Goldfields Voluntary Regional Organisation of Councils

An infrastructure strategy for industry growth

Opportunities identification study

January 2020

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Executive Summary

The charter of local governments and other participants in the regional development institutional framework includes an obligation to ensure that regional soft and hard infrastructure under its control and influence remains fit for purpose so that local industry remains competitive and community wellbeing is maintained.

This infrastructure strategy opportunities identification study for the Goldfields Voluntary Regional Organisation of Councils (GVROC) Region (incorporating the Goldfields-Esperance Region of Western Australia and the Shire of Wiluna) has been commissioned by the Goldfields Voluntary Regional Organisation of Councils and Regional Development Australia: Goldfields-Esperance. The strategy opportunities identification study has been commissioned in recognition of the fact that use of shared infrastructure by the Region's expanding gold, battery minerals and other technology minerals production sectors is both increasing and changing in nature, and that this is occurring in an environment where other sectors such as agriculture and tourism are also increasing their usage of certain aspects of that infrastructure.

In order to ensure that the Region's soft and hard infrastructure remains fit for purpose, a study that identifies opportunities and challenges with respect to ensuring the Region's infrastructure remains fit-for-purpose is the first step in ensuring that industry competitiveness and community wellbeing is maintained across the Region.

This strategy opportunities identification study has built on a range of existing economic development plans and infrastructure assessments pertaining to the Goldfields-Esperance Region and Shire of Wiluna and has been developed in consultation with owners, managers and users of a various categories of shared hard and soft infrastructure across the Region.

The GVROC Region and its Community

In geographical terms, the Goldfields-Esperance Region is the largest of Western Australia's nine regional areas, covering one-third of the total Western Australian landmass. The inclusion of the Shire of Wiluna (which from the perspective of the *Regional Development Commissions Act 1993* (WA), forms part of the adjoining Mid West Region) renders the geographical focus of this study even more significant.

Large areas of the GVROC Region are the subject of prospecting, exploration, mining and pastoral leases over Crown land, while freehold agricultural tenure is extensive in southern areas of the Region. While determinations under the *Native Title Act 1993* (Cth) are relatively recent across the Region, approximately 50 percent of the Region is the subject of native title determinations, with significant additional claims as yet to be determined.

Approximately 80 percent of the Region's population, 70 percent of jobs and 87 percent of businesses are concentrated in the two most populous Local Government Areas, City of Kalgoorlie-Boulder and Shire of Esperance. Approximately 10 percent of the Region's population are traditional owners and other Indigenous people, and while also concentrated in the most populous shires, the Indigenous population is more evenly distributed across other towns and communities across the Region.

The Goldfields-Esperance Region's economy generates approximately 3 percent of Western Australia's Gross Domestic Product (GDP). Outside of the discrete economies of its regional centres, the main drivers of economic activity are agriculture, tourism and particularly the Region's

cornerstone minerals industry that accounts for 80 percent of the Region's exports, one-third of all jobs in the Region and 45 percent of the Region's total payroll.

Noting that the Region's economic viability is underpinned by its diverse and large minerals industry, topical community issues reflect those that are common to most regional mining areas across Australia such as managing the industry-community interface, achieving enhanced liveability that attracts a greater resident workforce and achieving greater Indigenous economic and social participation.

The GVROC Region Mining and Minerals Processing Industry

Having produced a range of mineral products continuously for over 130 years, the Goldfields-Esperance Region is recognised as one of the world's most significant minerals provinces, particularly with respect to gold and nickel production, and increasingly with respect to a range of 'battery' and 'technology' minerals. In recent history, the minerals industry of the Region has accounted for in excess of $10 billion in gross value, equating to between 10 and 20 percent of the total value of Western Australian minerals production, or 40 percent if production from the State's dominant, largely Pilbara Region based iron ore industry is excluded.

The rate and nature of use of shared infrastructure by the Goldfields-Esperance Region's minerals industry is changing as a result of three key trends. Firstly, a decade of sustained high average gold prices is driving increased gold production from the Region, resulting in new mines, expansions, activation of satellite deposits and increased frequency of third-party toll treating arrangements. Because this new production is typically characterised by higher operating costs, the average all-in sustaining cost of gold production across the Region is also increasing.

Secondly, escalating global demand for electric vehicles (EVs) and a range of other technology products is driving increased demand for minerals used in the manufacture of these products, particularly spodumene (lithium) concentrate and nickel, which are used in the manufacture of nickel-rich lithium-ion battery cathodes, as well as heavy and light rare earths. Production of these minerals (and some other technology-oriented minerals) is increasing across the Region including from several world-class deposits.

Thirdly, the Region's significant 'battery' and 'technology' mineral primary production profile raises the question as to how this production will optimally interface with what are complex and sometimes opaque global battery and technology supply chains. While the Region will face significant cost competition from downstream processing operations in Asia, and to a lesser extent the Kwinana and Kemerton Strategic Industrial Areas, there is prospect of increased downstream processing of these minerals within the Goldfields-Esperance Region.

These trends have a number of implications for the infrastructure that the minerals industry shares with particularly the agricultural and tourism sectors, as well as the community. This includes:

- Likely increase in the number of heavy vehicles on the Region's road networks, possible rail congestion, congestion at Esperance Port and increased throughput at the Region's aviation facilities;
- Increased demand for high quality water, waste management solutions, affordable and reliable energy, telecommunications and industrial land; and
- Potential increased usage of soft infrastructure across the Region.

This may result in an increasingly compelling case for investment in aspects of shared infrastructure.

The GVROC Region Agricultural Industry

There are approximately 720 agricultural businesses in the GVROC Region, collectively producing GVP of around $820 million per annum. Cropping enterprises that operate as pure-cropping or sheep and/or beef cattle mixed enterprises in the southern areas of the Region account for about 85 percent of both farm businesses in the Region and agricultural GVP. In the northerly interior areas of the Goldfields-Esperance Region and the Shire of Wiluna, a much smaller number of agricultural enterprises graze beef cattle and sheep under extensive operations on primarily unimproved pastures.

Increasing grains production in the southern areas of the Region will place greater pressure on road infrastructure as the number (and potentially size) of heavy vehicles increases, particularly during harvesting season. Future productivity growth in the grains industry will be increasingly dependent on the competent deployment of digitally enabled farm systems, an endeavour that is currently challenged by limited availability of commercial grade broadband in farming areas.

The GVROC Region Tourism Industry

An estimated 680,000 people visit the Goldfields-Esperance Region annually, patronising a tourism industry that contributes an estimated $270 million to Gross Regional Product. Around 80 percent of visitors to the Region are intra-state visitors and over half of all domestic visitors and the vast majority of international visitors, visit the Region for business purposes.

Non-business tourism in the Region revolves primarily around the Region's natural and biodiversity assets, post-European heritage assets that are linked largely to the Region's mining industry history, several iconic events and increasingly recognition of the Region's significant Indigenous heritage. Further, the Region's geographical location as a nexus between Western Australia and the eastern States results in relatively large numbers of road tourers visiting and transecting the Region as part of a more geographically extensive road-trip holiday.

Tourism assets are better utilised when the infrastructure that services them is adequate to encourage patronage. Tourists to the Region utilise all aspects of shared infrastructure. However, the greatest impact is on road and accommodation usage, and in the case of business travellers, aviation facilities. The key issue from an infrastructure management perspective is ensuring that larger numbers of passenger vehicle, recreational vehicles and caravans on roads do not hinder industry productivity, whilst maintaining safety for all road users.

Transport and Logistics Infrastructure

The Main Roads and local government managed roads that form the Region's road network are the main facilitator of hinterland logistics and intra-regional, inter-regional and interstate transport connectivity for the GVROC Region for both industry and the community. Increasing volumes of heavier vehicles servicing the minerals and grains industries in the Region which intersect with community and tourism users will increasingly lead to higher road maintenance costs, reduced industry productivity and safety concerns.

The Leonora-Kalgoorlie-Boulder-Esperance heavy rail that intersects with the Perth-Kalgoorlie-Boulder-Adelaide network also performs an important transport function for the Region. This is particularly so with respect to transport of some reagents and products for certain sectors of the minerals industry, in addition to general freight for the Region's community and industry. While congestion on the rail network is currently limited, increasing volumes may result in congestion at certain bottlenecks on the network. Importantly, perceived high network charges are reportedly driving more freight onto road transport, further exacerbating the abovementioned issue.

Servicing the Region's large number of remote mining operations and the various towns is a network of around 26 aerodromes and airports, more than half of which are operated by mining companies. The two main public airports have experienced long-term growth in passenger throughput, with passenger numbers at the Kalgoorlie-Boulder Airport approaching a regulatory trigger that will see a significant airport infrastructure investment requirement, and while not as critical and different in terms of investment requirement, Esperance Airport is on a similar trajectory.

In terms of vessel calls and throughput, Esperance Port is one of Western Australia's smallest regional ports. However, it is one of few with dedicated container handling capacity and one of few deep-water ports along Australia's southern coast. Esperance Port is an important facilitator of input imports and product exports for the Region's grains industry, sectors of its minerals industry and minerals and timber industries that reside outside of the Region. The Port has both berthing and land constraints that can be tested at times of high throughput, while periods of low throughput can test the commercial sustainability of the Port operations. Ensuring a commercially sustainable Esperance Port that is able to meet the Region's maritime logistics needs cost competitively, will be important to maintaining productivity in the Region's grains industry and key sectors of its minerals industry.

Services Infrastructure

Universal access to high quality and affordable telecommunications and digital connectivity is naturally limited by the Region's geographical expanse and sparsely distributed population and industry. This impacts all sectors of the Region's economy as well as remote communities. However, from an economic perspective, its impact is most severely felt by the grains sector whose productivity growth is increasingly dependent on digitally enabled farming equipment and systems.

For a relatively remote region, as a result of decades of ongoing infrastructure investment reticulation of natural gas across the GVROC Region is reasonably extensive. Nevertheless, the vast nature of the Region's landscape means that many energy intensive minerals projects still do not have direct access to natural gas, rendering them dependent on trucked LNG or diesel to meet energy requirements, which approximately doubles their energy costs.

While geographically speaking, the majority of the Region is not serviced by the South West Interconnected System (SWIS), the majority of its population's electricity needs are, with the remainder of the Region reliant on isolated systems operated by Horizon Power or proprietary generation assets. The Goldfields-Esperance Region is on the fringe of the SWIS resulting in relatively high electricity costs and frequent outages. Ultimately, solutions to this will most likely be in the form of specific distributed energy generation and storage systems that will be identified from the Western Australian Government's Energy Transformation Taskforce.

Water supply to the Region is either from the C.Y. O'Connor Perth to Kalgoorlie water pipeline or from a limited number of ground-sources, some of which require desalination. As a result of water scarcity, around 42 percent of waste water in the Region is recycled and water costs are relatively high.

Approximately 75 percent of waste generated in the Region goes to local landfill. There are around 75 separate waste management facilities across the Region, with the majority of those operated by mining companies for their exclusive use. Across the Region a number of facilities are reaching capacity creating scope for a potential regionally coordinated and optimised waste management solution.

Industrial Land, Housing and Labour

Availability of fit-for-purpose, affordable and serviced industrial land, as well as the ability to be flexible in zoning Crown land for industrial purposes is somewhat limited in the major population centres of Kalgoorlie-Boulder and Esperance. Both centres are examining options to address this issue, with towns in closer proximity to these major centres also looking to establish industrial areas.

Outside of Kalgoorlie-Boulder and Esperance, the quality of housing stock in most towns is problematic rendering it difficult to attract a resident workforce.

High employment rates across most of the Region is resulting in labour markets across most job categories being tight. As part of a solution, several local governments in the Region have entered into a Designated Area Migration Agreement with the Australian Government that covers over 70 specific occupations in the minerals, agriculture, hospitality and human services sectors.

Soft Infrastructure

The main population centres of Kalgoorlie-Boulder and Esperance offer a range of options in private and public K-12 education, with most other major towns having at least one k-12 option. However, across the region a limited number of child-care places is problematic.

From a higher education perspective, while local course offerings are limited, the Western Australian School of Mines Kalgoorlie campus is an iconic tertiary education facility and the Rural Clinic School has a significant presence in the Region. From a vocational education and training perspective, the Region is serviced by a Kalgoorlie-Boulder campus of Central Regional TAFE and the Esperance campus of South Regional TAFE, both delivering a wide portfolio of programs, or able to rapidly activate programs in response to demand. Optimising the education precinct in Kalgoorlie-Boulder, better integrating training and education with industry in the Region and developing and implementing new curriculum that supports more technology oriented jobs in mining and agriculture are training and education initiatives that are priorities for the Region and currently underway.

Primary healthcare facilities in the Region include the 106-bed Kalgoorlie Health Campus (which in addition to its own primary healthcare offerings services health infrastructure across the Region), 36-bed Esperance Health Campus and smaller regional hospitals in Leonora, Laverton and Norseman. Community Health Centres operate in most of the Region's main towns, as do primarily volunteer paramedic services. While Kalgoorlie-Boulder and Esperance have numerous general practitioners, and most towns have at least one, retaining general practitioners is generally problematic across the Region, and issue that is common to rural and regional Australia. Other healthcare challenges include servicing a greater incidence and breadth of mental health cases, servicing dental care needs, ensuring adequate paramedic and aged care capacity.

Towards Regional Infrastructure Investment Priorities

Informed by the context and issues detailed in this study, and underpinned by statutory and other obligations, the members of GVROC have a sound basis on which to establish specific infrastructure priorities. For infrastructure that spans multiple Local Government Areas, GVROC working in collaboration with Regional Development Australia: Goldfields-Esperance and the Goldfields-Esperance Development Commission provides a robust forum for identifying, agreeing and pursuing shared infrastructure priorities.

Working together to pursue cross-regional priorities that are grounded in the evidence-base provided by this study will optimise the competitiveness of infrastructure investment proposals targeted at industry, the Western Australian Government and/or Commonwealth Government.

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1. About this Infrastructure Strategy Opportunities Identification Study

KEY POINTS

The Goldfields Voluntary Regional Organisation of Councils (GVROC) is a cooperative arrangement between the local governments that comprise the Goldfields-Esperance Region as well as the Shire of Wiluna that is formed to facilitate, among other things, a collaborative mechanism for the local governments to address region-wide issues.

Increasing production from the Goldfields-Esperance gold, battery and technology minerals and grains sectors is driving increased demand for shared infrastructure and changing the nature of infrastructure demand across the Region.

Building on existing economic development plans, existing information pertaining to current and future usage and status of infrastructure as well as consultation with users and managers of infrastructure in the Region, this infrastructure strategy opportunities identification study assesses current and anticipated future infrastructure usage, suitability of existing infrastructure and identifies opportunities for future Regional infrastructure investment.

1.1. What is GVROC?

The Goldfields Voluntary Regional Organisation of Councils (GVROC) is a non-legislative, co-operative arrangement between the nine local governments that comprise the Goldfields-Esperance Region of Western Australia (see Section 0) and the Shire of Wiluna. As with other Voluntary Regional Organisation of Council's, the purpose of GVROC is to provide a forum and platform from which these ten local governments can:

- Assess and advocate for issues that impact the wider GVROC Region to the Western Australian and Australian Governments;
- Facilitate planning and economic development for the wider GVROC Region; and
- Promote the GVROC Region more generally.

The nature of infrastructure in the GVROC Region is such that much of the infrastructure and its users transect local government boundaries, connecting local government areas, their population centres and industry intra and extra-regionally. As such, the development of a regional infrastructure strategy opportunities identification study is very much a project that fits within the remit of GVROC.

1.2. What is Regional Development Australia: Goldfields-Esperance

Regional Development Australia (RDA) is an Australian Government initiative that brings together all levels of government to enhance the development of Australia's regions. This is facilitated by a network of 52 RDA Committees comprised of local leaders who work with all levels of government, business and community groups to support the development of their regions. RDA: Goldfields-Esperance (RDAGE) is the RDA Committee with responsibility for the Goldfields-Esperance Region.

Each RDA Committee is supported by an executive and has a mandate to consult and engage with communities, promote and participate in regional programs and initiatives, provide information and advice on their region to all levels of government and support informed regional planning. As such, the development of a regional infrastructure strategy is a project that also fits within the remit of RDAGE.

1.3. What is an infrastructure strategy?

The term 'infrastructure' refers to the capital assets and institutions that underpin the operations of a society and its economy. Infrastructure can be broadly categorised as:

- **Hard infrastructure** – which refers to physical capital assets of this nature such as road, rail, ports, airports, energy generation and distribution systems, telecommunication networks, water distribution systems and waste management systems.
- **Soft infrastructure** – which refers to institutional assets that provide civic services such as education, health care and law and order services.

An infrastructure strategy:

- Identifies current and future infrastructure needs of a region's society and industry;
- Identifies the capacity and capability of a region's existing hard and soft infrastructure portfolio;
- Assesses current and future demand for specific elements of that infrastructure portfolio;
- Identifies current and potential future deficiencies in infrastructure with respect to that demand; and
- Prioritises investments in existing and future infrastructure that are designed to ensure that the infrastructure portfolio remains fit-for-purpose with respect to society and industry needs.

By identifying opportunities for investments to address infrastructure bottlenecks and/or enhance regional productivity, this infrastructure strategy opportunities identification study is the first step in developing a full infrastructure strategy for the Region.

1.4. Why is an infrastructure strategy needed for the GVROC Region?

There is an existing infrastructure portfolio

The Goldfields-Esperance Region (see Section 0) is one of Western Australia's oldest and most established regions. It has been the subject of periods of substantial population and industrial growth (and contraction) since the late 1800s. Today, by regional Western Australian standards, it is relatively populated (albeit the population is geographically concentrated within the Region) and industrialised.

The regional capital of Kalgoorlie-Boulder is Western Australia's fifth largest regional city (behind Bunbury, Busselton, Geraldton and Albany[1]). Almost exclusively as a result of the minerals industry (see Section 3), particularly the central and northern areas of the Region are characterised by a large number of capital intensive industrial operations. While there are some minerals operations (including significant operations) in the southern areas of the Region, the south of the Region can

[1] Mandurah is also considered a regional city and is larger than Kalgoorlie-Boulder. However, for the purposes of a practical assessment of infrastructure, Mandurah is generally considered and outer extension of Perth.

be distinguished by its agricultural, particularly grains, sector (see Section 4). Conversely, the north-eastern area of the Region is currently sparsely populated with limited industry.

Across the Region, other important but relatively smaller sectors such education, human service delivery, manufacturing, professional services, seafood and tourism collectively make a significant contribution to the economy and local employment. In most cases the businesses and organisations that comprise these other sectors demonstrate significant direct or indirect dependence on the Region's cornerstone minerals and agricultural industries.

As a result of this profile there are significant parts of the Region that are characterised by a relatively established portfolio of hard and soft infrastructure, albeit the suitability of some legacy infrastructure is variable across the Region. However, like many other Regions in Western Australia, there are areas that have little or no infrastructure.

There is a high prevalence of shared infrastructure

Much of the GVROC Region's infrastructure is 'shared infrastructure'. That is, it is largely public infrastructure that is utilised by multiple participants in a particular sector and across sectors, as well as the local community. Alternatively, it is private or 'partly-privatised' infrastructure that services multiple clients within and across sectors of the local economy. These circumstances are somewhat in contrast to the State's other major regional minerals economy, the Pilbara Region, where while there is some shared-infrastructure, the major operations operate proprietary road, rail, port and energy facilities that are designed specifically to optimise the delivery of logistics, energy and other service requirements of their operations.

Demand for shared infrastructure in the Region is changing

In recent years there has been a notable increase in production of gold and various minerals used in the manufacture of lithium-ion batteries and other technology products across the Region. At the same time, grains production has increased in the southern areas of the Region. This is, and will likely continue to, result in both increased demand for shared infrastructure, as well as a shift in the nature of the usage of that shared infrastructure.

The Region's fundamental economic viability and opportunities to expand into downstream processing and diversify the regional economy are critically dependent on the extractive and primary production operations of Region's cornerstone minerals and agricultural sectors remaining competitive in the global markets they service.

Ensuring shared infrastructure remains fit-for-purpose and competitive is a paramount concern to local governments across the Region

Therefore, ensuring that Regional infrastructure remains fit-for-purpose and cost effective is of critical importance. It is also important that the usage of shared infrastructure by these important sectors does not unduly compromise other important sectors of the Regional economy, or the quality of life and public amenity experienced by the residents of the Region. A key factor distinguishing the Goldfields-Esperance Region from the State's other major minerals province, the Pilbara Region, is the extent to which infrastructure is shared between the mining, agriculture, tourism and community sectors. As such, any consideration of the infrastructure needs of one sector, must also consider the needs of the sectors with which it shares that infrastructure.

The cyclical nature of the GVROC Region's economy undermines confidence in infrastructure investment decisions

Adding to complexity that is derived from the shared nature of most infrastructure in the GVROC Region are challenges associated with assessing long-term demand for infrastructure. Not only is most infrastructure shared by multiple users who may, for a variety of reasons, come and go or vary their usage of infrastructure, but periods characterised by low commodity prices can see dramatic decline in usage of infrastructure as production volumes decrease, operations are placed in care-and-maintenance and staff numbers are reduced.

This environment of uncertainty renders it difficult to develop 'bankable' business cases for particularly large, 'step-change' infrastructure investments in the GVROC Region, with most 'bankable' investments being incremental in nature.

In recognition of the changing profile of demand for infrastructure in the GVROC Region, as well as the fact that infrastructure is a cross-regional and complex issue, GVROC and RDAGE have commissioned the development of this infrastructure strategy opportunities identification study to inform the prioritisation of infrastructure investment actions and to identify opportunities for cross-government and cross-sector investment in priority infrastructure projects.

1.5. Other regional development plans

Like many regional jurisdictions across Australia, the GVROC Region has a long history of economic development plans. This infrastructure strategy options identification study builds on the knowledge generated from prior economic development plans.

It also acknowledges and seeks to align with the themes and priorities of strategies that are currently the focus of key regional governance institutions, particularly the Goldfields-Esperance Regional Investment Blueprint and the Growing Kalgoorlie-Boulder Growth Plan. Fit for purpose and efficient regional infrastructure is fundamental to the economic growth and quality of residential life that these strategies seek to address.

Goldfields-Esperance Regional Investment Blueprint

Developed under the previous Western Australian Government and administered by a Western Australian government instrumentality, the Goldfields-Esperance Development Commission (GEDC), the Goldfields-Esperance Regional Investment Blueprint is a 'roadmap' for the social and economic growth and prosperity of the Goldfields-Esperance Region out to 2050.

The key elements of the Goldfields-Esperance Regional Investment Blueprint are summarised in the following Table 1[2].

[2] Goldfields-Esperance Development Commission (2015), *Goldfields-Esperance Regional Investment Blueprint*, Government of Western Australia

TABLE 1 – KEY ELEMENTS OF THE GOLDFIELDS-ESPERANCE REGIONAL INVESTMENT BLUEPRINT

<table>
<tr><th colspan="2">Regional Vision</th></tr>
<tr><td colspan="2">In 2050, the Goldfields-Esperance Region enjoys exceptional lifestyle opportunities and a prosperous, diverse economy built upon our skills, natural resources and rich cultural heritage.</td></tr>
<tr><th colspan="2">Regional Aspirations</th></tr>
<tr><td>Knowledge Based</td><td>With greater business sophistication, innovation, education, networking and partnerships supported by the creation and growth of local businesses that export their services and products across the nation and internationally.</td></tr>
<tr><td>Globally Connected</td><td>Where world class, affordable logistics for existing and emerging industry and digital technologies have expanded global trade of services, creative industries and professional expertise.</td></tr>
<tr><td>Economically Diverse and Resilient</td><td>Where economic growth is achieved by supporting emerging and existing industries and building on a capable and innovative small business sector. Professionals and new residents are attracted and retained to live, work and study in the Region.</td></tr>
<tr><td>Inclusive</td><td>Where the Region's residents and businesses are at the forefront of initiatives that ensure equal opportunity, with enhanced opportunities enabling residents to reach their potential as an integral part of the Region's development, valuing and strengthening the Region's culture and society.</td></tr>
<tr><td>Sustainable and Renewable</td><td>Where the Region's unique natural assets are valued, alternative and renewable energy sources are exploited and waste and soil management are optimised.</td></tr>
<tr><td>World Renowned</td><td>Where the Region is globally recognised for its major industries, products, services, experiences and business expertise; where local industries are early adopters of new and emerging technology, where the Region is considered an attractive destination in which to live, work and do business.</td></tr>
<tr><th colspan="2">Challenges to Growth and Comparative Advantages</th></tr>
<tr><th>Challenges</th><th>Advantages</th></tr>
<tr><td>▪ Equity of opportunity
▪ Geography (isolation)
▪ Boom & bust cycle
▪ Land use conflicts
▪ Primary production costs
▪ Population retention & attraction
▪ Skills requirement
▪ Digital readiness</td><td>▪ Primary industry innovation
▪ Natural resources & assets
▪ Strategic location
▪ Skilled, experienced and diverse workforce
▪ Geography
▪ Culture & heritage
▪ Logistics infrastructure & access</td></tr>
</table>

Regional Priorities
Enhancing regional living Enabling infrastructure Fostering an innovative economy

Growing Kalgoorlie-Boulder Growth Plan

Initiated under the previous and concluded under the current Western Australian Government, the Growing Kalgoorlie Boulder Growth Plan was conducted in accordance with a State Government policy platform designed to identify major regional towns and cities and put in place a 'community-owned' strategy to grow and improve the liveability of those key regional population centres. These strategies have also been developed for Albany, Broome, Busselton, Carnarvon, Greater Bunbury, Greater Geraldton, Kununurra and Mandurah.

The Growing Kalgoorlie-Boulder Growth Plan was launched in mid-2017, with the City of Kalgoorlie-Boulder as its custodian. It has the specific objectives of:

- Strengthening the City of Kalgoorlie-Boulder's capacity to drive long term investment, business and employment growth;
- Delivering population growth that is generated by sustainable economic growth; and
- Supporting the efficient and effective delivery of development effort and investment.

To these ends, the Growing Kalgoorlie-Boulder Growth Plan is designed to achieve three strategic themes for the City by focusing on initiatives in seven priority areas. This framework is summarised in the following Figure 1[3].

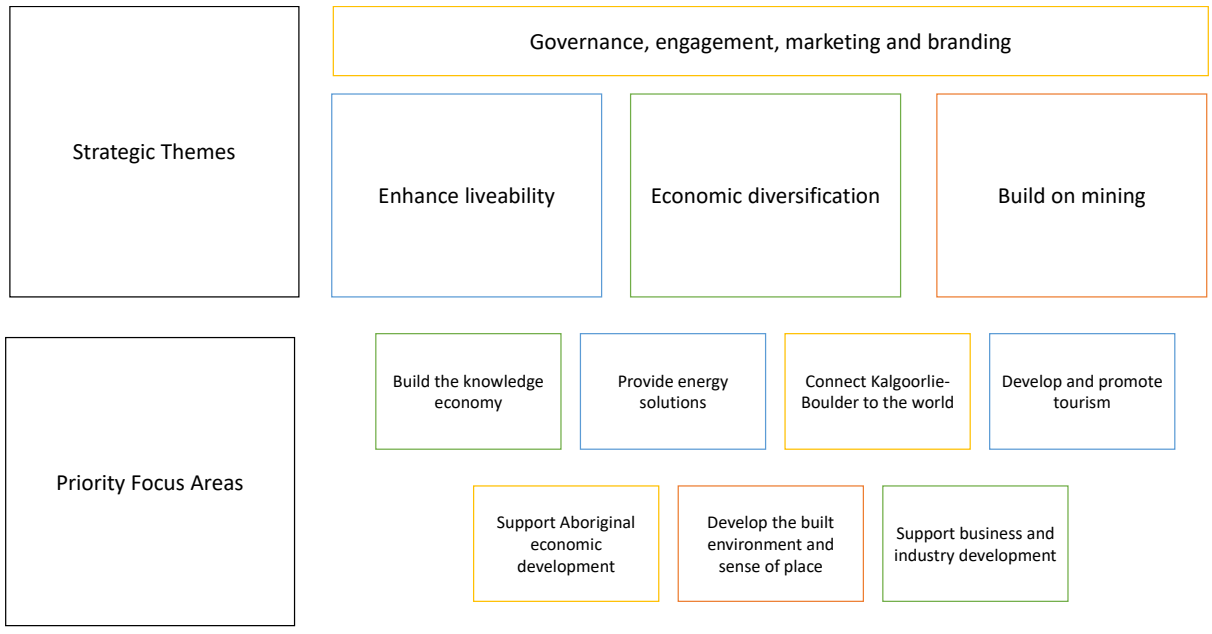


FIGURE 1– KEY ASPECTS OF THE GROWING KALGOORLIE-BOULDER GROWTH PLAN

[3] Kalgoorlie-Boulder Growth Plan Partnership (2017), *Growing Kalgoorlie-Boulder*, City of Kalgoorlie-Boulder

1.6. Methodology used to develop this infrastructure opportunities identification study

In addition to knowledge acquired from review of the development plans discussed in Section 1.5, the analysis in this infrastructure opportunities identification study is based on review of other historical infrastructure strategies and infrastructure related assessments undertaken for the GVROC Region, socio-economic and other data and statistical information that is relevant to current and future infrastructure usage, and direct consultation with approximately 40 infrastructure managers, users and experts (see Appendix 1). A draft of this strategy was also reviewed by a wide range of stakeholders in infrastructure in the GVROC Region.

The overall methodology used to develop this infrastructure strategy is illustrated in Figure 2 below.

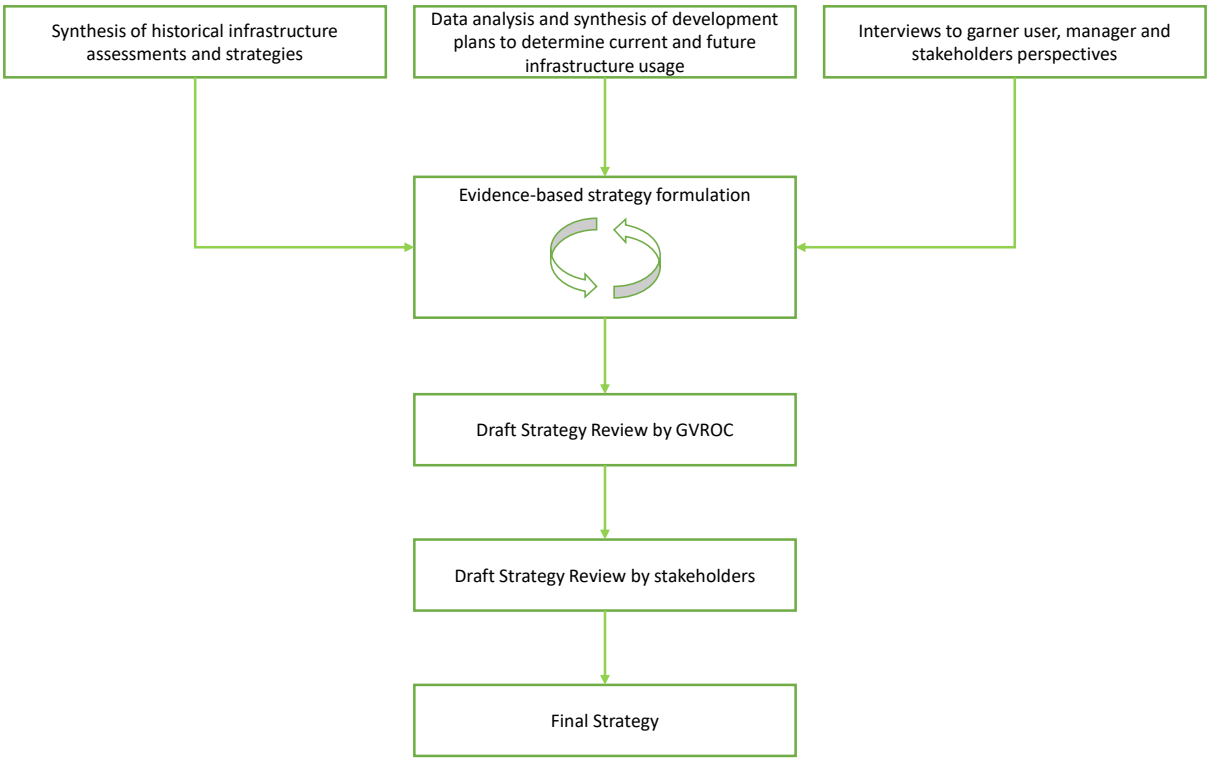


FIGURE 2 – METHODOLOGY USED TO DEVELOP THE STRATEGY

1.7. Structure of this infrastructure opportunities identification study

The description, analysis and strategy preparation pertaining to a diverse and large infrastructure portfolio such as that of the GVROC Region is a significant task, resulting in somewhat voluminous outputs. The community of interest in this infrastructure portfolio is similarly diverse. With these circumstances in mind, this infrastructure opportunities identification study has been structured using a systemic flow of analysis, supported by detailed appendices so that different users of the strategy can efficiently navigate the document for their specific purposes.

The structure of this strategy is summarised in the following Table 2.

TABLE 2 – STRUCTURE OF THIS INFRASTRUCTURE OPPORTUNITIES IDENTIFICATION STUDY

Section	Description	Page	Relevant Appendices
2	**The GVROC Region** This section provides a largely statistically driven overview of the GVROC Region, its community and the economy that supports that community. It also identifies key community issues that must be taken into consideration in the formulation of a regional infrastructure strategy.	10	2
3	**The GVROC Mining and Minerals Processing Industry** This section provides a detailed overview of trends and current status of minerals production and processing in the GVROC Region. It discusses the main projects that are driving growth and changing demand for shared infrastructure, and identifies key infrastructure related challenges to sector growth and productivity.	36	3 and 4
4	**The GVROC Agricultural Industry** This section provides an overview of the current status of and trends in agricultural production from the GVROC Region. It has a particular focus on the grain sector and its likely impact on demand for shared infrastructure in the Region	66	n.a.
5	**The GVROC Tourism Industry** This section provides an overview of the current status of visitation and tourism in the Region, the Region's main tourism assets and how patronage of the sector impacts on shared infrastructure.	78	n.a.
6	**Transport and Logistics Infrastructure** This section describes in detail the status and usage of the Region's road, rail, aviation and maritime transport and logistics networks and identifies issues associated with that infrastructure in the context of the analysis in Sections 2, 3, 4 and 5.	94	5,6 and 7
7	**Services Infrastructure** This section describes in detail the status and usage of the Region's natural gas, electricity, water, waste water and waste management infrastructure and identifies issues associated with that infrastructure in the context of the analysis in Sections 2, 3, 4 and 5.	124	8
8	**Industrial Land, Housing and Labour** This section discusses the current availability of industrial land, housing and labour across the Region and issues associated with these markets in the context of the analysis in Sections 2, 3, 4 and 5.	157	

Section	Description	Page	Relevant Appendices
9	**Soft Infrastructure** This section discusses the status, plans and identified needs for primary and secondary education, vocational education and training, higher education, healthcare and law and order in the Region. It also identifies key issues associated with that infrastructure in the context of the analysis in Sections 2, 3, 4 and 5.	162	9
10	**Infrastructure Planning Priority Actions** This section sets out the key priority infrastructure planning issues for the GVROC Region based on this analysis.	178	

2. The GVROC Region and its Community

KEY POINTS

The GVROC Region is comprised of the nine Local Government Areas that comprise the Goldfields-Esperance Region, as well as the Shire of Wiluna.

Covering one-third of the State's landmass, the Goldfields-Esperance Region is the State's largest Region, with 50 percent of the Region the subject of determined Native Title. Inclusion of the Shire of Wiluna for the purposes of defining the GVROC region, renders GVROC by far the largest WALGA Zone.

Approximately 80 percent of the Region's population, 70 percent of jobs and 87 percent of businesses are concentrated in the two most populous Shires, with a significant portion of the Region's Indigenous population residing in more remote towns and communities across the Region.

A further 23 percent of jobs in the Region are located in the minerals industry intensive Shires of Laverton, Leonora and Coolgardie.

The Region accounts for approximately 3 percent of State GDP, with its dominant minerals sector accounting for 80 percent of regional exports, one-third of all regional jobs and 45 percent of the Region's total payroll.

Key community development issues include enhancing the industry-community interface, creating stronger small communities, achieving enhanced liveability across the Region and greater Indigenous economic and social participation.

The GVROC Region is comprised of ten Local Government Areas (LGAs), namely the City of Kalgoorlie-Boulder and the Shires of Coolgardie, Dundas, Esperance, Laverton, Leonora, Menzies, Ngaanyatjarraku, Ravensthorpe and Wiluna. Nine of these LGAs comprise the Goldfields-Esperance Region, with the Shire of Wiluna located in the adjacent Mid West Region.

Illustrated in Figure 3 below, the Goldfields-Esperance Region of Western Australia is located in the southeast corner of the State. Incorporating an area of some 771,276 square kilometres, it represents approximately one-third of Western Australia's total landmass[4]. Geographically, it is the largest of Western Australia's nine regional areas as defined by the *Regional Development Commissions Act 1993* (WA), and is bounded by the Pilbara Region to the north, Wheatbelt, Mid West and Great Southern Regions to west, South Australia and Northern Territory to the east and the Southern Ocean to the South.

[4] Regional Development Australia Goldfields-Esperance

FIGURE 3 – THE GOLDFIELDS-ESPERANCE REGION

The Shire of Wiluna is located on the northern boundaries of the Shires of Leonora and Laverton and to the west of the Shire of Ngaanyatiarraku, and covers an area totalling 181,297km^2.[5] As illustrated in Figure 4[6] below, the integration of the geographically large Shire of Wiluna with the Goldfields-Esperance Region shires for the purposes of defining the GVROC Western Australian Local Government Association (WALGA) Zone, results in the GVROC Region being by far the largest WALGA Zone.

[5] Australian Bureau of Statistics (2018), *Regional Population Growth: Estimated Residential Population by Local Government Areas*, Cat. 3218.0, Australian Government, Canberra
[6] Western Australian Local Government Association

FIGURE 4 – GVROC WALGA LOCAL GOVERNMENT ZONE

The distribution of the GVROC Region over two Regional Development Commission boundaries presents difficulty to some aspects of the analysis in this report. Some third-party statistics and data used in this Study[7] is sourced and presented as aggregated data at a regional level aligned with the Regional Development Commission boundaries, and is not adequately granular to facilitate individual LGA level resolution. In these cases, because Wiluna is located in the neighbouring Mid West region along with 18 other local governments, it is difficult to extrapolate out individual data for the Shire of Wiluna with any degree of accuracy. This means that in some instances, individual analysis of Wiluna or the entire GVROC area has has not been possible. Where this is the case, it is noted throughout this report.

[7] Such as those sourced from the Regional Development Commissions, WA State Government Departments, ABARES and the ABS.

Overall, large areas of the GVROC Region are the subject of prospecting, exploration, mining and pastoral leases over Crown land, while freehold agricultural tenure is extensive in southern areas of the Region. As discussed in detail in Section 2.2, increasing areas within the Region are the subject of native title.

2.1. Regional population dynamics

2.1.1. Population trends

Based on official estimates that are derived from the Australian Bureau of Statistics Census data[8], the current residential population of the GVROC Region is approximately 55,000. As a result of the significant Fly-In-Fly-Out (FIFO) workforce that operates in the Region and which is primarily (but not exclusively) associated with the Region's minerals industry, the total service population is larger. However, while some of this FIFO workforce resides on a rotational basis in Regional population centres, a significant portion reside in work camps located on remote mine sites utilising limited if any public infrastructure.

It is typical of regional economies that are dependent on the mining industry to demonstrate significant population volatility that is a result of the naturally cyclical nature of the industry. The Region is somewhat of an anomaly in this regard. While the residential population is certainly responsive to mining industry activity, over the past decade population has remained relatively stable at between 50,000 and 60,000 residents. This is likely the result of an increasingly diverse Regional economy, the relative liveability of its main population centres, and the relative proximity to and ease of access from those centres to the Western Australian capital, Perth. As illustrated in Figure 5[9,10] below, based on current birth, mortality and immigration patterns, this is also a trend which, subject to an unanticipated change such as the commissioning of large resources projects in close proximity to major population centres that mandate a large residential workforce, is expected to continue into the foreseeable future.

[8] Australian Bureau of Statistics (2018), *Regional Population Growth: Estimated Residential Population by Local Government Areas*, Cat. 3218.0, Australian Government, Canberra

[9] Australian Bureau of Statistics (2018), *Regional Population Growth: Estimated Residential Population by Local Government Areas*, Cat. 3218.0, Australian Government, Canberra

[10] Western Australian Planning Commission, *Western Australia Tomorrow Medium Term Population Forecasts* - (Median Forecast Projections based on historical fertility, mortality and migration trends)

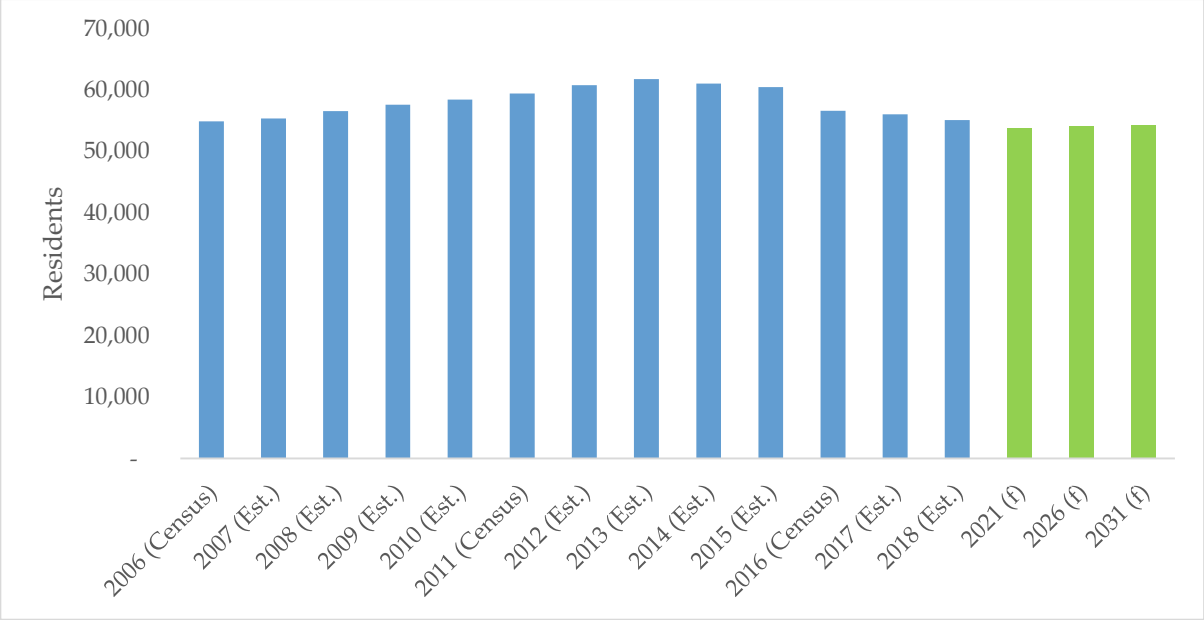


FIGURE 5 – Historical and Forecast Residential Population of the GVRIC Region

In 2018, it was estimated that just under 55 percent of residents of the GVROC Region lived in the regional centre of the City of Kalgoorlie-Boulder, with a further 25 percent in the coastal Shire of Esperance. The next most populated LGA is the Shire of Coolgardie, whose 3,500 residents represent approximately 6.3 percent of the Region's population. The Shires of Ngaanyatjarraku, Ravensthorpe, Leonora and Laverton each host between two and three percent of the Region's residential population, and the Shires of Dundas and Menzies, approximately 1 percent of the population each. The Shire of Wiluna hosts a similarly small residential population estimated at 706[11] people, projected by the Planning Commission[12] to decrease steadily to 560 in 2021, 495 by 2026, and 410 by 2031.

As illustrated in Figure 6 below, this concentration of population is a trend that is expected to continue. While the development or expansion of large resources projects with a large residential workforce in close proximity to other towns may slightly change the distribution of population across the Region, such an eventuality is unlikely to result in a dramatic geographical redistribution of the Region's residential population.

[11] Australian Bureau of Statistics (2018), *Regional Population Growth: Estimated Residential Population by Local Government Areas*, Cat. 3218.0, Australian Government, Canberra

[12] Western Australian Planning Commission, *Western Australia Tomorrow Medium Term Population Forecasts* - (Median Forecast Projections based on historical fertility, mortality and migration trends)

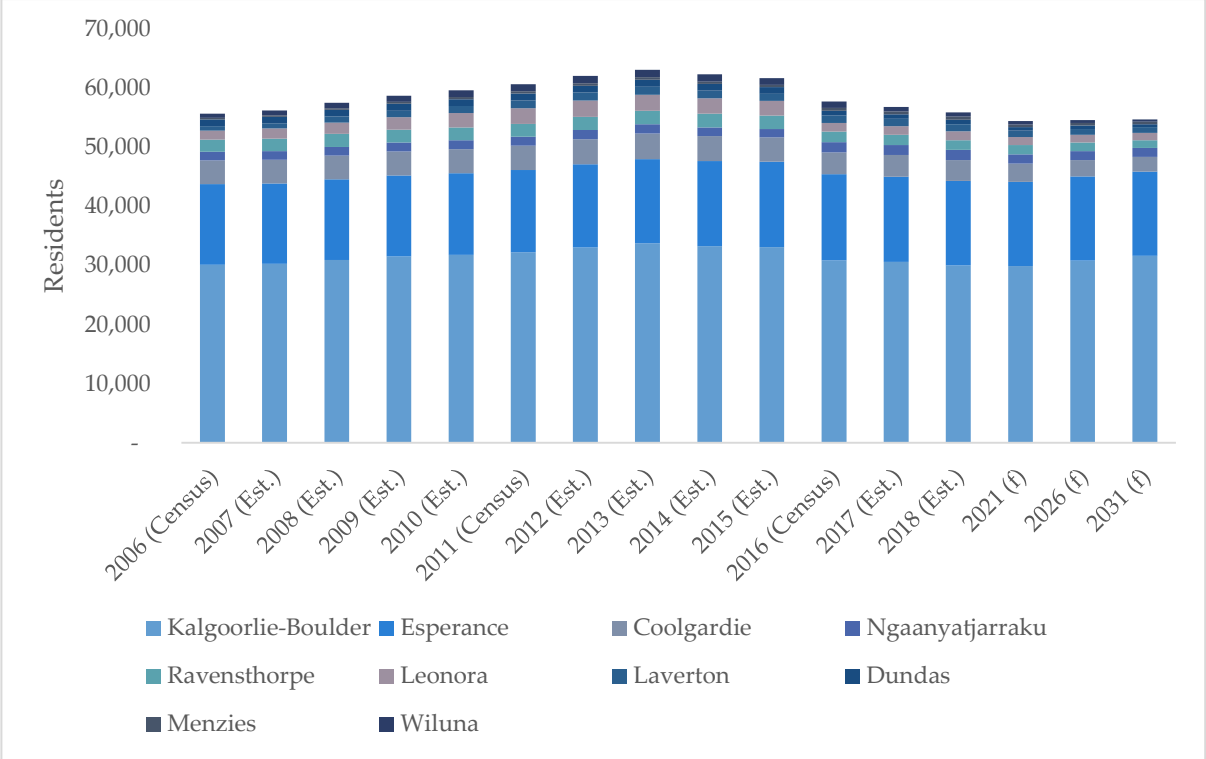


FIGURE 6 – Historical and Forecast Residential Population of the GVROC Region by Local Government Area

The City of Kalgoorlie-Boulder is a major regional service centre and from a residential population perspective, Western Australia's fifth largest regional centre behind Bunbury, Busselton, Geraldton and Albany[13].

The population of the GVROC Region is relatively young, with 23 percent of the Region's population being 15 years of age or younger, and only 10 percent being 65 years or older. The City of Kalgoorlie-Boulder, Shire of Coolgardie, Shire of Esperance and Shire of Ngaanyatjarraku each demonstrate a more youthful population compared to the State average. Whereas, the portion of the populations of the Shires of Dundas, Esperance and Ravensthorpe that is 65 years of age or older is higher than that State average.

At 5.1 percent, the unemployment rate across the Region is well below the State average. Most localities within the Region have an unemployment rate that is below or broadly equivalent to the State average, with the exception of the Shire of Naanyatjarraku, which has an unemployment rate that is more than twice the State average.

The following Table 3[14] summarises the population dynamics of the Region. Additional demographics are summarised in Appendix 2.

[13] City of Mandurah is also technically a regional centre and larger than Kalgoorlie-Boulder, but for the purposes of this analysis is considered an extension of the Perth metropolitan area.
[14] Australian Bureau of Statistics, 2016 Census Data

TABLE 3 – GVROC Region Population Dynamics

Local Government Area	2016 Population	Youth (0-15) (WA 20.5%)	Seniors (65+) (WA 14%)	Unemployment rate (WA 6.1%)
Coolgardie	3,613	24.61%	8.22%	7.31%
Dundas	767	13.17%	16.56%	5.92%
Esperance	14,238	22.28%	16.13%	3.80%
Kalgoorlie-Boulder	30,053	24.26%	6.97%	5.10%
Laverton	1,156	13.75%	4.93%	6.41%
Leonora	1,406	17.21%	6.33%	1.91%
Menzies	490	14.49%	8.16%	7.62%
Ngaanyatjarraku	1,606	26.15%	6.29%	14.19%
Ravensthorpe	1,732	18.53%	21.42%	4.51%
Wiluna	720	11.9%	5.4%	6.4%
GVROC Region	**55,061**	**23.0%**	**9.9%**	**5.1%**

2.1.2. The GVROC Aboriginal community

The geography of the Region includes the traditional lands of around 17 Traditional Owner Groups, approximately half of which have determined Native Title (see Section 2.2).

For at least 45,000 years the lands, inland waters, coastal areas and biodiversity of the GVROC Region have been a source of food, trade and commerce for the Aboriginal Traditional Owners of the Region. These natural resources are also fundamental to the spirituality and traditional custom and lore that the various Aboriginal language groups for whose Traditional Lands are within the boundaries of the GVROC Region continue to practice today.

The period of history of the GVROC Region that is characterised by non-Aboriginal settlement represents approximately 0.3 percent of Aboriginal history in the Region. This recent and relatively brief period of Aboriginal history has, like most other parts of Australia, been characterised in large part by violent occupation, subjugation and the imprisonment of large numbers of Aboriginal people; dispossession of lands and natural resources; destruction of cultural sites; and government assimilation policies that have permanently damaged many Aboriginal families and communities. Furthermore, policies of more recent decades that have sought to benefit Aboriginal people have, in many cases had the opposite effect, resulting in large numbers of Aboriginal people with relatively less socio-economic capacity, which in turn limits their ability to effectively engage with the economy, political process and development of regulatory and management frameworks that affect their lives.

Today, there are approximately 5,860 Traditional Owners of the Region and other Aboriginal and Torres Strait Islander people living in the Region[15], representing approximately 10 percent of the total population and around 5.4 percent of Western Australia's total Aboriginal population.

[15] Australian Bureau of Statistics, Census 2016

As with the non-Aboriginal population, the majority of the Region's Aboriginal residents live in the City of Kalgoorlie-Boulder and Shire of Esperance. However, the Aboriginal population is far less concentrated, with around one quarter of Aboriginal residents of the Region living in the Shire of Ngaanyatjarraku, and another quarter living in more remote towns and communities across the other Shires. The geographical distribution of the Aboriginal population of the GVROC Region is summarised in Figure 7[16] below.

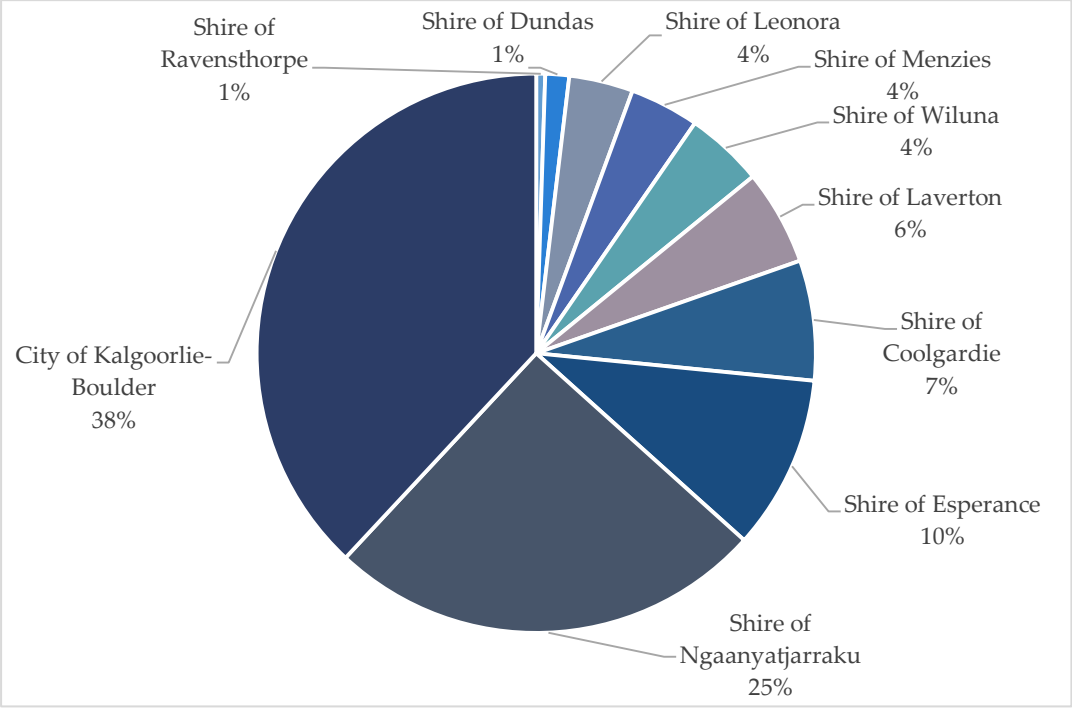


FIGURE 7 – Geographical Distribution of Aboriginal Residents of the GVROC Region

The portion of individual LGA populations that are Aboriginal is highly variable across the Region. Almost 90 percent of residents of the Shire of Ngaanyatjarraku, half the residents of the Shire of Menzies, approximately one-third the residents of the Shires of Wiluna and Laverton and around one-fifth of the residents of Leonora are Aboriginal. The Shire of Ravensthorpe has the lowest Aboriginal representation in its population, at around 2 percent, illustrated in Figure 8[17] below.

[16] Australian Bureau of Statistics, Census 2016
[17] Australian Bureau of Statistics, Census 2016

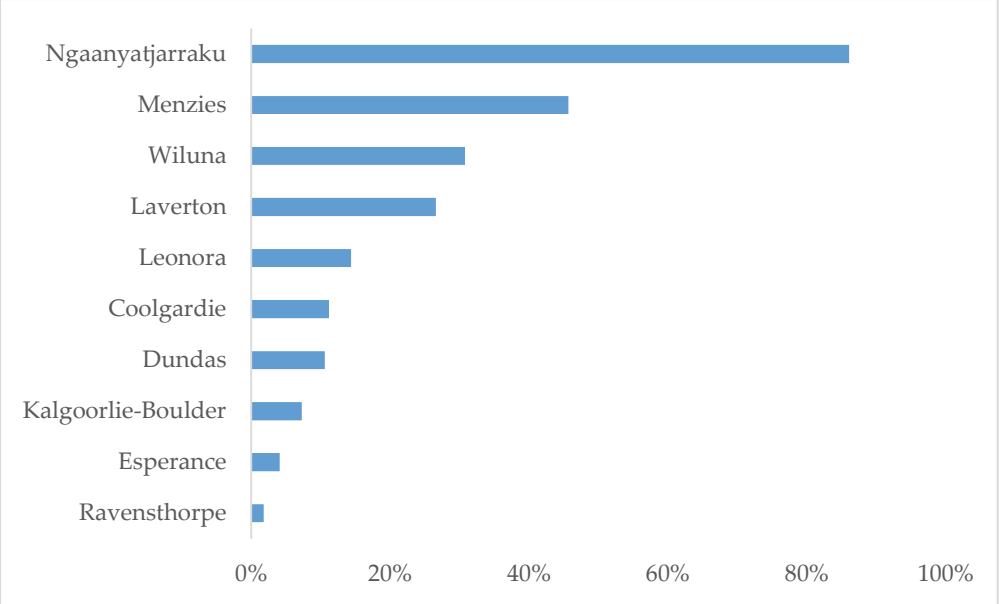


FIGURE 8 – Portion of Shire Population that is Aboriginal

There are at least 15 discrete Aboriginal communities and outstations in the Region, with approximately one-third of the Region's Aboriginal residents residing in these communities. As summarised in Table 4[18] below, over two-thirds of these discrete communities collectively accounting for an estimated 60 percent of Aboriginal people living in communities in the GVROC Region are located in the Shire of Ngaanyatjarraku.

[18] Western Australian Department of Planning, Lands and Heritage

TABLE 4 – Discrete Aboriginal Communities and Outstations in the GVROC Region

Community	Language	Est. Total Population	Est. Aboriginal Population	Est. Percentage Aboriginal
Shire of Ngaanyatjarraku				
Irrununtju (Wingellina)	Pitjantjatjara	179	159	89%
Mantamaru (Jameson)	Ngaanyatjarra	135	115	85%
Papulankutja (Blackstone)	Ngaanyatjarra	176	152	86%
Patjarr (Karliywara)	Pintupi	30	30	100%
Tjirrkarli	n.a.	n.a	n.a.	n.a.
Tjukural	n.a.	n.a.	n.a.	n.a.
Wanarn	Ngaanyatjarra	142	121	85%
Warakurna	Ngaanyatjarra	268	239	89%
Milyirrtjarra (Warburton)	Ngaanyatjarra	576	490	85%
Sub-total		1,506	1,306	87%
Shire of Menzies				
Tjuntjuntjarra	Pitjantjatjarra	184	163	89%
Marmion Village		n.a.	n.a.	n.a.
Sub-total		184	163	89%
Shire of Laverton				
Cosmo Newberry	Ngaanyatjarra	58	49	84%
Mount Margaret	Wangkatha	100	94	94%
Mulga Queen	n.a.	50	50	100%
Wongatha Wonganarra	n.a.	n.a.	n.a.	n.a.
Sub-total		208	193	93%
Shire of Leonora				
Nambi Village		302	~302	~100%
Shire of Coolgardie				
Kurrawang	Wangkatha	90	81	90%

Community	Language	Est. Total Population	Est. Aboriginal Population	Est. Percentage Aboriginal
City Kalgoorlie-Boulder				
Ningia Mia (Ninga Mia)	Wangkatha	56	48	86%
Coonana		83	~83	~100%
Sub-total		139	131	94%
Shire of Wiluna				
Bondini	n.a.	105	102	97%
Kutkabubba	n.a.	n.a.	n.a.	n.a.
Windida	n.a.	n.a.	n.a.	n.a.
Sub-total		105	102	97%
EST. TOTAL COMMUNITY POPULATION		**2,534**	**2,278**	**90%**

While data pertaining specifically the socio-economic status of Aboriginal residents of the GVROC Region is limited (see Appendix 2), it is clearly lower than the non-Aboriginal population of the Region.

2.2. Native Title and Aboriginal lands

In accordance with the *Native Title Act 1993* (Cth), determined Native Title rights must be held by a Prescribed Body Corporate on trust or as agent for the Traditional Owners of those rights. In the Goldfields-Esperance Region, such Prescribed Body Corporates currently exercise some degree of control over 55 percent of the 770,000 square kilometres of the Goldfields-Esperance Region. Furthermore, there are currently five Native Title Claims before the Native Title Tribunal, that if determined will result in a further estimated 15 to 20 percent of the Region being the subject of Native Title.

This subsection discusses the somewhat unique nature of the Ngaanyatjarra Lands Indigenous Estate, as well as other Native Title lands in the Region.

2.2.1. Ngaanyatjarra Lands

The governance and administration of the Ngaanyatjarra Lands are unique in Goldfields-Esperance Region, integrating a large Native Title determination, with independent communities and a local government.

Yarnangu Ngaanyatjarraku Parna Aboriginal Corporation RNTCB

The Ngaanyatjarraku native title determination is the largest in the Goldfields-Esperance Region, covering some 168,845 square kilometres in the north-eastern corner of the Region, representing approximately 22 percent of the total Goldfields-Esperance Region landmass. The claim was determined in two separate parts, with a larger Part A determination area awarded in 2005, and

a much smaller Part B determination area in 2008. These native title interests illustrated in Figure 9[19] below are held by the Yarnangu Ngaanyatjarraku Parna Aboriginal Corporation Registered Native Title Body Corporate (RNTBC).

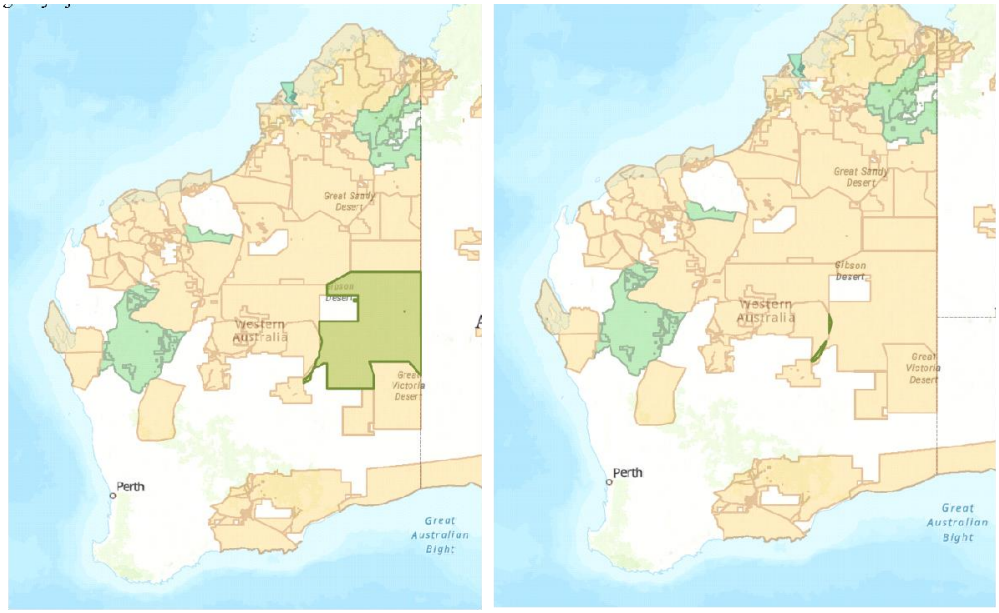


FIGURE 9– Ngaanyatjarra Part A and Part B Native Determination Area

Ngaanyatjarraku Aboriginal Council (Aboriginal Corporation)

Each of the Ngaanyatjarra communities is an autonomous entity operating a body that is incorporated either under the *Corporations (Aboriginal and Torres Strait Islander) Act* 2006 (Cth) and regulated by the Office of the Registrar of Indigenous Corporations, or the *Associations Incorporation Act 2015* (WA) and regulated by the Western Australian Department of Mines, Industry Regulation and Safety.

Specifically, the Ngaanyatkarraku Aboriginal Council represents the Ngaanyatjarra, Pintupi and Pitjantatjara Traditional Owner groups who reside in the communities of Warburton Irrunytju (Wingellina), Papuankutja (Blackstone), Mantamaru (Jameson), Warakurna, Tjirrkarli, Tjukural, Wanarn, Kiwirrkurra, Patjarr and Pira Kata (Kanpa) (see Table 4).

The purpose of the Council is to support the development of its members in relation to health, education, training and employment, housing, law and justice, finance, land management and commercial endeavours.

Shire of Ngaanyatjarraku

The Shire of Ngaanyatjarraku was created in July 1993 as an excised land area from the Shire of Wiluna, with its main administrative offices located in Warburton. The Shire is responsible for the provision of local government and the delivery of services to ten communities within the Shire's boundaries. These services include welfare, communication infrastructure, waste services, health, sports and recreation and community-based programs. The Shire also advocates for the community with the Western Australian and Australian Governments.

[19] National Native Title Tribunal

The communities within the Shire of Ngaanyatjarraku are illustrated in the following Figure 10[20].

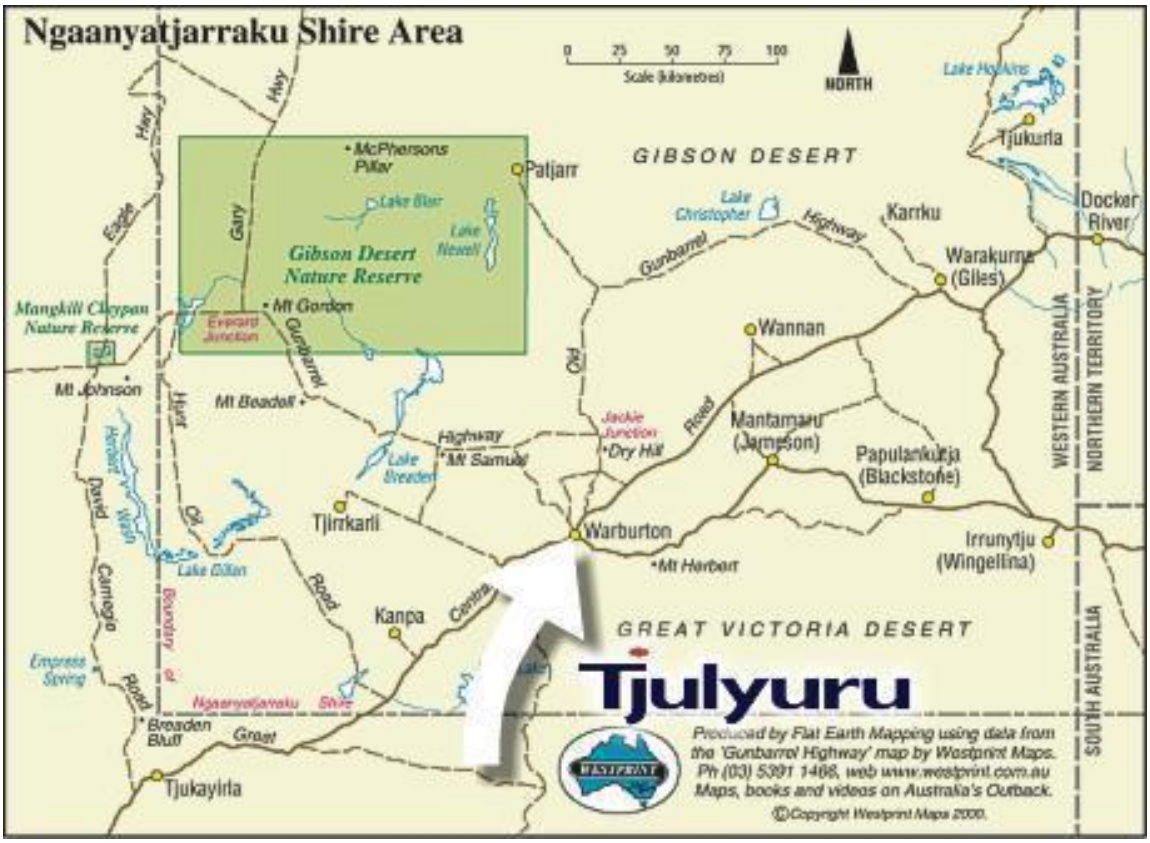


FIGURE 10 – Aboriginal Communities in the Shire of Ngaanyatjarraku

2.2.2. Other Native Title determinations and claims

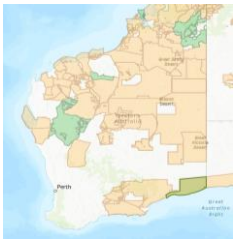
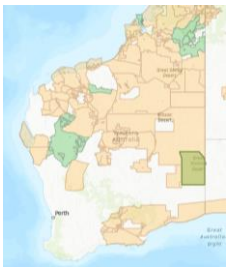
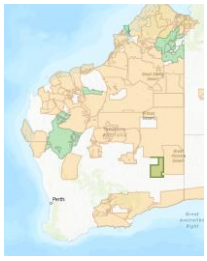
Native Title determinations

The following Table 5[21] summarises the existing Native Title determinations and the Prescribed Body Corporates holding those determinations in trust or agency on behalf of the Traditional Owners that are in addition to that which pertains to the Ngaanyatjarra Lands discussed in Section 2.2.1.

TABLE 5 – Native Title Determinations in the Goldfields Esperance Region

Native Title Determination Area	Prescribed Body Corporate
	**Ngadju Native Title Aboriginal Corporation** Claims pertaining 102,000 square kilometres of land in the south western portion of the Goldfields-Esperance Region, representing approximately 10 percent of the total landmass of the Goldfields-Esperance Region, were awarded to the Ngadju Traditional Owners in November 2014 and July 2017. The Ngadju Native Title determination includes exclusive Native Title over 41,300 square kilometres around the town of Norseman in the Shire of Dundas.

[20] Shire of Ngaanyatjarraku
[21] National Native Title Tribunal

Native Title Determination Area	Prescribed Body Corporate
	**Esperance Tjaltjraak Native Title Aboriginal Corporation** The Esperance Tjaltjraak Native Title determination covers 26,839 square kilometres around and primarily west of the township of Esperance, including 9,927 square kilometres of non-exclusive Native Title. The Esperance Tjaltjraak Native Title Corporation was incorporated in March 2015 to hold and manage these interests, with the six Noongar family groups who are the recognised Traditional Owners having representation on the Board.
	**Mirning Traditional Lands Aboriginal Corporation** The Mirning Native Title determination is located in the south eastern corner of the Goldfields-Esperance Region adjacent to the South Australian border. The 32,711 square kilometres of the determination was awarded by consent in October 2017 and is held by the Mirning Traditional Lands Aboriginal Corporation.
	**Pila Nguru Aboriginal Corporation** North of the Mirning Native Title determination also adjacent to the South Australian border is the Spinifex People's determination over 54,204 square kilometres that has been held by the Pila Nguru Aboriginal Corporation since 2001.
	**Kaltupakal Aboriginal Corporation** Established in 2016, the Kaltupakal Aboriginal Corporations holds the determine Native Title rights of the Pilki People. These rights pertain to an area of 17,885 square kilometres immediately west of the Spinifex People's determination.
	**Wakamurra Aboriginal Corporation** Wakamurra Aboriginal Corporation represents the Native Title interests of the Manta Rirrtinya people's determination, an area of 23,549 square kilometres in the northwest of the Goldfields-Esperance Region.

In the case of the Shire of Wiluna, four separate native title determinations cover almost the entire LGA. These determinations are summarised in the following Table 6.

TABLE 6 – NATIVE TITLE DETERMINATIONS IN THE SHIRE OF WILUNA

Marputu Aboriginal Corporation Established in 2017, the Marputu Aboriginal Corporation holds the rights of the Gingirana people to the 12,150 square kilometres of land located on the west boundary of the Shire of Wiluna.
Tjiwarl Aboriginal Corporation The 12,867 square kilometres of land represents the Native Title determinations Tjiwarl and Tjiwarl #2, and lies on the south west edge of the Shire of Wiluna. This Native Title was determined in April 2017.
Tarlka Matuwa Piarku Aboriginal Corporation The PBC represents the NT interests of the Wiluna people, determined in July 2013. This area covers 40,664 square kilometres in the Shire of Wiluna, to the north of the Gingirana Native Title. The Aboriginal Corporation also represents native title Wiluna #2, which lies in a similar region, determined in September 2013 and covering 5,603 square kilometres.
Mungarlu Ngurrarankatja Rirraunkaja Aboriginal Corporation (MNRAB) Established in June 2008, the native title of the Birriliburu People – Part A, is located centrally in the Shire of Wiluna, and covers an area of 66,558 square kilometres. This PBC also represents the native title interests for the determinations of Birriliburu People, Birriliburru #2, and Birriliburu #4, covering a relatively small 105 square kilometres in the Shire of Wiluna, and the Birriliburu #3 determination that covers 3,302 square kilometres, all finalised in June 2016.

Native Title claims

The following Table 7 summarises current claims as yet to be determined under the *Native Title Act 1993* (Cth) in the Goldfields-Esperance Region.

TABLE 7 – Native Title Claims in the Goldfields-Esperance Region

Claim Area	Claimant
	**Yilka and Yilka #2 and Sullivan Family** registered a claim over 12,239 square kilometres in the north western part of the Goldfields-Esperance Region in October 2017.
	**The Nyalpa Pirniku** people registered a claim over 30,884 square kilometres in the north western part of the Goldfields-Esperance Region in February 2019.

	**The Nantadjarra** people registered a claim over 57,134 square kilometres in the northern central part of the Goldfields-Esperance Region in July 2017.
	**The Tjalkadjara** people registered a claim over 24,248 square kilometres in the north western part of the Goldfields-Esperance Region in December 2018.
	**The Maduwongaa** people registered a claim over 25,476 square kilometres in the central western part of the Goldfields-Esperance Region in April 2017.
	**The Marlinyu Ghoorlie** people registered a claim over 98,639 square kilometres in December 2017, most of which is within the Wheatbelt Region, but partly in the Goldfields-Esperance Region
	**The Darlot** people registered a claim of 47,206 square kilometres in April 2018, which encompasses Leonora

In addition to the native title claims set out in Table 7 above, the Wakamurru Aboriginal Corporation registered a claim in May 2019 for an area covering 23,548 square kilometres stretching through the Shires of Wiluna, Laverton and Ngaanyatjarraku.

2.2.3. Goldfields Land and Sea Council

The Goldfields Land and Sea Council (GLSC) was a Native Title Representative Body established in accordance with the *Native Title Act 1993* (Cth) and recognised by the Commonwealth Department of Prime Minister and Cabinet as representing the Indigenous people of the Goldfields-Esperance area. In this capacity, its primary statutory function was to consult with and represent Traditional Owners within the Region with the objective of achieving meaningful Native Title outcomes and other land justice initiatives for Traditional Owners in the Region.

The GLSC performed a key role in achieving successful outcomes for the Ngadju, Esperance Noongars and Mirning claims under the *Native Title Act 1993* (Cth) (see Table 5), with these native title interests now represented by the relevant Prescribed Body Corporate.

The GLSC's NTRB role and funding ceased as of 1st July 2019, with the future entity to serve its former role and purpose unknown as of the date of writing.

However, the GLSC continues to provide a range of other services to Aboriginal people who are ordinarily resident in the Region. The GLSC is managed by an elected board, an executive committee and chief executive officer.

2.2.4. Aboriginal Ranger Programs

For over a decade the Goldfields Land Sea Council Ranger Program, under funding from the Western Australian Government, Australian Governments and others, has provided training and employment opportunities for local Aboriginal people through programs that apply traditional knowledge to natural resource management and conservation initiatives across the Region. As of December 2016, the Program employed 28 Rangers on a part-time, full-time or casual basis, and has secured State and Commonwealth funding commitments to underpin operations out to 2021.

Other Aboriginal ranger programs in the Region include the Desert Rangers, Ngadgju Rangers and the Tjaltjraak Ranger groups.

2.3. GVROC Local Government Fiscal Profiles

The ten local governments across the GVROC Region demonstrate quite different fiscal profiles. In 2017-18, the local governments of the two most populated Local Government Areas, City of Kalgoorlie-Boulder and Shire of Esperance, demonstrated both significantly higher rating receipts as well as other operational income than the other seven local governments. The ratings income of all other local governments in the Region is well below $10 million, with all but the Shire of Ravensthorpe and Coolgardie having total operating income above $10 million. The Shire of Nganyatjarraku is almost entirely dependent on non-rating operational income. The following Figure 11[22] summarises the 2017-18 operating income of GVROC members[23].

[22] Data sourced annual reports.
[23] 2017-18 Annual Reports for City of Kalgoorlie-Boulder, Shires of Leonora, Laverton, Dundas, Ravensthorpe, Coolgardie, Esperance, Nganyatjarraku, Wiluna; 2016-17 Annual Report for Shire of Menzies.

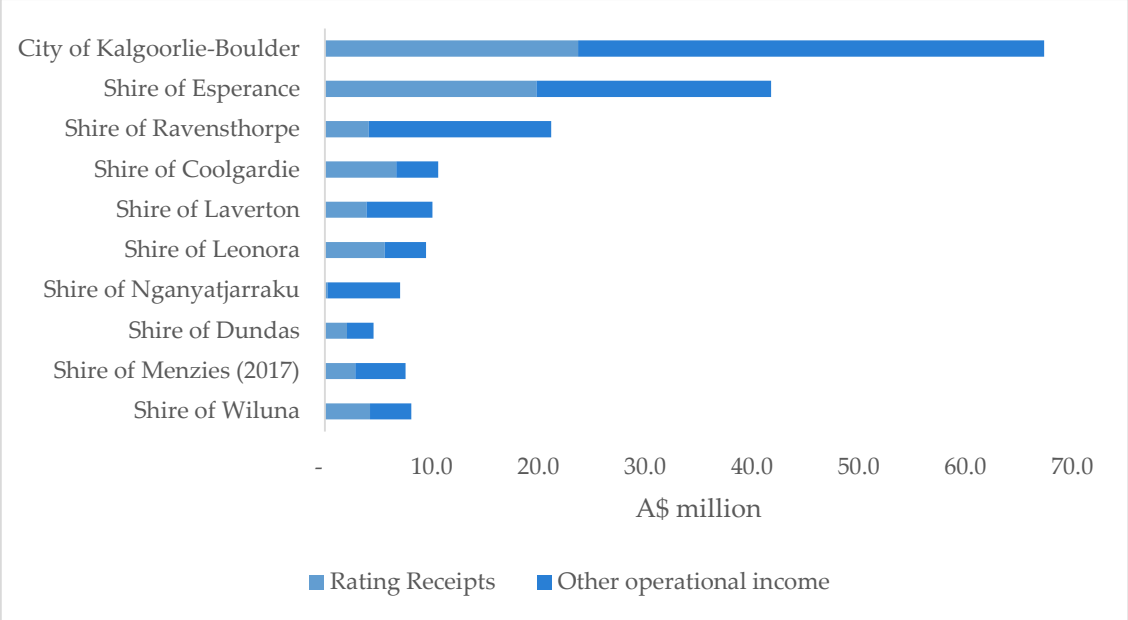


FIGURE 11 – Operating Income of the GVROC Region Local Governments (2017-18)

Figure 12 below compares the rating income in 2017-18 per resident for each GVROC member, and serves to illustrate the extent to which all of the local governments, with the exception of the City of Kalgoorlie Boulder and Shire of Esperance, are dependent on non-residential ratings, particularly ratings pertaining to mining operations and in the case of Ravensthorpe, freehold broad-acre farming operations.

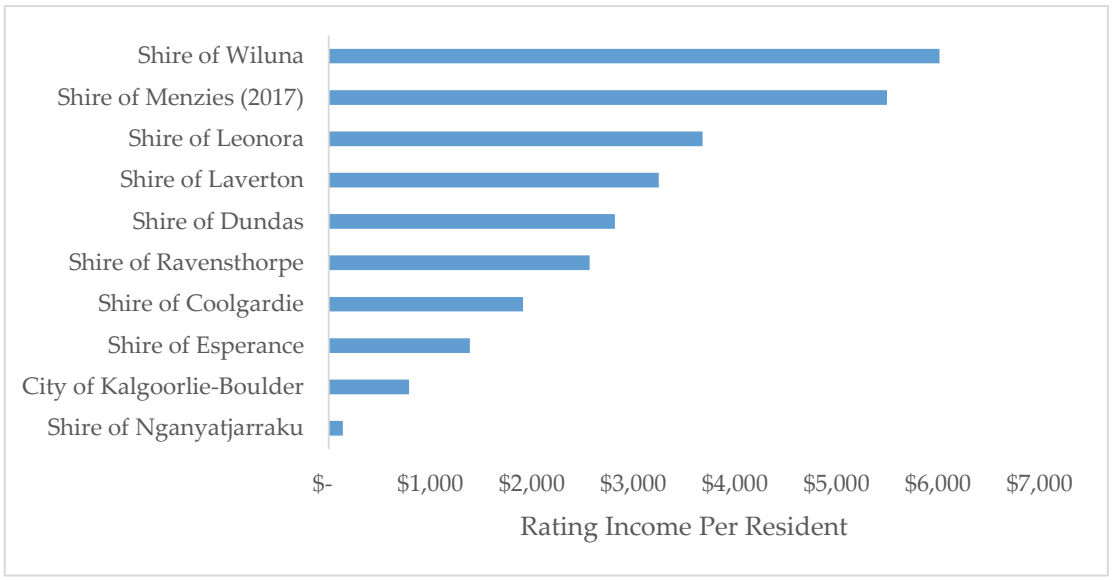


FIGURE 12 – GVROC Local Governments – 2017-18 Ratings Income per Resident

2.4. GVROC regional economy

The Goldfields-Esperance Region currently produces real Gross Regional Product (GRP) of approximately A$7.3 billion, representing approximately 3 percent of Western Australia's Gross State Product (GSP). Over the period 2008 to 2011, the Goldfields-Esperance economy expanded from approximately $7.0 billion to $11.0 billion in real GRP, when it accounted for approximately 5.5 percent of Western Australia's Gross State Product (GSP). In 2012 the Regional economy contracted back to approximately $7.5 billion in real GRP and has remained in the range of

approximately $6.0 to $8.0 billion since, showing a gradually increasing trend over the past few years. This is illustrated in the following Figure 13[24,25].

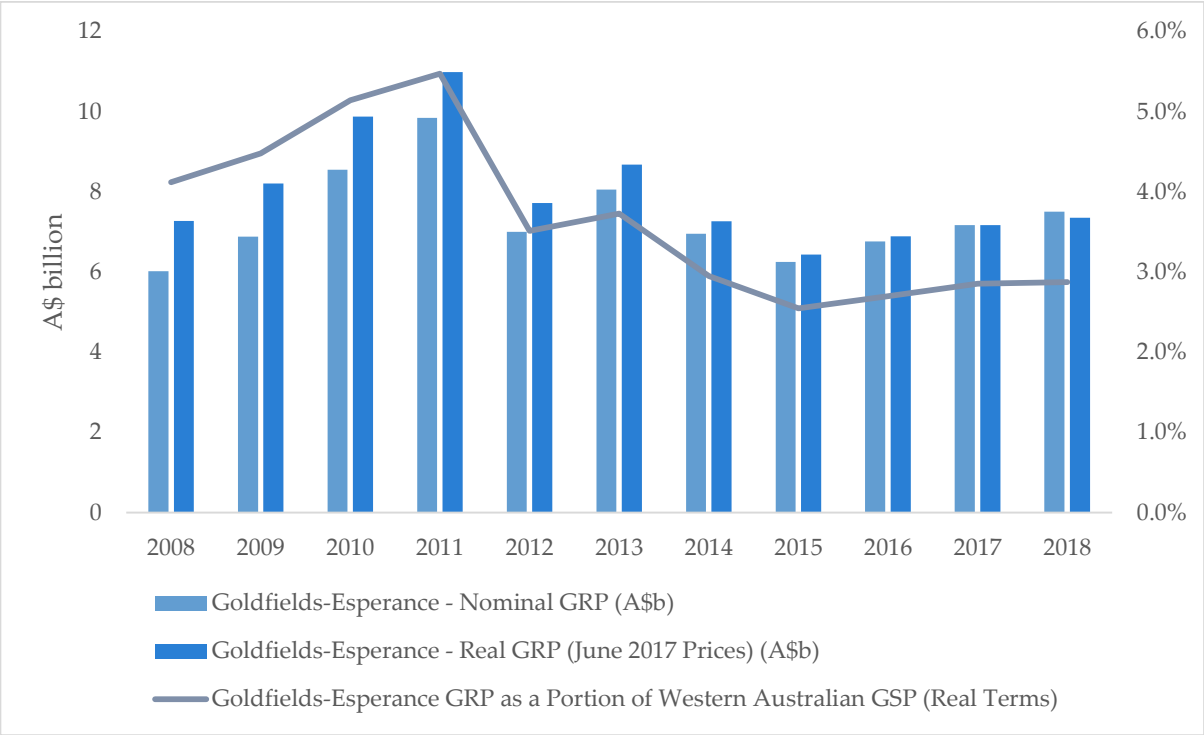


FIGURE 13 – Goldfields-Esperance Gross Regional Product

In 2017-18, the mining (82 percent), manufacturing (8.2 percent) and agriculture, forestry and fishing (3.5 percent) sectors accounted for the vast majority of $11.5 billion of goods and service exports from the Region[26]. As illustrated in Figure 14[27] below, the mining industry is by far the largest employer in the Region, accounting for approximately one-third of all jobs. These are relatively high paying jobs, with the mining sector also accounting for approximately 44 percent of total wages and salaries paid in the Region[28].

As the Shire of Wiluna does not fall within Goldfields-Esperance boundaries, aggregate statistics and figures for the region presented above do not include Wiluna. In 2011 GRP for the Shire of Wiluna reached a decade high of $1.01 billion[29], before declining sharply to $427 million in 2012 and remaining at around that level since. In 2017-18, GRP for the Shire of Wiluna totalled $329.9

[24] Australian Bureau of Statistics (2018), *Australian National Accounts, 2017-18*, Cat. 5220.0, Australian Government Canberra

[25] REMPLAN IN: Goldfields-Esperance Regional Development Commission (https://www.economyprofile.com.au/goldfieldsesperance/trends/gross-regional-product#table)

[26] REMPLAN IN: Goldfields-Esperance Regional Development Commission (https://www.economyprofile.com.au/goldfieldsesperance/industries/regional-exports)

[27] REMPLAN IN: Goldfields-Esperance Regional Development Commission (https://www.economyprofile.com.au/goldfieldsesperance/industries/employment)

[28] REMPLAN IN: Goldfields-Esperance Regional Development Commission (https://www.economyprofile.com.au/goldfieldsesperance/industries/wages-salaries)

[29] REMPLAN IN: Mid West Development Commission (https://www.economyprofile.com.au/midwestregion/trends/gross-regional-product)

million[30], whilst the value of exports from the area reached $875.9 million[31]. The mining industry is the main driver of economic activity in the Shire of Wiluna accounting for 63 percent of the 1,193 jobs[32] and 72.5 percent of total payroll[33] in the Shire.

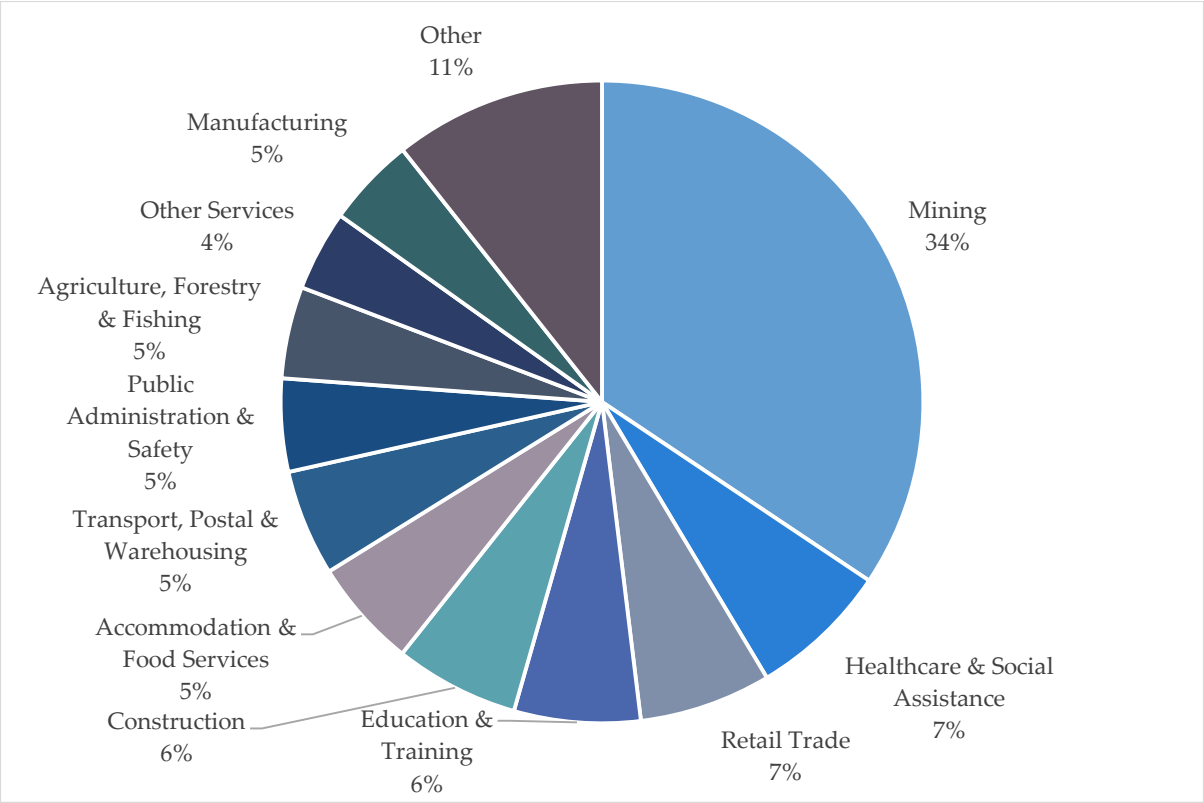


FIGURE 14 – Goldfields-Esperance Employment by Industry

Not surprisingly, the majority of employment occurs in the major population centres, followed by the LGA's that host significant mineral production (see Section 3). The following Figure 15[34] summarises the geographical location of employment in the Region.

[30] REMPLAN IN: Mid West Development Commission (https://www.economyprofile.com.au/midwestregion/industries/gross-regional-product)

[31] REMPLAN IN: Mid West Development Commission (https://www.economyprofile.com.au/midwestregion/industries/regional-exports)

[32] REMPLAN IN: Mid West Development Commission (https://www.economyprofile.com.au/midwestregion/industries/employment)

[33] REMPLAN IN: Mid West Development Commission (https://www.economyprofile.com.au/midwestregion/industries/wages-salaries)

[34] REMPLAN IN: Goldfields-Esperance Regional Development Commission (https://www.economyprofile.com.au/goldfieldsesperance/industries/employment)

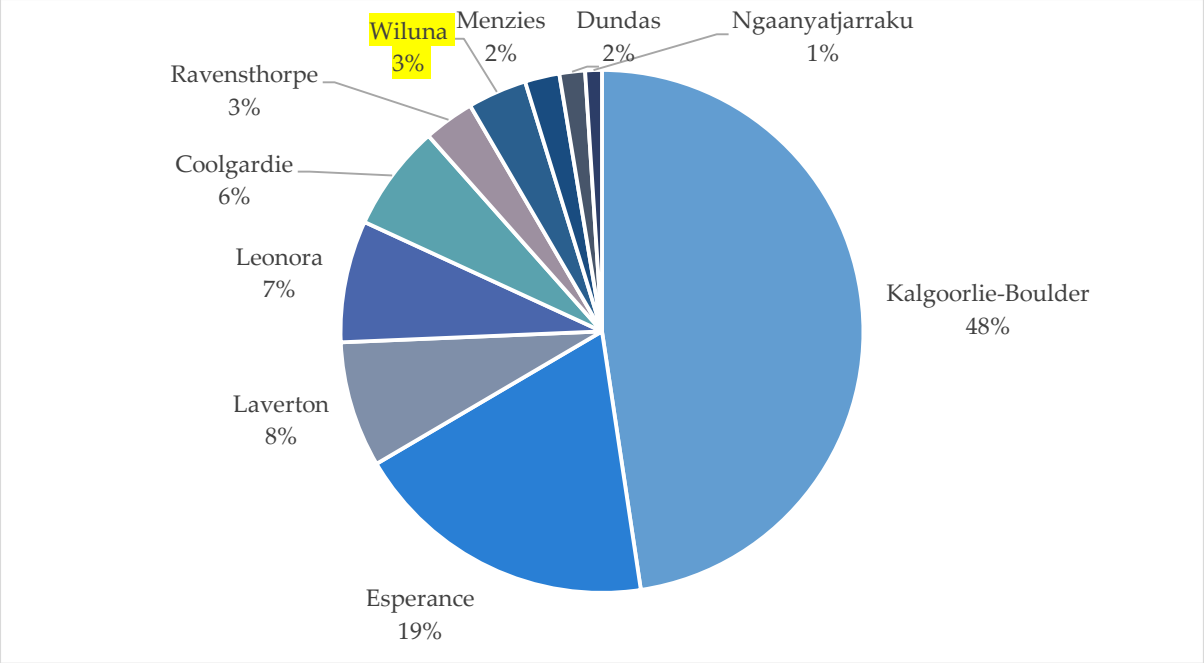


FIGURE 15 – GVROC Region Employment by Local Government Area

The vast majority of businesses domiciled[35] in the Region are non-employing businesses (55 percent) and businesses with between 1 and 19 employees (43%). The total number of businesses domiciled in the Region has remained relatively stable over the past three years. This is illustrated in Table 8[36] below.

TABLE 8 – GVROC Region – Number of Businesses

No. of Employees	June 2016	June 2017	Jun 2018	CAGR
Non-employing businesses	2,350	2,191	2,311	-0.8%
1 to 19 employees	1,809	1,803	1,828	0.5%
20 to 199 employees	131	117	96	-14.4%
200 employees or more	6	8	7	8.0%
TOTAL	4,296	4,219	4,242	-0.6%

The following Table 9[37] summarises the distribution of GVROC Region domiciled businesses across the Region.

[35] Additional businesses operate in the Region that are not domiciled in the Region
[36] REMPLAN IN: Goldfields-Esperance Development Commission (https://www.economyprofile.com.au/goldfieldsesperance/trends/business-counts/staff#table). Shire of Wiluna not included in these aggregate stats.
[37] Australian Bureau of Statistics (2019), Economy and Industry by Local Government Area, Cat. 1410.0, Australian Government, Canberra

TABLE 9 – Number of Businesses by Local Government Area (2018)

Local Government Area	Non-Employing	1 to 19 Employees	20 to 199 Employees	Total
Coolgardie	59	55	3	110
Dundas	20	18	0	35
Esperance	1,002	723	22	1,750
Kalgoorlie-Boulder	1,053	875	83	2,011
Laverton	15	6	20	41
Leonora	43	24	62	129
Menzies	0	0	0	0
Ngaanyatjarraku	0	0	0	0
Ravensthorpe	136	117	3	254
Wiluna	10	9	3	0
TOTAL	2,338	1,827	196	4,330

Among the businesses summarised in Table 8 and Table 9 are at least 50[38] Aboriginal owned and operated businesses, representing approximately 1 percent of businesses domiciled in the Region.

2.5. Key community issues relevant to infrastructure

Community issues pertaining to specific categories of infrastructure are discussed in Sections 6 through 9 accordingly. This section identifies broader community issues that impact on assessing infrastructure and planning for future infrastructure investment.

2.5.1. Minerals industry-community interface

The issue

There can be no confusion as to the extent that the prosperity of the GVROC Region is dependent on the economic contribution of its cornerstone minerals industry. From a direct contribution perspective, as discussed in Section 2.4, the sector accounts for the vast majority of GRP and exports from the Region, around one-third of jobs and just under 45 percent of all wages and salaries in the Region. It also accounts for a significant portion of local government revenue. From an indirect perspective, the sector is a major customer of many businesses in the Region and as discussed in subsequent sections of this report, its direct and indirect patronage is a significant underwriter of infrastructure in the Region.

Nevertheless, and while those expressing the sentiment seem to be in the minority, there is an emerging community animosity toward the sector. This sentiment appears to be based on the following:

[38] Goldfields-Esperance Development Commission IN: Pin, P. (2019), 'Aboriginal businesses and miners get working', *Kalgoorlie Miner*, 26 June

- A perception that the industry does not make an adequate socio-economic contribution to the Region, primarily in terms of local employment, procurement and investment in local soft and hard infrastructure. In some instances, a comparison to the Pilbara resources industry towns is made, whereby because the companies have significant operations within those towns their socio-economic footprint is much greater than companies operating the GVROC Region that are by nature smaller companies with operations that in most instances are remote from the towns.
- Notably increased negative externalities, particularly with respect to larger numbers of heavy vehicles on the Region's road network.

Anecdotally, this sentiment has recently manifested itself in a number of ways including:

- Certain local government objections to proposed projects and project expansions that are not so much based on an objection to the project *per se*, but are made to incentivise the project to meet local government engagement expectations;
- Select community discussions around proposing an increase in mining royalties charged by the Western Australian Government on the condition that a portion of the royalty revenue is provided to local government;
- Proposed advocacy for the introduction of legislation akin to the *Strong and Sustainable Resources Communities Act 2017* (QLD), which prescribes resources company interactions with communities under certain conditions, including restrictions on FIFO workforces; and
- Increased community concerns over particularly increased numbers of double, triple and quad road trains on the Region's road network and particularly passing through the smaller towns in the Region resulting in safety and noise issues.

Opportunities

Friction between the resources industry and regional communities has become increasingly common across Australia over the past decade, a phenomenon that has demonstrated a propensity to be counterproductive, with escalating confrontation causing significant damage to both industry and the community. From the industry's perspective social licence to operate can be significantly eroded and difficult to revive. From the community's perspective an 'anti-development' reputation can slow external investment and restrict its economy for many years. An extreme case example of this is Broome and the Woodside and Western Australian Government's proposed James Price Point LNG Precinct.

It is vitally important for the prosperity of the GVROC Region that this issue does not escalate. To achieve this, industry and GVROC community leadership should work together to resolve issues as a matter of priority. It is important that resolution is achieved without undermining the competitiveness of the Region's minerals industry and without the implementation of additional taxation or regulation that will inevitably reduce productivity and operational flexibility, ultimately damaging the Region's economy.

This can be achieved through a structured dialogue that endeavours to develop a mutually owned understanding across:

- The community as to the nature of community investments and engagements that mining companies can make in the context of the legal, commercial and capital markets frameworks in which they operate; and
- Industry as to what the community's reasonable expectations of it are.

From this understanding an industry-community interaction and investment plan can be developed which can be implemented on the basis of mutual benefit and agreement. Such a plan would clearly articulate industry and community infrastructure investment priorities,

identifying shared interests as a basis for investment. It could also identify opportunities for local procurement and employment in industry and shared infrastructure investments.

This plan should then be considered in the context of infrastructure decisions.

2.5.2. Stronger small communities

The issue

The concentration of the GVROC population and to a lesser extent its economy in the two main population centres means that some of the smaller towns and communities can, particularly during regional economic downturns, struggle for viability. For many of these smaller towns, it is likely that for the foreseeable future their economic viability (and therefore the viability of their communities) will be dependent on businesses servicing the local community and industry, as well as tourism.

As is the case for most regional and remote areas across Australia, business and entrepreneurial skills can be limited in these smaller settlements.

Opportunities

The concept of an 'entrepreneur-in-residence', whereby an experienced entrepreneur with strong business skills in a relevant sector is immersed in an organisation or community to assist aspiring entrepreneurs in achieving their business objectives, is increasingly common practice globally. The program's activities can be extended to supporting local sectors through initiatives such as shared infrastructure planning and engagement with larger infrastructure projects to optimise opportunities for local small businesses.

A business case investigating the merits of such a program in the GVROC Region should be undertaken and if the outcome of that business case is positive, a pilot program conducted in a suitable GVROC Region town or community. Determining a mechanism that allows small business issues to be considered in infrastructure investment decisions should be a component of the program.

2.5.3. Indigenous Socio-economic participation

The issue

As discussed in Section 2.1.2, circumstances post non-Aboriginal settlement of the GVROC Region have resulted in Aboriginal people of the GVROC Region, on average, experiencing lower socio-economic circumstances than non-Aboriginal residents of the Region. These are circumstances that exist to varying degrees Australia-wide. It is testament to the resilience of Aboriginal people that Traditional Owners of the GVROC Region have continued to practice traditional culture and lore and live on their traditional lands despite these circumstances.

Today, the Aboriginal community in the GVROC Region has a significant population, legal and leadership 'footprint' in the Region. For example:

- As discussed in Section 2.1.2, Aboriginal people account for approximately 10 percent of the total population of the Region and in some parts of the Region, a much higher portion of the population, approaching 100 percent in some instances;

- As a result of the advent of Native Title, Traditional Owners in the Region exercise some degree of control over at least 50 percent of the Region's landmass and this may, in the near future, increase substantially(see Section 2.2); and
- Aboriginal organisations such as Ngaanyatjarraku Council, numerous Prescribed Body Corporates that hold Native Title interests and other Aboriginal organisations are key organisations in the Region's governance framework, with other Aboriginal organisations such as Aboriginal Ranger Groups and Goldfields Aboriginal Medical Services delivering important services for the Region.

Despite this significant and growing 'footprint', unemployment rates are generally higher in communities that are characterised by a relatively large Aboriginal population. Furthermore, the approximately 50 Aboriginal owned and operated businesses in Region (see Section 2.4) represent just 1 percent of businesses domiciled in the Region, suggesting Aboriginal participation in the local economy is well below population parity.

There is a strong community desire to see the socio-economic gap that exists between Aboriginal and non-Aboriginal residents of the Region close, for Aboriginal people to perform a key role in community leadership, and for Aboriginal culture to be a visible and important component of the Region's identity. These are important considerations for all infrastructure decisions in the Region.

Opportunities

With most of the Region experiencing unemployment rates that are at or better than the State average, skills shortage is a significant productivity challenge for businesses, government organisations and NGOs operating in the Region (see later Section 8.3). A significantly higher portion of the Region's Aboriginal population is unemployed, representing a potential latent workforce of stable, local residents that can activated. To this end, every aspect of particularly soft infrastructure investment should give consideration to optimally ensuring that Aboriginal people in the Region have access to essential services, health, education and training that supports pathways to employment.

Because a significant portion of the Aboriginal community reside in remote communities and settlements outside of the main population centres (see Section 2.1.2), access to hard infrastructure such as road networks, electricity, telecommunications, water and waste management services will be important for creating an operating environment where economically viable Aboriginal owned and operated businesses of all types (businesses based on land interests, traditional knowledge and custom as well as mainstream businesses) can be established and sustained. To this end, in addition to infrastructure investment directly targeting Aboriginal interests, all infrastructure investment decisions should give consideration to optimising opportunities for Aboriginal owned and operated businesses across the Region.

2.5.4. Enhanced liveability

The issue

As discussed in Section 2.1, for a region that is significantly dependent on a cyclical resources industry, the GVROC Region residential population is relatively stable and the liveability of its major population centres of Kalgoorlie-Boulder and Esperance are key factors that contribute to this stability.

The ability to grow these centres either through FIFO-replacement or economic diversification is also largely dependent on current and potential future resident perceptions as to the liveability pf those centres. Liveability also affects the ability of these larger population centres and the smaller

settlements to attract and retain quality staff that underpin the delivery of essential, human and other services across the Region.

It is therefore not surprising that continuing to enhance the liveability of the Region's population centres is a key community issue.

Opportunities

Liveability is determined by a wide range of factors including the cost and efficiency of logistics (road, rail, aviation and maritime networks); cost and reliability of essential services (energy, water and waste management); availability, quality and cost of soft infrastructure (education, healthcare, law and order); availability, cost and quality of housing stock and other accommodation; the range of cost and commercial services available to residents such as retail and professional services; and general public amenity.

Addressing the soft and hard infrastructure issues identified in Sections 6 through 9 of this report will make a significant contribution to achieving this and opportunities to optimise regional liveability should be a consideration in all infrastructure investment decisions.

3. The GVROC Region Mining and Minerals Processing Industry

KEY POINTS

The Goldfields-Esperance Region is recognised as one of the world's premier minerals production provinces, particularly with respect to gold and nickel, and increasingly with respect to a number of minerals used in the manufacture of various globally important technology products.

In recent history, minerals production from the Region has accounted for between 10 and 20 percent of State minerals GVP, or around 40 percent excluding in the mainly Pilbara-centric iron ore sector. The Shire of Wiluna also hosts significant minerals operations.

A decade of sustained high gold prices is driving increased gold production from the Region in the form of new mines, expansion of existing mines, activation of satellite deposits (including under third party toll treatment arrangements). This is also resulting in an increased average all-in-sustaining cost for gold production across the Region.

Increasing global demand for electric vehicles and other technology products is resulting in increased derived demand for the mineral inputs to these manufacturing processes including increased demand for spodumene (lithium) concentrate and nickel that is derived from demand for nickel-rich lithium-ion battery chemistries, as well as rare earths that are derived from demand for a range of technology products. The Region's production of these 'technology' minerals is increasing in the form of new operations and expansions of existing operations.

While the Region will face significant cost competition from downstream operations in Asia, and to a lesser extent the Kwinana and Kemerton Strategic Industrial Areas (SIA), there is prospect of increased downstream processing of mineral concentrate products in the Region.

The Region's minerals industry is serviced in part by local mining services, research and education and training sectors that is in the context of regional Western Australia is unique in scale.

The Goldfields-Esperance Region's infrastructure portfolio, particularly road and port infrastructure, is also used by operations whose primary production assets are located outside of the Region.

Much of the infrastructure in the Goldfields-Esperance Region is shared infrastructure used by the mining, agriculture and tourism industries, as well as the community.

Current trends in the Region's minerals industry have a number of implications for its shared infrastructure including a likely increase in the number of heavy vehicles on the Region's road networks, increased rail freight congestion, congestion at Esperance Port and increased throughput at aviation facilities; increased demand for high quality water, waste management solutions, affordable and reliable energy; improved telecommunications and industrial land availability; pressure on aspects of the Region's soft infrastructure; and a possible case for investment in additional shared infrastructure.

3.1. Overview of the GVROC Region minerals and mineral processing industry

Various mineral products have been produced from across the GVROC Region continuously since the Western Australian 'Gold Rush' in 1890s, and the Region continues to be recognised as one of the world's premier minerals provinces, particularly with respect to the production of gold and nickel products[39].

As illustrated in Figure 16[40],[41] below, over the course of the past decade the Goldfields-Esperance Region has consistently accounted for between 10 and 20 percent of the total value of Western Australian minerals production, or 40 percent if production from the State's dominant Pilbara iron ore sector is excluded.

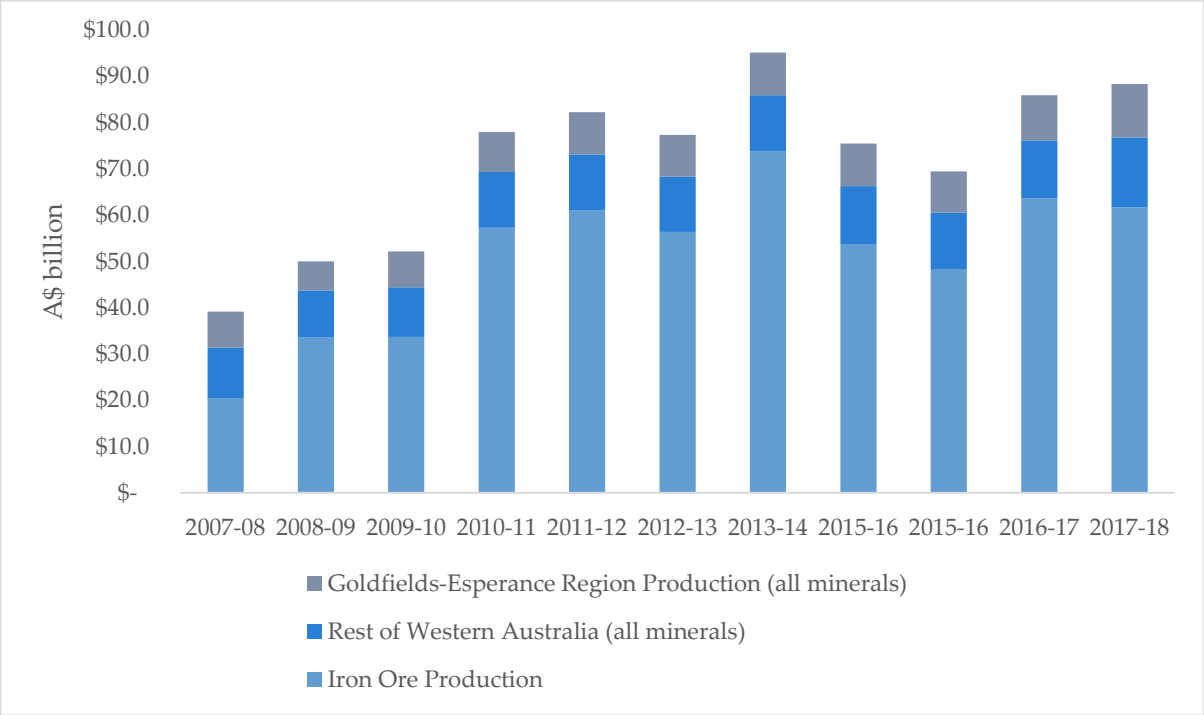


FIGURE 16 – Goldfields-Esperance Regional Minerals Production in the Context of Total Western Australian Minerals Production

Over the same time period, the total value of minerals production from the Goldfields-Esperance Region grew from approximately A$7.8 billion to A$11.5 billion, representing a Compound Annual Growth Rate (CAGR) of 3.9 percent.

[39] The most reliable independent data source for Western Australian minerals sector data is the WA Department of Mines, Industry Regulation and Safety. However, this dataset is primarily available at a regional level, aligned with Regional Development Commission boundaries. Hence, minerals industry data for the Shire of Wiluna – part of the Mid-West RDC, along with 18 other local government authorities – is not available for inclusion in the following analysis due to significant dilution issues affecting statistical analysis, except where otherwise noted.

[40] Department of Mines, Industry Regulation and Safety (2007-08 to 2017-18), *Western Australian Minerals Statistics Digest*, Western Australian Government, Perth

[41] Excludes Shire of Wiluna contribution

Within the wider GVROC Region, the LGA's of Coolgardie, Kalgoorlie -Boulder, Laverton and Leonora account for the vast majority of the value of minerals production, with the strongest growth occurring in the Laverton LGA (CAGR of 10.8 percent). This is illustrated in Figure 17[42] below.

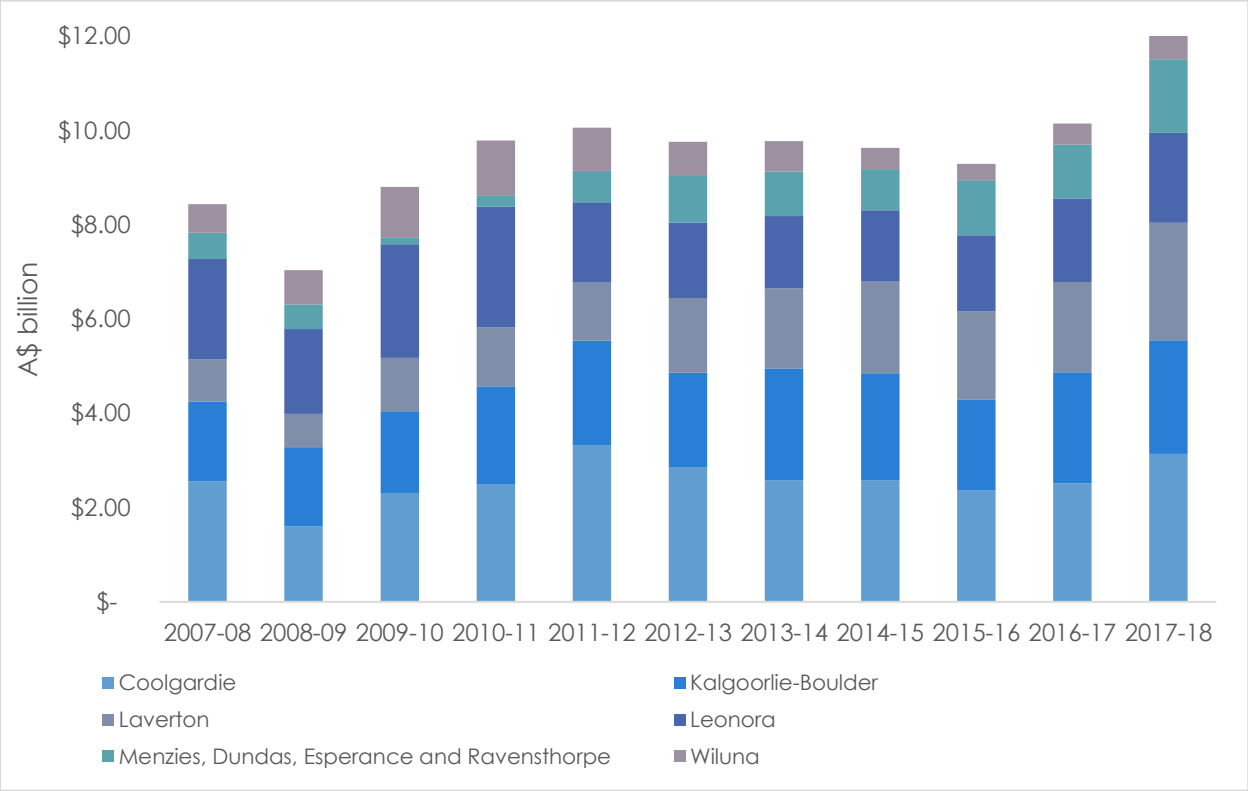


FIGURE 17 – GVROC Region Minerals Production by Local Government Area

The dominance of gold and nickel and its co-products (primarily cobalt) is self-evident. Over the past decade, production of nickel from the GVROC Region has accounted for between 70 and 90 percent of Western Australian nickel production, and in the case of gold, the Region consistently accounts for approximately 65 percent of Western Australian production. This is illustrated in Figure 18[43] below.

[42] Department of Mines, Industry Regulation and Safety (2007-08 to 2017-18), *Western Australian Minerals Statistics Digest*, Western Australian Government, Perth
[43] Department of Mines, Industry Regulation and Safety (2007-08 to 2017-18), *Western Australian Minerals Statistics Digest*, Western Australian Government, Perth

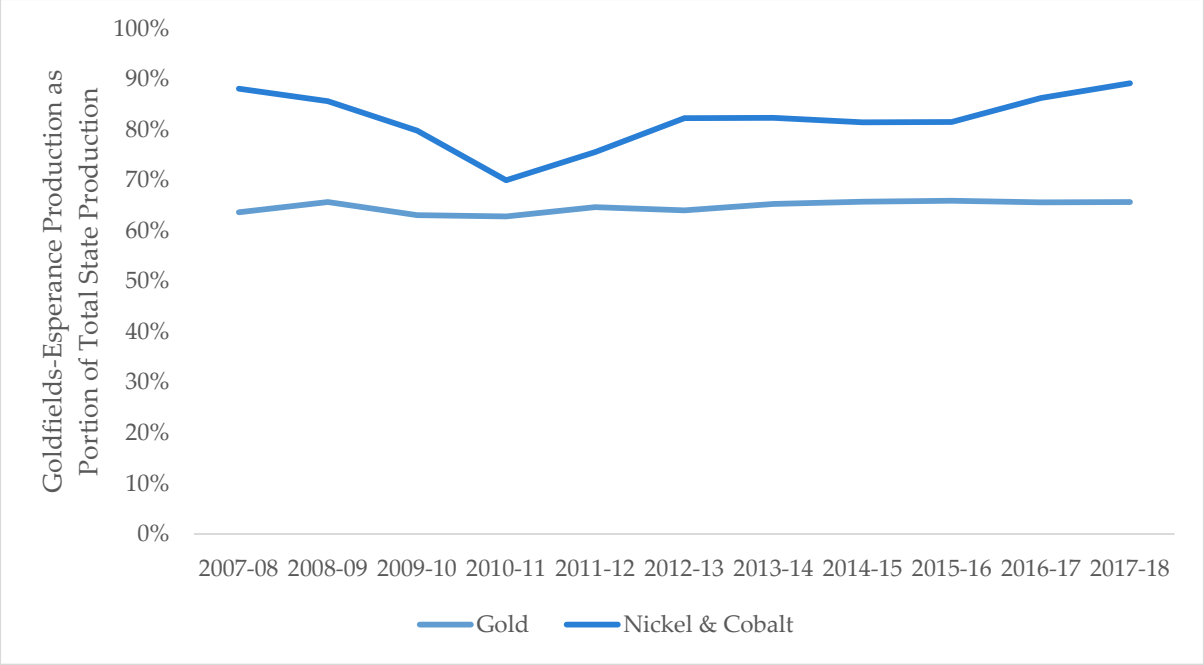


FIGURE 18 – Goldfields-Esperance Gold and Nickel-Cobalt Production as a Portion of Total State Production

The dominance of the gold and nickel sectors is reiterated in Figure 19[44] below. Pertinent to the subject matter of this infrastructure strategy are three notable trends:

- The value of gold production has increased over the past decade, with a notable increase in the past three years;
- Following a significant decline in the value of production in 2015-16, the value of production of nickel and nickel co-product has increased dramatically in the past couple of years; and
- The value of 'other' minerals production has increased significantly in the last two years.

The increase in the value of gold production is a function of sustained higher gold prices and as a result, new production coming on stream. The increase in the value of the production of nickel, cobalt and 'other' minerals is the result of a notable increase in production of minerals used in the manufacture of nickel-rich lithium-ion battery chemistries. These trends and their drivers are discussed in more detail in the following subsections.

[44] Department of Mines, Industry Regulation and Safety (2007-08 to 2017-18), *Western Australian Minerals Statistics Digest*, Western Australian Government, Perth.

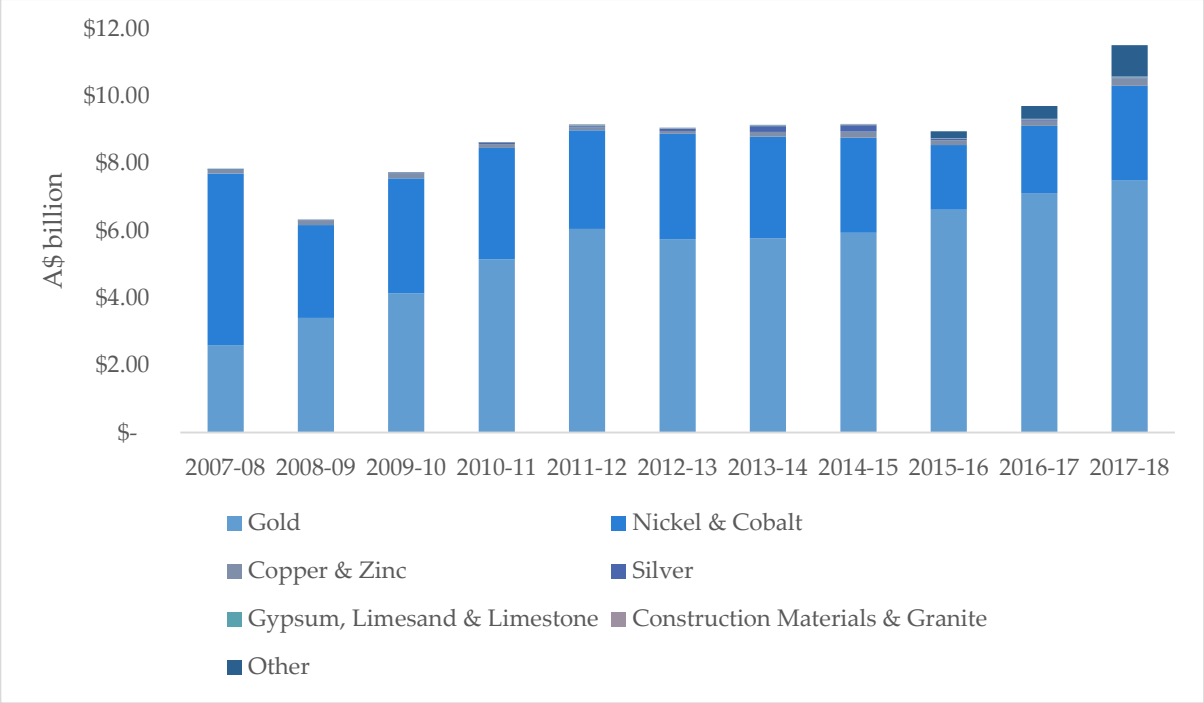


FIGURE 19 – Goldfields-Esperance Mineral Production by Commodity

3.2. The Growing Gold Sector

A protracted period of sustained high gold prices is driving increased production of gold in the GVROC Region and changing the nature of that production landscape.

3.2.1. Sustained historically high gold prices

As mentioned in the introduction to this Section, mining operations in the Goldfields-Esperance Region have produced gold continuously for around 130 years. However, increasing global economic, political and geostrategic uncertainty, combined with sustained low interest rates globally (which decreases the opportunity cost of holding non-yielding bullion as an investment) has changed the dynamics of the gold sector in the GVROC Region over the past several years.

While the spot price of gold is currently below its historical high of over US$1,700 per ounce during 2011-12, the last decade has been characterised more generally by sustained trading well in excess of US$1,000 per ounce. This is illustrated in Figure 20[45] below.

[45] IndexMundi

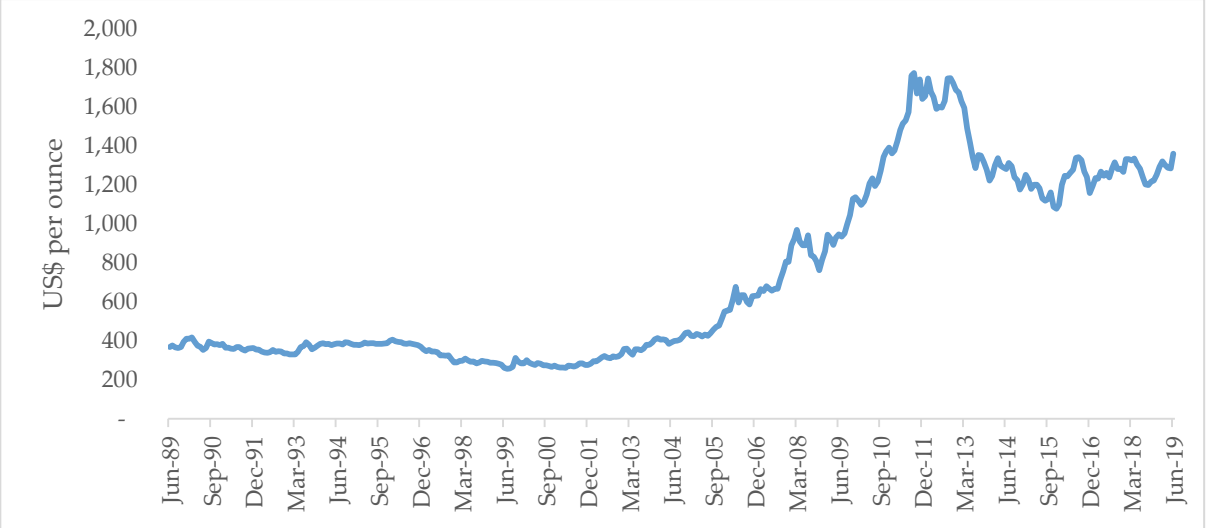


FIGURE 20 – Spot Gold Price (June 1994 to May 2019)

3.2.2. The current gold production landscape

There are approximately 50 operating gold mines in the GVROC Region. This includes 22 mining and processing operations, including some that comprise several mines supplying a centralised processing facility, producing over 50,000 ounces per annum. As summarised in Table 10 below, these larger operations are operated by 16 separate operating companies or joint ventures. The approximate 5 million ounces produced by these larger operations accounts for the vast majority of gold production from the Region and 75 percent of Western Australia's total gold production.

TABLE 10 – Major GVROC Region Gold Producers (2018) [46]

Operator	Project	LGA	Approx. Annual Production (Oz)	Total Regional Production (Oz)
Gold Fields	St Ives	Coolgardie	405,580	
	Granny Smith	Laverton	310,305	
	Agnew-Lawlers	Leinster	250,000	
	Gruyere (Gold Road JV)	Ngaanyatjarraku	100,000[47]	1,065,885
Barrick-Newmont JV	KCGM	Kalgoorlie-Boulder	815,922	815,922
Anglogold Ashanti	Sunrise Dam	Laverton	297,888	
	Tropicana	Ngaanyatjarraku	354,820	652,708
Saracen	Carosue Dam	Menzies	196,000	
	Thunderbox	Leonora	161,000	357,000
Regis	Duketon	Laverton	297,828	297,828
Northern Star	Kalgoorlie Operations	Kalgoorlie-Boulder/Coolgardie	262,000	262,000
St Barbara	Gwalia	Leonora	297,465	297,465
Norton Goldfields	Paddington	Kalgoorlie-Boulder	190,000	190,000
Dacian Gold	Mt Morgans	Laverton	186,000	186,000
Ramelius	Kathleen Valley	Leinster	64,000	
	Vivian	Leinster	105,000	169,000
Silverlake	Mt Monger	Kalgoorlie-Boulder	157,000	157,000
Evolution Mining	Mungari	Coolgardie	125,000	125,000
Westgold	Higgnsville	Dundas	56,000	56,000
Bardoc Gold	Kalgoorlie North	Kalgoorlie-Boulder	55,000	55,000
Blackham Resources Ltd.	Matilda-Wiluna	Wiluna	70,565	70,565
Northern Star	Jundee	Wiluna	283,288	283,288
TOTAL				**5,042,661**

[46] Values are sourced from a variety of publicly available data sources, are approximate only.
[47] 2019 forecast

3.2.3. Implications for the GVROC Region gold sector

The period of sustained historically high gold prices driven by global political and economic conditions that seem somewhat persistent as described in Section 3.2.1, is changing the nature of the GVROC Region gold sector. It is doing this by providing:

- Established producers in the Region and their investors with confidence to undertake brownfields expansions through investment in ore reserve development, pit expansions, underground development, activation of satellite deposits and investment in increasing plant capacity and efficiency;
- Capital markets with confidence to support smaller companies and new entrants to the sector to acquire and develop existing mines that are in care-and-maintenance because they were sub-economic at lower gold prices; and
- Companies of all sizes with confidence to invest in greenfields exploration.

In turn, these circumstances have resulted in:

- A higher volume of gold production;
- Higher average all-in sustaining cost across the sector that are the result of more high-cost production coming on-stream across the Region;
- A larger number of junior and mid-tier operators in the Region; and
- Increased exploration activity across the Region.

In turn, this is placing increased demand on the Region's infrastructure. In particular:

- There is a higher frequency of dual, triple and quad road trains on the Region's road networks that are transporting ore to centralised processing facilities from either satellite deposits of the operator or from third parties under toll-treating arrangements, as well as larger volumes of reagents as inputs to larger plants;
- There is more equipment being transported around the Region, primarily on trucks, to support the construction of new and expanding projects and exploration across the Region; and
- The associated increase in workforce means more aircraft and passenger throughput at the Region's airports.

This is discussed further in Sections 6 through 9.

3.3. The emerging battery minerals sector

Rapidly escalating demand for particularly nickel-rich (nickel-cobalt-aluminium and nickel-cobalt-manganese) lithium-ion battery technology is also changing the minerals production landscape in the Goldfields-Esperance Region. A summary of the relationship between the lithium-ion battery industry and Western Australian minerals production is contained in Appendix 3, but can be briefly described as follows:

- Nickel-rich cathode battery chemistries are emerging as the predominate technology for lithium-ion batteries that are used in electric vehicles, the fastest growing and likely largest future market for lithium-ion batteries;
- The manufacture of the nickel-rich precursor chemistries that are inputs to the manufacture of cathodes used in high performing lithium-ion batteries targeting the electric vehicle market require high quality lithium hydroxide, nickel sulphate and cobalt sulphate as feedstock;
- Whereby the lithium carbonate that is used in the manufacture of precursors that are inputs to the manufacture of cathodes used in other lithium-ion battery technologies can be more cost competitively produced from brine based lithium resources located in Latin America, high quality lithium hydroxide can be produced cost competitively from Western Australia's spodumene hard-rock resources, including substantially from those in the Goldfields-Esperance Region;

- Western Australia currently produces approximately 45 percent of the 230,000 tonnes of Class 1 Nickel powders and briquettes produced globally that are the feedstock for the manufacture of battery grade nickel-sulphate, with the Goldfields Esperance Region being a major part of the primary production, concentrating and smelting components of the value chain that produces this product; and
- Cobalt is produced as a co-product from nickel production in the Region and could be converted to battery grade nickel sulphate.

These circumstances have prompted the Western Australian Government to develop a Western Australian Battery Minerals Strategy (which is also summarised in Appendix 3). They are also driving increased production of spodumene concentrate and nickel products in the Region and generating interest in the prospect of establishing a downstream battery chemicals industry in the Region.

This is discussed in the following subsections.

3.3.1. A transforming nickel sector

High grade nickel sulphide deposits were first discovered in the GVROC Region by Western Mining Corporation in 1966. The development of these resources and their commercialisation, which was the result of significant investment in downstream concentrator, smelter and refinery infrastructure by Western Mining Corporation, resulted in the Western Australian 'nickel boom' of the early 1980s.

During the mid-1990s the Western Australian and GVROC Region nickel sector underwent considerable structural change driven by the following events[48]:

- **Development of laterite resources**
  The introduction of High Pressure Acid Leaching (HPAL) technology demonstrated the potential to render a number of laterite hosted nickel resources in the Region viable. While significant investment was directed toward developing these resources, and in some cases implementing and commissioning HPAL circuits (see below), there is only one nickel laterite operation currently producing in Western Australia, Murrin Murrin, which accounts for approximately 30 percent of Western Australia's nickel output and the vast majority of the State's cobalt output as a co-product.

- **New entrants in nickel sulphide production**
  A series of additional high-grade komatiite-associated nickel sulphide deposits were discovered by companies other than Western Mining Corporation. These new sulphide deposits include Emily Ann, Flying Fox Deeps, Cosmos, Silver Swan, Waterloo/Amorac and Mt Goode. Some of these sold ore into Western Mining Corporation's downstream infrastructure, while others developed their own downstream capacity.

- **Western Mining Corporation partial divestment of nickel assets**
  In 2000, Western Mining Corporation sold its Kambalda-Widgiemooltha mining assets to independent operators under conditions which provided Western Mining Corporation with ore offtake rights, maintaining feedstock for its concentrator, smelter and refining infrastructure.

- **Creation of BHP Nickel West**
  Following BHPs acquisition of Western Mining in 2005, the main Western Mining Corporation developed mines and infrastructure are now owned and operated by BHP Nickel West (see below).

[48] Elias, M. and Donaghy, T. (2015), 'Focus on nickel in Western Australia', *Mining Journal*

During the period 2000 to 2007, the value of Western Australian nickel production grew from approximately A$2 billion to A$8 billion, supported by higher global nickel prices (which reached a peak of approximately A$35,000 per tonne in 2006-07). Primarily as a result of this dramatic expansion phase, Western Australia has at least 30 individual delineated nickel resources, some of which have been the subject of historical production and many of which are located in the GVROC Region.

However, as a result of a sustained depressed nickel price that is primarily the result of lower cost pig nickel substitution in many nickel applications, the vast majority of these projects were either never commercialised or have since ceased production.

As discussed in Section 3.3, the rapid escalation in actual and forecast demand for nickel-rich lithium-ion battery chemistries (which are emerging as the preferred technology platform for electric vehicles) is reinvigorating the Western Australian nickel industry and the GVROC Region is a major participant in the primary production and stages of processing that produce the Class 1 nickel product that is used in the manufacture of these chemistries.

As illustrated in Figure 16 above, approximately 90 percent of Western Australia's nickel product is sourced from primary production in the GVROC Region. The vast majority of regional nickel production is sourced from the BHP Nickel West production complex and the Minara (Glencore) Murrin Murrin Project. The location of key Western Australian nickel production assets is illustrated in Figure 21[49] below.

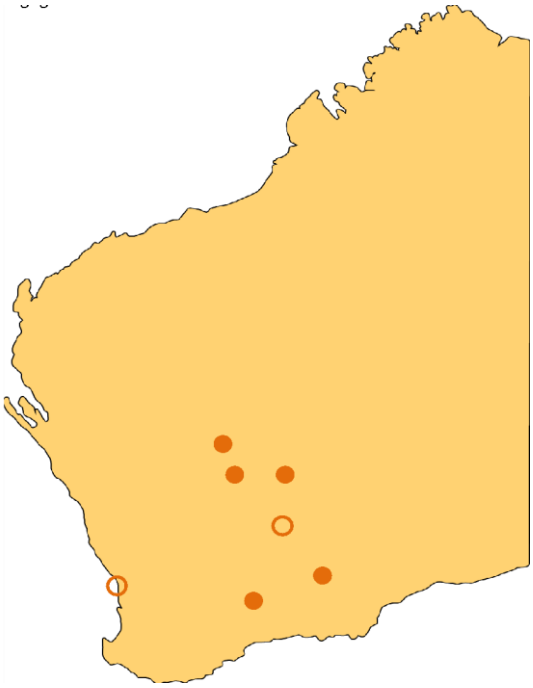


FIGURE 21 – Key Western Australian Nickel Production Assets

These and other key nickel assets in the GVROC Region are summarised in the following Table 11and discussed, together with other prospective projects in the following subsections.

[49] Australian Venture Consultants (2019) 'WA's Future in the Lithium-ion Battery Value Chain: Nine Months Down the Road', *CCIWA Works Conference Presentation*, Crown Towers, June 2019

TABLE 11 – KEY GVROC REGION NICKEL PROJECTS

Operator	Project	LGA	Approx. Annual Production
BHP Nickel West	Mt Keith, Leinster and Cliffs mines; Mt Keith, Leinster and Kambalda concentrators; Kalgoorlie smelter; and Kwinana refinery and nickel sulphate plant.	Wiluna, Leonora, Kalgoorlie-Boulder and Coolgardie	96,000 tonnes (nickel metal equivalent
Minara Resources (Glencore)	Murrin Murrin	Laverton and Leonora	41,900 tonne nickel sulphide and 3,000 tonnes cobalt sulphide
Independence Group	Nova Bollinger	Dundas	22,258 tonnes nickel and 9,545 tonnes coper
First Quantum Minerals	Ravensthorpe Nickel Mine	Ravensthorpe	n.a.

BHP Nickel West

Nickel West is a 100 percent owned subsidiary of BHP and is comprised of a portfolio of upstream and downstream nickel assets acquired from the former Western Mining Corporation. This includes mining operations at Mount Keith, Leinster and Cliffs; nickel concentrator circuits at Mouth Keith, Leinster and Kambalda; a nickel smelter at Kalgoorlie; and a nickel refinery at Kwinana. These operations produce approximately 50 percent of all Western Australian nickel and in terms of nickel concentrate production, Nickel West is the third largest producer in the world[50]. In 2017-18, Nickel West operations produced 90,600 tonnes of nickel metal equivalent[51].

In addition to ore from Nickel West mines, the Nickel West Kambalda concentrator also sources sulphide nickel ore from a number of other smaller mines in the Region. These third-party arrangements have historically accounted for around 30 percent of the feedstock at the Kambalda concentrator[52], albeit softer nickel prices over the past several years have seen much of this third-party supply cease.

Nickel West has recently undertaken significant investment to expand production at its Mount Keith mine, with production at the Yakabindie satellite deposit expected to commence in 2019, together with a study into the feasibility of increasing the Mount Keith concentrator capacity to 50,000 tonnes per annum, and restarting and upgrading pits at the Leinster operations with an aspirational target of 40,000 tonnes per annum[53].

Nickel West is also investing in downstream capacity at its Kwinana Refinery to produce nickel sulphate, a chemical product that is used to manufacture battery precursor chemicals for nickel-

[50] *Minerals Statistics Digests* (1990-91 to 2015-16), Department of Mines, Industry Regulation and Safety
[51] *BHP Operational Review for the year ended 30 June 2018*, published BHP Billiton, 30 June 2018
[52] *Third party supply to Kalgoorlie Smelter* in *Nickel West: Think Big – A view to the future*, published BHP Billiton, 6 August 2018
[53] *Nickel West: Think Big – A view to the future*, published BHP Billiton, 6 August 2018

rich lithium-ion batteries used in electrical vehicles. The soon to be commissioned 100,000 tonne per annum plant is currently the subject of an expansion study that if implemented would see nickel sulphate production double to 200,000 tonnes per annum and potentially the addition of a cobalt sulphate module.

Minara Resources (Glencore): Murrin Murrin

The Murrin Murrin project is a lateritic nickel project that utilises High Pressure Acid Leaching (HPAL) technology to recover nickel and cobalt. The project is located between Leonora and Laverton in the north-east Goldfields region and has been operating under different ownership since 1999. Primarily as a result of low mining costs, the Murrin Murrin project is one of the lowest cost nickel operations in the world[54].

The project is currently owned and operated by Minara Resources, a wholly owned subsidiary of Glencore. In 2017, the Murrin Murrin operation produced 41,900 tonnes of nickel sulphide and 3,000 tonnes of cobalt sulphide. All production is marketed through Glencore's global operations and is the subject of offtake agreements[55].

Independence Group: Nova Bollinger

The Nova-Bollinger project is an operating mafic nickel-copper-cobalt open-stope underground mine, targeting predominantly nickel and copper recovery but also producing cobalt as a by-product. The project is 100 percent owned by Independence Group and first shipments of ore from the project commenced in 2017, achieving first commercial-scale production at nameplate capacity of 1.5 million tonnes per annum of ore throughput the following year[56]. An expansion of the project to increase throughput to 1.8 million tonnes per annum is presently under way, due to be completed in 2019-2020[57]. In 2017-18, the project produced 22,258 tonnes of nickel and 9,545 tonnes of copper.

Both nickel and copper production from the project is secured with three-year offtake agreements supplying nickel to BHP Nickel West and Glencore, and copper to Singaporean entity Trafigura Group[58].

With approximately 11.7 million tonnes of ore reserves, and increasing production rates, there are obvious issues relating to the life of the project. Discovery of the nearby Silver Knight deposit 25 kilometres from the Nova-Bollinger ore body by Mark Creasy, a 16 percent owner of Independence Group, has led to speculation regarding a partnership or sale agreement to extend the mine life.[59]

Independence Group is also exploring the potential to develop a nickel sulphate production facility based on proprietary technology. This is discussed further in Section 3.6.

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[54] *Anaconda Nickel Ltd Nickel and Cobalt Mine*, published Mining Technology, accessed 01/08/2018
[55] *Amended and Restated Offtake Agreement* in *Notice of Annual General Meeting and Explanatory Memorandum*, published Minara Resources, April 211
[56] *Nova Site Visit*, published Independence Group, 4 August 2018
[57] *Nova Site Visit*, published Independence Group, 4 August 2018
[58] *First nickel concentrate shipment from Nova project*, published Independence Group, 12 December 2016
[59] *Official figures show Creasy's WA nickel-copper find could provide needed feed for hungry Independence*, Fitzgerald, B, published Resources Rising Stars, 2 August 2018

First Quantum: Ravensthorpe Nickel Project

The Ravensthorpe Nickel Project is located at Bandalup Hill, approximately 35 kilometres east of the town of Ravensthorpe.

Consisting of nickel laterite deposits found in an approximately 3km by 1km tabular body extending north-west from Bandalup Hill, the Halley's, Hale-Bopp and Shoemaker-Levy deposits (collectively Bandalup Hill) were first subject to significant exploration and resource development in the late 1990s by Comet Resources, culminating in a relatively modest mining proposal[60]. In partnership with Billiton (soon to merge with BHP) and following a further feasibility study in 2002, an expanded proposal was developed. This formed part of an integrated development with BHP's Yabulu nickel refinery at Townsville, Queensland which would see 220,000 tonnes per annum of an early-stage mixed nickel-cobalt hydroxide product derived from a pressure acid leach process exported from Esperance Port for final refining at Yabulu, resulting in final production of around 50,000 tonnes per annum of nickel metal and 1,400 tonnes per annum of cobalt over a 25-year lifespan[61].

Significant State and Commonwealth government interest in the project and the accompanying development of southern Western Australia more generally resulted in approximately $40 million in combined funding committed to development of multi-user infrastructure supporting the Ravensthorpe Nickel Project[62]. In contrast to prevalent FIFO models, the mine was to be developed with significant local community participation, guided by a Community Liaison Committee, which would see a locally-based workforce of 650 employees based in the region at Ravensthorpe, Hopetoun and Esperance, supported by a relatively small FIFO workforce[63], in addition to investment in community infrastructure and procurement involving local businesses. Final investment decision was made in 2004, with an estimated capital cost of $1.1 billion. However project costs escalated through construction, and by commissioning in mid-2008 costs had increased to $2.3 billion after a four-year construction period characterised by significant delays[64].

Once commissioned, the project was in operation for less than a year, with production indefinitely suspended in January 2009, resulting in the loss of approximately 800 directly employed and a further 1,000 contract positions[65], including approximately 350 employees already relocated to the Ravensthorpe region to service the project[66]. Community concerns were expressed

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[60] Comet Resources NL/ICF Kaiser (1998), *Ravensthorpe Nickel Project Feasibility Study – Consultative Environmental Review*, published Environmental Protection Authority/State Library of WA, July 1998

[61] Environmental Protection Agency (2003), *Ravensthorpe Nickel Project – Changes to Environmental Conditions*, Bulletin 1093 (April 2003), Environmental Protection Agency WA; Department of Industry and Resources (2008), *Ravensthorpe unveiled* in *Prospect* magazine, East Perth, WA

[62] Department of Industry and Resources (2008), *Ravensthorpe unveiled* in *Prospect* magazine, East Perth, WA

[63] Department of Industry and Resources (2008), *Ravensthorpe unveiled* in *Prospect* magazine, East Perth, WA; BHP Billiton (2008), *Australian Site Tour: Ravensthorpe Nickel Operation*, 29 October 2008

[64] Sharples, B (2008), *BHP to tackle Ravensthorpe's laterite*, Sydney Morning Herald, 20 May 2008

[65] ABC News (2009), *1,800 jobs lost as BHP shuts Ravensthorpe nickel mine*, ABC News, 21 January 2009

[66] Department of Industry and Resources (2008), *Ravensthorpe unveiled* in *Prospect* magazine, East Perth, WA

particularly with respect to the flow-on effects to the local region, including the ability of local businesses to service finance taken out to expand to meet project demand[67].

After significant write-downs and impairment, BHP sold the asset in December 2009 to Canada-based First Quantum Minerals (FQM) for $375 million. FQM invested in several improvements in processing to reduce costs and improve returns, estimating a restart date of late 2011 with a plant workforce of approximately 600[68]. Under FQM, production resumed in October 2011, with commercial production achieved by end of 2011 with a peak workforce of 578, of which 200 were locally based in Ravensthorpe and Hopetoun[69]. The mine subsequently achieved nameplate production of around 25,000 tonnes per annum of nickel, exporting a containerised nickel hydroxide precipitate product via the South Coast Highway to the Port of Esperance under a long-term agreement with Southern Ports[70]. The mine supported a workforce of 450, with around 150 based in residential accommodation in Hopetoun and Ravensthorpe[71].

As a result of declining nickel prices, the Ravensthorpe mine was again placed into care-and-maintenance in October 2017 at an estimated cost of $10 million and ongoing costs of $5 million per annum[72].

With nickel prices recently recovering, FQM has undertaken preparatory works to underpin a potential recommissioning of the project, including additional drilling on the Shoemaker-Levy deposit and early discussions with Southern Ports Authority. FQM has further stated a preference to source workers from the Ravensthorpe, Esperance and Albany region under a drive-in-drive-out model, in addition to utilising existing housing stock in Hopetoun[73].

Other Nickel and Cobalt Prospects

Mincor Resources: Kambalda Nickel Projects

Mincor Resources (Mincor) is currently developing a number of projects in the Kambalda Region. When commissioned, ore production from these projects will be the subject of an Offtake and Processing Agreement (OTCPA) with BHP Nickel West that will see this ore treated via the Nickel West Kambalda Concentrator. The final agreed OTCPA was executed in August 2019.

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[67] Lague, D (2009), *BHP mine mire uncovered as Ravensthorpe post-mortem continues*, Sydney Morning Herald, 7 February 2009

[68] First Quantum Minerals (2009), *News Release – Acquisition of the Ravensthorpe nickel operation, Western Australia*, 8 December 2009; Murphy, M (2009), *We'll fix Ravensthorpe, says First Quantum*, Sydney Morning Herald, 10 December 2009

[69] First Quantum Minerals (2011), *2011 Annual Report*, 31 December 2011; First Quantum Minerals (2012), *2011 Annual Report*, 31 December 2012

[70] Esperance Ports Sea and Land (2014), *2014 Annual Report*, Esperance, WA

[71] Rintoul, C (2017), *First Quantum Minerals to place Ravensthorpe Nickel Operation on care and maintenance*, The Esperance Express, 9 August 2017; MiningLink, *Ravensthorpe – First Quantum*, http://mininglink.com.au/site/ravensthorpe, website accessed July 2019

[72] First Quantum Minerals (2017), *2017 Annual Report*, 31 December 2017; Rintoul, C (2017), *First Quantum Minerals to place Ravensthorpe Nickel Operation on care and maintenance*, The Esperance Express, 9 August 2017

[73] First Quantum Minerals, *Operating Mines – Ravensthorpe*, https://www.first-quantum.com/Our-Business/operating-mines/Ravensthorpe/default.aspx, website accessed July 2019; Mining.com (2019), *First Quantum signals potential restart of Ravensthorpe mine*, Mining.com, 13 May 2019; Regional Coordination Group (2019), *Attachment A – Ravensthorpe-Esperance Mining Activity*, supplied.

Mincor also recently completed acquisition of Long Operations (Long) from Independence Group in May 2019. The Company is currently completing a definitive feasibility study (DFS) for an integrated mine operation encompassing initially, Long, Durkin North, and their high grade discovery at Cassini. The ore from these projects will be fed into the Kambalda Concentrator at a targeted range of between 400,000 to 600,000 tonne per annum. Depending on the ultimate feed grade, nickel in concentrate production will be around 13,000 tonnes of contained nickel in concentrate which will be immediately sold to BHP Nickel West. The Cassini Mineral Resource is the first new greenfields discovery in the Kambalda region for decades and has delivered high grade intersections. Mincor is actively exploring for potential repeats of Cassini nearby.

Ardea Resources: Goongarrie Nickel-Cobalt

The Goongarrie Nickel-Cobalt Project is 100 percent owned by Ardea Resources and is located near Kalgoorlie. The largest known cobalt resource outside of the Democratic Republic of Congo, the high grade resource has been the subject of exploration and feasibility studies since 2004[74].

The results of a pre-feasibility study released in 2018 indicate a JORC-compliant total reserve of 40.1 million tonnes of high-grade cobalt, supporting a 'base case' of 1 million tonnes per annum ore processing and resulting in approximate output of 41,500 tonnes battery grade nickel sulphate and 5,000 tonnes cobalt sulphate per annum[75]. The company is understood to be progressing a definitive feasibility study looking at increasing total ore throughput to 2.25 million tonnes per annum, which would result in a cobalt sulphate output of around 10,000 tonnes per annum[76].

Barra Resources and Conico: Mt Thirsty Cobalt-Nickel

Located near the town of Norseman in the Shire of Dundas, the Mt Thirsty project is based on a somewhat unusual highly oxidised nickel-cobalt-manganese deposit, with high-grade cobalt-bearing ores supporting a focused atmospheric leaching cobalt recovery process, resulting in lower processing capital costs compared to more typical pressurised acid leach[77]. As a result, approximately 80 percent of project revenue is expected to derive from cobalt[78].

The project is a 50:50 Barra Resources and Conico joint venture. Scoping studies completed in 2018 support a 21-year life of mine, scaling to 1,900 tonnes per annum cobalt and 1,760 tonnes per annum nickel, with a pre-feasibility study commencing May 2018 to firm these results further[79].

3.3.2. Increasing spodumene production

As with the Region's nickel sector (see Section 3.3.1), rapidly escalating current and expected future demand for nickel-rich lithium-ion batteries that are becoming the platform technology for electric vehicles is driving rapid demand for spodumene concentrate that is the feedstock for the manufacture of lithium hydroxide. This is resulting in a dramatic increase in the expansion of existing and activation of new spodumene mines and concentrator facilities in the South West, Pilbara

[74] *Quarterly Operations Report*, published Ardea Resources, 30 June 2018
[75] *Goongarrie – Highly-scalable, multi-decade project*, in *Advancing our Flagship, Multi-Decade Goongarrie Nickel Cobalt Project Towards Production*, presented Aredea Resources, Battery Material 2018, Shanghai, PRC, 18-19 April 2018
[76] *2.25Mtpa Goongarrie Nickel Cobalt Project Expansion Study Demonstrates Enhanced Project Economics,* published Ardea Resources, 24 July 2018
[77] *Mt Thirsty Cobalt-Nickel Project*, published Barra Resources, accessed 01/08/2018
[78] *Ibid*
[79] *Ibid*, *Conico and Barra hand out contracts for Mt Thirsty*, McKinnon, S published The West Australian, 31 May 2018; *Mt Thirsty PFS Contracts Awarded*, published Conico, 31 May 2018

and Goldfields-Esperance Regions, committed investment in lithium hydroxide conversion plants in Kwinana and Kemerton and consideration of additional prospective plants in these locations and elsewhere.

The following Figure 20[80] illustrates the location of key lithium production assets in Western Australia.

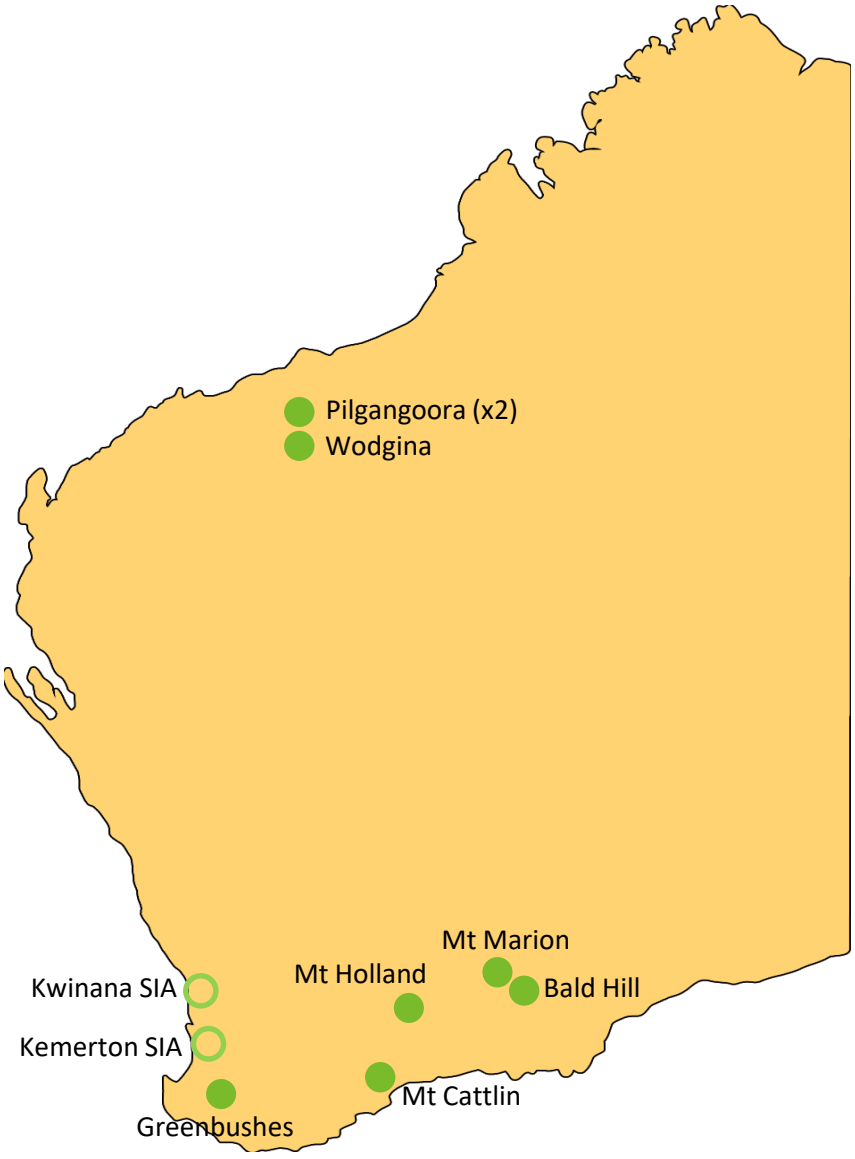

FIGURE 22 – Key Western Australian Lithium Production Assets

Lithium hosting pegmatites were first discovered in the Goldfields-Esperance Region in the early-1900s, and while mined at small scale in the late 1950s, it wasn't until 2009 that they were mined at a commercial scale and have only been mined continuously since 2016[81].

[80] Australian Venture Consultants (2019) 'WA's Future in the Lithium-ion Battery Value Chain: Nine Months Down the Road', *CCIWA Works Conference Presentation*, Crown Towers, June 2019`

[81] PorterGeo Database, Mount Marion (http://www.portergeo.com.au/database/mineinfo.asp?mineid=mn1543)

Today, three separate operations in the Region account for approximately one third of Western Australia's spodumene concentrate production. While based on current projections, spodumene concentrate from the Region and its immediate surrounds is expected to increase from approximately 750,000 tonnes to 1,200,000 tonnes, significant increases in production from the Greenbushes operation in the South West Region and several operations in the Pilbara Region will likely see the Goldfields-Esperance Region's share of Western Australian spodumene concentrate production stabilise at around 25 percent. This is summarised in the following Table 12[82].

TABLE 12 – Western Australian Spodumene Concentrate Production

Region	Project	Late 2018 Approx. Production	Aspirational Production[1]
South West		**1,100,000**	**2,340,000**
	Greenbushes (Tianqi & Albemale)	1,100,000	2,340,000
Goldfields[83]		**746,000**	**1,200,000**
	Bald Hill (Alita Minerals)	155,000	240,000
	Mt Cattlin (Galaxy)	156,000	210,000
	Mt Marion (Mineral Resources & Ganfeng)	435,000	450,000
	Mt Holland (Kidman & SQM)		300,000
Pilbara		**550,000**	**1,170,000**
	Pilgangoora (Pilbara Minerals)	330,000	1,200,000
	Pilgangoora (Altura)	220,000	450,000
	Wodgina (Mineral Resource & Albemarle)		750,000
TOTAL		**2,396,000**	**4,710,000**

Key spodumene concentrate producing assets are summarised in the following subsections.

Mineral Resources and Ganfeng Lithium: Mt Marion

The world's second largest known high-grade spodumene resource, the Mt Marion mine and concentrator is located south-west of the town of Kalgoorlie in the eastern Goldfields. While the Mt Marion resource has been the subject of exploration since the 1950s[84], production has only

[82] Australian Venture Consultants (2019) 'WA's Future in the Lithium-ion Battery Value Chain: Nine Months Down the Road', *CCIWA Works Conference Presentation*, Crown Towers, June 2019

[83] For the purposes of this analysis, the Mt Holland Project which is located in the adjacent Yilgarn Shire of the Wheatbelt Region is included as a 'Goldfields' asset as it is likely to be serviced by Goldfields based infrastructure

[84] *Mount Marion pegmatites*, published Mindat.org, accessed 01/08/2018

recently commenced under the current 50:50 joint venture between Mineral Resources and Ganfeng Lithium in 2017.

Offtake from the Mt Marion project is secured through a life-of-project binding offtake agreement with Jiangxi Ganfeng Lithium for 100 percent of production for so long as the mine is operating, with Neometals (a former joint venture partner) and Mineral Resources having an option to purchase 51 percent of production from the fourth year of production onwards if a price premium over the price specified in the Jiangxi Ganfeng Lithium offtake agreement can be secured[85].

The project is currently operating at a nameplate capacity of 435,000 tonnes of spodumene concentrate per annum. Ongoing works at the site to increase throughput to approximately 450,000 tonnes per annum continue, with commissioning expected by end of financial year 2019, while exploratory drilling is under way to further define the Mt Marion ore body[86].

Galaxy Resources: Mt Cattlin

Mt Cattlin is Western Australia's second largest lithium mine and a globally significant source of raw material for the lithium chemical industry. Located near Ravensthorpe, Mt Cattlin is an open pit lithium-tantalum operation mining a relatively flat ore body. Like the Greenbushes operation, the ownership of Mt Cattlin has changed hands several times over its long history, which as an exploration project dates back to the 1960s.

Current owners, Galaxy Resources, operated the mine from 2009-2012, before placing it in care-and-maintenance in 2013 and sourcing supply from the Greenbushes project, citing a high Australian dollar and increased low-cost supply from Latin American brine operations as factors rendering Mt Cattlin production uncompetitive at the time.[87]

Following additional capital works designed to upgrade the processing plant and double throughput to 1.6 million tonnes per annum[88], the Mt Cattlin mine was recommissioned in 2016, with first concentrate production shipped through Esperance Port in early 2017. The project is underpinned by five separate offtake agreements that cover 100 percent of planned production with conversion plants across Asia[89] (understood to be predominately with PRC converters[90]), that extend out to 2023.

Spodumene concentrate is currently trucked to Esperance Port via South Coast Highway rather than previous export arrangements through Bunbury[91], with Qube Bulk, having constructed a

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[85] *Reed Industrial Minerals signs offtake and funding deal with lithium producer Jiangxi*, Venna, S, published Mining Technology; *Neometals sends maiden shipment to "lithium giant" Ganfeng,* published InvestorIntel, 9 February 2017

[86] *Quarterly Exploration and Mining Activities Report Jan to Mar 2019 (Q3 FY19)* (2019), Mineral Resources, 30 April 2019

[87] *Lithium mine shut down in blow to Ravensthorpe,* Kagi, J, published ABC News Online, 20 March 2013

[88] *Galaxy Resources waves off first lithium shipment from Mt Cattlin mine*, Lucas, J, published ABC Rural News, 3 January 2017

[89] *Galaxy signs binding long-term offtake agreements for Mt Cattlin*, published Galaxy Resources, 29 November 2017

[90] *Galaxy Resources Limited shares storm higher on massive offtake agreement*, Mickleboro, J, published The Motley Fool, 29 November 2017

[91] Galaxy Resources (2016), *Quarterly Cashflow and Activities Report*, December 2016; Galaxy Resources (2017), *First lithium concentrate shipment from recommissioned Mt Catlin operations*, January 2017

purpose-built storage facility in Esperance with a capacity of 30,000 tonnes, providing current trucking services under a long-term contract[92]. By February 2017, production had increased to nameplate capacity at 156,000 million tonnes per annum of spodumene concentrate[93].

At present, processing operations at Mt Cattlin consist of an open pit mine, three-stage crushing circuit and concentrator. Plant upgrades over the course of 2018 have improved recovery rates, and production is expected to rise to 210,000 million tonnes of spodumene concentrate by end of 2019.

Galaxy has also acquired a number of additional tenements over 2018, conducting targeted exploration seeking to extend the Mt Cattlin mine life. Over 2018, the JORC-compliant total mineral resource was upgraded to 16.7 million tonnes at 1.15 percent lithium oxide with further increases expected[94]. However, in late 2019, Galaxy announced plans to scale-back production from the Mt Cattlin operation.

Alita Resources Limited: Bald Hill

The Bald Hill Project is located near Kambalda in the Shire of Coolgardie. Initially a 50:50 joint venture between Tawana Resources and Alliance Mineral Assets, in December 2018 ownership was consolidated into Alliance Mineral Assets under a scheme of arrangement[95], with Alliance Minerals subsequently changing its name to Alita Resources Limited.

The operation is an open-cut lithium and tantalum ore mining supplying an onsite concentration plant. Following completion of the scheme of arrangement, Alita Resources embarked on an exploratory drilling program at the Bald Hill site, combining infill drilling to convert the 8.8 million tonnes of inferred resource to reserve status, extension drilling at the eastern extension of the defined resource and exploratory drilling at the fringes of the current known mineralised area[96]. On the basis of these results, an exploration target of 17 to 24 million tonnes at 1.25-1.40 percent lithium oxide was announced in May 2019[97].

Production at the mine for the first quarter 2019 has been positive and exceeded previous quarterly results, with a reported 38,291 tonnes of spodumene concentrate produced (68 percent increase over Q4 2018) and 44,305 tonne shipped (100% increase over Q4 2018), including a trial shipment to a potential new customer not identified by Allita[98].

All concentrate production from Bald Hill is currently shipped to the PRC. Offtake agreements with previous exclusive partner Burwill Commodity Limited have been renegotiated to allow Alliance to sell to other customers, while the Burwill offtake rights and obligations have been transferred to

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[92] Regional Coordination Group (2019), *Attachment A – Ravensthorpe-Esperance Mining Activity*, supplied.
[93] Galaxy Resources (2017), *2017 Q3 Results Presentation*, October 2017
[94] Galaxy Resources (2018), *Annual Report – Year ended December 31 2018*, December 2018
[95] *Implementation of Scheme of Arrangement with Tawana Resources* (2018), Alliance Mineral Assets Ltd, 14 December 2018
[96] *Resource Drilling Recommences at Bald Hill Mine* (2019), Alliance Mineral Assets Ltd, 18 March 2019
[97] *New Exploration Target identified at Bald Hill* (2019), Alliance Mineral Assets Ltd,10 May 2019
[98] *Record quarterly production at Bald Hill Lithium production up 68%* (2019), Alliance Mineral Assets, 8 April 2019

a new entity, PRC-based Jiangxi Bao Jiang Lithium Industrial (a 50:50 joint venture between Burwill and Jiangte Special Electric Motor)[99].

On 30 August Alita Resources entered into administration.

Covalent Lithium: Mt Holland

While located in the adjacent Shire of Yilgarn in Wheatbelt Region, if developed the Mt Holland project will possibly be serviced to some degree by Goldfields-Esperance infrastructure. The project has delineated a resource of 189 million tonnes at 1.50 percent lithium oxide. The project, which is currently the subject of a Definitive Feasibility Study was a 50:50 joint venture between Kidman Resources and Sociedad Quimica y Minera (SQM). Conditional offtake agreements are in place and the project has also acquired an option over a site in the Kwinana SIA with a view to establishing a hydroxide conversion plant

In September 2019, Wesfarmers Ltd acquired Kidman Resources, including its interest in the joint venture, with Covalent Lithium appointed by Wesfarmers and SQM as the joint venture manager.

Final Investment Decision on a mine and concentrate operation with a nameplate capacity of 300,000 tonnes was expected in 2019-20. However, in January 2020, Wesfarmers announced that it had delayed its final investment decision on the project to the first quarter of 2021.

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3.4. Other battery minerals projects

3.4.1. Graphite

Mineral Commodities: Munglinup Graphite

The graphite deposits near the town of Munglinup, approximately 70 kilometres east of Ravensthorpe, have been known and sporadically explored since the early 20th century, with repeated interest in its high-grade deposits failing to result in significant commercial production[100]. Previous feasibility studies and exploration by the Western Australian Government, Gwalia Consolidated and Battery Limits have established a JORC-compliant resource of 3.625 million tonnes at 15.3 percent graphite, with a commercially favourable flake size distribution of 65 percent greater than 150 micrometres and 35 percent 'Jumbo' (greater than 300 micrometres)[101].

Current tenement majority owner Mineral Commodities acquired a 51 percent controlling stake from Gold Terrace in 2017, with the farm-in agreement establishing a pathway for Mineral Commodities to secure 100 percent ownership upon commercialisation[102]. A feasibility scoping study and expanded drilling program over late 2017 and early 2018 indicated an economic, low-

[99] *Alliance Mineral to add market pricing, drop exclusivity in restructured offtake deal* (2019), Ng, R.J, published The Business Times (Singapore), 15 January 2019
[100] *Munglinup Graphite deposits*, published Mindat.org, accessed 01/08/2018
[101] *Ibid*, *Munglinup Graphite Announcement*, published Mineral Commodities, 11 September 2017
[102] *Ibid*; *Mineral Commodities to acquire stake in Munglinup graphite project*, Masige, S, published Australian Mining, 11 September 2017

cost project, with potential production of 55,000 tonnes of high purity graphite concentrate per annum over a mine life of nine years[103].

No offtake agreements are yet in place, however Mineral Commodities is understood to be in early stage discussions in this regard[104], and a pre-feasibility study released in May 2018 utilises an assumption that long-term offtake agreements will be in place by June 2019[105].

A definitive feasibility study was completed in January 2020. Positive results from additional drilling has defined a further mineralised zone of higher purity graphite mineralisation, influencing final project design. Ongoing discussions are understood to be underway between Mineral Commodities and the EPA as to the level of environmental assessment the final project will require. Subject to a positive outcome, Mineral Commodities plans to increase its stake in the joint-venture to 90 percent[106].

3.5. Other important sectors

3.5.1. Rare Earths

The Goldfields-Esperance Region has consistently produced a rare earth minerals concentrate product for almost a decade. The term 'rare earths' refers to the 15 lanthanides as well as scandium and yttrium. They can be categorised as 'light rare earths' (lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium and gadolinium), 'heavy rare earths'(terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium and yttrium) and 'other rare earths' (scandium).

Rare earths actually exist in the Earth's crust in relative abundance. However, there existence in concentrations and mineralisations that facilitate economic recovery is relatively rare. Some rare earths such as lanthanum and cerium have been sourced from mining operations and used in industrial applications for many decades. However, the unique chemical, catalytic, magnetic, optical, electronic and metallurgical properties associated with different rare earths has rendered them critical components of many hi-tech products, such as the neodymium-iron-born magnets used in small and large electric motors and generators, battery chemistries, various military applications, satellite applications, advanced ceramics and other chemical processes.[107]

The strategic importance of rare earths, extent of PRC control over supply and the fact that Western Australia (particularly the GVROC Region) is one of few established sources of supply outside of the PRC, has led to a strengthening of formal bilateral relations in rare earths trade and investment between Australia and the United States.

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[103] *Munglinup Graphite Project scoping study results,* published Mineral Commodities, 27 November 2017; *Munglinup Metallurgical Testwork confirms premium flake graphite*, published Mineral Commodities, 8 February 2018; *Expandable graphite produced from Mineral Commodities' Munglinup ore*, Nicholas, L, published SmallCaps, 8 May 2018

[104] *Race is on at Munglinup*, Washbourne, M, published Australia's Paydirt magazine, 1:259 (Apr 2018)

[105] *MRC Munglinup graphite PFS confirms robust project*, published Mineral Commodities, 30 May 2018

[106] *Quarterly Activities Report*, published Mineral Commodities, 31 March 2019; *2019 Annual General Meeting Presentation*, published Mineral Commodities, 30 May 2019

[107] Australian Venture Consultants (2014), *Australian Strategic Minerals Industry: A Preliminary Assessment of the Viability of Western Australian Projects and Downstream Processing Opportunities in Rare Earths and Lithium*, Chamber of Minerals and Energy Western Australia

Lynas Corporation: Mount Weld Central Lanthanide Deposit and Duncan Deposit

Lynas Corporation is the owner and operator of the Mt Weld Central Lanthanide Deposit (CLD) light rare earths mine and mineral concentrate facility, as well as the adjacent and yet to be developed, heavy rare earths deposit. Located 30 kilometres south of Laverton, these projects represent one of the few large-scale commercial rare earth deposits outside of the PRC.

The Mt Weld concentrator is a flotation plant designed to process 240,000 tonnes per annum of ore, producing 66,000 tonnes per annum of a light rare earth minerals concentrate containing 26,500 tonnes of rare earth oxides. This concentrator was commissioned in May 2011 and has been exporting mineral concentrate to the Lynas Advanced Materials Plant in Kuantan, Malaysia, for separation into specific light rare earth oxide products since 2012. The mineral concentrate product is trucked in containers from the project site to Leonora, where the containers are loaded onto rail transport to Esperance Port for export.

In May 2019, Lynas announced an A$500 million growth plan out to 2025, which may include:

- Further investment in the Lynas Advanced Materials Plant in Kuantan
- Increased processing in Western Australia
- Development of the Duncan heavy rare earths project
- Partnering in heavy rare earth separation capacity in the United States

In December 2019, Lynas announced plans to construct a rare earths cracking and leaching plant in Kalgoorlie.

3.5.2. The Iron Ore Sector

While primary production of iron ore does not occur in the GVROC Region, production from the Koolyanobbing iron ore mine located in the Shire of Yilgarn in the adjacent Wheatbelt Region, has been transported via rail through the Goldfields-Esperance Region to Esperance port since 1993 and when in production, is a major component of the cargo profile of Esperance Port (see Section 6.4.1).

Mineral Resources: Koolyanobbing

Prior to the acquisition of the Koolyanobbing mine by Mineral Resources in June 2018, the project was operated by Cleveland-Cliffs (a subsidiary of Cliffs Asia Pacific Iron Ore) at a rate of approximately 11 million tonnes per annum. In March 2018, Cleveland Cliffs announced that as a result of the profitability of the project being eroded by lower PRC contract prices for lower-grade iron ore, it would be closing the operations[108].

Because the project directly employed approximately 400 people at the mine site, and arguably more importantly, accounted for 75 percent of total export tonnage and approximately 120 jobs at Esperance Port, the Southern Ports Authority and Western Australian Government worked with Cleveland Cliffs to identify and secure an acquirer of the operating asset, which is understood to include concessions on port charges and royalties[109].

Mineral Resources completed its acquisition in June 2018 which includes the mine and associated infrastructure, rolling stock and improvements to facilities at Esperance Port. The company has

[108] Chiat J. (2018), *Cliffs Koolyanobbing mine closure to put hundreds out of work*, The West Australian, 20 March
[109] Hon. Mark McGowan (2018), Government works with Mineral Resources to protect WA jobs, Media Statements, WA Government, 13 June

committed to a five-to-six year operation, but at a significantly lower throughput of 6.5 million tonnes per annum and with a smaller mine workforce of 280. The first shipment of iron ore under Mineral Resources management occurred in December 2018. Mineral Resource has previously operated the nearby 5 million tonne per annum Carina iron ore project, which following a decision by the Western Australian Government not to permit an expansion of the project, was placed in care-and-maintenance in the first half of 2018.

3.5.3. Uranium prospects

The Centipede, Millipede, Lake Maitland and Lake Way uranium deposits collectively form the Wiluna Uranium Project under development by Toro Energy, the owner of further two uranium deposits in the north-east Goldfields region, Dawson Hinkler and Nowthanna.

As shown in Figure 21[110] below, the Centipede and Millipede deposits are located 30 kilometres south of the Wiluna township. Federal approval for development of the mine was granted in 2013, with environmental approval for further expansions received in 2017 and a comprehensive agreement with native title owners finalised in 2016[111].

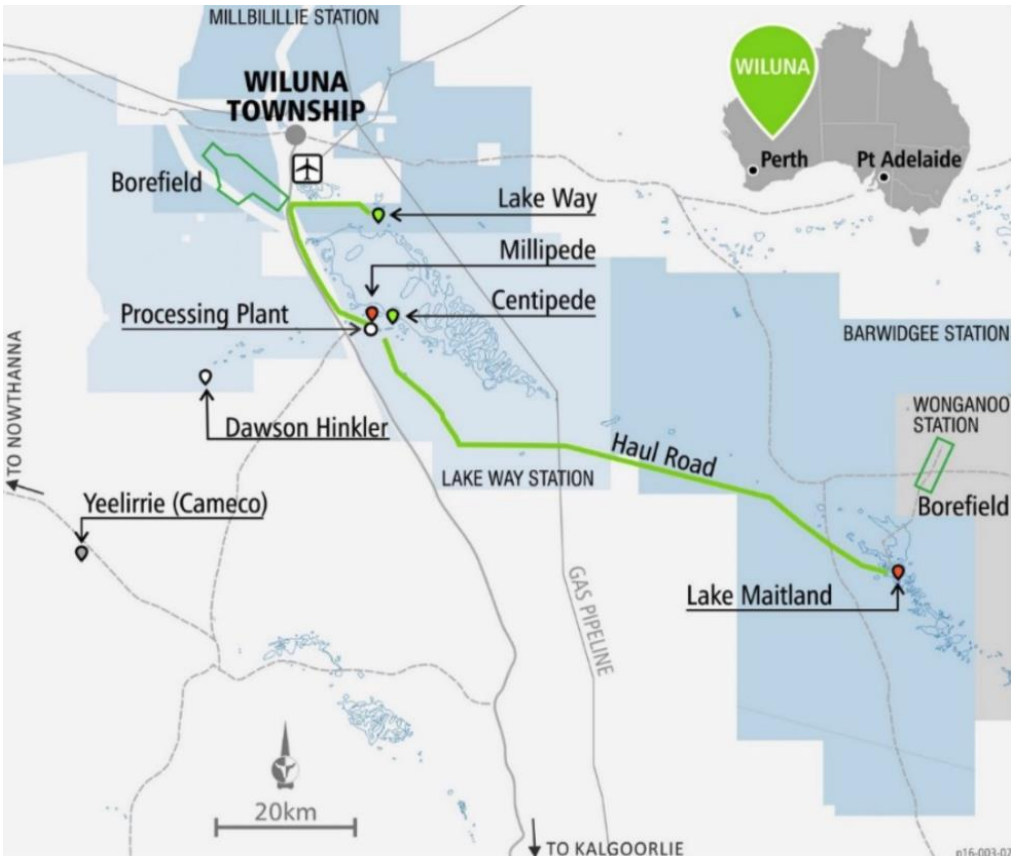

FIGURE 23 – Wiluna Uranium project location

In addition to the four mines, the Project encompasses the construction of a processing facility and related infrastructure, including tailings storage facilities. Finished uranium oxide is currently planned to be road freighted interstate to the Port of Adelaide in South Australia for final export overseas. During the 2017-18 financial year, Toro stated a primary goal was to continue to advance the development of the Project, securing finance and bring it to production with the

[110] Toro Energy Limited
[111] Toro Energy Limited (2018), *2018 Annual Report*

lowest possible cost. As of mid-2018, Toro Energy has reiterated its commitment to securing finance for the project, and over the course of 2018-19 preliminary metallurgical work has been completed and a pilot plant constructed.

3.6. Downstream processing

The Goldfields-Esperance Region has a long history of downstream processing of mineral production. This includes its many gold operations that produce and export refined bullion, concentration and smelting of nickel and cobalt product and HPAL production of nickel and cobalt product. The current and projected significant increase in spodumene concentrate (see Section 3.3.2) and nickel (see Section 3.3.1) production, as well as the prospect of further rare earths processing (see Section 3.5.1) from the Region, has created interest in the prospect of a new battery and technology chemicals industry in the Region.

In terms of committed projects, this new emerging sector in Western Australia is currently concentrated in the:

- Kwinana Strategic Industrial Area where Tianqi is currently commissioning the first stage of a 48,000 tonne per annum lithium hydroxide conversion plant and BHP Nickel West, a 100,000 tonne per annum nickel sulphate production facility associated with its refinery; and
- Kemerton Strategic Industrial Area where the Albemarle-Mineral Resources joint venture is constructing a 20,000 tonne per annum lithium hydroxide conversion plant, that is scalable to 100,000 tonnes per annum.

Both the Albemarle and Tianqi lithium hydroxide conversion plants source spodumene concentrate from the Talison Lithium Greenbushes operation in the South West Region which is a 50:50 joint venture between Albemarle and Tianqi and the lowest cost hard rock lithium mining and concentrate operation in the World. The BHP Nickel West nickel sulphate plant is an extension of the Nickel West production system that has a significant footprint in the Goldfields Region.

Additionally, other downstream chemical conversion plants have been proposed and are at various stages of assessment, with the Goldfields-Esperance Region being considered a possible location for some of these plants. This is summarised in the following Table 13.

TABLE 13 – Location of Current and Prospective Downstream Processing Facilities Associated with Western Australian Battery Minerals Production

Downstream Plants for which the Goldfields-Esperance Region is being considered a location	Downstream Plants Being Developed or Considered for Other Locations
Independence Group Nickel Sulphate Plant Independence Group is currently conducting a study into the commercial viability of a proprietary technology for producing quality nickel sulphate directly from the nickel sulphide concentrate product produced from its Nova Bollinger project. Depending on the outcomes of this study, a feasibility study into the project will consider a site near Kalgoorlie as an option.	**Covalent Lithium Lithium Hydroxide Plant** The Wesfarmers-SQM (Covalent Lithium) Mt Holland Joint Venture has secured an option over a site at the Kwinana Strategic Industrial Area, where if the project proceeds, it intends to establish a lithium hydroxide conversion plant.

Neo Metals Lithium Hydroxide Plant Former minority shareholder in the Mt Marion Project, Neometals, has conducted process testing to produce lithium hydroxide from Mt Marion-sourced spodumene, and is in the process of an engineering design study for a 10,000 tonne per annum lithium hydroxide plant to be operational by 2021[112] at a site near Kalgoorlie. If commissioned, Neometals will use its offtake option to provide feedstock for the proposed conversion plant.	**Pilbara Minerals Lithium Hydroxide Plant** Pilbara Minerals, owner and operator of one of the Pilgangoora spodumene concentrate projects in the Pilbara Region of Western Australia, has entered into a joint venture with Korean company POSCO which involves an equity position in a downstream lithium conversion plant located in Korea sourcing feedstock from Pilbara Mineral's Pilgangoora operation.
Lynas Corporation Expansion As discussed in Section 3.5.1, Lynas Corporation's expansion plans for the Mt Weld CLD and Duncan deposits include potential further downstream processing in Western Australia, which may revolve around an investment in plant in the Goldfields-Esperance Region.	**Albermarle-Mineral Resources Lithium Hydroxide Plant** The Albemarle-Mineral Resources 50:50 joint venture on the Wodgina spodumene mine and concentrate project in the Pilbara Region is currently undertaking a feasibility study exploring the viability of a 60,000 to 110,000 tonne per annum lithium hydroxide plant to be located in the Pilbara Region.
	Albemarle-Mineral Resources Lithium Hydroxide Plant Expansion The 20,000 tonne per annum Albemarle-Mineral Resources lithium hydroxide conversion plant, currently under construction at the Kemerton Strategic Industrial Area, is scalable to 100,000 tonnes on-site.
	BHP Nickel West Nickel Sulphate and Cobalt Sulphate Expansion BHP Nickel West is investigating expansion of its Kwinana nickel sulphate plant to 200,000 tonnes per annum, as well as viability of a cobalt sulphate module at Kwinana SIA facility.

Additionally, with the exception of Albemarle and Tianqi controlled projects which can be funded off-balance sheet, all other battery mineral projects in Western Australia are financed by medium-term off-take agreements with downstream processors, the vast majority of which are operating lithium, nickel sulphate and cobalt sulphate conversion plants in Asia, primarily the PRC.

Given the PRC's track-record in using various policy leavers such as taxation and export controls to manipulate markets in key inputs to technology products that favour its production base and market position, there are strategic reasons for operators in the lithium-ion and other technology product supply chains to locate elements of the supply chain outside of the control of the PRC government. However, Western Australian downstream operations face fundamental competitive challenges with respect to operations located in Asia, particularly those located in the PRC. The battery and technology chemical sectors of East Asia and particularly the PRC have a distinct competitive advantage that revolves around:

- First mover advantage, with established production facilities that can be expanded though lower cost brownfields development, existing large local industrial ecosystems that deliver more competitive inputs, a skilled workforce and intellectual property;
- Significant capital and operating cost advantage that for structural reasons is difficult for Western Australian industry to match and which automation can only partially address;

[112] *Outstanding vendor test results for lithium hydroxide produced from Mt Marion concentrates*, published Neometals, 10 April 2018

- More facilitative and concessionary industry development policy frameworks that for legal and political reasons Australian governments are unable to replicate; and
- Very large local markets for the end products[113].

While the strategic rationale for having some chemical and downstream production outside of the PRC combined with the ability to produce a very high quality and traceable product might assist Western Australian downstream production competing with lower cost Asian production in some markets, the established Asian sector is a formidable threat in most cases[114].

All aspiring downstream chemical operations in Western Australia face this challenge. However, *ceteris paribus*, operations in Kwinana and Kemerton have the capacity to partly mitigate this threat by virtue of being in close proximity to chemical industry ecosystems (albeit much less diverse and much smaller than those in Asia) and by being relatively better connected to global chemical industry supply chains.

While there are some chemical industry operations in the Pilbara and Goldfields-Esperance Regions, they are less robust. However, operations in the Pilbara and Goldfields-Esperance Regions of Western Australia have an advantage that they are close to the source of the relevant mineral concentrate input and may be able to more efficiently manage waste streams. Whatever the case, it is very clear that fit-for-purpose, cost effective infrastructure will be critically important to the viability of a future downstream chemicals industry in the Goldfields-Esperance Region.

3.7. Mining Services Sector

In 2016, Western Australia accounted for over 25 percent of the A$90 billion Australian Mining Equipment, Technology and Services (METS) industry, the operations of which are primarily located in Perth[115].

Concentrated primarily in the City of Kalgoorlie-Boulder, the Goldfields-Esperance Region's mining services sector has a significant heritage. Local engineering, fabrication, drilling, civil and earthworks, training and other mining services businesses initially developed in the Region to service the rapidly growing mining industry in what was then a very remote part of Western Australia. Some of these companies grew into global operations. For example, Ausdrill was established in Kalgoorlie in 1987 and by 1990 had expanded into Africa and today employs over 4,500 people across 10 countries with turn-over of A$0.75 billion per annum[116].

In 2012, there were approximately 200 manufacturing and services sites in the City of Kalgoorlie-Boulder[117] servicing local and in some cases, national and international markets. The sector is

[113] Australian Venture Consultants (2018), *WA's Future in the Lithium Battery Value Chain,* Chamber of Commerce and Industry WA
[114] Australian Venture Consultants (2018), *WA's Future in the Lithium Battery Value Chain,* Chamber of Commerce and Industry WA
[115] Department of Jobs, Tourism, Science and Innovation (2016), Invest in the West: Mining Equipment, Technology and Services (METS) in Western Australia, Western Australian Government, Perth
[116] City of Kalgoorlie-Boulder (2018), Submission: Inquiry into how the mining sector can support businesses in regional economies
[117] Satchwell, I. (2012), *Building mining services clusters in Australia*, International Mining for Development Centre, Peru International Gold Symposium and Silver Forum

underpinned by a propensity for mining operations in the Region to optimise local procurement. For example, KCGM sources approximately 30 percent of its supplies locally[118].

The Region has a unique advantage, whereby by regional standards it has a significant native mining technology, research and education capability in the form of the Curtin University Western Australian School of Mines and Central Regional TAFE that are integrated with its mining services sector. In 2017, a new mining innovation hub was launched in Kalgoorlie-Boulder as an initiative developed by the Cooperative Research Centre for Optimising Resource Extraction (CRC ORE) and the WA School of Mines (see Section 9.2.1). Other partners in this hub include the Chamber of Minerals and Energy, Central Regional TAFE (see Section 9.2.2), City of Kalgoorlie-Boulder and METS Ignited. The hub has cash and in-kind support totalling $112 million from industry, various government agencies and not-for-profit organisations out to 2021.

3.8. Implications for GVROC Region Infrastructure

Hard infrastructure usage by minerals operations in the GVROC Region is highly variable, ranging from operations that are totally self-reliant, to those that use a mix of proprietary and common use infrastructure, with some operations relying on common-use infrastructure extensively. Appendix 4 provides an overview of how different minerals operations in the Region access hard infrastructure requirements.

The shifting dynamics of the Region's minerals industry as discussed in this Section have a number of implications for infrastructure in the Region. These are discussed in the following subsections.

3.8.1. Increasing prevalence of dual, triple and quad road trains

Increased volumes of ore, reagent and waste movements are likely to drive increased number and size of heavy vehicles, including dual, triple and quad road trains, on the Region's road networks (see Section 6.1).

Ore, concentrate and waste transport

The volume of ore, concentrate and waste being transported on the Region's roads is likely to increase as a result of increased:

- Activation of satellite gold deposits and smaller mines that have toll treating arrangements with established operations, requiring ore to be transported from mining operations to processing facilities via the road network;
- Continued and potentially increased volumes of crushed iron ore being transported via road from the Yilarn deposits (located in the Wheatbelt Region, rather than the Goldfields-Esperance Region) to Esperance Port;
- Volumes of nickel concentrate and rare earths mineral concentrate from mine sites to rail loading facilities along the Leonora-Kalgoorlie-Esperance line;
- Volumes of spodumene concentrate from production facilities across the Region to Esperance Port, other regional Western Australian ports and potentially lithium hydroxide plants that are not located at the mine site; and
- Volumes of solid and liquid processing plant residues and tailings that cannot be disposed of at site.

[118] City of Kalgoorlie-Boulder (2018), Submission: Inquiry into how the mining sector can support businesses in regional economies

Reagent transport

Plant expansions and new plants being constructed in the Region to support increased production of gold, nickel, cobalt and spodumene concentrate will naturally need to be serviced by larger volumes of various reagents used by those plants such as cyanide, sulphuric acid, caustic soda and other chemical inputs. The potential development of downstream chemical conversion plants for lithium hydroxide and rare earth concentrate product will significantly add to demand for reagents, which are typically a major component of total cost and, in terms of volume, can equate to or even exceed that of the final product.

These products will likely primarily be sourced from the Kwinana chemicals industry where they are manufactured or imported from overseas suppliers, and in some instances from the Eastern States and inter-regionally (e.g. some lime from the Mid West Region). Apart from some reagents sourced from the Eastern States which are transported to the Region by rail, such cyanide, the majority of reagents are imported to the Region via road transport. In the future they could potentially be imported directly to the Region via Esperance Port, however capacity constraints may limit the extent to which this can occur.

Reagents that are likely to be required in increased volumes include cyanide, sulphuric acid, caustic soda, soda ash, liquid carbon dioxide, ammonia, phosphoric acid, silica, lime and quick-lime.

3.8.2. Possible case for additional shared infrastructure

As discussed in Section 3.6, the aspirations of the Goldfields-Esperance Region to establish a downstream chemicals industry may become hindered by cost implications of the absence of a local chemical industry ecosystem that can cost effectively supply various reagent inputs.

This disadvantage could potentially be overcome if multiple downstream plants invested in shared facilities ranging from a localised source of lime, to a local caustic or carbon dioxide plant that can service multiple facilities. However, it is highly likely that the investment case for such a proposal would require to be underpinned by significant confidence in sustained long-term demand from multiple projects.

3.8.3. Possible increase in rail freight

From a minerals industry perspective, the Region's rail network (see Section 6.2) is used primarily to transport nickel and rare earths product from production facilities in the north of the Region to downstream processing facilities in the centre of the Region and Kwinana, or to export through Esperance Port or Fremantle Port. Under current volumes, the rail network is not congested.

However, two eventualities may increase volumes of mineral product on the rail network, potentially leading to congestion:

- Increased nickel and rare earths production; and
- Increased transition of cargo from road transport to rail as result of cost, availability of vehicles or community pressure to reduce the number of heavy vehicles on the Region's road network (see Section 2.5.1).

3.8.4. Possible congestion at Esperance Port

Current projections and development plans for developments in the nickel, rare earths, spodumene concentrate and iron ore sectors will see increased volumes of mineral product

through Esperance Port (see Section 6.4.1). This will place further pressure on berth occupancy rates, ship-loading and other cargo handling infrastructure, storage and laydown capacity at the Port.

While there are expansion limitations at Esperance Port, this risk is somewhat mitigated (congestion issues aside) by the export optionality that is provided by other regional ports (Albany, Bunbury and Geraldton), Fremantle Port and eastern state's ports that are connected by the Region's road and rail network.

3.8.5. Increasing throughput at aviation facilities

While the expansion of the minerals industry that is discussed in this Section will potentially result in some increase in the residential workforce, the remote nature of many of the operations and the requirement for specialist skills means that the FIFO workforce will also increase. In some instances, this workforce will access projects directly via a site airstrip. In others, the FIFO workforce will access projects via public airstrips (see Section 6.3) that are in reasonable proximity to the project site.

Furthermore, while a portion of exploration activity will be supported by the local mining services sector (see Section 3.7), it too will be serviced significantly by a FIFO workforce, who in the majority will access the Region via RPT and charter flights to and from the Region's main public airports and aerodromes.

3.8.6. Possible increase in demand for soft infrastructure

Given the relatively low average unemployment rate across the Region (see Section 2.1.1), to the extent that the expansion discussed in this Section endeavours to deploy a residential workforce, it is likely that a significant portion of that residential workforce will be immigrating to the Region.

Should this occur, additional pressure will be placed on all categories of infrastructure, particularly soft infrastructure (see Section 9) such as education and healthcare.

3.8.7. Possible increase in demand for high quality water

Most downstream processing of minerals produced in the GVROC Region revolve around circuits that include significant hydro-metallurgical components, requiring a source of process water. In many cases saline and hyper-saline ground-water sources are in relative abundance (see Section 7.4) and can be accessed, treated for plant specifications and recycled for re-use in the process circuit.

In the case of downstream processing circuits that are producing high quality chemical products for the lithium-ion battery or other technology supply chains, very high purity water is required as a process input. While all water sources must be treated upstream (typically by processes such as reverse osmosis) to achieve the necessary levels of purity, and most water sources are able to be treated for this purpose, generally speaking, the more pure the feedstock water the lower the treatment costs and the smaller and less problematic the waste stream.

High quality water is relatively scarce in most areas of the GVROC Region.

3.8.8. Possible increased in demand for waste management

Most minerals projects manage waste through licensed landfill, tailings piles and ponds and other approved waste management systems that are located on their mining lease in close proximity to operations (see Section 7.6). Downstream processing systems that produced chemical

products from spodumene concentrate and particularly rare earth concentrates can in some instance produce waste products that require specialist treatment and disposal in long-term containment systems.

This may result in a need for specialist waste processing and transport systems in the Region.

3.8.9. Increased in demand for affordable and reliable energy

Obviously, minerals processing plants are energy intensive. They require reliable and affordable electricity to operate plant motors and control systems, and in some instances as an input to a separation or recovery process such as electrowinning. They also require reliable and affordable access to thermal energy to heat solutions, often to very high temperatures.

Energy, particularly access to affordable and reliable electricity, is a significant issue in parts of the GVROC Region (see Sections 7.2 and 7.3).

3.8.10. Possible need for improved telecommunications

Increased automation, particularly as the gold sector increasingly transitions to underground operations, will require to be supported by regional data networks that connect mining and processing systems to remote control centres and other sources of information. Like many parts of regional Australia, the extent to which the GVROC Region has access to reliable commercial grade broadband services is variable, and largely constrained to operations in close proximity to major infrastructure corridors (see Section 7.1).

Most operations are able to overcome this challenge by establishing proprietary networks, typically via satellite.

3.8.11. Possible increase in demand for industrial land

For most projects, immediate downstream processing facilities are located adjacent to the mining operations on the mining lease. However, for more complex downstream operations such as those that produce chemicals for the lithium-ion battery or other technology product supply chains land availability in the GVROC Region is more problematic.

As the result of the various infrastructure challenges set out in this Subsection 3.8, to be competitive these plants need to be located in areas that optimise efficient and reliable access to services such as logistics, electricity, natural gas, water and waste management services. Such locations tend to be in or in close proximity to the major population centres and in the case of the Goldfields the availability of suitable, serviced heavy industrial land in these locations is currently constrained (see Section 8.1).

4. The GVROC Regional Agricultural Industry

KEY POINTS

Approximately 720 agricultural enterprises in the Goldfields-Esperance Region produce GVP of approximately $820 million per annum.

While the agricultural industry performs important economic and social functions across the Region, cropping enterprise in the southern areas of the Region account for approximately 85 percent of agriculture GVP and enterprises in the Region.

Livestock operations dominate agricultural production in the northerly interior parts of the Region, operating under an extensive grazing model on mainly unimproved pastures.

Increasing crop volumes are driving greater volumes of heavy vehicles on the southern road networks, and could potentially contribute to congestion at Esperance Port, albeit port optionality for grain exports provides some mitigation in this regard.

Future productivity growth in grains production will be increasingly dependent on digitisation of farm equipment and the supply-chain. Current limitations to commercial grade broadband access across the Region are a potential barrier to this.

Non-mining primary production in the GVROC Region is focused mainly on broad-acre cropping, mixed enterprise (crops, sheep and cattle) and extensive grazing of livestock. There is some agriculture and natural forestry production of sandalwood, mallee, bluegums and pine, and Esperance Port serves an export function for wood chip products sourced from plantations in the Great Southern Region. The potential for marine aquaculture in proximity to the town of Esperance is also being explored.

As with data pertaining to the GVROC minerals industry, reliable independent agricultural data for the Shire of Wiluna is limited. In most cases, agricultural data pertaining to the Shire of Wiluna is amalgamated with the neighbouring Shire of Meekatharra, or the wider Mid West Region. As such, unless otherwise noted, the analysis presented in this section is exclusive of the Shire of Wiluna. Given there are fewer than 10 agricultural enterprises in the Shire of Wiluna employing just 3.5 percent of the Shire's population[119], the omission of analysis of the agricultural industry in the Shire of Wiluna is not considered material for the purposes of this infrastructure strategy opportunities identification study.

Agricultural production occurs across the GVROC Region, albeit in terms of Gross Value of Product (GVP), it is very much concentrated in the Esperance Sub-region[120]. In 2015-16, the GVROC Region

[119] Australian Bureau of Statistics, 2016 Census Data

[120] The agricultural sector statistics used in this section are derived from the more current ABARES Agricultural Census Data at the time of writing. This dataset does not provide resolution at an LGA scale. Instead data is reported under 'ABARES sub-region, namely Leinster-Leonora, Kambalda-Coolgardie–Norseman and Esperance. Notably, the Esperance Sub-Region includes the Shire of Jerramungup, which is not located in the Goldfields-Esperance Region.

produced total agricultural GVP of approximately $817 million, of which almost 95 percent was generated from the Esperance Sub-region. This is illustrated in Figure 24[121] below.

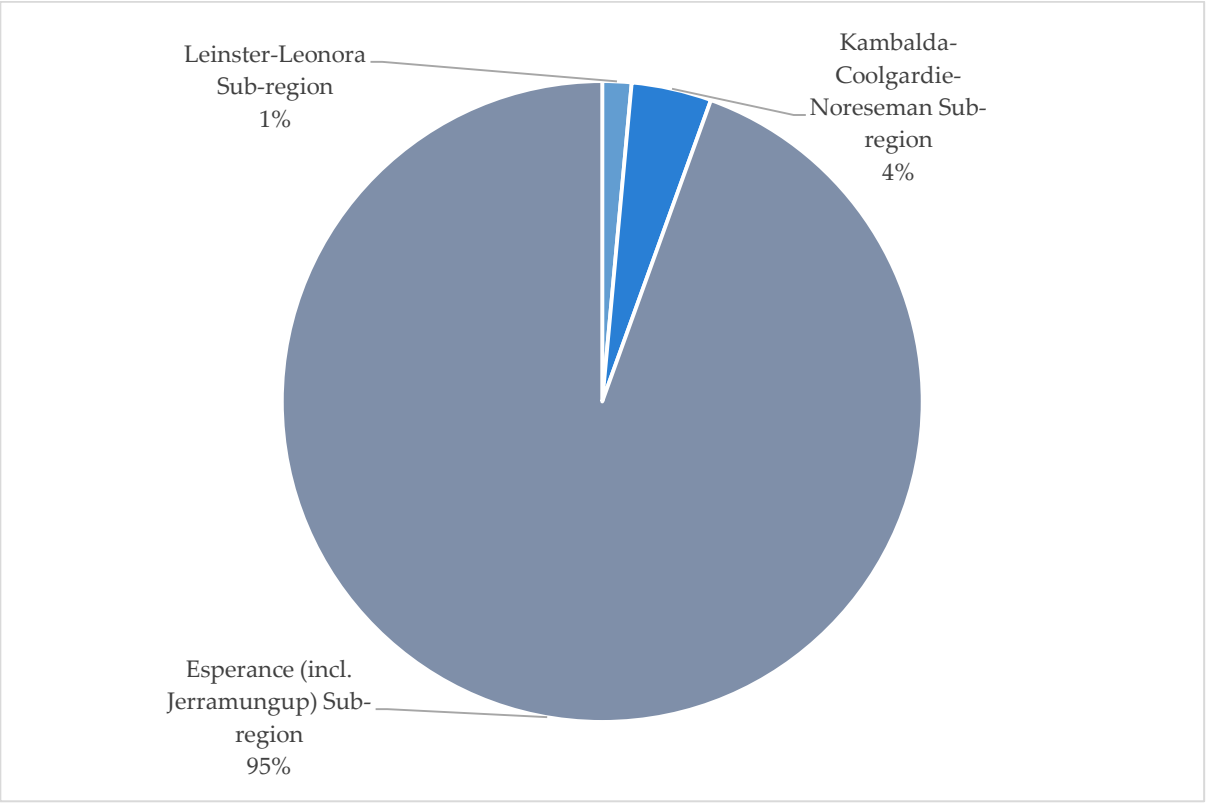

FIGURE 24 – GEOGRAPHICAL CONCENTRATION OF AGRICULTURAL GVP IN THE GVROC REGION (2015-16)

The cropping sector accounts for 85 percent of GVROC Region agricultural GVP and is 97 percent concentrated in the Esperance Sub-region. Similarly, 77 percent of the A$124 million of livestock GVP produced in the GVROC Region is produced from operations in the Esperance Sub-region. This is illustrated in Figure 25 below.

[121] Australian Bureau of Agricultural and Resource Economics and Sciences/Commonwealth Department of Agriculture (2017), *Australian Agricultural Census 2015-16*, Australian Government, Canberra ACT

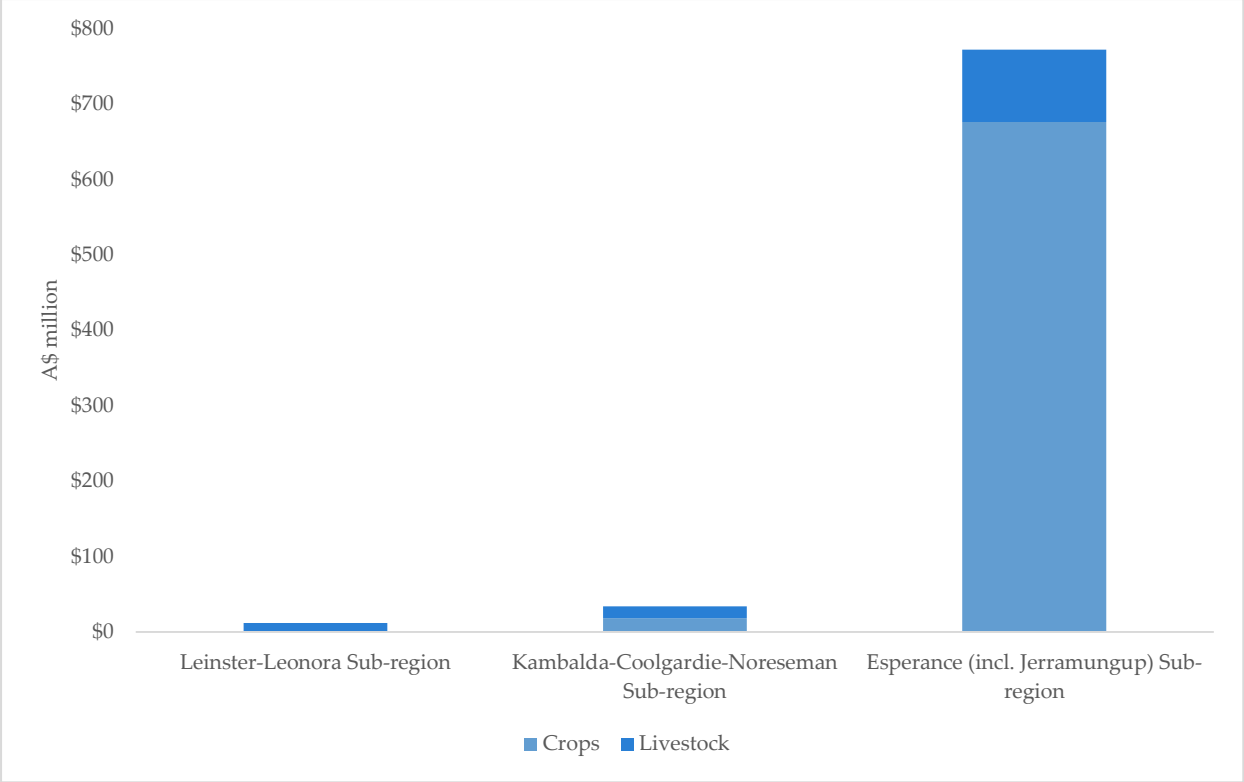

FIGURE 25 – GVROC REGION CROP AND LIVESTOCK PRODUCTION BY SUB-REGION (2015-16)

The Esperance Sub-region also accounts for approximately 95 percent of the approximate 710 individual agricultural enterprises operating in the GVROC Region, including 100 percent of cropping enterprises, 95 percent of sheep enterprises and 86 percent of cattle enterprises.

4.1. The Esperance sub-region

As illustrated in Figure 26 below, the Esperance Sub-region incorporates the Shires of Esperance and Ravensthorpe, as well as the Shire of Jerramungup which is part of the adjoining Great Southern Region rather than the Goldfields-Esperance Region.

FIGURE 26 – ESPERANCE SUB-REGION

The Esperance Sub-region is characterised by high rainfall and soil productivity, and hosts some of the most productive agricultural land in Western Australia, with GVP per hectare across the region of $530. Given this agronomic profile, it is not surprising that the predominate sector in the Esperance Sub-region is cropping, with over 80 percent of agricultural businesses in the Sub-region undertaking some cropping and 40 percent being cropping-only enterprises. The following Table 14 summarises the Esperance Sub-region cropping sector.

TABLE 14 - Esperance Sub-region Cropping Sector

	Value	Portion of Sub-region Total
Gross Value of Product	$676m	87.5%
Total area of land	934,189ha	64.6%
Wheat yield	1,052,260t	
Barley yield	667,578t	
Number of agricultural enterprises	389	

As a major cropping region of Western Australia, more current and detailed information on cropping in the Region is produced by the Grains Industry Association of Western Australia in the form of monthly cropping reports[122]. The data collected to inform the monthly cropping reports does not conform with the ABARES regions otherwise used as the basis for the analysis in this Report.

[122] Grains Industry Association of Western Australia, *GIWA Crop Reports*, South Perth, WA

Rather it is based on the CBH receival zones illustrated in Figure 27[123] below, whereby Zones 18 and 19 comprise the Esperance Zone.

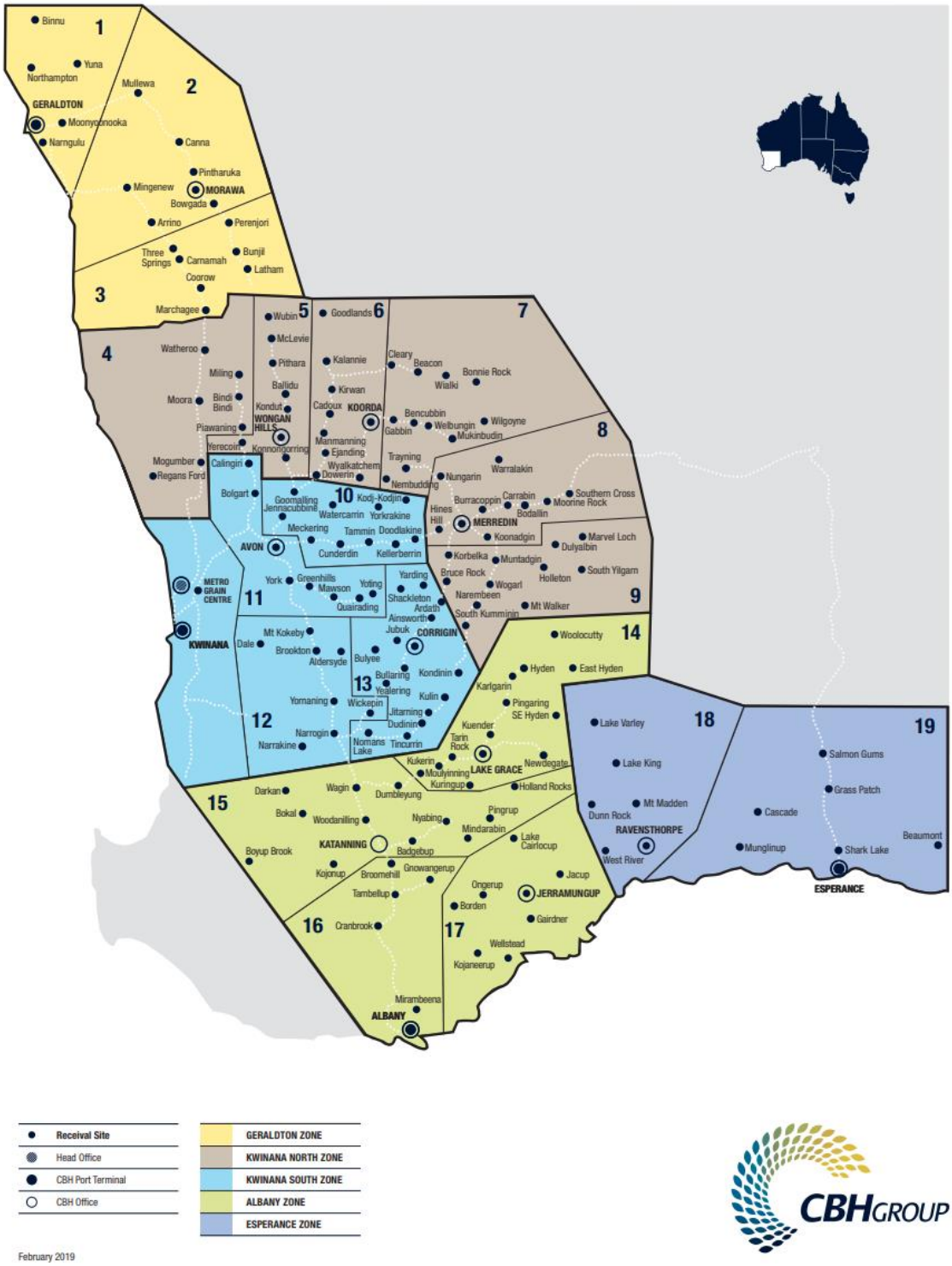

FIGURE 27 – CBH Grain Receival Zones (Esperance Zone – Zone 18 and 19)

[123] Co-operative Bulk Handling Group Ltd (2019), *CBH Network Map – Receival Sites*, Perth, WA

While not consistent with the geospatial basis on which the rest of the analysis in this section is based, the Grains Industry Association data provides a more current indication of trends in the important GVROC Region cropping sector. As summarised in Table 15[124] below, while the area of cropping given over to wheat production in the Region has remained relatively stable and canola has declined since 2015, it is apparent that the production of barley and pulses from the Region has increased dramatically. The net affect has been an increase in the area planted to crops over the past five years. This, combined with increased yields across many operations in the Region, is resulting in increased volume of grains production.

TABLE 15 – Area Planted to Crops in the Esperance Zone (2015 to 2019)

Area planted (ha)	July 2015	July 2016	July 2017	July 2018	July 2019	2019 % of state total
Wheat	500,000	490,000	539,000	510,000	500,000	10.9%
Barley	288,000	288,000	290,000	350,000	380,000	19.5%
Canola	270,000	278,000	281,000	210,000	165,000	16.6%
Oats	6,000	6,000	6,000	10,000	10,000	2.9%
Lupins	9,000	9,000	9,000	10,000	10,000	2.8%
Pulses[125]	12,000	15,000	15,000	20,000	35,000	66.1%
TOTAL	**1,085,000**	**1,086,000**	**1,140,000**	**1,110,000**	**1,100,000**	

Livestock enterprise in the Esperance Sub-region produces beef cattle, sheep meat and wool, primarily from improved pastures. The following Table 16 summarises the Esperance Sub-region livestock sector.

[124] Derived from *GIWA Crop Reports* for month of July, period 2015 to 2019.
[125] Reported as field peas prior to 2018.

TABLE 16 - Esperance Sub-region Livestock Sector

	Value	Portion of Sub-region Total
Gross Value of Product		
Slaughter cattle	$35m	4.6%
Slaughter sheep	$27m	3.5%
Wool	$34m	4.4%
Total	$96m	
Total Area of Land		
Improved pastures	276,515ha	
Unimproved pastures	20,414ha	
Total	296,928	
Yield		
Cattle herd	80,408	
Sheep flock (breeding 1yr+)	378,458	
Lambs marked	318,719	
Number of Agricultural Enterprise		
Cattle	128	32.9%
Sheep	228	58.6%

4.2. Kambalda-Coolgardie-Norseman sub-region

As illustrated in Figure 28 below, the Kambalda-Coolgardie-Norseman Sub-region comprises the central Goldfields-Esperance Region Shires of Coolgardie and Dundas, as well as the City of Kalgoorlie-Boulder.

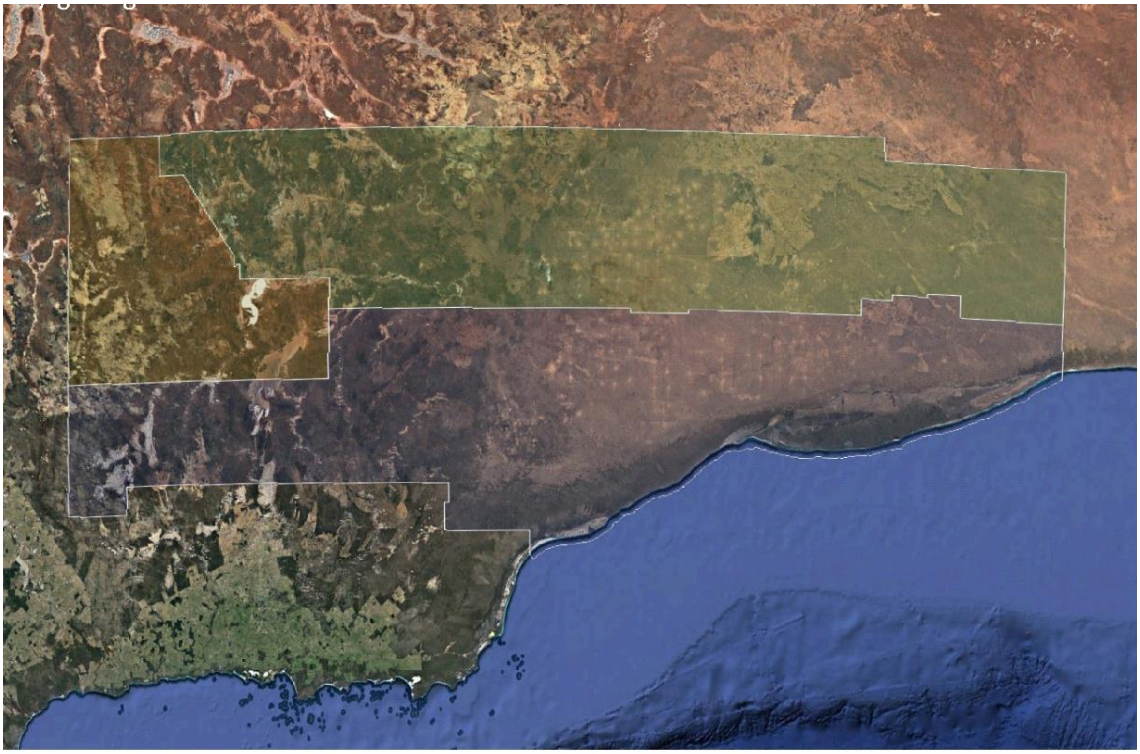

FIGURE 28 – The Kambalda-Coolgardie-Norseman Sub-region

The Kambalda-Coolgardie-Norseman Sub-region is characterised by some extensive sheep and cattle grazing operations in its northern areas, and mixed cropping-livestock enterprises in its southern areas. Cropping accounts for just under 55 percent of the $33 million of agricultural GVP produced by this Sub-region, with cattle accounting for the vast majority of the balance. The following Table 17 summarises the Kambalda-Coolgardie-Norseman cropping sector.

TABLE 17 - Kambalda-Coolgardie-Norseman Cropping Sector (2015-16)

	Value	Portion of Sub-region Total
Gross Value of Product	$18m	54.5%
Total area of land	12,560ha	0.2%
Total crop yield	8.372t	

The following Table 18 summarises the Kambalda-Coolgardie-Norseman livestock sector.

TABLE 18 - Kambalda-Coolgardie-Norseman Sub-region Livestock Sector

	Value	Portion of Sub-region Total
Gross Value of Product		
Slaughter cattle	$14m	42.4%
Slaughter sheep	<$1m	
Wool	<$1m	
Total Area of Land		
Grazing	4,291,356ha	
Yield		
Cattle herd	30,669	
Sheep flock (breeding 1yr+)	13,359	
Lambs marked	7,494	
Number of Agricultural Enterprise		
Cattle	9	35.7%
Sheep	5	64.3%

4.3. Leinster-Leonora Sub-region

As illustrated in Figure 29 below, the Leinster-Leonora Sub-region incorporates the northerly Goldfields-Esperance Shires of Laverton, Leonora, Menzies and Ngaanyatjarraku.

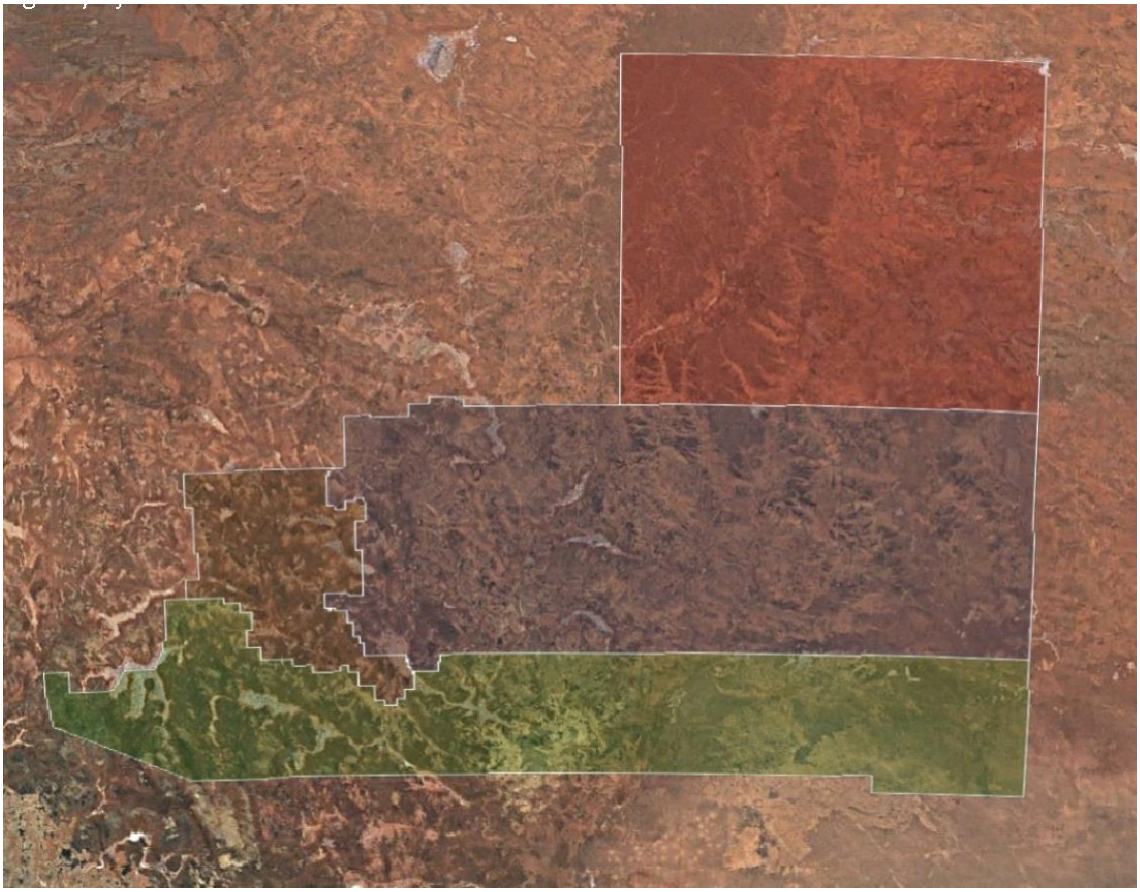

FIGURE 29 – Leinster-Leonora Sub-region

The semi-arid and desert nature of the landscape that is characteristic of this Sub-region limits agricultural practice to extensive pastoral grazing enterprises, running primarily beef cattle, as well as some beef-sheep operations. These enterprises produce a collective GVP of approximately A$12 million.

The following Table 19 summarises the livestock sector in the Leinster-Leonora Sub-region.

TABLE 19 - Leinster-Leonora Sub-region Livestock Sector (2015-16)

	Value	Portion of Sub-region Total
Gross Value of Product		
Slaughter cattle	$11m	91.6%
Slaughter sheep	<1$m	3.5%
Wool	$1m	4.4%
Total	$12m	
Total Area of Land		
Improved pastures	441,486ha	
Unimproved pastures	3,265,381ha	
Total	3,706,867ha	
Yield		
Cattle herd	27,212	
Sheep flock (breeding 1yr+)	1,251	
Lambs marked	141	
Number of Agricultural Enterprise		
Cattle	16	
Sheep	3	

4.4. Implications for regional infrastructure

4.4.1. Increased prevalence of dual, triple and quad road-trains

The main source of pressure on Regional infrastructure that is likely to come from the agricultural industry is in the form of road transport. Where most of the Western Australian grain-belt is serviced by an extensive rail network characterised by multiple regional grain receival points (see Figure 27), the southern part of the GVROC Region (which is also the southern end of the Western Australian grain-belt) is largely void of such a network. Instead agricultural operations are serviced by a large network of local government managed roads (see Figure 33).

While it is potentially possible for agricultural operations to truck grain production from the source of production, via this road network, to existing grain receival terminals along the Kalgoorlie-Esperance rail line (see Figure 35), as a result of rail costs and proximity to Esperance Port, it is more cost effective for producers to truck product directly to the Esperance Port receival terminal.

As a result, increasing grain production from the Region is likely to result in either a larger number of a range of heavy vehicles (dual, triple or quad road trains), or a smaller number of heavier

vehicles (triple and quad road trains) on the road network (see Section 6.1) in the southern part of the Region.

4.4.2. Potential congestion at Esperance Port

Increased grains production from the Region will result in increased throughout at Esperance Port (see Section 6.4.1) potentially placing pressure on berth occupancy rate, cargo handling and storage facilities at the Port, scope for expansion of which is constrained. However, compared to the minerals industry usage of the Port, additional pressure from the grains sector is likely to be incremental. Furthermore, this risk can be mitigated by using the Region's road and rail network to access other grain export facilities at Albany, Bunbury, Fremantle and Geraldton Ports.

4.4.3. Need for improved telecommunications

Productivity growth in the Western Australian grains industry will be increasingly dependent on the application of automated seeding, harvesting and other systems that facilitate precision agriculture. Robust deployment of such systems requires access to commercial quality broadband, which generally can't be delivered through satellite networks such as Skymuster.

Compared to many other regions of Western Australia, the agricultural areas of the southern GVROC Region have reasonable access to an optical fibre backbone (see Figure 56). However, other infrastructure will be required to access this backbone and ensure commercial quality.

5. GVROC Tourism Industry

KEY POINTS

An estimated 680,000 people visit the Goldfields-Esperance Region each year, with over 80 percent of those visitors being intrastate visitors. Over half of all domestic visitors and the vast majority of international visitors visit the Region for business purposes.

Tourism and tourism related services are estimated to contribute approximately $270 million to Gross Regional Product.

Tourism activity in the Region primarily revolves around natural assets, heritage assets that are mainly linked to the Region's mining history, several iconic events and the Region's Indigenous heritage.

The Region's geographical location as a major nexus between the eastern states, central Australia and northern, western and southern parts of Western Australia results in a relatively large number of road tourers transecting and visiting the Region as a part of a more extensive road-trip holiday.

Tourists to the Region primarily share road and accommodation infrastructure with other sectors and the community, with business travellers being major users of aviation infrastructure and a smaller number of tourists visiting the Region by rail (Prospector and Indian-Pacific services) and port (cruise ships visiting Esperance Port).

From an infrastructure management perspective, the main issue associated with the tourism sector is congestion and safety on the Region's road network.

As discussed in Section 2.4, the GVROC Region economy is relatively diverse, with all sectors using key aspects of the Region's infrastructure to varying degrees. However, with respect to 'footprint' on infrastructure that is shared with the Region's minerals and agricultural industries, it is arguably the Region's tourism sector that is most relevant. Furthermore, tourism is a significant sector in its own right, estimated to account for approximately $267 million of the Goldfields-Esperance Region's total Gross Regional Product (GRP) in 2016-17[126].

The relationship between infrastructure and tourism has two aspects. Firstly, visitors to the Region use a range of, primarily transport and accommodation infrastructure, therefore increasing demand and placing pressure on that infrastructure. Secondly, generally speaking, tourists are more attracted to areas that offer a certain or minimum standard of infrastructure and therefore, tourism business tend to advocate for infrastructure to meet those standards.

The GVROC Region tourism sector involves a range of tourism assets that revolve around the Region's rich heritage (particularly its mining heritage, Aboriginal culture, historical trails and routes), iconic events (such as the annual Kalgoorlie-Boulder Race Round and Diggers-and-Dealer Conference), biodiversity, and its diverse and dramatic natural environment which includes arid, desert and coastal landscapes. As a road nexus between the Eastern States, Central Australia

[126] Australian Bureau of Statistics

and the northern, western and southern parts of Western Australia, the Region is the subject of significant visitation or passage of vehicle-born tourists. However, tourists also visit the region by cruise-ship, air transport and rail.

While determining visitation at a regional scale is difficult, it is clear that the majority of visitors to the Region are from within Western Australia, around half visit for work related reasons, around one-third travel alone and the majority are male.

The following subsections discuss the nature of visitation to the GVROC Region, as well as key tourism assets in the Region.

5.1. Visitation to the GVROC Region

The estimates of visitor numbers and nights presented below are based on information from Tourism Research Australia's National and International Visitor Surveys (NVS and IVS respectively), which surveys a sample of visitors coming to or travelling within Western Australia[127]. As a result of data limitations pertaining to the Shire of Wiluna, the analysis in this section pertains primarily to the Goldfields-Esperance Region[128].

As with all surveys, the estimates are subject to sampling error. Interstate estimates are based on smaller sample sizes than either the intrastate or international measures, and as a result can fluctuate significantly year-to-year, making it difficult to determine trends. To increase the sample size and hence improve the reliability of the data, estimates are based on an average of the past three calendar years (2016, 2017 and 2018)[129]. Table 20[130] below identifies the sample size for each category of visitors and visitor nights to the Goldfields-Esperance region.

TABLE 20 – Average Visitation to the Goldfields-Esperance Region – 2016 to 2018

Goldfields-Esperance Visitor Sample Size **(Average of Year Ended Dec 2016/17/18)**	**Sample Size**	**95% confidence intervals**	
		Visitors	**Visitor nights**
Intrastate visitors	772	+/- 8.4%	+/- 11.9%
Interstate visitors	149	+/- 21.7%	+/- 26.6%
International visitors	797	+/- 9.5%	+/- 24.7%

Based on this survey, Table 21[131] below summarises the overnight visitors to the Region by origin for the period 2016 to 2018, and identifies that approximately 83 percent of visitors to the Region are travelling from within Western Australia.

[127] Additional Detail on the methodology can be found on the Tourism WA Corporate Web Site https://www.tourism.wa.gov.au/Research-Reports/Facts-Profiles/Pages/Changes.aspx#/

[128] As with most other State Government bodies, tourism data from Tourism WA is presented in the aggregate by RDC boundary and is not available at a local government level. Accordingly, unless otherwise noted, the data and statistical analysis in this section is not inclusive of visitation to the Shire of Wiluna, which is aggregated within the Mid West Region along with 18 other local governments and therefore not possible to extrapolate.

[129] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet

[130] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet

[131] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet

TABLE 21 – Goldfields-Esperance Annual Average Overnight Visitor Summary – 2016 to 2018

Overnight Visitor Summary	Year ended Dec 2016/17/18 Annual Average Visitors	Year ended Dec 2016/17/18 Percent %
Estimated Visitors		
Intrastate	562,300	83%
Interstate	81,700	12%
International	36,500	5%
Total	**680,500**	**100%**
Estimated Visitor Nights		
Intrastate	2,499,300	74%
Interstate	495,900	15%
International	402,300	12%
Total	**3,397,500**	**100%**
Average Length of Stay		
Intrastate	4.4	-
Interstate	6.1	-
International	11.0	-
Total	**5.0**	-

Table 22[132] below illustrates a summary of the purpose of visiting the Region over the period 2016 to 2018, demonstrating that approximately 47 percent of domestic and 78 percent of international visitors are travelling to the Region for business purposes.

[132] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet

TABLE 22 – Goldfields-Esperance Annual Average Visitors by Purpose – 2016 to 2018

Visitors by Purpose	Year ended Dec 2016/17/18 Annual Average Visitors	Year ended Dec 2016/17/18 Percent %
Estimated Domestic[133] Visitors		
Business	305,000	47%
Holiday	211,500	33%
Visiting friends and relatives	99,200	15%
Other	31,300	5%
Estimated International[134] Visitors		
Business	28,400	78%
Holiday	5,300	14%
Visiting friends and relatives	1,800	5%
Other	2,100	6%

Table 23[135] below identifies that approximately 70 percent of domestic visitors to the Region were male, compared to approximately 52 percent of international visitors.

TABLE 23 – Goldfields-Esperance Annual Average Visitors by Gender 2016 to 2018

Visitors by Gender	Year ended Dec 2016/17/18 Annual Average Visitors	Year ended Dec 2016/17/18 Percent %
Estimated Domestic Visitors		
Male	451,200	70%
Female	192,700	30%
Total	**644,000**	**100%**
Estimated International Visitors		
Male	19,100	52%

[133] Domestic Visitors (Intrastate and Interstate) are defined as Australian residents aged 15 years and over who spent at least one night away from home in Western Australia
[134] International Visitors are defined as visitors aged 15 years and over who spent at least one night in the region and are staying in Australia for 12 months or less
[135] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet

Female	17,400	48%
Total	**36,500**	**100%**

Table 24[136] below identifies the age distribution of visitors to the Goldfields-Esperance Region.

TABLE 24 – Goldfields-Esperance Annual Average Visitors by Age 2016 to 2018

Visitors by Age	Year ended Dec 2016/17/18 Annual Average Visitors	Year ended Dec 2016/17/18 Percent %
Estimated Domestic Visitors		
15 -19 years	29,500	5%
20 – 34 years	179,800	28%
35 – 49 years	186,100	29%
50 – 64 years	170,000	26%
65+ years	78,600	12%
Total	**644,000**	**100%**
Estimated International Visitors		
15 -19 years	1,300	3%
20 – 34 years	17,000	47%
35 – 49 years	4,900	13%
50 – 64 years	8,400	23%
65+ years	5,000	14%
Total	**36,500**	**100%**

The top accommodation choices for visitors travelling to, or within, the Goldfields-Esperance Region are reflected in Table 25[137] below.

[136] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet
[137] Tourism Western Australia (2018), Goldfields-Esperance 2018 Visitor Fact Sheet

TABLE 25 – Top Three Accommodation Choices by Visitor Type (2016 to 2018)

Top Three Accommodation Choices	Year ended Dec 2016/17/18 Annual Average Visitors	Year ended Dec 2016/17/18 Percent %
Estimated Domestic Visitors		
Hotel/resort/motel or motor inn	184,900	29%
Other accommodation	121,700	19%
Caravan or camping – non-commercial	104,100	16%
Estimated International Visitors		
Hotel/resort/motel or motor inn	8,900	26%
Other accommodation	8,000	23%
Caravan or camping – non-commercial	7,100	21%
Note: Accommodation is a multiple response question. Totals may not add up to 100 percent. The base for the percent category is derived from total estimated Intrastate, Interstate and International visitor numbers		

Table 26 below illustrates the type of travel party for visitors to the Region.

TABLE 26 – Type of Travel Party by Visitor Type 2016 to 2018

Travel Party	Year ended Dec 2015/16/17 Annual Average Visitors	Year Ended Dec 2015/16/17 %
Estimated Domestic Visitors		
Travelling alone	200,800	31%
Other	151,500	24%
Adult Couple	115,900	18%
Friends / relatives	99,600	16%
Family group – parent(s) and children	74,300	12%
Total	**642,100**	**100%**
Estimated International Visitors		
Travelling alone	16,700	49%
Adult Couple	10,200	30%
Friends / relatives	5,200	15%
Family group – parent(s) and children	1,700	5%
Other	500	1%
Total	**34,300**	**100%**

5.2. Key tourism assets in the GVROC Region

While most physical tourism assets in the Region are concentrated in or in close proximity to the major centres of Kalgoorlie-Boulder and Esperance, there are numerous and diverse tourism experiences located across the Region. These are discussed in the following subsections.

5.2.1. City of Kalgoorlie-Boulder

The City of Kalgoorlie-Boulder hosts two significant iconic annual tourism events, the Kalgoorlie-Boulder Race Round and the Diggers and Dealers Conference, each which attract a significant volume of visitors to the Region.

Table 27 below identifies the physical tourist attractions in the City Kalgoorlie-Boulder[138].

[138] KalgoorlieTourism.com

TABLE 27 – Key Tourism Assets in the City of Kalgoorlie Boulder

Asset	Description
Kalgoorlie Super Pit and Lookout	Guided tours are available of the Super Pit, which is one of the largest open-cut mines on earth and the biggest gold mine in Australia. The Super Pit now incorporates the historic Golden Mile, marking the spot where Irishman Paddy Hannan first struck gold and sparked the great gold rush of the late 1800s.
Hannans North Tourist Mine	The historical Hannans North Tourist Mine site was one of the first mines in the Kalgoorlie area, dating back to 1893. The Hannans North shaft is 395 metres or 1300 feet deep, and comprises 13 levels, with a single seam of gold bearing quartz. It has been open to visitors since the mine's decommissioning in 1991.
Museum of the Goldfields	The Museum of the Goldfields showcases the history of the Eastern Goldfields and the city's mining heritage, and the role the town played in WA's development, both as a centre of mining and its place at the edge of the Nullarbor Plain. It houses the largest display of the State's collection of gold bars and nuggets.
Beaten Track Brewery	Beaten Track Brewery is the only brew house operating in Kalgoorlie Boulder producing craft beer.
Goldfields War Museum	The Goldfields War Museum was established in 1989 to showcase the Goldfields community contribution to conflicts in which Australia has been involved, including the Boer War, World Wars I and II, through to the 21st Century.
Goldfields Arts Centre	The Goldfields Arts Centre is the City of Kalgoorlie-Boulder endorsed hub for Arts and Culture in Kalgoorlie-Boulder, and is home to one of just three A Class galleries in regional Western Australia, and with a 700 seat capacity theatre.
Hammond Park	Hammond Park is the primary reserve in the Kalgoorlie region, housing a diverse range of activities, a native bird and animal collection including kangaroos, emus and peacocks, and a variety of fish and birds. Hammond Park is also home to a miniature Bavarian Castle that is said to have 40,000 gemstones decorating the facade. Groups and organisations utilise the park for functions, parties, BBQs, christenings, weddings and community days. There are two separate BBQ areas with sheltered seating for hire and a large gazebo area.
Kalgoorlie Boulder Racing Club and Museum	The Kalgoorlie Boulder Racing Club hosts 24 race meetings a year and is host to the Kalgoorlie Boulder 'Race Round', where people visit from all over Australia. The western end of the 'Old Tote' building has now been restored and renovated to house the Signposts Goldfields Racing Museum and the many items of historical value previously housed in the old Trainers' rooms.
Kalgoorlie Golf Course	The Kalgoorlie Golf Course is an 18-hole grass golf course designed by Graham Marsh and is currently ranked #18 in Australia's Top 100 Public Access Courses.
Nullarbor Links	The Nullarbor Links is an 18-hole, par 72 golf course which spans 1,365 kilometres with one hole in each participating town or roadhouse along the Eyre Highway, from Kalgoorlie in Western Australia to Ceduna in South Australia. Each hole includes a green and tee and rugged outback-style natural terrain fairway. The concept was developed to complement and enhance the tourism industry along the Highway, by providing travellers with an additional attraction and hence a reason to spend more time in the region.
Kalgoorlie Town Hall	The Kalgoorlie Town Hall was opened in 1908 and is one of the City of Kalgoorlie-Boulder's major landmarks. It includes a Sporting Hall of Fame, the Council Chambers and Mayor's Parlour, and a commemorative statue of Paddy Hannan.
Boulder Town Hall and the	The Boulder Town Hall was built in 1908 and demonstrates the architectural style of the prosperous gold rush days. The heritage listed hall became famous as the host venue for celebrity performers such as Dame Nellie Melba, Eileen Joyce, Joan Sutherland and even the rock band AC/DC. The theatre features the famous theatre stage curtain painted in 1908 by Philip Goatcher in the Tromp-

Asset	Description
Goatcher Curtain	l'oeil style. It is believed to be the last remaining working stage curtain of its kind in Australia. Guided tours are available.
Eastern Goldfields Historical Society	The Eastern Goldfields Historical Society was established in 1946 and covers 320 000 square kilometres of Western Australia, including towns and centres such as Kalgoorlie Boulder, Coolgardie, Kambalda, Leonora, Gwalia, Laverton, Norseman, Leinster, Wiluna, Menzies and Sandstone. The Eastern Goldfields Historical Society aims to support 'Preserving and Promoting Goldfields History' and provides these services; family history information, local history research, excursions to historical locations, tours of historical buildings, volunteering opportunities, workshops, collections/photographs/bookshop and heritage education.
Heartwalk	Heartwalk is a two year public art project that seeks to revitalise the Kalgoorlie CBD through the installation of professionally curated, high quality painted murals featuring more than 40 local, indigenous and Western Australian professional artists.
Royal Flying Doctor Visitor Centre	The Royal Flying Doctor Service is both a Visitor Centre and Working Base and provides an extraordinary insight into the work of one of Australia's truly legendary organisations. The Visitor Centre incorporates the Roger Waller Theatre, Doc Shop and interactive displays.
Two Up School	The Kalgoorlie Two Up School is an original corrugated iron shed and bush ring situated near the Kalgoorlie town centre.

5.2.2. Shire of Esperance

In the context of tourism, the Shire of Esperance is unique in the Region, as Esperance Port receives visits from around a dozen cruise-ships per annum (see Section 6.4.1). Table 28[139] below identifies the physical tourist attractions in the Shire of Esperance.

[139] Australiasgoldenoutback.com;

TABLE 28 – Key Tourism Assets of the Shire of Esperance

Asset	Description
Cape Le Grand National Park	Within 45 minutes' drive of Esperance, this national park includes a number of spectacular coastal landscape attractions such as Thistle Cove, Dunn Rocks, Le Grand Beach, Hellfire Bay, Rossiter Bay, Lucky Bay, and Frenchman Peak.
Cape Arid National Park	A large national park known for its beaches and rocky headlands, it is a conservation area for 1,100 species of plants and more than 160 bird species, several of which are threatened or endangered. Migrating whales pass by close to the headlands in late winter and spring.
Recherche Archipelago	A cluster of more than 100 islands and islets make up the Recherche Archipelago, a chain of islands stretching 230km from Esperance to the Great Australian Bight. The archipelago includes the bright pink Lake Hellier and Woody Island – the home of white bellied sea eagles, dolphins, sea lions and seals.
Nuytsland Nature Reserve	Nuytsland Nature Reserve contains the 190km long and 80m high Baxter Cliffs - one of longest unbroken cliffs in the world.
Esperance Museum	The Esperance Museum houses a collection of photographs, agricultural and marine machinery, antique furniture, and the world's most comprehensive collection of NASA's 'Skylab' Space Station.
Dempster Homestead	Built in 1867 this was the homestead of Esperance's most famous pioneering family, the Dempsters, and the first home to be built in what would later become the townsite of Esperance.
Historic Museum Park Period Village	A collection of small historical buildings which now house little shops (selling all types of wares), and the Esperance Visitor Centre. Located in the centre of town, the Museum Village is on the site of the town's old railway marshalling yards, and the buildings have been relocated from various different sites around Esperance.
Bijou Theatre	The Bijou Theatre opened in 1896 and over the generations its been used for dances, meetings, agricultural shows, a cinema, and even a roller skating rink. It is currently used for community theatre, and other events including weddings.
Civic Centre	Esperance's primary performance and multi-function space.
The Cannery Arts Centre	A converted fish cannery, it is now an art gallery and workshop craft space. Exhibitions are showcased each month and a variety of cultural classes and events are conducted within the grounds and attracts approximately 20,000 visitors annually.
Esperance Community Arts Centre	Esperance Community Arts (ECA) is committed to bridging the gaps between local artists, community groups, networked agencies and government organisations and features work from over 40 local artists available for sale.
Esperance Stonehenge	The Esperance Stonehenge is the only full size replica of the original Stonehenge in the UK. It appears as the original would have looked around 1950BC. It consists of 137 stones of Pink Granite
Cindy Poole Gallery	Onsite studio and café featuring kiln-fired glasswork, bespoke and conceptual artworks, glass jewellery, functional and decorative glass objects and unique Australian souvenirs.
Mermaid Leather	Australia's only specialist fish and shark leather tannery.
Rotary Lookout	The Rotary Lookout Esperance is located high on a granite outcrop, and offers expansive views of the surrounding coastal town, its beaches and the Recherche Archipelago.
Peak Charles	The national park is approximately 100 kilometres south of Norseman and is a camping, climbing and trekking attraction. The Peak is 651 metres high.

5.2.3. Shire Coolgardie

Like the City of Kalgoorlie-Boulder, the Shire of Coolgardie has a long mining industry heritage, which is a key feature of its tourism asset portfolio. Table 29 below identifies the physical tourist assets in the Shire of Coolgardie.

TABLE 29 – Key Tourism Assets in the Shire of Coolgardie

Asset	Description
Goldfields Exhibition Museum	Occupying the former Warden's Court Building (1898), the Goldfields Exhibition Museum hosts artefacts and photographs depicting Coolgardie's goldrush era.
Ben Prior's Park	Located on Bayley Street opposite the Goldfields Exhibition Museum, this open air 'museum' is a display of machinery and other unusual and eclectic things collected by the late Ben Prior, a garage-owner who found most of the objects that are on display while prospecting in and around Coolgardie.
Warden Finnerty's Residence	The residence of Coolgardie's first resident Magistrate and Mining Warden. Constructed in 1895, it is a National Trust Asset featuring preserved interiors and furniture.
Railway Museum	The Coolgardie Railway Station is a museum that is undergoing restoration, with current access restricted to the platform with its steam locomotive, carriages and other interesting artefacts.
The Holland Track	The Holland Track links Broomehill in the south-west with Coolgardie. Carved through bushland by pioneer John Holland in 1893 as a short cut to the Goldfields, this 700 kilometre track which for half is accessible by 4WD vehicles only, demonstrates how the early settlers would have travelled to reach their destination from the south.
The Green Trail	Linking in with the Golden Quest Discovery Trail, The Green Trail highlights sites in the Coolgardie bioregion with outstanding Environmental, Historical and Cultural values. The Trail sites include Karlkurla Bushland Park, Red Hill and the Red Hill Lookout, Cave Hill Nature Reserve, Burra Rock Conservation Park, Victoria Rock Nature Reserve, and Rowles Lagoon Conservation Park.

5.2.4. Shire of Dundas

The Shire of Dundas is home to a diverse range of natural, heritage and experiential tourism assets. Table 30[140] below identifies the physical tourist attractions in the Shire of Dundas.

TABLE 30 – Key Tourism Assets of the Shire of Dundas

Asset	Description
1st Tee Nullarbor Links Golf Course	The town of Norseman is home to the first tee of the Nullarbor Links Golf Course, an 18 hole, par 72 golf course that spans 1,385 kilometres along the Nullarbor Plain.
The Granite Woodlands Discovery Trail	The Trail is approximately 300 kilometres long and links Norsemen to Hyden and Wave Rock.

[140] Norseman Visitor Centre

Asset	Description
Norseman Museum	A collection of memorabilia in what was historically the school of mines building. It includes a large remnant of Skylab, a restored horse wagon, a railway pumper, and mining equipment from the school of mines Heritage Collection.
Corrugated Iron Camels	The Corrugated Iron Camels on Prinsep Street are a sculptural tribute to the camel trains that carried freight and mail in the early days of the township.
Gallery of Splendid Isolation	The Gallery of Splendid Isolation is situated on the corner of Ramsay and Prinsep streets, directly across from the corrugated iron camels. Local photographer, Lynn Webb, has an exhibition that covers the full spectrum of photographic opportunities in the shire.
Phoenix Park	An Educational and historical mining park close to the town centre, which displays items of machinery, equipment and buildings representing the area's mining history.
Mt Jimberlana	A large granite outcrop offering spectacular views 5 kilometres east of the township.
Eyre Bird Observatory	Home to more than 240 species of birds, many of which are rare or endangered.
Eucla National Park	Adjacent to the Great Australian Bight, Eucla National Park covers approximately 3,340 hectares.

5.2.5. Shire of Laverton

The Shire of Laverton host a diverse mix of cultural, heritage and experiential tourism assets.

Table 31 below[141] identifies the tourism assets of the Shire of Laverton.

TABLE 31 – Key Tourism Assets of the Shire of Laverton

Asset	Description
Laverton Outback Gallery	A not for profit organisation established to display, promote and sell authentic Aboriginal art on behalf of the people of the Laverton and Western Desert area
The Great Beyond Explorers Hall of Fame	The Hall of Fame pays tribute to not only the explorers but also to the pioneers and women of the same era. From the gold rush days to the flora and fauna, pastoral history to the nickel boom of 1969, the Hall of Fame provides an overview from pre-history to present day.
The Outback Way	A high grade 2,800-kilometre road link between Laverton and Winton in Queensland (via Warburton, Giles, Docker River, Uluru and Alice Springs). Dubbed 'Australia's longest shortcut', it's a diagonal east-west/west-east highway traversing central Australia.
Windarra Minesite Lookout	Located 28 kilometres from Laverton, this is the site of the Windarra Nickel Mine, made famous during the Poseidon Nickel Boom 1969. The lookout provides panoramic views over the famous site and its main mining structures that remain standing.
Old Police Precinct	The original Police Sergeant's house, the Police Office and the Jail, all of which have been extensively refurbished in recent years.

[141] AustraliasGoldenOutback.com; Laverton.wa.gov.au/tourism; goldfieldstourism.com.au

Golden Quest Discovery Trail (Site 13)	Laverton is the northernmost site on the Golden Quest Discovery Trail, a 965km self-drive adventure tour incorporating the Dr Laver statue, and other sites on the trail close to Laverton include Mt Morgans, Hawks Nest and Murrin Murrin.

5.2.6. Shire of Leonora

The Shire of Leonora hosts a small portfolio of heritage and experiential tourism assets. Table 32[142] below identifies the tourism assets of the Shire of Leonora.

TABLE 32 – Key Tourism Assets of the Shire of Leonora

Asset	Description
Gwalia Ghost Town and Museum	Its main points of interest include the Gwalia State Hotel, a large open cut mine, the old miners' cottages and other commercial buildings, left by residents in December 1963 when the Sons of Gwalia Gold mine closed. Hoover House, now a guest house, but originally built in 1898 as a home for the mine manager was commissioned by Herbert Hoover, who later became 31st President of the United States of America.
Leonora Trails	Created as 'extension' self-drive trails to complement the Golden Quest Discovery Trail, the Leonora Loop Trails comprise two drives, one via Mertondale and 'The Terraces' to Darlot; the other to Agnew and Leinster via the old mining settlement of Lawlers.
The Terraces	So-called 'break-away' formations, created through the erosion of plateaux by wind and rain, some 40 kilometres north-east of Leonora.
Malcom Dam	Like Niagara Dam, the Malcolm Dam was constructed by the WA Government in the early 1900's to provide fresh water for the ever-expanding railway network, its steam trains requiring huge volumes of the precious fluid.

5.2.7. Shire of Menzies

While compared to most other Shires in the Region, the tourism assets in the Shire of Menzies are relatively limited, it does host the globally renowned sculptures at Lake Ballard.

Table 33[143] below identifies the tourism assets of the Shire of Menzies[144].

TABLE 33 – Key Tourism Assets in the Shire of Menzies

Asset	Description
Lake Ballard, and Anthony Gormley's 'Inside Australia' Sculptures	The Turner Prize-winning British artist, Antony Gormley, has fused nature and art in a striking display of 51 stark black steel sculptures scattered across seven square kilometres of the vast, flat salt lake. The sculptures are located 55 kilometres from the outback town of Menzies, and approximately one and a half hours' drive north of Kalgoorlie. It is Australia's largest outdoor art installation.
Kookynie 'Living Ghost Town'	A gold rush town which now has a resident population of 11, tourists visit the Kookynie Grand Hotel, CY O'Connor's Niagara Dam, and Morapoi Station.

[142] Australiasgoldenoutback.com.au; Goldfieldstourism.com.au
[143] AustraliasGoldenOutback.com; Lakeballard.com
[144] AustraliasGoldenOutback.com;

5.2.8. Shire of Ngaanyatjarraku

Relative isolation and intensity of Aboriginal culture makes the Ngaanyatjarraku Land a unique experience. Table 34[145] below identifies the tourism assets in the Ngaanyatjarraku Shire.

TABLE 34 – Key Tourism Assets in the shire of Ngaanyatjarraku

Asset	Description
Tjulyuru Cultural and Civic Centre	The Tjulyuru Cultural Centre complex is a civic and cultural hub for visitors and locals based at the Warburton Community on the Great Central Road. The Tjulyuru Regional Arts Gallery exhibitions draw from contemporary art practice in the region and the Warburton Art Collection.
Giles Weather Station	The Giles Weather Station is a fully functioning meteorological observation station based at Warakurna Community. Visitors can view the daily release of the observation balloon from the Weather Station carpark. Named after Ernest Giles, an explorer of the area during the 1870s, the station includes the remains of the first Blue Streak Rocket, launched from Woomera on June 5 1964, and the grader that was used to build the Gunbarrel Highway.

5.2.9. Shire of Ravensthorpe

As summarised in Table 35[146] below the main tourism assets in the Shire of Ravensthorpe are natural environment oriented.

TABLE 35 – Key Tourism Assets of the Shire of Ravensthorpe

Asset	Description
Ravensthorpe Range and Fitzgerald National Park.	The Ravensthorpe Range lies to the north and east of the Fitzgerald River National Park in the far south of Western Australia and together with the Fitzgerald River National Park, is considered one of the world's biodiversity hotspots. The UNESCO recognised Fitzgerald River National Park is one the largest and most botanically significant national parks in Australia. Within the park are found nearly 20 per cent of Western Australia's flora species, many of which occur only within its boundaries, including approximately 1,800 species of flowering plants, 22 species of mammal, 200 bird species and 41 species of reptile.
Public Silo Trail	In August 2016, Fremantle-based artist Amok Island created the Public Silo Trail's second artwork on the trail, Ravensthorpe's Six Stages of Banksia baxteri, a 25 metre high wildflower inspired mural painted across three CBH Group silos in Ravensthorpe. The project was the second in a series of monumental mural artworks on grain silos delivered by FORM in partnership with CBH Group. The mural joins silo artworks in Northam, Merredin, Newdegate, Pingrup and Albany, which together form a self-drive trail for tourists and travellers to take through regional Western Australia.

[145] Australiasgoldenoutback.com.au, Ngaanyatjarraku.wa.gov.au
[146] Australiasgoldenoutback.com.au; fitzgeraldcoast.com.au

5.2.10. Shire of Wiluna

A remote region of Western Australia, often referred to as the "edge of the desert", the Shire of Wiluna has various historic and culturally significant tourism attractions. Table 36[147] below identifies tourism assets for the Shire.

TABLE 36 – Key Tourism Assets of the Shire of Wiluna

Asset	Description
Town Heritage Trail	An efficient way to explore the heritage of Wiluna is the Town Heritage Trail. A host of places on this trail are described on the circuit, which have been important to the community and give a fascinating insight into life in the town.
World War II Bomb Shelter	Said to be used in the 1940s, the underground shelter provided shelter from potential Japanese air raids on the local arsenic mine, which was known to be a vital cog in the war effort.
Canning Stock Route	Commissioned in 1906 by Alfred Canning, the Canning Stock Route is one of the most isolated and challenging tracks on earth. Stretching approximately 1500 kilometres through harsh desert terrain, the route took four years to complete. The CSR sees many ambitious 4WD enthusiasts each year who look to conquer one of the most challenging tracks anywhere in the world.
Tjukurba Gallery	This is an Indigenous art gallery located at the start of the Canning Stock Route. Previously operating as a hospital until 1967, it opened in 2005 as an art gallery, as a venue for creative expression that provides local artists with a space to dream. The gallery blends professional and contemporary exhibition space, with the beautiful historical elements of the original heritage-listed building. Tjukurba is supported via funding through the Indigenous Visual Arts Industry Support government program.
The Gunbarrel Highway	The Gubarrel Highway is known as one of Australia's most famous,and runs from Wiluna to the Uluru-Kata Tjuta National Park. It was completed in 1958 as the first east-west road to go across the centre of Australia. The Highway directly connects Western Australian to many tourist destinations in central Australia, and is a popular 4WD route with its rugged and isolated landscapes an attraction to visitors.
Red Hill Lookout	Located just south of the town centre, the rocky Red Hill Lookout provides stunning views of the goldmine in the east, over old suburbs of Wiluna and back over the town itself.
Shire of Wiluna Canning-Gunbarrel Discovery Centre	Co-located with the Tjukurba Art Gallery at the town's historic old hospital complex, this centre provides visitors with an opportunity to explore Wiluna's colourful past, natural heritage, and cultural history through multiple changing interpretive displays.
Statue of Warri & Yatungka	In 2007, this monument was built in the Shire of Wiluna to commemorate the lives of Warri and Yatungka, who were an Aboriginal couple in love. Known as the "Last of the Nomads", they were believed to be the last desert nomads, choosing to lead a traditional Indigenous lifestyle for approximately forty years in the Gibson Desert. After falling in love in the 1930's, Indigenous tribal law forbade them from marrying. The couple escape into the desert, living a life of isolation, surviving off the land using their local knowledge. In 1979 they died within weeks of each other, after returning the previous year to urban settlement. Their deaths marked the end of an Indigenous lifestyle that lasted over 40,000 years.

[147] Wiluna.wa.gov.au/tourism; Wilunatraders.com/Wiluna.html

5.3. Implications for Regional Infrastructure

5.3.1. Improved access to regional tourism assets

Improved access to tourism assets, particularly more remote assets, will contribute to both encouraging more destination visitors to the Region and attracting visitors who are passing through the Region by vehicle to visit those assets. For very remote assets such as those located in the Shires of Ngaanyatjarraku and Wiluna, this will be critical to developing a robust and economically sustainable tourism sector in those Shires. Achieving this outcome should be a consideration in all road infrastructure investments.

5.3.2. Competition on transport networks

Visitors to the Region use a wide range of local hard and soft infrastructure. However, in terms of intensity of use and competition with minerals and agricultural sector usage, it is transport infrastructure where the largest impact is felt. Further, while visitors enter and leave the Region by aviation, maritime and rail modes of transport, it is road transport where the greater intensity of interaction occurs with the minerals and agricultural sectors.

Large numbers of passenger vehicles and caravans on the Region's road networks can reduce productivity of industry logistics and present significant safety issues. Additionally, damage to roads caused by heavy vehicles can create hazards for smaller vehicles, particularly when they are towing caravans. Ensuring that road networks remain productive and safe for all users should be a paramount consideration in all road infrastructure investment decisions.

5.3.3. High regional airfares

As is the case for all relatively remote tourism markets in Western Australia, relatively high regional airfares (see Section 6.3.5) potentially serves as a barrier to increased tourism.

6. Transport and Logistics Infrastructure

KEY POINTS

Road Transport and Logistics

An extensive Main Roads and local government road network is the main facilitator of hinterland logistics and intra-region, inter-region and interstate transport connectivity for the GVROC Region.

Increasing volumes of heavier vehicles servicing the grains and minerals sector which intersect with community and tourism traffic are resulting in increasingly problematic road maintenance, productivity and safety issues that will need to be addressed.

Rail Transport and Logistics

The north-south Leonora-Kalgoorlie-Boulder-Esperance heavy rail that intersects with the west-east Perth-Kalgoorlie-Boulder-Adelaide rail network also performs a critical transport function for the Region

Rail transport is critical for the transport of some reagents and product for certain sectors of the minerals industry, as well as general freight for local industry and the community.

Congestion on the rail network in absolute terms is currently limited, however perceived relatively high rail charges are resulting in increased use of road freight by industry, exacerbating the road issues mentioned above.

Aviation Transport and Logistics

Servicing a large number of relatively remote minerals operations and townships is a network of at least 26 airports and aerodromes across the Region, more than half of which are operated by minerals industry operations.

The Region's two main public airports have experienced long-term growth in passenger throughput, with passenger numbers at Kalgoorlie-Boulder reaching a critical trigger for major investment in infrastructure.

While not as critical and with differing infrastructure requirements, Esperance Airport is on a similar trajectory.

Maritime Transport and Logistics

In terms of vessel calls and throughput, Esperance Port is one of Western Australia's smallest regional ports. However, it is one of few deep-water ports on the southern coast of Australia, and the only port in the region with significant dedicated container handling capability.

The Port is an important facilitator of input imports and product exports for the Region's grains industry and certain key projects in the Region's minerals industry and neighbouring minerals and timber industries.

Esperance Port has berthing and land constraints that are tested at times of high throughput, while periods of low commodity pricing resulting in reduced throughput have threatened its commercial viability in the past.

Ensuring a commercially sustainable Esperance Port that is able to meet the Region's maritime logistics needs will be important to maintaining productivity for the Regions grains and minerals industries.

This Section describes the road, rail, aviation and maritime infrastructure that underpins transport and logistics services and functions in the GVROC Region's minerals, agricultural and tourism industries, as well as the local community. It also identifies key issues with this infrastructure and potential solutions.

6.1. GVROC Region road network

The GVROC Region road network is the main facilitator of hinterland logistics and intra-region, inter-region and interstate transport connectivity.

The main arterial routes in the Region are Western Australian Government roads, managed under the jurisdiction of Western Australian Main Roads Department ('Main Roads'). These 'main' roads are illustrated in Figure 30 below and listed in Appendix 5. The Great Eastern Highway is the principal interstate road connection between Perth and the GVROC Region, and via the Coolgardie-Esperance and Eyre Highways, the Eastern States. Given its critical importance to interstate road freight, the roads comprising this interstate logistic connectivity are the subject of regular assessment with respect to capacity, safety and amenity.

The Goldfields Highway provides critical logistics connectivity between the mining industry in the northern Goldfields, the City of Kalgoorlie-Boulder population centre, Perth and the eastern states. The Coolgardie-Esperance Highway provides hinterland connection for the Goldfields Region, Perth and eastern states with Esperance Port (see Section 6.3.2) and the South Coast Highway connects areas to the west of Esperance, including significant agricultural areas, with Esperance Port. These main arterial routes are critical for hinterland movements of minerals and agricultural produce for export to Esperance Port, as well as the delivery of inputs such as fuel, reagents and fertiliser to mineral and agricultural operations across the Region. They are also the main routes through which driving tourists access the Region and key tourism assets within the Region.

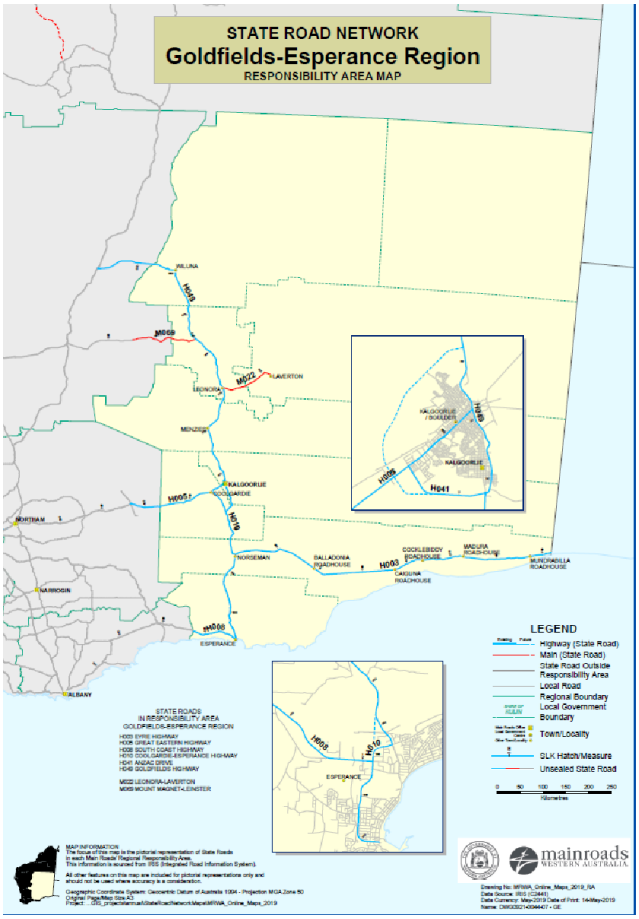

FIGURE 30 – WESTERN AUSTRALIAN GOVERNMENT ROADS IN THE GOLDFIELDS-ESPERANCE REGION

Other major roads such as Anzac Drive, Leonora-Laverton Road, Mount Magnet-Leinster Road, Agnew Sandstone Road and Harbour Road provide critical connectivity between the major arterials, as well as population centre by-pass functions. The following Figure 31[148], summarises maximum daily vehicle movements on main roads in the Goldfields-Esperance Region in 2018.

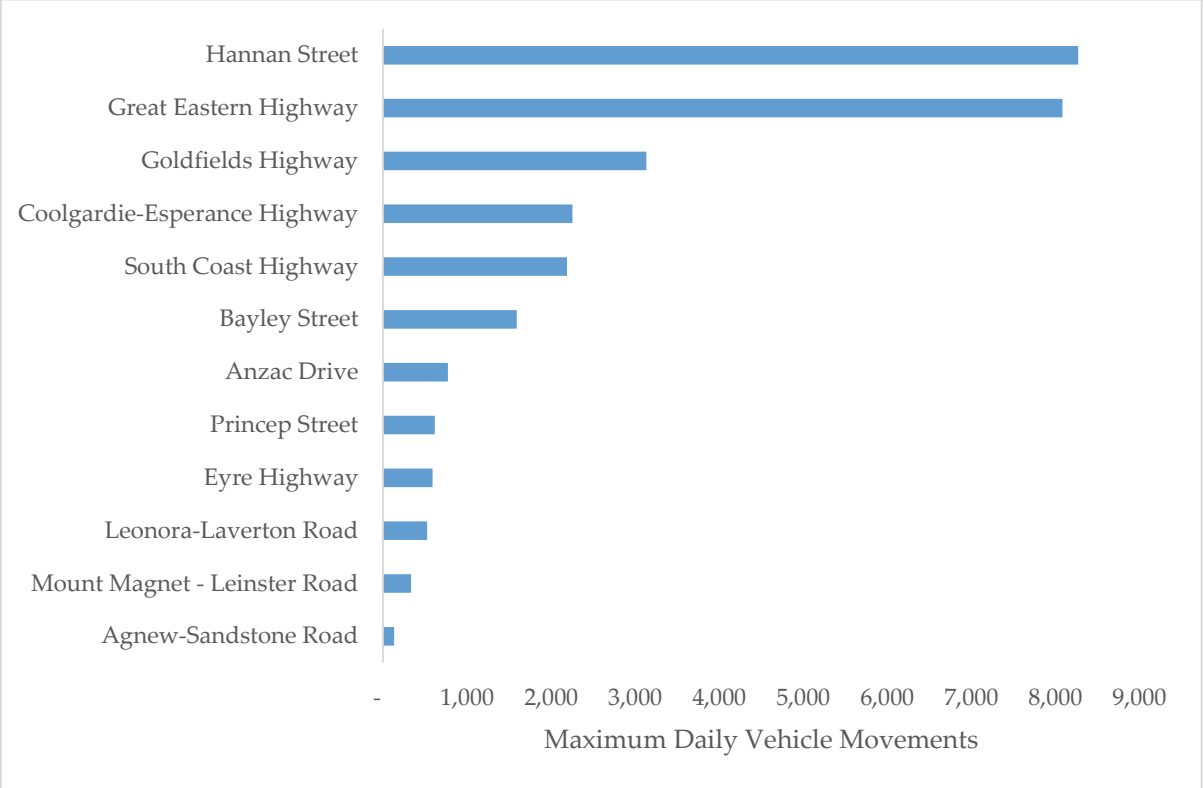

FIGURE 31 – MAXIMUM DAILY VEHICLE MOVEMENTS ON MAIN ROADS IN THE ESPERANCE-GOLDFIELDS REGION

The Main Roads arterial network is supported by approximately 30 additional significant roads that are managed under the jurisdiction of GVROC member local governments. These are listed in Appendix 5. A number of these roads traverse multiple LGAs and are thus the responsibility of two or more local governments.

Comprised of a series of sealed and unsealed roads connecting Laverton to the Central Desert, Alice Springs and Queensland, the longest multi-jurisdiction road in the Region is the Outback Highway, also known as the Great Central Road. At approximately 2,800 kilometres in total length, the Outback Highway is considered the Goldfields-Esperance Region's second and Western Australia's third interstate link. It is used by logistics and mining operations as well as tourists travelling through central Australia to reduce transit time by up to 2 days depending on the eastern state terminus, and in the case of tourists, to access central Australian tourism experiences and assets, including the road itself. It also performs a key function in enabling the provision of essential services, food, fuel, health and education to the Central Desert Aboriginal communities from Perth, Kalgoorlie and Alice Springs service centres. Given these important functions, increasing the capacity of the Outback Highway is identified as a key project in the Developing

[148] Main Roads (2018), Traffic Map, where traffic varies along different stretches of road the maximum recorded average vehicle movements has been applied in Table 5

Northern Australia Whitepaper[149], and as illustrated in Figure 32[150] below is currently the subject of upgrading investment.

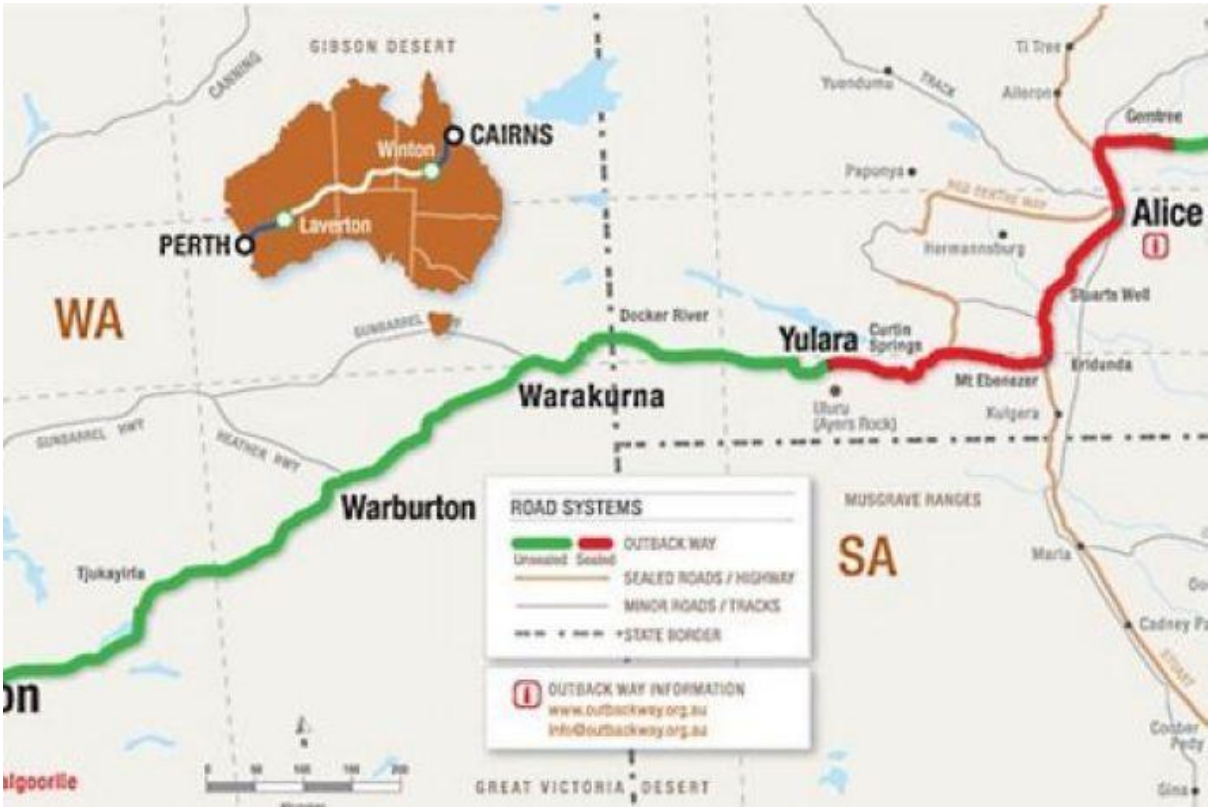

FIGURE 32 – OUTBACK HIGHWAY

As illustrated in Figure 33[151] below, the intensity of smaller, local government managed regional roads is relatively significant in the agricultural areas of the southern GVROC Region, connecting individual crop and livestock operations with Esperance Port. Indeed the Shire of Esperance manages the longest total length of roads in the State.

[149] Department of Industry, Innovation and Science (2015), *Our North, Our Future: White Paper on Developing Northern Australia*
[150] Outback Way, Australian Broadcasting Corporation
[151] Hema Regional Map 9786500

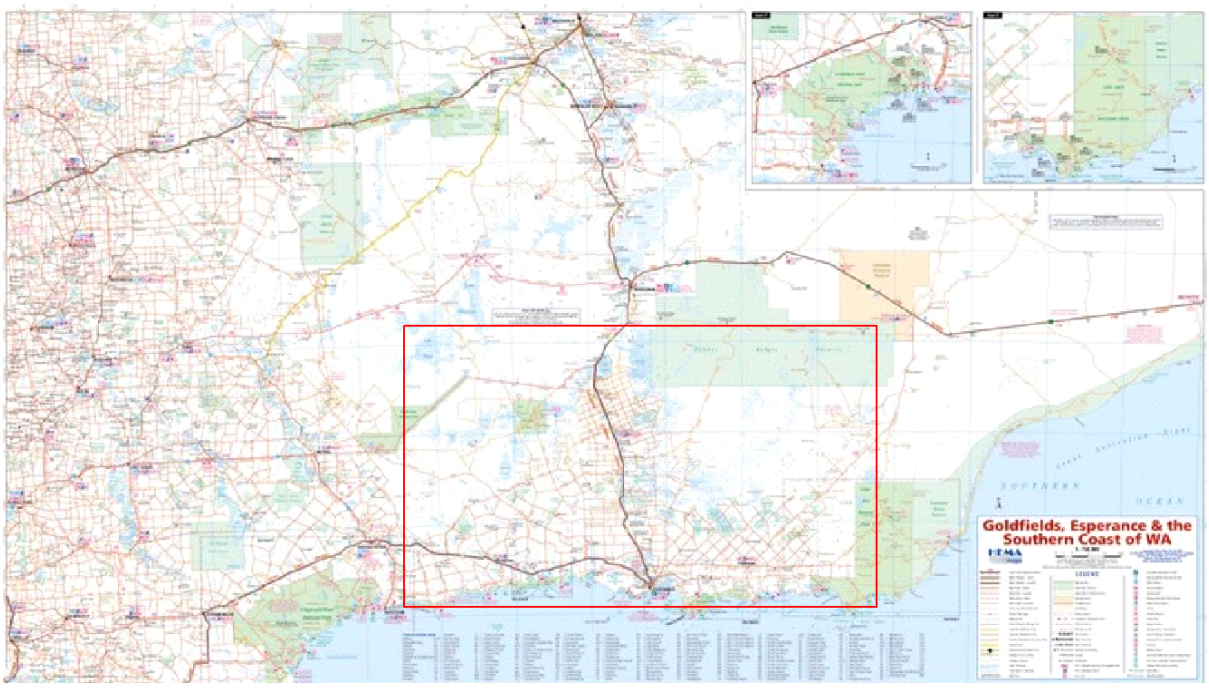

FIGURE 33 – REGIONAL ROAD INTENSITY IN THE SOUTHERN GVROC REGION

6.1.1. Key issues

Maintaining standard of main arterial roads

Issue

As discussed in Section 6.1, primarily as a result of being key interstate logistics infrastructure, and being resourced by the Western Australian and at times, the Australian Government, the main arterial routes transecting the Goldfields-Esperance Region are generally maintained at a high standard.

It will be important that as the volume of heavy vehicles (and heavier vehicles) increases on these roads that these standards are maintained. This includes ensuring safety with respect to passenger vehicle usage on the road by ensuring that overtaking lanes are adequate and that surfaces, shoulders, marking and signage are suited to all typical weather conditions. The somewhat cyclical nature of the use of some of these main arterial routes presents challenges to investment in their maintenance. For example, the South Coast Highway is a major route for grains transport and an increasingly important tourism corridor. It is also Western Australia's oldest pavement and not designed for today's heavy vehicles and therefore subject to significant damage by intensive heavy vehicle usage presenting productivity and road safety issues. These circumstances are exacerbated when minerals product is periodically transported from mining operations that periodically operate in the Region to Esperance Port.

There are also extensions of some major arterial routes outside of the GVROC Region which if upgraded would improve the Region's connectivity. An example of this is the stretch of the Goldfields Highway from Wiluna to Meekatharra and onto the Pilbara that is currently unsealed. Upgrading this road would provide competent direct road connection between the GVROC Region and the Pilbara Region. In the *Mid-West Roads 2025* Road Development Strategy[152], Main

[152] Main Roads Western Australia (2007), Mid West Roads 2025 Road Development Strategy

Roads highlighted the need to prioritise the sealing of the 125 kilometre stretch of unsealed highway between Wiluna and Meekatharra, due to its key strategic freight, tourist and inter-town route characteristics. The unsealed portion of the highway presents a safety concern for very large road trains that utilise the road, particularly during seasonal rainfall periods, with the unreliable and dangerous conditions identified by stakeholders as of concern and potential economic impost.

As of mid-2019, $1 million[153] has been allocated by the State Government to trial the staged delivery of the unsealed highway, providing employment, training and business opportunities for the local Aboriginal community. The project will seal a preliminary four-kilometre section of the road that if successful, is expected to result in a rolling program to seal further sections of the road.

Opportunities

Modelling should be undertaken to determine, based on current gold, nickel, lithium, rare earths and other sector expansion plans, the likely increase in volume, nature of and key routes of heavy vehicles as input to ta plan to invest in main arterial road safety measures as necessary.

Improve the standard of key non-arterial roads

Issue

There are many non-arterial roads that cover a range of sealed and non-sealed standards. In some cases they are used variably by heavy vehicles servicing mining and agricultural operations and can also be used by local residents and tourists. The most significant instance of this is the extensive local roads network managed by the Shires of Esperance and Ravensthorpe (see Figure 33), where suitability for large volumes of heavy vehicles transporting grain and some minerals product is variable.

Some of these non-arterial routes exhibit variable standards along their length, transect multiple LGAs and have multiple frequent users, including multiple mining companies. An example of this is Yarri Road that connect City of Kalgoorlie-Boulder with Saracen's Carosue Dam and the Tropicanna Anglogold Ashanti Joint Venture. While part of the road is sealed other parts are not and difficult to maintain. The road is used by mining ventures, prospectors, operators of pastoral stations in the area and tourists. There has been a significant number of vehicle incidents along the road over the past decade that are a result of its condition in parts and the nature of traffic using the road. Determining responsibilities for investing in road improvements and maintaining roads is complicated by the multi-jurisdictional and multi-user nature.

Most shires in the region also have a portfolio of gazetted unsealed roads that were originally established with a service function, but no longer have a purpose or are not used. Because they are gazetted, their maintenance has to be provisioned, causing fiscal issues particularly for smaller shires.

Opportunities

Detailed modelling of usage of non-arterial routes should be undertaken that identifies who is currently using specific routes, the nature and frequency of use, as well as projected use. This can be correlated with assessment of road condition to establish a non-arterial road upgrade priority

[153] Media Statements WA Government 2019, Wiluna-Meekatharra Road upgrade to support local jobs. (https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/05/Wiluna-Meekatharra-Road-upgrade-to-support-local-jobs.aspx)

plan. This modelling would require input from local government, various state government agencies and other sectors that use these roads.

It should be noted that for mining companies to invest in road infrastructure, a very clear case of operational dependency needs to be made for legal and shareholder accountability reasons. This should also be considered in the investment plan.

Increased heavy vehicle traffic through townships

Issue

As discussed in Sections 3.8.1 and 4.4.1, the number and size of heavy vehicles on arterial roads in the GVROC Region is increasing, including through the centre of numerous towns and population centres located on these main arterial routes. By way of example, the town of Norseman in the Shire of Dundas currently experiences around 75 heavy vehicles on its main thoroughfare a day, including during the night, while the town of Coolgardie experiences an average around 530 heavy vehicles per day representing approximately 26 percent of total traffic through the town. While trucks obviously slow to town speed limits, the scale of the vehicles and engine, rolling-mass and braking noise significantly detracts from local amenity.

Opportunities

The cost associated with establishing and maintaining town by-passes is likely to prove prohibitive in the case of most towns. However, a business case for investing in traffic slowing and safety devices, and in some case noise barriers in areas of important town amenity should be explored.

Managing activation of isolated communities and economies

Issue

As discussed in Section 2.5.2 and 5.3.1, all road infrastructure decisions in the Region should give consideration to opportunities to enhance local economies and provide improved access to regional tourism assets. As a case in point, upgrading of the Outback Highway (see Figure 32) will likely see increased traffic along that route, including tourism traffic. This creates several opportunities in the Shire of Ngaanyatjarraku, including:

- Opportunities for a range of commerce simply by virtue of being able to move factors of production to the area and product out to markets;
- Opportunities for unique cultural and eco-tourism products that will be accessible by a larger market as a result of the more navigable road; and
- Improved economic viability of known mineral projects in the area.

It is very important that the local communities are provided with the capacity to make decision regarding the socio-economic impact of these circumstances, to optimally capitalise on the opportunities and manage any negative externalities that might arise. This includes prioritising investment in laterals that will assist in delivering socio-economic benefits to communities in the Shire.

6.2. Rail network

6.2.1. Existing Rail Infrastructure

The GVROC Region hinterland road network is supplemented by a north-south heavy rail connection that connects Leonora in the norther Goldfields Region, to the City of Kalgoorlie Boulder and onto Esperance Port, as well as an east-west connection between the City of

Kalgoorlie- Boulder and City of Perth, Kwinana and Bunbury and the Wheatbelt Region rail network. This network, which is operated by Arc Infrastructure under licence from the Western Australian Government, is illustrated in Figure 34[154] below.

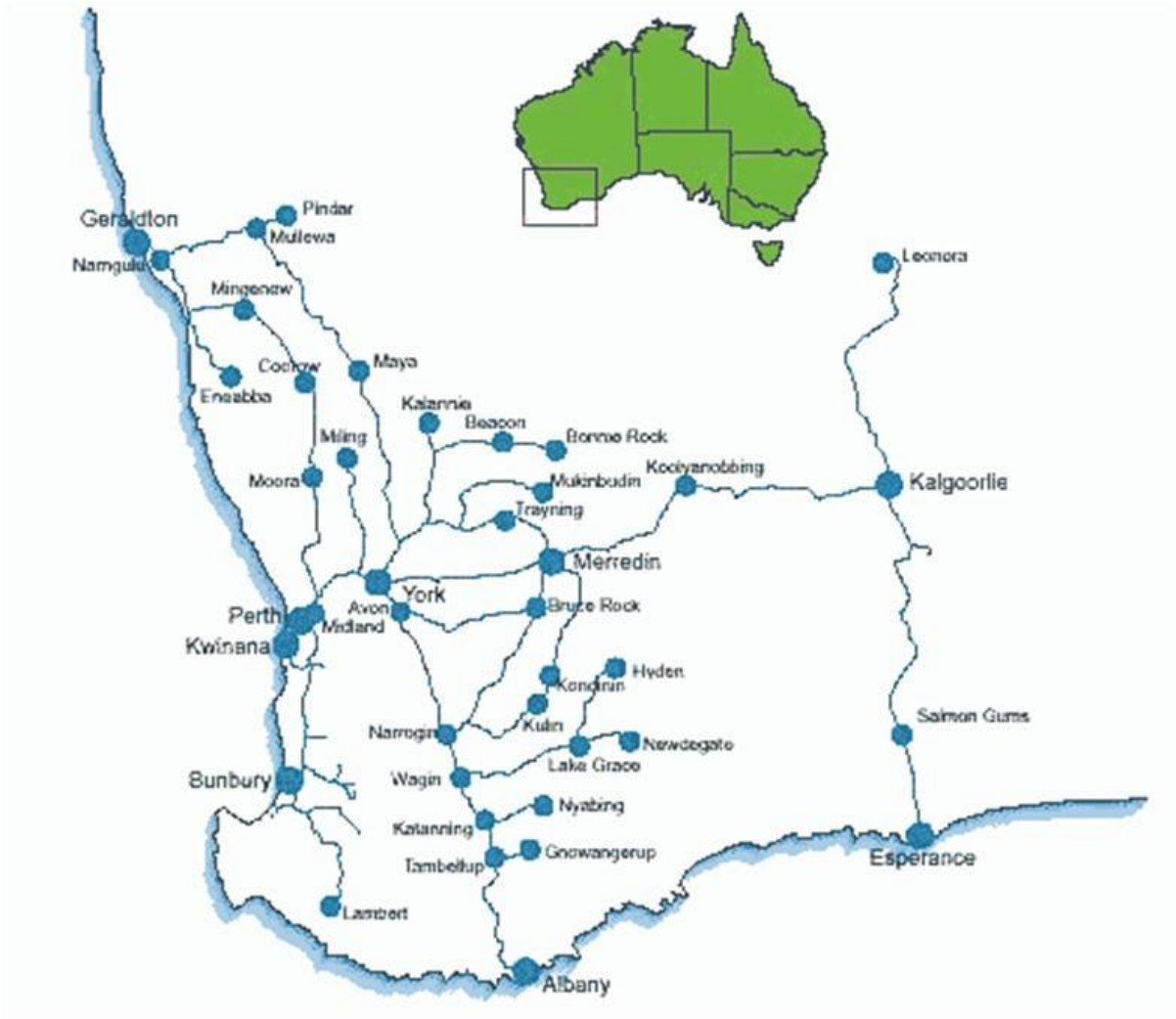

FIGURE 34 – Arc Infrastructure Western Australian Rail Network

The following Figure 35[155] illustrates the Arc Infrastructure network within the Goldfields-Esperance Region, identifying rail stations and loading facilities on that network.

[154] ARC Infrastructure
[155] ARC Infrastructure, *Rail Freight Network Map*

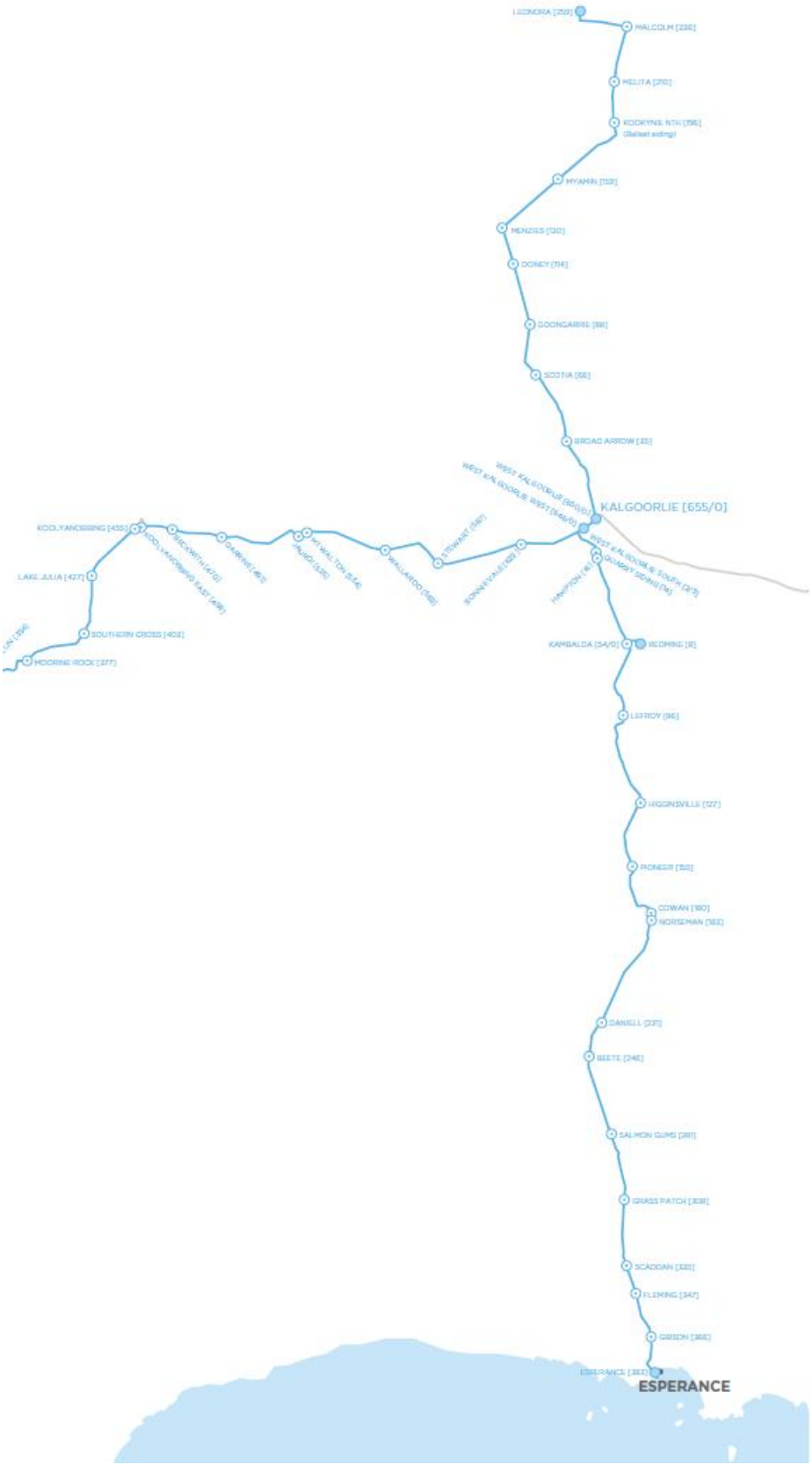

FIGURE 35 – Arc Infrastructure Rail Network in the Goldfields-Esperance Region

Connecting the Goldfields-Esperance and remaining Western Australian rail network to the eastern states is the Trans-Australian east-west railway which connects the City of Kalgoorlie-

Boulder with Adelaide and the relatively extensive eastern states rail network, and which is operated by the Australian Rail Track Corporation (ARTC).

Being the sole rail link between Perth and the eastern states and transporting approximately 80 percent of all freight from the eastern states to Western Australia, the line between Perth and the City of Kalgoorlie-Boulder carries not only a large amount of diverse freight to the Goldfields-Esperance Region, but also between Perth and the Eastern States. It also carries a daily passenger train between Perth and Kalgoorlie-Boulder (the Prospector) and the Indian-Pacific passenger train between Perth and the eastern states on a weekly basis.

Haulage on the Region's north-south rail line, which connects the Northern Goldfields to Esperance Port, includes iron ore, nickel and intrastate and interstate freight for a range of organisations including Cliffs Natural Resources, Minara Resources, BHP Nickel West, Pacific National, SCT Logistics and TransWA.

6.2.2. Kalgoorlie Rail Realignment Project

Freight flows through the City of Kalgoorlie-Boulder are expected to increase significantly over the next 20 years, with interstate rail freight through the City expected to reach approximately 5 million tonnes per annum by 2031[156].

Various iterations of a proposal to realign rail in and around the City of Kalgoorlie-Boulder to give effect to a more efficient larger scale multi-modal logistics hub, and release current land quarantined by the existing rail line for further minerals development have been the focus of different advocates over the past 30 years. The current proposal involves decommissioning approximately 25 kilometres of the existing Australian Rail Track Corporation (ARTC) rail line at the point of connection with the Western Australian Rail Network, and construction of new rail and passing lanes approximately 7 kilometres south of Kalgoorlie-Boulder. An intermodal terminal would then be constructed and commissioned on newly zoned strategic land (see Section 8.1.6) which adjoins the new rail line route.

The project is currently being explored by a formal collaboration between the City of Kalgoorlie-Boulder, Australian Rail Track Corporation and Kalgoorlie Consolidated Gold Mines (KCGM), and is expected to deliver several benefits including:

- Reduced costs for freight operators;
- Increased road safety; and
- Increased freight productivity.

Preliminary estimations of capital cost are approximately $156 million, with the project partners having recently made a Stage 1 submission with a view to it being considered as a priority project for the State.

[156] PriceWaterhouseCoopers (2019), Realignment of the National East West Railway Line, Kalgoorlie: Preliminary Business Case, City of Kalgoorlie Boulder

6.2.3. Key issues

Potentially increasing rail freight

Issue

From a minerals product transport perspective, at current volumes the existing rail infrastructure is generally considered to be adequate and the Region's grain sector is not a major user of rail transport. However, as discussed in Section 3.8.3, volumes of nickel, rare earths and iron ore transported on various lines that comprise the network may increase in the future.

Additionally, road congestion and increased cost and community concerns discussed in Section 6.1.1, may see increased transfer of road freight to rail freight where possible. The net increase would likely result in increased congestion in the current network configuration. However, it is difficult to justify rail network expansion without confidence in usage.

Opportunities

As network operators are commercial entities that will require network investment to be justified by increased usage, there may be scope for collaboration between GVROC member councils and industry to develop usage projections with a higher degree of confidence. This could potentially be undertaken in collaboration with the State and Commonwealth Governments who bear the cost of increased road maintenance that is the result of increased freight on main arterial roads that would otherwise be carried on rail.

High network costs

Issue

There is a perception held by some rail freight users and prospective users that freight charges associated with the Arc Network are particularly high. Arc charges different rates for different cargo, reflecting volume, reliability of patronage and network maintenance implications of different freight types. However, it is understood that on average freight costs on the Arc network can be up to five times the ARTC charges on a tonne per kilometre basis.

Opportunities

GVROC could advocate to the Western Australian Government to commission an inquiry into Western Australian rail freight charges, similar to that which was commissioned to investigate regional airfares. This is not to suggest that Arc Infrastructure charges are unreasonably high, but rather to provide an evidence-base to resolve this issue and to inform infrastructure investments such as the proposed Kalgoorlie Rail Realignment Project (see Section 6.2.2)

Potential congestion at the Aurizon Kalgoorlie Rail Yard

Issue

The rail line between Kalgoorlie and Esperance has significant constraints with respect to the number of trains travelling in both directions that it can handle at one time. Furthermore, there is limited land available at Esperance Port to expand a rail yard. Historically, when mineral export volumes have been substantial at Esperance Port, this has caused congestion at the Aurizon West Kalgoorlie Rail Yard.

Solution

A study that identifies likely future total freight through Esperance Port, its origin and mode of transport and based on this, optimal increase to rail infrastructure between Esperance and Kalgoorlie (including if necessary dual tracks for the entire length), as well as the optimal expansion of a Kalgoorlie rail yard, laydown and storage area could be commissioned by GVROC, industry, Western Australian Government, Arc Infrastructure and Esperance Port.

Kalgoorlie rail-realignment and multi-modal capability

Issue

As discussed in Section 6.2.2 the Kalgoorlie Rail Realignment and multi-modal hub has been proposed in various forms for the past three decades. The project is an infrastructure priority for the City of Kalgoorlie-Boulder and if successfully implemented, is expected to deliver the following specific logistics benefits:

- Provide a holding facility to de-bottleneck the Kalgoorlie-Esperance line;
- Provide multi-modal capacity to improve general efficiency of logistics in the Region; and
- Provide export port optionality by giving regionally generated freight eastern states port options.

Solution

While the project makes *prima facie* sense, the project will only likely be supported if a compelling commercial case for investment in the facility can be made. A feasibility study into the facility should be undertaken.

6.3. Aviation facilities

Servicing sparse population and industry distributed over vast geographical distance are numerous airports, aerodromes and airstrips across the GVROC Region. These include local government owned and operated facilities, as well as private aerodromes and airstrips servicing primarily remote mining operations. Of the 26 Australian Government Civil Aviation Authority (CASA) registered and certified aerodromes in the Goldfields-Esperance Region, 15 are operated by mining companies[157]. These are listed in Appendix 6.

The main public airports in the Region facilitating Regular Passenger Transport (RPT) routes, charters and general aviation are the airports of Kalgoorlie-Boulder and Esperance, as well as smaller aerodromes in Leonora, Laverton, Leinster and Ravensthorpe. Kalgoorlie-Boulder Airport is Western Australia's fifth busiest regional airport in terms of aircraft movements and passengers, and Esperance Airport is Western Australia's 11th busiest regional airport in terms of passenger movements and tenth busiest in terms of aircraft movements[158]. This is illustrated in Figure 36 and Figure 37 below.

[157] https://www.casa.gov.au/aerodromes/

[158] Department of Infrastructure, Transport, Cities and Regional Development (2019), *Australian Airport Statistics*, Australian Government, Canberra

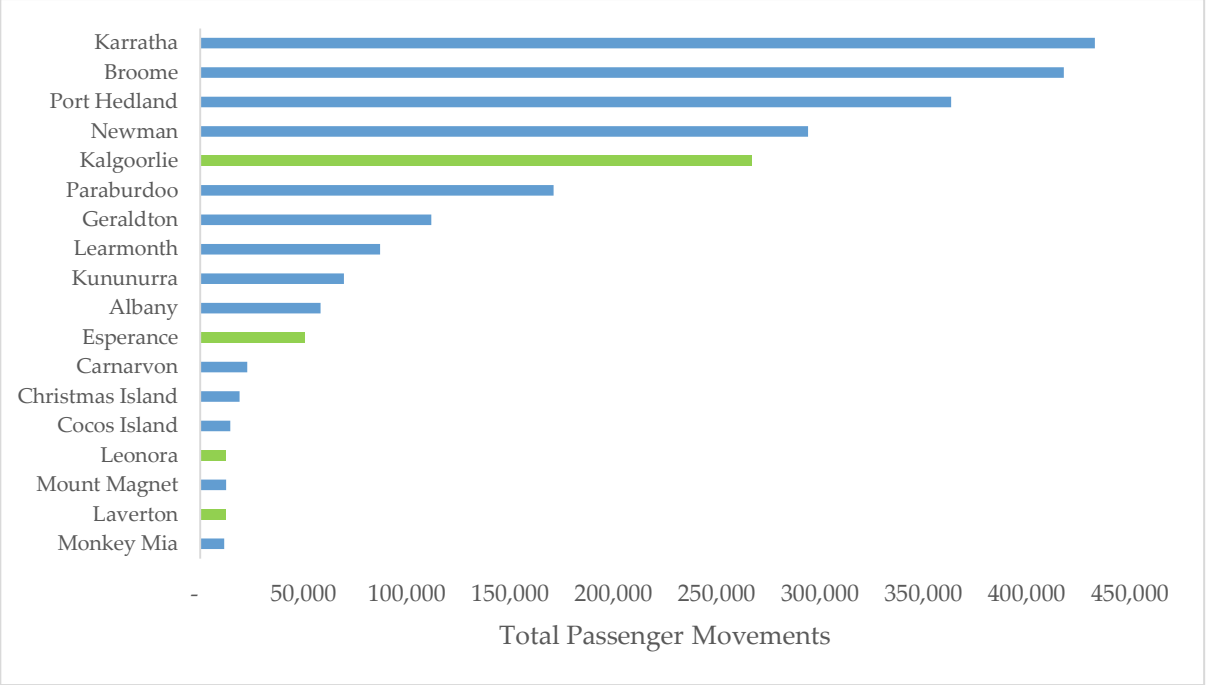

FIGURE 36 – Western Australian Regional Airport Passenger Movements (2017-18)

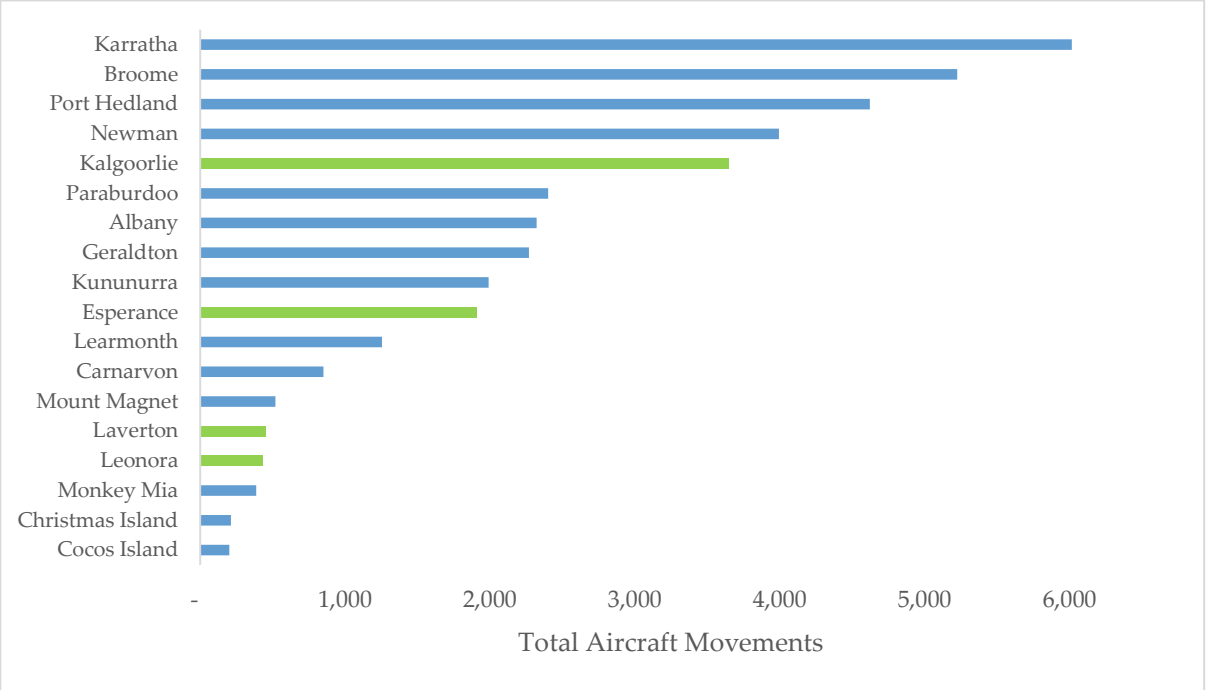

FIGURE 37 - Western Australian Regional Airport Aircraft Movements (2017-18)

Within the Region, Kalgoorlie-Boulder Airport accounts for approximately 80 percent of passenger movements and Esperance Airport an additional 15 percent. This is illustrated in Figure 38 below.

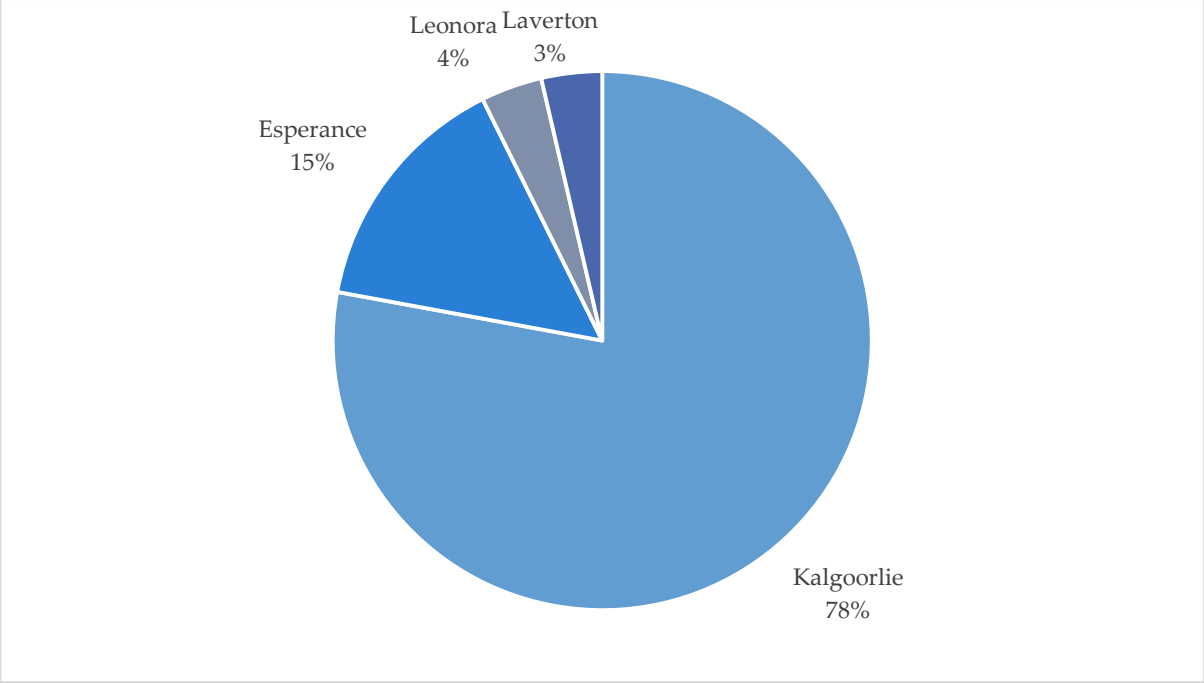

FIGURE 38 – Distribution of Passenger Movements Among Goldfields-Esperance Public Airports (2017-18)

However, the regional distribution of aircraft traffic is less skewed toward Kalgoorlie-Boulder Airport, indicative of the larger number of commercial routes operating larger airframes to and from Kalgoorlie-Boulder airport compared to the other regional airports, as well as the larger number of charters visiting the smaller airports and aerodromes. This is illustrated in Figure 39.

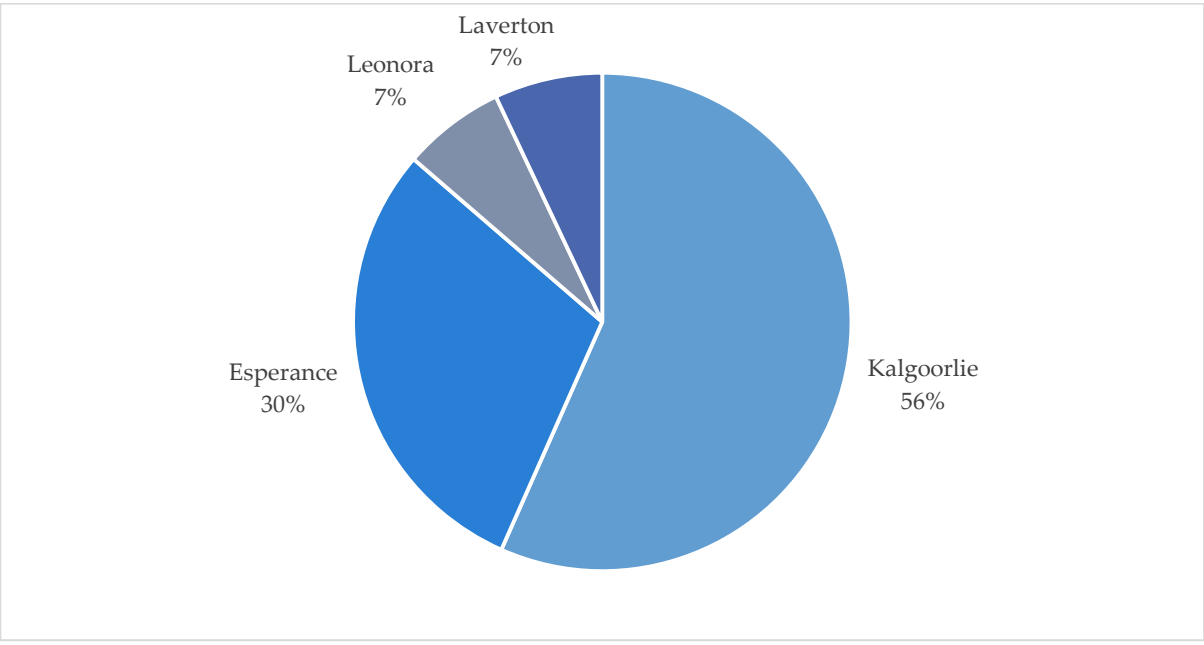

FIGURE 39 - Distribution of Aircraft Movements among Goldfields-Esperance Public Airports (2018)

While regional air services can be chartered for intra-regional flights, the RPT and main charter services operating in the Region primarily operate direct routes with Perth. Figure 40[159] below, illustrates the regulated and unregulated RPT routes operating in the Region.

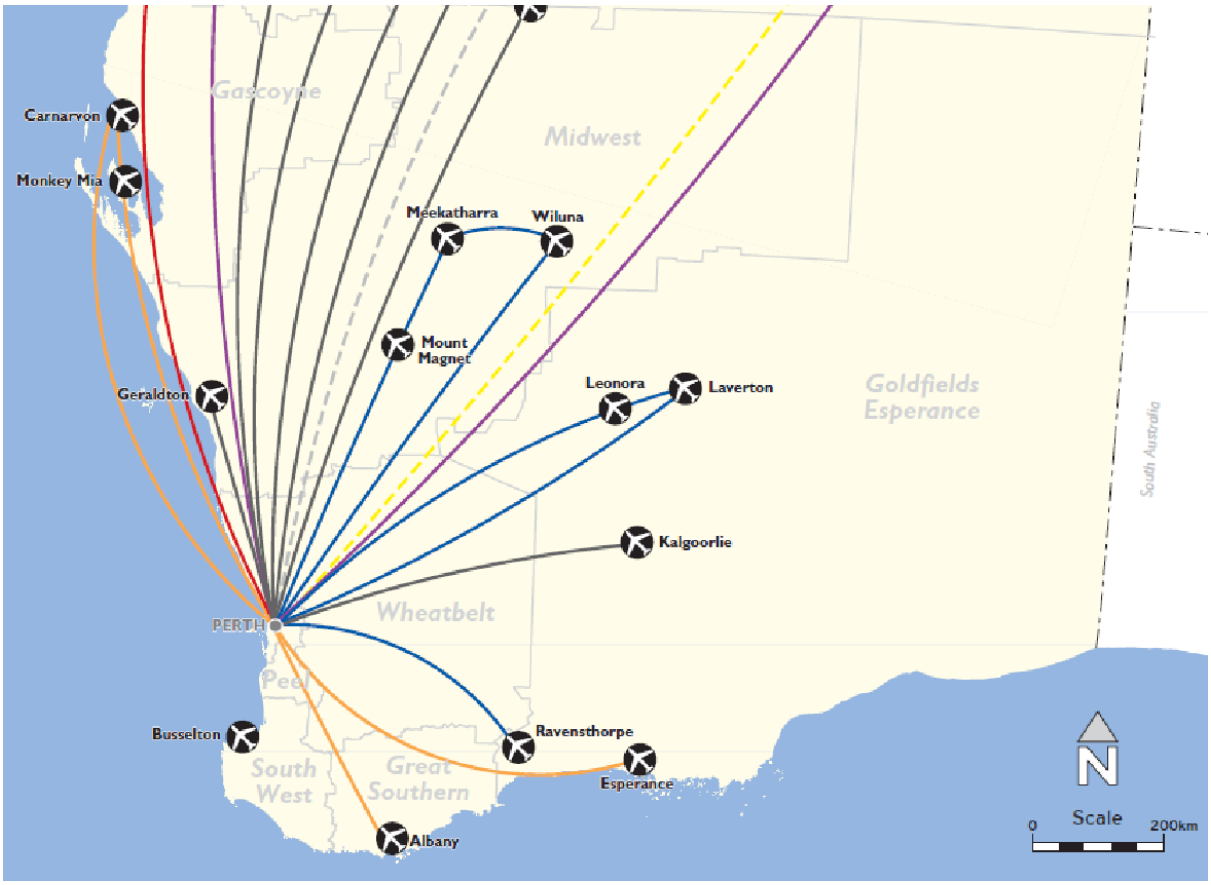

FIGURE 40 – Regulated and Unregulated RPT Routes Operating in the Goldfields-Esperance Region

The regional airports and aerodromes operated by mining companies also support the operations of the Royal Flying Doctor Service in the Region.

6.3.1. Kalgoorlie-Boulder Airport

Owned and operated by the City of Kalgoorlie-Boulder, Kalgoorlie-Boulder Airport is the main regional airport for the Goldfields-Esperance Region. In 2017-18, the airport processed approximately 265,000 passengers travelling on approximately 3,650 flights. As illustrated in Figure 41[160] below, 2017-18 represents the largest number of passengers ever handled by the Kalgoorlie-Boulder Airport. The sensitivity to throughput at Kalgoorlie-Boulder airport to mining industry activity in the Region is also evident from Figure 41.

[159] Western Australian Department of Transport (2018), *Regulated and Unregulated RPT Air Routes*

[160] Bureau of Infrastructure, Transport and Regional Economics (2018), *Aviation Statistics*, Australian Government, Canberra

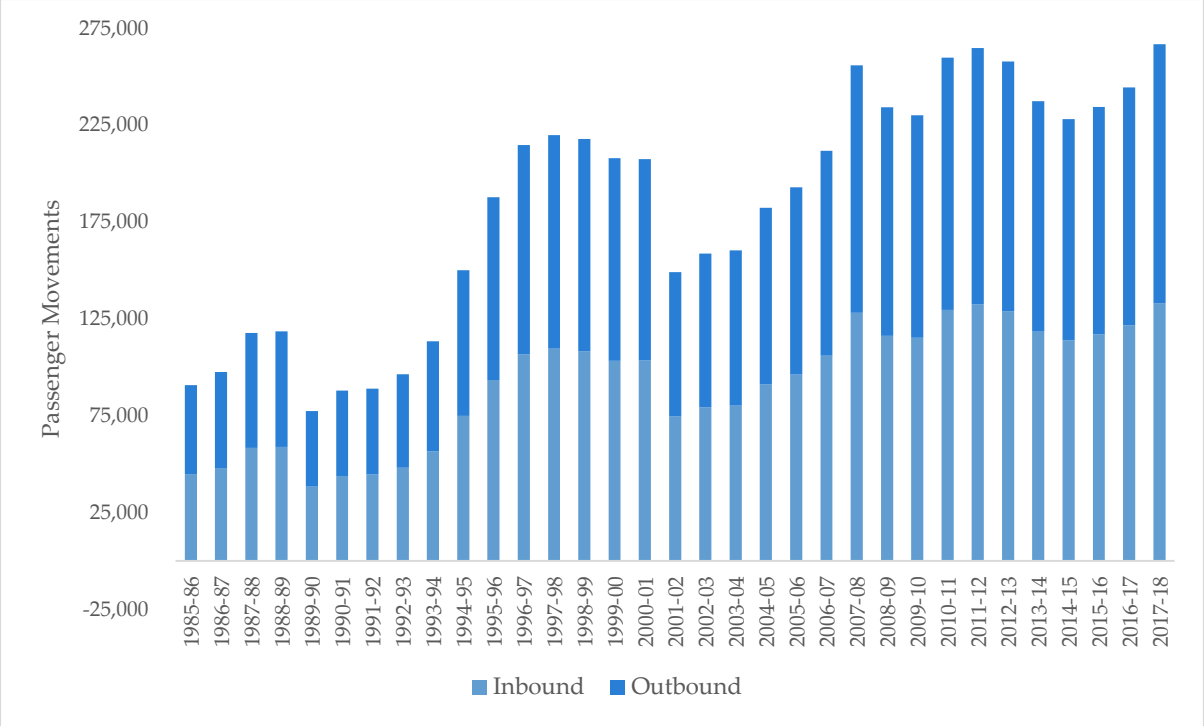

FIGURE 41 – Kalgoorlie-Boulder Airport Passenger Throughput (1985-86 to 2017-18)

While aircraft movements at the airport are at a five year high, as illustrated in Figure 42[161] below, they are below historical levels. This is the result of larger RPT airframes (such as Boeing 717, Fokker 100, Embraer 146, Boeing 737 and Airbus A320) routinely servicing the route in more recent years.

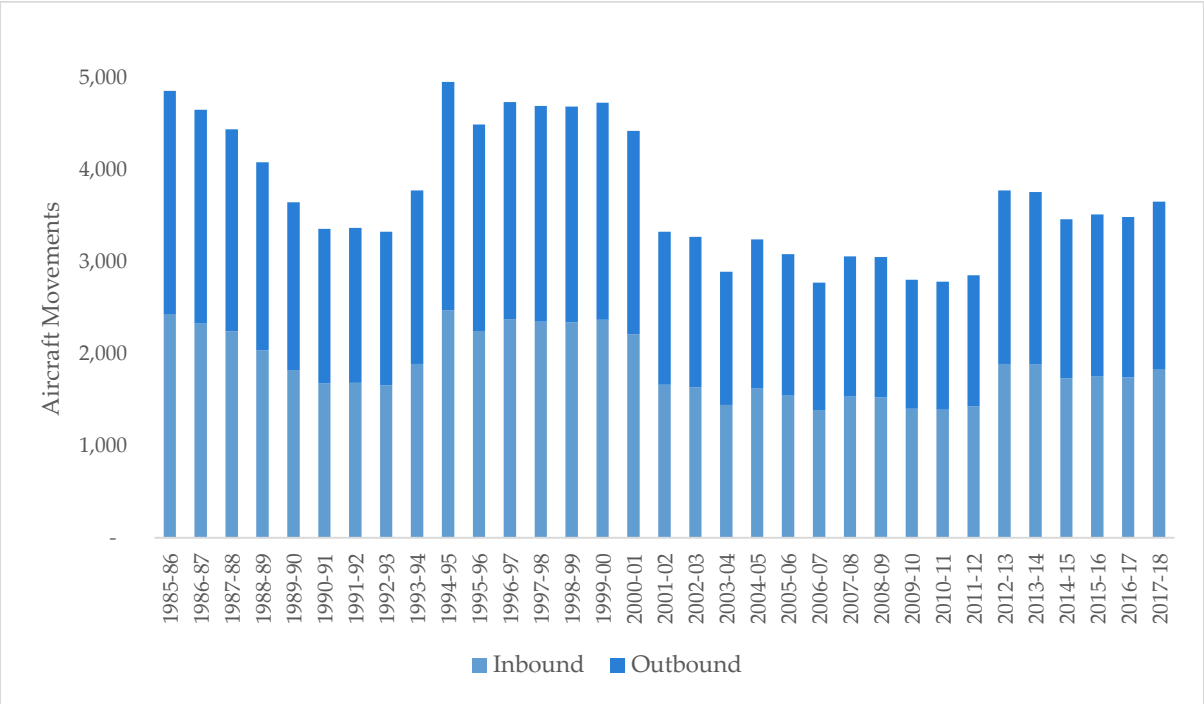

FIGURE 42 – Kalgoorlie-Boulder Airport Aircraft Movements (1985-86 to 2017-18)

[161] Bureau of Infrastructure, Transport and Regional Economics (2018), *Aviation Statistics*, Australian Government, Canberra

The Perth-Kalgoorlie-Boulder-Perth RPT is serviced competitively, mainly by Qantas and Virgin who currently operate an average of approximately eight services per day Monday to Friday and four services per day over the weekend. This is complemented by Alliance Charter and Cobham Charter also offering services. Virgin also operates a Melbourne-Kalgoorlie-Perth-Melbourne route.

Aviation operations at Kalgoorlie-Boulder Airport is facilitated by a 2,000 metre 110-290 oriented runway with a width of 45 metres and 150 metres of central graded area, as well as a 1,200 metre 180-360 oriented runway with a width of 18 metres. The apron includes five dedicated parking bays for airframes up to Airbus A320 and Boeing 737.

Passenger processing facilities include 10 check-in counters, with six currently spare. There is a single screening point and the sterile holding lounge has a maximum capacity of 200 people.

The commercial and general aviation fleet has access to two JetA1 fuel storage tanks of 87,000 litres capacity each, and one Avgas tank with a capacity of 75,000 litres.

The general aviation fleet at Kalgoorlie-Boulder airport is relatively small at around one dozen private and charter aircraft. While RFDS aircraft are not based at Kalgoorlie-Boulder Airport, PC 12 and C4 jets regularly visit the airport.

Gold is the main freight throughput, which is transported under secure arrangements on commercial RPT.

6.3.2. Esperance Airport

Owned and operated by the Shire of Esperance, passenger movements at Esperance Airport have grown at a CAGR of 3.2 percent over the past 33 years, with approximately 50,000 passengers per annum currently transiting through the airport. This is illustrated in Figure 41[162] below. It is also evident from Figure 43, that passenger movements at Esperance Airport are less sensitive to Regional mining industry activity than the other public airports in the Goldfields-Esperance Region.

[162] Bureau of Infrastructure, Transport and Regional Economics (2018), *Aviation Statistics*, Australian Government, Canberra

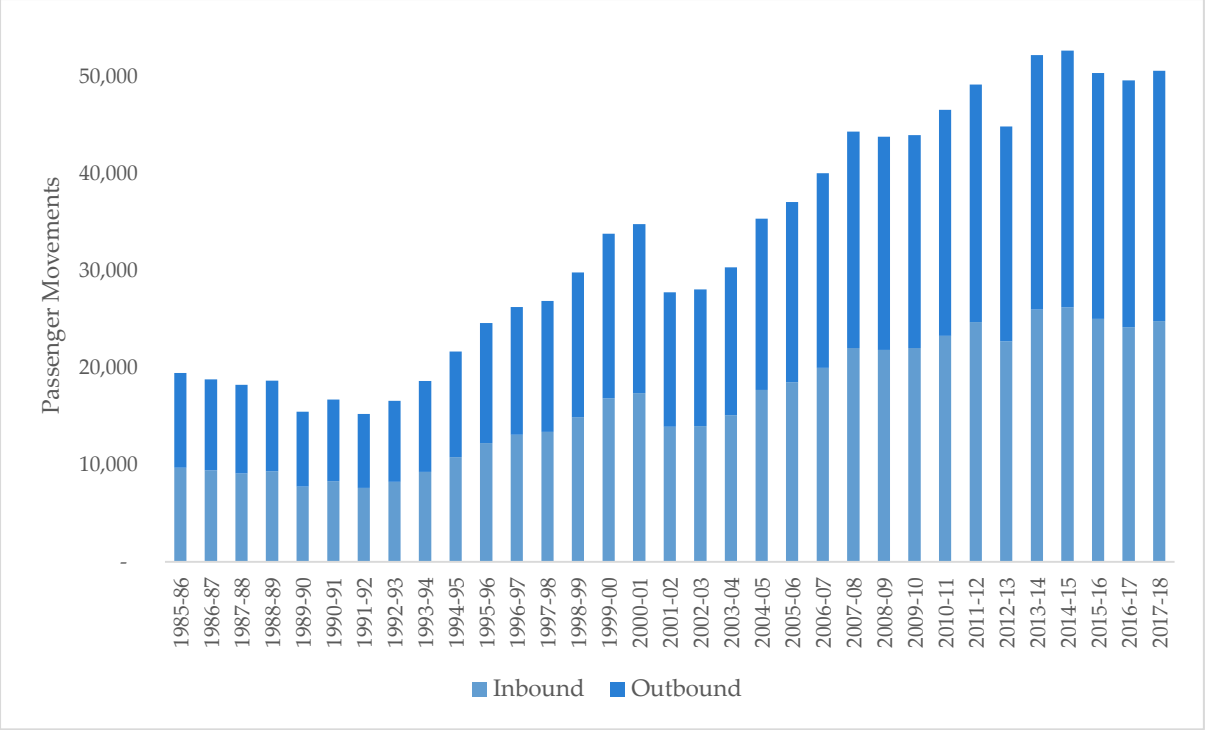

FIGURE 43 – Esperance Airport Passenger Movements (1985-86 to 2017-18)

Compared to the consistent growth in passenger movements, aircraft movements at Esperance Airport have been relatively stable. This is illustrated in Figure 44[163] below.

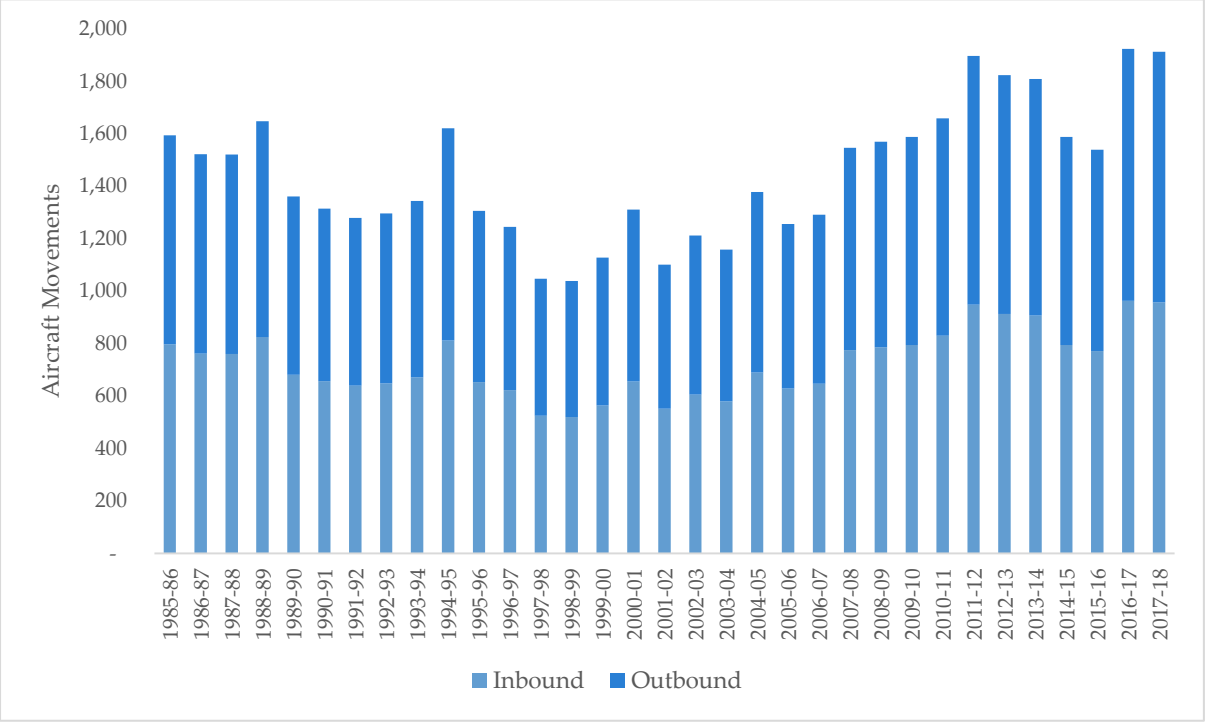

FIGURE 44 – Esperance Airport Aircraft Movements (1985-86 to 2017-18)

[163] Bureau of Infrastructure, Transport and Regional Economics (2018), *Aviation Statistics*, Australian Government, Canberra

6.3.3. Laverton Airport

There has been a 200 percent increase in passenger movements at Laverton Airport over the past year, which has primarily been the result of agreements with local mining operations to use the airport rather than proprietary airstrips that a prone to closure in poor weather. This has been supported by investment in a new terminal facility. This is illustrated in Figure 45[164] below.

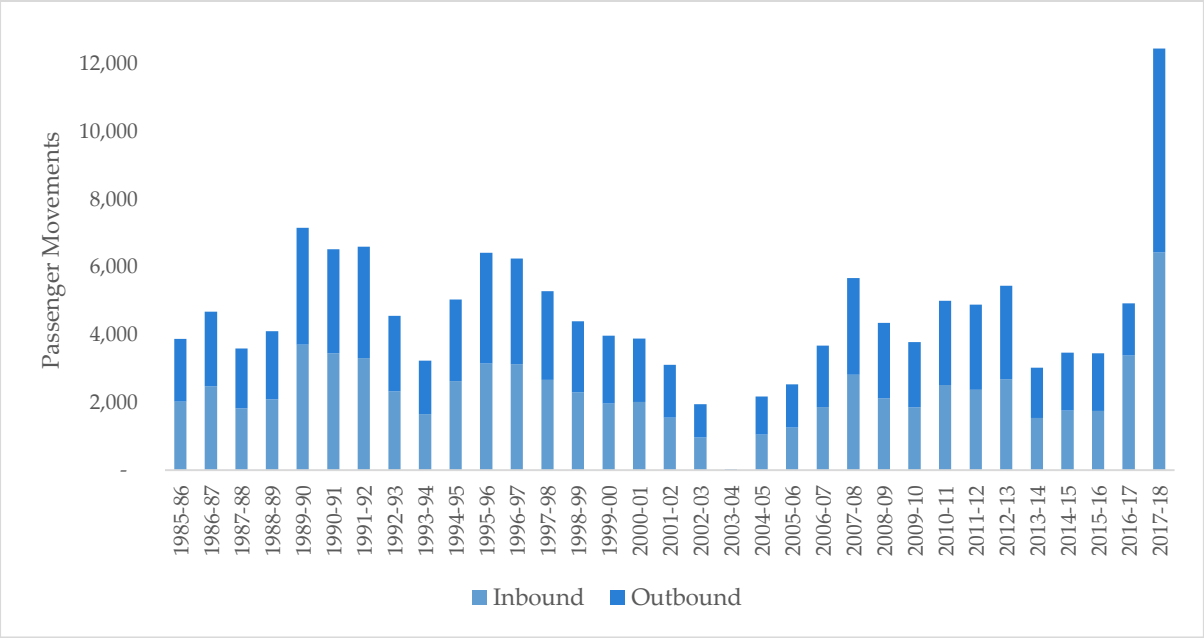

FIGURE 45 – Laverton Airport Passenger Movements (1985-86 to 2017-18)

As illustrated in Figure 46[165], this has been supported by a similarly dramatic increase in aircraft movements over the past 12 months.

[164] Department of Infrastructure, Regional Development and Cities, *Airport Traffic Data*
[165] Department of Infrastructure, Regional Development and Cities, *Airport Traffic Data*

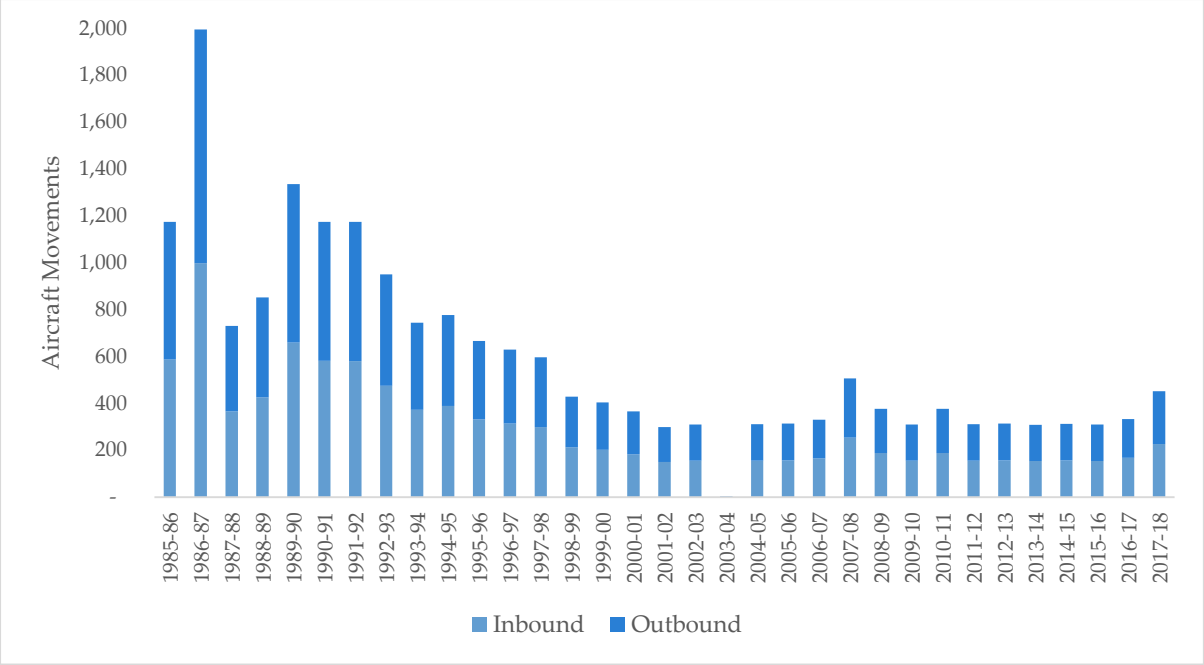

FIGURE 46 – Laverton Airport Aircraft Movements (1985-86 to 2017-18)

6.3.4. Leonora Airport

After five years of declining passenger numbers, passenger movements at Leonora Airport have increased over the past two years. This is illustrated in Figure 47[166] below.

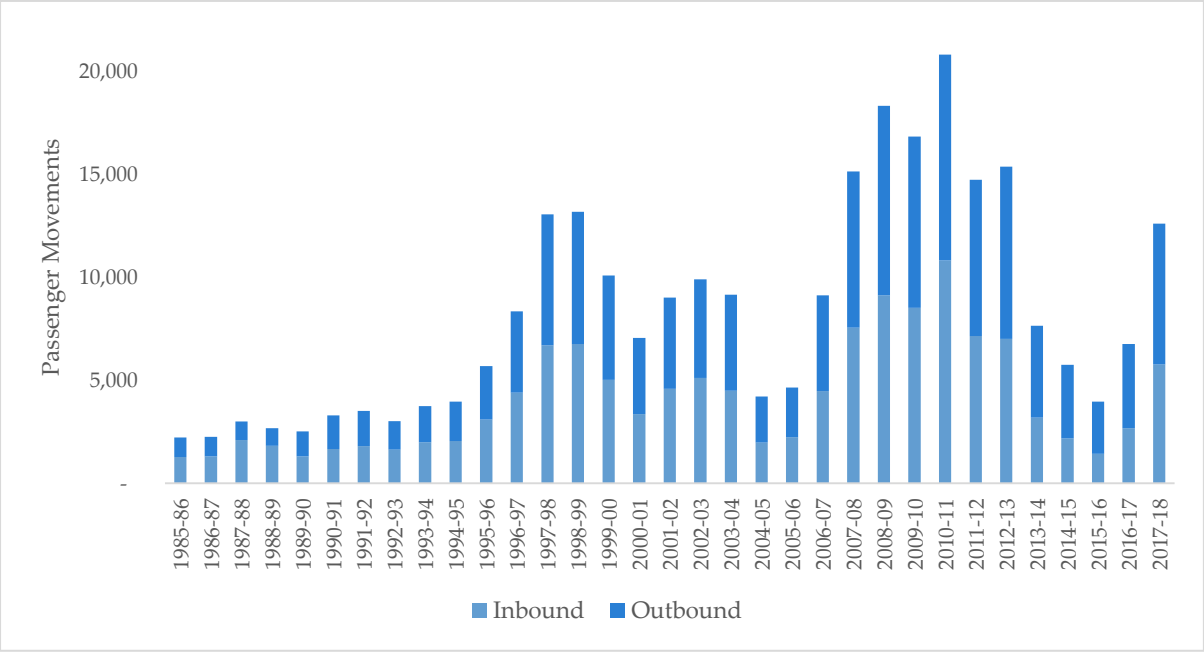

FIGURE 47 – Leonora Airport Passenger Movements (1985-86 to 2017-18)

[166] Department of Infrastructure, Regional Development and Cities, *Airport Traffic Data*

The increase in passenger movements at Leonora Airport over the past couple of years has occurred in an environment where aircraft movements have stabilised, indicating the use of larger airframes. This is illustrated in Figure 48[167] below.

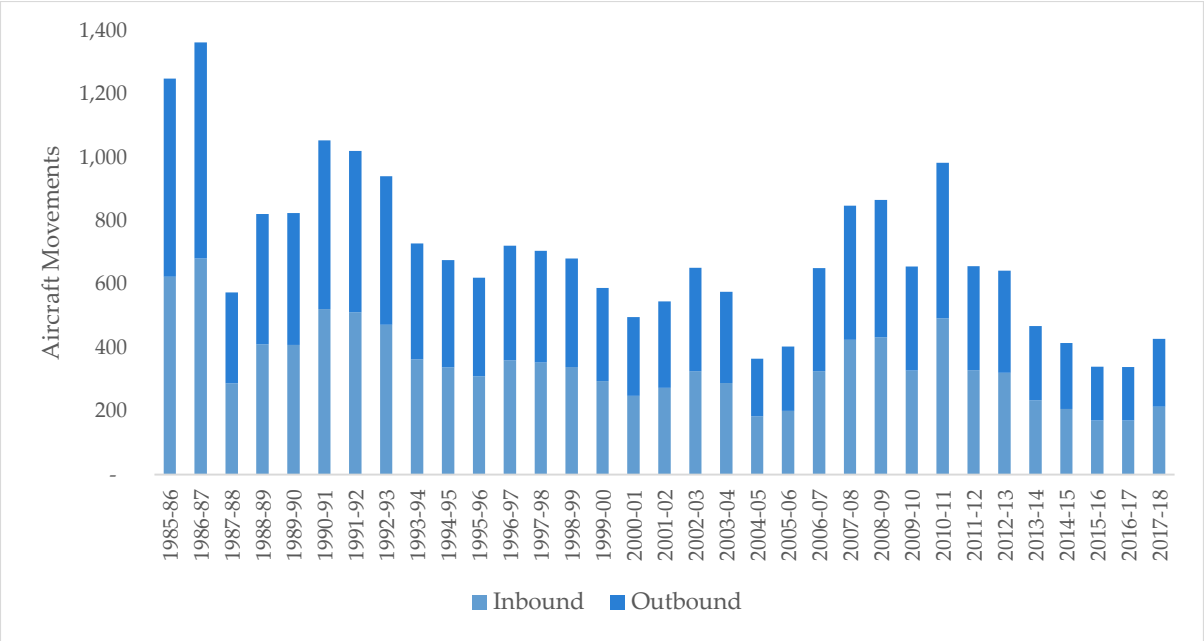

FIGURE 48 – Leonora Airport Aircraft Movements (1985-86 to 2017-18)

6.3.5. Key Issues

Kalgoorlie-Boulder approaching CASA trigger for controlled airspace

Issue

Should passenger throughput at Kalgoorlie-Boulder Airport reach 350,000 (approximately 25 percent more passengers than currently), the Civil Aviation Safety Authority requirement for controlled airspace will be triggered. To meet these requirements, the City of Kalgoorlie-Boulder will be required to invest in a new control tower and fire-fighting infrastructure. Based on the investment required at Broome International Airport to establish this infrastructure in 2012, the cost is estimated at approximately A$20 to A$25 million[168].

The challenge associated with meeting this potential investment requirement is that, as discussed in Section 6.3.1, passenger throughput at Kalgoorlie-Boulder is sensitive to mining industry activity, as it is at all Goldfields-Esperance Regional airports and aerodromes with the exception of Esperance. Therefore, if the threshold is triggered, passenger numbers could quickly reduce below the threshold after the investment has been made.

Opportunities

There are two possible solutions to this issue. Firstly, and most simply, the City of Kalgoorlie-Boulder could simply wait until passenger throughput reaches the trigger and make the necessary

[167] Department of Infrastructure, Regional Development and Cities, *Airport Traffic Data*
[168] Australian Venture Consultants (2015), *Unlocking the Door: A study into the feasibility of Broome as a commercial and logistics hub for the Kimberley Region*, Broome Future Alliance Limited

investment. Alternatively, a study could be undertaken to explore the extent to which charter flights could be diverted to other regional airports in order to reduce or slow the growth in passenger throughput at Kalgoorlie-Boulder airport. As suggest below, this could form a component of a more comprehensive regional aviation optimisation study.

Pending upgrade investment at Esperance

Issue

As discussed in Section 6.3.2, there has been strong long-term growth in passenger throughput at Esperance Airport. Currently, the Perth-Esperance RPTs are serviced by a Saab 340B airframe which is a twin-prop aircraft, seating approximately 35 passengers.

In order to accommodate larger Fokker 100 or Boeing 717 aircraft, the aerodrome must attain an exemption from the Civil Aviation Safety Authority. If passenger throughput continues to increase at Esperance Airport, an investment in upgrading facilities will be required to accommodate the larger airframes that are routinely used by Australian commercial airlines to service regional airports.

Opportunities

Given the consistent long-term trend in passenger throughput growth at Esperance Airport, this additional investment is ultimately likely to be unavoidable, particularly if new project developments along the southern coast drive population growth in the area. As such, planning for the investment and identification of sources of funding should be undertaken.

High regional airfares

Issue

The relative high cost of regional airfares has been a contentious issue across regional Australia, particularly regional Western Australia. The associated high cost of travel between regional centres and Perth is a significant cost for businesses and residents of the Region. While operators of large FIFO workforces can mitigate the high cost of RPT fares in some instances by using charters, local firms that routinely or on an *ad hoc* basis need to move staff, contractors or service providers between Perth and the Region incur significant cost as a result of high airfares. Additionally, high costs of travelling between the Region and Perth detracts from the ability to attract a residential workforce, as potential staff are less likely to move to the Region if the cost of visiting Perth for personal reasons is prohibitive.

Opportunities

It is probable that future airfare relief will only be found as a result of special packages offered for residents and/or government subsidisation of airfares to support policies such as growing tourism. For example, the City of Kalgoorlie-Boulder have negotiated a package with Qantas whereby passenger service charges are waived for local residents on certain fares.

Facilitating regional approach to FIFO

Issue

One of the challenges to establishing a residential mining sector workforce in regional areas is the cyclical nature of the industry, whereby potential residential staff are concerned that they will relocate to a region, only to find themselves redundant as the result of a cyclical downturn.

Some regional centres have been successful in mitigating this risk by establishing inter-regional FIFO connections, effectively allowing FIFO workforces to operate from regional homes, as opposed to capital cities. This can create opportunities in regional centres where unemployment is high, as well as help reduce the impact of local cyclical employment.

Opportunities

A scoping study could be initiated by GVROC members in partnership with RDAGE, GEDC, Department of Transport and industry to better explore the potential for inter-regional air links, such as between Karratha, Port Hedland, Broome and Kalgoorlie-Boulder.

Managing volume fluctuations challenges of the smaller aerodromes

Issue

As illustrated by the case of Laverton Aerodrome (see Section 6.3.3), passenger and aircraft throughput can vary dramatically in the smaller northern regional aerodromes in response to mining industry activity in the Region. Because infrastructure is typically limited at these smaller airports congestion can arise very quickly.

Opportunities

The ability of local government to swiftly respond to spikes in aviation demand that are a function of individual resources projects will always be limited. At the same time, establishing new aerodromes only to service peak periods of demand can represent an inefficient deployment of capital. GVROC could commission an aviation optimisation strategy for the Region that clearly maps current and possible future aviation demand, determines optimal shared usage of existing aviation infrastructure and then prioritises investment on a regional basis.

6.4. Maritime facilities

Esperance Port is the GVROC Region's only commercial port, with recreational marinas located in the towns of Esperance and Hopetoun.

6.4.1. Esperance Port

Operated by the Southern Ports Authority, which also manages Albany and Bunbury Ports, Esperance Port is the second least visited port in Western Australia. This is illustrated in Figure 49[169] below.

[169] Ports Australia (2018)

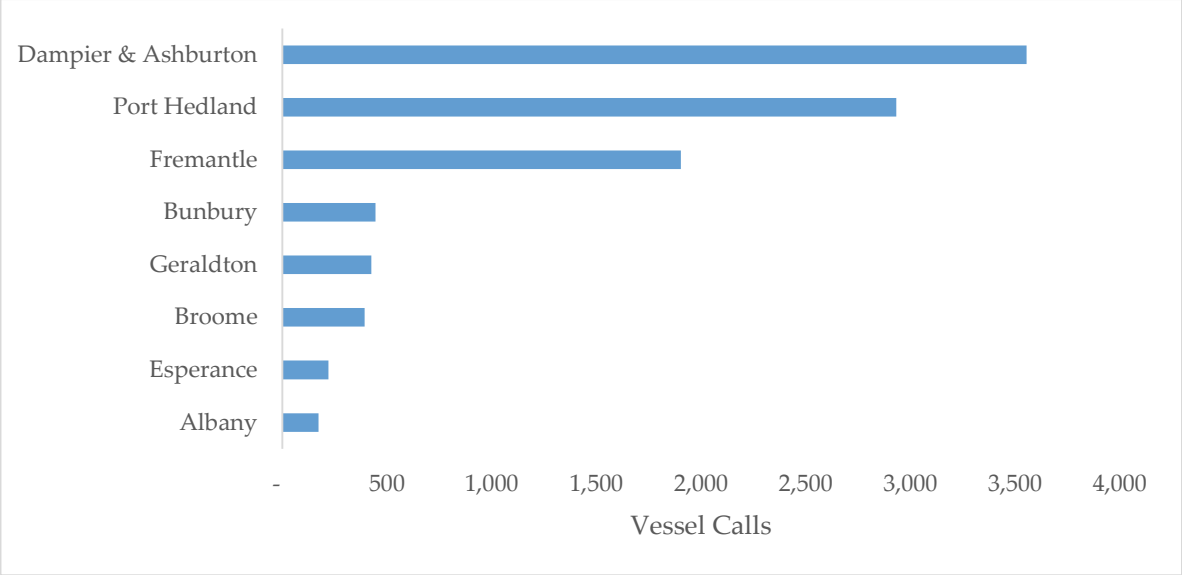

FIGURE 49 – Vessel Calls at Western Australian Ports (2016-17)

However, in terms of throughput, Esperance Port is broadly equivalent to Geraldton, and Bunbury Port. This is illustrated in Figure 50[170]. Esperance Port also has a similar minerals and grain bulk commodity export profile to these other ports.

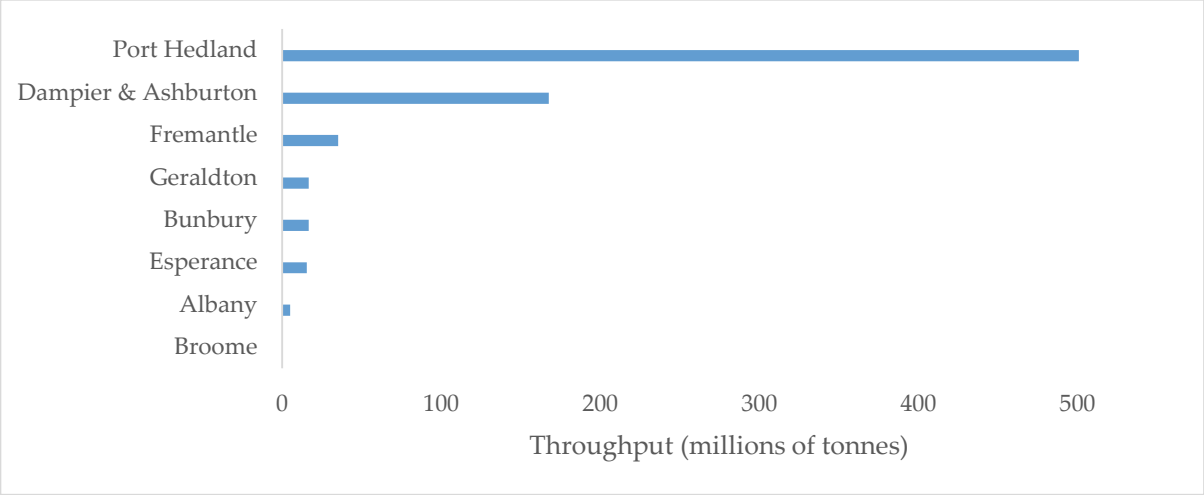

FIGURE 50 – Throughput at Western Australian Ports (2016-17)

Esperance Port is the deepest port in Southern Australia with a capacity to dock fully loaded Panamax vessels up to 75,000 tonnes and Cape Class vessels up to 200,000 tonnes. It is also one of few regional Western Australian ports with dedicated container handling facilities. The following Figure 51[171] illustrates facilities at Esperance Port.

[170] Ports Australia (2018)
[171] Southern Port Authority

FIGURE 51 – Esperance Port

As illustrated in Figure 52 below, the number of vessel calls over the past decade has remained relatively constant at around 200 vessels per annum and is dominated by commercial vessels. Only three naval vessels have visited Esperance Port over the past decade. Whereas the number of cruise-ships visiting the Port has increased from four in 2012-13 to a peak of 13 in 2015-16.

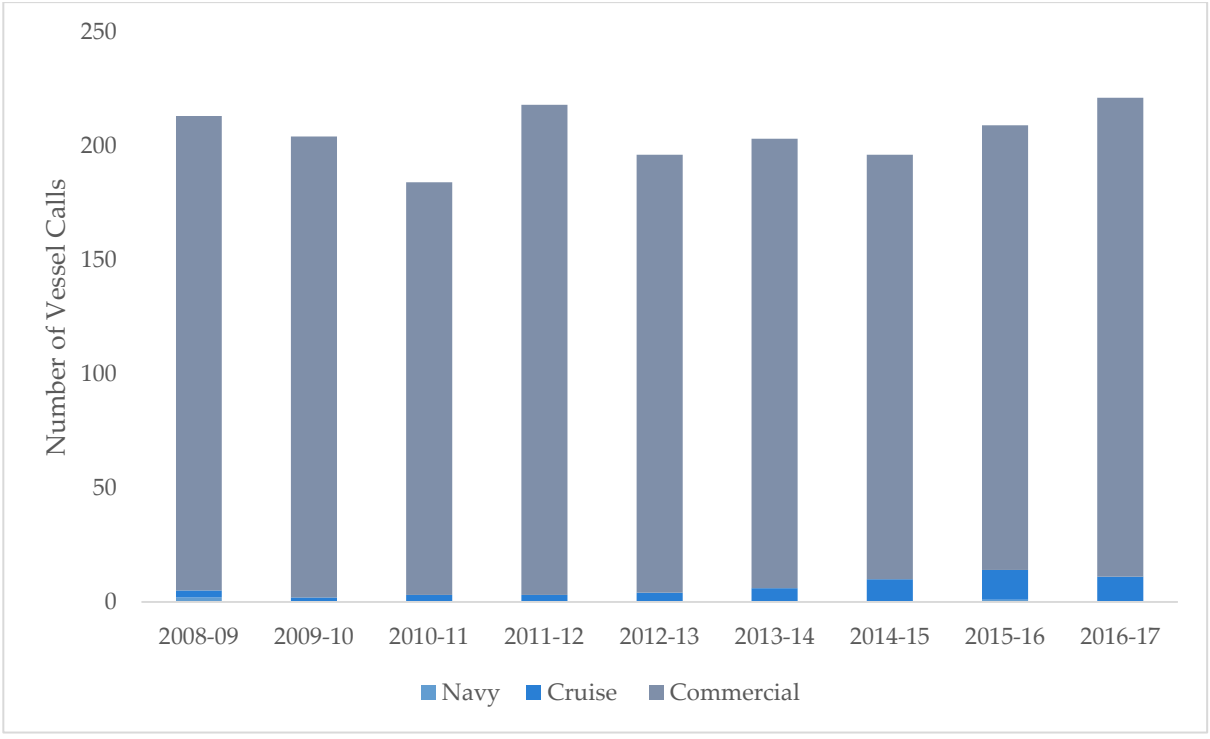

FIGURE 52 – Vessel Calls at Esperance Port

As illustrated in Figure 53 below, the vast majority of vessels visiting Esperance Port are dry-bulk carriers exporting minerals and grain production from the Region. The Port also receives around 20 container vessels and a dozen bulk-liquid carriers per annum. A significant portion of the container cargo is exporting minerals product. Historical trends in imports and exports through Esperance Port are detailed in Appendix 7.

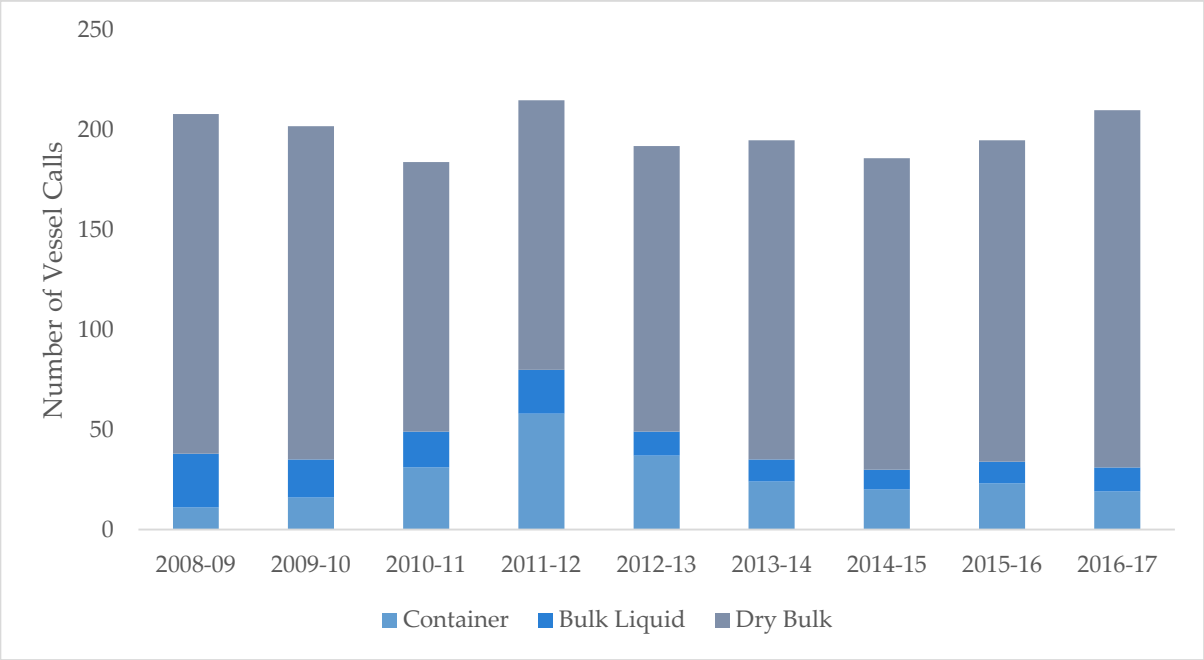

FIGURE 53 – Vessel Calls at Esperance Port by Cargo Type

Most vessels visiting the Port of Esperance are export oriented with the number of Australian coastal shipping calls having decreased from 20 vessels carrying a total of 140,000 tonnes of cargo in 2009-10 to two vessels carrying a total 12,000 tonnes of cargo in 2016-17.

In terms of exports, iron ore dominates throughput on a tonnage basis, followed by grains and nickel, with woodchip exports emerging over the past couple of years. This is illustrated in Figure 54 below.

FIGURE 54– Esperance Port Exports by Commodity (2008-09 to 2016-17)

Imports at Esperance Port are comprised almost exclusively of petroleum products. The trend in petroleum imports at Esperance Port is illustrated in Figure 55 below.

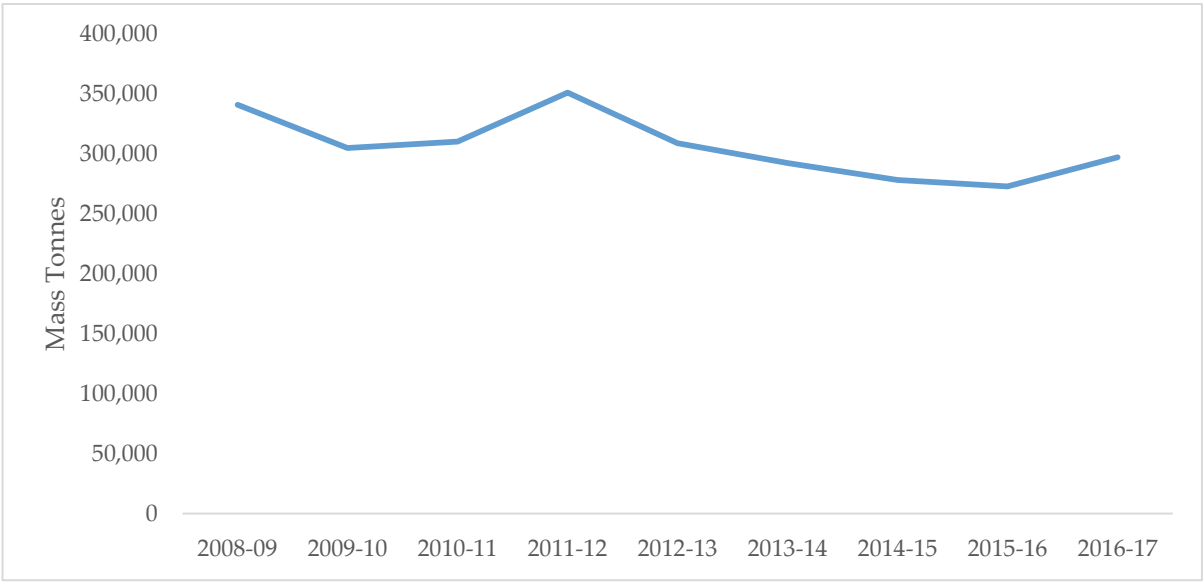

FIGURE 55 – Esperance Port Oil and Petroleum Imports

6.4.2. Other Marinas and Boating Facilities

Bandy Creek Board Harbour

The Bandy Creek Boat Harbour is managed by the Western Australian Department of Transport and is located approximately 10 kilometres to the east of Esperance Port. The boat harbour comprises a commercial area on the east side with 26 boat pens accommodating vessels of up

to 20 metres, a 30.6 metre trawler jetty and a 150 metre land-backed service wharf. Facilities include single phase and limited three phase power, water, lighting, a waste oil facility, diesel fuel, maintenance facilities and public toilets.

The normal depth of water within the turning basin of the harbour and at the land backed service wharf is 4.2 metres below datum.

The recreational facilities are situated to the west and comprise 20 Mediterranean-type boat pens accommodating vessels up to 15 metres, a two lane boat ramp with catwalk, a public access park with barbeques, fish cleaning tables and public toilets. Single phase power, water and lighting is also available.

The Esperance Professional Fisherman's Association operates a private slipway on the northern side of the harbour. This slipway is accessible from the eastern side and Bandy Creek Road and has a 60 tonne capacity[172].

Esperance Bay Yacht Club

The Esperance Bay Yacht Club is a private yacht club that offers marina pens and hardstand storage for club members and occasional visiting yachts. The marina infrastructure is aging and is increasingly unable to meet demand.

Hopetoun Boating Facility

The Hopetoun boating facility is managed by the Western Australian Department of Transport and consists of a 38 metre service jetty and a single lane boat launching ramp, along with public toilets, and approximately 8,000 square metres of parking and hardstand area. Water is available, however there is no permanent fuel distribution service on the jetty[173].

6.4.3. Key Issues

Esperance Port land constraints

Issue

As commodity and concentrate volumes through the Port potentially increase, additional laydown and storage solutions will be required, including in some instances storage solutions that prevent product cross-contamination.

The amount of land around Esperance Port that can be developed for additional quay-side laydown and storage is significantly constrained by the local geography and the Port's proximity to the town.

Opportunities

A possible solution to this issue is to have greater storage and laydown at an expanded Aurizon Yard in Kalgoorlie and more efficient rail linkage between the Yard and the Port.

[172] Department of Transport, Esperance Boating Guide
[173] Department of Transport, Hoptoun Boarting Guide

Maintaining long term viability of Esperance Port

Issue

Esperance Port is an asset of the Southern Port Authority, a government trading enterprise. While the Southern Port Authority has some facilitation of trade legislative responsibilities, for all intent and purpose it is a business enterprise that operates at arms-length from the government, subject to certain direction from the responsible Minister. In addition to facilitating trade, it is important that the portfolio of regional ports operated by Southern Ports Authority also meets the return expectations set by the Western Australian Government.

The continued facilitation of trade and meeting return expectations is a function of an economically sustainable and profitable business. This requires a consistent level of throughput that keeps a workforce employed and capital operations, as well as generating and return of and return on that capital.

As a relatively small commercial port, the throughput of which is largely dependent on a few sectors of the local mining industry and the local grains industry, profitability and sustainability of Esperance Port is more at risk than some other regional Western Australian Ports.

Opportunities

Considerable effort goes into ensuring diversity and continued throughput at the Port. This is principally the responsibility of and a matter for the Southern Port Authority, however there is arguably a case for local government to take a more direct interest to secure the long-term viability of Esperance Port and the industries that depend upon it. Any policy approach in this area should be maximally informed by and achieved through ongoing engagement with Southern Ports Authority, GEDC and the State government, seeking to identify areas of likely cooperation.

Confidence to invest in new capital at Esperance Port

Issue

If the spodumene concentrate, nickel concentrate, iron ore and rare earth production that is expected to come on stream is exported through Esperance Port, the Port will likely experience periods of congestion, not only in terms of laydown and storage but also in berthing, loading and cargo handling capacity.

Current berth occupancy is at approximately 45 percent, with 60 to 65 percent generally considered the trigger for requiring increase in berths or berth productivity. This may require investment in a new Berth 3 multi-loader, a loader at Berth 2 for smaller vessels and an extension of Berth 1 to accommodate two post-panama class vessels concurrently at Berths 1 and 2. Increasing the draft at Berth 1 and 2 is challenged by the granite seabed.

If the expansion of mineral processing occurs, a business case for sulphuric acid and caustic soda import facilities may also arise.

However, to make these investments, confidence is required to the long-term security of throughput and that the Port will not become unproductively constrained as a result of laydown and storage constraints.

Opportunities

These constraints are not new and have been consistently identified as of concern by Southern Ports Authority and Esperance Port management over the medium term. Existing engagement and consultation processes under way to identify methods by which the Shire of Esperance can assist the Port to address these capacity constraints should be continued, and should be expanded to include RDAGE, the GEDC and industry stakeholders. This could include initiatives such as a demand analysis for sulphuric acid and caustic soda import facilities.

Esperance Bay Yacht Club Marina

Issue

The Esperance Bay Yacht Club Marina is aging and increasingly unable to meet demand. The Yacht Club is currently seeking to secure funding to build a new marina, which could potentially be designed to be integrated with the Esperance foreshore amenity.a

7. Services Infrastructure

KEY POINTS

Digital and Telecommunications

Universal access to high quality and affordable telecommunications and digital connectivity is limited by the Region's geographical expanse and sparsely distributed population and industry.

Because the minerals industry is able to invest in proprietary networks, and because connectivity along major transport corridors in the Region is reasonable, this is less of an issue for the minerals or tourism sectors.

However, for a grains industry that is increasingly dependent on digitally enabled equipment for productivity growth, limited access to commercial grade broad-brand is a major challenge to the Region's grains sector.

Natural Gas

For a relatively remote region, the reticulation of natural gas across the Goldfields-Esperance Region is reasonably extensive.

Nevertheless the vast nature of the Region means that many energy intensive minerals projects do not have direct access to natural gas pipelines, relying on trucked fuel which approximately doubles their energy costs.

Electricity

While geographically speaking the majority of the Region is not serviced by the South West Interconnected System (SWIS) electricity network, the majority of its population is, with the rest of the Region serviced by either Western Power operated isolated grids or proprietary systems.

The Goldfields-Esperance Region is on the 'fringe' of the SWIS resulting in relatively high electricity charges and frequent outages. Solutions to this issue will most likely be identified through distributed energy generation and storage initiatives that will lcome from the work of the Western Australian Government's Energy Transformation Taskforce.

Water

Water supply to the Region is either from the Goldfields and Agricultural Water Supply Scheme (C.Y. O'Connor Pipeline) or from ground water supplies within the Region.

Across the Region, significant local sources of a potable water are relatively scarce and supply from the pipeline is limited. As a result approximately 42 percent of waste water is recycled and water charges are generally high.

Waste Management

Around 75 percent of waste generated in the Region goes to land-fill. There are around 75 waste management facilities in the Region with the majority operated by mining companies. Across the Region a number of facilities are reaching capacity creating scope for regionally coordinated means of optimising waste management, particularly with respect to more problematic waste.

7.1. Digital and telecommunications infrastructure and services

The geographical expanse and sparsely distributed population and industry in the GVROC Region presents a challenge to universal telecommunications infrastructure. Access to broadband internet is limited outside of major towns, with regional residents and businesses often dependent on slower and less reliable satellite broadband for internet connectivity.

Combined with cellular phone network coverage of only approximately 33 percent of the geography of the Goldfield-Esperance Region (and less in the case of the Shire of Wiluna), telecommunications and digital connectivity is a significant obstacle for businesses operating outside of major centres that do not have the capacity to establish private networks.

The following Figure 56[174] illustrates the extent of national telephone exchanges, NBN points of interconnection, and approximate fibre locations in Western Australia.

FIGURE 56 – NBN Points of Interconnection, Fibre Locations and Maritime Cables in Western Australia

As illustrated in Figure 57[175] below, which demonstrates Telstra's mobile network coverage in the Region, cellular phone network coverage in the Region is also limited to locations in relative close proximity to the major infrastructure corridors.

174 http://dafwa.maps.arcgis.com/apps/webappviewer/index.html?id=79b128266e2f4966adde9d84b9d07eaa

175 https://www.telstra.com.au/coverage-networks/our-coverage

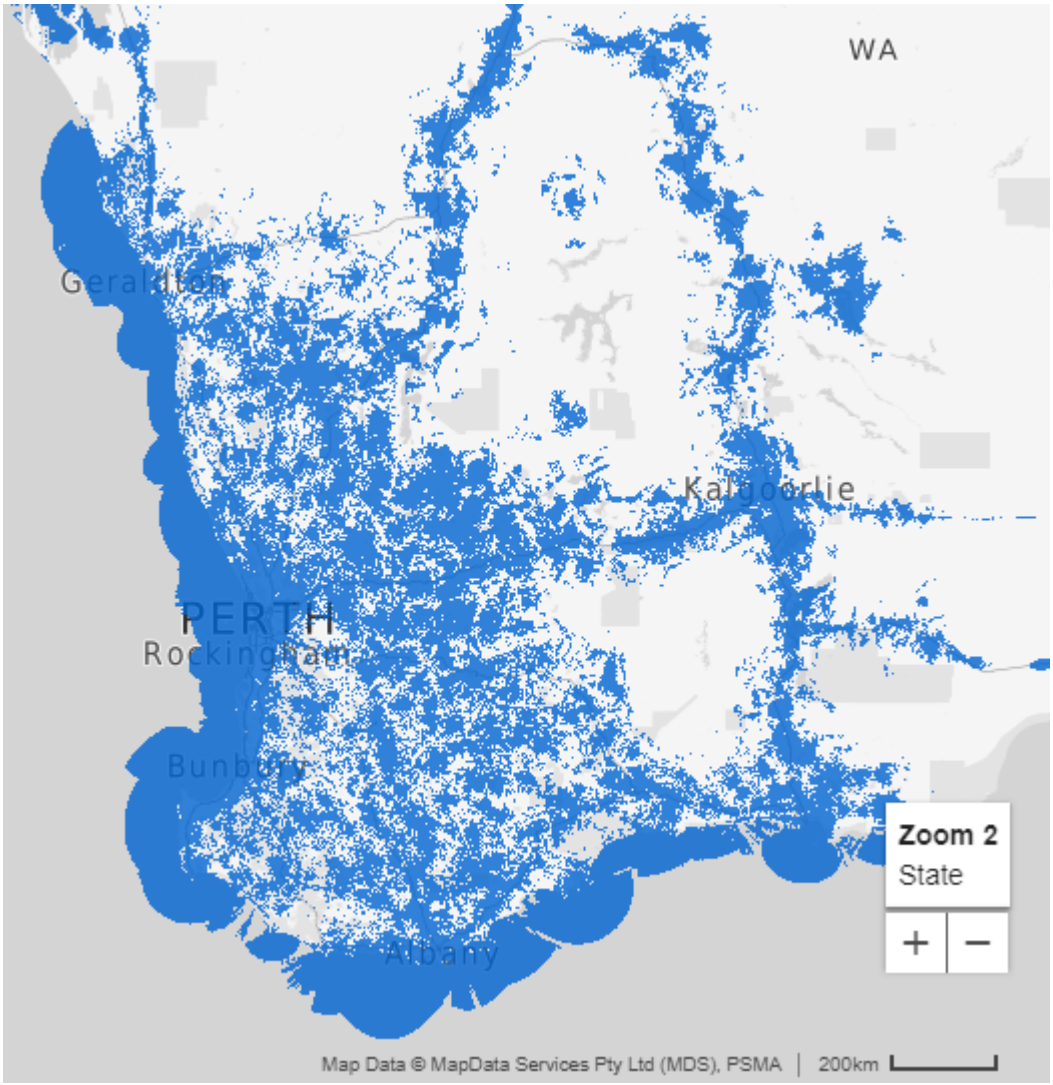

FIGURE 57 – Telstra Mobile Coverage

Given that vast areas of the GVROC Region do not have fibre or cellular phone connectivity, it is not surprising that there are a significant number of Radio Communications Licences in the Region. The location of these licences is illustrated in Figure 58[176] below.

176 http://dafwa.maps.arcgis.com/apps/webappviewer/index.html?id=79b128266e2f4966adde9d84b9d07eaa

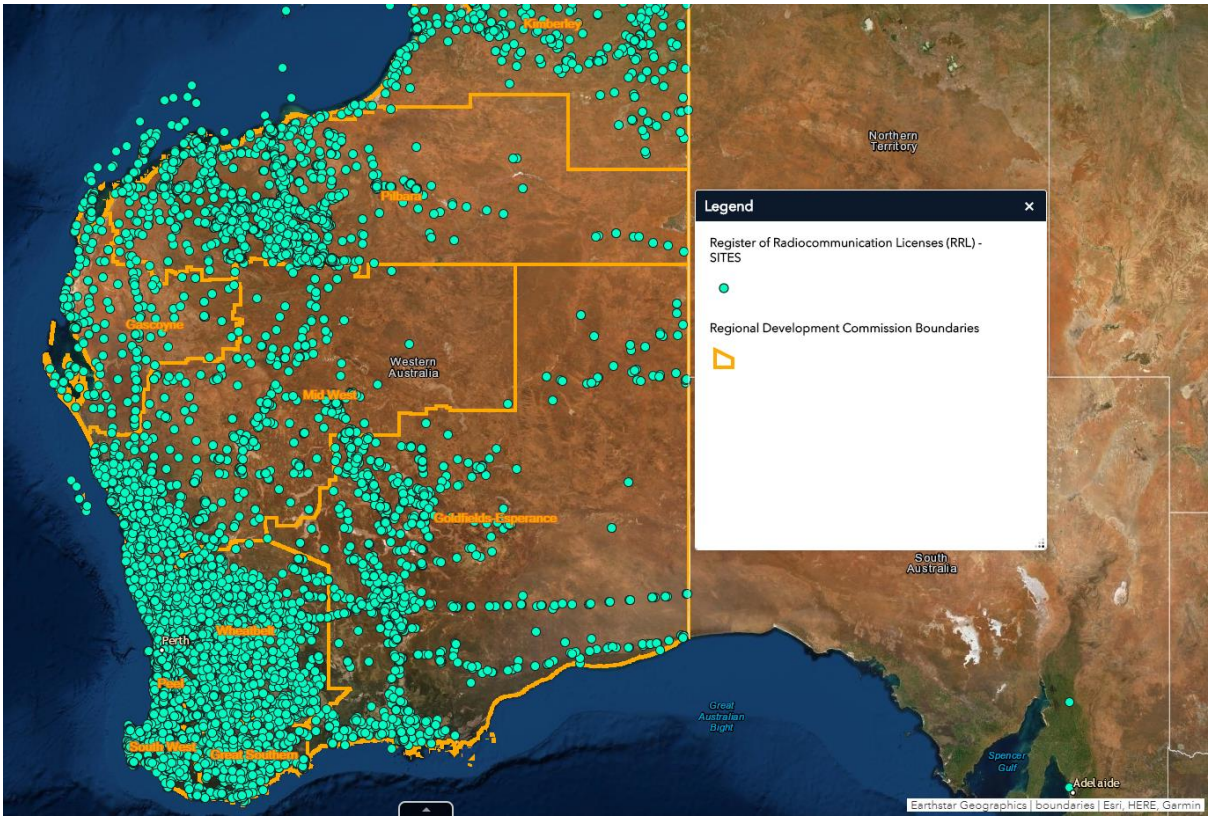

FIGURE 58 – Radio Communications Licences

7.1.1. Key Issues

Mobile 'Blackspots'

Issue

In addition to the generally limited geographical coverage of mobile phone networks in the Region, there a numerous 'Blackspots' within areas that are intended to have coverage, a phenomenon that is not uncommon in the case of regional Australian cellular phone networks.

Opportunities

GVROC member councils should continue to pursue funding opportunities to address the digital and connectivity divide, including through sources such as the Commonwealth Department of Communications and the Arts Mobile Black Spot Program. Partnerships with industry, particularly the resources sector, may be achievable in some priority areas.

Supporting this GVROC members could work with GEDC and RDAGE to develop a comprehensive database of identified 'blackspots' across the Region.

Facilitation of real-time data intensive services

Issue

The ability of digital networks in the Region to support real-time data intensive applications is becoming increasingly important. For example:

- As the mining industry increasingly automates, particularly with respect to underground operations of the Region's many gold mining operations, commercial grade broadband

will be increasingly necessary to support the data requirements of these systems and to connect to remote operating centres;
- Improved productivity of the Region's grains sector will become increasingly dependent on the deployment of automated seeding, harvesting and other agricultural equipment that facilitate precision agriculture. Optimising the performance of this equipment typically requires access to commercial grade broadband so that systems can access real-time data; and
- From a human services perspective, the use of telemedicine is likely to become increasingly important for delivery of health care services into smaller towns and remote parts of the Region.

While large companies and organisations can navigate this issue through the deployment of private networks, albeit at significant additional cost, smaller business typically cannot afford private digital networks.

Opportunities

Efforts should be made to continue to build an investment case for commercial grade broadband network deployment in key areas of the Region through projects such as WA Supernet.

7.2. Natural gas distribution

The natural gas supply chain in Western Australia consists of upstream gas suppliers who produce gas, gas transportation through transmission and distribution pipelines to downstream users, and large users and energy retailers who on-sell gas to consumers.

The Economic Regulatory Authority (ERA) regulates third party access to 'covered' gas pipelines in Western Australia. This includes approving access arrangements, ring fencing and associate contracts. The ERA's responsibilities in this area are prescribed under the *National Gas Access (WA) Act 2009* and the *National Gas Rules (NGR)*[177].

Table 37 below[178] identifies the gas pipelines in the GVROC Region and surrounding areas. The Goldfields Gas Pipeline is 'covered' by the regulation, and the Kalgoorlie to Kambalda Pipeline is 'lightly regulated'. The remaining pipelines are classified as 'non-scheme', albeit the ERA has a role enforcing and monitoring compliance with the non-scheme gas pipeline information disclosure and arbitration framework.

[177] Economic Regulatory Authority, https://www.erawa.com.au/gas/gas-access
[178] Australian Energy Market Commission, Gas Scheme Register

TABLE 37 - Gas Transmission and Distribution in the GVROC Region

Title	Type	Owner/Operator	Regulation
Yamarna Gas Pipeline	Transmission	APA Group	Uncovered
Wiluna Lateral	Transmission	APA Group	Uncovered
Murrin Murrin Lateral	Transmission	APA Group	Uncovered
Mount Morgans Lateral	Transmission	APA Group	Uncovered
Mount Keith Lateral	Transmission	APA Group	Uncovered
Mid West Lateral	Transmission	APA Group	Uncovered
Mid West Pipeline	Transmission	APA Group / Horizon Power	Uncovered
Leinster Lateral	Transmission	APA Group	Uncovered
Kambalda to Esperance Pipeline	Transmission	Robe River Iron Associates JV / Rio Tinto	Uncovered
Kalgoorlie Gas Distribution System	Distribution	ATCO	Uncovered
Gwalia Lateral	Transmission	APA Group	Uncovered
Esperance Distribution System	Transmission	APA Group	Uncovered
Eastern Goldfields Pipeline	Transmission	APA Group	Uncovered
WMC Laterals	Transmission	APA Group	Uncovered*
GGP to Kalgoorlie Power Station	Transmission	APA Group	Uncovered*
Goldfields Gas Pipeline	Transmission	Goldfields Gas Transmission Joint Venture	Covered
Kalgoorlie to Kambalda Pipeline	Transmission	APA Group	Covered - Light Regulation

A high level overview of the gas transmission and distribution pipelines in the GVROC Region is illustrated in Figure 59 below[179].

[179] AEMC, Gas Scheme Register

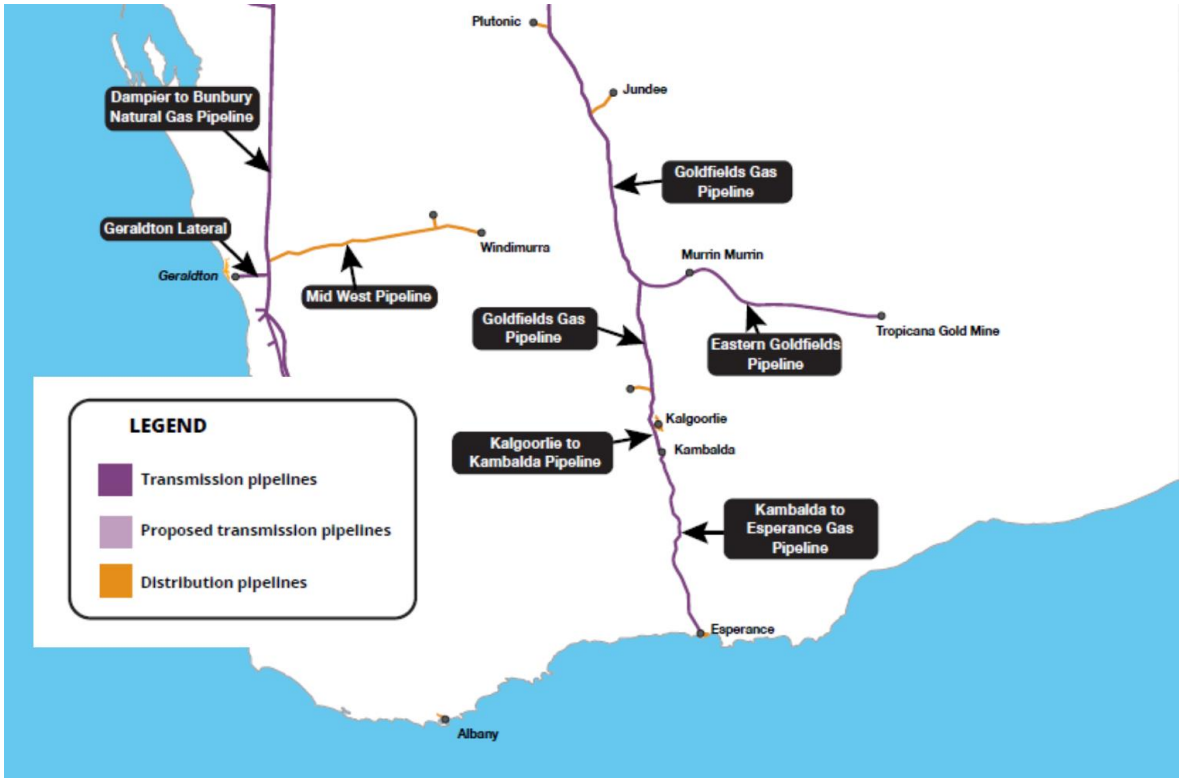

FIGURE 59- Gas Transmission and Distribution Pipelines in the GVROC Region

The Goldfields Gas Pipeline (GGP) supplies gas to the GVROC Region from Varanus Island in the north-west of Western Australia. The GGP is a 1,378-kilometre transmission pipeline that extends from Yarraloola in the Pilbara Region of Western Australia to Kalgoorlie. The 47-kilometre Newman lateral is also part of the GGP. Other laterals that connect to the CGP are as follows:

- The Wiluna Lateral is 8 kilometres in length, connecting the GGP to APA's Wiluna gas-fired Compressor Station and Blackham Resources' Matilda-Wiluna Gold Operation;
- The Mt Keith Lateral is 8 kilometres in length and transports gas from the GGP to Mt Keith, where the gas is used for power generation;
- The Leinster Lateral is 5 kilometres in length and transports gas from the GGP to Leinster, where the gas is used for power generation; and
- The GGP to Kalgoorlie Power Station Lateral (GGPKPS) is 8 kilometres in length and transports gas from the GGP to Kalgoorlie, where the gas is used for power generation.

The GGPKPS Lateral also supplies gas to the ATCO Gas Australia owned and operated Kalgoorlie gas distribution system. The Kalgoorlie Gas Distribution System is currently a non-scheme distribution system and is subject to the access regime for non-scheme pipelines. It currently has approximately 7,500 connections.

The GGP (and Newman Lateral) are predominantly (88.157 percent) owned by APA Group. The Wiluna, Mount Keith, Leinster and Parkeston Laterals are wholly owned by APA Group[180]. Figure 60[181] below illustrates a diagram of the GGP and interconnected pipelines, including current name plate capacities and key facilities connected to the pipelines.

[180] APA
[181] APA (2018), Goldfields Gas Pipeline System Schematic – June 2018

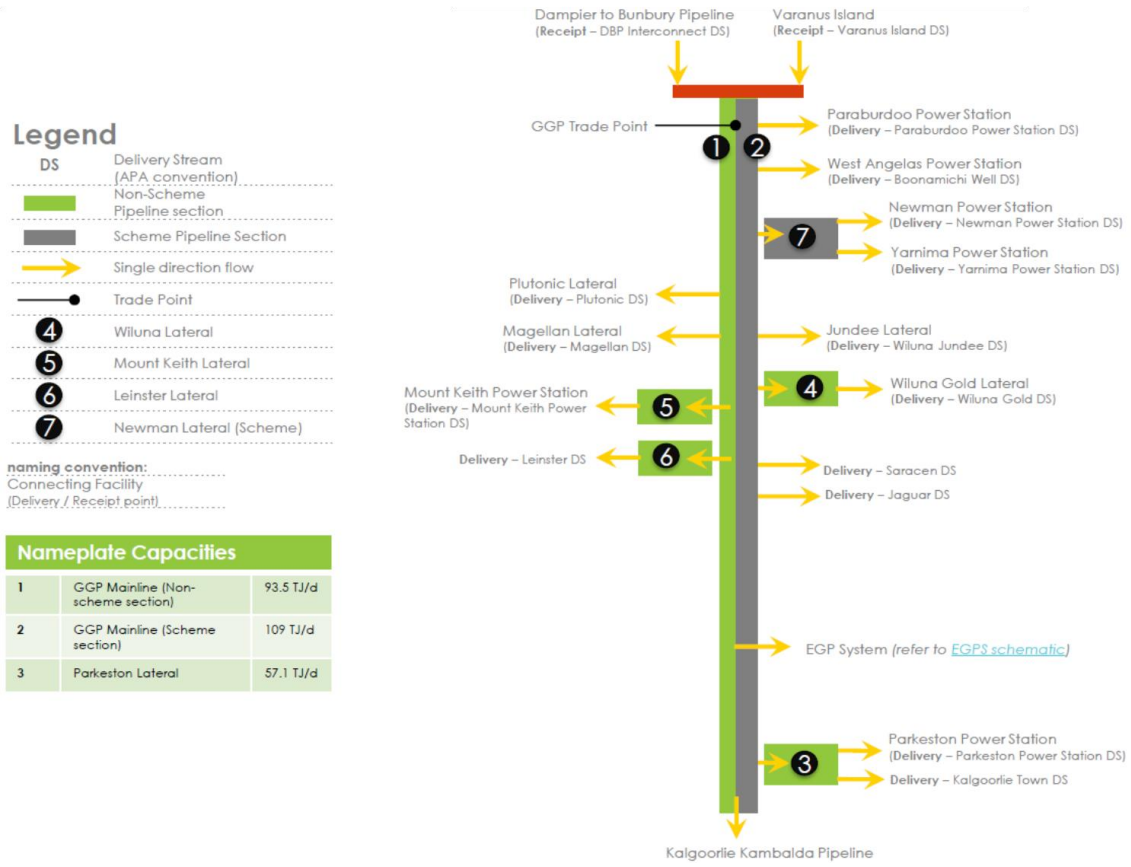

FIGURE 60 - Goldfields Gas Pipeline System Schematic

The GGP also interconnects with the Eastern Goldfields Pipeline System (EGPS) at Leonora. The EGPS is comprised of:

- The 85-kilometre Murrin Murrin Lateral (MML) which is connected to the GGP and transports gas to the Murrin Murrin mine site approximately 69 kilometres east of Leonora, and to the Eastern Goldfields Pipeline (EGP);
- The 293-kilometre EGP which has a capacity of 20.6 tera joules per day and transports gas from the end of the MML to a number of gold mines east of Leonora, including the Sunrise Dam, Tropicana and Granny Smith gold mines;
- The Gwalia Lateral which is 5.7 kilometres in length and delivers gas from the MML to the Gwalia mine site just south of Leonora;
- The Mount Morgans Gas Pipeline which delivers gas from the Eastern Goldfields Pipeline to the Mt Morgan Gold Mine, approximately 20 kilometres west of Laverton; and
- The 198-kilometre Yamarna Gas Pipeline which runs from the EGP to the Gruyere gold mine site in the Shire of Ngaanyatjarraku. Gas is transported almost 1,500 kilometres to the Gruyere mine site using four APA interconnected gas pipelines – the GGP, the MML, the EGP, and the Yamarna Gas Pipeline[182].

All pipelines that make up the EGPS are non-scheme pipelines. Figure 61 below illustrates the EGPS.

[182] AEMC, Gas Scheme Register

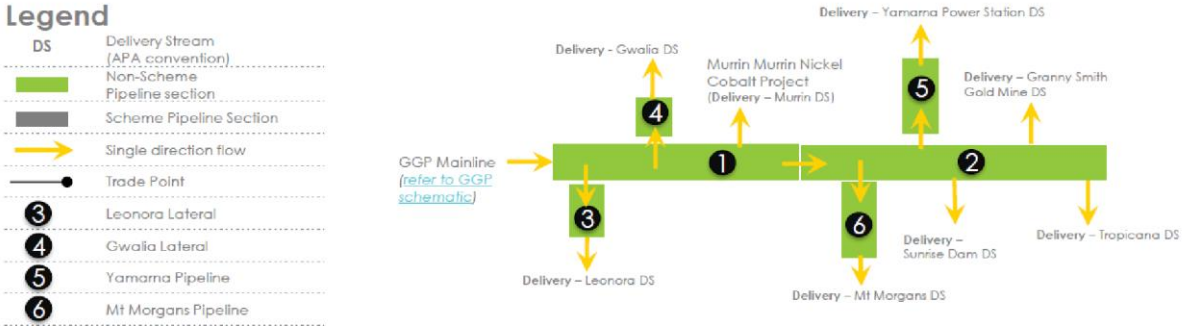

FIGURE 61 - Eastern Goldfields Gas Pipeline System

At its southern extremity, the GGP connects with the Kalgoorlie to Kambalda Pipeline. The 44-kilometre Kalgoorlie Kambalda Pipeline (KKP) is a transmission pipeline transporting gas from the end of the Goldfields Gas Pipeline (at Kalgoorlie South) to a nickel refinery at Kambalda, and finally, to the inlet of the Kambalda to Esperance Gas Pipeline for delivery of gas into the Kambalda to Esperance Gas Pipeline. The KKP is a scheme pipeline under the access regime of the *National Gas Access (Western Australia) Act 2009*.

7.2.1. Key issues

Pipeline access

The issue

Since completion of the core Goldfields-Gas Pipeline trunk-line in 1996, direct access to natural gas has spread across the Region, facilitated by investment in multiple lateral pipeline connections (see Section 7.2). Nevertheless, many projects remain 'stranded' from direct access to pipelines, a situation that is not surprising given vast geography of the Region.

For minerals projects that do not have access to a natural gas pipeline, the cost of trucked fuel is approximately double the cost of directly accessed natural gas on a per kilowatt hour basis.

Opportunities

Given the large commercial impost posed to resources projects by non-pipeline natural gas, there is an arguable case for co-investment (multiple private and government partners) into new lateral pipeline connections where wider economic and community benefits can be demonstrated. Such a proposal would require the successful conclusion of a business case based on economic and community impact (i.e. total value of production activated per unit cost and total economic and social benefit derived from the investment).

7.3. Electricity generation and distribution

The energy supply chain in Western Australia is regulated by the State government and structured into three functional elements of generation, distribution and retail.

Within the South West Interconnected System (SWIS), competitive markets have been established for the generation and retail aspects, while responsibility for the distribution, or network function, is assigned to the state owned and regulated Western Power Networks Corporation. Companies wishing to participate in these markets must obtain a generation or retail licence and contract with Western Power for access to the network. Outside the SWIS, companies wishing to generate,

distribute or retail electricity must obtain a licence for the location or town in which they wish to operate. Integrated regional licences covering all three functions are also available.

Geographically, the majority of the GVROC Region sits outside the boundaries of the SWIS which supplies electricity to the majority of south Western Australia. However, as illustrated in Figure 62 below, the majority of the population in the Region is serviced by the SWIS, with the SWIS network providing electricity to the population centres and surrounds of Coolgardie, Kalgoorlie-Boulder, Kambalda and Ravensthorpe[183].

FIGURE 62 - Western Power Network Boundary

[183] Western Power, SWIS Towns and Locations

Horizon Power owns and operates generation facilities that supply electricity to towns located outside of the SWIS. There are also a number of privately owned and operated generation facilities throughout the Region. Electricity for private industry (such as mining operations) is supplied via a commercial arrangement with generators that can meet the client's precise specifications. Most mining operations are contestable customers due to the significant energy consumption requirements of mining systems. If the mine site is located within the SWIS power grid network (within an 80 kilometre radius of Kalgoorlie-Boulder, Kambalda, or Coolgardie) it is likely that it will be connected to the SWIS and would purchase electricity supply from a gas power generator such as TransAlta or Alinta Energy.

Mining operations located outside of the SWIS either produce their own electricity through self-generation systems, or in instances where they are located in close proximity to a settlement that is serviced by Horizon Power and there is excess capacity in that network, they may purchase supply from Horizon Power. Most mining companies have contracted with independent power producers under Build-Own-Operate style contracts and 'take-or-pay' arrangements.

7.3.1. Overview of the SWIS electricity supply in the GVROC Region

The Wholesale Energy Market (WEM) for the SWIS is regulated by the Economic Regulatory Authority (ERA) and operated by the Australian Energy Market Operator (AEMO). The electricity distribution network is operated by Western Power (the 'Network Operator).

The objectives of the WEM are to provide secure and reliable electricity supplies, encourage competition and minimise the long-term cost of electricity to consumers. Within the WEM, market generators sell electricity to market customers, who consist of retailers and large scale consumers, as well as demand side participants[184].

Electricity generators, transmitters, distributors and retailers must have a licence issued by the ERA to supply electricity within the SWIS. Gas distributors and retailers must also have a licence issued by the ERA. There are approximately 60 market generators and 20 major customers in the WEM. Table 38 below[185] provides a summary of the types of WEM participant classes, and the corresponding registration requirements. A rule participant can belong to more than one class, except where this is explicitly restricted.

[184] Demand side participants are loads or a group of loads that reduce consumption, substituting the requirement for additional electricity generation.
[185] AEMO

TABLE 38 - Wholesale Energy Market Rule Participant Classes and Registration Requirements

Entity	Registration requirements
Owns, controls, or operates a transmission or distribution network in the SWIS.	Must register as a network operator, except in the following situations (in which case registration is optional): 1. The person is exempted because system management does not require information about the facility, or 2. No market participant facilities are connected to it, or 3. AEMO has exempted the person from the requirement to register. A person who intends to own, control, or operate a network may also register.
Owns, controls, or operates a generating facility with a rated capacity of greater than 10 MW that is connected to a network in the SWIS.	Must register as a market generator unless AEMO has exempted the person from the requirement to register (in which case registration is optional). A person who intends to own, control, or operate such a generator may also register.
Owns, controls, or operates a generating facility, with a rated capacity of less than or equal to 10 MW, but greater than 0.005 MW, which is connected to a network in the SWIS.	Has the option to register as a market generator, but this is not compulsory. A person who intends to own, control, or operate such a generator may also register.
Sells or intends to sell electricity to customers in the SWIS.	Must register as a market customer, unless AEMO has exempted the person from the requirement to register (in which case registration is optional). A person who intends to sell electricity to consumers may also register.
Any other person who sells or purchases electricity, or another service contemplated by the WEM Rules, to or from AEMO.	Registration as either a market generator or market customer, as determined by AEMO, is compulsory, unless AEMO has exempted the person from the requirement to register (in which case registration is optional).
System management	Automatically registered as System Management.
AEMO	Automatically registered as AEMO.

The majority of energy in the WEM is traded bilaterally between market participants through long term agreements. However, events frequently differ in real-time, because of changes in demand or because of electricity generating equipment outages. Thus, generation and consumption patterns frequently require market participants to deviate from their original plans to satisfy their trades. In the SWIS, these deviations are settled (via AEMO) through the day-ahead Short Term Energy Market (STEM) and real time adjustments through the Balancing Mechanism.

The Eastern Goldfields Region that falls within the SWIS boundaries is considered to be on the 'fringe' of the SWIS. The Region is connected to the main SWIS via a 220 kilovolt (kV) line approximately 650 kilometres from the Muja Power Station in Collie, and is stepped down to 132 kilovolt at West Kalgoorlie Terminal to supply the substations in the area[186].

[186] Western Power (2018), State of the Infrastructure Report 2017-18

Table 39 identifies the major energy generation assets that are owned by State or Independent Power Producers within the SWIS that are located in the GVROC Region.

TABLE 39 - Goldfields-Esperance Power Plant – SWIS

Goldfields-Esperance Power Plant	Type	Owner/Operator	Capacity (MW)
West Kalgoorlie Power Plant[187]	Gas/Diesel	Synergy	62.8
Southern Cross	Gas	TransAlta	245
Parkeston Gas Power Plant	Gas	Goldfields Power	110
Ravensthorpe Power Station	Liquid Fuel	Western Power	

Appendix 8 details the full list of registered generation facilities in the SWIS.

7.3.2. Overview of non-SWIS electricity supply in the GVROC Region

Outside of the SWIS, the electricity requirements of the towns of Laverton, Leonora, Menzies, Norseman, Esperance, Salmon Gums, Grass Patch, Condingup, Scaddan, Gibson and Hopetoun are serviced by Horizon Power, with electricity generated from stand-alone power stations fuelled by either diesel or natural gas.

In these towns, Horizon Power has entered into 10 to 20 year power purchase agreements (PPAs) with independent power producers (IPPs) to supply all its electricity requirements in each town. Horizon Power has retained management of the network and retail functions.

Elsewhere in the Region, privately owned generation assets are frequently located at mine sites and processing facilities, with other generational assets also often co-located with mining and processing operations. Table 40 illustrates those generation assets, to the extent they are known.

TABLE 40 - Non-SWIS Power Generation Assets – GVROC Region

Power Plant	Type	Owner/Operator	Capacity (MW)
Bronzewing	Diesel	Echo Resources	15
Carosue Dam	Diesel	Pacific Energy	10
Darlot	Gas/Diesel	Energy Developments Limited	11.6
Esperance Power Plant	Gas/Diesel	Esperance Power Station	
Esperance Wind	Wind	Synergy	35
Esperance Solar	Solar	Synergy	5.63
Garden Well		Pacific Energy	
Gwalia Deeps	Gas/Diesel	Pacific Energy	17
Higginsville	Diesel	Pacific Energy	11
Hopetoun Solar/Diesel	Solar/Diesel	Horizon Power	10

[187] Connected to SWIS grid but not currently certified

Power Plant	Type	Owner/Operator	Capacity (MW)
Hopetoun Wind/ Diesel	Wind/Diesel	Synergy	3.44
Jundee	Gas/Diesel	Jundee Gold Mine	13.2
Kalgoorlie Nickel Smelter	Gas	BHP	23
Laverton	Diesel	Laverton Gold Mine	23.8
Laverton	Liquid Fuel	Energy Developments Limited	1.7
Leinster	Gas/Diesel	TransAlta Energy	65
Leonora	Gas	Minara Resources	78
Leonora	Gas	Energy Developments Limited	4.4
Matilda Gold Project	Gas / Diesel	Pacific Energy	18
Menzies	Liquid Fuel	Energy Developments Limited	0.4
Menzies Remote Power Station	Diesel	Energy Developments Limited	0.3
Moolart Well		Pacific Energy	
Mount Keith Power Station	Gas	TransAlta Energy	116
Mount Morgans	Gas/Diesel	Dacian Gold	17
Mount Weld			
Murrin Murrin	Gas	Minara (Glencore)	86
Norseman Gold Power	Diesel	Pacific Energy	9
Nova	Solar/Diesel	Independent Group	25
Ravensthorpe	Gas	Ravensthorpe Nickel Mine	55.5
Red October		Pacific Energy	
Sunrise Dam	Diesel	Energy Developments Limited	42.6
Thunderbox		Pacific Energy	
Tropicana Main Station		Pacific Energy	
Tropicana Borefields		Pacific Energy	
Yamarna Power Station	Gas	APA Group	45
Blackham Wiluna	Gas / Diesel	APA Group	12
Wiluna Remote Power Station	Liquid Fuel	Pacific Energy	1.3

In addition to the identified private power generation assets identified in Table 40, a number of additional generation assets exist that are located within the vicinity of the GVROC border, either near the Mid-West or East Pilbara border. These are summarised in Table 41 below.

TABLE 41 – Independent Generation Facilities in Close Proximity to the GVROC Region

Other relevant (e.g. Mid-west)	Type	Owner/Operator	Capacity
Dalgaranga Gas/Diesel		Dalgaranga Mine	15
Deflector		Pacific Energy	
Degrussa Diesel Genset		Pacific Energy	19
Degrussa Plant	Solar/ Diesel	Pacific Energy	10.6
Degrussa Battery Storage	Battery Storage	Pacific Energy	4
Meekatharra	Hybrid Solar/Diesel	Pacific Energy	2.9
Mount Magnet	Gas	Pacific Energy	1.9
Nullagine	Solar / Diesel	Horizon Power	1.16
Plutonic	Gas		28.3
Sandstone	Liquid Fuel	Pacific Energy	0.4

The main Independent Power Producers (IPPs) in the Region include TransAlta Energy, APA Group, Energy Developments Limited (EDL), and Pacific Energy, and their various sub-brands. These IPPs own and operate a significant number of generation assets at various mine sites in the GVROC Region as illustrated in Table 40 and Table 41.

Remote Aboriginal communities in the Ngannyatjarra Lands and the communities of Tjuntjuntjarra and Coonana have diesel generators located at each community. The systems are serviced via the Remote Areas Essential Services Program (RAESP) managed by Parsons Brinckerhoff on behalf of the Department of Housing. Ngaanyatjarra Essential Services is responsible for the repairs, maintenance and capital works for these generators and has recently commenced a new contract for the provision of these services[188].

Within private or closed communities such as pastoral stations, roadhouses and tourist facilities, the owner or operator of the community is generally responsible for the electricity supply.

7.3.3. Challenges to capacity and reliability of electricity supply in the GVROC Region

Electricity supply and reliability within the GVROC Region is both a controversial and complex issue. From a minerals sector productivity perspective it is one of, if not the, most important issues.

The controversy arises from an expectation that the Goldfields Esperance Gas Pipeline (see Section 7.2) would provide energy security for the Region, combined with the reality of high electricity costs and frequent outages. Whereas the complexity arises from challenges associated

[188] Regional Development Australia (2013), Audit of Renewable Energy Projects in the Goldfields-Esperance Region

with the traditional transmission and distribution power system model across the vast, mostly remote and sparsely populated geographic expanse that characterises the Region.

Within the SWIS

Currently, there is no single entity responsible for planning the power system in the SWIS. There are deficiencies in the current legislative framework which have resulted in a lack of clarity over the responsibility for some specific obligations relating to adequacy of supply and reliability. For example, if the main transmission line into the Eastern Goldfields fails, the technical rules require Western Power to ensure the network can continue to supply electricity to the towns of Kalgoorlie and Coolgardie but not surrounding districts. The system manager interprets the market rules as continuing to supply electricity to all users in the area, with no emphasis on only supplying local towns[189].

This creates confusion over the responsibilities of the Australian Energy Market Operator (AEMO) and Western Power and risks the reliability of electricity supplies, particularly for some customers at the edge of the grid[190].

Transmission Network Constraints

Western Power routinely assesses the ability of its transmission network to supply existing and future demand growth in accordance with the levels of supply reliability and system security specified by the Technical Rules.

Western Power has identified a number of transmission network voltage stability limitations in the Eastern Goldfields area[191,192]. Customers supplied from voltage constrained feeders are likely to experience voltages outside the range stipulated in the Technical Rules. As these feeders tend to be long radial feeders, there is limited ability to shift load to adjacent feeders and therefore few operational options for managing voltage fluctuations.

Constraints impacting Block Loads

The term 'block loads' refers to large energy requirements (typically mining or industrial) that are not represented within 'underlying load growth' forecasts that account for factors such as historical trends and expected population growth[193].

New block loads can add significantly to the utilisation of the transmission network and affect its transfer capability. Where network capacity is available, loads can be connected on an unconstrained basis. In other areas which are capacity constrained, Western Power applies criteria to assess if the load is eligible for an unconstrained connection, or otherwise must fund network upgrades to provide unconstrained supply. In some cases, in order to avoid costs associated with network upgrades or augmentation, customers may request a curtailable supply that limits their demand under some system conditions.

The Eastern Goldfields part of the transmission network is classified by Western Power as capacity constrained, and the connection of loads which do not satisfy the criteria are subject to

[189] Economic Regulatory Authority (2017), WEM Report to the Minister
[190] Economic Regulatory Authority (2017), WEM Report to the Minister
[191] The transfer constraints to the Eastern Goldfields are due to both voltage and generation rotor angle instability limitations.
[192] Western Power (2018), State of the Infrastructure Report 2017-18
[193] Western Power (2018), State of the Infrastructure Report 2017-18

curtailability requirements unless funding network upgrades or network control services to relieve the constraints. Network upgrades and network control services may either be funded solely by the applicant or shared as part of a 'competing applications group'[194] solution.

Due to the relative remoteness of the Eastern Goldfields Region, there are engineering challenges associated with the integration of additional block loads. New load connections are subject to technical considerations including[195]:

- Equipment thermal ratings;
- Voltage recovery limitations;
- Transient overvoltage limitations;
- Synchronous stability constraints;
- Power system load rejection; and
- Spinning reserve requirements.

Historically, AEMO contracted with Synergy to supply existing Western Power customers in the Region through the use of a 'dispatch support services contract' to cover the event of a network plant contingency. This dispatch support services contract expired in September 2018 and has been replaced with a 'network control service contract' between Western Power and Synergy.

The key objective of this network control service contract is to supply the Kalgoorlie-Boulder and Coolgardie town loads under the event of loss of the 220 kilovolt line, and to defer the long-term network investment of a second line to the Eastern Goldfields[196].

Constraints impacting generation

The SWIS network, like all transmission networks, has physical limits to the amount of electricity it can transmit safely, reliably and securely at any one time.

The SWIS currently operates on an 'unconstrained' basis, which means that Western Power must design connections on the basis of allowing the worst case credible dispatch from all existing generation and the new generating unit(s). In some locations, the level of already connected generation means that new generation cannot be connected on an unconstrained basis without prohibitively costly network reinforcement.

In many cases there is sufficient physical capacity in the network, but the unconstrained access rights of incumbent generators mean that 'spare' network capacity is contracted out, effectively locking it up and reducing the amount of capacity available for other generators to connect. This can be a barrier to any new generator seeking to connect in certain parts of the transmission network.

This is because Western Power must ensure any new generation connections do not affect the access rights of generators with previously negotiated unconstrained access contracts. Therefore, if a new generator wants to transmit electricity through a part of the network where most of the network capacity is contracted out to a generator with unconstrained access, then the network capacity must be increased to allow both generators to transmit electricity at the same time. It is not simply a case of dispatching one generator or the other in that part of the network. The

[194]http://www.westernpower.com.au/aboutus/accessArrangement/accessArrangement.html

[195] Western Power (2018), State of the Infrastructure Report 2017-18

[196] Western Power (2018, State of the Infrastructure Report 2017-18

generator with unconstrained access rights must always have sufficient network capacity available, and it cannot legally be curtailed[197].

To reduce connection costs, some generators agree to be constrained by high speed runback schemes that automatically restrict their output when required to maintain system security. There is very limited capability, and in some parts of the network no capability, to support additional runback schemes.

In 2016, following an electricity market review, the Western Australian Government announced plans to transition to the National Electricity Law and National Electricity Rules, which would ultimately result in the transition to a 'constrained' network access model by 1 July 2018. A constrained access model would facilitate more efficient and cost-effective connections to the existing network and reduce interconnection and access costs for incoming generators.

However, the transition to the National Electricity Law, and adoption of a constrained network access regime under the National Electricity Rules has been delayed, which has meant that there is limited ability to safely and securely connect any large scale new entrant generators to the network. Accordingly, the ability for new efficient and low-cost generation to join the SWIS is low, which ultimately increases the cost of electricity for consumers.

This led to the recognition that an interim network connection solution must be in place by July 2018 to accommodate those connection applicants which could not be connected on an unconstrained basis or high-speed runback schemes.

The Public Utilities Office (PUO), AEMO and Western Power jointly designed the Generator Interim Access (GIA) solution to allow new entrant generators to connect to the SWIS without affecting the contracted unconstrained access of existing generators. The GIA solution utilises Network Control Service contracts entered into by Western Power and GIA proponents, requiring GIA proponents to be curtailed first in situations where network capacity is limited and existing generators would otherwise be impeded[198].

Impact of historical market reform

In recent years, it was determined that an oversupply of capacity existed in the SWIS, partially due to the unanticipated refurbishment of aged State-owned generation assets that were scheduled for retirement. This was exacerbated by the proliferation of solar PV beyond forecast expectations which had the effect of reducing demand.

The ERA conducts an annual review of electricity market effectiveness, and a number of key recommendations were consistently reported over the years 2011 to 2017, including addressing the oversupply of capacity (which results in higher costs to market customers) and reducing the market dominance of the State-owned Synergy.

In 2017, Synergy was subject to a Ministerial direction to reduce its generation capacity for a number of reasons, including to:

- Reduce excess capacity in the WEM;
- Reduce Synergy's market power;

[197] Under a normal SWIS operating state and subject to other exceptions which may be in the relevant access agreement.
[198] Western Power (2018, State of the Infrastructure Report 2017-18

- Reduce prevalence of inefficient, old technology generators that are inconsistent with Federal government emissions policy; and
- Foster competitiveness in the market (e.g. independent private producers).

One of the facilities to be retired was the West Kalgoorlie facility that was subject to the dispatch support services contract between AEMO and Synergy discussed above.

AEMO opted not to renew the DSS in preference of Western Power negotiating a 5-year network control service arrangement with Synergy because the latter was considered to be better aligned to the Ministerial direction, as it permits the facilities to be dispatched only to support power supply reliability and precluded the facilities from receiving certification.

The retirement of West Kalgoorlie power station has exacerbated supply and reliability issues experienced in the fringes of the SWIS, as it could delay the restoration of power to some Eastern Goldfield regions for as long as a few days following a major disruption in supply[199].

While future electricity demand forecasts are based on consultation with industry, it is understood that this consultation is focused on individual loads with a minimum of 20 megawatt (MW) peak capacity[200]. It is possible therefore that this consultation could overlook the cumulative impact of many smaller loads.

Furthermore, Demand Side Management (DSM) participants were previously eligible to receive capacity credits to incentivise large loads to 'turn down' during periods of high demand, thus reducing reliability issues. A recent reform outcome resulted in a significant reduction to financial incentives for DSM participants, thus reducing the incentive to modify behaviour[201].

Outside the SWIS

As indicated above, much of the area of the Goldfields Esperance Region that sits outside of the SWIS is not serviced by a traditional centralised generation and interconnected transmission and distribution network model. Electricity to these areas is generally supplied by standalone power systems fuelled by either gas or diesel.

Outside of the towns supplied by Horizon Power, individual entities are generally required to procure their own electricity supply, either through direct investment in generation infrastructure or through contract power arrangements with third party specialist suppliers such as TransAlta, Pacific Energy, or APA. Access to reliable fuel supplies is critical, particularly in the absence of access to ancillary network support services if a contingency event occurred.

Loads in the area are typically relatively large and lumpy due to the nature of operations in the Region, such as mining and industrial processes. Although self-generation is common where excess generation capacity exists, it is generally unable to be on-sold due to the lack of electricity network infrastructure. A traditional 'poles and wires' network in many of these areas is cost-prohibitive due to the geographical expanse and low population density of the Region.

[199] Economic Regulatory Authority (2017), WEM Report to the Minister
[200] Interview with Greg Ruthven, AEMO, 14-06-2019
[201] Interview with Greg Ruthven, AEMO, 14-06-2019

7.3.4. Emerging Energy Policy and Initiatives

There is broad recognition from all stakeholders – both within and outside the SWIS – that adequacy of generation capacity and reliability in the GVROC Region is a critical issue. This subsection summarises initiatives that are currently underway to address this issue.

Energy Transformation Taskforce

After experiencing mostly incremental change over the last century, the electricity sector is currently confronted with the most transformational period of change since the late 1800's. The widespread adoption of distributed energy resources such as rooftop solar and battery storage, and declining asset utilisation rates are simultaneously impacting the traditional centralised power system model.

In March 2019, the State Government launched the Energy Transformation Strategy and announced the establishment of the Energy Transformation Taskforce to undertake comprehensive power system planning for the SWIS.

The Energy Transformation Taskforce will develop a Whole of System Plan, which will be complemented by a Distributed Energy Roadmap to guide the integration of onsite solar PV generation and battery storage into the States power system and Wholesale Energy Market. This is currently scheduled for completion by late 2019[202].

The proposal to establish constrained market access is currently scheduled for implementation by October 2022[203].

Distributed Energy and Storage Initiatives

Distributed Energy Resources (DER) have some advantages in an environment of uncertainty around large-scale generation investment. DER can be a faster, less expensive option to the construction of larger centralised power plants, or an alternative to extending high-voltage transmission lines and even to distribution systems, particularly at edge of the grid. DER also has the potential to offer customers lower cost, reliable, efficient energy, as well as the prospect of energy independence.

A number of distributed energy solutions are currently under trial to address the current challenges in the Region, including standalone power plant, virtual power plant and micro-grid solutions.

For example, Synergy's proposed Virtual Power Plant Project in Kalgoorlie will comprise a combination of individual solar PV units, behind the meter batteries and three community batteries to supply power to approximately 420 public housing residences[204]. Similarly, Horizon Power has demonstrated significant success with its Standalone Power Systems across Esperance and Hopetoun, as well as the Onslow Distributed Energy Resources Management System (DERMS) Pilot.

While standalone power systems are used for single customers, such as agriculture, micro-grids are used for towns or mine sites, and can either be used to supplement the main grid or are able to operate completely separately. The technology is now considered to be sufficiently competitive

[202] Treasury.wa.gov.au/Energy-Transformation/Distributed-Energy-Resources
[203] Western Power (2018, State of the Infrastructure Report 2017-18)
[204] Interview with Krystal Skinner, Synergy, 24-06-2019

and scalable for adoption in major industrial and mining applications, and some major mining and industrial projects have recently been announced.

One such example is the installation of a micro-grid at the Gold Fields Agnew gold mine. The renewable hybrid micro grid will consist of five wind turbines delivering an 18 MW wind farm, a 10,000 panel 4 MW solar farm and a 13 MW / 4 MWh Battery Energy Storage System (BESS) with security and reliability of a micro grid underpinned with a 16 MW gas engine power station. The Australian Renewable Energy Agency (ARENA) contributed $13.5 million in funding to the project[205]. This will be the first time wind generation as part of a large hybrid micro grid in the mining sector in Australia. The renewable energy micro grid is expected to provide 55 to 60 per cent of the energy requirements with the potential to meet almost all energy requirements at certain times.

Gold Fields will also adopt innovative operational practices such as dynamic load shedding, renewable resource forecasting and IPP-controlled load management to maximise renewable energy use while maintaining system security. Distributed energy producer EDL will design, construct, own and operate the micro grid to power the Agnew Gold Mine in two stages under a 10 year agreement with Gold Fields. The first stage involving a new off-grid power station incorporating gas, diesel and solar generation is due to be completed in mid-2019. The second stage including the wind, battery and micro grid system recently commenced construction and will be completed in 2020[206].

7.3.5. Key issues

As discussed throughout this subsection, cost and reliability of electricity supply in the Region is a critical issue experienced by businesses and residents of the Region, and acknowledge by the State.

Energy security on the SWIS

Issue

Because much of the challenge is associated with the fact that the Region is on the 'fringe' of an integrated electricity generation and distribution network that in addition to servicing the electricity needs of most residents and some industry in the GVROC Region, also serves the needs of a residential population that is around 36 times that of the GVROC Region and an economy that is also much larger.

However, this is of little comfort to residents and businesses in the Region who pay high prices for an unreliable source of electricity and to businesses, particularly mining operations who:

- Are adjacent to distribution infrastructure but are unable to access supply from the SWIS;
- Can access supply from the SWIS, but as a result of supply uncertainty must operate a hybrid self-generation facility as back-up, adding significantly to cost and operational complexity; and
- Projects that are connected to the SWIS or adjacent to distribution infrastructure that could sell excess electricity generated by their plants back into the SWIS, but are unable to do so.

This issue is more acute in some localities. For example, the frequency of outages in Ravensthorpe have prompted a move toward the use of stand-alone power systems among farmers. Moreover,

[205] ARENA (2019), Gold Fields gold mine to be powered with wind, solar and battery
[206] ARENA (2019), Gold Fields gold mine to be powered with wind, solar and battery

Horizon Power and Western Power have significantly increasing the number of stand-alone systems deployments for rural customers in recent years.

Opportunities

Because that in addition to servicing the GVROC Region, the integrated SWIS also services a much larger region, population and industry base, the pathway to resolving these issues for the Region is to continue to advocate for and engage in the initiatives discussed in Section 7.3.4.

Esperance electricity supply

Issue

Electricity is supplied to residents and businesses in the town of Esperance by a facility comprised of seven open cycle gas turbines, supplemented by the 5MW Ten Mile Lagoon Wind Farm and distributed by an isolated network within the town and its immediate surrounds.

Esperance Port is by far the largest energy user in the town and when ship-loaders are operating there is significant draw on the capacity of the plant, albeit total capacity is currently adequate. This infrastructure is also expensive with retail and commercial electricity rates relatively high, and no peak-off-peak pricing regime.

The plant is managed by Horizon Power, with the current contract expiring in 2020-21.

Solution

Progressive transfer of some customers in more remote parts of the grid to stand-alone systems is making some contribution to relieving demand pressure.

A range of technologies are now readily commercially available to secure supply and underwrite costs, particularly where loads are geographically concentrated. With projections indicating increased usage of the Port, it is likely that additional energy generation capacity will be required. Given the importance of Esperance Port as an asset to the overall Region, there is a case for co-investment or advocacy and partnership in leveraging State or Commonwealth funding to support this proposition. The business case for this will need to address both the economic activity and therefore impact of the Port, but also the role that the Port's usage plays in providing baseload demand, thereby underpinning commercial-scale generation.

Horizon Power is presently undertaking a program of work to secure future electricity supply for Esperance from March 2022. Solutions incorporating distributed and/or centralised renewable energy technology such as solar, battery storage and wind generation will be considered and evaluated, supported by diesel, natural gas or LNG generation systems. Potential solution partners have been shortlisted through an EOI process.

7.4. Water supply

7.4.1. GVROC Region Water Supply

The main supply of potable water to the City of Kalgoorlie-Boulder, Coolgardie, Kambalda and Norseman (and Menzies via truck) is the Goldfields and Agricultural Water Supply Scheme (GAWS), also known as the C.Y. O'Connor Pipeline. GAWS sources water from Mundaring Weir just east of Perth which is charged by run-off from the Mundaring Weir Catchment Area, as well as from the Kwinana Seawater Desalination Plant.

For parts of the GVROC Region not serviced by GAWS, which geographically speaking is most of the Region, locally sourced ground-water is the principle supply. Many towns in the Region have declared public drinking water source areas and water source protection plans to assist in separating potable water sources from incompatible land uses. Figure 61below illustrates Water Corporation service infrastructure in the Goldfields-Esperance Region.

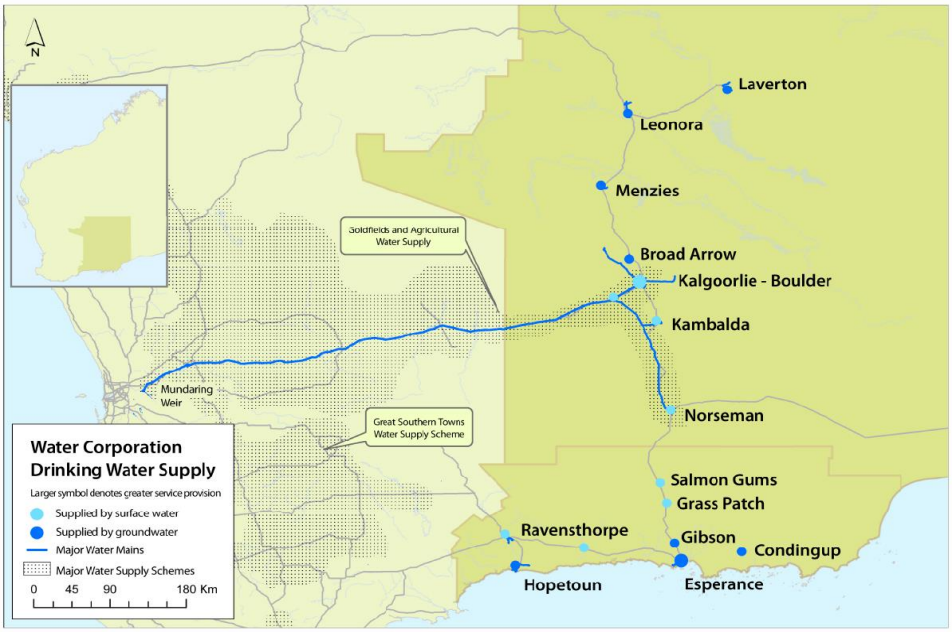

FIGURE 63 – Goldfields-Esperance Drinking Water Supply – Water Corporation

Water used in mining and mineral processing operations is mostly sourced from local saline or hyper-saline aquifers located in proximity to mining operations.

7.4.2. Shire of Wiluna Water Supply

Water in the Shire of Wiluna is supplied by groundwater, shown in Figure 64 below, treated by electro-dialysis reversal (EDR). Areas in the Murchison and Goldfields regions such as Wiluna are characterised by naturally occurring underlying rock conditions that affect the quality of drinking water, including issues such as salinity, hardness, magnesium and various metals. Treatment rates result in approximately 90% of treated water meeting potable standards.

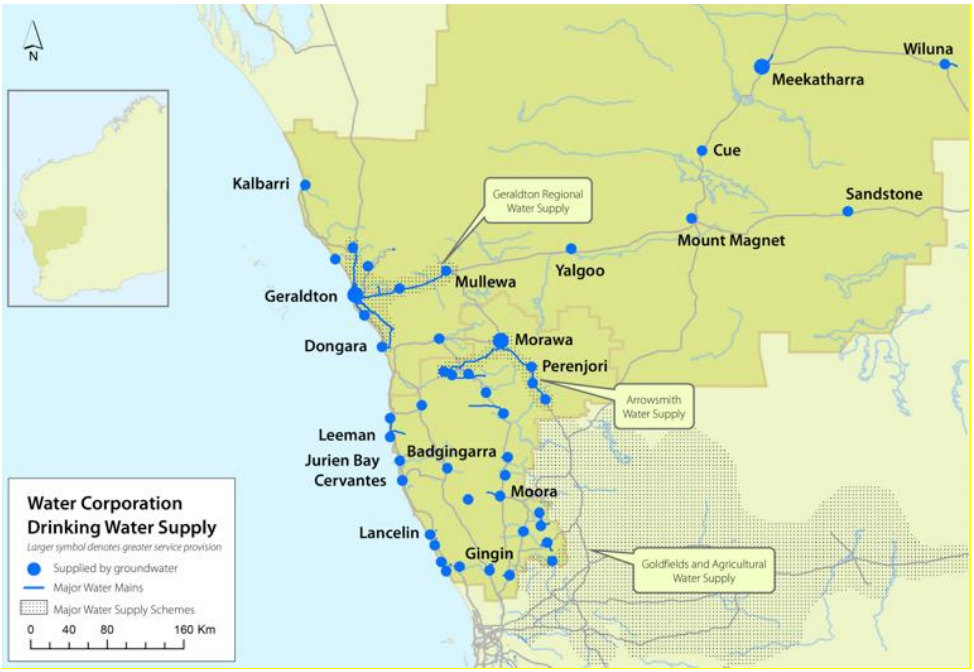

FIGURE 64 – Mid-west/Goldfields-Esperance Drinking Water Supply – Water Corporation

7.4.3. Key issues

Potable water scarcity and cost

Issue

Across the GVROC Region, local natural sources of potable water are relatively scarce. While brackish and saline groundwater resources can be converted to potable water via treatment through reverse osmosis plants, this adds to water cost.

The combination of scarcity of natural sources of potable water, cost of treatment and cost of transporting the principle supply of water via the GAWS, means that water charges are high across the Region, at approximately double the cost of water in Perth.

Furthermore, in some locations such as Esperance, water scarcity has the potential to limit future growth prospects and is a significant problem for some primary producers along the coast who are reliant on carted water.

Opportunities

Availability of potable water is a critical human need that will need to be addressed within the Region to support the current and projected future population, particularly in the context of a changing climate and likely reduced rainfall. These concerns are not new and have been noted by State and Commonwealth governments over the medium term. Additional pipelines and desalination facilities may be required, combined with increased recycling and efficiency measures. Existing implementation of such technologies within the Region may support the growth of a local industry providing professional and technical services, supporting regional employment.

Potential cost of high purity water

Issue

Downstream processing of mineral concentrates into high purity chemicals used in the manufacture of lithium-ion batteries and other technology products require significant volumes of very high purity process water. Achieving the water purity specifications for these processes involves upstream treatment in any event. However, *ceteris paribus*, the cost of treatment is less if the feedstock is potable or relatively pure water. Given that sources of large volumes of water in the GVROC Region are likely to be saline or hyper-saline groundwater sources, the cost of processing to adequate purity may present an additional cost.

Opportunities

As with the need for potable water discussed above, the demands of industry in this area will need to be met to support future growth and expansion. Higher requirements for industrial/technical supplies may further support the development of local water infrastructure, albeit high cost water will detract from the Region's competitiveness in the downstream processing sectors.

7.5. Wastewater management

Water Corporation operates five waste water treatment plants in the Goldfields-Esperance Region, with approximately 42 percent of the Region's waste water recycled[207]. In Esperance, Kambalda and Leonora, recycled water replaces approximately 370 million litres of water per annum that would otherwise be sourced from natural and climate dependent sources.

In Kalgoorlie-Boulder, the City owns and operates a waste water recycling facility. The City manages its sewer system, which is the largest facility not managed by Water Corporation in Western Australia. Approximately 2.5 giga-litres of waste water is received at the South Boulder treatment plant each year and is recycled for use on parks and reserves. The Shire of Esperance is also a major user of recycled waste water for parks and reserves.

In 2007, a wastewater treatment plant was opened in Wiluna that comprises a pumping main, new pump station, connecting pipeline and an evaporation pond located 1.5 kilometres out of town. This new wastewater plant replaced three ponds formerly located more central to the township, and viewed as undesirable from an urban planning perspective.

7.5.1. Key issues

There are currently no significant issues with the Region's waste water management systems.

7.6. Waste management

7.6.1. Overview of Waste Management Requirements and Practices

In Western Australia, waste generated by private entities is managed and regulated primarily under the *Environment Protection Act 1986* (WA) and the subsidiary *Environmental Protection Regulations 1987*, with some particular wastes such as tyres subject to additional controls under the *Environmental Protection (Controlled Waste) Regulations 2004*. Local governments and State entities are subject to additional requirements and oversight by the Waste Authority under the *Waste Avoidance and Resource Recovery Act 2007* (WA). While the definition of 'waste' has been

[207] Water Corporation

the subject of some recent debate[208], broadly it captures anything discharged to the environment or declared so by regulation.

This management regime established seven headline categories of waste product, summarised in the below Table 42[209].

TABLE 42 – Waste Types

Waste type	Examples	Landfill type
Clean fill	Raw excavated natural material (eg. sand, clay, soil)	Class I
Uncontaminated fill	Inert waste type I falling below maximum contaminant levels; neutralised acid sulfate soils	Class I
Inert waste	Non-biodegradable but non-hazardous - includes Type I (eg. construction/demolition waste, asphalt); Type II (tyres)	Class I
Putrescible waste	Readily biodegradable (most municipal and office waste, treated sewage solids, manure and carcasses)	Class II and III
Hazardous waste	Dangerous goods (medical and pharmaceutical waste, quarantine, explosive/corrosive/toxic, asbestos)	Class IV
Special waste	Dangerous but stabilised/lower-risk (asbestos, buriable biomedical, PFAS containing solids)	Class IV or lesser licensed
Intractable waste	Non-destructible hazardous wastes imposing significant management difficulties (radioactive, industrial sludges)	Class V

Waste processing and disposal facilities are similarly regulated and controlled, as shown in Table 43[210] below.

[208]Per eg. Eclipse Resources series of cases; *Eclipse Resources Pty Ltd v The Minister for Environment [No 2]* [2017] WASCA 90.
[209] Department of Water and Environmental Regulation (2018), Landfill Waste Classification and Waste Definitions 1996 (as amended 2018), Environmental Protection Act 1986
[210] *Schedule 1* in *Environmental Protection Regulations 1987* (WA)

TABLE 43 – Waste Handling Facilities

Landfill class	Prescribed premises category	Waste types	Production design capacity (tonnes per annum)
Class I	63	Clean fill, uncontaminated fill, inert waste	>500
Class II	89	Putrescible waste (quantity limits)	>20 but <5,000
Class III	64	Putrescible waste	>20
Class IV	65	Hazardous waste	N/A
Class V	66	Intractable waste	N/A

At an operational level, waste products are typically addressed and handled with reference to stream (what the waste is a result of) and sector (which economic sector produced it). Waste streams are generally categorised as:

- Municipal Solid Waste (MSW);
- Commercial & Industrial (C&I); and
- Construction & Demolition (C&D)

Within Western Australia, the Western Australian Waste Strategy[211] has been enacted to attempt to redress the large amount of waste generated within the State – the highest in Australia on a per-capita basis when the Strategy was implemented. Aspirational diversion targets have been set for each waste stream, summarised below in Table 44[212], however significant challenges have been encountered in meeting these targets and there remains a very significant need for additional landfill facilities, particularly in regional Australia.

[211] Western Australian Waste Authority (2012), Western Australian Government, Perth WA
[212] Western Australian Waste Authority (2018), *Annual Report 2018-19*, Western Australian Government, Perth WA

TABLE 44 – Waste Diversion Rates within Western Australia by Waste Stream

Waste stream	2015/16 diversion from landfill (%)	Target 2015	Target 2020
Metropolitan MSW	35%	50%	65%
Regional MSW	31%	30%	50%
C&I	46%	55%	70%
C&D	64%	60%	75%

7.6.2. Waste Generation in the GVROC Region

The most complete study of regional waste generation within the GVROC Region was conducted in 2014-15[213], concluding that around 257,000 tonnes of waste was generated annually. To support a more detailed analysis, six sub-catchment areas were identified, reflecting the key generation, treatment locations and waste flows within the study area:

- Greater Wiluna (including Wiluna town site);
- Northern Goldfields (including Leonora and Laverton town sites);
- Central Goldfields (including Menzies to Norseman and towns in between);
- Remote East Goldfields;
- Esperance (including Esperance town site); and
- Ravensthorpe (including Ravensthorpe and Hopetoun town sites).

Given the significantly different social and economic characteristics of the sub-regions, the waste produced by each also differs. A breakdown of waste generation by waste stream is shown in Table 45[214] below.

TABLE 45 – Total Waste Generation (Tonnes) in 2014-15 in the Study Area

Stream	Greater Wiluna	Northern Goldfields	Central Goldfields	Remote East Goldfields	Esperance	Ravensthorpe	Study Area
MSW	308	888	49,904	-	15,623	1,194	67,917
C&I	7,166	44,233	83,123	6,112	19,960	2,330	162,923
C&D	85	1,175	22,180	-	2,665	1	26,105
Total	**7,559**	**46,296**	**155,207**	**6,112**	**38,248**	**3,524**	**256,945**

Approximately 35 percent of total waste in 2014-15 was generated from the mining sector, followed by the domestic (27 percent) and other/mixed sectors (24 percent). This is illustrated in Figure 65 below[215].

[213] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA
[214] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA
[215] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA

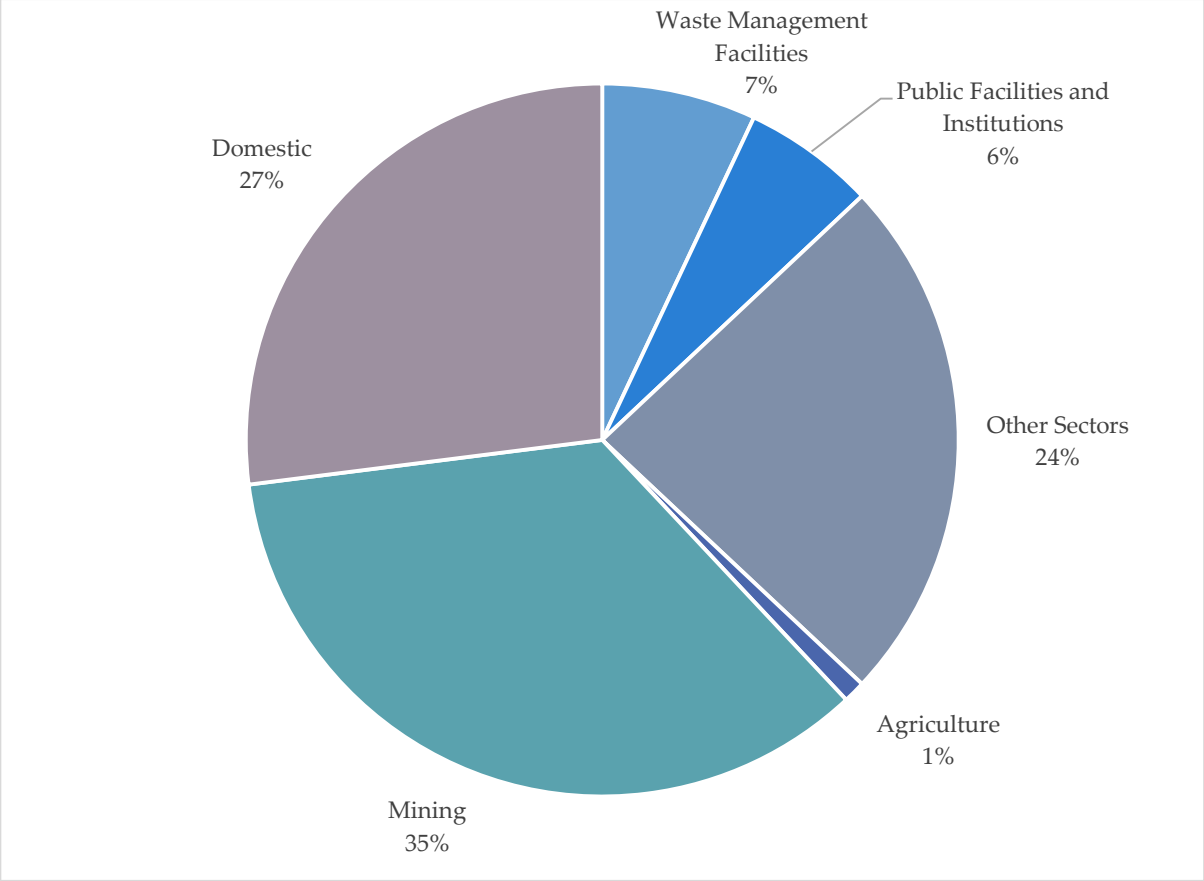

FIGURE 65 – Waste Generated by Sector – 2014-15

By far the largest waste stream within the study area was mixed general (non-hazardous) refuse, including both from households and commercial and industrial waste. Table 46[216] below summarises the top 5 waste streams identified in the study.

TABLE 46 – Top 5 Peak Waste Streams 2014-15

Material Code	Material Type	Total Generated in Study Area (t)
801	Mixed Refuse	107,994
302	Kerbside Refuse	27,417
613	Clean fill	19,807
183	Industrial waste treatment plant residue	18,226
617	Ferrous metals (non-packaging)	11,257

As would be expected, these waste streams differed significantly in their distribution across the GVROC Region, shown in Table 47[217] below.

[216] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA
[217] Derived; Talis (2016), Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA

TABLE 47 – Proportionate Sub-regional Share of Top 5 Peak Waste Streams by Tonnage

	Greater Wiluna	Northern Goldfields	Central Goldfields	Remote East Goldfields	Esperance	Ravensthorpe
Mixed refuse	3.1%	20%	61%	1.9%	12.9%	1.1%
Kerbside refuse	1.1%	3.2%	52.6%	-	40.8%	2.3%
Clean fill	-	-	70.1%	-	29.9%	-
Industrial waste treatment plant residue	-	-	100%	-	-	-
Ferrous metals	9.4%	41.5%	26.6%	5%	14.9%	2.6%

Industrial waste treatment residue and sludge generation is highly concentrated within the Central Goldfields, with 100 percent of this waste stemming from that sub-region. Management of residues, which may include metals (such as zinc, silver, cadmium, thallium, etc.) acids, alkalis and non-metallic elements (such as arsenic or selenium) has been identified as a priority issue requiring careful management and specialised facilities[218].

7.6.3. Waste Treatment and Disposal in the GVROC Region

The most commonly used treatment method for waste in the region was landfill disposal, with 61.7 percent of overall waste disposed to public landfills and 17.9 percent disposed to on-site landfills. Approximately15 percent of waste was recycled[219].

Figure 66[220] below identifies the waste treatment methods breakdown by sub-catchment area. This illustrates the variation between areas, with the southern areas of Esperance and Ravensthorpe relying predominantly on public landfill for waste, while Greater Wiluna and Northern Goldfields areas primarily utilised private landfills. Central Goldfields waste generators utilised both public and on-site landfills. Overall, the study area had a very high reliance on landfills (both public and on-site), with landfill accommodating over 77 percent of all waste generated[221].

[218] Eg. Department of Water (2009), *Water Quality Protection Note 51 - Industrial wastewater management and disposal*, Western Australian Government, Perth WA
[219] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA
[220] Adapted from Talis Consulting (2016), *'Figure E5: Waste treatment method breakdown by sub-catchment area'* in *Goldfields Waste Data and Priorities Study*, Leederville, WA
[221] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA

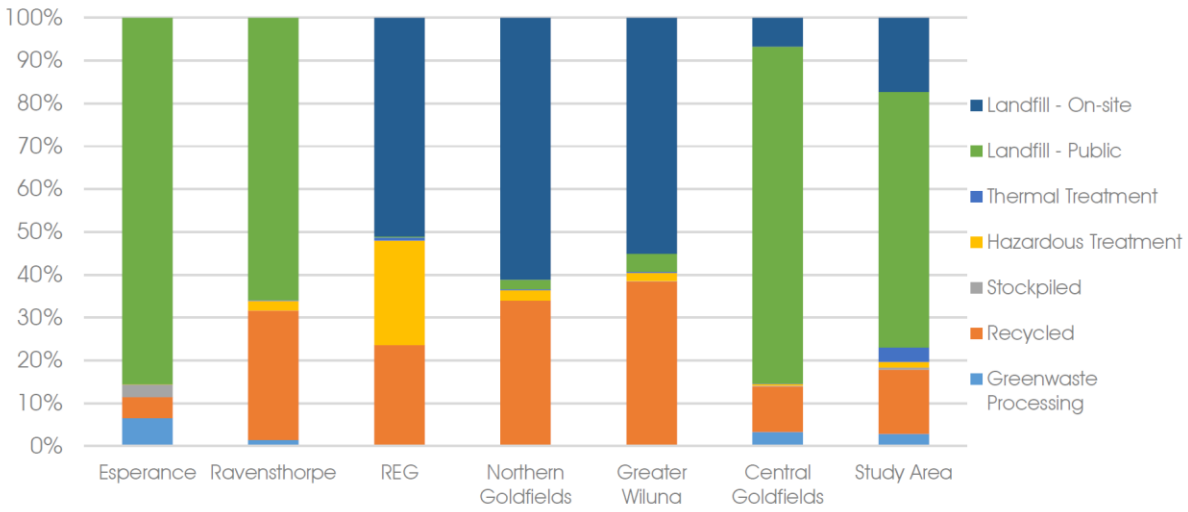

FIGURE 66 – Waste Treatment Method by Sub-catchment Area

In addition to identifying waste generation within the region, the Talis study captured waste management facilities operating as of 2016, summarised by sub-region and operator type (public or private) below in Table 48[222].

TABLE 48 – Waste Management Facilities within the GVROC Region

	Northern Goldfields		**Central Goldfields**		**Rem. East Goldfields**		**Esperance**		**Ravensthorpe**		**Greater Wiluna**	
	LGA	*Prv*	*LGA*	*Prv*	*LGA*	*Prv*	*LGA*	*Prv*	*LGA*	*Prv*	*LGA*	*Prv*
Store/stockpile	-	3	2	4	-	1	2	-	2	-	-	-
Recyle/ repurpose	-	-	-	3	-	-	1	1	-	-	-	-
Class I (cat. 63)	-	2	-	3	-	-	-	-	-	-	-	-
Class II (cat. 89)	2	8	3	7	-	-	-	-	1	-	-	1
Class III (cat. 64)	-	10	2	8	-	1	1	-	1	-	1	4
Class IV (cat. 65)	-	-	-	-	-	-	-	-	-	-	-	-
Class V (cat. 66)	-	-	1	-	-	-	-	-	-	-	-	-

The vast majority of waste facilities are therefore privately operated, with most of these run on-site by mining companies and found in the Northern and Central Goldfields sub-regions. Waste generators investing in privately operated facilities have prioritised Class II and III facilities, indicating market demand in handling this form of waste. Increased resources project activity, including production from emerging sectors and associated new downstream processing, is expected to further diversify waste streams and create additional demand.

[222] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA

Given the regional facilities, infrastructure links and industrial base, some waste is a particular issue for Local Government Authorities and waste generators. Although there was broad accord on many problem waste materials, some difference of opinion between LGAs (as primarily providers of public disposal facilities) and waste generating industry is apparent, as illustrated in Table 49[223].

TABLE 49 – Problematic Waste Identified by Local Government Authorities and Waste Generators

Material stream	LGA identified	Industry identified	Likely waste categories	Likely landfill destination
Glass	Yes	Yes	Uncontaminated; Inert	Class I
Light steel	Yes	No	Uncontaminated; Inert	Class I
Wood (inc. pallets)	No	Yes	Uncontaminated; Inert	Class I
Mattresses	Yes	No	Inert	Class I
Intermediate bulk containers	No	Yes	Inert	Class I
Polypipe	No	Yes	Inert	Class I
Used cars	No	Yes	Inert	Class I
Rubber C&D (eg piping)	No	Yes	Inert	Class I
Tyres	Yes	Yes	Inert (controlled waste)	Class I (controlled waste)
Hydrocarbon contaminate - soil, 44g drums	No	Yes	Putrescible; Hazardous	Class II; III
Cardboard	No	Yes	Putrescible	Class II; III
Misc hazardous (household grade)	Yes	Yes	Putrescible; Hazardous	Class II; III; IV
Chemical plastic	No	Yes	Putrescible; Hazardous	Class II; III; IV
Waste oil	No	Yes	Putrescible; Hazardous	Class II; III; IV
Aerosol cans	No	Yes	Hazardous	Class IV
Class IV hazardous	No	Yes	Hazardous	Class IV

A key message communicated from respondents to the Talis study was that there are limited waste management services in the GVROC Region with respect to treating problematic waste in a cost-effective manner. Notable market gaps identified by study respondents included:

- Local industrial waste facilities paired with regional collaboration;
- Appropriate hazardous waste management and collection, including for hydrocarbon contaminated soil collection and household hazardous waste management;
- Organic waste facility in Central Goldfields; and
- Increased alternative waste treatment (AWT) and recycling facilities.

Potential solutions identified in the study included amalgamation and commitment of waste tonnages and a more regional or joint tendering approach for waste management services.

[223] Talis Consulting (2016), *Goldfields Waste Data and Priorities Study*, Leederville, WA

7.6.4. Key issues

Developing a regional waste solution

Issue

Across the GVROC Region several municipal landfill and waste management facilities are reaching capacity and/or contain contaminated legacy waste that needs to be managed. Similarly, some Shires such as Esperance, have limited land availability to develop additional waste management systems.

Rather than continuing to develop small facilities across the Region, a case could likely be made to concentrate waste management services in a location(s) that provide the best geology for safe storage of different classes of waste generated from across the Region at scale, supported by an effective and safe waste transport system.

Opportunities

The identified opportunity to coordinate a regional response to waste is currently being discussed at an early stage with stakeholders and industry partners. Should a case be demonstrated, additional planning work between the GVROC members, industry and the State Government will be required.

Processing problematic waste

Issue

The GVROC Region's vast and remote geography combined with stable and in certain locations geology that is highly suited for large scale, long-term, safe storage of hazardous waste creates an opportunity for a new sector in the Region. As discussed in Section 7.6.2, the Region already produces reasonable volumes of various processing plant residue. As processing continues to expand in the Region, particularly that associated with prospective downstream chemical plants, the volume of a wider range of plant residues will increase, some of it potentially requiring special management. More generally, industry has identified the management of hazardous waste in the Region as problematic.

Furthermore, the management of waste streams from downstream chemical processing plants located in Kwinana and Kemerton is becoming increasingly problematic, potentially creating an opportunity for waste to be imported into the GVROC Region for processing and long-term storage.

Combined with the Class IV and V private Sandy Ridge facility operated by Tellus Holdings, the opportunity exists for the Region to offer a full spectrum of Class I through V waste management services.

Opportunities

The identified opportunity with regards to storage of problematic/hazardous waste is currently being discussed at an early stage with stakeholders and industry partners.

8. Industrial Land, Housing and Labour

KEY POINTS

Industrial Land

Availability of fit-for-purpose, affordable and serviced industrial land, as well as the ability to be flexible in zoning Crown land for industrial purposes is somewhat limited in the major population centres of Kalgoorlie-Boulder and Esperance.

Both centres are examining options to address this issue, with towns in closer proximity to the major centre also looking to establish industrial areas.

Housing

Outside of Esperance and Kalgoorlie, the quality of housing stock is problematic, rendering it difficult to attract residential workforce to the Region.

Labour Markets

Relatively high employment rates across most of the Region are resulting in tight labour markets across most job categories.

As part of the solution, the City of Kalgoorlie-Boulder and Shires of Coolgardie, Leonora and Menzies have recently entered into a Designated Area Migration Agreement (DAMA) with the Australian Government that covers 72 specific occupations across the minerals, agriculture, hospitality and human services sectors.

8.1. Industrial Land

Despite the GVROC Region's vast geographic expanse, and while there are some vacancies in areas zoned for heavy and light industry, the availability of fit-for-purpose, affordable and serviced industrial land, as well as the ability to be flexible in zoning Crown land for industrial purposes is somewhat limited in the major population centres of Kalgoorlie-Boulder and Esperance.

A number of factors have likely contributed to this, including:

- Large areas of land around the regional centres (and across the Region more broadly for that matter) are effectively 'sterilised' from development by virtue of the existence of mining and exploration tenements, and the ability of the owners of those tenements to continue to extend tenure under the *Mining Act 1978* (WA) on the basis of limited works.
- As discussed in Section 2.2, the determination of much Native Title in the GVROC Region is a relatively recent phenomenon. The fact that Native Title has been undetermined for large areas until relevantly recently, has created uncertainty with respect to negotiation of Indigenous Land Usage Agreements (ILUAs) with respect to areas that are subject Native Title that might be suitable for industrial zoning.
- Some areas that have been zoned for particularly heavy industrial use do not have services that are adequate to render them competitive, or are in locations that are not desirable for project proponents.

- In the case of Esperance, urban encroachment and environmental assets restrict the extent to which additional industrial land can be developed within or in close proximity to the town.
- In some cases, concentrated ownership of commercial land leads to limited price competition, circumstances that are not unusual in regional towns.

8.1.1. Kalgoorlie-Boulder

Anzac Drive Industrial Estate

When completed, the Anzac Drive Industrial Estate is comprised of 41 lots in an area that is bounded by Great Eastern Highway and Anzac Drive. The 37.5 hectare Estate has been designed to accommodate large lot users, targeting particularly the transport and logistics sector.

Key features of the Anzac Drive Estate include:

- Dual-road frontage lots that are suitable for triple road-trains;
- Serviced lots with underground power and water;
- Street lighting;
- Roads with wide corners and mountable kerbs for triple road-train manoeuvrability;
- Direct access to Anzac Drive and connection to Great Eastern Highway;
- Access and close proximity to West Kalgoorlie rail freight yards and linkage to the Kalgoorlie Business Park; and
- Design guidelines that underpin a high standard of development.

Stage 1 of the development has been fully sold. Stage 2(Anzac Drive West) is currently the subject of a feasibility study, with design likely revolving around 140 to 150 lots, including several larger lots of four to five hectares in size.

West Kalgoorlie and Boulder

It is understood that some limited privately held industrial zoned blocks are available in other locals within the City such as West Kalgoorlie and Boulder

8.1.2. Shire of Coolgardie

Mungari Strategic Industrial Area

The Strategic Industrial Area policy framework was developed by the Western Australian Government partly as a land planning and management framework, and partly to offer project proponents some of the certainty that is provided by the State Agreement framework without the significant obligations that the State Agreement framework places on proponents and the State.

Strategic Industrial Areas (SIA) are areas of land in strategic locations that are set aside, or 'quarantined', for industrial use in order to attract investment in downstream processing, heavy industry and other industrial activity associated with the State's main upstream primary industries. This is given effect through a coordinated, 'whole-of-government' approach to planning for SIA areas.

SIAs are delivered through LandCorp, with some project communication activity coordinated through the relevant Regional Development Commission, but with the Department of Jobs, Tourism, Science and Innovation performing a lead agency role. The land that is the subject of a SIA is either held freehold by LandCorp and leased to a tenant, or is Crown land that converts to freehold land and is vested in LandCorp once a tenant is prepared to enter into a lease. Most SIAs

form part of State regional planning strategies and are appropriately zone within the relevant local government area jurisdiction.

There are currently 12 SIAs operating or under development. The only SIA in the Golfields-Esperance Region is the 700 hectare Mungari SIA, which is planned to create heavy and strategic downstream processing opportunities in the Region. Located between Kalgoorlie-Boulder and Coolgardie, the site is adjacent to major road, rail, water and power infrastructure, but remains untenanted.

The Mungari SIA has remained untenanted since its establishment 30 years ago. There are likely a number of reasons for this including the proponent borne cost to activate the site, its location and uncertainty with respect to Native Title claims around the site buffer zone.

Kambalda Light Industrial Area

The Kambalda Light Industrial Area services mining and processing sectors in and around the town of Kambalda, with several 2,000 to 3,000 square metre lots currently on the market.

8.1.3. Shire of Esperance

Shark Lake Industrial Park

With head-works commencing in 2007, the Shark Lake Industrial Park in the town of Esperance was a joint initiative between the Shire of Esperance and the then Esperance Port Authority. It is a 378 hectare site located on the Coolgardie-Esperance Highway 12 kilometres from the town centre.

8.1.4. Shire of Ravensthorpe

Ravensthorpe Light Industrial Area

The Ravensthorpe Light Industrial Area is serviced with power and is located close to the town of Ravensthorpe.

8.1.5. Shire of Wiluna

Wiluna Light Industrial Land

The Shire of Wiluna currently has 5 hectares of developed industrial land, illustrated in Figure 67 [224] below, with Industrial or Future Industrial zones in purple.

8.1.6. Prospective new Kalgoorlie Strategic Industrial Area

If the Region is to grow is heavy industry sector and potentially host a downstream chemical industries it will require areas of strategic land that have cost effective access to transport logistics, natural gas, electricity, water and other critical factors of production. Given that the Mungari SIA has proved uncompetitive in this regard, the City of Kalgoorlie-Boulder is investigating developing an area of land approximately 5 kilometres southwest of the City that will be zoned for heavy processing industry and potentially seeking to have the site zoned as a Strategic Industrial Area.

This area of land would also be the location of multi-modal transport hub discussed in Section6.2.2.

[224] Department of Planning (2016), *Central Regions Land Capacity Analysis – Shire of Wiluna*

8.1.7. Other New industrial land releases

In response to the Regional industrial land shortage, several other Shires in the GVROC Region are investigating re-zoning land within their jurisdiction for light industrial purposes, particularly those that are in close proximity to concentrated industry activity such as the Shire of Coolgardie.

The Shire of Wiluna in particular has 23 hectares of Future Industrial land, as identified by the Department of Planning (see Figure 67). This denotes land that is 'capable of substantial further development', consisting of undeveloped or underdeveloped land on greenfield sites.

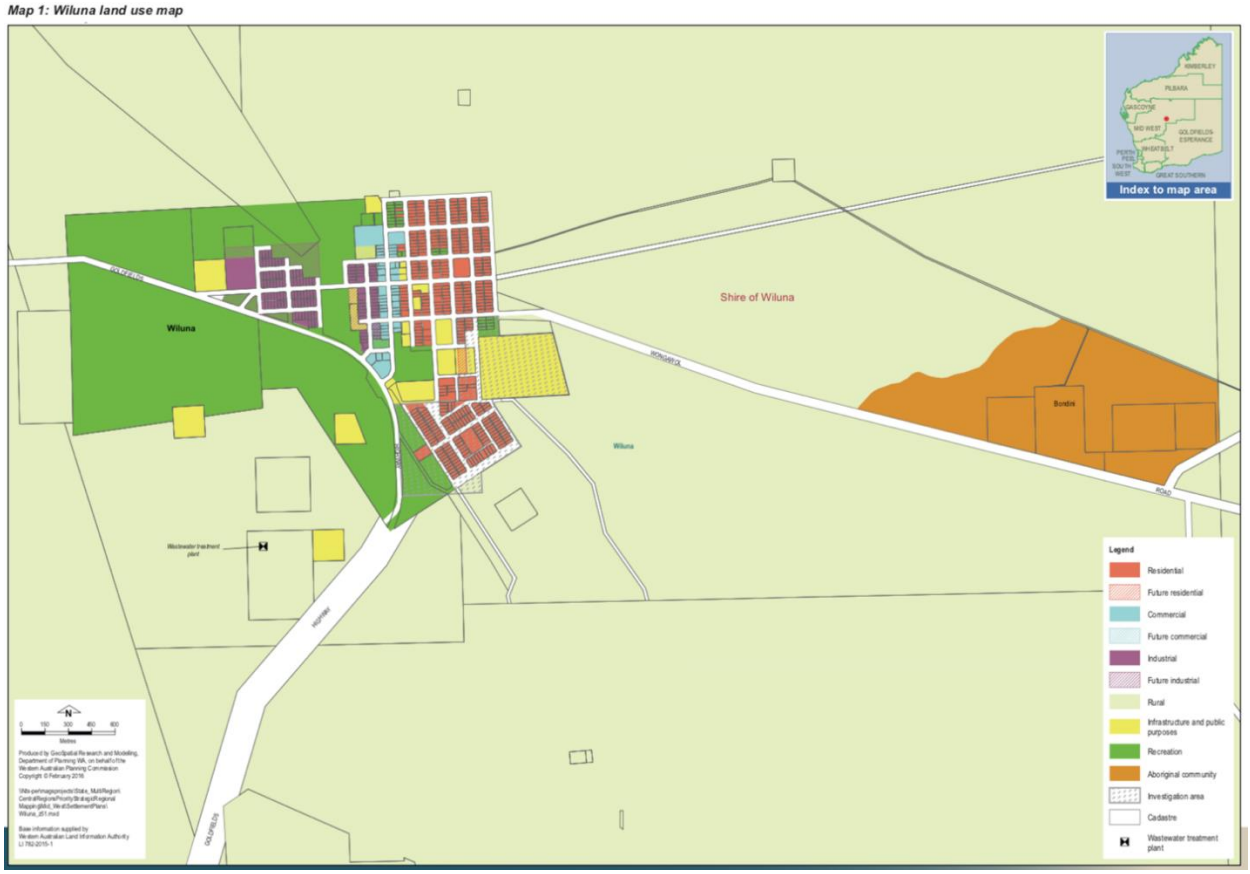

FIGURE 67 - Wiluna Land use – existing and future releases

8.2. Housing

Outside of Kalgoorlie-Boulder and Esperance, residential housing stock is generally limited and of relative poor quality. This presents a challenge to growing the residential population and attracting and retaining staff for service delivery outside of the main population centres.

8.3. Labour

As discussed in Section 2.1.1, unemployment across the Region is generally well below the State average. Labour shortage has been cited by the Goldfields-Esperance business sector as one of, if not the biggest current challenge. For example, in February 2018, over 1,000 job vacancies were reported across different sectors in the City of Kalgoorlie-Boulder[225].

[225] Kalgoorlie-Boulder Chamber of Commerce and Industry (2018), *Goldfields Business Report*

To partly address this issue, in March 2019, the City of Kalgoorlie-Boulder and Shires of Coolgardie, Leonora and Menzies entered into a five year Designated Area Migration Agreement (DAMA) with the Australian Government. This allows employers operating in these shires to sponsor skilled overseas workers in specific sectors that are currently experiencing critical skill and labour shortages. There are 72 occupations covered by the Goldfields DAMA including key occupations in the minerals, agricultural, hospitality and human services sectors.

8.3.1. Key issues

Access to suitable industrial land

Issue

As discussed in Section 8.1, the shortage of industrial land that is appropriately zoned, proximate to all necessary infrastructure and well-served by labour, business services and logistics chains serves as a barrier to increased industry participation, diversification and profitability.

Opportunities

If not already underway, it is proposed that GVROC, in partnership with industry and government stakeholders, coordinate a feasibility study into the proposed Kalgoorlie SIA to ensure that the suboptimal utilisation currently seen in the Mungari SIA is not repeated.

More broadly, further options for low-cost light industrial areas, whether SIA-declared or otherwise achieved through zoning reform, should be investigated throughout the GVROC Region.

Improved housing stock

Issue

The relatively poor quality of housing stock outside of Kalgoorlie-Boulder and Esperance is a challenge to growing the Regional population and attracting and retaining quality staff.

Opportunities

To ensure optimal delivery of fit-for-purpose housing stock, it is proposed that GVROC and GEDC work with the Department of Communities and Development, as well as other relevant stakeholders (potentially including industry in some instances) to establish an ongoing process to determine investment requirements and priorities in this area. These findings will enable the targeted and timely delivery of improved housing stock in the areas where it is most required.

Growing a local fit-for-purpose labour market

Issue

A local workforce that is of adequate size and competitive with respect to the skills that industry requires is the fundamental factor in reducing FIFO and maximising local employment, and therefore growing the population and economy.

Opportunities

Local children are more likely to stay and live in the Region if there are attractive local jobs that they have the skills to do. Ensuring local training prepares the local population for the skillsets that are required in the Region will ensure that young residents are optimally prepared for and competitive with respect to local employment opportunities.

9. Soft Infrastructure

KEY POINTS

Primary and Secondary Education

The main population centres of Kalgoorlie-Boulder and Esperance offer a range of options in private and public K-12 education, with most other major towns having at least one k-12 option.

Across the Region, limited child-care places is problematic.

Vocational Education and Training and Higher Education

The Region is serviced by two TAFE campuses – Central Regional TAFE in Kalgoorlie-Boulder and a campus of Southern Regional TAFE in Esperance.

While local course offerings are limited, the Western Australian School of Mines Kalgoorlie campus is an iconic tertiary education facility and the Rural Clinic School of Western Australia is also active in the Region.

Optimising the education precinct in Kalgoorlie-Boulder, better integrating training and education with industry in the Region and developing and implementing new curriculum that supports the increasingly prevalence of technology oriented jobs in mining and agriculture are initiatives that are currently underway.

Healthcare

Primary healthcare facilities in the Region include the 106 bed Kalgoorlie Health Campus, 36 bed Esperance Health Campus and smaller regional hospitals in Leonora, Laverton and Norseman.

Community Health Centres operate in most of the Region's major towns, as do primarily volunteer paramedic services.

While Kalgoorlie-Boulder and Esperance have numerous general practitioners, and most other major towns at least have one general practitioner, retaining general practitioners is problematic across the Region.

Other challenges include servicing an increasing incidence and diversity of mental health issues, servicing dental care needs, and ensuring adequate paramedic capacity.

Law and Order

Law and order infrastructure is considered to currently be adequate.

Broadly, soft infrastructure refers to the services required to maintain the economic, wellbeing, cultural and socio-economic living standards of a population. It is often (and misleadingly) described as being in contrast to'hard' infrastructure such as roads and bridges, but importantly soft infrastructure includes both non-tangible assets, such as the provision, governance and control of professional services (such as healthcare), and the physical assets, equipment and buildings required to provide those services.

Soft infrastructure services are wide-ranging, and include financial, legal, justice, policing and delivery of and participation in government by the population. However, within the Australian Federal system, and for the purposes of this Strategy reflecting matters within the influence of GVROC members, soft infrastructure is defined as including the healthcare; primary, secondary, vocational and higher education; and law and order sectors.

9.1. Primary and secondary education

Appendix 9 contains a list of all primary and secondary education facilities in the GVROC Region. These facilities are discussed in the following subsections.

9.1.1. Primary and secondary education in City of Kalgoorlie-Boulder

As the main population centre, the City of Kalgoorlie-Boulder hosts the highest number and most diverse range of primary and secondary schooling facilities in the Region.

There are seven public primary schools in the City of Kalgoorlie-Boulder namely, Boulder Primary School, East Kalgoorlie Primary School, Hannans Primary School, Kalgoorlie Primary School, North Kalgoorlie Primary School, O'Connor Primary School and South Kalgoorlie Primary School. There are also two public secondary schools, Eastern Goldfields College which caters for year 7 through to year 12, and Kalgoorlie-Boulder Community High School which caters for year 7 through to year 10. The City of Kalgoorlie-Boulder also hosts Kalgoorlie School of the Air which caters for kindergarten to year 6 students living in remote parts of the GVROC Region.

Services for children with special learning needs are provided by the Eastern Goldfields and O'Connor Education Support Centres.

Kalgoorlie-Boulder also hosts the Christian Aboriginal Parent-Directed (kindergarten to year 6), Saint Mary's and St Joseph's non-government primary schools, as well as the Goldfields Baptist College (kindergarten to year 10) and John Paul College (year 7 to year 12) non-government secondary schools.

9.1.2. Primary and secondary education in the Shire of Esperance

Esperance

As the second largest population centre in the Region, the town of Esperance hosts the second largest concentration of relatively diverse primary and secondary education offerings.

There are a total of 13 primary and secondary education institutions in the Shire of Esperance. The town of Esperance is serviced by two non-government primary schools, Esperance Christian Primary School and Our Lady Star of the Sea Catholic Primary School, as well as the Esperance Anglican Community School, which is a kindergarten to year 12 facility. There is also are also three public primary school - Esperance Primary School, Castletown Primary School and Nulsen Primary Schools - as well as Esperance Senior High School.

Other Towns

In addition to the facilities in Esperance, the town of Gibson which is approximately 20 kilometres north of Esperance hosts the non-government Wongutha Christian Aboriginal College secondary school.

Each of the towns of Cascade, Condingup, Grass Patch, Salmon Gums and Scaddan host public primary schools.

9.1.3. Primary and secondary education in the Shire of Ravensthorpe

Each of the towns of Hopetoun, Jerdacuttup and Munglinup are serviced by public primary schools. Additionally, the town of Ravensthorpe hosts the Ravensthorpe District High School.

9.1.4. Primary and secondary education in the Shire of Coolgardie

Coolgardie

The town of Coolgardie is host to one public primary school, Coolgardie Primary School and one non-government Kindergarten to Year 12 institution, Christian Aboriginal Parent Directed School.

Kambalda

Additionally, the town of Kambalda host the public Kambalda Primary School and Kambalda West District High School, which provides tuition up to year 10.

9.1.5. Primary and secondary education in the Shire of Dundas

Kindergarten through to year 12 tuition in the Shire of Dundas is serviced by the public Norseman District High School.

9.1.6. Primary and secondary education in the Shire of Laverton

The public Laverton School (Cosmo Newberry Campus) is a Remote Teaching Services School that caters for kindergarten through to year 11. Approximately 30 kilometres from the town of Laverton is the Mount Margaret Remote Community School that provides kindergarten to year 6 tuition to residents of the Mount Margaret Aboriginal Community.

9.1.7. Primary and secondary education in the Shire of Leonora

Situated in the town of Leonora is the public Leonora District High School that caters for kindergarten to year 12. Additionally, the independent public school, Leinster Community School, provides kindergarten to year 11 tuition in the town of Leinster.

9.1.8. Primary and secondary education in the Shire of Menzies

Located in the town of Menzies, the public Menzies Community School provides kindergarten through to year 12 tuition.

9.1.9. Primary and secondary education in the Shire of Ngaanyatjarraku

Each of the main Aboriginal communities located within the Shire of Ngaanyatjarraku hosts a public school, with all by two offering kindergarten to year 12 tuition. Nine of the 10 schools are campuses of the Ngaanyatjarra Lands School, namely:

- Ngaanyatjarraku school (kindergarten to year 12)
- Blackstone Campus (kindergarten to year 12)
- Jameson Campus (kindergarten to year 12)
- Kiwirrkurra Campus (kindergarten to year 12)
- Tjukurla Campus (kindergarten to year 10)

- Wanarn Campus (kindergarten to year 12)
- Warakurna Campus (kindergarten to year 12)
- Warburton Campus (kindergarten to year 12)
- Wingellina Campus (kindergarten to year 12)

Additionally, the Tjunttjuntjara Remote Community School provides kindergarten to year 11 tuition.

9.1.10. Primary and secondary education in the Shire of Wiluna

The Wiluna Remote Community School has a student body of usually around 100 students, catering for years K-12. The school also has an on-site kindergarten and Pre-Primary Centre. With generally consistent student numbers, three Primary classes are offered, however lower numbers of senior students attend the school, with only two single sex streams of years 8 to 12.

9.1.11. Key Issues

Limited child-care supply

Issue

As a result of investment in upgrades under various Royalties for Regions programs over the past decade, primary and secondary school facilities across the Region are generally fit-for-purpose and in good condition. However, child care facilities, particularly in the main population centres are inadequate to meet demand, which is undoubtedly constraining supply in the local labour market and reducing workforce productivity in the Region.

Opportunities

It is arguable that the lack of appropriate child care facilities in the Region represents an instance of market failure which GVROC member councils would be justified in taking steps to rectify. Options to remedy this would require further and more detailed assessment in order to deliver solutions appropriately adapted to the individual circumstances, risk profile and specific needs of each local government. Likely first steps capable of being coordinated between GVROC member councils (and potentially the GEDC) would include data-gathering to better understand the child care needs of the Region's population and to quantify the potential value-add that additional facilities would provide.

Decreasing secondary school retention

Issue

Anecdotally, it is reported that retaining in-Region students in years 11 and 12 is proving increasingly problematic, with increasing numbers of students either leaving school or attending boarding school in Perth or other Regions. This undermines the viability of later stage secondary education in the Region and can have flow-on effects to the local workforce and case for local services, if students do not return to the Region.

Opportunities

The fundamental right of a parent to control the schooling of their children is likely to render this issue only partly within the control of local governments. The basis for reduced patronage by the Regional population of local secondary schools is not clear at this stage, and hence a deeper understanding of the reasons for this is required before any clear action can be formulated to address this issue. Further, despite forming part of Regional soft infrastructure, factors such as school amenities, staffing, curriculum and ethos are outside the control of local government, and

to effect any change in this area would require substantial engagement with, for example, the Department of Education. However, infrastructure issues such as school bus routes or timing may also be contributing factors, which are capable of being remedied.

9.2. Higher Education and Vocational education and training

A strong and diverse post-secondary school education sector is important for quality of life and is a foundation for civic growth.

9.2.1. Higher Education

Curtin University WA School of Mines

Curtin University's WA School of Mines offers undergraduate and graduate qualifications in mining, minerals processing and energy related engineering, science and economics disciplines. Specific discipline offerings include mining engineering, metallurgical engineering, chemical engineering, petroleum engineering, exploration geophysics and mineral and energy economics.

These programs are delivered variably across Curtin University's Perth campuses, as well as the historical WA School of Mines campus in Kalgoorlie, with the student experience at the Kalgoorlie campus supported by the adjacent Agricola residential college.

University of Western Australia Rural Clinical School of Western Australia

Operated by The University of Western Australia (UWA), the Rural Clinical School of Western Australia places students in their second last year of their medical degree in one of 14 rural locations across the State. The purpose of these placements is to provide students with valuable hands-on experience and close mentoring, as well as to assist rural communities in sustaining a locally trained and loyal medical workforce.

The Rural Clinical School operates placements in Kalgoorlie-Boulder and Esperance.

9.2.2. Vocational Education and Training

Central Regional TAFE

Central Regional TAFE is one of five regional TAFE organisations in Western Australia. It operates campuses in Carnarvon, Exmouth, Geraldton, Kalgoorlie, Merredin, Moora, Northam, Wiluna and Kalgoorlie.

The Goldfields Campus located in central Kalgoorlie offers a range of courses, but has a specific focus on mining industry related vocational education and training, offering qualifications from Certificate 1 through to Advanced Diploma. Available course areas include Certificate IV in Accounting and Bookkeeping, Certificate III in Beauty Services and Certificate IV in Beauty Therapy, Certificate II in Building and Construction, Certificate IV and Diploma in Business, Certificate II in Community Services, Certificate IV in Disability, Certificate III and Diploma in Early Childhood Education and Care, Certificate IV in Engineering, Certificate IV in Engineering (Instrumentation), Certificate I in Horticulture, Certificate III in Individual Support, Diploma in Leadership and Management, Advanced Diploma in Metalliferous Mining, Diploma in Nursing, Certificate IV in Resource Processing, Certificate II in Salon Management. It also offers a number

of skillset qualifications including Traffic Management and Forklift Operations. The student experience is supported by the adjacent Agricola residential college.

In 2017, Central Regional TAFE transferred ownership of the Wiluna Remote Community School to the Department of Education. Under this new management arrangement, local Martu elders are involved in determining the courses vocational education and training courses that are offered through the School, with Central Regional TAFE assisting with program delivery.

Southern Regional TAFE

Southern Regional TAFE is another of five regional TAFE organisations in Western Australia. It operates campuses in Albany, Bunbury, Busselton, Collie, Denmark, Harvey, Katanning, Manjimup, Margaret River, Mount Barker, Narrogin and Esperance.

The Esperance Campus is located adjacent to Esperance Senior High School, and hosts a range of facilities including an industry-standard beauty and hairdressing salon, construction workshop, computer laboratories and gymnasium. The campus is currently the subject of an $18 million upgrade investment that will include new special purpose classrooms, simulating aged and disability care workplaces and fitted with industry training equipment for metal fabrication, light automotive and building construction. Works are expected to be completed by early 2021.

Courses available at the Esperance Campus include Certificate III and IV in Beauty Services, Certificates II, III and IV and Diploma in Business, Certificate III in Carpentry and Joinery, Certificate III and Diploma in Early Childhood Education and Care, Certificate III in Education Support, Certificate III in Engineering Fabrication Trade, Certificate III in Engineering Mechanical Trade, Certificate III and IV in Fitness, Diploma in Graphic Design, Certificate III in Hairdressing, Certificate III in Heavy Commercial Vehicle Mechanical Technology, Certificate III in Individual Support (Ageing), Certificate II and III in Information, Digital Media and Technology, Certificate IV and Diploma in Leadership and Management, Certificate III in Light Vehicle Mechanical Technology, Certificate IV in Preparation for Health and Nursing Studies, Certificate IV in Project Management Practice, Certificate II in Salon Assistant and Certificate III in Tourism.

9.2.3. Key Issues

Optimisation of the education and training precinct in Kalgoorlie-Boulder

Issue

For a regional City, Kalgoorlie-Boulder demonstrates a relatively unique concentration of vocational education and training and higher education services in the form of Central Regional TAFE and WA School of Mines. This infrastructure exists across three City blocks, providing a physically integrated precinct.

Should demand for trades in particular increase there will be a requirement for increased investment in upgrading the TAFE's trade facilities including the light-auto, fitting and machining, electric, auto-electrician, heavy duty mechanics, diesel mechanics and hydraulic mechanics workshops and training facilities.

Given that large scale facilities of this nature will generate noise, consideration will need to be given as to how to maintain the integrated nature of the inner city education precinct while managing negative externalities that might detract from the City's amenity.

Opportunities

The siting and location of future workshop training facilities within Kalgoorlie-Boulder will require engagement with local community and other stakeholders as part of a comprehensive modernisation and growth agenda to increase patronage and industry linkages (as discussed further below).

Better integration and modernisation of regional training

Issue

The ongoing staff training needs for mining operations are considerable. As a result there are numerous private Registered Training Organisations (RTOs) operating in the Region, typically delivering a range of training programs at site. There is potentially an opportunity for Central Regional to position itself in this market either directly or by supporting delivery undertaken by other RTOs. This may serve to provide critical mass of student throughput to further underwrite the activities of the Kalgoorlie Central Regional TAFE campus and also result in better training outcomes. The Esperance Campus of South Regional TAFE could also potentially support the training needs of mining operations along the south coast, supported by other South Regional TAFE campuses, particularly Bunbury and Albany.

Both Central Regional TAFE and the WA School of Mines are in the process of developing new technology skills and expertise-oriented curriculums that are designed to produce graduates that have skills to support increasing deployment of automation and other technology in the mining industry. These curriculums include articulation pathways from TAFE courses to associate and bachelor degrees. The delivery of these curriculums will potentially be supported by facilities such as the proposed Centre of Excellence in Hard Rock Processing and Engineering and Training, which is a proposed collaboration between Curtin University, Central Regional TAFE and the City of Kalgoorlie-Boulder that will provide systems simulators for education and training purposes.

There is an opportunity for Kalgoorlie-Boulder to carve out niche capability in the interface between vocational education and training and higher education in mining technology-oriented disciplines.

Opportunities

The resources sector in Western Australia is always focused on ways of reducing operating costs, with a significant current focus on the application of automation, digitisation of processes and use of big data analytics. As the nature of jobs within the sector change to effect this paradigm shift, so too will training and certification requirements. To date, a notable feature of this shift has been to emphasise remote work, automation, data analytics and other increasingly technical and specialist fields. Higher education providers and RTOs offering such courses are concentrated in metropolitan Perth, and combined with reduced need for workers to be physically present on-site there is a risk that regional centres will see a reduction in local training and employment opportunities.

Increased emphasis and resourcing of regional higher education facilities, as part of an industry-focused realignment and partnership approach seeking to offer in-place training to a high standard, may reduce the metropolitan pull factors, increase participation and improve employment outcomes for regional populations. First steps in this area will likely involve an ongoing engagement process with input from RTOs, employers and the State government to develop this agenda further.

Ensuring ongoing viability of the Kalgoorlie Campus of the Western Australian School of Mines

Issue

While there has been a recent recovery, enrolments in specific under-graduate and graduate technical courses delivered at the Kalgoorlie campus of the Western Australian School of Mines have at times reached levels that question the viability of those courses.

Opportunity

GVROC members can work with industry to promote professional careers in mining to local secondary school student to increase the likelihood of enrolments in those programs.

9.3. Healthcare

The Goldfields-Esperance Region, which for the purposes of Western Australia Country Health Services (WACHS) includes the Shire of Wiluna, is geographically the largest of the seven regions in the WACHS portfolio. As the main regional centre, the City of Kalgoorlie-Boulder provides coordination and support for the delivery of WACHS across the Region. The following Figure 68 illustrates the location of the main healthcare facilities in the WACHS Goldfields-Esperance Region.

FIGURE 68 – Healthcare Facilities in the Goldfields-Esperance Region

9.3.1. Kalgoorlie Health Campus

The 106 bed Kalgoorlie Health Campus is the major regional hospital facility in the WACHS Goldfields-Esperance Region. The following Table 50 summarises the care healthcare services provided by the facility.

TABLE 50 – Kalgoorlie Health Campus Services

Core Clinical Services	Outpatient Services	Visiting Specialists
▪ Acute physician services ▪ Acute psychiatric services and 6 bed mental health unit ▪ Acute general, orthopaedic and gynaecological surgery ▪ Allied health services ▪ Chemotherapy and cancer services ▪ Day surgery ▪ Diabetes education ▪ Emergency medicine ▪ High dependency unit ▪ Medical imaging ▪ Obstetrics and gynaecology ▪ Onsite Pathwest pathology ▪ Paediatrics ▪ Palliative care ▪ Pharmacy ▪ Renal dialysis and renal services	▪ Antenatal and antenatal high risk ▪ Audiology ▪ Chemotherapy ▪ Diabetes ▪ Dietetics ▪ Fitness to drive ▪ General medicine ▪ General surgery ▪ Minor surgery ▪ Monthly oncology clinic ▪ Neurology ▪ Obstetrics and gynaecology ▪ Paediatrics ▪ Podiatry	▪ Cardiology ▪ Dermatology, ENT ▪ Genetics ▪ Oncology ▪ Ophthalmology ▪ Pacemaker clinic ▪ Paediatrics ▪ Palliative care ▪ Diabetes ▪ Endocrinology ▪ Respiratory ▪ Rheumatology ▪ Urology ▪ Vascular

The Kalgoorlie Health Campus also operates a Tier 3 adult, older adult and Child and Adolescent Mental Health Service (CAMHS). The mental health team includes a consultant psychiatrist, visiting senior medical officer, visiting child and adolescent consultant psychiatrist, visiting older adult consultant psychiatrist, clinical staff, youth counsellor, Aboriginal mental health coordinator, senior Aboriginal mental health officer and female and male Aboriginal mental health workers.

9.3.2. Esperance Health Campus

The 36 bed Esperance Health Campus is a district hospital and the second largest healthcare facility in the Goldfields-Esperance Region. The following Table 51 summarises the services delivered by the Esperance Health Campus.

TABLE 51 – Esperance Health Campus Services

Core Clinical Services	Visiting Specialists
▪ Ambulatory care ▪ Acute medical ▪ Acute surgery ▪ Aged care assessments ▪ Allied health services (audiology, occupational therapy, physiotherapy, social work, dietetics and speech pathology) ▪ Chemotherapy ▪ Continence advice ▪ Day procedures ▪ Dental services ▪ Emergency medicine ▪ Medical imaging ▪ Mental health ▪ Obstetrics ▪ Onsite Pathwest pathology ▪ Palliative care ▪ Pharmacist	▪ Cardiology ▪ Diabetic clinic ▪ Echocardiography ▪ Gastroenterology ▪ General surgeon ▪ Geriatrician ▪ Gynaecology ▪ Oncology ▪ Ophthalmology ▪ Orthopaedic surgeon ▪ ENT ▪ Paediatrician ▪ Renal physician ▪ Rheumatology ▪ Urologist

The Esperance Health Campus also operates a Tier 3 adult and older adult, and CAMHS mental health service. The team delivering the adult and older adult services is comprised of four clinical staff, visiting older-adult consultant psychiatrist and visiting consultant psychiatrist. The CAMHS team includes a CAMHS clinician and youth counsellor.

9.3.3. Small Regional Hospitals

Smaller regional hospitals are also located in the towns of Leonora, Laverton and Norseman. The services provided by these smaller hospitals are summarised in the following Table 52.

TABLE 52 – Leonora, Laverton and Norseman Hospital Services

Leonora Hospital	Laverton Hospital	Norseman Hospital
Core clinical services include acute admission beds, residential aged care, respite beds, 24-hour accident and emergency, limited X-ray facilities and S100 prescriptions.	**Core clinical services** include 24 hour observation admission beds, 24 hour accident and emergency, limited X-ray facilities and S100 prescriptions.	**Core clinical services** include acute admission beds, residential aged care, respite beds, 24 hour accident and emergency, limited X-ray facilities
Visiting services are provided by podiatrist, paediatrician, dietician, occupational therapist, speech pathologist and mental health professional.	**Visiting services** are provided by podiatrist, renal physician, paediatrician, dietician, occupational therapist, speech pathologist and mental health care professional.	**Visiting services** are provided by podiatrist and psychologist.
Non-hospital care for the aged and disabled include centre based day care activities, home care, meals on wheels and general support for community members.	**Non-hospital care for the aged and disabled** include centre based day care activities in conjunction with Shire services, home care, meals on wheels and general support for community members.	**Non-hospital care for the aged and disabled** include centre based day care activities in conjunction with shire services, home care, meals on wheels and general support for community members.

9.3.4. Other regional health service delivery

In addition to the hospital services discussed in Sections 9.3.1, 9.3.2 and 9.3.3, community health centres operate in Kalgoorlie-Boulder, Kambalda, Coolgardie, Leonora, Laverton, Leinster, Menzies, Norseman and Esperance. The health care teams that operate these centres deliver a range of child health, school and youth health, immunisation and disease prevention services to the communities in which they operate. In the case of the Community Health Centres in Menzies, Coolgardie and Kambalda, nursing staff also provide outpatient and nurse-led emergency services as required.

The Allied Health teams at the Kalgoorlie and Esperance Health Campuses also work across the various WACHS sites in the Region to provide access to audiology, child development services, dietetics, occupational health and safety, physiotherapy, podiatry, social work and speech pathology services.

The Public Health Unit at Kalgoorlie Health Campus coordinates and manages communicable disease prevention and control, sexual health, regional immunisation coordination, the trachoma program and pandemic disaster planning across the WACHS Goldfields-Esperance Region. Support for infection control programs is also provided by this unit. It also supports public health delivery by general practitioners, hospitals, community health teams, local governments and other relevant organisations across the WACHS Region.

The remote nature of the Shire of Wiluna results in a scarcity of local health services for residents. The Ngangganawili Aboriginal Health Service Community (NAHS) was established in 1993 and is located centrally in the town of Wiluna, just off the Goldfields Highway. NAHS is a community controlled Aboriginal corporation that provides affordable, culturally appropriate health and medical services to the Indigenous and wider population of Wiluna and surrounding areas. NAHS also provides training and employment opportunities for Indigenous and non-Indigenous people in the Region. The specific health services provided by NAHS are listed in the following Table 53.

TABLE 53 – Shire of Wiluna

Ngangganawili Aboriginal Health Service Community – Services	
• Outpatient GP service • 24 Hour Accident & Emergency service • X-ray, Pathology, Immunisation, Physiotherapy, Ultrasound, Gynaecology • Ear, nose and throat specialist services • Maternal and child health services and sexual health counselling and education • Hearing screening and vision screening	• Drug and alcohol misuse programs • Community Aged Care • Home and Community Care • Health and Nutrition education • Environmental Health Management • Parenting and Early Childhood Development centre • Chronic disease prevention • Dental Health care

9.3.5. Key issues

Increasing demand for mental health services

Issue

Because the population of the Region is skewed toward younger people, physical health indications are relatively less common, with a higher incidence of mental health, drug and communicable disease (e.g. sexually transmitted disease) being more prevalent. Demand for mental health services is further exacerbated by the significant remote Aboriginal population and areas that are characterised by relatively large numbers of single males, circumstances that are often associated with higher rates of mental illness.

Opportunities

It is likely that the increasing demand on mental health services will underpin a case for a comprehensive mental health facility and associated outreach services based on Kalgoorlie-Boulder health campus.

Retaining general practitioners

Issue

Most population centres across the Region struggle to attract and retain general practitioners. The exception to this is Esperance. In addition to sustaining actual service delivery, high turnover means that local residents and families are unable to establish a long-term health care relationship with their general practitioner. This is a challenge faced by most rural and regional areas across Australia.

Opportunities

With State government incentives already in place to encourage trainee doctors to take up regional placements, it is likely that the most fruitful approach to addressing this deficiency would be to engage with the State government, and potentially higher education and training institutions, to seek to identify complementary policy areas and approaches. This should be informed by a more nuanced understanding of the reasons underlying the poor attraction and retention rate, and will likely require a coordinated data-gathering process that is led by the WACHS.

Appropriate upgrades to Laverton, Leonora and Norseman Hospitals

Issue

The smaller hospitals in Laverton, Leonora and Norseman are aged and generally run-down. Additionally, the method for delivering healthcare services from these facilities has changed with a greater reliance on telemedicine delivery. As such, these facilities require investment in general upgrades, as well as to render them more suitable to the new service delivery methods.

Opportunities

It is likely that additional direct investment in infrastructure upgrades will be required to remedy this deficiency. A partnership approach should be pursued with the State government, industry and the NFP sector in order to optimally leverage available funding sources. Better resourcing of regional hospitals may also contribute to medical practitioner attraction and retention, discussed above, as well as underpinning health outcomes for regional communities that will likely deliver economic benefits through population retention and the creation of larger medical technical services markets.

Sustaining culturally secure health care delivery

Issue

Servicing the health needs of the Region's large and geographically distributed Aboriginal population is a major aspect of WACHS operations, and an area that is likely to continue to grow. The effective delivery of health services to Aboriginal people requires the delivery of those services to be culturally secure, or appropriate. There will be an ongoing need to train and employ Aboriginal medical professionals in this regard.

Opportunities

Increased Indigenous economic participation is a notable priority of both State and Commonwealth governments. A partnership approach incorporating stakeholders from local communities, other levels of government, training and education providers, NFPs and the Indigenous sector should be pursued to optimally leverage and engage with existing resources and processes in this area.

Ensuring adequate paramedic capability

Issue

The City of Kalgoorlie-Boulder is the only settlement in the Region with professional paramedic staff, with all other settlements dependent on volunteers. The paramedic workforce and volunteers also have to service vast areas. As such, even in the case of Kalgoorlie-Boulder, if the two paramedics that are on duty are called out to service a regional incident, the City can be left un-serviced for considerable periods of time.

In addition to not having a critical mass of incidents to justify a larger workforce, recruiting paramedics is challenged by the fact that significant local knowledge is required, particularly with respect to un-gazetted roads that are not contained on GPS databases.

Opportunities

While provision and staffing of paramedics through the public health system is likely outside the control or influence of GVROC member councils, data collection and provision, including existing mapping and digitisation initiatives, will deliver a range of benefits to improve the provision of

emergency medical care and other users of geospatial information. Together with other regional digital infrastructure and connectivity programs, a priority should be placed on ensuring reliable and accurate geospatial data is available for the Region at large.

Dental Care

Issue

There is increasing demand for dental care services in the Region, and as is the case with general practitioners and many other categories of staff, attracting and retaining dentists is likely to prove increasingly problematic.

Opportunities

As discussed above, incentives to encourage regional positions are already in place. Efforts should be made to identify complementary policies and approaches that could be delivered to increase the impact and efficacy of these incentives, and to optimally leverage existing investments.

Maintaining critical mass of demand for local health care services

Issue

Greater demand for health services justifies the investment in improving the capacity and capabilities of health care facilities in the Region. Because, the GVROC Region's population is relatively stable, the Region is challenged in this regard.

Opportunities

Currently, most mining operations operate their own health care functions, with limited capacity clinics on site and a policy of returning cases that can't be treated adequately by these clinics to Perth. If efficient and effective systems could be established whereby the healthcare needs of mining operations are increasingly serviced by local healthcare facilities, demand for local facilities would increase, potentially underwriting further investment.

Aged care services and housing stock

Issue

As with wider Australia, the changing demographics of the Region are resulting in an aging population and proportionate increase in demand for medical services, including specialist geriatric and palliative care, dementia outreach and other associated services. Further, an increase in appropriate housing stock will be required to suit a range of individual needs, both intensive assisted/monitored care as part of a hostel or village model and independent living.

Opportunities

As identified in the *Aging in the Bush* report[226], a 'Four Planks' framework is required to address the outstanding needs in this area, including further provision of aged-friendly community infrastructure and amenities, better and more appropriate housing stock and residential living arrangements, and community aged care programs. GVROC member councils continue to respond to these recommendations, and are working with industry and other stakeholders to deliver better outcomes in this area, albeit this effort is at time fragmented. There is scope for

[226] Regional Development Council (2016), *Aging in the Bush – An ageing in place strategy for Regional Western Australia*, Government of Western Australia

GVROC members to work with industry, GEDC, RDAGE and the Department of Communities to develop an age-friendly community planning framework at a Regional level.

9.4. Law and order

9.4.1. Police Force

The main Western Australian Police Force presence in the Region is in the main police stations of Kalgoorlie and Esperance. The following Table 54 summarises police stations in the Region.

TABLE 54 – Police Stations in the GVROC Region

Shire	Police Station	Districts Serviced
Coolgardie	Coolgardie Police Station	Boorabbin, Bulllabulling, Coolgardie, Karramindie, Mount Burges, Victoria Rock, Wallaroo
	Kambalda Police Station	Higginsville, Kambalda East, Kambalda West, Londonderry, Widgiemooltha
Dundas	Norseman Police Station	Balladonia, Caiguna, Dundas, Fraser Range, Norseman
	Eucla	Cocklebiddy, Eucla, Forrest, Madura, Mundrabilla, Rawlinna
Esperance	Esperance Police Station	Bandy Creek, Beaumont, Boyatup, Buraminya, Cape Arid, Le Grand, Cascade, Castletown, Chadwick, Congingup, Coomalbidgup, Dalyup, East Mungilup, Esperance, Gibson, Grass Patch, Howick, Israelite Bay, Lort River, Merivale, Mongingup, Mount Ney, Myrup, Neridup, North Cascade, Nulsen, Pink Lake, Salmon Gums, Scaddan, Sinclair, West Beach, Windabout, Wittenoom Hills.
Kalgoorlie-Boulder	Kalgoorlie Police Station	Binduli, Boorara, Broadwood, Brown Hill, Bulong, Cundeelee, Emu Flat, Feysville, Fimiston, Hannans, Kalgoorlie, Kanowna, Karlkurla, Kurnalpi, Lakewood, Lamington, Mullingar, Ora Banda, Parkeston, Piccadilly, Somerville, South Boulder, South Kalgoorlie, Trafalgar, Victory Heights, West Kalgoorlie, West Lamington, Williamstown, Yilkari, Zanthus
Laverton	Laverton Police Station	Bandya, Cosmo Newbery, Lake Wells, Laverton, Neale
Leinster	Leinster Police Station	Lake Darlot, Leinster, Sir Samuel
Leonora	Leonora Police Station	Kookynie, Leonora, Menzies, Plumridge Lakes, Ularring
Ngaanyatjarraku	Blackstone MFPF	Beadell
	Warakurna MFPF	Ngaanyatjarragiles
	Warburton MFPF	Gibson Desert South, Warburton
	Kintore Police Station	Gibson Desert North (actually in Northern Territory)
Wiluna	Wiluna Police Station	Lake Carnegie, Little Sandy Desert, Wiluna

9.4.2. Justice Institutions

The following Table 55 summarises the justice institutions in the GVROC Region.

TABLE 55 - Justice Institutions in the GVROC Region

Court of Registry	Description
Kalgoorlie Courthouse	The heritage-listed Kalgoorlie Court recently underwent a $41 million transformation. Officially re-opened in 2013, it is now a four-courtroom complex with the ability to expand to five courts when required. It has three magistrates' courtrooms and one jury courtroom.
Esperance Courthouse	The current Esperance courthouse building is part of the Esperance Police Complex and was opened in November 1967.
Mining Registries	Mining registries have similar services available to court registries, and are situated in Coolgardie, Leonora and Norseman
Police Registries	Only certain civil cases, such as applications for extraordinary drivers licences and violence restraining orders, can be commenced where registry functions are performed by police officers. Police registries are situated in Blackstone, Eucla, Laverton, Leinster, Ravensthorpe, Warakurna and Warburton.

9.4.3. Key issues

No immediate policing or law and order issues have been identified by this study.

10. Infrastructure Planning Priority Actions

The purpose of this infrastructure opportunities identification study is to provide GVROC and RDAGE with an evidence-based identification of infrastructure issues across the Region, and opportunities to address issues in support of the changing nature of infrastructure usage by the Region's minerals industry so that it's productivity, productivity of other key sectors across the Region and amenity for the local community is not compromised.

Using this report as an evidence-base, the next step is for GVROC, RDAGE and other key stakeholders to work together to prioritise issues and develop plans to mitigate infrastructure related risks and capitalise on opportunities.

10.1. Summary of key issues – template summary

As a basis for moving forward, the following table sets out a template for GVROC, RDAGE and other stakeholders to systematically prioritise the identified issues, and develop a staged action plan for each issue as appropriate.

Issue	**Proposed actions/next steps**
Transport and Logistics Infrastructure	
Road network	
Maintain standard of main arterial roads	
Improve the standard of key non-arterial roads	
Increased heavy vehicle traffic through townships	
Managing activation of isolated communities and economies	
Rail network	
Potentially increasing rail freight	
High network costs	
Potential congestion at the Aurizon Kalgoorlie Yard	
Kalgoorlie-rail realignment and multi-modal capability	
Aviation facilities	
Kalgoorlie-Boulder Airport approaching CASA trigger for controlled airspace	
Pending upgrade investment at Esperance Airport	
High regional airfares	
Facilitating a regional approach to FIFO	

Managing volume fluctuations of smaller registered and certified aerodromes	
Maritime facilities	
Esperance Port land constraints	
Maintaining long-term viability of Esperance Port	
Confidence to invest in new capital at Esperance Port	
Service Infrastructure	
Digital and telecommunications infrastructure	
Mobile 'Blackspots'	
Facilitation of real-time data intensive services	
Natural gas distribution	
Pipeline access	
Electricity generation and distribution	
Energy security on the SWIS	
Esperance electricity supply	
Water supply	
Potable water scarcity and cost	
Potential cost of high purity water	
Waste management	
Developing a regional waste solution	
Processing problematic waste	
Industrial Land, Housing and Labour	
Access to suitable industrial land	
Improving housing stock	
Growing a local fit-for-purpose labour market	
Soft Infrastructure	
Primary and Secondary Education	
Limited child care supply	
Decreasing secondary school retention	

Higher Education and Vocational Education and Training	
Optimisation of the education and training precinct in Kalgoorlie-Boulder	
Better integration of Regional training	
Implementation and integration of new curriculums	
Health Care	
Increasing demand for mental health services	
Retaining general practitioners	
Appropriate upgrades to Laverton, Leonora and Norseman Hospitals	
Sustaining culturally secure health care delivery	
Ensuring an adequate paramedic capability	
Maintaining critical mass of demand for local health care services	

Appendix 1: Interviewees

The following Table 56 provides a list of people who were interviewed as a key component of the analysis that underpins this infrastructure strategy.

Participation in the interview process does not imply that any of the individuals listed in Table 56 or the organisations they represent necessarily agree with or endorse any of the analysis, observations or recommendations contained in this infrastructure strategy.

TABLE 56 - Interviewees

Interviewee	Position	Organisations
David Ayres	Manager-Mining	Minara Resources
Stean Barrie	General Manager – Leonora Operations	St Barbara Limited
Scott Bates	General Manager – Esperannce Port	Southern Ports Authority
Colin Bastow	Chief Executive Officer	Shire of Wiluna
Laurene Bonza	President	Shire of Dundas
Peter Craig	President	Shire of Leonora
Greg Dwyer	President	Shire of Menzies
Jim Epis	Chief Executive Officer	Shire of Leonora
Raleigh Finlayson	Managing Director	Saracen Mineral Resources
Peter Fitchat	Chief Executive Officer	Shire of Dundas
Sarah Fletcher	Senior Business Development Officer	Goldfields-Esperance Development Commission
Gary Frampton	General Manager	BHP Nickel West
Kim Gava		Minara Community Foundation
Gary Gray	General Manager – External Affairs	Mineral Resources Limited
Peter Hancock	Vice President	Minara Resources
Kevin Hannagan	Chief Executive Officer	Shire of Ngaanyatjarraku
Mia Hicks	Executive Manager – Economic Development	Shire of Coolgardie
Lee Jacobsen	Chair	Regional Development Australia - Goldfields
Simon Jessop	Chief Operating Officer	Saracen Mineral Holdings
Milo Mihovilovich	Supply and Logistics Manager – Murrin Murrin	Minara Resources

Interviewee	Position	Organisations
Joanne Monaghan	Airport Compliance Coordinator	City of Kalgoorlie-Boulder Airport
Peter Money	Chief Executive Officer	Shire of Menzies
Graham McGarry	Director	Beacon Minerals Ltd
Peter Naylor	Chief Executive Officer	Shire of Laverton
Rowena Olsen	Manger – Eastern Regions	Chamber of Minerals and Energy Western Australia
Linton O'Meara	Manager – Environment	Minara Resources
David Paton	Government and Industry Relations Manager	CBH Group
Jo Payne	Director – Training Services	Central Regional TAFE
Brianna Peake	General Manager – Grower and External Relations	CBH Group
Chris Reed	Managing Director	Neometals
Rose Riley	Assistant Director – Business Management	Goldfields-Esperance Development Commission
Matthew Scott	Chief Executive Officer	Shire of Esperance
Guy Singleton	Manger – Social Responsibility and External Relations	Northern Star Resources Limited
Jo Swan	Director – Regional Development	Regional Development Australia - Goldfields
Bill Sweetman	Managing Director	Central Regional TAFE
Peter Tredinnick	Operations Manager	Western Australian Country Health Service
Chris Tienmann	Environment and Community Manager	Independence Group
Darryl Tonkin	Airport Manager	City of Kalgoorlie-Boulder Airport
James Trail	Chief Executive Officer	Shire of Coolgardie
John Walker	Chief Executive Officer	City of Kalgoorlie-Boulder
Alex Wise	Executive Manager – Economy and Growth	City of Kalgoorlie-Boulder

Appendix 2: GVROC Region Demographics

Local Government Area Demographics

Table 57[227] below illustrates the population growth indicator data for each LGA.

TABLE 57 – Population Growth Drivers

Shire	Gender Distribution (F | M)	Median Age	Median Age Females	Median Age Males	Fertility Rate 2016	Births 2016 No.	Deaths 2017 No.	Death Rate (per 1,000 pop)	Net Internal Migration	Net Overseas Migration
WA Average	*50% | 50%*	*36.6*	*37.2*	*36*	*1.9*	*35,429*	*14,494*	*5.4*	*-13,934*	*13,384*
Coolgardie	48% | 52%	34.1	32.7	35	2.4	64	20	5.4	-119	13
Dundas	47% | 53%	47.5	44.2	49.7	NP	9	9	NP	-27	3
Esperance	50% | 50%	39.8	40	39.5	2.1	180	84	6.1	-220	20
Kalgoorlie Boulder	48% | 52%	32.7	32.2	33.3	2.4	616	132	8.1	-825	119
Laverton	34% | 66%	37.3	33.8	38.9	NP	11	4	NP	-11	2
Leonora	38% | 62%	34.5	32.4	35.5	NP	23	4	NP	-3	2
Menzies	39% | 61%	35.8	33.9	36.5	NP	3	6	NP	-4	1
Ngaanyatjarraku	51% | 49%	29.7	31	27.4	1.7	28	20	NP	0	3
Ravensthorpe	47% | 53%	45.9	44.3	48.3	NP	25	16	NP	-103	4
Wiluna	31% | 69%	36.5	34.5	36.8	NP	4	4	NP	-34	1

Table 58 below illustrates the education, workforce participation and unemployment rates for each Local Government Area in the Region.

[227] Australian Bureau of Statistics (2017), Data by Region

TABLE 58 – Education, Workforce Participation and Unemployment in the GVROC Region

Shire	Youth (15-19) Education and Workforce Participation							Total Labour Force (15+)		
	Studying Full time (Not Working)	Working Full time (Not Studying)	Working Part Time and Studying Full-time	Working Full Time and Studying Part Time	Working Part Time and Studying Part Time	Working Full Time and Studying Full Time	Youth Fully Engaged %	Completed Year 12 or equivalent	Total Unemployment Rate	Participation Rate
WA Average	*47.1%*	*5.9%*	*21.2%*	*1.7%*	*1.5%*	*0.4%*	*79.2%*	*51.7%*	*7.8%*	62.9%
Coolgardie	47.4%	11.6%	6.5%	1.7%			68.5%	28.3%	9.1%	58.4%
Dundas	28.0%	20.0%					48.0%	24.3%	9.0%	50.8%
Esperance	40.0%	10.9%	17.1%	1.7%	1.0%	0.6%	73.1%	36.4%	4.5%	59.1%
Kalgoorlie Boulder	32.8%	12.2%	19.0%	3.3%	1.9%	0.4%	70.3%	40.4%	5.8%	68.3%
Laverton	32.3%	9.7%					41.9%	32.4%	8.3%	64.6%
Leonora	23.7%	26.3%					50.0%	35.6%	3.7%	59.0%
Menzies	36.7%	26.7%					63.3%	32.4%	10.6%	57.7%
Ngaanyatjarraku	18.4%	2.1%					24.1%	14.3%	27.4%	32.4%
Ravensthorpe	46.2%	17.9%	7.2%				71.8%	38.0%	6.2%	57.8%
Wiluna	36.7%						46.7%	33.0%	6.3%	60.0%

Aboriginal Community Demographics

The following Table 59 summarises key socio-economic indicators for a selection of Aboriginal communities in the GVROC Region.

TABLE 59 – Key Socio-Economic Indicators for Aboriginal Communities in the GVROC Esperance Region

Community Name	% Aboriginal	Total No. Of Houses	% Female	% Male	% Care For Children	Number Employed	Median Weekly Income	No. Of Students	No. Graduated Year 12
Cosmo Newberry	84%	34	50%	41%	50%	12	288	17	3
Irrunuytju	89%	48	51%	50%	54%	38	258	67	7
Jameson	85%	24	53%	50%	50%	18	385	57	14
Kurrawang	90%	34	48%	52%	55%	18	350	28	5
Leonora	28%	339	45%	55%	18%	202	350	206	149
Mount Margaret	94%	45	50%	47%	52%	7	258	33	8
Ningia Mia	86%	23	45%	54%	15%	3	242	14	8
Papulankutja	86%	70	55%	46%	34%	20	240	87	4
Tjuntjuntjarra	89%	43	46%	51%	40%	39	290	38	37
Wanarn	85%	49	49%	47%	34%	24	340	72	13
Warakurna	89%	68	56%	45%	58%	44	248	97	24
Warburton	85%	181	49%	51%	51%	125	326	182	86

Appendix 3: Implications of Demand for Lithium-ion Batteries

This summary of the implications of the escalating demand for nickel-rich battery chemistries for the Western Australian minerals and minerals processing sector is sourced from an extensive investigation undertaken by the author of this infrastructure strategy[228].

Western Australia is well positioned to benefit from the exponential growth in demand for lithium-ion batteries. It is an established producer of several minerals critical for the manufacture of a range of chemicals used in the production of lithium-ion batteries, this production base is rapidly expanding and there is some current and planned investment in domestic downstream processing capacity that will see some of these minerals converted to chemical products for the global lithium-ion battery supply chain.

Implications for Western Australian Battery Minerals Sector

Strong and likely sustained driver of derived demand

On all accounts, global demand for lithium-ion battery technology is expected to grow at an unprecedented rate for the foreseeable future. This demand is derived from demand for products that is in turn driven by a potent, and likely irreversible combination of the proliferation of decarbonisation policy across the world, rapidly changing mainstream customer values, and an insatiable appetite for business productivity growth.

Global demand for personal and portable electronic devices, energy storage systems and particularly, electric vehicles is expected to result in orders of magnitude increases in demand for minerals used in the manufacture of lithium-ion batteries. As an established and expanding producer some of these minerals for the global lithium-ion battery supply chain, Western Australia stands to benefit from these megatrends.

For various fundamental reasons, lithium-ion battery technology will very likely remain the platform technology for most rechargeable battery applications for the foreseeable future. This further favours Western Australia's prospects. Additionally, the emerging dominance of nickel-manganese-cobalt (NMC) cathode chemistry in the fastest growing product segment, electric vehicles, favours Western Australia's existing battery minerals production base, particularly with respect to the immediate downstream production of high quality lithium hydroxide, nickel sulphate and potentially cobalt sulphate technical and potentially battery grade chemicals.

Lithium

Forecasts suggest that demand for lithium will increase dramatically out to 2025, with battery derived demand increasingly dominating the global lithium demand profile. Western Australia accounts for a significant portion of global lithium reserves, the vast majority of hard-rock primary lithium production, and as a result of recently commissioned projects, currently around half of total global primary lithium production.

Western Australian production of lithium pregnant spodumene concentrate measured in terms of lithium carbonate equivalent, while the lowest cost hard-rock producers, sits at a mid-point in the

[228] Australian Venture Consultants (2018), *WA's Future in the Lithium Battery Value Chain,* Chamber of Commerce and Industry WA

global cost curve, with particularly the larger Latin American brine producers demonstrating a significant primary production cost advantage. This, combined with the different process flows, renders Western Australian primary production uncompetitive as a feedstock for the manufacture of lithium carbonate, but competitive with respect to the manufacture of lithium hydroxide.

The People's Republic of China (PRC) hosts the vast majority of the world's lithium conversion plant capacity, with approximately half of that capacity producing lithium carbonate, a quarter lithium hydroxide and a quarter lithium metal. Around three-quarters of the feedstock for these lithium conversion plants is spodumene and spodumene concentrate, the majority of which is sourced from Western Australian production. Indeed, over 90 percent of Western Australian spodumene concentrate is exported to the PRC for conversion into technical grade lithium chemicals, with additional offtake agreements with PRC conversion capacity underpinning the financing of much of the expanding spodumene concentrate production base in Western Australia.

As a result of inefficient retrofits to legacy infrastructure designed to meet increasing demand, many existing PRC conversion plants are operating well below their nameplate capacity, resulting in a current bottleneck in the production of technical grade lithium chemical. To address this bottleneck and rising demand for lithium chemicals, several operators of these plants (including the world's leading lithium chemical companies) are investing in significant further brownfields expansion, as well as new conversion capacity in the PRC. Much of this new capacity has and will continue to source feedstock through offtake agreements with existing and emerging Western Australian spodumene production.

The recent significant investment in lithium hydroxide conversion in Western Australia has been underpinned by a variety of factors, including escalating global demand for lithium in hydroxide form, increased local feedstock availability, some operating cost equalisation, the processing bottleneck in the PRC and strategic reasons to invest in capacity outside of the PRC. Tianqi is currently constructing a plant in Kwinana and Albemarle is navigating the approvals process for a plant in Kemerton. Other lithium mining projects in Western Australia also have plans to establish local conversion plant capacity.

Nickel and Cobalt

In response to expanding demand for nickel-rich battery chemistries, demand for Class 1 nickel feedstock from nickel sulphate conversion plants will increase substantially. The Class 1 nickel briquettes and powders that are more readily convertible to nickel sulphate inputs to the lithium-ion battery supply chain comprise approximately only 10 percent of global nickel production. Western Australia is a major producer of this important subset of Class 1 nickel product, accounting for approximately 45 percent of the 230,000 tonne of Class 1 nickel briquettes and powders produced globally.

Lithium-ion battery supply chain demand for cobalt has increased three-fold over the past five years, with demand derived from battery manufacture now accounting for approximately 40 percent of global cobalt demand. Demand for cobalt is expected to approximately double again by 2025. By virtue of its current lack of substitutability, concentration of primary production in the Democratic Republic of Congo (which presents sovereign risk and by virtue of child labour issues, product acceptability risk) and refining in the PRC, cobalt is listed as 'critical' by both the European Union and United States. The Murrin Murrin nickel laterite operation in Western Australia produces significant volumes of cobalt as a co-product, with other Western Australian nickel projects producing smaller volumes of cobalt by-product.

Nickel sulphate chemicals used in the lithium-ion battery supply chain are supplied by around at least 15 chemical suppliers, approximately 75 percent of which are located in in East Asia across the PRC, Japan and Taiwan. Once Nickel West's Western Australian nickel sulphate plant is at full capacity it will be one of the largest producer of nickel sulphate globally.

Currently, approximately 80 percent of refined forms of cobalt suitable for battery use (including sulphates) are produced in the PRC. If Nickel West's plans to develop cobalt sulphate at its Kwinana refinery materialise it will likely be a significant ex-PRC supplier of cobalt sulphate.

It is likely that the nickel and cobalt sulphate materials produced in Western Australia will be of high quality, becoming increasingly important as the battery industry continues its quest for higher intensity, lower cost nickel-rich battery chemistries. Nevertheless, competition from East Asian production capacity will remain a competitive threat.

The Western Australian Battery Minerals Strategy

Over the course of the past 24 months there have been a number of investigations into opportunities presented to Western Australia by the surge in derived demand for minerals that are inputs to the manufacture of lithium-ion batteries[229,230]. In early 2019, the Western Australian Government launched its Future Battery Industry Strategy[231]. This strategy sets out five objectives, pathways to achieving those objectives and four separate action themes that will enable those pathways. The Western Australian Future Battery Industry Strategy is summarised in the following Figure 69.

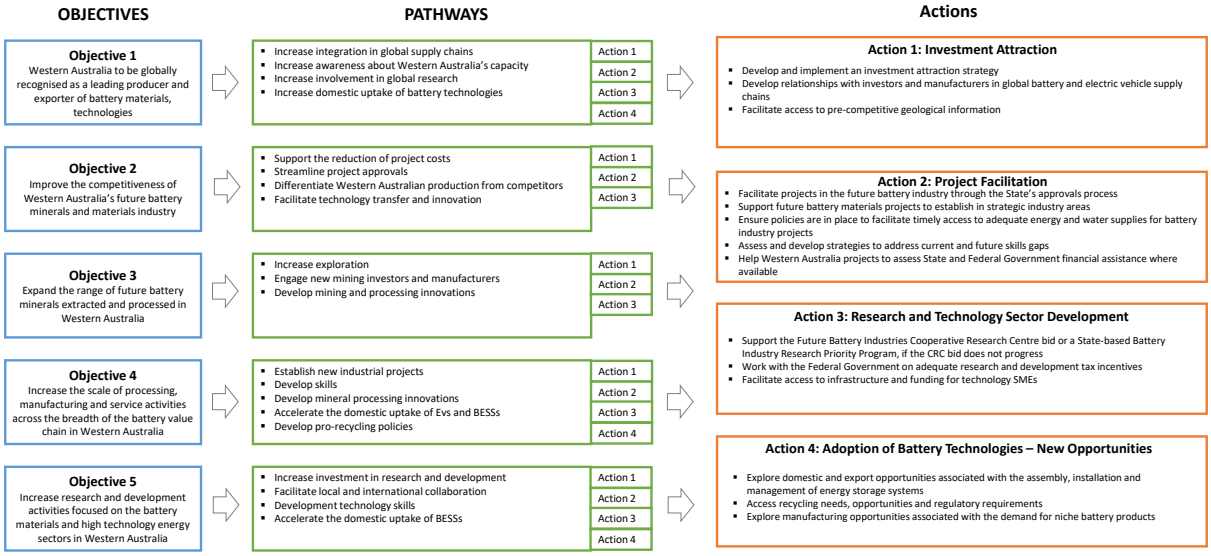

FIGURE 69 – Western Australian Government Future Battery Industries Strategy

229 Australian Venture Consultants (2018), *WA's Future in the Lithium Battery Value Chain*, Chamber of Commerce and Industry WA

230 Smart Strategies, InfraNomics and Curtin University (2018), *Lithium Valley: Establishing the Case for Energy Metals and Battery Manufacturing in Western Australia*, Regional Development Australia Perth

231 Government of Western Australia (2019), *Future Battery Industry Strategy: Western Australia*

Appendix 4: Minerals Sector Hard Infrastructure Usage Models

In the Goldfields-Esperance Region, the extent to and nature of which different projects intersect with common-user infrastructure varies across sectors and operations within sectors. The following Figure 70, Figure 71, Figure 72 and Figure 73 illustrates some of the shared infrastructure usage models that are typical in the Goldfields-Esperance minerals industry currently and which are likely to emerge in the near future..

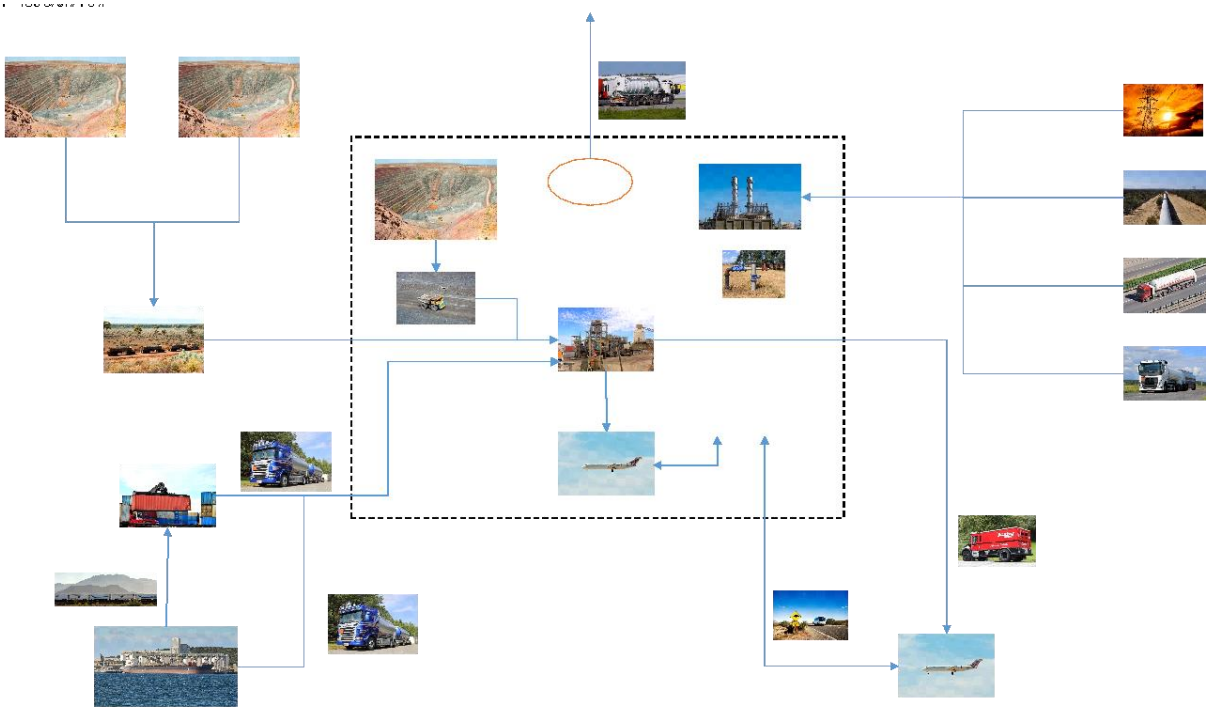

FIGURE 70 – Gold Sector Infrastructure Usage Models

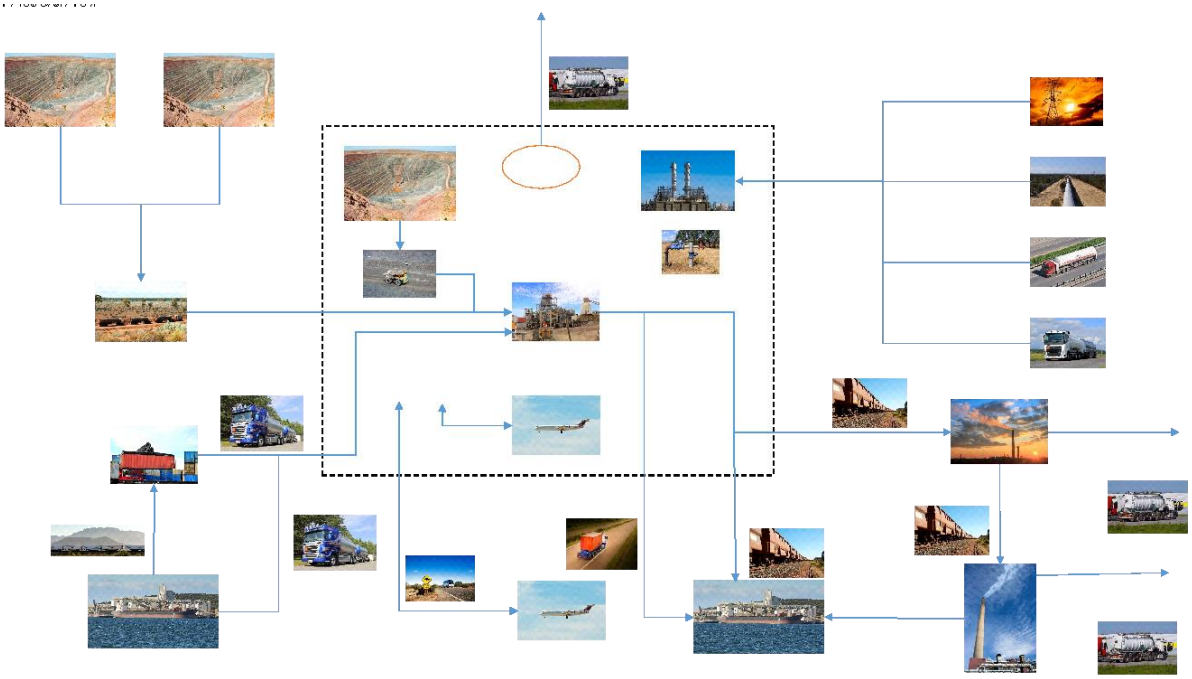

FIGURE 71 – Nickel Sector Infrastructure Usage Models

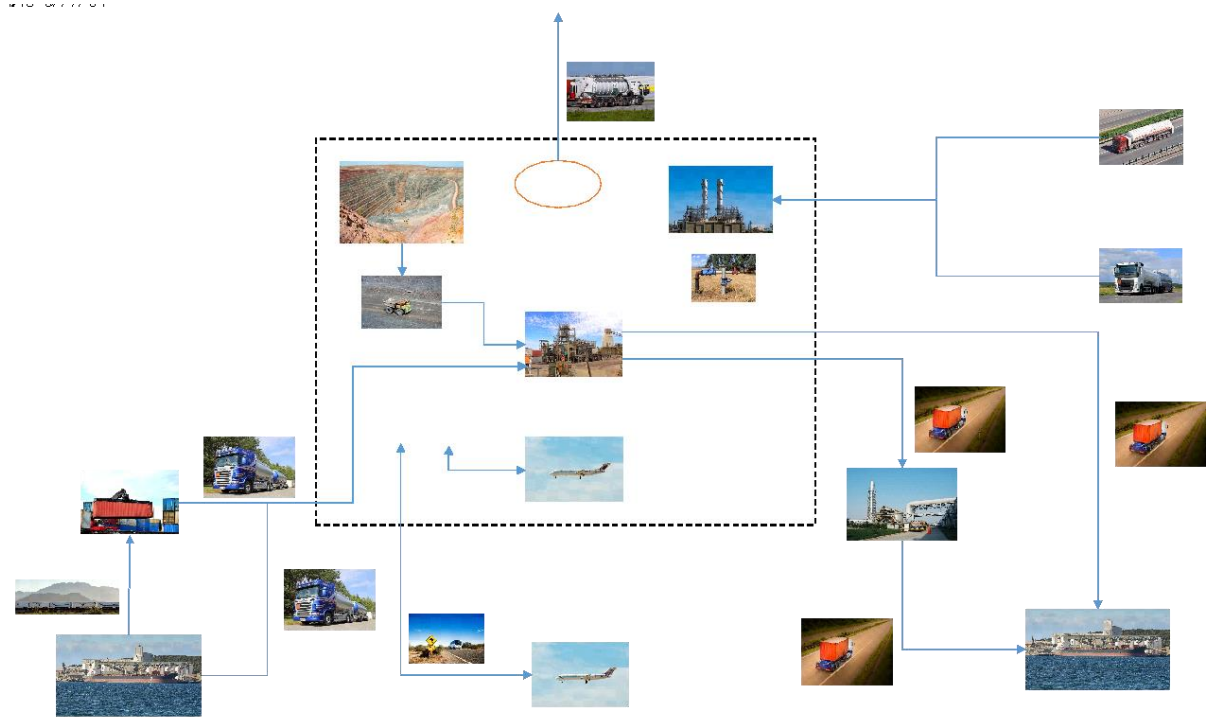

FIGURE 72 – Spodumene (Lithium) Sector Usage Models

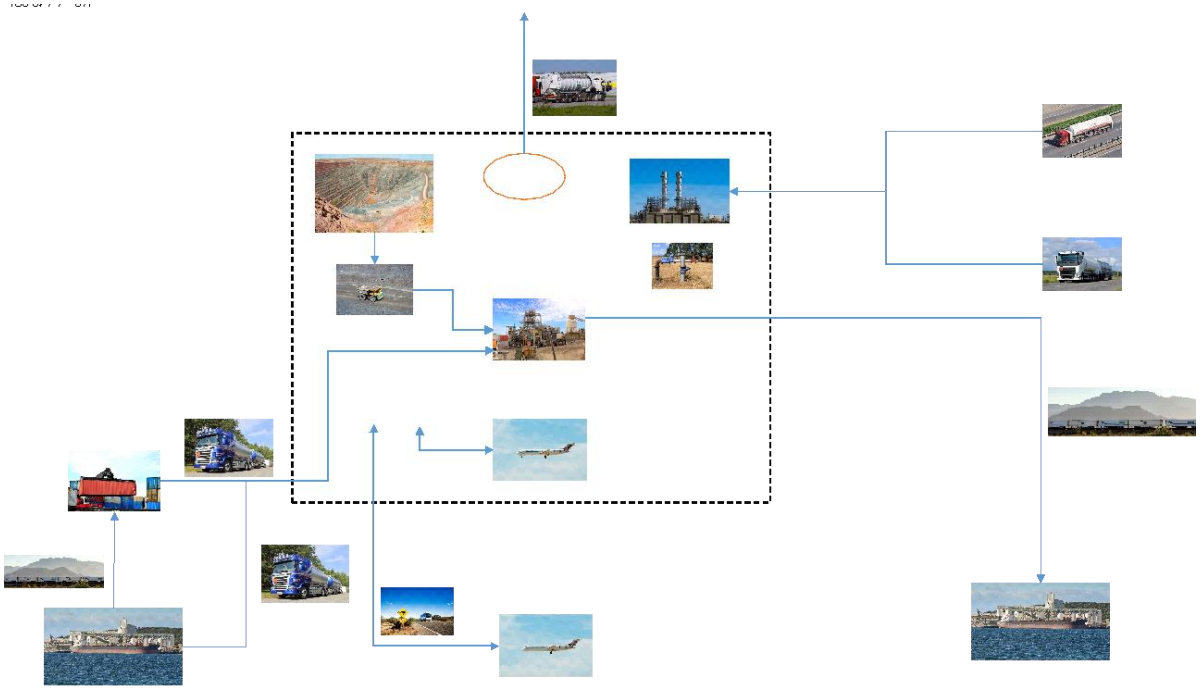

FIGURE 73 – Rare Earth Sector Usage Models

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The following Table 60 provides some examples of infrastructure usage of major gold projects in the Region.

TABLE 60 – Gold Project Infrastructure Usage

Project	Ore Transfer	Road Inputs	Road Product	Rail Inputs	Rail Product	Aviation	Electricity	Natural Gas Pipeline	Waste
Gold Fields									
St Ives	Internal Haul Roads	Yes	Yes	No		Public	Self-generation	Yes	Internal and External
Granny Smith	Internal Haul Roads	Yes	No	No	No	Proprietary	Self-generation	Yes	Internal and External
Agnew-Lawlers	Internal Haul Roads	Yes	Yes	No	No	Public	Self-generation	Yes	Internal and External
Gruyere	Internal Haul Roads	Yes	No	No	No	Proprietary	Self-generation	Yes	Internal and External
Barrick-Newmont									
KCGM	Internal Haul Roads	Yes	Yes	Yes	No	Public	SWIS and Self-generation	Yes	Internal and External
Anglogold-Ashanti									
Sunrise Dam	Internal Haul Roads	Yes	No	No	No	Proprietary	Self-generation	Yes	Internal and External
Tropicana	Internal Haul Roads	Yes	No	No	No	Proprietary	Self-generation	Yes	Internal and External
Saracen									
Carosue Dam	Internal Haul Roads	Yes	No	No	No	Proprietary	Self-generation	No	Internal and External
Thunderbox	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Proprietary	n.a.	No	Internal and External

Regis									
Duketon	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Proprietary	Self-generation	No	Internal and External
Northern Star									
Kalgoorlie	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Public	SWIS and self-generation	Yes	Internal and External
St Barbara									
Gwalia	Internal Haul Roads	Yes	Yes	No	No	Public	Self-generation	Yes	Internal and External
Norton Goldfields									
Paddington	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Public	SWIS and Self-generation	No	Internal and External
Dacian Gold									
Mt Morgans	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Public	Self-generation	Yes	Internal and External
Ramelius									
Kathleen Valley	Internal Haul Roads	Yes	Yes	No	No	Public	Self-generation	No	Internal and External
Vivien	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Public	Self-generation	No	Internal and External
Silverlake									

Mt Monger	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Proprietary	Self-Generation	No	Internal and External
Evolution Mining									
Mungari	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Public	Grid Supply	No	Internal and External

The following Table 61 summarises the infrastructure usage of major nickel projects in the Region.

TABLE 61 – Nickel Project Infrastructure Usage

Project	Ore Transfer	Road Inputs	Road Product	Rail Inputs	Rail Product	Aviation	Electricity	Natural Gas Pipeline	Waste
BHP Nickel West									
Production Complex	Internal Haul Roads and Public Roads	Yes	Yes	Yes	Yes	Public and Proprietary	Self-generation and SWIS	Yes	Internal and External
Minara/Glencore									
Murrin Murrin	Internal Haul Roads	Yes	No	Yes	Yes	Proprietary	Self-generation	Yes	Internal and External
Western Areas									
Forestania	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Proprietary	Self-generation	No	Internal and External
Independence Group									
Nova-Bollinger	Internal Haul Roads and Public Roads	Yes	Yes	No	No	Proprietary	Self-generation	No	Internal and External

First Quantum Minerals									
Ravensthorpe	Internal Haul Roads	Yes	Yes	No	No	Public	Self-generation	No	Internal and External

The following Table 62 summarises the infrastructure usage of spodumene (lithium) project infrastructure usage.

TABLE 62 – Spodumene (Lithium) Project Infrastructure Usage

Project	Ore Transfer	Road Inputs	Road Product	Rail Inputs	Rail Product	Aviation	Electricity	Natural Gas Pipeline	Waste
Galaxy Resources									
Mt Cattlin	Internal Haul Roads	Yes	Yes	No	No	Public	Self-generation	No	Internal and External
Mineral Resources/Jiangxi Gangfeng									
Mt Marion	Internal Haul Roads	Yes	Yes	No	No	Public	Self-generation	No	Internal and External

The following Table 63 summarises the infrastructure usage of rare earths projects in the Region.

TABLE 63 – Rare Earth Project Infrastructure Usage

Project	Ore Transfer	Road Inputs	Road Product	Rail Inputs	Rail Product	Aviation	Electricity	Natural Gas	Waste
Lynas Corporation									
Mt Weld	Internal Haul Roads	Yes	Yes	Yes	Yes	Public	Self-generation	Yes	Internal and External

Appendix 5: Roads in the GVROC Region

The following Table 64[232] lists roads located in the GVROC Region that are under the management jurisdiction of Main Roads.

TABLE 64 – Western Australian Government Roads in the GVROC Region Managed under the Jurisdiction of Main Roads

Ref. #	Road	Description	Road Type
H5	Great Eastern Highway	Link between Perth and Kalgoorlie-Boulder	State Road / Primary Distributor
H10	Coolgardie-Esperance Highway	Link between Coolgardie and Esperance	State Road / Primary Distributor
H8	South Coast Highway	Link between Esperance and the South West region	State Road / Primary Distributor
H3	Eyre Highway	Link between Goldfields-Esperance and South Australia	State Road / Primary Distributor
H41	Anzac Drive	Runs between Great Eastern Highway and Goldfields Highway	State Road / Primary Distributor
H49	Goldfields Highway	Runs between Wiluna and Widgiemooltha	State Road / Primary Distributor
M22	Leonora-Laverton Road	Runs between Leonora and Laverton	State Road / Primary Distributor
M69	Mount Magnet-Leinster Road	Runs between Mount Magnet and Leinster	State Road / Primary Distributor
	Agnew-Sandstone Road	Runs between Goldfields Highway and Great Northern Highway	State Road / Primary Distributor
	Hannan Street	Main Street in Kalgoorlie linking Great Eastern Highway to Goldfields Highway	State Road / Primary Distributor
	Bayley Street	Joins Coolgardie Esperance Highway and Great Eastern Highway through Norseman	State Road / Primary Distributor
	Princep Road	Joins Coolgardie Esperance Highway and Eyre Highway through Norseman	State Road / Primary Distributor
	Harbour Road	Connects Coolgardie Esperance Highway and South Coast Highway to Esperance Port	State Road / Primary Distributor

[232] Regional Development Australia boundaries used in Goldfields-Esperance determination thus Shire of Wiluna not included in table.

The following Table 65[233] list major roads in the GVROC Region that are managed by local governments.

TABLE 65– Key Roads in the GVROC Region Managed by Local Government

Road	Description	Road Type
Emu Rocks Road	Joins Goldfields Highway in Kambalda	Primary Distributor
Agnew-Leinster Road	Connects Agnew Sandstone Road to Leinster Mine	Primary Distributor
Great Central Road	Runs between Leonora-Laverton Road and the eastern boundary of the state	Regional Distributor
Ramsay Street	Runs between Coolgardie-Esperance Highway and Hyden Norseman Road	Regional Distributor
Mort Harslett Drive	Runs between Coolgardie-Esperance Highway and Hyden Norseman Road	Regional Distributor
Meekatharra Road	Runs betweek Menzies and Kalgoorlie-Boulder	Regional Distributor
Federal Road/Boulder Road	Main road through Kalgoorlie town centre connecting to Goldfields highway in both directions	Distributor A
Picaddily Street	Connects Boulder/Federal Road to Goldfields Highway. Main access to hospital	Regional Distributor
Bulong Road	Runs between Kalgoorlie -Boulder town centre and Yarri Road	Regional Distributor
Yarri Road	Runs between Kalgoorlie-Boulder town centre and Kanowna	Regional Distributor
Williamstown Road	Connects Goldfields Highway to Yarri Road and Bulong Road	Local Distributor
Broad Arrow - Ora Banda Road	Runs between Great Eastern Highway and Goldfields Highway	Regional Distributor
Gatacre Drive	Connects Great Eastern Highway to Kalgoorlie-Boulder Airport, RFDS and Goldfields Air Services	Local Distributor
Coolgardie North Road	Runs between Great Eastern Highway and Goldfields Highway	Regional Distributor
Cascade Road	Runs between Southcoast highway and Norseman Road	Regional Distributor
Norseman Road	Runs between Norseman and the Wheatbelt	Regional Distributor
Lake King-Norseman Road	Runs between Norseman and the Wheatbelt	Regional Distributor

[233] Regional Development Australia boundaries used in Goldfields-Esperance determination thus Shire of Wiluna not included in table.

Road	Description	Road Type
Hyden-Norseman Road	Runs between Norseman and the Wheatbelt	Regional Distributor
Fisheries Road	Runs between Esperance and the eastern boundary of the state	Regional Distributor
Menzies-Sandstone Road	Runs between Menzies and Sandstone	Regional Distributor
Wongawol Road	Runs between Goldfields highway and the eastern boundary of the state	Regional Distributor
Carnegie Road	Extension of Wongawol Road leading to eastern boundary of the state	Regional Distributor
Laverton Bypass	Connects Leonora-Laverton Rd and Great Central Rd plus local distributor roads Old Laverton, Mt Weld and White Cliffs Rd	Regional Distributor
Lancefield Diversion Road	Connects Leonora-Laverton Road to Great Central Road, north of Laverton	Regional Distributor
Old Laverton Road	Connects Leonora-Laverton Road to Great Central Road, via Laverton	Local Distributor
White Cliffs Road		Local Distributor
Mt Weld Road		Local Distributor

Appendix 6: Registered and Certified Aerodromes in the GVROC Region

The following Table 66 lists the Civil Aviation Safety Authority (CASA) registered and certified aerodromes and airports in the GVROC Region.

TABLE 66 – Civil Aviation Safety Authority (CASA) Registered and Certified Aerodromes and Airports in the GVROC Region

Registration/Certification Number	Aerodrome	Location	Operator
ADREG.0142	Belleveue	Belleveu	Western Areas Limited
R164	Warburton	Warburton	Warburton Community
CASA.ADCERT.0225	Carosue Dam	Carasue Dam	Saracen Gold Mines
1-Z5D5	Darlot	Darlot Mine	Darlot Mining Company
1-XISNU	Duketon Gold	Duketon Mine	Regis Resources
1-6GBO	Esperance	Esperance	Esperance Shire Council
1-Z5VDN	Granny Smith	Granny Smith Mine	GSM Mining Company
CASA.ADCERT.0218	Gruyere	Gruyere Mine	Gruyere Management
1-12W6M3	Jundee	Jundee Mine	Northern Star Resources
1-6GBD	Kalgoorlie-Boulder	City of Kalgoorlie-Boulder	City of Kalgoorlie Boulder
1-6GBM	Laverton	Laverton	Shire of Laverton
1-6GA5	Leinster	Leinster	BHP Nickel West
1-6GBQ	Leonora	Leonora	Shire of Leonora
1-1496X	Mt Keith	Mt Keith	BHP Mount Keith Operations
1-1H2K8	Murrin Murrin	Murrin Murrin	Minara Resources
CASA.ADCERT.0201	Nova	Nova	Sirius Gold
CASA.ADCERT.0206	Plutonic	Plutonic	Billabong Gold
C009	Ravensthorpe	Ravensthorpe	Shire of Ravensthorpe
1-1LZW3	Sunrise Dam	Sunrise Dam	Anglogold Ashanti
CASA.ADCERT.0210	Thunderbox	Thunderbox	Saracen Minerals
1-UVSJA	Tropicana	Tropicana	Anglogold Ashanti

Appendix 7: Esperance Port Trade

In 2016-17 total throughput was approximately 15.5 million tonnes, the majority of which related to commodity exports. Iron ore represented 77 percent of the 14.6 million tonnes of exported product, followed by grain (20 percent), timber woodchips (1.4 percent) and nickel (0.7 percent). Table 67 below illustrates Esperance port throughput over the past decade[234].

TABLE 67 - Esperance Port Throughput 2008-09 to 2016-17

Through-put (Mass Tonnes)	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Import	501,465	371,721	413,952	768,311	841,071	829,024	829,726	794,299	878,819
Export	9,453,264	10,895,266	10,706,306	10,982,856	13,033,973	14,109,931	14,227,398	14,465,367	14,634,030
General Cargo									
Import	11,566	9,356	16,674	51,076	83,033	68,557	118	84	-
Export	64,355	137,231	241,341	366,793	387,791	286,415	-	15,141	-
Bulk Cargo									
Import	489,899	362,365	397,278	717,235	758,038	760,467	765,841	704,029	846,981
Export	9,388,909	10,758,035	10,464,965	10,616,063	12,646,182	13,823,516	13,944,863	14,180,416	14,473,868
Container Cargo (Mass Tonnes)									
Import	11,566	9,356	16,674	50,837	83,033	68,557	63,766	90,186	31,838
Export	64,355	61,613	233,375	3,333,531	387,791	686,415	282,535	269,810	160,162
Container Cargo (TEU)									
Import Full	256	-	-	-	1,828	1,585	1,861	3,172	861
Import Empty	1,488	3,422	6,255	14,210	14,462	10,917	1,036	7,615	4,520
Export Full	2,640	2,085	7,930	12,944	15,281	11,232	10,823	9,907	5,186
Export Empty	320	-	13	-	1,150	2,452	1,708	1,030	635

[234] Ports Australia

Appendix 8: SWIS Registered Generation Systems in the GVROC Region

The following Table 68 lists all electricity generation facilities that are registered on the SWIS and located in the GVROC Region.

TABLE 68 – SWIS REGISTERED GENERATION SYSTEMS IN THE GVROC REGION

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
ALBGRAS	SRV AGWF Pty Ltd as trustee for AGWF Trust	ALBANY_WF1	Intermittent Non-Scheduled Generator	Non-Active	7.757	21.6	12/10/2018 0:00
ALBGRAS	SRV AGWF Pty Ltd as trustee for AGWF Trust	GRASMERE_WF1	Intermittent Non-Scheduled Generator	Non-Active	5.074	13.8	12/10/2018 0:00
ALCOA	Alcoa of Australia Limited	ALCOA_KW_IL	Non-Dispatchable Load	Non-Active			1/11/2008 0:00
ALCOA	Alcoa of Australia Limited	ALCOA_PNJ_IL	Non-Dispatchable Load	Non-Active			1/11/2008 0:00
ALCOA	Alcoa of Australia Limited	ALCOA_WGP	Scheduled Generator	Active	26	26	1/11/2008 0:00
ALCOA	Alcoa of Australia Limited	ALCOA_WGP_IL	Non-Dispatchable Load	Non-Active			1/11/2008 0:00
ALINTA	Alinta Sales Pty Ltd	ALINTA_PNJ_U1	Scheduled Generator	Active	135	143	1/07/2003 0:00
ALINTA	Alinta Sales Pty Ltd	ALINTA_PNJ_U2	Scheduled Generator	Active	135.5	143	1/07/2003 0:00
ALINTA	Alinta Sales Pty Ltd	ALINTA_WGP_GT	Scheduled Generator	Active	195.152	195.152	2/12/2006 0:00
ALINTA	Alinta Sales Pty Ltd	ALINTA_WGP_U2	Scheduled Generator	Active	196.848	196.848	2/12/2006 0:00
ALINTA	Alinta Sales Pty Ltd	ALINTA_WWF	Intermittent Non-Scheduled Generator	Active	26.096	89.1	1/07/2003 0:00
ALINTA	Alinta Sales Pty Ltd	BADGINGARRA_WF1	Intermittent Non-Scheduled Generator	Active		130	11/01/2019 0:00
AMAUST	Amanda Australia Pty Ltd	AMAUST_DSP_01	Demand Side Program	Non-Active			1/10/2012 0:00

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
AMAUST	Amanda Australia Pty Ltd	AMAUST_DSP_02	Demand Side Program	Non-Active			8/06/2014 0:00
AMENERGY	Amanda Energy Pty Lt	ADERRTL_DSP_01	Demand Side Program	Non-Active			1/06/2015 0:00
BAICOMMS	Broadcast Australia Pty Ltd	BAICOMMS_DSP_01	Demand Side Program	Non-Active			1/10/2016 0:00
BLAIRFOX	Blair Fox Pty Ltd	BLAIRFOX_KARAKIN_WF1	Intermittent Non-Scheduled Generator	Non-Active	0.824	5	1/06/2013 0:00
BLAIRFOX	Blair Fox Pty Ltd	BLAIRFOX_WESTHILLS_WF3	Intermittent Non-Scheduled Generator	Non-Active		5	10/10/2013 0:00
CCL	Cockburn Cement LTD	CCL_DSP_01	Demand Side Program	Non-Active			1/10/2015 0:00
COLLGAR	Collgar Wind Farm	INVESTEC_COLLGAR_WF1	Intermittent Non-Scheduled Generator	Active	20.567	206	11/05/2011 0:00
CTE	CleanTech Energy Pty Ltd	BIOGAS01	Intermittent Non-Scheduled Generator	Non-Active	1.654	2	30/09/2015 0:00
DCWL	Denmark Community Windfarm Ltd	DCWL_DENMARK_WF1	Intermittent Non-Scheduled Generator	Non-Active	0.695	1.44	2/03/2013 0:00
EDWFMAN	EDWF Manager Pty Ltd	EDWFMAN_WF1	Intermittent Non-Scheduled Generator	Active	28.037	80	1/07/2003 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ALINTA_DSP_01	Demand Side Program	Non-Active			1/10/2014 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ALINTA_DSP_02	Demand Side Program	Non-Active			1/10/2013 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ALINTA_DSP_03	Demand Side Program	Non-Active			1/10/2013 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ALINTA_DSP_05	Demand Side Program	Non-Active			1/10/2013 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ENERNOC_DSP_01	Demand Side Program	Non-Active			1/10/2011 0:00

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
ENERNOC	EnerNOC Australia Pty Ltd	ENERNOC_DSP_02	Demand Side Program	Non-Active			1/06/2012 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ENERNOC_DSP_03	Demand Side Program	Non-Active			1/09/2012 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ENERNOC_DSP_04	Demand Side Program	Non-Active			2/01/2014 0:00
ENERNOC	EnerNOC Australia Pty Ltd	ENERNOC_DSP_05	Demand Side Program	Non-Active			1/10/2015 0:00
ENERNOC	EnerNOC Australia Pty Ltd	KANOWNA_DSP_01	Demand Side Program	Non-Active			1/10/2012 0:00
ENERNOC	EnerNOC Australia Pty Ltd	LAMANCHA_DSP_01	Demand Side Program	Non-Active			1/10/2015 0:00
GLDFLDPW	Goldfields Power Pty Ltd	PRK_AG	Scheduled Generator	Active	59.4	68	1/07/2003 0:00
GRENOUGH	SRV GRSF Pty Ltd as Trustee for GRSF Trust	GREENOUGH_RIVER_PV1	Intermittent Non-Scheduled Generator	Active	2.528	10	9/04/2018 0:00
GRIFFIN2	Bluewaters Power 2 Pty Ltd	BW2_BLUEWATERS_G1	Scheduled Generator	Active	217	217	9/08/2007 0:00
GRIFFINP	Bluewaters Power 1 Pty Ltd	BW1_BLUEWATERS_G2	Scheduled Generator	Active	217	217	15/07/2007 0:00
GRIFFINP	Bluewaters Power 1 Pty Ltd	GRIFFINP_DSP_01	Demand Side Program	Non-Active			1/10/2011 0:00
LNDFLLGP	Landfill Gas and Power Pty Ltd	KALAMUNDA_SG	Scheduled Generator	Non-Active	1.3	1.3	26/01/2011 0:00
LNDFLLGP	Landfill Gas and Power Pty Ltd	RED_HILL	Intermittent Non-Scheduled Generator	Non-Active	2.776	3.64	1/07/2003 0:00
LNDFLLGP	Landfill Gas and Power Pty Ltd	TAMALA_PARK	Intermittent Non-Scheduled Generator	Non-Active	4.213	4.8	1/07/2003 0:00
MBARKER	Mt.Barker Power Company Pty Ltd	SKYFRM_MTBARKER_WF1	Intermittent Non-Scheduled Generator	Non-Active	0.766	2.43	18/03/2011 0:00
MERREDIN	Merredin Energy	NAMKKN_MERR_SG1	Scheduled Generator	Active	82	92.6	31/07/2012 0:00

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
MPOWER	Metro Power Company Pty ltd	AMBRISOLAR_PV1	Intermittent Non-Scheduled Generator	Non-Active	0.431	0.96	26/09/2018 0:00
MUMBIDA	Mumbida Wind Farm Pty Ltd	MWF_MUMBIDA_WF1	Intermittent Non-Scheduled Generator	Active	10.631	55	7/03/2013 0:00
NEWGEN	NewGen Power Kwinana Pty Ltd	NEWGEN_KWINANA_CCG1	Scheduled Generator	Active	327.8	335	1/07/2003 0:00
NGENEERP	NewGen Neerabup Partnership	NEWGEN_NEERABUP_GT1	Scheduled Generator	Active	330.6	342	19/10/2009 0:00
NSFPTNRS	Northam Solar Project Partnership	NORTHAM_SF_PV1	Intermittent Non-Scheduled Generator	Non-Active	4.101	7.753	5/11/2018 0:00
NWMNTMN	Newmont Power Pty Ltd	NWNMTMN_FIM_INML1	Non-Dispatchable Load	Non-Active			1/07/2003 0:00
PERTHNRGY	Perth Energy Pty Ltd	ATLAS	Intermittent Non-Scheduled Generator	Non-Active		0	1/07/2003 0:00
PERTHNRGY	Perth Energy Pty Ltd	GOSNELLS	Intermittent Non-Scheduled Generator	Non-Active		0	1/07/2003 0:00
PERTHNRGY	Perth Energy Pty Ltd	ROCKINGHAM	Intermittent Non-Scheduled Generator	Non-Active	2.022	4	1/07/2003 0:00
PERTHNRGY	Perth Energy Pty Ltd	SOUTH_CARDUP	Intermittent Non-Scheduled Generator	Non-Active	2.954	4.158	1/07/2003 0:00
PERTHNRGY	Perth Energy Pty Ltd	WAPL_WORSLEY_IL1	Non-Dispatchable Load	Non-Active			6/07/2016 0:00
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_01	Demand Side Program	Non-Active			1/10/2011 0:00
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_02	Demand Side Program	Non-Active	19.908		1/10/2011 0:00
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_03	Demand Side Program	Non-Active			30/11/2011 0:00

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_04	Demand Side Program	Non-Active			29/09/2012 0:00
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_05	Demand Side Program	Non-Active			1/06/2012 0:00
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_06	Demand Side Program	Non-Active			1/06/2012 0:00
PREMPWR	Wesfarmers Kleenheat Gas Pty Ltd	PREMPWR_DSP_07	Demand Side Program	Non-Active			1/06/2012 0:00
STHRNCRS	Southern Cross Energy	STHRNCRS_EG	Scheduled Generator	Active	20	23	1/07/2003 0:00
STHRNCRS	Southern Cross Energy	STHRNCRS_IL	Non-Dispatchable Load	Non-Active			1/07/2003 0:00
TIWEST	Tronox Managemen t Pty Ltd	TIWEST_COG1	Scheduled Generator	Active	36	42.1	1/03/2011 0:00
TSLA_GER	Tesla Geraldton Pty Ltd	TESLA_GERALDTON_G1	Scheduled Generator	Non-Active	9.9	9.9	3/08/2012 0:00
TSLA_KEM	Tesla Kemerton Pty Ltd	TESLA_KEMERTON_G1	Scheduled Generator	Non-Active	9.9	9.9	11/09/2012 0:00
TSLA_MGT	Tesla Corporation Managemen t Pty Ltd	TESLA_PICTON_G1	Scheduled Generator	Non-Active	9.9	9.9	27/07/2011 0:00
TSLA_NOR	Tesla Northam Pty Ltd	TESLA_NORTHAM_G1	Scheduled Generator	Non-Active	9.9	9.9	11/09/2012 0:00
WABIOM	Western Australia Biomass Pty Ltd	BRIDGETOWN_BIOMASS_PLANT	Scheduled Generator	Active		40	30/11/2009 0:00
WATERCP	Water Corporation	WATERCORP_DSP_01	Demand Side Program	Non-Active			1/10/2011 0:00
WATERCP	Water Corporation	WATERCORP_DSP_02	Demand Side Program	Non-Active			1/10/2011 0:00
WATERCP	Water Corporation	WATERCORP_DSP_03	Demand Side Program	Non-Active			30/11/2011 0:00
WATERCP	Water Corporation	WATERCORP_DSP_04	Demand Side Program	Non-Active			1/10/2016 0:00
WENERGY	Western Energy Pty Ltd	PERTHENERGY_KWINANA_GT1	Scheduled Generator	Active	109	116	8/09/2010 0:00

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
WGRES	Waste Gas Resources Pty Ltd	HENDERSON_RENEWABLE_IG1	Intermittent Non-Scheduled Generator	Non-Active	1.938	3	1/07/2003 0:00
WPGENER	Synergy	BREMER_BAY_WF1	Intermittent Non-Scheduled Generator	Non-Active	0.151	0.6	11/11/2015 0:00
WPGENER	Synergy	COCKBURN_CCG1	Scheduled Generator	Non-Active	240	249.7	1/07/2003 0:00
WPGENER	Synergy	COLLIE_G1	Scheduled Generator	Non-Active	317.2	318.3	1/07/2003 0:00
WPGENER	Synergy	KALBARRI_WF1	Intermittent Non-Scheduled Generator	Non-Active	0.323	1.6	12/08/2008 0:00
WPGENER	Synergy	KEMERTON_GT11	Scheduled Generator	Non-Active	155	154.7	1/07/2003 0:00
WPGENER	Synergy	KEMERTON_GT12	Scheduled Generator	Non-Active	155	154.7	1/07/2003 0:00
WPGENER	Synergy	KWINANA_GT1	Scheduled Generator	Non-Active		20.2	1/07/2003 0:00
WPGENER	Synergy	KWINANA_GT2	Scheduled Generator	Non-Active	98.5	103.2	13/06/2012 0:00
WPGENER	Synergy	KWINANA_GT3	Scheduled Generator	Non-Active	99.2	103.2	12/05/2012 0:00
WPGENER	Synergy	MUJA_G5	Scheduled Generator	Non-Active	195	195.8	1/07/2003 0:00
WPGENER	Synergy	MUJA_G6	Scheduled Generator	Non-Active	193	193.6	1/07/2003 0:00
WPGENER	Synergy	MUJA_G7	Scheduled Generator	Non-Active	211	212.6	1/07/2003 0:00
WPGENER	Synergy	MUJA_G8	Scheduled Generator	Non-Active	211	212.6	1/07/2003 0:00
WPGENER	Synergy	MUNGARRA_GT1	Scheduled Generator	Non-Active		39.5	1/07/2003 0:00
WPGENER	Synergy	MUNGARRA_GT2	Scheduled Generator	Non-Active		39.5	1/07/2003 0:00
WPGENER	Synergy	MUNGARRA_GT3	Scheduled Generator	Non-Active		38	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT1	Scheduled Generator	Non-Active	31.072	38.5	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT10	Scheduled Generator	Non-Active	110	118.2	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT11	Scheduled Generator	Non-Active	124	130	1/07/2003 0:00

Participant Code	Participant Name	Facility Code	Facility Type	Balancing Status	Capacity Credits (MW)	Maximum Capacity (MW)	Registered From
WPGENER	Synergy	PINJAR_GT2	Scheduled Generator	Non-Active	30.3	38.5	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT3	Scheduled Generator	Non-Active	37	39.3	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT4	Scheduled Generator	Non-Active	37	39.3	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT5	Scheduled Generator	Non-Active	37	39.3	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT7	Scheduled Generator	Non-Active	37	39.3	1/07/2003 0:00
WPGENER	Synergy	PINJAR_GT9	Scheduled Generator	Non-Active	111	118.2	1/07/2003 0:00
WPGENER	Synergy	PPP_KCP_EG1	Scheduled Generator	Non-Active	80.4	85.7	1/07/2003 0:00
WPGENER	Synergy	PPP_KCP_IL1	Non-Dispatchable Load	Non-Active			1/07/2003 0:00
WPGENER	Synergy	SYNERGY_DSP_01	Demand Side Program	Non-Active			1/01/2014 0:00
WPGENER	Synergy	SYNERGY_DSP_02	Demand Side Program	Non-Active			1/01/2014 0:00
WPGENER	Synergy	SYNERGY_DSP_03	Demand Side Program	Non-Active			1/01/2014 0:00
WPGENER	Synergy	SYNERGY_DSP_04	Demand Side Program	Non-Active	37.518		1/01/2014 0:00
WPGENER	Synergy	SYNERGY_DSP_05	Demand Side Program	Non-Active			27/09/2014 0:00
WPGENER	Synergy	SYNERGY_SIMCOA_IL4	Interruptible Load	Non-Active			1/01/2014 0:00
WPGENER	Synergy	SYNERGY_TOWN_OF_KAMBALDA	Non-Dispatchable Load	Non-Active			1/01/2014 0:00
WPGENER	Synergy	WEST_KALGOORLIE_GT2	Scheduled Generator	Non-Active		41.2	1/07/2003 0:00
WPGENER	Synergy	WEST_KALGOORLIE_GT3	Scheduled Generator	Non-Active		23.3	1/07/2003 0:00

Appendix 9: Primary and Secondary Schools in the GVROC Region

The primary and secondary schools are tabulated below by each local Government area.

TABLE 69 - Coolgardie Primary and Secondary Schools

Coolgardie Education Facility	Suburb/ Township	LGA	Category	Type
Coolgardie Primary School	Coolgardie	Coolgardie	Public	Primary
Kambalda Primary School	Kambalda East	Coolgardie	Public	Primary
Kambalda West District High School	Kambalda West	Coolgardie	Public	K-10
Christian Aboriginal Parent-Directed School	Coolgardie	Coolgardie	Non-Government	K-12

TABLE 70 - Dundas Primary and Secondary Schools

Dundas Education Facility	Suburb/ Township	LGA	Category	Type
Norseman District High School	Norseman	Dundas	Public	K-12

TABLE 71 - Esperance Primary and Secondary Schools

Esperance Education Facility	Suburb/ Township	LGA	Category	Type
Esperance Christian Primary School	Esperance	Esperance	Non-Government	Primary
Esperance Anglican Community School	Esperance	Esperance	Non-Government	K-12
Our Lady Star of the Sea Catholic Primary School	Esperance	Esperance	Non-Government	Primary
CAPS Wongutha	Gibson	Esperance	Non-Government	Secondary
Cascade Primary School	Cascade	Esperance	Public	Primary
Castletown Primary School	Castletown	Esperance	Public	Primary
Condingup Primary School	Condingup	Esperance	Public	Primary
Esperance Primary School	Esperance	Esperance	Public	Primary
Esperance Senior High School	Esperance	Esperance	Public	Secondary
Grass Patch Primary School	Grass Patch	Esperance	Public	Primary
Nulsen Primary School	Nulsen	Esperance	Public	Primary
Salmon Gums Primary School	Salmon Gums	Esperance	Public	Primary

Esperance Education Facility	Suburb/ Township	LGA	Category	Type
Scaddan Primary School	Scaddan	Esperance	Public	Primary

TABLE 72 - Kalgoorlie Primary and Secondary Schools

Kalgoorlie Education Facility	Suburb/ Township	LGA	Category	Type
Boulder Primary School	Boulder	Kalgoorlie-Boulder	Public	Primary
East Kalgoorlie Primary School	Kalgoorlie	Kalgoorlie-Boulder	Public	Primary
Eastern Goldfields College	Kalgoorlie	Kalgoorlie-Boulder	Public	Secondary
Eastern Goldfields Education Support Centre	Kalgoorlie	Kalgoorlie-Boulder	Public	Education Support Centre
Hannans Primary School	Kalgoorlie	Kalgoorlie-Boulder	Public	Primary
Kalgoorlie Primary School	Kalgoorlie	Kalgoorlie-Boulder	Public	Primary
Kalgoorlie School of the Air	Boulder	Kalgoorlie-Boulder	Public	K-6
Kalgoorlie-Boulder Community High School	Kalgoorlie	Kalgoorlie-Boulder	Public	Y7-10
North Kalgoorlie Primary School	Kalgoorlie	Kalgoorlie-Boulder	Public	Primary
O'Connor Education Support Centre	Boulder	Kalgoorlie-Boulder	Public	Education Support Centre
O'Connor Primary School	Kalgoorlie	Kalgoorlie-Boulder	Public	Primary
South Kalgoorlie Primary School	Kalgoorlie	Kalgoorlie-Boulder	Public	Primary
Christian Aboriginal Parent-Directed School	Kalgoorlie	Kalgoorlie-Boulder	Non-Government	K-6
Goldfields Baptist College	Kalgoorlie	Kalgoorlie-Boulder	Non-Government	K-10
John Paul College	Kalgoorlie	Kalgoorlie-Boulder	Non-Government	Y7-12
Saint Mary's Primary School	Kalgoorlie	Kalgoorlie-Boulder	Non-Government	Primary
St Joseph's School	Boulder	Kalgoorlie-Boulder	Non-Government	Primary

TABLE 73 - Laverton Primary and Secondary Schools

Laverton Education Facility	Suburb/Township	LGA	Category	Type
Cosmo Newberry Campus (Laverton School)	Laverton	Laverton	Public	
Laverton School	Laverton	Laverton	Public	K-11
Mount Margaret Remote Community School	Mount Margaret	Laverton	Public	K-6

TABLE 74 - Leonora Primary and Secondary Schools

Leonora Education Facility	Suburb/Township	LGA	Category	Type
Leinster Community School	Leinster	Leonora	Public	K-11
Leonora District High School	Leonora	Leonora	Public	K-12

TABLE 75 - Menzies Primary and Secondary Schools

Name	Suburb/Township	LGA	Category	Type
Menzies Community School	Menzies	Menzies	Public	K-12

TABLE 76 - Wiluna

Name	Suburb/Township	LGA	Category	Type
Wiluna Remote Community School	Wiluna	Wiluna	Public	K-12

TABLE 77 - Ngaanyatjarra Primary and Secondary Schools

Ngaanyatjarra Education Facility	Suburb/Township	LGA	Category	Type
Blackstone Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Jameson Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Kiwirrkurra Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Ngaanyatjarra Lands School	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Tjukurla Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-10
Tjunttjuntjara Remote Community School	Ngaanyatjarra	Ngaanyatjarra	Public	K-11
Wanarn Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Warakurna Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Warburton Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12
Wingellina Campus (Ngaanyatjarra Lands School)	Ngaanyatjarra	Ngaanyatjarra	Public	K-12

TABLE 78 - Ravensthorpe Primary and Secondary Schools

Ravensthorpe Education Facility	Suburb/Township	LGA	Category	Type
Hopetoun Primary School	Hopetoun	Ravensthorpe	Public	Primary
Jerdacuttup Primary School	Jerdacuttup	Ravensthorpe	Public	Primary
Munglinup Primary School	Munglinup	Ravensthorpe	Public	Primary
Ravensthorpe District High School	Ravensthorpe	Ravensthorpe	Public	DHS