions—although pumping would entail further emissions through electricity use; the opportunity exists for this to be provided through renewable or energy sources with lower emissions than diesel fuel.

**Groundwater Extraction**

The majority of mines in South Australia extract groundwater, either as part of a dewatering program, as a supply for mine processes and/or dust suppression, as part of their recovery process (e.g. ISR uranium mines), or for use as a potable supply. Potential impacts associated with the extraction of groundwater include:

• Impacts on groundwater dependent ecosystems, e.g. mound springs
• Questions around potential yield in various regions and sustainability of yields
• Slow recharge rate for many aquifers
• Aquifers may become more saline as water is extracted
• If desalination required (or saline water used in processing) there will be a need to dispose of high chloride waste (tailings/brine).

The relative benefits of using groundwater at mine sites include:

• Groundwater being drawn relatively close to mine sites and would require shorter pipelines (with lower associated vegetation clearance) and less energy for pump stations
• The demand on potable (mains) supplies or water from the River Murray is significantly reduced.
Coastal Desalination Plants

Desalination by reverse osmosis (RO) is generally viewed as the most efficient method of desalination in Australia (in terms of energy use, capital and operating cost, and water recovery). In general, RO desalination plants pose the same potential impacts to the environment, including:

- Pipelines will be required to transport the water from the coast to mine sites, which may require vegetation clearance and interruption or restriction of existing land uses or access arrangements
- Considerable electricity usage (for both the RO process and pump stations) and associated emissions
- Impacts from trenching of intake and outfall pipelines
- Risk of seawater intake entraining biota such as planktonic larvae or other small, slow-swimming organisms
- Ecological impacts from disposal of brine and pre-treatment chemicals (although, in some cases, brine can be pumped to mine site for disposal in tailings), including:
  - increased local salinity
  - increased turbidity
  - ecotoxicological effects on local flora, including seagrasses and macroalgae
  - ecotoxicological effects on local fauna species (particularly sessile or sedentary organisms, or those with limited ranges or specific, localised habitats).

Relative benefits of coastal desalination plants include:

- Certainty of supply and water quality for mining operations
- No demand on groundwater
- No demand on existing potable supplies (reticulated mains water)
- No demand on water from the River Murray
- Desalination plants also have the potential to contribute to local potable (town) water supplies, reducing reliance on groundwater systems and/or reticulated mains water.

Power Generation, Transmission and Distribution

On-site power generation (diesel or gas)

- On-site diesel generation results in higher greenhouse gas emissions (per kWh of electricity generated and per tonne of product) than central power generation and also requires significant energy use in transporting fuel to site
- Co-generation can utilise waste heat from processing operations (such as acid plants) to generate electricity in a co-generation power plant
- No need for long-distance electricity transmission lines and associated impacts, such as vegetation clearance and interruption or restriction of existing land uses or access arrangements.

Transmission of power from central generation

- Potential for vegetation clearance along transmission alignment and associated maintenance access track
- Visual impact of transmission pylons
- Opportunity to provide power to multiple users and excellent economies of scale
- Requirement for significant cooling water supply
• Production of waste products at generation site (e.g., ash, wastewater, sludge, residues)
• Greater overall greenhouse emissions (depending on fuel source) but lower emissions per kWh of electricity generated than on-site generation, as emissions are centralised.

Renewable energy generation
• Potential for co-location with mines, other mining related infrastructure and/or other renewable generation facilities (e.g., wind/ solar/ geothermal)
• May not be in close proximity to existing transmission network
• Generally not considered able to provide base load power; however, it has been suggested that more renewables in the network means non-mining demand can potentially be diverted from traditional generation sources.

Considerations for individual projects

In addition to these general assumptions and principles applied in analysing each infrastructure project considered as part of the RMIP process, a number of proposed projects have been identified as requiring particular attention; this has been the case where acute or frequent community concerns have been raised or where the project has been identified in consultations with a peak body as requiring specific attention.

The following is a summary of the considerations specifically relevant to proposed infrastructure projects in the Eyre and Western region.

Eyre Peninsula Ports

Port Bonython

The Port Bonython development proposed by Spencer Gulf Port Links consortium includes the construction of a common-user bulk iron ore storage and handling facility, a 17.5km rail spur connecting the site to the existing Whyalla to Port Augusta rail line, and a 3km long jetty.

In addition to the environmental impacts associated with ports listed previously, potential impacts specific to Port Bonython include:
• Vegetation clearance for rail corridor from the main line to port site
• Impacts to visual amenity of isolated coastal environment
• Impacts to coastal homeowners (noise, dust, light from construction and operation of port, associated railway and landside facilities)
• Impacts to nursery (larval and juvenile) populations of marine species, including several significant fisheries species such as prawns and snapper
• Impacts to breeding aggregations of the Australian Giant Cuttlefish
• Impacts to commercial aquaculture developments in Fitzgerald Bay.

The Port Bonython project site is located within the Upper Spencer Gulf Marine Park. However, it should be noted that Marine Parks do not preclude industrial activities per se (except in specific areas such as Sanctuary Zones), but guide their development and operation. The proposed Port Bonython site is zoned Special Purpose Area (Harbour activities) within the Upper Spencer Gulf Marine Park. However, it is located

---

adjacent to the Cuttlefish Coast and Fairway Banks Sanctuary Zones of the Park which, respectively, provide breeding habitat for the Australian Giant Cuttlefish, and significant offshore seagrass habitat.

Concerns have been raised regarding sediment disturbance and resultant increased turbidity caused by dredging and limited keel clearance and propeller wash from loaded Capesize vessels being manoeuvred by tugs at Port Bonython.

It is noted that an Environmental Impact Statement (EIS) is currently being prepared for this site; the guidelines for this EIS specifically include requirements for consideration of impacts of dredging, blasting and piling (if required), impacts on Australian Giant Cuttlefish, fishery species and migratory species and cumulative impacts of such developments as existing and approved petroleum facilities, the Whyalla port and the approved BHP Billiton desalination plant at Point Lowly.9

Potential advantages of the Port Bonython site include:

- Land around the proposed port is zoned for industrial use, and is not in proximity to major population centres
- The project site is situated immediately adjacent to an existing industrial facility and existing port (Santos petroleum facility) which could provide consolidation of environmental impacts
- Opportunity to provide an export solution for a number of Eyre Peninsula, Far North and Braemar mines.

**Port Nonowie**

The proposed Port Nonowie site is located south of the boundary of the Upper Spencer Gulf Marine Park, near the Cowleds Landing Sanctuary Zone of the Park, which provides significant habitat for internationally important migratory seabirds and feeding grounds for blue crabs.10 The proposed site for Port Nonowie is also located north of the Munyaroo Conservation Park. Development of a port facility and the required links to existing power, rail and road networks would need to consider potential impacts to these conservation assets.

**Central Eyre Port**

There are currently two port developments proposed for the central Eyre Peninsula; Iron Road’s Cape Hardy and Centrex Metals’ Port Spencer. The two projects are located within 10 km of each other along the western coast of the Spencer Gulf between Tumby Bay and Port Neill. The South Australian Government’s position is only one new port will be constructed in the central Eyre Peninsula, which would be a multi-user facility.11

The proposed Port Spencer site is located approximately 6 km north of the Sir Joseph Banks Group Marine Park, which extends nearly 50km into Spencer Gulf. The Salt Creek Sanctuary Zone extends over 16km offshore, beyond which a Habitat Protection Zone extends for another 10 km and a General Managed Use Zone extends for another 20 km.12 The construction and operation of both projects could have potential impacts on this Marine Park, particularly with regard to shipping movements to and from the proposed jetties.

---

9 DAC 2012, op cit.
The proposed Port Spencer site is approximately 1.5 km from the Lipson Island Conservation Park. A baseline flora and fauna report has been undertaken to identify potential impacts to Lipson Island, which identifies Lipson Island as a significant rookery and roosting site for the Little or Fairy Penguin, as well as several species of Cormorants and Terns. The report also identifies several species of conservation significance, including migratory waders listed under the EPBC Act, the Australian Sea Lion, turtles and other seabird species as likely to utilise Lipson Island. The report concluded that a series of management plans should be prepared to maintain the ecological integrity of the island, which would include specific monitoring and further investigations, specifically focussing on the Little Penguin population and management of other seabirds. Potential impacts to Lipson Island identified in this report included:

- Noise and light impacts from drilling and blasting during construction and operation of the port and from shipping activities associated with the port
- Soil erosion, sedimentation and turbidity impacts on marine environments
- Impacts of weed proliferation, invasive bird species (e.g. Silver Gull), feral animals (e.g. fox, cat) and human disturbance on seabird rookeries and island ecology
- Impacts associated with uncontrolled release or spills of solid waste and wastewater
- Impacts of invasive species from ballast water or from the hulls of ships.

Potential environmental benefits of establishing a port in the central Eyre Peninsula include:

- Reduction in rail and/or heavy vehicle traffic on Eyre Peninsula transport networks (from mine to port) and reduced shipping traffic within Spencer Gulf (from port to market) with a resulting reduction in the overall emissions profile for minerals exports on the peninsula
- Opportunity to consolidate agricultural and mineral export facilities into a single site, which would allow for:
  - reduction in heavy vehicle movements through residential areas in existing grain port towns (e.g., Port Lincoln)
  - consolidation of terrestrial and marine environmental impacts to a single site.

**Eyre Peninsula Linear Infrastructure Corridors**

Potential linear infrastructure developments in the Eyre Peninsula include the following:

- Eyre Peninsula seawater pipeline from Central Eyre port to mine site
- Upgrade of rail line from Buckleboo to Central Eyre port and new rail where required
- Upgrade of roads from Port Lincoln to Central Eyre port
- Strengthening of Eyre Peninsula electricity transmission network.

---

As discussed previously, it is anticipated that all linear infrastructure developments would pose a similar range of potential impacts to the environment. The most significant of these for the Eyre Peninsula would include:

- Vegetation clearance: considering the level of historical clearance on the Eyre Peninsula and the peninsula's remnant vegetation (other than that retained in conservation reserves, which the alignments for these corridors would avoid) in existing linear infrastructure corridors, the potential impact of vegetation clearance associated with the establishment of new or enlargement of existing infrastructure corridors could be significant on a local and/or regional basis.

- Interruption to or restriction of existing land uses or access arrangements: the length of the proposed infrastructure corridors (150km or more) would affect dozens of individual land holders, predominantly agricultural land users.

Other region-specific impacts could include potential impacts to local groundwater supplies, given the importance of these in terms of domestic and agricultural water supplies on the Eyre Peninsula.

**Social impacts**

As briefly discussed in Chapter 2, infrastructure is a broad term which encapsulates more than just the physical infrastructure identified in the previous chapters; it also refers to the basic organisational structures required for business and community functions to operate. Ignoring the needs of workers, their families and existing communities will decrease the benefits that mining can deliver for South Australia, and also increase the risk that mining projects will not succeed. As raised by a range of stakeholders throughout the consultation process, the need to plan for social infrastructure is an important aspect of the RMIP project.

The figure below summarises the key types of social infrastructure that will need to be considered in order to provide for both the existing community as well as new people moving to the region.

**Figure 9.1: Types of social infrastructure**

- **Housing**
  - Employee
  - Community

- **Community**
  - Transport
  - Commerce
  - Recreation
  - Broadband
  - Water
  - Waste

- **Health**
  - Hospitals
  - Primary care

- **Education**
  - Schools
  - Training
  - Child care

- **Safety**
  - Police
  - Courts
  - Emergency services

There are a range of stakeholders beyond those currently living in communities in the Eyre and Western region (or predicted to move into the region) that will need to be involved in the planning and provision of social infrastructure. These stakeholders are outlined in Figure 9.2.

**Figure 9.2: Key social infrastructure stakeholders**

- Mining operators
- State Government and agencies
- Local Government
- Commerical and NFP operators
- Community
The social infrastructure needs of communities in the Eyre and Western region will depend heavily on the location of the mines in relation to existing population centres, the number of employees required at the mines and the employment model adopted at each mine (be that integrated housing in existing communities, fly-in/fly-out or drive-in/drive-out workers or the establishment of new communities).

The proximity of a number the Eyre and Western projects relative to townships are depicted in the figures below.

**Figure 9.3: Proximity of western mines to townships**

**Figure 9.4: Proximity of Eyre Peninsula mines to townships**
The DPTI planning report ‘Eyre and Western Regional Plan’ outlines the focuses of the significant population centres in the region:

- Whyalla and Port Lincoln – the regional centres for major retail, commercial, administrative, education, health, justice and recreational activities
- Ceduna – a west-coast focus for secondary retail, commercial, administrative, education, health and recreational activities
- Kimba, Cleve, Cowell, Tumby Bay, Streaky Bay and Cummins – supporting commercial and services centres
- Wudinna and Lock – supporting rural services centres
- Arno Bay and Streaky Bay – local and visitor services and retail centres
- Coffin Bay, Smoky Bay, Venus Bay, Sceale Bay and Elliston – centres for coastal living, fishing and tourism
- Cowell – centre for cultural, heritage and tourist activities.

Source: Eyre and Western Region Plan, DPTI April 2012

Housing

Model of housing

The impact upon regional social infrastructure of a mine is heavily influenced by the employment model that is used by the operation. Over the past 30 years, mines in Australia have increasingly utilised ‘Fly in Fly out’ (FIFO) or ‘Drive in drive out’ (DIDO) workforces. The reasons for the increase in the adoption of these workforce models include the remote locations of mines, the need to attract workforces who prefer to live in large cities, advances in technology and transport and differing models of operating costs.

In February 2013 the House of Representatives Standing Committee on Regional Australia tabled a report Cancer of the bush or salvation for our cities? Fly in, fly out and drive-in, drive-out workforce practices in Regional Australia. The report identified that many regional communities affected by FIFO or DIDO workforces hold significant concerns regarding a lack of engagement between the workforce and the existing community and related concerns including economic impact, safety, drain on social services and the cost of housing.

The extent to which FIFO or DIDO is used as the model for the workforce in this region will have a significant impact on the planning for the social infrastructure.

As illustrated in Figures 9.3 and 9.4, the Eyre Peninsula has significant population centres within a reasonable commuting distance from the mines being developed in the region. This would suggest opportunities for regional communities to provide workers for the mines, to grow their communities as new workers choose to live in the towns and grow their economies by providing services to the mines. For the FIFO or DIDO population, detailed planning will need to be considered by government, communities and proponents about how these additional employees can be integrated into the community.

Housing supply

There are currently almost 22,000 dwellings occupied in the region, with an additional 5,000 currently unoccupied. The large majority of dwellings are on the Eyre Peninsula, with the most being located in the regional centres of Whyalla and Port Lincoln.
Table 9.1: Dwellings in the Eyre Peninsula and South West Statistical Area

<table>
<thead>
<tr>
<th>Dwellings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total occupied private dwellings</td>
<td>21,943</td>
</tr>
<tr>
<td>Unoccupied private dwellings</td>
<td>5,033</td>
</tr>
</tbody>
</table>

Source: ABS 2011 Census

Despite the number of unoccupied dwellings, the State Government has noted that there is some concern regarding the availability of housing across the region.\(^{14}\) It has recommended that councils regularly conduct an audit of housing needs to identify and qualify gaps in supply and analyse future occupancy rates and dwelling size in order to best plan for housing needs across the region. In addition, it has been acknowledged that the availability of supply has increased rental rates significantly in Whyalla and Port Lincoln in particular.

As such, the region is already facing a lack of supply and increasing rents, and faces a further increase in demand as mining developments proceed. This means that further housing stock will be required to meet needs, particularly for rental accommodation that could be utilised by mining staff. Collaboration between State government, local government, mining proponents and property developers to identify best locations for developments, land releases and associated infrastructure, developments and affordable housing will be essential to plan for housing across the region.

Community

Transport

As well as the transport needs for the bulk freight tasks of the mines discussed earlier in this report, there also needs to be planning of the transport needs of FIFO, DIDO and locally based workers, as well as community members affected by new mining operations.

For DIDO workers, transport will likely involve the same roads that will need to be upgraded or constructed to build and service the mine. However, transport routes might be different, particularly if the mine is able to attract its workforce from centres in the region such as Port Augusta or Whyalla. Consideration will need to be given to road safety measures including road grading and overtaking lanes where changes in regional populations increases demand on local roads and highways.

A roll-on/roll-off ferry operation exists in this region, operating between Lucky Bay and Wallaroo, which could potentially service DIDO workforces and the regional community.

\(^{14}\) Source: Eyre and Western Region Plan, DPTI April 2012
The location of airports will be particularly important for FIFO workers, as well as the growing regional communities to be serviced from Adelaide and other cities. The Eyre Peninsula has some small regional airports with regular services and airstrips that potentially could be developed to cater for charter flights. Regular passenger services are currently available between Adelaide and Port Lincoln (Rex and Qantaslink), Whyalla (Rex) and Ceduna (Rex). Port Lincoln is the State’s busiest regional airport with approximately 200,000 passenger movements per annum. While there are landing strips in the region of the potential operations in the Western region above Ceduna, these landing strips would require development in order to service remote sites. The location and planning for airports and landing strips will also be important for the Royal Flying Doctors Services (RFDS) as a key linkage and provider of health services in the region.

**Commerce**

Commercial services are part of the mix of social infrastructure that needs to be in place to support new and growing communities. These services include retail, hospitality, commercial services and entertainment. While commercial operators will in many instances be attracted to establish and grow commercial operations to meet the needs of the local population, there are limiting factors and potential market failures that should be considered by mining operators and communities as part of the planning process. These considerations include:

- In a limited market with a large increase in demand fuelled by a highly paid workforce, there is the risk prices will increase, causing problems for the existing population. This has affected some mining developments in other states. As such, it is important to ensure a sufficient supply of commercial services are available so that prices are not driven up (beyond those which can be accommodated by the local community) as a result of an influx of highly paid mining sector workers
- Very remote operations may encounter significant difficulty in attracting commercial operations. This will necessitate mining proponents to support the provision of essential goods and services. Without financial and/or logistical support to set up at remote mining facilities it would be uneconomic to do so in many cases.

**Recreation**

**Figure 9.6: Recreation facility at Prominent Hill for FIFO and DIDO workers**

Providing recreation services for new workers and larger regional communities is a critical part of attracting a highly skilled workforce and increasing social cohesion within a community. In particular, sport is a critical part of the social fabric of regional communities; anecdotal evidence suggests this is certainly the case in the Eyre and Western region. While there are a number of existing multi-purpose sports and recreation facilities in the Eyre Peninsula region, the challenge will be to ensure that there is sufficient capacity at those facilities to ensure that they can be properly utilised by the existing community harmoniously with the new mining sector employees. If this is planned properly, these facilities should become settings where existing and new residents are able to develop a community bond.

In addition there may be additional demand upon other recreation facilities such as libraries and community centres that will need to be incorporated into planning by the local government and mining proponents.

Where mines are built in very remote locations, it will be necessary for the mining proponent to build sufficient sporting and recreation facilities for their employees. This will also be an important part of the attraction and retention of skilled employees at the mine.

**Broadband**

The National Broadband Network will be a key enabler of services for employees and communities in the region – helping to deliver services via the internet and videoconferencing, as well as allowing sophisticated communications for those employees who have travelled to work at mines.

Currently there is a mixture of internet utilisation across the region, with two thirds of residents having an internet connection (the vast majority of which is a broadband connection).
### Table 9.2: Internet connections for the Eyre Peninsula and South West Statistical Area

<table>
<thead>
<tr>
<th>Internet connection</th>
<th>Dwellings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet connection</td>
<td>67%</td>
</tr>
<tr>
<td>- Subset of broadband connection</td>
<td>59%</td>
</tr>
<tr>
<td>No internet connection</td>
<td>29%</td>
</tr>
<tr>
<td>Internet connection not stated</td>
<td>4%</td>
</tr>
</tbody>
</table>

*Source: ABS 2011 Census*

**Power, water, waste**

While this report has considered the need for electricity and water supplies for mines, consideration will also need to be had regarding growth in demand for this infrastructure from regional communities as they grow. In most cases these communities will benefit from the provision of supplies to the mines themselves. The greatest risk to security of community supply of infrastructure is if sufficient supply for the mine is not in place at the right time and then places pressure on the infrastructure supporting existing regional communities.

The disposal of community waste will need to be properly planned for as communities grow or new communities in remote areas are developed. This includes the collection, landfill and recycling needs of residential and commercial properties. This is a key responsibility of local government but must be considered jointly with mining proponents in remote locations that are far away from existing waste infrastructure.

**Health**

**Figure 9.7: Locations of hospitals in the Eyre Peninsula region**

*Existing health facilities*

The Port Lincoln Hospital and the Whyalla Hospital are classified as ‘general hospitals’, offering the widest variety of hospital services in the region.

The Ceduna Hospital recently underwent a $36 million redevelopment which included the construction of a GP Plus Health Care Centre. The hospital now includes a new emergency department, theatre suite, day procedure unit and residential aged care. The GP Plus Health Care Centre includes doctors, dentistry, community health, allied health, physiotherapy and mental health services.
Smaller hospitals are located in various towns across the Eyre Peninsula.

General Practitioners operating in this area are eligible for a range of Commonwealth Government incentives based on the SGC classification of the area in which they operate (as depicted in Figure 9.7). These incentives include relocation allowances, grants based on the length of time operating in the region, and HECS repayment assistance.

Residents within this region are also able to utilise Medicare payments for telehealth consultations with specialists.

**SA Health planning**

SA Health has developed a ‘Strategy for Planning Country Health Services in SA’ as an overall document to guide the approach to health planning in regional South Australia. One of the key principles of this document is planning for changing needs, including growth in communities associated with developments including mining.

The plan also provides for growth of a number of Country General Hospitals, including Port Lincoln and Whyalla hospitals, to manage the majority of the local population’s health care needs so that only patients requiring highly specialised or complex care need to travel to Adelaide. The plan for these hospitals includes staffing by salaried medical officers and capital upgrades (which are underway), enabling surgeries that were once conducted in Adelaide to be performed in these country locations.

Hospitals and medical centres will need to consider the specific needs of mining workers as work starts to expand. This includes the need to manage industrial accidents. There will also be a responsibility on mining companies to also contract providers to care for the health of their workforce, particularly when dealing with industrial accidents and preventative health. This will be particularly important in very remote localities that will where medical centres and hospitals cannot be readily accessed.

**Education**

**Schools**

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal/Anangu Schools</td>
<td>3</td>
</tr>
<tr>
<td>Child Care Centres</td>
<td>11</td>
</tr>
<tr>
<td>Learning Together @ Home</td>
<td>2</td>
</tr>
<tr>
<td>Family Day Care Schemes</td>
<td>3</td>
</tr>
<tr>
<td>Integrated Centres</td>
<td>4</td>
</tr>
<tr>
<td>Occasional Care</td>
<td>9</td>
</tr>
<tr>
<td>Out of School Hours Care</td>
<td>10</td>
</tr>
<tr>
<td>Playcentres</td>
<td>7</td>
</tr>
<tr>
<td>Preschools</td>
<td>24</td>
</tr>
<tr>
<td>Primary Education</td>
<td>18</td>
</tr>
<tr>
<td>Primary/Secondary Combined</td>
<td>12</td>
</tr>
<tr>
<td>Rural Care Program</td>
<td>3</td>
</tr>
<tr>
<td>Secondary Education</td>
<td>4</td>
</tr>
<tr>
<td>Special Education</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Department for Education and Child Development

There are a number of public schools across the region, ranging from major regional centre schools in Port Lincoln and Whyalla to small area schools in remote areas. Some of these schools will have capacity to increase enrolments if there is sufficient demand and if teaching resources were available. The demand for
Education services will come from those employees who base their families in the region, rather than FIFO or DIDO employees. Demand will also be driven by families moving into the area for work in related industries. While mines operating in the Eyre Peninsula are distributed across the peninsula (and hence demand for schools will also be distributed across the region), those in the remote western region may see a significant concentration of demand for education in Ceduna; this will need to be taken into account when planning for the resourcing of these services.

**Child care**

In addition to school education, families in the area will also need to access child care services. There are a range of child care types that are necessary, including out of hours school care, vacation care, occasional care and long day care. To provide a snapshot of current services, there are three child care providers with long day care vacancies in Port Lincoln, three in Whyalla and one in Ceduna. Funding for child care services is predominantly provided by the Commonwealth Government, while child care services providers are a mix of private and not-for-profit community providers. Where communities grow, it will be necessary to ensure that the capacity of child care facilities keeps pace with demand.

**Training**

**Table 9.4: Tertiary education centres in the Eyre and Western region**

<table>
<thead>
<tr>
<th>Location</th>
<th>Courses</th>
<th>Mining courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceduna TAFE</td>
<td>18 courses</td>
<td>No</td>
</tr>
<tr>
<td>Cleve TAFE</td>
<td>3 courses</td>
<td>No</td>
</tr>
<tr>
<td>Kimba TAFE</td>
<td>2 courses</td>
<td>No</td>
</tr>
<tr>
<td>Port Lincoln TAFE</td>
<td>77 courses</td>
<td>Yes</td>
</tr>
<tr>
<td>Whyalla TAFE</td>
<td>78 courses</td>
<td>Yes</td>
</tr>
<tr>
<td>Whyalla UniSA</td>
<td>8 degrees</td>
<td>Yes</td>
</tr>
<tr>
<td>Wudinna TAFE</td>
<td>5 courses</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: TAFE SA and UniSA

According to 2011 Census figures, there are 1,182 students enrolled in full-time or part-time training at a technical or further educational institution and 609 students enrolled in a university or other tertiary institution in the Eyre and Western region. The three main centres of further education in the region are at Port Lincoln TAFE, Whyalla TAFE and the Whyalla campus of the University of South Australia. All three of these sites conduct training for skills necessary in the mining industry. As skills training would need to increase to provide skilled workers for expanding mining operations, TAFE (in conjunction with the Department of Further Education, Employment, Science and Technology) could consider increasing the range and/or number of mining related courses at Whyalla and Port Lincoln, including potentially providing courses remotely from smaller regional TAFE centres.

**Safety**

**Police**

There are 17 police stations in the region, with the largest stations being located in Port Lincoln, Whyalla and Ceduna. Other stations are smaller and operate under limited operating hours. The Eyre and Western region coincides with a Local Service Area of SAPOL with similar boundaries to the region of this study.

To cater for an increase in population in the region, it will be necessary to plan for adequate resources across the region. As the population increases, the level of policing should continue to be reviewed to ensure adequate resources are available. The significant number of existing police stations is likely to represent...
sufficient infrastructure to cover the Eyre Peninsula; however, if the population was to grow substantially in the far western region, permanent or temporary police resources may be needed in new population centres.

**Emergency services**

Emergency services in the region include the Country Fire Service (CFS), State Emergency Service (SES) and Metropolitan Fire Service (MFS). The CFS and SES are volunteer organisations that operate throughout the region. The MFS has permanent paid staff at stations in Whyalla and Port Lincoln (the latter in a new station). The Department of Environment, Water and Natural Resources also provides paid fire fighters in national parks and reserves.

As mining increases in the region, effective communication is required between mine operators and emergency service providers to ensure the risks of emergencies at mines are properly addressed and planning for additional infrastructure or resources is effective. However, as part of careful planning for each project, the mining proponent should allocate adequate funding to provide emergency services and infrastructure sufficient for its own needs, preventing the need to draw on community resources.

**Courts**

At the centre of the justice system is the State and Federal courts system. There is a State Magistrates Court and Youth Court in Whyalla, Port Lincoln and Ceduna. The Port Lincoln courts also include a range of visiting courts such as Coroner’s Court, Residential Tenancies Tribunal and Federal Magistrates Court. The resourcing of all of these courts will need to be considered as the population grows and demand increases, it is unlikely that more courts would be necessary, as there are branches of the District and Supreme courts that sit in Port Augusta which are reasonably accessible from across the Eyre and Western region.

**Planning approach**

The social infrastructure needs of communities throughout the Eyre and Western region will differ significantly depending on the location and scale of mines nearby mines, models of employment and housing adopted and the adequacy of existing infrastructure in the immediate area. Planning for the social infrastructure will ensure that the benefits to the community of mining are maximised, the likelihood of the projects progressing maximised and the attractiveness of the region for the highly skilled workforce is improved.

As has been evident from the House of Representatives Committee report, a lack of early, consultative planning can lead to community concerns and gaps in social infrastructure. Therefore, it is beneficial for all stakeholders to be involved in an inclusive process of information sharing, planning and consultation. This will need to occur across all levels of government to ensure the aggregate demand and supply for social infrastructure in region is effectively planned for.

To facilitate the consultation process between miners and those responsible for planning and delivering social infrastructure, the South Australian Government might consider establishing a small, focused planning group involving key social infrastructure agencies. This group should then offer to meet privately with mining proponents to discuss their social infrastructure needs – initially in a non-committal information sharing dialogue. This will allow miners to describe their current planning and considerations without necessarily making pronouncements to the market – as well as feeding into those plans the best information available on the social infrastructure required. This process will also allow the State government to develop a stronger understanding of the potential social infrastructure requirements.

Once a project progresses with further confidence about the ability for a mine to succeed then it is recommended there should be a public process including the State government, local government and the miner to engage with the community about the mine and the associated social infrastructure. This could be aligned to the process of conducting an environmental impact statement. An important part of this stage of
planning would be the assessment of the state of community assets, the potential benefit for local commerce, the housing model and its integration to the community. Undertaking this process will allow opportunities of mutual benefit to be identified for the miner, community and government.

**Figure 9.8: Recommended social infrastructure planning approach**

Concurrently to this approach, State and local government should incorporate these findings into their other planning processes. For example, an alignment already exists in health between increasing the complexity and capacity of major country hospitals and the needs that mining operations to care for their employees.

**Economic impacts**

Growth in the mining industry in the Eyre and Western region provides a multitude of economic opportunities for both the region and the State. In considering this range of opportunities, it is important to consider how the development of these mining projects and associated infrastructure projects will affect the overall economic conditions of the region, including directly within the mining industry and indirectly within industries affected by or supplying to the mining industry.

These direct and indirect impacts will include changes to levels of employment and aggregate demand, as well as changes to particular industries as a result of increases in the level of output and, potentially, competition for workers and resources.

To gain an understanding of what these impacts mean, it is important to remember the context of the mining industry at present in terms of its economic impact on the State. In 2012, the gross value added by the mining industry (including indirect economic contributions through demand created by the mining industry) was approximately $8.5 billion in South Australia, with the value of minerals production worth over $4.2 billion.

---

Economic modelling of the impact of mining in the Eyre and Western region

The economy-wide impacts of these new mining and minerals developments have been modelled using the Deloitte Access Economics General Equilibrium Model (DAE-RGEM). The model projects macroeconomic aggregates such as gross regional product (GRP), employment, wages and exports. Modelling of the impact of this increase in mining activity was undertaken for the period 2013/14 to 2032/33. This time period captures the construction and operation of mines active in the medium and high economic growth scenario, including initial ramp ups and the stabilisation of production. The timeframe reflects the long term economic life of many existing and forthcoming minerals projects.

One of the realities of an extended analytical horizon is that it is coated with a layer of uncertainty. In particular, it is very difficult to forecast economic growth, advances in technology, external political dimensions and other dynamic factors which will impact commodity prices and the investment climate into the future. This analysis has therefore adopted a range of scenarios which represent current perspectives on plausible investment and price outcomes.

To gauge the economic impacts of varying levels of mining development, each scenario is compared against a baseline, or counterfactual. The baseline case sets out a story of how the regional economy would have evolved over time in the absence of new mining developments. In this respect, each scenario symbolises the potential incremental gains to the economy above and beyond what would have occurred without further capital and infrastructure investments associated with growth in the mining industry.

Interpreting the results of economic modelling

The results presented in Table 9.5 and Table 9.6 are the deviations from the base line described above, i.e. the increase (or decrease) in employment and gross regional product (GRP) which occurs as a result of the new mining activity forecast in the respective scenarios at this point in time.

In terms of how the figures for regions might compare, it is important to remember that the DAE-RGEM framework captures flows between sectors in a dynamic setting; as such, regions with greater connectivity are likely to witness greater deviations.

A detailed explanation of the DAE-RGEM model is provided at Appendix F.

**Medium growth scenario**

The forecast economic impact of the growth in the mining industry in Eyre and Western region under the medium growth scenario is summarised in Table 9.5 below.

**Table 9.5: Forecast economic impacts in the medium growth scenario**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Regional Product (GRP)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative GRP (NPV - $AU 2011-12 million)</td>
<td>244.3</td>
<td>1787.6</td>
<td>5622.9</td>
</tr>
<tr>
<td>Average GRP deviation (%)</td>
<td>1.9</td>
<td>15.4</td>
<td>26.6</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average deviation (FTE)</td>
<td>189.3</td>
<td>1,913.3</td>
<td>2,826</td>
</tr>
<tr>
<td>Average deviation (%)</td>
<td>0.7</td>
<td>6.3</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Under the medium growth scenario, the net present value (NPV) of the deviation in GRP is expected to increase from $244.3 million in the first period in 2013/2014 – 2017/2018 to $1.79 billion in the second period in 2018/19 – 2022/2023, and then increase significantly (and rapidly) to $5.62 billion in the final period in 2023/34 – 2032/2033. This rapid increase in the deviation in GRP between the second and final periods is predominantly driven by the Central Eyre mines expected to come online in 2017/2018.

In contrast to this timing, the most significant increase in average employment deviations is forecast to occur between the first and second periods, increasing from 0.7 per cent in 2013/2014 – 2017/2018 to 6.3 per cent in 2018/19 – 2022/2032. This can be explained by the need for significant amounts of labour during the construction phase of a mine’s operation, such as that which would occur in the Central Eyre mines if they are to begin production according to current plans, as illustrated in Figure 9.9 overleaf.
While these results illustrate the modelling of mining activity growth in the Eyre and Western region, one should also consider the results of the modelling of growth in the other two study regions of the RMIP (and the balance of South Australia) to obtain a holistic understanding of the economic impact to be made by growth in mining activity in South Australia.

**High growth scenario**

Table 9.6 summarises the forecast economic impact of growth in the mining industry in the Eyre and Western region under the high growth scenario.

**Table 9.6: Forecast economic impacts in the high case scenario**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Regional Product (GRP)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative GRP (NPV - $AU 2011-12 million)</td>
<td>1209.6</td>
<td>5683.6</td>
<td>10799.6</td>
</tr>
<tr>
<td>Average GRP deviation (%)</td>
<td>9.6</td>
<td>48.6</td>
<td>51.0</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average deviation (FTE)</td>
<td>1,071.8</td>
<td>7,335.1</td>
<td>5,732.0</td>
</tr>
<tr>
<td>Average deviation (%)</td>
<td>3.8</td>
<td>24.1</td>
<td>17.1</td>
</tr>
</tbody>
</table>
The deviations in employment and GRP are significantly larger under the high growth scenario, reflecting the additional mines that are expected to operate under this scenario, but also exhibit a narrower period of peak employment than under the medium growth scenario. This period of peak activity is forecast between 2019/20 - 2024/25. This concentration of economic activity explains why the deviation in GRP, measured as a percentage, is quite similar between the second and final period, as the figure for the average annual deviation over the 2018/19 – 2022/23 and 2023/24 – 2031/32 periods respectively.

The peak average employment deviation occurring in the second period between 2018/19 – 2022/23 can also be explained by this observation, with a high level of both construction and operational activity forecast for this period. These trends are illustrated in the figure below.

Figure 9.10: Deviations in GRP and employment under the high growth scenario

As in the medium growth scenario, this growth in employment and GRP in the Eyre and Western region under the high growth scenario should be considered in conjunction with the modelling for the other two RMIP study regions and balance of South Australia to obtain an understanding of the state-wide impact of growth in the mining sector.
10. Infrastructure prioritisation

The need to prioritise projects

The development and future prosperity of the mining sector and regional communities are interlinked. Efficiently developed, operated and coordinated infrastructure is vital to enabling and maximising the returns available from mining investment. Large capital requirements, constrained funding access and competing private and public sector needs means that each project cannot be considered in isolation from the other. Securing the infrastructure and network connectivity (i.e. freight, water and power) required to enable the efficient growth of the sector (and the communities they operate in) requires a coordinated and systematic prioritisation of the projects that will best address the gaps and issues curtailing current investment and development activity. Unless infrastructure is targeted where needed, infrastructure investment will achieve little except add to the level of private and public debt and drive up the underlying costs of operation.

Principles of prioritisation

The objective of the prioritisation process is to identify those infrastructure projects which have the greatest ability to facilitate growth in South Australia’s mining industry. In prioritising the projects, the below principles were used to ensure that projects were considered in the context of the broader environment in which they will be delivered:

- Timing is the core driver of prioritisation and issues in the first time period should be addressed first
  - There is a need to review projects to ensure they meet the test of being a long-term desirable solution
- Freight, electricity and water infrastructure is critical to the facilitation of mining and therefore all infrastructure issues must be addressed
- Following the selection of infrastructure projects, there must be a review to assess whether infrastructure issues persist in other clusters and future time periods
- The project assessments guide which projects are selected to address issues; the highest assessed project to address a given issues is chosen

The prioritisation process

To establish the full list of priority projects (and actions for reform) for the region, a three step prioritisation process was followed:

1. Assess projects strategic fit and delivery risk
2. Identify which projects best meet the region’s key emerging mining infrastructure issues
3. Identify the supporting infrastructure required to deliver effective paths to market

To begin each project included in the solutions outlined in Chapter 8, along with alternate delivery permutations, were assessed using a multi-criteria analysis that gauged each projects strategic fit and ability to be delivered.
• **The strategic objective** is a reflection of the extent to which the project aligns to the strategic objectives of government.

• **The deliverability objective** is a reflection of the extent to which the project exhibits or lacks barriers to implementation.

The assessment framework is a systematic and objectives-driven approach to prioritise potential infrastructure projects. Projects are assessed on a standalone basis, against the below criteria, to demonstrate the comparative merits of each project to address the identified issues.

**Strategic objective criteria:**

- Efficiency of delivery (strategic importance to multiple mines)
- Facilitation of growth in the mining and minerals processing industries
- Contribution to economic prosperity
- Regional and community impact
- Environmental benefit/costs

**Deliverability objective criteria:**

- Financial viability (affordability to the entity developing the project)
- Legislative and political risks
- Non-legislative and political risk (market and community)
- Planning gaps (whether an effective planning regime exist for the project)
- Constructability
- Commercial feasibility (can a bankable delivery model be developed)
- Sustainability (ongoing commercial viability)
- Ability to leverage partner funding for government and the private sector

Projects that demonstrated the strongest strategic alignment and capacity to be delivered, while also addressing the key emerging mining infrastructure issues were prioritised accordingly. Following this, linking or supporting infrastructure projects required to activate path to market connectivity for clusters were also prioritised. Once the projects have been assessed and prioritised, each is classified for its priority of action (i.e. importance and timing).
Project prioritisation

The priority projects for the region are identified and discussed below, and are grouped by their ability to address the key emerging mining infrastructure issues presented earlier in Chapter 7.

### Issue A

**Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines**

Five port locations, comprising 10 practical delivery permutations, have been identified and assessed for their ability to meet the needs of mining in the Eyre and Western region. A summary of the assessment scores for each port option is presented in the table below.

<table>
<thead>
<tr>
<th>Project</th>
<th>Notes on scoring</th>
<th>Strategic score</th>
<th>Deliverability score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Eyre Port</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Bonython - development of a 20mtpa facility with staged expansion of land side storage. Capacity to expand capacity to greater than 50mtpa.</td>
<td>1</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>Port Nonowie - development of a 20mtpa facility with staged expansion of land side storage. Capacity to expand capacity to greater than 50mtpa.</td>
<td>2</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Port Bonython - development of a 20mtpa facility with staged expansion of land side storage. Ability to expand capacity to 50mtpa, utilising Port Pirie to build (and service) demand for development and expansion.</td>
<td>3</td>
<td>Weak</td>
<td>Weak</td>
</tr>
<tr>
<td>Port Nonowie - development of a 20mtpa facility with staged expansion of land side storage. Ability to expand capacity to 50mtpa, utilising Port Pirie to build (and service) demand for development and expansion.</td>
<td>4</td>
<td>Weak</td>
<td>Weak</td>
</tr>
<tr>
<td>Central Eyre Port</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Spencer - development of up to a 20mtpa facility catering for grain and ore, with staged expansion of land side storage to provide for additional iron ore and grain storage</td>
<td>5</td>
<td>Good</td>
<td>Strong</td>
</tr>
<tr>
<td>Project</td>
<td>Notes on scoring</td>
<td>Strategic score</td>
<td>Deliverability score</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------------------</td>
<td>-----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Cape Hardy - development of up to a 20mtpa facility with staged expansion to cater for higher volumes (up to 10mtpa for third party users)</td>
<td>6</td>
<td>Good</td>
<td>Strong</td>
</tr>
<tr>
<td>Port Spencer - development of a 20mtpa facility with staged expansion of land side storage, utilising Port Lincoln to cover short term demand (i.e. offsite storage with single conveyor option)</td>
<td>7</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cape Hardy - development of a 20mtpa facility with staged expansion of land side storage, utilising Port Lincoln to cover short term demand (i.e. offsite storage with single conveyor option)</td>
<td>8</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Southern Eyre Port</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Lincoln with increased capacity - one (multipurpose) conveyor transitioning to two conveyors, transporting ore from an offsite storage location</td>
<td>9</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td>Port Lincoln with increased capacity - two conveyors (one for grain, one for ore), transporting ore from an offsite storage location</td>
<td>10</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Notes:**

1. Well positioned to support Far North mines (should they come online) and has existing zoning and surrounding land use suitable for industrial development, but is not well positioned for the majority of the Eyre and Western clusters (particularly for Central Eyre, which has the largest forecast demand). Involves high capital costs while providing limited scalability; as such, is not the most efficient for either the Eyre and Western region (apart from being comparable with a Central Eyre port for the South Gawler cluster) or Far North region in the medium growth scenario. Unlikely to be identified as the most financially viable option, however has attracted some interest from port proponents. Also attracts some community and environmental concerns.

2. Well positioned to support Far North mines (should they come online), but not for the majority of the Eyre and Western clusters (particularly for Central Eyre, which has the largest forecast demand; having said this, Port Nonowie would be slightly better positioned than Port Bonython.). Involves high capital costs (higher than Port Bonython) while providing limited scalability; as such, is not the most efficient for either the Eyre and Western region (apart from being comparable with a Central Eyre port for the South Gawler cluster) or Far North region in the medium growth scenario. The site has not been the subject of a detailed environmental impact or feasibility assessment and has not been backed as a commercially viable project by any port proponent or miner; as such, is unlikely to be identified as the most financially viable option. In contrast to Port Bonython, has not (to date) been identified with community concerns.
although would require rail through Whyalla to provide access to the Far North mines should demand exist. Land for the proposed site is currently zoned for coastal conservation, with pastoral land adjacent to the coast.

3. Comments are per Note 1. Would also require substantial interactions with the community in the movement of bulk product through Port Pirie. Does not present an efficient delivery model, and would not be an efficient option for Eyre and Western mines under any growth scenario.

4. Comments as per Notes 2 and 3.

5. Well positioned to support Eyre and Western mines while also proving a low operating cost solution which can be scaled to meet demand under the high growth scenario. Provides opportunity for potential rail connection from the South Gawler cluster, and has the added advantage of being a greenfield site with no identified constructability constraints (although a power solution is required) and no identified significant community or environmental concerns (with proximity to national and marine parks being able to be managed). Is likely to be the most efficient (and therefore financially viable) approach for Central Eyre cluster and also providing efficient support to Southern Eyre and South Gawler clusters; however, is unlikely to be an efficient option to support mines outside the Eyre and Western region.

6. Comments as per Note 5.

7. Comments as per Note 5 however Port Lincoln has limited capacity to handle large volumes and involves issues in the efficient handling of different commodities. Would also require substantial interaction with the community in Port Lincoln in having to move (additional) bulk product through the town. May be financially viable for the Southern Eyre cluster, but is not the most efficient option for Central Eyre and South Gawler mines under the medium growth scenario.

8. Comments as per Note 7.

9. Port is unable to accommodate Capesize vessel, and is unlikely to be able to support Central Eyre mines under the medium growth scenario. Involves issues in the efficient handling of different commodities, and would also involve substantial interaction with the community as a result of moving (additional) bulk product through the town. May be commercially viable for the Southern Eyre cluster, but is unlikely to be the most efficient option for Central Eyre and South Gawler mines under the medium growth scenario.

10. Comments as per Note 9.

The major driver of demand for a port in the Eyre and Western region comes from the Central Eyre and South Gawler clusters.

The Central Eyre cluster presents the strongest demand for a bulk commodity port with output of 31.34mtpa forecast for the period 2018-2022 increasing to 40.04mtpa for the period 2023-2032 under the medium case forecast. Providing a viable channel to market for this demand is critical to the viability (and hence development) of the mines in this cluster. Of the options presented above, a port on the central region of the Eyre Peninsula is best positioned to address this need. By virtue of its proximity to the mines, there is potential to leverage some existing infrastructure and moderate capital cost. This option provides the lowest mine to port costs for miners in the Central Eyre cluster, supporting the immediate development of mines in the area. A central Eyre port also provides sufficient capacity within a reasonable proximity to support the needs of mines in the Southern Eyre cluster as they begin operating over the medium to long term. It also provides an efficient path to market solution for establishing mines in the South Gawler cluster, with similar operating costs to a northern Eyre port for this cluster. A further potential benefit is the proximity to the existing
narrow gauge rail corridor, which may present an opportunity for development of this corridor from the South Gawler region to a central Eyre port as volumes increase beyond that which can reasonably be accommodated by road.

The assessment demonstrated no material difference between the two identified port options (Cape Hardy and Port Spencer), with the underlying deliverability strong for both. However, access to power and path to market dependencies are critical to triggering demand (see subsequent issue discussions).

Demand for a northern Eyre port is relatively low due to the cost of transport between the mines forecast to be active under the medium growth scenario and a northern Eyre port. While existing mining operations in the South Gawler cluster currently generate 6.0mtpa, increasing to 9.0mtpa, these mines are already serviced by an established transhipment solution at Whyalla, with adequate capacity to handle this growth. Other mines in the South Gawler region are likely to be serviced at least equally well by a central Eyre port. While the Far North region contains significant latent demand, current freight and mining costs result in low forecast production volumes for the region under the medium growth scenario. Subsequently, in the absence of additional demand from the South Gawler cluster or Far North region, there is not a pressing case for a northern Eyre port. However, it must be stressed that if the economic proposition for the development of these mines were to improve, the case for an additional port would emerge strongly. Therefore, while the port is not expected to be a high priority over the next two decades, planning for its future development is still required to enable a timely and low risk response from the market when it is required.

**Issue B**

**Inadequate electricity transmission links to South Gawler, Central Eyre and Southern Eyre mines**

Seven energy projects were identified which have the ability to meet the electricity needs of mining in the Eyre and Western region. A summary of the assessment scores for each option is presented in the table below.

<table>
<thead>
<tr>
<th>Project</th>
<th>Notes on scoring</th>
<th>Strategic score</th>
<th>Deliverability score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade of the existing transmission network</td>
<td>1</td>
<td>Good</td>
<td>Strong</td>
</tr>
<tr>
<td>Spencer Gulf undersea link</td>
<td>2</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>Gas line to on-site generation from Whyalla branch line</td>
<td>3</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>On-site diesel generation</td>
<td>4</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td>Transmission link from Cultana</td>
<td>5</td>
<td>Moderate</td>
<td>Strong</td>
</tr>
<tr>
<td>On-site LPG power station to service individual sites</td>
<td>6</td>
<td>Weak</td>
<td>Weak</td>
</tr>
<tr>
<td>Renewable generation to support mining loads</td>
<td>7</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Notes:**

1. Can provide strong transmission links in close proximity to most Eyre and Western region mining demands while also maximising use of the existing transmission network to provide long-term
1. Can support further renewable energy generation in the region and can also be built in stages as demand dictates. Has the potential to strengthen security of electricity supply for the Eyre and Western community, but may require additional generation capability and increases and/or strengthening of the transmission backbone to the main grid (if considered in conjunction with additional transmission demands elsewhere). Is likely to be the most commercially feasible approach, but does involve some community impacts with regards to land/easement requirements.

2. Can provide strong transmission links in close proximity to most Eyre and Western region mining demands while also strengthening security of supply for the Eyre and Western community. Supports further renewable energy development in the region, but may require additional generation capability and increases and/or strengthening of the transmission backbone to the main grid (if considered in conjunction with additional transmission demands elsewhere). Certain constructability aspects need to be considered with regards to an undersea cable, and is also likely to be more expensive (and thus less commercially desirable) than an upgrade to the existing transmission network on the Eyre Peninsula. Will also involve community impacts with regards to land/easement requirements.

3. Supports demand from the South Gawler cluster while also adding additional generation to support state-wide generation capabilities however, is unlikely to be the most efficient option for the cluster and subject to a high risk of inadequate gas supply from existing branch line; to secure sufficient supply, additional capital expenditure may need to be invested in augmentation works to the gas line back to the MAPS trunk line.

4. May be suitable as a start-up option for individual, low-demand sites, but would only support individual sites and involves operating costs that are too high for this to be considered a viable long-term solution under the medium growth scenario. Additional demand and transport of fuel will also produce environmental impacts.

5. Likely to be the most efficient option in supporting demand from the South Gawler cluster in the medium growth scenario, while also being able to support the high growth scenario. Potentially also provides opportunities to integrate with the upgrade to the existing transmission network on the Eyre Peninsula. Is likely to involve some community impacts with regards to land/easement requirements.

6. May be suitable as a start-up option for individual, low-demand sites, but would only support individual sites and involves operating costs that are too high (higher than diesel) for this to be considered viable even in this instance.

7. Supports the South Australian Renewable Energy Plan in providing additional generation capacity to the network, however is not considered to be suitable for 'base load' generation, and would hence require an alternative base load generation capability (making the capital costs higher than other options).

The processing requirements of magnetite operations in the South Gawler and Central Eyre clusters in particular are forecast to result in considerable extra demand on the Eyre Peninsula’s transmission network from the 2018-2022 period onwards. Given the current limitations on the capacity of the network to handle existing and projected non-mining growth on the Eyre Peninsula, significant augmentation of transmission networks is required to ensure reliable supplies of power are available to support the growth of the mining sector.

Centralised generation and transmission projects such as the proposed upgrades to the existing transmission network offer a clear cost advantage to miners as a result of electricity being generated at centralised power stations which are significantly more efficient than distributed on-site generation plants. Transmission and central generation has the added advantage of producing lower greenhouse gas emissions per unit of power generated than that produced by on-site diesel or LPG solutions.
The existing 132kV network on the Eyre Peninsula is not capable of transmitting significant loads created by additional renewable power generation. The proposed double circuit 275kV lines would be capable of carrying at least 600MW and potentially up to 1,000MW - providing capacity to carry additional loads which would be created by the expansion of renewables generation of the Eyre Peninsula. This ability to facilitate the expansion of the renewable generation sector on the Eyre Peninsula is shared with the Spencer Gulf undersea link.

In upgrading the existing transmission network, there is the distinct advantage in being able to support other industries and communities along the transmission corridor, including improving security of supply to the region, whereas the Spencer Gulf undersea link would provide power to mines in the Central Eyre cluster, but would not provide for security of electricity supply more broadly across the Eyre Peninsula without additional augmentation works. Furthermore the upgrade to existing transmission network on the Eyre Peninsula does not require any additional supporting infrastructure. It is recognised, however, that an upgrade and demand of this magnitude in the Eyre Peninsula does need to be planned and managed in a way which considers the overall management of other potentially significant demands across the regions and the State. This broader picture may identify a need for additional 'base load' generation, network security management approaches and/or upgrades to backbone elements of the transmission network over and above the individual requirements in the Eyre and Western region.

The use of on-site diesel generation provides a highly scalable option for providing electricity to individual sites, but requires relatively high operating expenditure as a result of diesel requirements; this also adds to the bulk freight task for the South Gawler mines, requiring more freight movements through a section of the South Australian road network that already experiences high levels of demand during the grain harvesting season. Diesel generation also produces more greenhouse gas emissions per unit of electricity generated than centralised generation projects, adding to the negative environmental and visual amenity impacts produced.

### Issue C

**Lack of mine to port bulk transport links for Central Eyre and Southern Eyre mines**

A total of eight supporting path to market network links were identified with the ability to meet the bulk transport needs of mining in the Eyre and Western region. A summary of the assessment scores for each option is presented in the table below.

<table>
<thead>
<tr>
<th>Project</th>
<th>Notes on scoring</th>
<th>Strategic score</th>
<th>Deliverability score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road to a northern Eyre Peninsula port servicing the South Gawler cluster</td>
<td>1</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Slurry pipelines to a northern Eyre Peninsula port servicing the South Gawler and Central Eyre clusters</td>
<td>2</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Rail to a northern Eyre Peninsula port servicing the Central Eyre and South Gawler clusters</td>
<td>3</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Road to a central Eyre Peninsula port servicing the Central Eyre, South Gawler and Southern Eyre clusters</td>
<td>4</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>SCORE</td>
<td>Quality</td>
<td>Recommendation</td>
</tr>
<tr>
<td>----------------</td>
<td>-------</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>Rail to a central Eyre Peninsula port servicing the Central Eyre cluster</td>
<td>5</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Rail to a central Eyre Peninsula port servicing the South Gawler cluster</td>
<td>6</td>
<td>Good</td>
<td>Moderate</td>
</tr>
<tr>
<td>Slurry to a central Eyre Peninsula port servicing the Central Eyre cluster</td>
<td>7</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Rail to Port Lincoln servicing Southern Eyre cluster</td>
<td>8</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Notes:**

1. Supports demand from the South Gawler cluster (excluding rail use by Arrium) while also supporting growth in the industry by linking South Gawler volumes to those from the Far North region, thereby potentially increasing the overall viability of infrastructure solutions; however, this is not considered large enough to change the overall viability of the project. Unlikely to be the most efficient solution – particularly with regards to the likely port options.

2. Can support growth in the industry by linking volumes from the Central Eyre cluster with those from the Far North to increase the viability of infrastructure projects. Does not support Southern Eyre demand (due to technical and cost issues associated with using a slurry pipeline to transport the product from these mines), and is unlikely to be the most efficient solution for the Central Eyre and South Gawler clusters or the Far North mines.

3. Can support growth in the industry by linking volumes from the Central Eyre cluster with those from the Far North to increase the viability of infrastructure projects. Could also be linked to the Southern Eyre cluster via the existing narrow gauge corridor, however capital and operating costs means it is unlikely to be the most efficient solution for the Central Eyre and South Gawler clusters or the Far North mines.

4. Although likely to be economically viable for the South Gawler mines initially, provides insufficient capacity for the Central Eyre cluster in the medium growth scenario and the South Gawler cluster in the event volumes increase in the long-term. Involves high operating costs (meaning it is not the most efficient option for the Central Eyre and South Gawler clusters or the Far North mines).

5. Providing an efficient delivery option (potentially the most efficient for the Central Eyre cluster) and a high level of scalability, this option also provides potential future links to existing Eyre Peninsula rail corridors to support South Gawler and/or Southern Eyre clusters if demand exceeds the levels acceptable for road transport. Would involve community interaction as a result of the new rail corridor, including land segregation, noise and level crossings etc., but also has the potential to support other industries in the area.

6. Maximises use of existing rail corridors, hence minimising community and environmental impacts (along existing segments of the link), while also providing opportunities for other sectors – namely grain. Potential for negative impacts on other sectors should also be considered (i.e. with grain in competing for access to the line). Could link to rail corridor from the Central Eyre cluster if this is constructed (providing overall strategic efficiencies), however the high capital cost under the medium growth scenario (for this project) means it is unlikely to be the most efficient option for the South Gawler cluster. Could become a suitable option if demand exceeds acceptable volumes for road transport.

7. May provide an efficient delivery solution (potentially the most efficient for the Central Eyre mines) while also offering a level of scalability, but would require power and water solutions. Community interactions reduced as pipeline can be buried, resulting in limited long-term impacts on existing land use, however provides no opportunity for use by other sectors. May be able to be integrated with a water supply solution, and may also enable a lower cost port solution. Risk of product suitability for efficient slurry.
8. Unlikely to be the most efficient solution for the Southern Eyre cluster due to rail efficiency issues into Port Lincoln (requiring substantial works to rectify), issues with the efficiency of handling different commodities and the port being able to accommodate Capesize ships. Would also involve substantial community interaction in moving (additional) bulk product through the town and by impacting existing rail operations for bulk grain movement.

Consideration of bulk transport links cannot be undertaken in isolation to the consideration of the preferred port solution. The assessment of the central Eyre Peninsula port option as being of the highest priority requires a focus on the mine to port bulk transport task between the Central Eyre and Southern Eyre cluster mines from the second time period and the central Eyre Peninsula port. The freight requirements of mines in the South Gawler cluster are expected to be met by existing links to Whyalla and at least initially by a planned link to Lucky Bay.

The largest proportion of demand for transport comes from the Central Eyre cluster (31.34mtpa in the period 2018-2022 increasing to 40.04mtpa in the period 2023-2032) and a considerably lower freight demand is expected from the Southern Eyre cluster (2.8mtpa to 3.1mtpa in the period 2018-2032).

The large forecast volumes from the Central Eyre cluster are too great for road transport to be a suitable long term solution because of the high operating cost and social and economic impacts on communities and other industries from a large number of truck movements. Both rail and slurry options are considered to be potentially viable, although it is understood that more detailed assessments undertaken by miners show difficulties for the slurry option because of the geotechnical parameters of the material to be transported. On this basis, rail is considered likely to be the most appropriate solution.

The relatively short distances and low volumes of ore to be transported (peaking at 3.45mtpa in 2018-2022) mean that road transport is the most desirable option for transporting ore from the Southern Eyre cluster to a Central Eyre Peninsula port. Detailed assessment of the route and proposed vehicles are expected to result in a requirement for pavement upgrades, intersection upgrades, shoulder widening and possibly passing lane/s to accommodate these bulk freight tasks. These works could be undertaken incrementally as required. The detailed assessment will need to consider the impact of the additional movements on other road users and local communities. Should significant growth occur in this region, there may be opportunity to use the existing narrow gauge rail corridor to link to a central Eyre Port.

Similarly, it is recognised that some mines within the South Gawler cluster are likely to rely on road transport. For example, Iron Clad is planning to transport by road to Lucky Bay. With the establishment of a central Eyre port, the lower port operating costs are likely to mean the additional road transport distance is a more viable option. At the point where the volumes become too significant for ongoing road use, there is an option to upgrade the existing narrow gauge rail corridor and provide rail linkages between the South Gawler region and a central Eyre port. It is noted that any potential use of the existing narrow gauge corridor would need detailed consideration of the impacts on the existing grain transport use.
A total of seven projects were identified which have the ability to meet the water needs of mining in the Eyre and Western region. The assessment of each project is summarised in the table below.

<table>
<thead>
<tr>
<th>Project</th>
<th>Notes on scoring</th>
<th>Strategic score</th>
<th>Deliverability score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater investigations</td>
<td>1</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>On-coast desalination plant and transmission to the Central Eyre cluster only</td>
<td>2</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>Transmission of seawater and on-site desalination in the Central Eyre cluster</td>
<td>3</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>On-coast desalination plant and transmission across the Eyre Peninsula</td>
<td>4</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>Transmission of seawater across the Eyre Peninsula and on-site desalination</td>
<td>5</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>Southern on-coast desalination plant with SA Water network integration</td>
<td>6</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Morgan-Whyalla pipeline to storage points</td>
<td>7</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Notes:**

1. Could provide benefits to both mining proponents and communities by providing a better understanding of the availability, quality and sustainability of groundwater, however is not expected to identify sufficient sustainable volumes to support the medium growth demand from mining sector development in the Eyre and Western region. Process to undertake further groundwater exploration works and to ensure consolidation of available data would be low-cost.

2. Will support demand from the Central Eyre cluster while also providing an opportunity to leverage community water benefits; however, will require management of environmental issues associated with disposal or re-use of brine. This option is likely to become more efficient if a larger percentage of water required for use needs to be desalinated. Desalination (involving either on-coast or on-site desalination) is likely to be the most efficient option for the Central Eyre cluster.

3. Comments as per Note 2, with an additional environmental risk in managing seawater leaks needing to be managed.

4. Will support mines across the Eyre and Western region while also providing an opportunity to leverage community water security benefits (including potentially linking with the SA Water network on the Eyre Peninsula). May be the most cost efficient option overall, although is unlikely to be more efficient than a standalone solution for the Southern Eyre cluster. Will also require management of the environmental issues associated with the disposal or re-use of brine.

5. Comments as per Notes 3 and 4.

6. Integration is likely to produce positive outcomes for both mining proponents and the community, and may enable greater flexibility in transferring water across the region (including potable supplies to
mines). Provides a scalable solution, potentially allowing for the replacement/duplication of existing transmission to provide greater capacity as required. May be the most efficient solution for the Southern Eyre cluster and sections of the Central Eyre cluster, but not more broadly due to the pumping distances, pipe lengths and need to supply water to a potable quality where it is not necessarily required.

7. May supply some mines with low-cost water of a potable standard, but will be insufficient to supply mining demand under the medium growth scenario within a system with limited available capacity.

As a result of the significant information gaps that exist with regards to the availability of groundwater on the Eyre Peninsula, there are a number of issues in assessing the viability of projects involving the use of groundwater in the Eyre and Western region. Although further information is needed before precluding groundwater projects, it is likely existing resources are already largely committed to and hence significant additional reliable availability of water is unlikely.

In considering alternatives to groundwater projects, the assessment of desalination projects (both on-coast and on-site desalination plants) did not identify a material difference in the suitability of either option for the purposes of supporting the development of mining in the Eyre and Western region. Having made this observation, it must be noted there are environmental aspects in relation to either option which would need to be assessed on a detailed level. The preferred option will also be impacted by mining water quality needs which may vary from site to site.

Given there is no material difference between these options in terms of their ability to meet the needs of mining, there is no reason for the government to prioritise one at the expense of the other; instead, if both options are open miners can decide which best meets their needs. Allowing the decision to be made in response to the commercial considerations of infrastructure proponents and miners will create the opportunity for innovative delivery solutions to be pursued. For example, consultations have identified opportunities for desalination to support SA Water by providing an additional water source and relieving demand pressures on the Eyre Peninsula network which is operating near capacity. However, because the mining industry’s requirements for water quality are generally not consistent with potable standards, it is likely the water produced for the mines will need to be treated further to form part of potable supply. Under all feasible scenarios it will be important to ensure consideration is given during the planning phase to possible benefits for community water supplies to ensure maximum overall benefits of the project(s).
11. Findings

The prioritisation process discussed in Chapter 10 of this report describes infrastructure required to support preferred solutions addressing critical and identifiable infrastructure needs for the Eyre and Western region. Importantly, this prioritisation process addresses issues separately identified within the three clearly defined time periods (i.e. 0-5 years, 6-10 years and 11-20 years).

For the preferred solutions to be progressed, recognition of the roles that both the public sector and private sector can play, needs to be made.

Role for government

The priority actions of the South Australian Government regarding the resources industry are documented with the South Australian Economic Statement 2013. Amongst a number of actions, a commitment is made to the following:

- Assisting the co-ordination and planning of regional infrastructure development
- Maintaining regulatory certainty and reducing red tape for the project proponents
- Pursuing growth for the mining services sector

The South Australian Government clearly recognises that the wider geographical dispersion of the State’s various resource deposits makes unlocking value within the South Australian resources sector more complex.

Co-ordinated, economically and socially efficient and effective infrastructure is necessary to generate broader regional sustainability driven through mining demand.

From a regional perspective, processes based on individual treatment of projects can result in sup-optimal outcomes. In such circumstances, the private sector (in seeking security in its path to market) can become ‘incentivised’ to find their own infrastructure solutions which ultimately can result in the absence of wider, more consistent and economically efficient infrastructure outcomes more likely to reflect the broader interests of the State.

Consequently, there is a clear role for the South Australian Government to deliver policy and planning processes which move beyond the single need and toward understanding the broader social, economic and environmental impacts for regional South Australia. These processes need to support longer term strategies aimed at addressing the future needs of the resources sector as well as other regional based industries and communities. These outcomes can only be achieved through consistent and co-ordinated regional planning and supportable economic modelling.

Decision making by the private sector

In conjunction with the role of government, the progression of preferred infrastructure solutions will more likely occur where the primary needs of the project proponents and wider private sector can be better understood and determined. The likelihood that the private sector would be willing to contribute towards financing and supporting delivery of the infrastructure projects considered in this plan is, at its core, a function of:
The perceived risk of a project
The expected return on the capital.

The greater the perceived risk of an infrastructure project, the greater the level of return which will be sought by the private sector in return for provision of financing. This logic holds in the absence of legal or other impediments which would prohibit the development of a project (e.g. where environmental legislation prevents the development of a port at a specified location under any circumstances).

Where there are acceptable rates of return for the perceived level of risk, it is more likely that project proponents will raise sufficient funding from capital markets required to contribute towards financing an infrastructure project. The perceived level of risk will be determined from numerous risk categories, including, but not limited to, the following:

- Design, construction and commissioning risk
- Financial risk
- Operating risk
- Market risk
- Interface risk
- Site risk (including environmental and approvals risk)
- Legislative and government policy risk
- Asset ownership risk.

These risk categories comprise factors within the control of project proponents, factors within the control of the public sector and factors beyond the control of any group of entities.

How government can support the private sector

The risk categories that encompass factors beyond the control of any group of entities have been particularly prolific over the past seven years. In relatively quick succession, the sub-prime mortgage crisis, the Global Financial Crisis, the European Debt Crisis and the simultaneous liquidity crises and commodity price cycles have resulted in a cumulatively massive impact on financial markets. These impacts are no less apparent in project finance markets than in other financial markets.

As a result of tighter funding markets, the manner in which investment decisions are made in accordance with the risk categories identified above has changed substantially as a result. While projects are able to deliver the same or similar levels of return as seven years ago, financiers and investors now require lower levels of risk for the same returns. This conclusion holds for both debt and equity funded projects alike.

As such, it is apparent that there is a need for government to increase its support in projects – or, as specific to this context, those which support growth in the mining industry - to address the reluctance of private project finance to fund these projects. For some projects, government may be able to facilitate decreases in the level of risk through mechanisms such as those that would provide greater certainty for demand. The intent would be to allow the private sector to make their investment decisions based on lower levels of risk.

Discussion of some of the impediments to the issues previously identified is continued in this chapter.
**Issue A**

Lack of suitable bulk commodities export port accessible by South Gawler, Central Eyre and Southern Eyre mines

*Development of central Eyre Peninsula port*

The development of the central Eyre Peninsula port is dependent on an entity being willing to accept the risk that there might not be sufficient throughput for the port to be commercially viable in the long-term. The risk of developing the port would be reduced if miners were able to agree to guarantee a throughput to underpin commercial viability. However, it is difficult for miners to make these guarantees in the absence of a port because a viable port solution is necessary for the miners to develop a bankable feasibility study.

Accordingly, the development of the central Eyre Peninsula port is dependent on breaking the self-reinforcing cycle between the port not being viable in the absence of mining and mines not being viable in the absence of a port. This cycle is exacerbated by the fact that any proponent (unless they are a third party port provider) can – and in fact has an incentive – to develop a port sufficient for their own needs but not for the needs of others. This can result in a scenario where larger, more efficient ports are not viable as demand leakage can flow to the smaller capital-expenditure, less efficient ports developed by individual proponents. Across all the projects, the cost of small multiple ports would be significantly higher than a limited number of larger ports. From a broader perspective, it is clear that a limited number of larger well-planned and well-managed ports will provide the most efficient outcome for a group of mines, ultimately benefiting each mine, the mining sector and the community as a whole.

**Issue B**

Inadequate electricity transmission links to South Gawler, Central Eyre and Southern Eyre mines

*Eyre Peninsula transmission upgrade*

The regulatory framework within which ElectraNet operates requires the firm commitment from any party connecting a new load to the transmission network before ElectraNet can effect that connection.

ElectraNet has been approached by a number of proponents on the Eyre Peninsula about possible significant additional connections to the existing transmission network. This potential demand has been verified through the processes undertaken as a part of the preparation of this report. On the basis of this potential demand ElectraNet has sought approval to proceed with an upgrade of the transmission network on the Eyre Peninsula to a standard which will accommodate the identified likely demand, as a regulated project.

At this stage, approval has been given for this work to be treated as a ‘contingent project’, which means that a case for the works to proceed as a regulated project can be re-submitted if a commitment is made to a significant additional load.

Many miners are currently unable to commit to a level of demand for power as they are still developing the feasibility of their mines (with this feasibility being contingent on having access to adequate power supply). Additionally, a commitment from a single mine generates a risk that the mine pays a high cost for network augmentation (as it is based on percentage of supply). It also generates a risk that a lower capacity solution is implemented which only meets the committed demand and does not protect likely future demand.
It is also recognised that the process of reaching a transmission agreement and then implementing major works of this nature takes a considerable amount of time, and in this case appears likely to result in a period where miners want to use the power but ElectraNet has not been able to complete the build of the infrastructure.

As such, there is a similar cycle to that witnessed with the central Eyre Peninsula port project, with mines not being viable in the absence of a transmission line and the proposed transmission upgrade not being viable without the mines.

Alternatives to the upgrade of the transmission network have been considered but have not been assessed as providing the same level of strategic benefit.

In a similar vein to the recommendations for the central Eyre port above, actions are focussed on creating an environment which maximises the incentive for investment in a transmission network on Eyre Peninsula.

While a ‘regulated’ upgrade provides ongoing benefits for the broader community there may also be cost competition benefits associated with establishing a stand-alone transmission network to support the mining demand.

In addition to the above, it is recognised that the state-wide impacts of this potential demand, when coupled with further potential demand increases in the Far North and Yorke and Mid-North/Braemar regions is likely to have deeper network implications. This may include a need for additional ‘base load’ generation or augmentation of other elements of the existing transmission network.

It is noted that the transmission network environment focuses on delivering stand-alone solutions to committed demands – not necessarily considering the longer term needs. This could result in upgrades that effectively need to be replicated or replaced in a relatively short timeframe because they failed to adequately consider the future bigger picture.

The electricity generation industry works largely separately to the transmission sector and will respond to identified demands in way which achieves maximum return for the generation. Again, this approach could result in outcomes which do not align with the ideal longer term outcomes.

In the context of significant potential changes to the South Australian electricity landscape as a result of mining, the above transmission and generation industry environment may translate to poor overall planning, therefore inefficiencies and overall cost impacts. It is understood that the Australian Energy Market Operator performs a role to oversee the broader network planning direction and it will be important that this is undertaken and supported appropriately.
Central Eyre rail/ slurry links

It is considered that both rail and slurry options are viable for the region with the final preferred option being dependent on further detailed analysis. As mentioned earlier, it is understood that assessments undertaken by miners in this region to date have identified some technical feasibility concerns associated with the slurry transport of the subject product(s) meaning that rail solutions appear more appropriate at this time.

As is the case with the development of a port, creating rail and/or slurry links for mines in the Central Eyre cluster is dependent on miners being able to make guarantees of the minimum use of the line. However, once the development of the central Eyre Peninsula port is finalised as expected, mines will be able to develop bankable feasibility studies and raise the finance necessary to guarantee use of the rail/slurry line.

In addition to demand for the rail link being contingent on the establishment of a central Eyre Peninsula port, its construction would also require an easement being secured. This will involve complex negotiations with a number of landowners and other stakeholders.

Southern Eyre road links

There are roads which link the Southern Eyre cluster to the central Eyre Peninsula port area, however a detailed assessment is required to determine what pavement, shoulder and intersection upgrades are required to safely meet the intended demand. This will be impacted by the proposed route(s) to be used and the vehicles to be used for transport. Higher Mass Limit vehicles will be more efficient but are likely to require a greater level of road upgrade and maintenance as they are not capable of carrying the loads necessary to support mining and therefore require capital investment. In addition to the required capital investment, the cost of maintaining the roads will increase as a result of the higher standard of the road and additional use from mining.

The same issues and principles above will apply to other substantial changes in road use which are also likely to occur from the South Gawler and Central Eyre clusters. While it is expected that the bulk freight task from Central Eyre in particular will be by either rail or slurry, there is still potential for road transport from some mines and also for significant impacts during the construction and start-up phases of works, as well as ongoing transport for inbound freight and staff. These road transport impacts also need to be planned and managed.

A key consideration in relation to the management, improvement and maintenance of road links is that the roads are owned by councils and the Government. There is a risk that the ongoing road maintenance cost to Councils in particular will be higher after mining has ceased as a result of the capital upgrades made.
**Issue D**

No identified suitable source of water for South Gawler, Central Eyre and Southern Eyre mines

---

**Groundwater investigation**

The majority of mines in South Australia extract groundwater, either as part of a dewatering program, as a supply for mine processes, for dust suppression, or for use as a potable supply. Much of this groundwater is highly saline, and often requires treatment at the mine site (desalination) prior to use. The feasibility of mining operations is often predicated on the availability of sufficient sustainable volumes of water within reasonable proximity of the mine site. Quality considerations with regard to processing requirements are also significant, depending on the commodity mined.

Given the majority of mining exploration is in the sparsely populated (and often infrequently visited) regional and remote areas of South Australia, there is a paucity of available data on groundwater resources in the key mining areas of the State. Therefore, given the lack of information available to inform the assessment of the sustainability and potential impacts (both environmental and social) of groundwater use by mining operations, the acquisition of additional groundwater data is considered imperative to provide greater certainty both to mining proponents and the communities in which they operate.

A number of programs have or are currently being implemented to provide this additional data for other areas of the State, including the Finding Long-term Outback Water Sources (FLOWS) program and non-prescribed groundwater assessments (undertaken by DEWNR). However, these studies do no currently extend to the Eyre Peninsula.

---

**Water pipeline from the coast**

At present, the development of a desalination plant and associated pipelines is complicated by the lack of a clear and definitive planning process. Desalination plants can be built, but the process by which their development is approved is not obvious to potential proponents as it has been developed in a largely ad hoc fashion.

In addition to this, easements are required to allow for the construction of the pipelines needed to distribute the water to mines at various clusters; the process for obtaining these easements is – while better understood than for desalination plants – still a complex one.

Furthermore, a desalination plant and associated pipelines are likely to have substantial electricity requirements. Given the existing constraints on the Eyre Peninsula transmission network, it is likely that additional transmission requirements will be needed.
General findings

Early engagement in the planning process

A core function of the planning process is to facilitate the implementation of government policy by providing clarity in relation to the intended future use of land. Early consideration of infrastructure projects in the Government’s land use planning will provide guidance and clarity to miners and infrastructure proponents.

Until approval to build a project is granted, the planning process is not able to provide perfect certainty to infrastructure proponents. However, as successively more detailed information in relation to a project becomes available, the planning process is able to provide progressively greater certainty.

Greater clarity reduces the risks associated with infrastructure development for proponents by clearly signalling the Government’s intentions.

It should be noted that the planning process in South Australia has the ability to restrict the future use of land, but not prevent the continuation of land being used for its existing purpose.

Review of planning procedures

The development of infrastructure, particularly in association with mining, and particularly in remote and often undisturbed areas, is a perpetual struggle between various stakeholders pursuing potentially competing interests. The South Australian planning system as it pertains to the approval of mining related infrastructure developments is widely perceived as fair, consistent and efficiently administered. However, it is generally conceded that there is some room for improvement; it is viewed by some, both within and outside the mining industry, as cumbersome, time-consuming, opaque and inflexible.

The most common complaints from miners and explorers relate to the timeliness of receiving approvals. As mining exploration activity and, consequently, the number of mining proposals, have increased over the last decade, the pressures on the approvals processes provided for in the Mining Act and Development Act have also increased. Concerns have been expressed about the alignment of the types of mining-related infrastructure projects with categories of developments approval processes available; this has led to a perceived need to “shoe-horn” developments into either a Miscellaneous Purpose License or a Section 46 or Section 49 status under the Development Act 1993. This creates the perception that these processes may not be appropriate for the development concerned.

Although it is generally conceded that government personnel in the relevant departments, such as DPTI and DMITRE, do their best to facilitate the assessment of proposals in a timely manner, the complexity of some statutory requirements is seen as the major reason for delays, with concerns that project approval timelines are extending several years from initial application to final approval. A particular issue that has been raised on several occasions is the complex nature of establishing a corridor for linear infrastructure (e.g. for a pipeline or electricity transmission line) that traverses numerous individual tenures, and a desire to see the process streamlined to provide greater certainty for proponents, landholders, government and other parties. Another issue is the complexity around the approval of proposals for the development of infrastructure (including linear infrastructure requiring the establishment of a corridor) by a party which is not itself seeking approval to develop the mine that the infrastructure will service.

Conversely, concerns expressed by those external to the mining sector commonly contend that the assessment process is not rigorous, detailed or transparent enough, particularly with regard to land access, use and tenure issues, environmental impacts, and the extent of community consultation required or undertaken, in particular with regard to Section 49 developments and projects located in or adjacent to sensitive areas (such as towns, heritage sites or areas of conservation significance).
A recent issues paper\textsuperscript{17} produced by the Productivity Commission identified further non-financial barriers to mineral and energy resource exploration in Australia, including lack of regulatory certainty due to incremental legislative amendment rather than reviewing how processes interact as a whole and increasing complexity with regard to overlapping layers of State and Commonwealth jurisdiction.

The State Government last undertook a review of the Mining Act in 2009. This review and the subsequent public consultation process resulted in a number of amendments to the Act being passed in late 2010; these amendments included provisions regarding land access and exemption of land from mining activity, management and approval of exploration licences, conditions of approval and compliance requirements.

The Government has recently announced (February 2013) that it has commissioned a review of the Development Act 1993, known as the “Planning Improvement Project” (PIP).\textsuperscript{18} The PIP is the first comprehensive review of the State’s planning legislation since the review that resulted in the drafting and subsequent enactment of the Development Act in 1993. An expert panel has been established to undertake the PIP, and has been asked to review statutory and non-statutory governance and administrative arrangements relating to the planning system, and to propose a new statutory framework, governance and administrative arrangements. The panel is required to report to Government and to Parliament by December 2014 and, particularly relevant to the mining sector, the PIP’s terms of reference state that the “panel’s recommendations must be directed to realising the vision of … thriving, sustainable regional communities”.\textsuperscript{19}

**The Regional Mining and Infrastructure Plan**

The findings identified in this Contractor Report for the Eyre and Western region, along with the findings from the other two regional Contractor’s Reports, form the basis of the SA Government’s Regional Mining and Infrastructure Plan. In doing so, the Plan considers the aggregated demand for each mining cluster to then identify the preferred solution from a regional or cross-regional perspective. This approach enables a more holistic consideration of environmental issues in the development of infrastructure solutions, along with those of the community, and desirable social and economic outcomes.

The Plan should be read in conjunction with the three regional Contractor’s Reports for the Regional Mining and Infrastructure Planning project, in order to fully appreciate the level of detail and complexity of analysis undertaken to develop the priority actions.


References

Aurecon (2010) RESIC Infrastructure Demand Study - January 2010
Australian Bureau of Statistics, Census, 2011
Department of Planning Transport and Infrastructure (2012) Future Directions – Optimising our Transport Corridors – August 2012
Department of the Premier and Cabinet (2011) South Australia’s Strategic Plan (and Regional Volumes)
DMITRE (2012) RESIC Resources and Energy Infrastructure Demand Study – Consultation Paper
DMITRE (2012) South Australian Government response to the RESIC recommendations – Directions Statement
Drew, G (2007) SA’s Mining Boom - Presentation to the 16th State History Conferenc August 2007
Invest in SA (2012) Draft Report, Copper in South Australia
Invest in SA (2012) Iron Ore in South Australia
Invest in SA (2012) Uranium in South Australia
Klaasen, N (1999) Early South Australian Mining Industry
Parsons Brinckerhoff (2011) RESIC Resources and Energy Infrastructure Demand Study – Volumes 1 - 4
Port Bonython Bulk Commodities Export Facility – Industry Presentation
Regional Development Australia Yorke and Mid North (2012) Yorke and Mid North Regional Roadmap – August 2012
Regional Development Australia, Far North (2011) Regional Roadmap and Strategic Plan 2010-2013, updated 2011
RESIC – Infrastructure Demand Study
Rural Solutions (2012) Resources and Energy Infrastructure Demand Study – Community Consultations: Analysis and findings
SA Government’s response to the Infrastructure Demand Study
SA Water (2011) Eyre Peninsula Demand and Supply Statement – Apr 2011
SA Water Eyre Region Desalination Plant data sheet
South Australian Centre for Economic Studies, Social Health Atlas
Tumby Bay Museum (2013) Tumby Bay Museum
Various Development Approvals
Various publicly available data for mines
Stage 1 – Review of existing infrastructure

Stage 1 is focused on understanding the state of the infrastructure currently servicing regional mining activity along with the expected future demand profile for freight, water and power that will be required to support growth in the sector.

Task 1.1 – identify existing regional infrastructure

A detailed understanding of the mining sector in South Australia was gained through information gathering from the following sources:

- Mining company annual reports
- Public statements by mining companies in relation to future mining plans
- Private consultations with mining companies
- Review of State Government databases
- Outputs from RESIC’s IDS
- Consultation and validation with the Department of Manufacturing, Innovation, Trade, Resources and Energy
- Published feasibility reports and environmental impact statements for mining projects
- Technical mining and infrastructure assessment by a specialist mining consultancy.

To develop a holistic understanding of the existing infrastructure environment, additional insights were gained through face to face consultations and workshops with industry bodies, government agencies, RDAs, infrastructure operators and other interested parties.

Information was gathered on a mine by mine basis in relation to each mines respective infrastructure requirements over the 20 year life of the plans. This included any planned or proposed infrastructure solutions identified by the mine proponents.

Task 1.2 – assess existing regional infrastructure

The focus of this task was to establish a comprehensive understanding of existing infrastructure capabilities. This assessment determines the condition, capacity and capability of existing infrastructure to meet current and emerging mining infrastructure demands and highlights the likely infrastructure deficiencies across the region.

The consultations discussed above included exploration of the extent to which existing infrastructure is likely to be suitable to support the development of the South Australian mining industry. Information gathering was tailored to reflect the unique nature of each type of infrastructure and is detailed in Appendix C.
Task 1.3 – forecast future mining infrastructure demand

Using the data collected and refined in tasks 1.1 and 1.2, mining infrastructure demand was forecast over the period to 2037.

Mining industry data led to the development of clusters which grouped mines likely to have common infrastructure needs. The clusters were developed by grouping mines in close proximity to each other with relatively homogeneous mineral production profiles.

The likelihood of individual mines proceeding to production was modelled with reference to:

- Forecasts of commodity prices
- Estimates of likely mine operating cost
- Estimated mine and direct procured (by mine proponent) infrastructure capital cost
- Estimated cost of feasible mine to port transport solutions
- Allowance for minimum market benchmark return on invested capital.

Commodity price forecasts (i.e. for iron ore, copper, uranium and gold), were drawn from leading international forecasters Consensus Economics. Consensus Economics develops forecasts using predictions submitted by more than 30 commodity forecasters, including private sector consultancies and leading investment and commercial banks. The forecasts of each contributor are aggregated using a proprietary Consensus Economics’ moderation technique to develop a weighted forecast for each commodity.

Prospective mines whose fully burdened cost (including return on capital) are lower than the relevant long-run forecast commodity price were included in the forecast mining activity for the cluster (and region). Demand forecasts based on high, medium and low world economic growth scenarios were produced.

Using this forecast mining output, demand for freight, water and power infrastructure supply was established for each individual mine, with results consolidated for reporting at the cluster level. In collecting the data to enable this analysis, commercially sensitive information (not publicly available) was disclosed to the project team by established and developing miners. As a result, key mine level data and operating assumptions have not been disclosed in the regional mining infrastructure plans and forecasts have been presented at a mine cluster level.

Stage 2 – Identify supply chain solutions

The objective of the second stage was the development of a list of infrastructure projects able to contribute to meeting the needs of the South Australian mining industry. Both tasks 2.1 and 2.2 involved a preliminary identification and a workshop refinement process.

Task 2.1 – identify potential infrastructure gaps and issues

Based on the assessment of existing infrastructure in task 1.2 and the future cluster demand profiles established in task 1.3, the gaps and issues faced by existing infrastructure to service growing mining infrastructure requirements were identified. The analysis drew on findings contained in previous studies (including the 2011 Infrastructure Demand Study commissioned by RESIC), along with commentary from mining proponents and interest groups to establish a base list of mining project inhibitors or challenges. This list was then refined through targeted stakeholder workshops focused on freight and logistics, water and power (electricity and gas).
Task 2.2 – identify potential infrastructure solutions
Following detailed technical research, industry consultation with key mining proponents and industry stakeholders, the project team was able to articulate for each of the regions:

- The current state of relevant infrastructure
- The likely future infrastructure gaps
- Key issues impeding existing infrastructure meeting future demand (i.e. prohibitive commercial or access arrangements, reliability concerns, environmental or social issues)
- Solutions which have been proposed by miners or infrastructure proponents.

This information was presented to targeted stakeholder workshops for consideration. Structured group discussions among workshop participants were used to first test the issues identified and subsequently augment the list of infrastructure solutions which could be capable of addressing the identified infrastructure needs and issues. The ideas of the individual groups were consolidated to produce a complete list of potential infrastructure projects (Refer to Chapter 8 for a complete list of these projects).

Following this workshop the list was refined and any approved or funded projects were removed from further consideration by this project. Further projects determined to be unlikely to meaningful contribute to the strategic delivery of infrastructure for mining in South Australia were removed from the list. This included projects that addressed the requirements for a single mine only and projects so closely aligned it was not meaningful to investigate the projects separately.

Stage 3 – Technical consideration
The objective of the third stage was to gather technical information for each of the identified infrastructure projects, to identify potential path to market solutions (i.e. from mine clusters to port) that address the identified infrastructure deficiencies. This involved grouping dependent and interconnected infrastructure projects into solutions for the alternate mining clusters across the regions.

Task 3.1 – review technical merits of identified projects
This task involved gathering data to establish a deep understanding of the technical merits of each project. To develop this understanding a comprehensive information gathering exercise was undertaken, including the collection and review of the following key metrics:

- Capital cost
- Operating cost
- Capacity
- Mining clusters which would be serviced
- Potential for scalability
- Estimated life
- Supporting infrastructure required
- Key technical and operational risks
- High level pro’s and con’s
- General social, environmental and commercial commentary.
Workshop attendees were consulted where the key metrics identified in task 3.1 could not be sourced from within our project team. This also gave the opportunity for issues to be discussed which could not be raised in the workshops due to time constraints or commercial concerns of workshop participants.

**Task 3.2 – identify alternate infrastructure solutions**

Using the technical information gathered in task 3.1, the project list was consolidated into alternate path to market solutions. The paths are designed to address the needs of regional clusters while reducing unnecessary infrastructure duplication and enabling public benefits. The paths group interrelated, dependent and optional infrastructure projects that would be involved in activating these paths over the twenty year life of the plans. Specifically the freight and logistics projects are grouped by the exit port solution they potentially service. Potential solutions were grouped into packages capable of servicing one or more of the mining clusters.

While energy and water are central to the operation of mines and their associated freight solutions, their demands can be equally addressed (from a technical perspective) by distributed or onsite solutions. Consequently the alternate water and energy solutions that have been identified are decoupled from the path to market solutions and presented separately as standalone solution options.

**Stage 4 - Undertake public consultations**

Before the infrastructure projects are prioritised, an interim report outlining the key regional gaps and issues and the list of infrastructure projects and potential path to market solutions has been released for public consultation. This process enabled the key drivers of the RMIP project to be discussed and validated with a broad range of community and industry stakeholders to ensure a robust foundation for determining the priority activities for driving development and growth of regional mining activity and growth and development.

**Task 4.1 – release interim reports**

All relevant information gathered over the course of the project were compiled in interim reports for the consideration of interested stakeholders.

The interim reports were not a detailed inventory of the full range of investigations undertaken and information gathered over the course of the project to date. The interim reports presented a consolidated summary of the factual and material findings of the project to date which are able to inform submissions of interested stakeholders.

The analysis of the forecast mining infrastructure gaps and the infrastructure projects which may potentially address these gaps were contained with the interim report released for public comment.

The interim report provided interested parties an understanding of:

- The nature and level of mining activity in the region
- Forecast nature and level of mining activity in the region
- Key risks to the forecast level of mining activity being achieved
- Forecast infrastructure gap
- Our initial assessment of the proposed projects.

The insight of stakeholders, particularly in relation to the questions posed in Chapter 1, were gathered to enhance the understanding of the relative merits of each of the infrastructure proposals under consideration.
Task 4.2 – stakeholder consultations

A range of consultation activities have been undertaken to give the greatest possible opportunity for interested parties to provide comment on the interim reports. These consultation activities included:

- Roving interviews
- Drop in information sessions
- Invitee workshops
- Request for hard copy or electronic submissions.

Respondents to the consultation process were asked to provide their thoughts on the interim reports with respect to five specific questions:

- Are the future infrastructure gaps and/or issues adequately identified?
- Have all feasible potential infrastructure solutions been identified?
- When assessing potential solutions, what are the key issues which should be considered?
- Are barriers to the development of priority infrastructure solutions government may seek to address adequately identified?
- Are there any other issues in relation to the RMIP project you wish to raise?

The information gathered in the project (including the consultation processes) was collated for each of the potential infrastructure solutions. This information provided the basis of a detailed process of prioritisation of which the ultimate intention is identifying viable path to market, energy and water infrastructure solutions. Consideration of the timing of the delivery of infrastructure capacity will be critical to the development of clusters.

Projects were prioritised based on their alignment to the criteria below:

- Efficiency of delivery (strategic importance to multiple mines)
- Facilitation of growth in the mining and minerals processing industries
- Contribution to economic prosperity
- Regional and community impact
- Environmental.

Further details of the prioritisation process developed are provided in Chapter 10.

Task 4.3 – refine solution list

Feedback from consultations furthered the project team’s understanding of the implications of each of the project clusters under consideration.

The feedback provided by interested stakeholders was used by the project team to further refine the list of potential solutions and their clustering. Shortlisting of the projects based on the outcomes of consultation focused the deliberations of the project team.

Stage 5 - Infrastructure assessment

The objective of the fifth stage is to identify the priority paths to market solutions and infrastructure projects for each region. The assessment applies a multi-criteria approach that considers a range of economic, financial, strategic, environmental, and social and government criterion. The assessment considers the priority of projects over the twenty year life of the plans based on the evolving demand from the regions.
Task 5.1 – assess strategic alignment

The prioritisation process identified projects with the greatest strategic alignment to the intended outcomes of this project. The prioritisation process identified which projects are the most important to the development of the South Australia mining industry and the time period in which the project needs to be delivered.

Task 5.2 – assess deliverability

In addition to assessing the strategic alignment, the deliverability of the identified solutions has assessed. The deliverability assessment analysed the extent to which the identified solutions are able to be implemented in South Australia.

Task 5.3 – prioritise infrastructure solutions

At the completion of the prioritisation process a priority ranking will be given to each of the infrastructure projects. The priority ranking will also outline the expected relative timing for each of the projects.

Strategically important areas are those in which infrastructure delivery is able to support the development of multiple mines and/or provide demonstrable community benefits.

Stage 6 - Identify actions required

The objective of the sixth stage is to identify the key actions that would facilitate the development of priority infrastructure. This particularly focused on how the State Government can assist in reducing the risk of projects through policy and regulation reform, process improvement, capital investment, coordination and strategic planning and commercial collaboration or facilitation.\(^\text{20}\)

Task 6.1 - identify scope for government and private sector involvement in projects

Having identified the priority infrastructure projects, consideration was given to the potential role for government\(^\text{21}\) and the private sector in facilitating investment in the preferred infrastructure. The core principle driving the identification of the role for government involved focusing on removing impediments to the private sector delivering the necessary infrastructure.

Consideration of the potential role for government focused on projects which are:

- Likely to alleviate ‘blockages’ preventing further private sector investment
- Market failures in which agents pursuing individual interests are not motivated to pursue outcomes which are optimal from a state wide perspective.

Examples of the identified role for government in facilitating the preferred infrastructure solution may include, policy change, partnering and direct financing, among many others.

Task 6.2 - identify means and timing of government involvement

Having identified the role for government in facilitating the delivery of the prioritised infrastructure to support the development of the mining sector in South Australia, consideration will be given to the most effective means of intervention.


\(^{21}\) This will involve the roles that all tiers of government (i.e. local, State and Commonwealth) can contribute to facilitating the delivery of priority projects.

Appendix A - Approach
Consideration has been given to the most effective and efficient means of government intervention to address the gaps identified in Subsection 6.1. The recommended role for government will be that which is most likely to deliver the desired infrastructure with the fewest expected negative consequences.

**Stage 7- Finalisation of plans**

**Task 7.1 – finalise regional mining infrastructure plans**

The final task of the project will be the preparation and finalisation of the regional mining infrastructure plan. The final plan will build on the technical assessments and demand modelling presented in this final report and include a summary of feedback (and refinements) from the community and stakeholder consultations, the assessment of infrastructure priorities and discussion of the key activities required to facilitate development of critical mining freight, water and power related infrastructure. This will also include the role of government and identification of likely regional social infrastructure requirements.

**Task 7.2 – policy and project proposals**

The finalised plan will identify the priority mining infrastructure projects and supporting activities required to enable the growth of the mining sector. These plans will be used over this period to guide the development of policy and project proposals in support of the State Government’s involvement in facilitating these priorities. As required, the policy and project proposals will present, to a preliminary or feasibility level of detail, the case for project action, the required involvement of government (and the private sector), options for the projects and governments involvement and affordability and delivery considerations. This proposal will be used to seek endorsement from Cabinet for policy, regulatory and/or procedural changes to be pursued or alternatively for a detailed business case to be developed seeking funding or commercial engagement (i.e. for joint ventures) approval.
Appendix B – Eyre and Western environmental assets

Matters of National Environmental Significance protected under the Environment Protection and Biodiversity Conservation Act 1999 for the Eyre and Western include:

- One threatened ecological community:
  - Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia (Critically Endangered Community) likely to occur within area

- Other significant ecological communities
  - Drooping Sheoak (Allocasuarina verticillata) woodland
  - Rough-barked Manna Gum (Eucalyptus viminalis ssp. cygnetensis) woodland

- Significant Species
  - 72 listed threatened species
  - 59 listed migratory species
  - 102 listed marine species
  - 30 listed cetacean species

- Examples of threatened species and habitats
  - Mallee fowl (Leipoa ocellata), Sandhill Dunnart (Sminthopsis psammophila), Fat-leaved Wattle (Acacia pinguifolia) and Yellow Swainson-pea (Swainsona pyrophila) in mallee habitats
  - Thick-billed Grasswren (eastern) (Amytornis textilis modestus) and Slender-billed Thornbill (western) (Acanthiza iredalei iredalei) in chenopod shrublands.

- Great Australian Bight Marine Park (Commonwealth Waters)
Appendix C – Alignment of mines to DMITRE Pipeline

General points on the mines we have excluded:

Our list has been based primarily on the Department of Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) triangle and available information (e.g. information from the RESIC Infrastructure Demand Study, Invest in SA commodity data, information from miners); anything not on the DMITRE triangle was only included in our assessment if it would have a significant infrastructure demand (e.g. Hawsons project in NSW - Braemar).

We have not included the north west corner of South Australia (Musgraves, Far North region) because:

- The timelines for development of resources in the region are uncertain
- Most of the projects in this region (except Metals X’s Wingellina project in Western Australia) are not advanced
- The commodities in this area are produced in low volumes (nickel, zinc, uranium).

Points on the mines we have included

Our assessment focuses on iron ore projects as it is an infrastructure intense commodity – it is a bulk product with significantly greater freight, power and water demands than any other commodity due to the volumes involved (i.e. mtpa vs. ktpa) – we have included almost every iron ore project on the DMITRE triangle except for five (all of which are not very advanced).

Copper and uranium commodities are also assessed because:

- Copper and uranium are SA’s biggest mineral export earners
- There is information available on the development of these commodities (e.g. Invest in SA).

We have also concentrated on the operations for which we have the most comprehensive and accurate data; the less advanced a project is, the more uncertainty there is as to its potential infrastructure requirements. Therefore, if we included all prospects in their initial exploration phases the resultant demand estimates would have included a lot of variability which would have skewed the curves and provided little value to the planning process

Summary of included and excluded projects

Some projects included in the DMITRE triangle were excluded from our assessment for the reasons below:

- Associated with other projects White Dam North, Olympic Dam Expansion, Beverley South, Four Mile
• Coal projects (not included in this project as they energy related, infrastructure supporting Leigh Creek included in considerations of projects), Leigh Creek, Clinton, Arckaringa, Lock

• Out of the region, Kingston

• Focus on commodities outside scope this project, Beltana

• Sufficient information is not available to robustly assess the infrastructure needs to develop these deposits, Jungle Dam, Parkinson Dam, Baggy Green, Barns, Black Hills, Golf Bore, Mainwood, Monsoon, Tomahawk/Tunkillia area 191, Mongolata, Sheoak, Skye, Ultima Dam, Yanyarrie, Mount Christie Siding, Willy Willy, Glenrae, Mount Woods, Stuart, Mount Cora, Mount Brady, Jamieson Tank, Pollinga, Claude Hills, Mount Davies, Pindari, Kenmore II, Mount Caroline, Telephone Dam, Menninnie Dam, Weednanna, Alvey, Kangaroo Dam, Taurus, Prospect Hill, Samphire, Armchair, Yadglin, Yarramba, Radium Hill, Aristotle, Oakdale, Malache, Aroona 2, Blinman, Emmie Bluff, Emmie North, Moorilyanna, Bagot Well, Burra, Miranda, Moonta, Netherleigh Park, Princess Royal, Punt Hill, Titan, Toondulya, Torrens South JV, Wirrda, Erunilla Dome, Melton, North Kalkaroo, North Portia, Shylock, Willamulka, Blue Rose, Mount Gunson, Mutooroo, Netley Hill, Zeus, Winjabbie East, Flinders Island, Eurelia, Barton West, Dromedary, Gullivers, Mojave, Notrab

• Mining largely complete, White Dam

• Outside the regions in the plans, Bird-in-Hand, Deloraine, Lady Jane, Kanmantoo, Mount Torrens, Springfield, Mindarie, Angas, Wheal Ellen
Appendix D – Infrastructure assessment benchmarks

The assessment of the adequacy of infrastructure to meet the current and future infrastructure needs of the mining industry were undertaken with reference to the data sets below.

**Roads**
The heavy vehicle routes in each of the regions were assessed with reference to:
- the current condition of roads
- the capability of the roads to cater for heavy vehicles
- the location and proximity of routes to possible mine sites
- the traffic volumes on routes to determine if capacity exists
- the proximity of routes to other freight (particularly rail) to determine if intermodal opportunities exist
- current use patterns by mining and non-mining traffic.

**Rail**
Reference material was reviewed and infrastructure proponents interviewed to assess rail infrastructure in relation to:
- the location and proximity of routes to possible mine sites
- the traffic volumes on routes to determine if capacity exists
- the proximity of routes to other freight (particularly roads) to determine if intermodal opportunities exist
- rail gauge
- ability to accommodate different commodities
- current use patterns by mining and non-mining traffic
- the current condition and compatibility with national rail network
- ownership structure and access regime
- capability of lines (i.e. to handle axle loads)

**Ports**
The review of ports infrastructure included the following key areas for assessment:
- shipping channel and swing basin specifications and dimensions, including maximum vessel sizes
- prevailing subsea geology, tide and current conditions and related maintenance dredging
- towage and pilotage service capacity (equipment and labour force)
- aids to navigation inventory
- berth size and wharf conditions (including all mooring and fendering)
- cargo handling equipment – both ship and stevedoring and terminal related
- cargo storage capacity and operating constraints
- other considerations such as covered loading requirements
- encroachment of incompatible land uses
- community or local government expectations and concerns
- ownership structure and access arrangements
- environmental implications such as proximity to marine parks and recreational facilities
- land transport access (road and rail).

**Energy**

Gas and electricity providers were identified in each of the regions and information gathered in relation to existing infrastructure affecting the region included:

- location and extent of network
- capacity
- capability (pressure, interruptible etc.)
- upgradability
- current condition and remaining economic life
- constraints and opportunities to optimise use of existing infrastructure
- current and expected demand for commercial and industrial use
- opportunities and challenges of connecting to renewable energy supply
- regulatory and commercial environment
- ownership of assets
- security of supply.

**Water**

Key information in relation to water assets and potential constraints on supply was reviewed in each of the regions, including:

- population growth forecasts
- climate change and demand impacts
- water allocation (River Murray, prescribed wells, Great Artesian Basin)
- demand projections
- yield capacity and water quality potential water sources, including:
  - prescribed and non-prescribed groundwater resources
  - surface water catchments
  - stormwater reuse
  - wastewater and effluent reuse
  - reservoir capacities
  - transfer pipeline capacities
  - water treatment plant capacities and water quality
  - desalination plant capacities and water quality
  - existing operating rules.
Appendix E – Commodity price scenarios

Deloitte Access Economics (DAE) has developed three forecast scenarios for commodity prices over the next 10 years. DAE’s forecasts for commodity prices reflect three different set of assumptions in relation to international macroeconomic conditions; a base case, high growth and low growth scenario.

The commodity price forecasts are drawn from Consensus Economics’ quarterly energy and metals forecasts. Consensus Economics develops forecasts using predictions submitted by more than 30 commodity forecasters (of which DAE is one), including private sector consultancies and leading investment and commercial banks. The forecasts of each contributor are aggregated using Consensus Economics’ moderation process to develop a weighted forecast for each commodity. Drawing forecasts from a range of parties supports the consideration of the forward outlook from a broad range of international perspectives.

The weighted forecast for iron ore, copper, gold and uranium published in Consensus Economics’ December 2012 energy and metals forecast is the base case which has been adopted by DAE.

The outlook for Australian macroeconomic conditions is not considered in detail because forces impacting commodity prices are determined by international markets and minimally impacted by Australian economic conditions.

The following commentary for each scenario provides a background to the likely international economic conditions that would be expected to underpin each commodity price scenario. Charts of the forecast price paths are provided following the commentary.

Base case
This is the forecast most likely scenario for international economic conditions.

Scenario overview
Significant risk remains present in the global environment as a result of continuing sovereign debt problems in the Eurozone and uncertainty in China. However, these risks are lower than observed in recent years and global growth prospects are greater than they have been in recent times. Economic growth in the United States in the short-term in this scenario is supported by a turnaround in the housing market and cheap energy.

Supressed by potential downside risks from the Eurozone, United States debt issues, declining Chinese investment and possible disruptions to oil supplies, global economic growth in the short-term is lower than the long-term average. Developing nations, while not returning the rates of growth seen pre-GFC, would be expected to continue to outperform the developed nations and will be key to global growth over the next decade in this scenario.

Commodity prices continue on a relatively volatile path, particularly over the short-term as a result of the uncertainly detailed above. Base commodity prices trend downward over the next decade. Investment from developing countries cools, while new supply enters the market as investment in new export capacity gradually leads to increased levels of production.

Country expectations
This scenario is predicated upon improving conditions in the housing market, the addition of cheap energy and the willingness of the US Federal Reserve to persist with aggressive monetary policy easing being enough for the United States to start to deliver some much needed momentum to the global economy. Confidence in the business sector would be expected to improve and economic growth would be expected to provide a stronger employment outlook which would lead to the unemployment rate trending down. This scenario assumes the United States’ fiscal issues are negotiated without incident in 2013, but the need to
consolidate debt over the long term ensures average economic growth over the next decade is lower than in the previous decade. After a period of adjustment the United States economy would be expected to make a solid recovery with economic growth, unemployment and consumer spending all returning to more normal levels by the decade end.

This scenario assumes China’s willingness to support steel-intensive, investment driven activity will remain the key driver of China’s economic growth over 2013 and will keep global commodity prices elevated (albeit at lower peaks than seen in 2012). Credit growth in China has also been strong, however this may soon begin to drag on economic growth as interest repayments make up a greater share of spending. This scenario envisions the Chinese economy still being heavily reliant on manufacturing and export growth. The share of output from industry is expected to shrink at the same time as the services sector expands as incomes continue to rise over the long-term (a higher income population places additional demand on services). China’s export share of gross domestic product (GDP) is expected to shrink while imports increase as the share of output from industry decreases. These changes would be slow to manifest. Overall, this scenario assumes income growth in China is solid throughout the next decade and consumption slowly accounts for a greater share of the economy over time.

Europe is the major risk to the global economic outlook over the next decade – its banks are undercapitalised, making it hard for them to finance new growth and political divisions threaten the recovery process. In this scenario recession in Europe’s periphery creeps towards its core and economies on Europe’s southern fringe remain on the back foot for some years until wage costs are restrained (relative to those in Germany and France). Unemployment within the Eurozone is expected to remain at record rates for a few more years and with austerity measures on top it is unlikely Europe’s economy will return to positive economic growth in the short-term. The Eurozone is expected to drag on global economic growth for some years in this scenario with a long period of adjustment and austerity over the next decade.

Japan faces a unique mix of economic and demographic challenges to be addressed over the next decade. Government debt in Japan is a larger multiple of national income than in Greece and economic growth has been almost stagnant for the past decade. Japan’s population is shrinking and ageing rapidly. In this scenario Japan is expected to undergo a period of structural adjustment and debt consolidation over the next decade resulting in only modest rates of real economic growth.

India, Brazil and Turkey all slowed in 2012, meaning the outperformance of emerging economies over the past decade suffered some headwinds, while Asia’s Tigers (Korea, Taiwan, Hong Kong, Singapore, Thailand, Malaysia, Indonesia and the Philippines) are also seeing more modest growth prospects. This scenario assumes growth in these economies will trend above global averages, but be lower than has been recorded over the past decade.

**Commodity price outlook**

Iron ore prices bounced back from their lows in September 2012. Strong investment led growth in China is expected to ensure excess supplies accumulated over the latter half of 2012 are quickly used up and prices remain high over 2013. The massive surge in investment in iron ore projects across many countries earlier in the decade will result in a gradual ramping up of supply in this scenario. The increase in supply is expected to cause prices ease a little after 2014, but continuing strong growth from emerging economies would be expected to support prices for most of the next decade. As China moves from an investment-driven to a consumption-driven economy, global demand for iron ore is expected to ease somewhat and cause prices to cool toward the latter half of the next decade.

The high rates of investment expected to keep the iron ore price strong in 2013 are expected to do the same for copper. More positive business sentiment and stronger residential housing construction in developed countries over the short-term would be expected to help support the copper price at current highs in this scenario. After that, prices are expected to cool as new supply becomes available and Chinese economic growth slows over the next decade.

After good gains over 2012, a better global economic outlook for 2013 would drive the price of gold downward over the short-term as investors seek higher returns in riskier assets. The record prices seen at the end of 2011 do not return in this scenario and the end of monetary easing policies from many of the world’s major central banks would be expected to place further downward pressure on the gold price into the middle of the next decade. The gold price would be expected to settle as threats to the global economy subside over the latter half of the next decade and the world enters a phase of sustained growth.

Uranium demand would be expected to return to growth over time in this scenario as the memory of the Fukushima disaster in Japan fades. Additional energy demands from developing countries with rapidly urbanising populations and growing incomes make nuclear a more attractive energy source – this is particularly pronounced in response to the growing air pollution issues in many of Asia’s major cities. This
scenario assumes uranium exporting countries invest heavily in new mine capacity to keep pace with demand over the next decade. Uranium prices rise, but remain below the levels seen in recent years.

High economic growth scenario

Below is a scenario for international macroeconomic conditions which is at the higher end of expectations.

Overview

This scenario assumes the global economy hits its straps in 2013 after stumbling throughout 2012. Sovereign debt issues in the Eurozone subside as unconventional monetary policy from the European Central Bank (ECB) has the desired effect, while government investment in infrastructure in China drives strong economic growth in the short-term. United States growth surprises in the short-term, as a resurgence in housing construction and consumer spending drives a sustained turnaround in economic activity.

This scenario assumes the global economy moves into full recovery mode, the major economies track well and global uncertainty retreats over 2013. Developing countries, led by China, will continue to make a substantial contribution to global economic growth and outpace the economic growth of developed countries. Developing country growth in this scenario continues to be driven primarily by engineering construction investment, supporting commodity prices over the short-term. This scenario is reliant upon political unrest in a number of oil exporting nations being negotiated without any disruption to oil supplies and the world economy being positioned to make a sustained recovery.

Base commodity prices continue to be buoyed by robust demand from developing nations in this scenario. Indeed, demand for base commodities would outpace supply even in light of the massive amount of new mine capacity which would push the global output of raw materials to record levels. Uranium prices would rise in this scenario as the world demand for energy drives upward. A better global economic outlook would cause the price of gold to fall sharply in the short-term as investors chase higher returns in riskier assets.

Country expectation

In the scenario the United States performs strongly over 2013. Low interest rates and continued monetary easing would drive a better than expected recovery in housing construction and prices. Banks would be provided greater liquidity facilitating increased access to capital for the private sector. Exports of gas would increase significantly to underpin this scenario. The unemployment rate would fall sharply over the short-term as a resurgent United States business sector provides a platform for robust jobs growth, while better business and consumer confidence drives a turnaround in retail spending. This scenario assumes United States Government debt issues will be resolved with Congress negotiating the approaching debt ceiling without issue, while also reaching its target of 2.5 per cent debt consolidation in 2013. Indeed, United States economic growth is strong enough over the next decade in this scenario to ensure the United States can consolidate its debts while not impeding economic growth.

In this scenario strong short-term growth in China is driven by engineering construction as the new government renews steel-intensive, investment driven growth. The immediate excess supplies of raw materials are expected to be quickly used up and base commodity prices rise as a result of the lift in demand. In the next five years the consumption share of output in China rises as a result of stronger income growth, particularly in China’s major cities. The rate of consumption growth overtakes growth in investment within a few years, but investment remains the most significant contributor to economic growth in the interim. As a result of increasing consumption growth, base commodity prices begin to fall after 2015 in this scenario. Over the long-term, China’s economic development follows the same pattern of the other developed nations in the region – such as Japan and Korea – with higher household income associated with a relative decline in the industrial sector and an expansion in the services sector.

Even under this scenario the outlook for the Eurozone is modest at best. The ECB’s commitment to aggressive and unconventional monetary easing ensures liquidity in the financial system. Banks begin to issue more loans resulting in some small gains in business investment and housing construction. Fiscal consolidation reduces government debt and provides some confidence in financial markets, but limits economic growth as the government sector contracts. The recessionary conditions in the periphery countries ease, though growth is slow.

Japan remains a key risk to global economic stability in this scenario, with few prospects for growth over the next decade. The Asian Tigers perform well, with economic growth riding high on an engineering construction boom which lasts well into the next decade. India negotiates its fiscal and monetary issues in this scenario – keeping inflation under control and beginning the process of reducing its fiscal deficit.
**Commodity price outlook**

Strong investment-led growth in China in this scenario pushes iron ore prices higher over 2013. The massive surge in investment in iron ore projects across many countries earlier in the decade increases supply post-2013. Continuing strong growth in emerging economies ensures demand outpaces supply for at least the first half of the next decade – pushing prices up until around 2015. As China’s demand for iron ore eases toward the latter half of the next decade, prices retreat in this scenario.

Strong investment-led growth in China would also be good news for the copper price, ensuring it remains high over the short-term. New supply is expected to be significantly less than for other base metals and demand is expected to continue to increase until at least 2015 as the global demand is driven up by rapidly urbanising populations in a number of developing countries in this scenario. Hence, demand for copper may outstrip supply over the medium-term. The copper price is therefore projected to rise – coming close to the historic highs seen in 2011 – but then cool in line with falling engineering construction in developing countries over the latter half of the next decade.

Strong growth in the global economy in 2013 in this scenario drives the price of gold downward over the short-term, as investors seek higher returns in riskier assets. Monetary policy easings from many of the world’s major central banks are stopped short in this scenario, placing further downward pressure on gold prices over 2013. Indeed, above average global economic growth over the next few years would ensure the gold price remains on a downward path until around 2015.

Additional energy demands from developing countries in this scenario will ensure the uranium price grows strongly over the short-term. As the memory of Fukushima disaster in Japan fades, and amid rapid growth in population and income in developing countries, nuclear energy is expected to become a more attractive energy source. Prices for other energy commodities would also be expected to increase; ensuring the uranium price remains well above historical averages over the next decade.

**Low economic growth scenario**

Below is a scenario for international macroeconomic conditions which is at the lower end of expectations.

**Scenario overview**

In this scenario the global economy continues to stumble for a number of years. Global economic growth is plagued by a series of small financial crises as high government debts, particularly in the Eurozone and the United States destabilises financial markets. Chinese growth shudders as falling demand from the Eurozone and the United States (China’s two largest export partners) cause export volumes to fall dramatically. The global output of base commodities increases significantly in this scenario over the next few years as investment in new mine capacity from years past pushes supply to record levels. Demand for these commodities does not keep pace and prices fall as a result.

Some years after the end of the GFC, the world economy may remain in a state of flux, with low growth and high debt in high-income countries a major concern. Global growth over the short-term grinds to a halt as downside risks from the Eurozone, United States debt issues and declining Chinese investment damage global growth prospects in this scenario.

Base commodity prices suffer as demand from developing nations, particularly from China, begins to moderate. Global demand for base commodities struggles to keep up with supply as a lift in new mine capacity pushes the global output of raw materials to record levels in this scenario. Uranium prices would remain stagnant, in line with global energy demand. The price of gold would be expected to make some strong gains as investors seek to secure their wealth from volatile movements in other asset prices, including equities.

**Country expectation**

The United States underperforms over the short-term in this scenario. The United States housing market is expected to remain flat, with little in the way of price growth or new construction, in spite of low interest rates and continued monetary easing. Unemployment in the United States remains above 7.5 per cent leading into middle of the next decade, while business and consumer confidence is plagued by uncertainty in the financial sector and insipid retail spending remains a drag on economic performance. This scenario assumes Congress manages to negotiate the approaching debt ceiling, but without a turnaround in economic performance, the United States is unable to consolidate any of its debts over 2013. The United States does not make any significant contribution to global economic growth over the next decade in this scenario.
In this scenario China’s economy feels the pinch of a slower global economy and financial market uncertainty. Investment spending is expected to begin to cool and domestic consumption remains subdued after the most recent government stimulus package has run its course. All efforts by China’s new government to encourage growth in consumption spending in the short-term fail. Household income growth would be expected to slow and ensure China’s reliance on export growth and investment to drive economic growth continues over the medium-term. However, China’s export volumes would be expected to fall significantly, particularly in the short-term, as instability in the Eurozone and the United States cause demand for Chinese manufactures to fall. China’s economic growth is projected to slow significantly over the next decade in this scenario and contribute to the general fall in commodity prices.

Monetary easing by the ECB in this scenario is not enough to pull the countries on the periphery of the Eurozone out of recession. The economic instability felt on the fringes of the Eurozone moves towards the core. Political divisions and the varying degree of competitiveness between member countries stifle the Eurozone’s recovery. Unemployment within the Eurozone would be expected to remain at record levels over the medium-term as a result of uncertainty and austerity measures.

Political uncertainty and a lack of policies to reduce excessive government debt damages growth in Japan in the short-term and a need to consolidate debts and a rapidly ageing population damages prospects for economic growth in the long-term in this scenario. The Asian tigers would be expected to slow as a result of weaker growth in China, Europe and the United States. India is expected to continue to struggle with high inflation on the one hand and low growth on the other. The Indian Central Bank and the government in this scenario would be limited in their ability to encourage economic growth through monetary and fiscal policy. A period of low growth relative to years past would be expected to set in for the next decade.

**Commodity price outlook**

In this scenario the iron ore price would be expected to begin to fall over the first half of 2013 as China does not utilise excess supplies accumulated over the latter half of 2012. The surge in supply resulting from recent investment combined with slower growth from emerging economies would mean demand struggles to keep pace with supply for at least the first half of the next decade in this scenario. The iron ore price would be expected to fall significantly in the lead-up to 2015. After that, prices settle well below current levels towards the end of the next decade.

**Copper** prices fall sharply in the lead-up to 2015 primarily as a result of softening Chinese investment in this scenario. This would be expected to be compounded by falling global energy demand reducing copper demand from new electricity infrastructure. The addition of new supply would be expected to place further downward pressure on copper prices. In this scenario the price of copper is expected to level off over the long-term as stability returns to global markets, but at significantly lower prices as a result of a structural shift in supply.

Weak growth in the global economy drives the price of gold upward over the short term in this scenario, as investors seek to secure their wealth. Monetary easing policies by many of the world’s major central banks extend well into the middle of the next decade and would be expected to depress currency values and place further upward pressure on gold prices. Softer global economic growth in this scenario ensures gold prices remain on an upward path over the long-term.

Governments across the globe remain wary around the use of uranium for nuclear power as the memory of the Fukushima disaster in Japan remains vivid in this scenario. Some governments may seek to reduce their use of nuclear energy and others look to increase it in pursuit of a less carbon-intensive base load energy. Uranium production would be expected to keep pace with demand over the next decade. However, a weaker global economy reduces overall global energy demand and ensures uranium prices remain relatively flat over the next decade.
Appendix E – Commodity price scenarios

Iron ore, $US / T
Australia-Japan contract, fines, 62% fe

Copper, $US / T

Forecast
The Deloitte Access Economics – Regional General Equilibrium Model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy, with these relationships are solved simultaneously.

Figure A.1 shows the key components of the model for an individual region. The components include a representative household, producers, investors and international (or linkages with the other regions in the model, including other Australian States and foreign regions). Below is a description of each component of the model and key linkages between components. Some additional, somewhat technical, detail is also provided.

**Figure A.1: Key components of DAE-RGEM**

DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a ‘regional consumer’ that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, Government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
• All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.

• Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.

• Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.

• The model contains a more detailed treatment of the electricity sector that is based on the ‘technology bundle’ approach for general equilibrium modelling developed by ABARE (1996).

• The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.

• Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.

• Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

• Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and Government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).

• For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.

• The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region’s emissions fall below or exceed their quota.

The representative household

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; Government consumption; and savings.

Going clockwise around Figure B, the representative household interacts with producers in two ways. First, in allocating expenditure across household and Government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household’s relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

Some detail

• The representative household allocates income across three different expenditure areas – private household consumption; Government consumption; and savings – to maximise a Cobb-Douglas utility function.

---


Appendix F – The DAE-RGEM model
Appendix F – The DAE-RGEM model

- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.

- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.

- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

Producers

Apart from selling goods and services to households and Government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and Government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

Some detail

- Sectoral output equals the amount demanded by consumers (households and Government) and intermediate users (firms and investors) as well as exports.

- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).

- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).

- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market ‘settings’ that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

Some detail

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions must be met such as global exports and global imports are the same and that global debt repayments equals global debt receipts each year.