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Western Tasmania Export Corridor Plan

Department of State Growth

Report

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Commercial in confidence information: The information in this report has been collected through detailed interviews with industry, peak organisations and infrastructure providers. The information collected includes both business-related data and the confidential views of participants. Confidentiality of discussions and the aggregation of data and views were key components supporting stakeholder participation.

Document history and status

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2	23 June 2015	Revised structure	SM	State Growth	
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10	22 February 2016	Final Report	KE/ SM	Andrew McConachy	
11	1 August 2016	Final Report	KE	State Growth	

Contents

Executive Summary

Introduction and background

The Department of State Growth is developing the Western Tasmania Export Corridor Plan with support from the Australian Government's Regional Infrastructure Fund. This project was designed to identify and prioritise solutions to supply chain constraints that affect the productivity and competitiveness of Tasmania's mining industry and other industries using freight transport infrastructure in the region.

The Department engaged Jacobs to provide important inputs to the overall plan, focussing on:

- Improved understanding of mineral and related supply chains – in particular how they work; why they are as they are, and constraints that limit performance and opportunities for improvement
- Assessment of port storage, ship loading and port capacity for bulk mineral tasks at Burnie and other relevant Tasmanian ports, using three outlook scenarios: current, medium growth and step change

This work had two main phases, with an initial phase focussing on supply chain mapping, assessment of constraints and determination of current port system capacity; and the second on a preferred model for bulk mineral export flows through Burnie port, prioritised supply chain solutions for identified opportunities and constraints, and assessment of potential for private sector investment in bulk commodity infrastructure.

The project drew on data and information from the 2011 Western Tasmania Industry Infrastructure Study, the 2011-12 Tasmanian Freight Survey and an extensive program of industry discussions. Infrastructure owners and managers including State Growth Roads Division, TasPorts and TasRail were key stakeholders.

Supply chain types

This study investigated the supply chains which are used in Western Tasmania:

- Bulk product by rail to Burnie port
- Bulk product by road to Burnie port
- Containerised product by road to Burnie port
- Bulk product by road to Burnie port, containerised at Burnie
- Product in slurry format to Port Latta

In general, the supply chains used by the various mining companies are appropriate to their needs, and are efficient within limitations imposed by terrain, road and rail infrastructure and port facilities.

Demand Scenarios

This study devised three scenarios for possible demand for supply chain capacity from current and potential mineral producers:

1) Current – existing operating mines with limited projected incremental growth
2) Medium growth – operations included in Scenario 1 with moderate growth, plus mines in care and maintenance which are likely to reopen and some small-medium new mines commencing export operations
3) Step change – operations included in Scenario 2 plus a new large mine coming online

Road, rail and port capacity was assessed under each of these scenarios.

Key findings

The key findings from this study are:

Existing road and rail capacity will be adequate to meet anticipated demand for mineral movements from Western Tasmanian to Burnie port until the end of the outlook period in 2028, and most likely for substantially longer under the current and medium growth outlook scenarios evaluated.

The only caveat is that should two or more of the high volume iron ore prospects come to fruition at the intended 1 million tonnes per annum (Mtpa) each, this will exceed current rail capacity, assessed at 1 Mtpa. It would also place substantial stress on the storage and shiploading capacity at Burnie, and would require port development to accommodate larger dry bulk mineral vessels. However, the scenario analysis assumes that this is unlikely within the outlook period.

The potential for new, high-volume mining developments in the region which would significantly increase supply chain demand will require specific infrastructure planning and development to provide necessary capacity should these prospects appear likely to come to operational reality.

Demand for port capacity is within 100,000 tpa of exceeding the existing capacity of 2 Mtpa at Burnie port under the step change scenario in later years.

The first real capacity constraints that are most likely to be encountered (in the sense that volumes exceed capacity over an extended period) are expected to be:

- The mineral storage shed becoming inadequate to hold sufficient stocks to meet likely desired increases in shipment parcel size or additional product lines
- Bulk mineral shiploader capacity inadequate to meet demand

The shiploader at Burnie port is a key supply chain impediment, and one that needs to be addressed over the medium-term, as the unit is generally agreed to be nearing the end of its reliable economic service life.

Storage for bulk minerals at Burnie port is limited to around 126,000 t in a two section storage shed with 9 compartments. This is likely to impose constraints if demand to accommodate additional products arises, or if mining companies seek to increase the average size of shipment parcels.

There are no other mineral storage facilities at Burnie port, the storage location preferred by all miners. Developing further storage would require a substantial rearrangement of berth utilisation by various commodities and trades to accommodate additional storage.

State investment in facilities to increase capacity needs to be tied to financial arrangements that ensure that potential users make an appropriate contribution to investment costs over the planned and expected life of the facilities developed.

In conclusion

The issues facing the mineral export supply chain from Western Tasmania in the short to medium term will focus on achieving greater efficiency, rather than developing strategies to cope with greater volumes. Demand from greater volumes will come over time, but this will be tied to the world demand for Tasmania's mineral products, assessed against the quality, convenience, reliability and cost of alternatives. When this situation returns, the key will be to have fundamental infrastructure in place, but to avoid over investing in anything that is purpose specific in the meantime.

Recommendations

There are a number of individual recommendations to increase capacity and improve efficiency, however it is noted that most are related, and the greatest outcomes will be achieved by considering a range of measures together. Port planning is central to longer term opportunities for increasing capacity and consideration of any infrastructure investment should be tied to demand.

The key recommendations from this study are:

1. Actions to plan for increasing mineral supply chain capacity and efficiency in the short term

- Additional supply chain capacity at Burnie port – to accommodate forecast scenario growth:
  - Investigate alternative arrangements to increase flexibility in configuration of the mineral storage shed to maximise efficiency
  - Review mineral storage shed charging arrangements and investigate modifications to provide incentives to improve efficiency of throughput
  - Investigate installing an undercover truck unloading facility outside the mineral storage shed, and associated conveyors
  - Investigate installing conveyors from truck loading facility to the shiploader inflow to enable direct loading from road deliveries
- Improving the efficiency of supply chain operations – landside
  - Investigate establishing HPV routes to Burnie port from container filling locations
  - Investigate establishing dry bulk mineral container filling and storage areas at Burnie port
  - Investigate establishing a multi-trailer truck decoupling and assembly facility at end of HPV/HML areas

2. Longer term opportunities for efficiency improvement and capacity increase

- Investigate options for replacement of the minerals shiploader. Planning for replacement of the shiploader needs to consider:
  - Demand for shiploading capacity
  - Cost
  - Capacity provided and overall total loading speed
  - Ability to meet present and possibly more stringent future environmental conditions
  - Flexibility to handle the range of vessel sizes, shipment parcel sizes, mineral densities, particle sizes, degree of abrasiveness and similar characteristics
  - Mobile versus fixed infrastructure, which also influences flexibility and capacity for both minerals and other commodities at the berths
  - Scalability – the ability to cost effectively handle the possible range of throughput quantities which could arise over the life of the equipment

This assessment process needs to be linked to the agreed overall outlook scenarios for likely demand over time, and must consider the overall port development planning process, including accommodation of various commodities and trades at the berths and location and size of storage facilities.

- Plan for staged development at Burnie port to meet future mineral demand. Planning should consider:
  - Accommodating panamax or larger ships
  - Storage and handling capacity structured for shipment parcel sizes from 3,000 t to 80,000 t
  - Requirements for other commodities at the port

3. Opportunities for increased coordination of supply chain activities

- Consider establishing links with NQRSC to understand how coordination initiatives work and their potential application to Tasmania, if there is a large increase in demand for infrastructure

1. Introduction

1.1 Background

Tasmania is one of the most highly and diversely mineralised areas in the world, with extensive high grade mineral deposits. Most of the major active and prospective mining operations are located in Western Tasmania. Major minerals extracted include copper, gold, lead, magnetite, silver, tin, zinc and ultra-high purity silica flour. In general, these are high value but relatively low volume commodities when compared with Australia's largest mineral exports such as iron ore and coal.

Tasmanian mineral exports are mostly in concentrate form, with some minerals being processed to achieve higher levels of value adding within the state. The Western Tasmania region also has important and growing aquaculture and tourism industries, plus significant forest resources. Dairy is increasing in importance particularly in the north west of the state.

Most mineral deposits support long-lasting operations, but with small tonnages, typically less than 200,000 tonnes per annum (tpa). When these operations are combined across the region the volume of freight becomes significant. New mining licences and transport permits indicate some higher volume but shorter life operations are emerging and need supply chain capacity planning and investment assessment and management.

There are some substantial newer operations currently in production or in development. While Grange Resources has a privately owned and operated supply chain, including a slurry pipeline to Port Latta, other existing and prospective volumes either use or are expected to use the road and rail systems and Burnie port. The current minerals export market is forecast to grow into the future with new mining permits granted and projects developed, notwithstanding current weakness in global commodity prices. This forecast volume growth is expected to place pressure on existing port storage and shiploading capacity.

In response to these issues, the Department of State Growth is undertaking the Western Tasmania Export Corridor Plan (WTECP) with support from the Australian Government's Regional Infrastructure Fund, which aims to identify and prioritise potential solutions to supply chain constraints that affect the productivity and competitiveness of the mining industry and economic development in the region more broadly.

The WTECP will build on the Western Tasmania Industry Infrastructure Study (WTIIS) undertaken in 2011, which developed and prioritised recommended infrastructure projects for Western Tasmania to encourage and support economic development in the region[1]. The WTIIS included an audit of existing infrastructure and condition, its current utilisation, a review of industry operations and development plans, plus an assessment of a range of potential infrastructure projects in the region. The WTIIS identified mining as the major user of infrastructure in Western Tasmania, with transport clearly identified as the key infrastructure development priority to address current and likely future deficiencies, particularly for export commodities. A number of the projects identified in the WTIIS have been funded, including upgrades on the Murchison Highway.

Jacobs was engaged by the Department of State Growth to assist with two components of the WTECP:

1. Supply chain analysis: improved understanding and outcomes
2. Storage, ship-loading and port capacity for bulk mineral tasks

[1] http://www.stategrowth.tas.gov.au/infrastructure/strategy/west-tas-study Accessed 19 May 2015

1.2 Western Tasmania region freight task

The Western Tasmania region[2] is Tasmania's largest freight generating region, containing the State's highest volume container ports at Burnie and Devonport, major agricultural processing, mining and industrial sites, and significant areas of primary agricultural and forestry production.

The region has an extensive State and local government road network, supported by rail links to the west coast, and to Railton, and inter-regionally to the northern and southern regions. Major ports at Burnie and Devonport facilitate container and bulk movements, and act as intermodal hubs.

1.2.1 Mining and Minerals Industry

The mining industry is a key economic driver for Tasmania, contributing almost 50% of Tasmania's export earnings and providing employment for over 3,500 people[3]. The sector also provides the majority of non-government employment in Western Tasmania.

Most of Tasmania's active and prospective mining operations are located within the Western Tasmania region, where mineral production has underpinned the development of local communities for more than a century. Western Tasmania is one of the most highly and diversely mineralised areas in the world and has extensive high grade mineral deposits. Predominantly, these minerals are exported to domestic and international markets, with some processing within the State. Mining ores comprise approximately 8% of the region's intra-regional freight task.

Major minerals mined in Western Tasmania include ores and concentrates of iron, copper, lead, zinc, tin, silica and tungsten. Lower volume, high-grade commodities include gold and silver.

Tasmania produces approximately 3 million tonnes of metal ores or concentrates each year, the majority from Western Tasmania. Most mineral deposits support long-term mining operations, producing annual outputs of between 20,000 and 200,000 tonnes. Grange Resources is the State's largest single mining operation, producing over 2 Mtpa. A number of prospective mines have anticipated volumes at or over 1 Mtpa.

Globally, the mining industry is cyclical, driven by demand and commodity prices. With prices typically set on a global exchange, the Australian exchange rate can fluctuate considerably, affecting the viability of mining operations.

The Western Tasmania mining industry has experienced mixed outcomes in recent times. One of the region's largest and long-term operations, Copper Mines of Tasmania in Queenstown, moved into care and maintenance in 2014, with plans to recommence mining in 2016. Unity Mining's Henty Gold mine moved into care and maintenance in late 2015. New operators Shree Minerals and Venture Minerals have both suspended plans for exports or further development of their respective mine sites.

While a number of new and potentially very large mines are currently in the planning stage, timing is dependent on the economics of each development.

1.2.2 Agriculture

Agricultural products including raw milk, fresh vegetables and live animals comprise the largest intra-regional commodity group at 31%. Recent investment in aquaculture facilities has seen this industry expand significantly. Supporting primary production there are several major dairy, vegetable and livestock processors located on the North West for which inputs are not only sourced within the Western Tasmania region but are also transported from the Northern Tasmania region for processing and export.

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[2] For the purposes of the Western Tasmania Export Corridor Plan, the Western Tasmania region includes the local government areas of Latrobe, Devonport City, Kentish, Central Coast, Burnie City, Waratah-Wynyard, West Coast and Circular Head in Northwest and Western Tasmania.

[3] http://www.brandtasmania.com/minerals-and-mining/ Accessed 22 June 2015

1.2.3 Forestry

While the forestry industry has undergone recent structural change, the Western Tasmania region contains significant plantation resources. Forico has recently restarted production at the Surrey Hills Mill with export through Burnie Port. The north-west region produced 550,000 tonnes of logs in 2011-12, and an increase in the overall forestry freight task is expected with the opening of Forico's operation.

1.3 Western Tasmania's freight transport infrastructure

The extensive transport infrastructure in Western Tasmania is largely suited to the tasks it services. Existing infrastructure is adequate to meet current capacity, and upgrades will be targeted to meet safety and efficiency needs over the long-term.

Port development is a key issue for the region, with the Tasmanian Government's Integrated Freight Strategy identifying a number of priority actions around Burnie port, including identifying final options to replace the shiploader and developing a bulk freight port investment prioritisation plan.

Mining and minerals exports from Western Tasmania utilise three infrastructure pathways: road, rail, and pipeline.

1.3.1 Ports

Burnie port is Tasmania's largest port, handling over 2.9 million export tonnes in 2014-15 or 39% of the State's total freight task, including ores and concentrates from mines located in the north-west region. The mineral task represents approximately 20% of exports from Burnie port. Burnie port also handles the largest proportion of the Tasmanian container task at 52% of total container throughput, and around 40% of forestry products. The State's only minerals concentrate loader is located at Burnie port.

The Devonport port handles a variety of freight as well as passengers through TT-line. Small quantities of inputs for the mining industry come through Devonport, however it is not utilised for bulk mining exports.

Uniquely, Grange Resources utilises its privately owned infrastructure pathway. Iron ore slurry is piped from Savage River to Port Latta where it is processed, stored and loaded onto ships. In 2011-12, 2.4 million tonnes was moved this way, representing around 70% of the mining freight task in Western Tasmania.

1.3.2 Road

The Ridgley Highway, Murchison Highway, Zeehan Highway, Anthony Main Road, Lyell Highway and Henty Main Road form Western Tasmania's major road corridor supporting the mining freight task. The Bass Highway provides the main road corridor to Burnie from North Western Tasmania. Key regional links are provided by local government including Trowutta Road and Irishtown Road. These routes are included in the Tasmanian approved B-double route network. Although on some roads the geometry is a constraint to allowing larger and heavier trucks to be used, the Department of State Growth also allows vehicles with higher mass limits on some roads where appropriate.

The Ridgley Highway carried approximately 0.6 Mtpa in 2011-12, while the Bass Highway between Smithton and Burnie carried approximately 1.8 Mtpa.

The road network generally meets the needs of exporters, although there are a number of challenges. The roads traverse mountainous terrain and are subject to ice and snow. Temporary road closures can occur during the winter months due to snow falls. Many roads are narrow with highly constrained alignments and inadequate superelevation. In addition to being used by heavy vehicles, the roads provide a commuting function for people working within the region and cater for increasing numbers of tourists.

Works to the Murchison Highway commenced in 2012-13 as part of a coordinated program upgrading the Highway as a high productivity vehicle (HPV) route. Works to date total $8 million, with a further $6 million of works programmed under Roads for our Future. This work is occurring in stages and is due to be completed by

2017-18. Improvements are also being made to roads around Strahan to support the growing aquaculture industry.

1.3.3 Rail

The dispersed locations and sometimes short operational life of mines means that it is not economically viable to provide a direct rail connection to many deposits. However, the rail line between Melba Flats and Burnie port (the Melba Line) is utilised by the mining industry, carrying approximately 200 ktpa currently.

Similar to the road network, the capacity of the rail network is influenced by the challenging terrain with tight curves and steep ruling gradients. Rail operations are subject to the same extreme weather as road infrastructure. There are limits on train lengths with the single bi-directional track network and length of passing loops. Axle load limits are restricted to 16 tonnes per axle and there are some speed restrictions on the track.

TasRail has undertaken substantial maintenance work on the Melba Line, concentrating on track, sleeper and ballast works in higher derailment risk locations and sections with tight curves. TasRail has an upgrade program underway which will increase average running speeds and is expected to be completed by 2019. Track upgrades will include continuous rail welding, some rail renewal, some sleeper renewal and maintenance work on bridges and culverts.

1.4 Western Tasmania supply chains

Freight supply chains are a key part of most businesses. For price sensitive operations located substantial distances from their markets, cost-effective supply chains are critical. Understanding how Western Tasmania's bulk freight supply chains operate, and identifying productivity and efficiency improvements that positively influence industry development is essential to supporting industry development over the long-term, and infrastructure and supply chain investment that is appropriate to freight demand.

2. Objectives and approach

2.1 Objectives

This project's objectives were:

1) **To achieve improved understanding and outcomes of supply chains used by the mining and minerals industry:**
   - Map export bulk commodity supply chains from freight origin to customer (where possible)
   - Develop informed, future freight demand scenarios based on knowledge of the factors affecting future export freight volumes
   - Focusing primarily on bulk mineral exports, identify supply chain constraints at a regional level, within infrastructure classes and for key producers. Work with key stakeholders to identify potential solutions for priority constraints.
   - Test market willingness for private sector investment in future supply chain improvements
2) **To assess future freight demand, infrastructure capacity and supply chain interactions at northern Tasmanian ports, focusing primarily on Burnie port:**
   - Review existing bulk commodity facilities and major users of the port, considering key supply chain needs such as:
     - Storage (including in relation to adjacent land uses)
     - Access routes to ports (roads, rail and pipelines)
     - Berths and shiploading
     - Ship size and scheduling
   - Analyse the maximum and optimum freight volumes that could be reliably handled through current supply chains, using existing infrastructure investment and considering product interaction
   - Develop a preferred model for the long-term management of bulk mineral export flows through Burnie port, including examining opportunities to reconfigure and develop port-landside interface infrastructure
   - Identify opportunities for improved coordination of operations, planning and investment for port related bulk commodity infrastructure
   - Identify opportunities for private sector investment in bulk commodity infrastructure

2.2 Approach

The study was based on analysis and extensive stakeholder consultation including:

- Key infrastructure providers
- Current and potential future mining operators
- Other bulk commodity producers using the same infrastructure
- Companies providing logistics and transport services
- Organisations with knowledge of the bulk minerals industry

The discussion checklist used is included in Appendix A and stakeholders consulted are listed in Appendix B. Confidential notes from these discussions were provided to interviewees for review and update as desired.

3. Mineral export supply chains in Western Tasmania

3.1 Mineral export supply chain principles

A company's supply chain is the set of activities and resources put in place to move goods produced to their customers, in accordance with the supply chain service standards and agreements with individual customers, at minimum cost and with the greatest level of reliability. The supply chain preferences of customers may not be the same as the supplier's, although frequently the method used suits both supplier and customer, as it is the most efficient and lowest cost approach. If there are differences in preferences then these need to be resolved by negotiation.

Supply chain decision making is nearly always concerned with trade-offs – for example:

- Transport cost against speed and reliability of delivery
- Location of product storage considering cost versus speed and convenience for access
- Minimising damage, losses and waste against costs of improved packaging and handling approaches

Total supply chain costs in Australia, including in Tasmania, typically make up the following percentages of total expenditure:

- 5-7% for companies which import and distribute products
- 12–15% for manufacturing industries
- <5% to >75% for mineral export companies, depending on the land transport distances and methods used, and on the complexity of other operations. The lower end of this range includes conveniently located companies with highly complex production processes (eg metal smelting and refining) or small production quantities (eg gold and silver). At the higher end of the range are mines in remote and difficult to access locations with simple extraction processes and long or complex supply chain arrangements to market.

Many mining companies find it difficult to accept the comparison of land based logistics costs for relatively short distances, which may be three times the sea based costs for much longer distances.

Mineral producers and exporters are price takers, not price setters. The price they receive is generally based on international market prices, such as the London Metals Exchange, and is paid upon delivery to a defined point in the customer's inwards supply chain, commonly in the ship at the customer's preferred port, or to the customer's receival hopper, or in containers delivered to the customer's premises. This means that supply chain costs are nearly always borne by the producer or supplier – and so there is incentive to minimise these costs, because savings achieved make the product more competitive against alternative suppliers, and go straight to the producer's profit margin.

Minerals can be supplied in various formats of packaging with the most common forms being in bulk (loose), bulk in shipping containers, or in bulka bags (Figure 3.1). The packaging format used is mostly dictated by the customer, and their requirements are primarily determined by:

- The largest vessel that can be accommodated at the destination port
- The volume of minerals required and processed
- The type of materials handling infrastructure at the customer's plant – in particular whether it is set up to handle product in bulk, in shipping containers, in bulka bags or in another format
- The relative value of the minerals concerned. The higher the value, the more benefit arises from more frequent ordering of smaller parcel sizes, to minimise inventory holding costs.

The packaging format used for minerals is generally highly influenced by the required shipment parcel size.

- Shipments of less than 100 t will generally be handled in bulka bags, most commonly packed into containers or shipped as break bulk cargo. Bulka bags will typically weigh 1.0 – 1.8 t each, depending on density of product and limitations of handling equipment between producer and customer.

- Shipments of a few hundred tonnes will generally be bulk in shipping containers, with 20' general containers suiting the high density of most mineral commodities. Road loading limits in most countries, including Tasmania, effectively limit containers to around 28 t gross, enabling typically 26.5 t of products[4].
- Larger shipments will generally be in bulk, generally with rail or road movement to port, via open stockpiles or storage sheds to bulk holds in purpose designed ships. For mineral concentrates, shipping parcel sizes are most commonly in the range 10,000 – 15,000 t but vary according to the customer's consumption rate and storage capacity, and value of the commodity. The maximum ship size that can be accommodated sets the ceiling for the maximum shipment parcel size at all ports.

Figure 3.1 : Bulka bags

Shipping by nature is lumpy – large quantities occasionally, rather than the smooth consistent volumes that suit most production plants and transport solutions with fixed resources. This introduces the need for storage – to accumulate the quantity required for the shipping parcel size, and at the customer's receival location.

Determining the best location for holding mineral production before shipment requires consideration of trade-offs – storage cost against availability for loading and reliability to meet customer needs, and avoiding delaying ships, which can be expensive. In practice, the following are the main considerations:

- Keeping product dry if this is required. There is no point in paying for storage sheds or air tight storage if this is not needed but wet product can be unsaleable and the cost of transporting excess moisture in the product can also be considerable.
- Having adequate storage at the port to minimise the chances of delaying ships is a general principle most minerals companies follow. Storage for around 120 – 150% of the quantity required for typical shipments is common practice. More will be held at the port when shipments are closer together than the routine schedule. The delivery rate achievable to the port will be limited by available trucks or trains, and so greater stock build up will be needed to avoid delaying subsequent shipments.
- Storage at the mine site will generally be the least cost, if space is available, but frequently it is not. Mine developers generally minimise the land sought for leasing to make the project appear small and less likely to attract environmental or other opposition.
- Storage anywhere other than at source (mine) or destination (port) will nearly always be more expensive, due to the additional handling costs involved.
- If the product is to be shipped in containers, it can be stored in the containers. This attracts additional container leasing costs and raises the issue of where to containerise the product, and where to store the full containers. If the containers are filled at the mine, equipment to do this is required, which will mostly be idle, and so this filling operation may cost less to perform at the port or at a transport company, where

[4] The general mass limit for the largest general access vehicle in Tasmania, six axle semitrailers to 19 m, is 42.5 t (see the Tasmanian Heavy Vehicle Driver's Handbook, p 77 http://www.transport.tas.gov.au/__data/assets/pdf_file/0007/109636/Heavy_Vehicle_Handbook.pdf Typical tare weights of prime movers are 9.5 t and trailers 5.0 t, leaving 28 t for total weight of goods carried. 20' containers typically weigh 1.5 t empty, leaving 26.5 t for mineral payload in a container on a semitrailer.

equipment can be shared among a number or users. Where containers are used, an additional consideration is the return supply and storage of empty containers.

This summary of general principles has been drawn from understanding of individual mining company supply chains as well as general industry knowledge and experience.

3.2 Mineral supply chain types and components

All mineral supply chains have various ways of performing the following steps from the point where the mine's production is ready for despatch from the mine, to loading in the ship's hold:

- Stockpile accumulation at the mine
- Transport loading
- Linehaul to port
- Unloading and stockpiling ready for ship loading
- Ship loading

Mining companies generally have little involvement once their product is loaded onto the ship. The shipping company controls activities during sailing, and the customer generally controls activities once the product arrives at their preferred port. Most mining companies and their customers use shipping agents as experienced liaison intermediaries to manage and carry out shipping arrangements on a day to day basis including liaising with all the organisations involved in one way or another. This includes shipping lines, stevedores, port authorities, Australian and overseas government departments responsible for customs, quarantine, taxes and duties and similar functions.

Each mining and mineral company's operation in Tasmania has supply chain arrangements that are designed to meet its needs and those of its customers at an acceptable level of quality, reliability and safety, at minimum cost. While each supply chain has unique aspects relating to the location of operations, the quantity and format of production and pack types for production (eg dry bulk, containerised, slurry, palletised etc), the format and origin of inputs, and the requirements of customers, there is a relatively small number of base supply chain types. These supply chain types are primarily characterised by:

- Commodity format: typically dry bulk powder or small to medium lumps
- Pack type: typically bulk (that is, loose), bulk in containers, in bulka bags or slurry
- The overall volume: the greater the volumes, the more suitable bulk options become
- Transport mode for the main linehaul journey (rail, road, pipeline etc)
- Destination of production: which port or other location

3.3 Mineral export supply chains in Western Tasmania

The scope of this study focuses on export mineral supply chains in Western Tasmania, with export through ports on the north west coast, which make up the majority of mineral production and movements in Tasmania. There are two ports primarily used for exports:

- Burnie port
- Grange Resources' privately owned Port Latta

There are a number of transport links between mining areas and these ports used for minerals and ores, with the primary ones being:

- The Melba rail line from Melba Flats to Burnie port
- The Murchison, Zeehan and Ridgley Highways and Anthony Main Road, linking mining areas to Burnie port
- The Grange Resources slurry pipeline linking their Savage River operations with Port Latta

The general location and arrangements of these primary infrastructure components are shown in the following figures, with Figure 3.2 showing the location of current mining operations and Figure 3.3 showing identified prospective mining operations.

The following supply chains are used in Western Tasmania:

- Bulk product by rail to Burnie port
- Bulk product by road to Burnie port
- Containerised product by road to Burnie port
- Bulk product by road to Burnie port, containerised at Burnie
- Product in slurry format to Port Latta

These supply chains are described in more detail in Appendix C.

The key drivers for supply chains in Tasmania are proximity to infrastructure, volumes and haul length and the product packaging requirements of the customer. The use of rail is dependent on a number of issues including proximity to rail infrastructure. Double handling costs can create challenges for rail to compete with road transport, particularly for lower volumes and shorter haul distances.

Environmental factors are also a key driver for some products. Careful management is required for the transport of some concentrates and rail transport can be preferred over the risks posed by road transport in this case.

Bulk product by road is typically used where rail alternatives are not available nearby and for shorter haul distances.

Containerised product tends to suit lower volumes. Road transport is generally more cost effective than rail transport for containers unless haul distances are very long (exceeding 1,000 km) or volumes high (exceeding say 2,500 containers per annum). All containerised transport in Western Tasmania is by road. Road haulage by containers can be used for higher volumes where the same vehicle can be used for moving inwards goods to the mining operation, reducing transport costs through two way loading of the same vehicle. Where customers seek minerals in containers to suit their plant's materials handling infrastructure and volumes, it will be necessary to supply minerals in this packaging format.

Grange Resources has established a privately owned slurry pipeline to move iron ore from its Savage River mine to its processing plant at privately owned Port Latta. This allows Grange Resources to have complete control over its supply chain.

Port Locations
Road Network
Rail Line
Slurry Pipeline
Current Mining Operations
Rail Mineral Loading Sites

N

August, 2015

PROJECTION - MGA Zone 55
DATUM - GDA94

FIGURE 3.2
CURRENT MINING OPERATIONS

1:1,000,000

0 12.5 25 50
Kilometers

Source: Department of State Growth, Mineral Resources Tasmania and Jacobs

Port Locations
Slurry Pipeline
Mining Prospects
Rail Mineral Loading Sites
Road Network
Rail Line

N

August, 2015

PROJECTION - MGA Zone 55
DATUM - GDA94

FIGURE 3.3
PROSPECTIVE MINING OPERATIONS

1:1,000,000

0 12.5 25 50

Kilometers

Source: Department of State Growth, Mineral Resources Tasmania and Jacobs

3.4 Supply chain aggregation and coordination

3.4.1 Supply chain aggregation

Supply chain aggregation involves one company making use of facilities or services operated by another, or more than one company jointly engaging service providers to handle both companies' needs with a common set of facilities, equipment and processes. The approach is to achieve improved economies of scale, reducing costs to all. Rail services where more than one company's production is on one train, or a company processing its ore through another's plant are typical examples. These can be successful where one company has spare capacity, and another has small quantities of material or production which are difficult to transport or process efficiently.

It is generally difficult for anyone other than the parties which could be directly involved to identify the opportunity or negotiate an arrangement to a successful outcome. These sorts of arrangements are relatively uncommon other than simple sharing of transport equipment, because the need and potential have to line up very closely, including geographic locations, commodity types and specification, quantities and so on. Many mining companies have a strongly independent approach, preferring to be totally in charge of their own destiny. There are many examples where companies with substantial spare capacity reject paid offers from others to use their equipment, because the risk of the facility owner not being able to have unfettered access whenever they choose is assessed as outweighing the revenue benefit.

Potential for greater aggregation in Western Tasmanian operations is probably confined to improving port road receival arrangements, storage and shiploading arrangements. However, all of these will involve relatively substantial expenditure, and the likely benefit must be assessed against costs incurred, and how these are recouped and an appropriate return earned. Most mining companies prefer improvements in supply chain efficiency and access to larger vessels which lead to lower freight costs.

3.4.2 Supply chain coordination

Supply chain coordination refers to an independent organisation charged with managing a generally complex set of supply chains involving a number of producers, transport service suppliers and port facility operators to maximise the total benefit of all involved. The Hunter Valley Coal Chain Coordinator[5] (HVCCC) is the best known, and arguably the most successful example, but there are similar examples at Hay Point, Dalrymple Bay and Gladstone coal terminals. Supply chain coordinators demonstrably work best when the following circumstances are present:

- Very high volumes of product being handled – typically 100 Mtpa or more
- Many producers sharing capacity constrained facilities (HVCCC has 21 colliers)
- Complex rail operations with numerous loading points, several rail lines funnelling into one or a central port terminal, and several above rail operators
- Several independently owned and operated parts of the supply chain infrastructure, commonly:
  - Below rail owner and access controller
  - Above rail train operators
  - Port mineral terminals receiving, storing, blending and despatching parcels of product
  - Port authority port operator.
- Situations where demand for mineral capacity exceeds supply, and companies have not developed their own mechanisms for working together optimally.

We are unaware of any coordination organisation that has been successful in reducing costs in circumstances when capacity exceeds supply and or when deteriorating commodity trading conditions is threatening to make existing operations unviable. The coordination body itself imposes another layer of management with attendant costs. Without benefits from success in squeezing more production through a constrained system and huge

5 https://www.hvccc.com.au/Pages/welcome.aspx Accessed 25 October 2015

volumes over which costs can be spread, coordination regimes are typically unsuccessful and do not retain the producers' confidence and preparedness to financially support them.

In the present circumstances, we cannot see a role for a supply chain coordination function bringing benefit for Western Tasmania, other than current informal arrangements applying between mining companies, TasPorts, TasRail and road transport companies bringing minerals to Burnie port.

3.5 Key observations and findings

The following observations are made about mineral export supply chains in Western Tasmania:

- The majority of bulk mining product moved on public infrastructure is transported by road to Burnie port
- The use of rail is linked to proximity to a rail loading facility. At present, there is one at Melba Flats, another at MMG Rosebery and one was planned for Venture Minerals' iron ore operation at Bastyan Dam.
- TasRail operates a 'pit to port' model for customers, which can include coordinating road deliveries to rail storage and loading facilities, operation of rail storage and loading facilities, rail linehaul, rail unloading, bulk mineral storage, road receival at bulk mineral storage facilities and shiploading. This gives TasRail substantial potential to effectively coordinate supply chain activities on the corridor.
- Burnie port has very limited storage space for containers. This lack of storage increases costs from moving the containers between mine, interim storage yard and port.
- Most supply chains operate efficiently. There are targeted opportunities for improvements that deliver benefits across supply chains, including storage and truck unloading at the port and road freight consolidation sites.
- There are not generally many real opportunities for mining companies to change their supply chain arrangements, including through aggregation or coordination – proximity to key infrastructure and production volumes generally limit alternatives and determine the best option
- The highest priority for most mining companies was reducing supply chain costs rather than other improvements such as infrastructure upgrades
- Based on current volumes and the type and location of individual mines, there is little need or opportunity for region wide aggregation across supply chains. There may be opportunities for enhanced supply chain coordination at Burnie port, particularly focussing on increasing storage and shiploader capacity and reliability.

4. Capacity analysis of land transport infrastructure and port facilities

4.1 Rail to Burnie port from Western Tasmania

4.1.1 Rail infrastructure

TasRail's rail infrastructure relevant to Western Tasmanian mineral operations is summarised in Figure 4.1. The principal infrastructure consists of:

- The **Melba Line** from Melba Flats to Burnie, which provides rail services for bulk minerals to Burnie port
- The **Hellyer spur line**, an 11 km spur line which ran from Hellyer mine to the eastern boundary of the Melba Line at Moorey Junction. This line is non-operational.
- The non-operational **Wiltshire Line,** which connects Burnie to Wiltshire, near Port Latta

The **Melba Line** passes through the townships of Rosebery, Hampshire, Highclere and Ridgley. It includes the rail loading facilities at Melba Flats and MMG Rosebery. It also passes immediately adjacent to Bluestone Mines JV operations at Renison Bell, but is not used by Bluestone Mines.

The Melba Line has a single bi-directional rail track for most of its length, with passing loops of approximately 650 m clear stand at Ridgley, Guildford and Boco. There is a loading siding at MMG Rosebery at which other trains can pass. There are two holding tracks at Burnie available for mineral trains.

The Melba Flats rail loading facility was refurbished in 2014[6] and provides an internal road truck unloading area, two similarly sized mineral storage bins with capacity of approximately 2,000 t each, a front end loader (FEL) operating area for stockpile maintenance and internal rail loading, an internal rail siding, an inline weighbridge where trains are placed while loading by FEL and a mechanical lifter and replacer for rail wagon lids.

The Melba Flats loading facility would suit up to two separate products from companies needing to store up to 2,000 t of each product. More than two product lines or larger storage volumes would be difficult to accommodate satisfactorily. There is adequate space at Melba Flats for additional storage to be constructed, either as an extension or duplication of the existing shed or as a new facility.

Current operations on the Melba Line are described in Section 4.1.2.

The **Hellyer spur line** was closed when the mine was exhausted in 2000. This spur line would likely require considerable remediation to reopen. Prospects in close proximity to this mine include Ivy Resources and Bass Metals.

The **Wiltshire Line** was used to transport logs to Wiltshire prior to its closure in 2003.

[6] A summary is in http://www.tasrail.com.au/client-assets/tracking-magazine/Tracking%20Apr%202014.PDF p 14 Accessed 25 October 2015

Figure 4.1 : Rail infrastructure in Western Tasmania

Source: TasRail

4.1.2 Current situation

TasRail's loco fleet consists of 17 x TR class, 9 x DQ and 4 x 2050 locos. Melba Line mineral trains are currently operated with the DQ locos.

TasRail's mineral operations on the Melba Line are currently performed by trains of 16 – 20 wagons pulled by three DQ locos. TasRail has 54 new mineral ore wagons and 58 older ones, meaning six rakes of around 18 mineral wagons could be operated. The older wagon fleet is not currently in service due to limited demand, and significant work would be required to return these to reliable ongoing service.

The Melba Line axle load limit is 16 t, so the maximum gross weight of each wagon is 64 t. The tare weight of the bulk mineral wagons is approximately 14 t, resulting in maximum carrying capacity of approximately 50 t per wagon. TasRail reports that bulk mineral wagons are currently loaded to 44 – 45 t, giving a total of 890 t mineral capacity per train, based on 44.5 t average per wagon.

Rail operations to Rosebery for MMG are based on hauling an empty train of 20 wagons to Rosebery, filling this train and returning to Burnie. The one way journey takes five hours; loading plus train turnaround at Rosebery takes around three hours, and tippling a 20 wagon train at Burnie takes two hours. This gives a total round trip time of 15 hours. There is a rail operational curfew at Rosebery permitting operations only between 0600 and 2200.

Rail operations from Melba Flats for CMT were based on hauling an empty train of 16 wagons to Melba Flats, leaving these wagons for filling, transferring locos to the waiting full train and returning to Burnie. The one way journey between Burnie and Melba Flats takes six hours; loading plus train turnaround at Melba Flats is four hours, plus two hours for train emptying at Burnie. This gives a total round trip time of 18 hours. The rail operational curfew at Rosebery limits times trains can pass through Rosebery to between 0600 and 2200.

Melba Flats is an offsite storage and loading facility. Melba Flats has been considered as a rail loading location by a number of prospective mines.

4.1.3 Rail capacity

Rail capacity is primarily a function of:

- The number, length, speed and carrying capacity of trains that can operate on the line simultaneously
- The loading rate achievable at each of the loading points
- The unloading rate (at Burnie port via the tippler facility)

This assessment of maximum available rail capacity has considered four approaches:

1) **Current arrangements** with existing track, current operating protocols and the existing fleet of wagons and locos available to be used for mineral operations on the Melba Line. This scenario assumes necessary refurbishment work would be undertaken to return the older 58 mineral wagons to reliable ongoing operational condition, and current wagon loading averaging 44.5 t per wagon.
2) **Current track and operating protocols, but with unconstrained loco and rollingstock availability** and wagon loading to 47.5 t
3) **Committed Melba Line track upgrades and existing rollingstock,** also including necessary refurbishment of existing older mineral wagons, and wagon loading to the current 44.5 t average
4) **Committed Melba Line track upgrades and existing rollingstock,** also including necessary refurbishment of existing older mineral wagons, but wagon loading to the 47.5 t average
5) **Potential maximum future capacity**, which assumes:
   - Completion of the current Melba Line track upgrades scheduled over the period 2015- 2019 which will improve safety and increase average line speeds
   - Unconstrained rollingstock availability and wagon loading to 49.5 t

These assessments assume unconstrained product availability to be transported by rail.

1. Current arrangements

The current capacity of the Melba Line is calculated at 1.07 Mtpa, based on current track, operational practices and rollingstock fleet permitting four return trains to operate per day. The largest single impediment is the eight hour Rosebery curfew, from 2200 to 0600 each day. This capacity is substantially above current utilisation, with current volumes approximately 0.2 Mtpa. Detail supporting this is in Appendix D.1.1.

It should be noted that this capacity would be higher for any new mine loading north of Rosebery as this section of the line is not constrained by the operating curfew.

This scenario assumes that the necessary refurbishment work would be undertaken to return the older 58 mineral wagons to reliable ongoing operational condition. The capacity would be reduced if less wagons were available.

2. Current track and operating protocols, but unconstrained loco and rollingstock availability

Even with unconstrained loco and rollingstock availability, the current track and operating protocols prevent more than four return train services from being operated. The largest single impediment is the eight hour Rosebery curfew, from 2200 to 0600 each day.

With unconstrained locos and rollingstock, and assuming wagon loading to 47.5 t rail capacity would be 1.14 Mtpa. Supporting calculations are included in Appendix D.1.2.

3. Committed Melba Line track upgrades and existing rollingstock and wagon loading to 44.5 t

This assessment is based on the anticipated position after completion of TasRail's current four year upgrade program for the Melba line expected to be completed in 2019, and the current loco and rollingstock fleet. TasRail has estimated that the track upgrade will permit six return train movements per day.

TasRail currently has 17 x TR locos, 9 x DQ and 4 x 2050 locos. It is estimated that the maximum loco fleet that could potentially be made available to mineral trains would be 15 locos. This would enable five mineral trains to be operated per day.

Rail capacity under this situation would be 1.34 Mtpa. Supporting calculations are included in Appendix D.1.3.

4. Committed Melba Line track upgrades and existing rollingstock and wagon loading to 47.5 t

This is the same as the previous scenario but with wagons loaded to 47.5 t. Rail capacity under this situation would be 1.43 Mtpa. Supporting calculations are included in Appendix D.1.4.

5. Potential maximum future capacity

This option includes both committed track upgrades and unconstrained rollingstock availability and wagon loading to the theoretical maximum of 49.5 t. TasRail has estimated that the track upgrade will permit six return train movements per day.

The capacity under this situation would be 1.78 Mtpa. Supporting calculations are included in Appendix D.1.5. It appears at least one and possibly two additional holding tracks would be required at Burnie.

The overall rail capacity under these options is summarised in Table 4.1.

Table 4.1 : Rail capacity estimates

Option	Current or assumed likely wagon loading (Mtpa)	Maximum wagon loading of 50 t (Mtpa)
1) Current track and rollingstock loaded to 44.5 t	1.07	1.20
2) Current track, unlimited rollingstock loaded to 47.5 t	1.14	1.20
3) Upgraded track, current rollingstock loaded to 44.5 t	1.34	1.50
4) Upgraded track, current rollingstock, loaded to 47.5 t	1.43	1.50
5) Upgraded track and unlimited rollingstock, loaded to 49.5 t	1.78	1.80

Source: Study team with TasRail review

4.1.4 Key observations and findings – rail transport

- The current capacity of the Melba Line is calculated at 1.07 Mtpa, based on current track, operational practices and rollingstock fleet. This is much higher than current utilisation which is in the order of 0.2 Mtpa.
- The current track and operating protocols prevent more than four return train services from being operated per day, with the largest single impediment being the Rosebery curfew, from 2200 to 0600 each day. Mines loading at sites north of Rosebery would not be subject to this constraint and consequently the available capacity would be higher for these mines.
- It is estimated that TasRail's current four year upgrade program for the Melba Line will permit six return train movements per day. With the upgraded track and unlimited rollingstock, capacity is estimated at 1.7 Mtpa.
- If rail wagons could be consistently loaded to just under their maximum 50 t capacity given the 16 t axle load limit and 14 t wagon tare, this would provide a 12.3% increase in capacity under current typical

loadings, and 5.2% increase over the assumed 47.5 t average used in these analyses. This would require investment in more accurate load scales where rail wagons are loaded and possibly more finely controlled loading equipment.

- Rail capacity could also be increased if there was greater rollingstock availability

4.2 Roads to Burnie port from Western Tasmania

The predominance of road transport stems from road's cheaper costs for smaller tonnages over shorter distances, which are common in Tasmanian mineral operations as well as proximity of mining operations to road rather than rail.

Mineral transport by road predominantly uses the roads shown in Figure 3.2 from western Tasmanian mineral provinces to Burnie port. These roads are listed in Table D.1 and Table D.2 in Appendix D.2, together with the maximum vehicle types permitted and an assessment of the maximum mineral truck carrying capacity.

The main route between Western Tasmania and Burnie port consists of the of Lyell Highway, Zeehan Highway, Anthony Main Rd, Murchison Highway, Ridgley Highway, Massy Greene Drive, Bass Highway, Edwards Street, Bollard Drive and Port Road.

The mountainous terrain, remoteness and dispersed location of mining sites in Western Tasmania create difficulties in the movement of mining product and maximising the size of vehicle used. Many roads are narrow with highly constrained alignments and inadequate superelevation. The Murchison Highway over Mt Black is a highly constrained route which is not permitted for use by HPVs. The alternative route via Anthony Main Road, which is HPV gazetted, is 21 km longer for the trip from Zeehan to Burnie. While limitations on the maximum size of vehicles on some roads impose higher costs on mineral transport operations, and result in more vehicles being needed to complete any given transport task, there is minimal impact on the total road capacity.

The total capacity of the main route between Western Tasmania and Burnie port is estimated at between 3.4 and 4.7 million tpa. This capacity analysis takes into consideration the needs of other traffic on the roads concerned and amenity issues, particularly in the towns these highways pass through, such as Hampshire and Highclere. The total capacity for the port access road is estimated at between 6.7 and 9.4 Mtpa.

The road network is used by other commodities moving within the Western Tasmania region. Taking into consideration road use by other commodities, the total available capacity for minerals of the main route between Western Tasmania and Burnie port (as described above) is estimated at 2.8 Mtpa. The lowest available capacity is between Ridgley and Burnie. Supporting calculations are provided in Appendix D.2.

Current mineral volumes on the main route between Western Tasmania and Burnie port are much lower than this estimated capacity, in the order of 0.3 Mtpa. Taking into account current volumes, the available capacity for additional minerals (or other commodities) is approximately 2.5 Mtpa.

The available capacity to accommodate additional minerals traffic would be reduced if other freight operations increased. If mineral volumes increased, there would be an associated increase in other commodities including mining inputs and general freight. Consequently the available capacity for mineral outputs would be slightly less.

The capacity limit occurs on the road sections from Ridgley to where Massy Greene Drive meets the Bass Highway. These sections have lower available capacity because there is more use of these road sections by other identified freight commodity operations, particularly forestry. The access roads into the port, Edwards Street, Bollard Drive and Port Road, have slightly greater available capacity at 3.6 Mtpa, but this could be affected by increases in other commodities imported and exported at Burnie port. If demand increased, capacity on these roads could be increased through provision of more lanes and port gates.

4.2.1 Key observations and findings – road transport

- Current mineral volumes on the main route between Western Tasmania and Burnie port (0.3 Mtpa) are much lower than the estimated capacity for minerals (2.8 Mtpa). Overall road capacity for all commodities is estimated at between 3.4 and 4.7 Mtpa.

- Roads do not impose overall capacity limitations in terms of the maximum quantity of minerals that could be carried. Other components in the total mineral supply chain have substantially lower capacity limits.
- The mountainous terrain, remoteness and dispersed location of mining sites in Western Tasmania create difficulties in the movement of mining product and maximising the size of vehicle used. Less efficient supply chains, due to more vehicles being needed to complete a given task, impose higher costs on mineral transport operations, but have minimal impact on total road capacity.

4.3 Northern Tasmanian port facilities

4.3.1 Overview

There are two ports in North-Western Tasmania that routinely handle minerals: TasPorts' Burnie port and Grange Resources' privately owned Port Latta. Burnie is a multi-purpose port which handles containers, woodchips, logs, minerals, roll on roll off and break bulk cargoes. Burnie port is Tasmania's highest trade volume port, handling 4,257,080 t and 239,254 TEU in 2014-15[7]. It is the main port for mineral exports from Western Tasmania, supported by Grange Resources' Port Latta. Port Latta was purpose built to handle exports of the bulk haematite pellets produced by Grange Resources at its nearby plant from iron ore transported to the plant in its slurry pipeline.

4.3.2 Burnie port

Port infrastructure

Facilities at Burnie port include four main berths with facilities for containers and roll on roll off (RoRo) items, dry bulk, liquid bulk and general cargoes. The overall layout of the port and facilities is shown in Figure 4.2. Figure 4.3 shows the general appearance of the bulk minerals facilities.

[7] http://www.tasports.com.au/tasports-annual-report/ Accessed 22 October 2015

Figure 4.2 Burnie port layout and facilities
Source: TasPorts

C	PORT REDEVELOPMENT SHOWN	ASW	JGM	JGM	13-7-15
REV.	AMENDMENT	DRAWN	CHECKED	APPROVED	DATE

DRAWN ASW DATE 3-7-15
SCALE 1:2500 AT ORIGINAL SIZE

PRELIMINARY

TasPorts

PORT OF BURNIE — PORT PLANS
PORT OF BURNIE
GENERAL ARRANGEMENT

SHEET A1L | SCALE 1:2500 | REVISION C
DRAWING NO. BRNPPL01000-DPP1

Figure 4.3 : Bulk minerals facilities at Burnie port

Bulk minerals shed

Minerals shiploader

Loco 2150 at tippler shed

Interior of tippler shed

Elevator conveyors from tippler to bulk mineral shed

Mineral wagons TOMY at Burnie

The minerals concentrate loader is situated on Berth No 5.

The maximum dry bulk ship size that has been loaded with minerals was a supramax, and was loaded with just under 45,000 t, somewhat below the typical maximum of supramax vessels, generally 50,000-60,000 t. Typical shipments range from 3,000 t to 20,000, with many in the 5,000 – 15,000 t. Figure E.1 shows the bulk mineral shed layout.

Current operations

The Burnie port operates 24 hours per day, 365 days per year, unless closed due to adverse weather conditions. This is reported as occurring quite infrequently, typically less than one day per year[8]. Strong winds occasionally delay vessels berthing or require vessels to leave a berth and sit at anchor awaiting moderation, but these are typically only for a few hours.

The minerals berth, No. 5 Berth, is owned by TasPorts and leased to TasRail. TasRail owns the bulk mineral unloading tippler, the bulk mineral shed and mineral shiploader. TasRail offers a variety of service packages to customers from integrated ‘pit to port’ through to storage and shiploading at the port only. The bulk mineral unloading tippler operates 24 hours per day. TasRail limits the operation of the shiploader to 16 hours per day 0600 – 2200, as demand does not require longer operational hours. However it is understood the shiploader could operate 24 hours per day if there was sufficient demand.

Berth allocation by TasPorts is essentially on a ‘first come, first served’ basis, with the operational definition being the order of arrival of vessels at the port with a pilot on board. Cruise vessel bookings are made and accepted up to three years in advance, and cruise vessels receive priority access to Berth 6 for days booked. Cruise vessels generally stay less than 24 hours, and always arrive on the day booked or not at all.

The bulk minerals shed is multi modal having both rail and road receival capacity. No road deliveries are permitted when shiploading from the same side of the shed is underway.

The bulk minerals shed at Burnie port is used to store various commodities for different customers. Storage capacity imposes throughput limits on the supply chain, as having export parcels ready for loading when the ship arrives is highly desirable to minimise ship detention charges. The bulk minerals shed is divided into 9 fixed bays, most of which are leased exclusively to specific companies.

Minerals can be received from road and rail, with a rail tippler train unloader and elevator conveyors to the bulk minerals shed. Road vehicles unload by rear tipping and material movement and stockpile management by FEL. FELs are also used to push product to offtake conveyors which take minerals to the bulk shiploader on Berth 5. The Burnie Port

A detailed description of the bulk minerals supply chain receival, storage and loading facilities and arrangements is in Table E.2.

4.3.3 Summary of Capacity

A detailed description of the methodology to calculate capacity for each component of the bulk mineral supply chain at Burnie port is included in Appendix E.

This study has concluded that the total capacity of the overall mineral export supply chains from Western Tasmania through Burnie port is currently around 2.0 Mtpa. The components of these supply chains imposing these limitations were assessed as shown in Table 4.2, with the primary constraint being the bulk mineral storage shed throughput capacity.

8 http://www.weatherzone.com.au/news/bad-weather-disrupts-port/20856 Accessed 27 October 2015

Table 4.2 : Burnie port bulk mineral supply chain throughput capacity- major components

<table>
<tr><th>Component group</th><th colspan="2">Realistic maximum achievable capacity</th></tr>
<tr><td>Channel and passage to open water</td><td colspan="2">Essentially unconstrained at maximum volumes of other supply chain components</td></tr>
<tr><td>Tugs</td><td colspan="2">Not a constraint at maximum volumes of other supply chain components</td></tr>
<tr><td>Berth and shiploader</td><td colspan="2">2.9 Mtpa
Maximum dry bulk ship size at berth 5 is 213 m LOA and draught 9.8 m.
The largest vessel handled was a supramax, with largest shipment handled just under 45,000 t
Total berth occupancy for all commodities handled at berth 5 was 14.06% in 2014-15, against a maximum acceptable berth occupancy of 62%.</td></tr>
<tr><td>Rail receival at port</td><td>2.7 Mtpa</td><td rowspan="2">Rail delivery system to port limited to 1.0 Mtpa by current track and operating protocols</td></tr>
<tr><td>Rail transport system – deliveries of minerals to port</td><td>1.0 Mtpa due to rail curfew in Rosebery, single bi-directional track and three passing loops</td></tr>
<tr><td>Road receival at port (weighbridge)</td><td>4.3 Mtpa</td><td rowspan="3">Limit of 2.3 Mtpa imposed by road unloading arrangements in bulk mineral shed</td></tr>
<tr><td>Road unloading in bulk mineral shed</td><td>2.3 Mtpa</td></tr>
<tr><td>Road transport system</td><td>2.8 Mtpa – road capacity between Ridgley and Burnie</td></tr>
<tr><td>Total inwards delivery and receival capacity</td><td colspan="2">Rail 1.0 + road 2.3 = 3.3 Mtpa</td></tr>
<tr><td>Mineral concentrate shed</td><td colspan="2"></td></tr>
<tr><td>Rail receival</td><td colspan="2">2.7 Mtpa</td></tr>
<tr><td>Road receival</td><td colspan="2">2.3 Mtpa</td></tr>
<tr><td>Total receivals</td><td colspan="2">5.0 Mtpa</td></tr>
<tr><td>Storage</td><td colspan="2">2.0 Mtpa throughput capacity, based on 15 stockturns per annum
Maximum readily handled shipment size 3,000 t to 10,000 t based on loading from accumulated product in bulk minerals shed. Up to 45,000 has been handled.
2.9 Mtpa would be achievable with various relatively minor upgrades to road receival infrastructure</td></tr>
<tr><td>Outloading to shiploader</td><td colspan="2">3.6 Mtpa</td></tr>
<tr><td>Shiploader</td><td colspan="2">2.9 Mtpa</td></tr>
<tr><td>Total overall system capacity</td><td colspan="2">2.0 Mtpa</td></tr>
</table>

Source: Study team

It would be possible to increase the throughput capacity of the bulk mineral shed with a number of management process changes and infrastructure upgrades, with the most important listed in Table 4.3.

Table 4.3 : Initiatives to increase bulk mineral shed throughput capacity

Initiative	Capacity increase estimate
• Mineral shed operator flexibility to store product wherever convenient, rather than in fixed, allocated locations	+ 300,000 tpa
• Modify mineral storage shed charging arrangements	+ 50,000 tpa
• Modify mineral shed to enable receival by road and rail at all times regardless of shiploading (except for receiving the same product from rail that is being shipped out) by: - Installation of a truck receival facility outside the mineral shed with two receival hoppers to allow one stop unloading - Installation of new conveyors from truck receival facility to existing conveyors inside mineral shed. This will mean that there is minimal requirement for FEL to move product inside shed except for outloading - Repair of non-operational conveyors inside the mineral shed so all product placement to all bins is by overhead conveyor	+ 250,000 tpa
• Modify mineral shed to all for just in time road deliveries by: - Installation of bypass conveyor direct from road receival facility to shiploader	+ 300,000 tpa

Source: Study team

It is estimated that this would increase the mineral facility capacity by around 900,000 tpa, to around the effective shiploader and berth capacity.

4.3.4 Port Latta

Port Latta is adjacent to Grange Resources' haematite pelletising plant and was purpose built to export the 2.5 – 3.0 Mtpa of pellets produced per annum. Facilities at Port Latta include:

- Haematite pellet stockyard capacity with 500,000 t, but comfortable working range around 100,000 to 350,000 t
- Two dry bulk stockpile reclaimers
- Single 1.6 km jetty with one conveyor and pedestrian access only
- Two radial shiploaders capacity 2,000 to 2,500 tph for pellets but slower for fines and broken pellets
- Ships are moored to eight buoys and held just clear of the radial loaders each located on a dolphin. A lines boat is used to moor vessels in this way.
- Most ships handled are 80,000 t panamax, but 100,000 t call occasionally and the largest is up to 120,000 t. Port draught is 17 m.

The port is weather exposed, particularly to east winds, and operations are not possible on 10 to 15 days per year at current utilisation of 32 shipments per year each taking 3 to 5 days at port. Days closed due to bad weather would increase to around 25 days per year if port utilisation increased to a maximum acceptable level of around 62%.

TasPorts supplies loading crew, line boats, tugs and pilot on a contract basis. The crew used at Port Latta is also used at other ports, and tugs are shared across Burnie, Port Latta and other northern Tasmanian ports as required.

It would be possible to expand operations at Port Latta to include other exporters. New stockpiles to the east of existing ones would be required, but space is available. This would be connected to by a new conveyor to the root of the jetty. The existing jetty conveyor could handle some products, but others may need a new jetty conveyor.

4.3.5 Key observations and findings - port facilities

- The overall total bulk mineral capacity of the Western Tasmanian mineral supply chain through Burnie port as currently configured is approximately 2.0 Mtpa
- The factors that limit capacity (in limiting order) are:
  - Mineral storage shed storage capacity including subdivision into 9 fixed size compartments: 2.0 Mtpa
  - Shiploader capacity with maximum acceptable berth occupancy of 62%: 2.9 Mtpa
  - Inwards delivery and receival capacity: 3.3 Mtpa (rail 1.0 and road 2.3 Mtpa)
    - Rail is limited by track, rollingstock and an operational curfew
    - Unloading arrangements in the bulk mineral shed limit the capacity of road deliveries
- It is possible to make modifications to the mineral storage shed which could increase mineral capacity by around 900,000 tpa to around the effective shiploader and berth capacity
- The largest bulk ship size that has been handled at Burnie port was a Supramax class, which was loaded just under 45,000 t
- Utilisation of Berth 5 at Burnie port was 14.06% in 2014-15, against a theoretical acceptable maximum of 62%
- Port Latta was purpose designed for Grange Resources needs, and has handled vessels up to 120,000 t capacity, but most are 80,000 t panamax size
- There is substantial spare port capacity at Port Latta, but handling other products would require investment in stockyards and conveyors

5. Demand for supply chain capacity from Western Tasmanian mineral producers

5.1 Future freight demand scenarios approach

Assessment of demand for supply chain facilities from minerals projects considers those producing or seeking to produce minerals in formats and quantities that place noticeable demand on supply chain facilities. From Western Tasmania, this falls into two main categories:

- Higher volume, generally lower value ores such as iron ore
- Higher value, generally lower volume concentrates of base metals such as copper, lead, tin and zinc. The high grade silica produced by Tasmanian Advanced Minerals has similar characteristics and is included in this group.

While Tasmania produces substantial quantities of silver and gold, the on-site refining to metal bars makes the transport task small, so the precious metals sector has not been considered in this report. Grange Resources' dedicated supply chain has not been included in the scenarios.

This study has devised three scenarios for possible demand for supply chain capacity from current and potential mineral producers:

1) Current – existing operating mines with limited projected incremental growth
2) Medium growth – operations included in Scenario 1 with moderate growth, plus mines in care and maintenance which are likely to reopen and some small-medium new mines commencing export operations
3) Step change – operations included in Scenario 2 plus a new large mine coming online

Estimates of the mineral volumes that would be expected from each project under the current, medium growth and step change scenarios were developed based on attributes such as commodity, location, and supply chain arrangements planned. Estimates could vary from zero (existing project closes or possible new project does not proceed) through to the maximum volumes forecast by the company. All calculations were based on tonnes of production which would be sent for export per annum, regardless of whether in bulk, containerised or in other handling formats.

Scenarios were informed by proponents stated plans and expectations and overall global mineral outlooks and commodity specific outlooks for all commodities in identified Western Tasmanian mining operations and prospects. These were compiled by Jacobs from publically available and subscriber information sources supplemented with industry specialist discussions.

Assumptions have been made for new mines coming into production based on factors such as market demand, approval timeframes, and need for capital infrastructure investment. Assumptions have also been made around supply chains of potential operations based on factors such as location, size and life expectancy of mine and proximity to road or rail infrastructure. In order to understand the impact of a large new mine on supply chain infrastructure, the step change scenario includes the use of either road or rail for one large new mine.

The mining, resources, minerals and metals industries are notoriously cyclical, and a great deal of time and effort is devoted to assessing and aiming to predict when booms and busts will commence and finish. This assessment is commonly applied to inform stockmarket investors, investors in projects and others involved in mining related infrastructure improvement decision making. It must be stated that the accuracy of much of this work is low, with many trends only evident in hindsight.

There is little doubt that the current global position for resources is one of declining demand, low commodity prices and low levels of investment. Project proponents are finding attracting investment very challenging, and many anticipated new projects and expansions have not proceeded. Declining commodity prices have seen existing mining and resources projects scaled back in operational volumes or put into 'care and maintenance' awaiting more favourable economic times.

This situation is particularly evident for iron ore, and this is highly relevant for Tasmanian mineral supply chains, because nearly all of the potential large increases in mineral volumes advanced by mining proponents are from these types of projects. The step change scenario includes one large new mine coming online within the outlook period.

Outcomes from this approach are summarised in Figure 5.1. All scenarios fall within the capacity constraints of the transport system components.

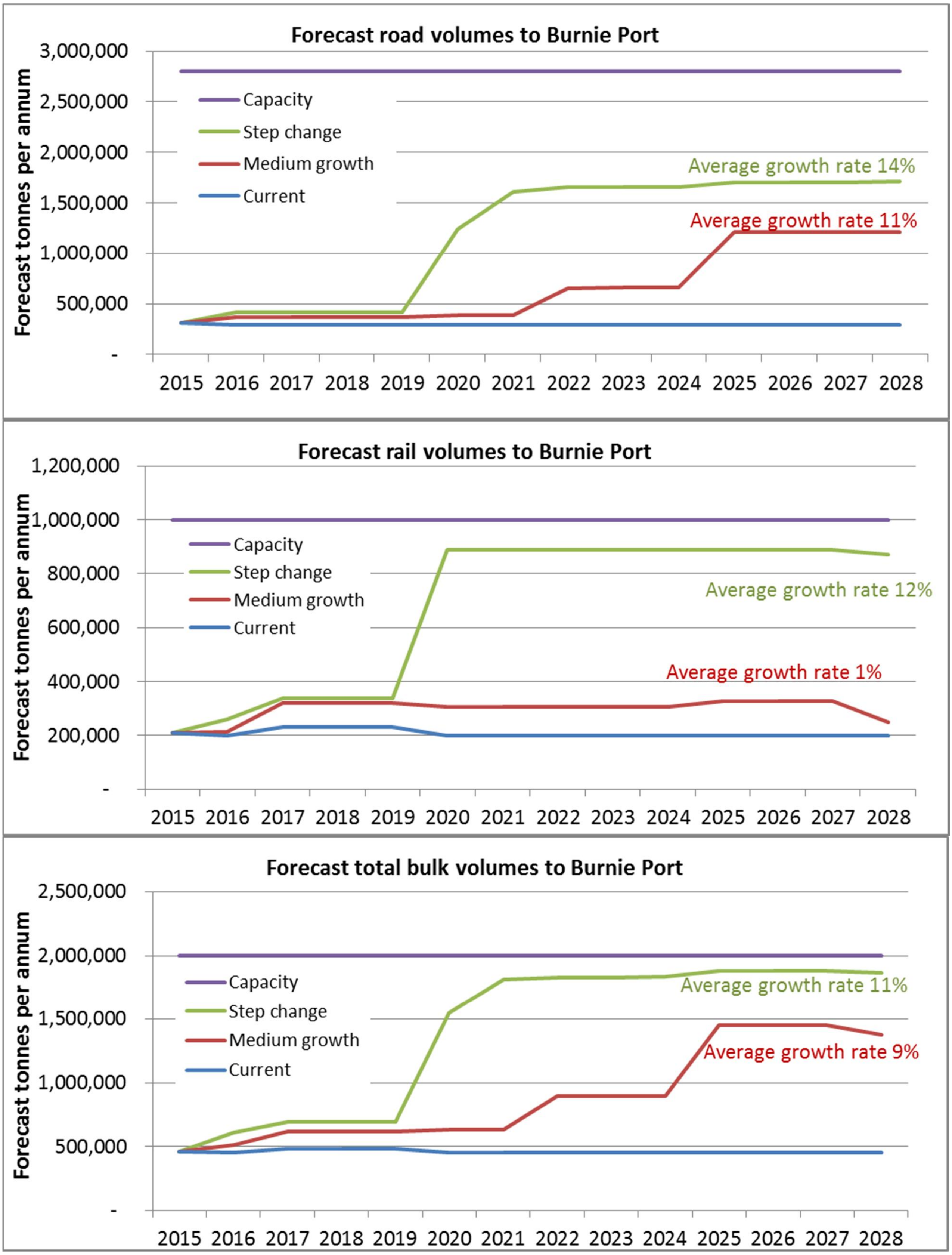
Outside of the scenarios shown in Figure 5.1**,** there are a number of potential substantial mining developments which have been assumed as unlikely to proceed in the outlook period. The scenarios are not intended to provide an economic assessment of individual mining prospects. While one large volume new mine has been included in the outlook period, the range of total volumes from all prospective mines is up to 6 Mtpa. Clearly this would have a significant impact on infrastructure.

Analysis of these possible volumes shows that rail and port capacity would be exceeded – rail by a factor of nearly 100% and Burnie port by more than 100%. These outcomes demonstrate that should this situation occur, Tasmania would be facing an overall change in demand and the facilities required to cope with that demand. These volumes are an increase in the order of 1000% of the current total task.

This would be similar to coal exports from the Hunter Valley and Gladstone over the period mid 1990s to late 2000s, where new port terminals were constructed, complete new railways were built and existing ones had duplicated tracks replace single bidirectional lines with passing loops, and major truck sections grew from two to six tracks.

It is also worth considering that since the downturn in coal since around 2010, much of that asset base would be idle now if not for the 'take or pay' contracts entered into by coal miners which meant that the costs they faced for rail and port services were similar, regardless of whether their contracted services were used or not.

Figure 5.1 : Summary of forecast demand under outlook scenarios



Source: Study team

5.2 Implications for transport and logistics infrastructure and facilities

Key observations and findings include:

- Under the three demand scenarios road and rail capacity will be more than adequate to meet demand to the end of the outlook period, however if a large new mine uses rail infrastructure, this will likely be close to capacity
- In aggregate, volumes are manageable utilising existing infrastructure and supply chains under current and medium growth scenarios
- Capacity at Burnie port will be within about 100 kt of being exceeded under the Step Change scenario around 2025, triggered by additional volumes from a large new mine. As throughput gets closer to capacity, the impacts of anything which causes deviation from steady operations, such as breakdowns and irregular ship arrivals will become progressively greater.
- Demand from major new mines will require specific planning. The key will be to have fundamental infrastructure in place and well developed plans for anticipated infrastructure likely to be sought but to avoid over investing in anything that is purpose specific in the meantime unless it is supported by appropriate risk sharing.
- The first real capacity constraints most likely to be encountered (in the sense that volumes exceed capacity over an extended period) are expected to be:
  - Mineral storage facilities become inadequate to hold sufficient stocks to meet likely desired increases in shipment parcel size
  - Shiploader capacity inadequate to meet demand

6. Actions to plan for increasing mineral supply chain capacity and efficiency in the short term

Recommended actions for further investigation fall into two main categories:

1. Projects to deliver additional mineral supply chain capacity at Burnie port when likely to be required
2. Projects to improve the efficiency of supply chain operations to aid the retention, growth and international competitiveness of existing operations, and to increase the probability that prospects progress into new mining projects.

Some opportunity projects identified will aid in both categories.

6.1 Additional supply chain capacity at Burnie port – to accommodate forecast scenario growth

This analysis shows that capacity constraints will first arise from the minerals shed ability to handle desired throughput and likely required shipment parcel sizes, and subsequently from the mineral shiploader capacity to load mineral volumes anticipated.

The main upgrade alternatives that will achieve this include:

- Change management arrangements such that the mineral shed operator has flexibility to store product to maximise overall efficiency, and not in predetermined fixed locations
- Modify mineral storage shed charging arrangements
- Install an undercover one stop truck unloading facility outside the mineral shed, and conveyors from this to the existing mineral shed overhead inflow conveyors. This will enable road and rail loading to all locations at all times, except to bins from which product is being reclaimed for shiploading.
- Install conveyors from the truck load facility to the shiploader inflow, bypassing the mineral shed, to enable direct shiploading from road deliveries
- Investigate options to replace the bulk mineral shiploader, discussed in more detail in section 7.1.3

6.2 Improving the efficiency of supply chain operations – landside

Discussions with stakeholders raised a number of potential supply chain opportunities. Consideration of these opportunities across supply chains has identified the following as the most beneficial:

- Establish HPV routes to Burnie port from container filling locations, to enable two x 20' containers per super b-double
- Install undercover truck unloading facility near bulk mineral shed with conveyor into existing overhead distribution conveyor. This would reduce unloading delays due to congestion, when FELs are busy with other duties and enable truck deliveries while shiploading is underway. Twin discharge hoppers may be possible to enable multi trailer trucks to unload both trailers simultaneously.
- Establish dry bulk mineral container filling and storage areas at Burnie port (to eliminate full container move costs from transport company yards)
- Establish a multi trailer truck decoupling and assembly facility at a convenient location at the end of HPV / HML operating areas, so that vehicles can be combined more easily into the largest possible combination for those road sections approved for HPV / HML. Possible locations could be on the Murchison Highway immediately north of Tullah or near the Cradle Mountain Link Road junction.

7. Longer term opportunities for efficiency improvement and capacity increase

7.1 Development and management of mineral and other facilities at Burnie Port

7.1.1 Berths and storage facilities

The existing arrangements at Burnie port provide more than adequate accommodation for existing trades at current volumes and the current mix of ship sizes, with some capacity for incremental growth. The 30 year outlook plan *TasPorts 2043* which covers all ports managed by TasPorts recommends continuation of the multi-port system with the four main ports continuing to focus on their areas and trades of strength, influenced by location, proximity of main port users and existing developed infrastructure. Under this assessment, Burnie port's strength and focus should remain on:

- Containers and RoRo Bass Strait trade
- Forestry (woodchip and logs)
- Minerals
- Cruise
- Fuel
- General cargo.

TasPorts is developing a Master Plan for Burnie port, which will provide greater detail on its plans for the future of the port. Our assessment shows that the maximum capacity of Burnie port for minerals is around 2.0 Mtpa, and that the main limitations come from the shiploader, bulk minerals shed and berth capacity to accommodate larger vessels. Major constraints limiting expansion at Burnie port include hard rock seabed making berth dredging challenging, proximity of the township limiting expansion options, and limited port land.

Our conclusion is that there is no real potential to significantly increase this capacity with the current port layout and trades arrangements across berths. The recently completed Burnie Port Optimisation Project has improved capacity at Berth 4 for Bass Strait container and RoRo trade, with removal of rail tracks in the Toll yard and along the western foreshore to increase yard capacity by about 30% and improve town amenity and beach access[9]. If there is demand for substantial capacity increases at the port, reconfiguration would be required, including consideration of the following:

1) Need for additional capacity for containers and RoRo trade. There have been a number of expressions of interest for additional container services between Burnie and international destinations, including most recently from China Shipping[10] and Swire. DP World Australia had announced a possible $20 m container terminal redevelopment for Burnie[11] with a target operational date of January 2017. DP World had stated that this was dependent on passage of the Coastal Shipping Act 2015, which was defeated in the Senate on 26 November 2015[12], and so this development appears less likely to proceed at present.
2) Location of trades including petroleum, logs, bulk cargoes and cruise operations
3) Location of loading and storage facilities
4) Accommodating appropriate vessel sizes to meet demand. It is noted that preparing the port to handle larger vessels, such as panamax or capsize vessels, would entail significant costs. The maximum throughput of such a development would be very substantial.

Construction of new port developments needs to be tied to demand. Private sector users could be encouraged to build new facilities to accommodate their own needs, with potential to on sell capacity to third party users,

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9 http://www.theadvocate.com.au/story/3523017/burnie-port-launched-at-event-today/?cs=87 Accessed 3 December 2015
10 http://www.theadvocate.com.au/story/3499698/chinese-shipper-eyes-extra-burnie-service/ Accessed 3 December 2015
11 http://www.dpworldaustralia.com.au/news-and-media/media-releases/dp-world-australia-and-tasports-plan-for-new-international-container-terminal-at-port-of-burnie-north-west-tasmania/ Accessed 3 December 2015
12 http://www.logistixau.com/2015/11/26/the-senate-toripping-reforms/ Accessed 3 December 2015

however there are issues associated with this model. If TasPorts undertakes such developments, it should be on the basis of measures that will ensure reliability of return on investment from users seeking additional facilities and increased port capacity. History demonstrates that it is not satisfactory to construct facilities for mining proponents and trust that usage will provide the anticipated returns. Much Australian coal chain capacity at Hunter Valley, Gladstone, Hay Point and Dalrymple Bay would be idle now if it were not for these agreements. Many coal miners are making little or nothing on coal exported at current prices, but they would lose more if they stopped, because they would still have the liabilities for rail and port handling charges, without coal sale revenues to fund these costs.

7.1.2 Mineral storage at Burnie port

All exporters aim to minimise their export costs, and minimising the number of times products are handled is a central tenet of this, resulting in almost all exporters desiring storage at the port. Storing nearby with a short road transport move to the port can easily add $4.00 - $6.00 per tonne to the land based transport costs. While some exporters undertake mineral storage and containerisation at transport company facilities near the port, they would prefer to do this at the port due to cost savings from avoiding the final transport move into the port.

The Port of Burnie is highly constrained in expansion options, because it is surrounded by the township and the ocean. Creating more space for minerals would potentially mean moving other trades or commodities away from the port, unless reclamation is possible, which may be challenging given the proximity of the township and environmental concerns. TasPorts has the ability to reclaim land to the east of the current port, provided all environmental considerations are met.

As discussed previously, the bulk mineral storage shed will impose capacity constraints at higher volumes, primarily because it will make assembling larger shipment parcels difficult, and limit the ability to receive export commodities just in time during mineral vessel loading. However, it is satisfactory for current arrangements, and is assessed as coping at volumes up to around 2.0 Mtpa provided export shipment parcel sizes remain in the range 3,000 t – 15,000. While it has coped with parcels up to 45,000 t, this is challenging and regular shipments of these sizes, particularly if of different products or for different companies, would be difficult. The port's ability to accommodate larger ships is the largest impediment to larger shipment parcel sizes. As throughput gets closer to capacity, the impacts of anything which causes deviation from steady operations, such as breakdowns and irregular ship arrivals will become progressively greater.

If demand remains within these ranges, it is difficult to justify building a new facility.

Any developments would need to be tied to sustained increased demand for bulk minerals capacity, and Tasmanian Government investment should contain measures that will ensure reliability of return on investment from users seeking additional facilities and increased port capacity. TasPorts Master Plan for Burnie port will consider the need for any additional development at the port in the context of likely demand for both the bulk and container trades.

7.1.3 Mineral shiploader

It is generally, although not universally agreed that TasRail's bulk mineral ship loader is nearing the end of its reliable economic working life, with replacement or other agreed solution necessary within around five years.

TasRail has undertaken a study to identify and assess options, with a number of alternatives considered within the context of current and anticipated operations and demand. These options include like for like replacement of the existing shiploader, as well as a number of lower capacity options and more mobile loading equipment which would provide more flexibility on which berths could be used for bulk minerals loading. The condition of the rails on which the shiploader moves may need further consideration. Considerations for assessment of these options include:

- Demand for shiploading capacity
- Cost
- Capacity provided and overall total loading speed

- Ability to meet present and possibly more stringent future environmental conditions
- Flexibility to handle the range of vessel sizes, shipment parcel sizes, mineral densities, particle sizes, degree of abrasiveness and similar characteristics
- Mobile versus fixed infrastructure, which also influences flexibility and capacity for both minerals and other commodities at the berths
- Scalability – the ability to cost effectively handle the possible range of throughput quantities which could arise over the life of the equipment

This assessment process needs to be linked to the agreed overall outlook scenarios for likely demand over time, and must consider the overall port development planning process, including accommodation of various commodities and trades at the berths and location and size of storage facilities.

7.2 Potential for improved coordination of operations

At present, TasRail provides a coordination function for a substantial part of the mineral supply chain, with its pit to port solution for rail customers and operation of bulk mineral shed, shiploader and connecting conveyors. They have little control over road transport or receival demand, and vessel scheduling is the responsibility of TasPorts. This provides advantages from one organisation managing and scheduling the bulk minerals shed, minerals shiploader and conveyors linking the two.

In our opinion, it is not particularly important whether these facilities are owned and operated by TasRail, TasPorts or another organisation, but having one organisation in control is recommended.

Given the potential for multiplicity of mining company users, some quite small, having such facilities in public ownership and management is preferable.

There would be a greater need for improved coordination of supply chain operations from rail and through bulk mineral facilities and shiploaders if demand grew to the point where the port was exporting more than around 2/3 of its capacity. At present, there is less need for this as capacity is generally available when required.

The approach recommended is the same as currently being implemented on the Mt Isa to Townsville port supply chain, which is predominantly bulk mineral concentrates. Entitled the North Queensland Resources Supply Chain Project[13] it focusses on:

- Enhancing long-term strategic planning and identification of infrastructure upgrade requirements
- Day-to-day operations and coordination between corridor operators and participants
- Developing improved information and pathways for new, smaller entrants seeking export solutions on the corridor. The major issues that are likely to arise for such entrants include identifying and assessing supply chain options, assessing alternative service suppliers and how to obtain the most cost effective solution for their specific situation and needs.

The coordination aspect is initially being approached by a two person coordination team with assistance from committee structures with representatives from mining company and supply chain users, infrastructure owners and managers, transport operators and Townsville port. These working party committees exist at two levels, with one at supervisor level focussing on day to day scheduling and problem resolution issues and the other at senior management with a longer term strategic focus. Colocation of control room functions across port and rail is under consideration. We doubt that the Western Tasmanian mineral supply chain could justify the costs of additional people to carry out such functions, but enhanced interaction among port users, TasPorts, TasRail and the major road transport operators carrying minerals could provide a useful common understanding of the opportunities and how to better address them. The NQRSC Steering Committee report[14] provides a good level of detail into the issues, conclusions and actions undertaken.

[13] http://www.statedevelopment.qld.gov.au/regional-development/regional-priorities/nqrsc-project.html Accessed 28 October 2015
[14] http://www.statedevelopment.qld.gov.au/resources/report/nqrsc/nqrsc-steering-committee-report-december-2013.pdf Accessed 28 October 2015

There is a variety of arrangements in place at other multiuser mineral ports, heavily influenced by the scale and complexity of operations. In broad terms, the larger the scale, the more likely facilities are to be owned and operated by mining interests, and the smaller the scale, they are more likely to be owned and operated by port authorities.

In Townsville, nearly all shiploading, internal port rail equipment and road receival facilities are owned and operated by mining companies, mostly exclusively for their own needs, or by stevedores which offer a variety of integrated 'pit to port' packages through to simple 'receive product and load ship' services. Those owning and operating also undertake coordination and scheduling with others in the supply chain such as rail and road transport companies, ports and shipping companies. In Esperance, facilities and equipment are mostly owned and operated by the Western Australian Government owned Southern Ports Authority. In Thevenard, berths and common user facilities are owned by Flinders Ports, the private operator of most South Australian trading ports, but commodity specific equipment, such as the gypsum storage and ship loading facilities are owned and operated by mineral companies.

At large coal ports, rail receival, storage, blending and shiploading equipment is mostly owned and operated by specific purpose companies set up by consortia of coal miners for this task. However there are examples where the port authority owns and operates such equipment, such as Gladstone's RG Tanna coal terminal. Major export coal ports have sophisticated coordination organisations, generally owned and operated by all the coal exporters operating at the port, with board representation from coal exporters and supply chain service suppliers including above and below rail companies, coal terminal operators and port authority.

Coordination can bring substantial benefits where the key issue is to accommodate a higher throughput. It can reduce misalignment and improve scheduling to reduce downtime and suboptimal prioritisation. However it has not delivered benefits in terms of reducing costs when there is substantial spare capacity. Rather, it tends to increase costs by imposing an addition layer of management. Overall volumes in Tasmania are modest, and coordination across different mines and operations provides the greatest benefit in high volume chains. The Hunter Valley Coal Chain Coordinator[15] is the best developed example, but the scale of Hunter Valley coal operations makes it of limited relevance for Tasmania.

7.3 Opportunities and potential for private sector investment in bulk commodity infrastructure

Private sector investment is tied to the anticipated return on that investment and comparison with alternative ways of achieving the same or similar capacity or outcomes. Companies generally confine investment to areas of 'core business' – and seek other required services from others, whether via purchasing, outsourcing, alliances or other sourcing mechanisms. Business trends over the last decades have seen a greater acceptance of external sourcing and many companies now restrict their core business to increasingly narrow areas of specialisation. These trends have generally been more evident in freight and logistics, with very few large companies owning their own transport equipment and many outsourcing the entire operation to integrated logistics companies, covering warehousing, inventory management as well as transport.

Most companies have less available investment resources than they have projects they could invest in, and so selecting what to spend available investment funds on generally focuses on what will provide the greatest return on investment, what will solve problems or reduce bottlenecks in capacity, complement existing investments, or eliminate the need for external expenditure to purchase similar services from others. Companies will invest in their own supply chain and logistics facilities and services if they are unable to obtain services of desired quality at acceptable price from external suppliers, or if they perceive competitive advantage in doing so.

Many of Australia's largest mining companies have invested heavily in their own supply chain capacity, with the Pilbara iron ore operations with private railways and ports owned by BHP Billiton, Rio Tinto, Fortescue Metals Group and most recently Roy Hill. All but the last named have rejected offers from others to use their facilities, assessing the downside risk of not having facilities available as greater than the revenue upside from usage fees. These companies have sophisticated vertically integrated logistics management systems, and adding

15 https://www.hvccc.com.au/ Accessed 28 October 2015

product from other companies where key information may be unavailable or held in different IT systems makes the logistics management tasks more complex and difficult, and likely to reduce efficiency.

The private sector will not invest in these sorts of facilities unless there is an assured ongoing need to permit amortisation of the usually substantial investments required, typically over a period of 10-20 years. If facilities are to be constructed for others to use, 'take or pay' contracts typically for 10 years ensure a reasonable assurance of return over a sustained period.

Most mineral supply chains constructed by the biggest miners were done to give certainty of availability when required and control over their own destiny. It permits better vertical integration of operations from mine through transport and port. The Pilbara iron ore facilities owned and operated by BHP Billiton, Rio Tinto and Fortescue are all undertaken in this way. They have all strenuously opposed access rights for others, because they want the certainty of having the facilities available for their own use when required. BHP Billiton's Townsville bulk mineral shed and handling equipment has utilisation less than one third, and others have sought capacity but have been refused because the costs and risks were assessed as being greater than the revenue that would be generated. There is also the inherent competitive approach which does not encourage giving a competitor anything that could assist the competitor against your own interests. With minerals, there is also a reluctance to permit other products in a facility you own and manage due to fears of contamination. So typically mining companies will not allow different products in their facility for fear of contamination, and they will not permit the same product owned by a competitor, because they do not want to assist a competitor.

However, the vast majority of Australian mining companies largely use supply chain facilities and infrastructure owned and managed by others – rail track, above rail train operators, port terminals, ports and ships owned by government bodies and other private sector companies. In some cases groups of larger mining companies may have an interest in logistics infrastructure companies, but these are mostly operated by independent management structures which aim to meet all customers' varying needs equitably. Private ownership by a single mining company is commonly confined to on wharf storage sheds and loading facilities, such as bulk mineral concentrate facilities owned by Glencore, BHP Billiton and Queensland Nickel on Port of Townsville owned wharves.

As a general principle, there is little reason for a mining company to invest in supply chain infrastructure if there are adequate facilities available at reasonable price. One of the challenges facing mining companies is that in poor times, they cannot afford to invest, but in good times the potential for supply chain disruption from construction activities makes major development risky. For example Rio Tinto decided against electrifying their Pilbara rail lines in 2009 due to loss of track capacity during construction, even though the savings over current diesel loco operations were substantial.

Grange Resources established a privately owned slurry pipeline to move iron ore from its Savage River mine to its processing plant at the privately owned Port Latta in 1967[16]. This has allowed Grange Resources to have complete control over its supply chain. Grange Resources has stated that it is willing to consider the potential for others to use its facilities. Port Latta has been considered as an alternative to Burnie port by a number of prospective operations as it can accommodate substantially larger ships than Burnie. Substantial infrastructure upgrades would be required in order to handle another proponent's product at Port Latta, including stockyards for product storage, conveyor connection to the existing conveyor and shiploader. Depending on proposed product characteristics, investment may be required to modify or duplicate the existing conveyor and or shiploader. Potential users would need to be willing to invest in these upgrades.

There appear to be limited opportunities for private sector investment in supply chains in Western Tasmania. However, if attracting private sector investment in facilities at Burnie port was sought, it would best be undertaken by defining the opportunity including facilities and capacity sought, the land parcel to be made available, and calling for expressions of interest. Maintaining competition by offering a single site thus engendering the perspective of "act now, for there may never be another chance" should be effective at flushing out any latent interest in developing such facilities.

[16] See http://pipeliner.com.au/news/the_savage_river_slurry_pipeline/054155/ for more information on Grange Resources' pipeline and associated infrastructure. Accessed 15 January 2016

It should be noted that these facilities are currently all owned and operated by TasPorts or TasRail, and that TasPorts' preference is that all such facilities should be owned and operated to provide open access to all potential users. This is frequently not achieved with private facilities, where the owners commonly rate the ability to have control over their own facilities and to be able to use them as and when they desire as greater than revenue generated from use by third parties.

7.4 Additional supply chain capacity at Burnie port – to accommodate all possible mineral volumes

Should all possible volumes identified from all prospects eventuate, maximum possible demand for minerals through Burnie port could be as high as 6 Mtpa.

Potential demand to handle even one million tonnes of iron ore per annum at Burnie port places a whole new set of issues, stemming primarily from the shipment sizes which would be demanded by exporters for competitive sea freight rates. Worldwide, most iron ore is shipped in cape class vessels up to 180,000 t, but there is an increasing use of WOZmax (Western Australia) vessels of 250,000 t and Valemax from Brazil of 400,000 t. To put this in perspective, the largest dry bulk minerals vessels which have been handled at Burnie are Supramax carrying just under 45,000 t.

Scale economies in sea freight rates as vessels increase in size are substantial. If there was demand for large volume exports from Burnie port, producers would likely be seeking to use panamax vessels up to around 80,000 t at the minimum. Investigations undertaken for this project estimated that iron ore shipping rates from Australia to China are typically around USD$15.00 per tonne in Capesize vessels, around USD$17.50 in Panamax and around USD$26.25 in Supramax. These rates are volatile, stemming from supply and demand fluctuations in the major shipping regions of the world. Supporting information and data sources are in Appendix F.

These sizes of ships and the facilities needed to assemble shipments and load them in an acceptable time frame would demand entirely new landside supply chain facilities to receive trains, stockpile minerals and load vessels. This requirement could not be met by scaling up from the existing facilities: it would mean a new berth for vessels to 300 m LOA, draught to accommodate 12.5 m ships, stockpile areas to accommodate ideally 200,000 t minerals (around 1.5 ha), and a shiploader capable of loading 4,000 – 5,000 tph. Under cover shed accommodation would most likely be required to meet environmental standards considering the proximity of Burnie port to the surrounding town.

7.5 Key observations and findings

Berths and wharf facilities

- The existing arrangements at Burnie Port are more than adequate for current trades and volumes
- TasPorts' long term development strategy *TasPorts 2043*, covering all the ports it manages, sets out a "business as usual" view with maintenance of current port specialisation and limited development, unless sustained demand provides evidence of greater capacity requirements
- The current capacity at Burnie port for mineral exports is around 2.0 Mtpa. This capacity is constrained by:
  - Bulk mineral shed storage capacity
  - Shiploader speed, and likely reliability if utilisation increased
  - Draught and LOA limitations at Berth 5 – maximum vessel size to date has been supramax class loading just under 45,000 t
  - Limited land availability for expansion
- There is no real potential to substantially increase capacity for minerals at Burnie port without major rearrangement of trades across berths and immediately adjacent land areas
- TasPorts is developing a Master Plan for Burnie port, with consideration of any need for development at the port in the context of likely demand

- Should all possible identified mining prospects eventuate, these volumes could not be handled by scaling up from the existing facilities. It would require substantial upgrades at the port.
- These are major developments, and investment should be tied to demonstrated need, and linked to sharing of investment risk with the users

Storage

- Exporters prefer a single transport move from mine to port storage next to shiploading facilities. This minimises mineral product handling and reduces costs.
- Storage next to the shiploader also means the product will be ready when the ship arrives, minimising demurrage costs
- The Burnie bulk minerals store can hold around 126,000 t, in 9 storage bins, mostly allocated to specific customers and products
- This facilitates export in shipment parcels of 3,000 – 10,000 t. If total throughput volumes were to increase, shipment parcel size is very likely to increase also, which would be challenging given the bin sizes in the minerals store and road receival arrangements.
- The maximum practical throughput capacity of the mineral store is estimated at 2.0 Mtpa

Shiploader

- It is concluded that the existing bulk minerals shiploader is nearing the end of its reliable economic service life, and replacement will be necessary within 5 -10 years depending on use and maintenance effectiveness
- As with all assets nearing the end of their service life, maintenance costs and reliability issues are likely to continue to increase until the shiploader is replaced
- TasRail has examined various options including like for like replacement of the existing shiploader, as well as a number of lower capacity options and more mobile loading equipment which would provide more flexibility on which berths could be used for bulk minerals loading
- This assessment process needs to be linked to the agreed overall outlook scenarios for likely demand over time, and must consider the overall port development planning process, including accommodation of various commodities and trades at the berths and location and size of storage facilities

Supply chain coordination

- TasRail provides a good deal of supply chain coordination from management of rail, tippler, shiploader and connecting conveyors
- If volumes increased to over about 2/3 of supply chain system capacity, increased coordination effort is very likely to provide benefits. The North Queensland Resources Supply Chain Project (Mt Isa to Townsville port) provides a suitable model.

Opportunities and potential for private sector investment in bulk commodity infrastructure

- TasPorts' stated preference is for port authority development of open access, multi user facilities
- There are few examples of successful multi user or open access arrangements for bulk mineral facilities in Australian export supply chains where the developer is a mining company which welcomes other similar companies to use their facilities on a fee for service basis
- Most successful multi user examples have been developed and operated by specific purpose companies owned by a group of mining companies (for example PWCS and NCIS coal terminals in Newcastle) or are third party transport companies offering services to all comers (such as Pacific National, Aurizon and Toll)
- Grange Resources has stated that it is willing to consider the potential for others to use their facilities at Port Latta. Substantial investment in infrastructure upgrades would likely be required by any potential new user.

8. Key Recommendations

There are a number of individual recommendations to increase capacity and improve efficiency, however it is noted that most are related, and the greatest outcomes will be achieved by considering a range of measures together. Port planning is central to longer term opportunities for increasing capacity and consideration of any infrastructure investment should be tied to demand.

8.1 Actions to plan for increasing mineral supply chain capacity and efficiency in the short term

8.1.1 Additional supply chain capacity at Burnie port – to accommodate forecast scenario growth

- Investigate alternative arrangements to increase flexibility in configuration of the mineral storage shed to maximise efficiency
- Review mineral storage shed charging arrangements and investigate modifications to provide incentives to improve efficiency of throughput
- Investigate installing an undercover truck unloading facility outside the mineral storage shed, and associated conveyors
- Investigate installing conveyors from truck loading facility to the shiploader inflow to enable direct loading from road deliveries

8.1.2 Improving the efficiency of supply chain operations – landside

- Investigate establishing HPV routes to Burnie port from container filling locations
- Investigate establishing dry bulk mineral container filling and storage areas at Burnie port
- Investigate establishing a multi-trailer truck decoupling and assembly facility at end of HPV/HML areas

8.2 Longer term opportunities for efficiency improvement and capacity increase

8.2.1 Investigate options for replacement of the minerals shiploader

- Planning for replacement of the shiploader needs to consider:
  - Demand for shiploading capacity
  - Cost
  - Capacity provided and overall total loading speed
  - Ability to meet present and possibly more stringent future environmental conditions
  - Flexibility to handle the range of vessel sizes, shipment parcel sizes, mineral densities, particle sizes, degree of abrasiveness and similar characteristics
  - Mobile versus fixed infrastructure, which also influences flexibility and capacity for both minerals and other commodities at the berths
  - Scalability – the ability to cost effectively handle the possible range of throughput quantities which could arise over the life of the equipment

This assessment process needs to be linked to the agreed overall outlook scenarios for likely demand over time, and must consider the overall port development planning process, including accommodation of various commodities and trades at the berths and location and size of storage facilities.

8.2.2 Plans for staged development at Burnie port to meet future mineral demand

The current capacity at Burnie port for mineral exports is around 2.0 million tpa. The first real capacity constraints most likely to be encountered (in the sense that volumes exceed capacity over an extended period) are expected to be:

- Mineral storage facilities become inadequate to hold sufficient stocks to meet likely desired increases in shipment parcel size
- Shiploader capacity inadequate to meet demand

The Burnie bulk minerals store can hold around 126,000 t, in 9 storage bins, mostly allocated to specific customers and products. This facilitates export in shipment parcels of 3,000 – 10,000 t. If total throughput volumes were to increase, shipment parcel size is very likely to increase also, which would be challenging given the bin sizes in the minerals store and road receival arrangements.

There is no real potential to substantially increase capacity for minerals at Burnie port without major rearrangement of trades across berths and immediately adjacent land areas.

It is recommended that planning be undertaken for Burnie port to stage development to meet future mineral demand. Planning should consider:

- Accommodating panamax or larger ships
- Storage and handling capacity structured for shipment parcel sizes from 3,000 t to 80,000 t
- Requirements for other commodities at the port

8.2.3 Opportunities for increased coordination of supply chain activities

- Consider establishing links with NQRSC to understand how coordination initiatives work and their potential application to Tasmania, if there is a large increase in demand for infrastructure

8.2.4 Opportunities for private sector investment in bulk commodity infrastructure

- Consider defining opportunities for private sector investment if demand for infrastructure increases and reflects a potential need for additional upgrades

Abbreviations and definitions

DIER	Former Tasmanian Department of Infrastructure, Energy and Resources (restructured to form the Department of State Growth in 2014)
DSO	Direct shipping ore (crushed but no requirement for concentration or more elaborate processing to meet customer specification)
FEL	Front end loader
FT	Forestry Tasmania
GA	General Access
General Access	Refers to most roads without specific access restrictions or higher limits. Typically the maximum vehicle size is 6 axle semitrailer to 19 m x 4.3 m x 2.5 m with GCM 42.2 t.
GCM	Gross combination mass (multi trailer trucks)
HML	Higher mass limits
HPV	High productivity vehicle. Generally refers to b-doubles and truck and dog combinations in Tasmania
ktpa	Thousands of tonnes per annum
MRT	Mineral Resources Tasmania
Mtpa	Millions of tonnes per annum
PBS	Performance Based Standards (for non standard vehicle registration)
TasPorts	Tasmanian Ports Corporation
tpa	Tonnes per annum
tph	Tonnes per hour
WTECS	Western Tasmanian Export Corridor Study
WTIIS	Western Tasmanian Industry Infrastructure Study

References

This references list includes major references in addition to sources identified in footnotes within the report.

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Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to identify and prioritise solutions to supply chain constraints that affect the productivity and competitiveness of Tasmania's mining industry and other industries using the same freight transport infrastructure, in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed by the Client and set out in the study Brief and request for proposal documentation.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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It must be noted that forecasting commodity prices and mineral business cycles is one of the least accurate areas of business advice. Market sentiment can and does change rapidly, and investors are commonly caught in positions they would have avoided with more accurate foresight. In particular, the timing for changes is very challenging, and the year by year positions forecast could be interpreted as implying timing accuracies that cannot be reliably predicted.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs' Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Appendix A. Discussion checklist

This checklist should be used as a guide to ensure that all issues are covered, and not as a rigid questionnaire. Discussions should be undertaken as a natural flowing conversation as far as possible. The order in which issues are covered is not important, but the introduction should come first, and a check through just before the end will ensure that no major issues are overlooked.

1. **Introduction:**

   Refer to WTIIS and whether or not they participated in that study.

   Broader project purpose and objectives – to identify and prioritise potential solutions to supply chain constraints that effect the productivity and competitiveness of the mining industry, other users of the existing infrastructure and economic development of the region. Jacobs has been engaged to prepare a report on the following aspects of the project:

   - Supply chain analysis: improved understanding and outcomes
   - Storage, ship-loading and port capacity for bulk mineral tasks
   - Update information for Tasmanian Freight Survey 2014-15 financial year

   Client (State Growth, with funding from federal Regional Infrastructure Fund)

   Brief introduction to consultant and background (minimum as required to provide credibility only)

2. **Interviewee background:**
   - Interviewee role, length of time in that role, previous roles of relevance etc

3. **Company operations:**
   - Current operations overview (sites, commodities, origins, destinations, volumes / tonnages, use of road, rail and other modes, truck type, pack type, number, cycle and frequency of trips, storage, port and shipping arrangements)
   - Major suppliers and inwards goods flows
   - Major outwards goods flows
   - Customer types (importers, exporters, manufacturers, assemblers, retail supplier, wholesalers)
   - Cross reference against Tasmanian Freight Survey data request
   - Numbers of employees and permanent contractors and any anticipated changes

4. **Why do you use your current arrangements (transport mode, route etc)?**
   - Key drivers
   - Who makes decisions about the supply chain
   - Triggers for change – other options which were or could be considered

5. **Rail- realistically could you use it? Why/ why not?**

6. **Main priorities for road level of service?**
   - Travel time reliability, speed, access for HPVs, road quality/ roughness, number of completed round trips per legal driving shift?

7. **Changes and developments expected, anticipated or possible**
   - Growth, decline, new products / markets and services, customers, competitors, other service suppliers or service offerings, routes, origins, destinations, ports used
   - Changes in tonnages, processing on site, ore / concentrate / refined metal or other products
   - General changes in the region – growth, decline, initiatives etc
   - Company expected outlook for world market for their products – next 1, 2, 5 and 10 years

8. **Opportunities**
   - Is there co-ordination with other supply chains/businesses (either on West coast or elsewhere)
   - What opportunities can you see for improvement (including greater co-ordination)
   - What are the possible benefits from any changes–($, time, employment, profitability, number of vehicles, any quantification is better than none)
9. **Are freight costs a significant cost to your business? Roughly what percentage of total costs?**
10. **Does your business backload trucks? What percentage roughly?**
11. **Do you have a preferred transport logistics provider? Who?**
12. **Other issues as arising or desired to discuss**
13. **Study next steps – notes for review, potential for further discussion**

Appendix B. Stakeholders consulted

- Department of State Growth (State Roads)
- TasPorts
- TasRail
- Toll Shipping
- Mineral Resources Tasmania
- Australian Hualong
- Avebury Nickel Mine
- Bass Metals
- Bluestone Mines Tasmania JV
- Copper Mines of Tasmania
- Elementos
- Grange Resources
- Henty Gold Mine
- Ivy Resources
- Lottah Mining / Forward Mining
- Mancala Resources
- MMG Rosebery
- Niumenco / TNT / Minemakers
- Shree Minerals
- Stellar Resources
- Tasmania Magnesite
- Tasmania Mines
- Tasmania Advanced Minerals
- Torque Mining
- Venture Minerals
- Britton Timbers
- De Bruyn’s Transport
- Fonterra
- Forestry Tasmania
- Forico
- McCain
- Ta Ann
- Tasmanian Dairy Products / Murray Goulburn
- Timberlands

Appendix C. Supply Chains in Western Tasmania

Potential supply chains in Western Tasmania include the following:

- Bulk product by rail to Burnie port
- Bulk product by road to Burnie port
- Containerised product by rail to Burnie port
- Containerised product by road to Burnie port
- Bulk product by road to Burnie port, containerised at Burnie
- Product in slurry format to Port Latta
- Bulk product by road to Port Latta

These supply chains are discussed in the following sections.

The key drivers for supply chains in Tasmania are proximity to infrastructure, volumes, haul length and mineral packaging format, which is mostly determined by customer requirements. The use of rail is largely dependent on proximity to rail infrastructure. Double handling costs create challenges for rail to compete with road transport, particularly for lower volumes and shorter haul distances.

Environmental factors are also a key driver for some products. Careful management is required for the transport of some concentrates such as lead and rail transport is preferred over the risks posed by road transport.

Bulk product by road is typically used where rail alternatives are not available nearby and for shorter haul distances.

Containerised product tends to suit lower volumes (less than 2,000 tpa). Road transport is generally more cost effective than rail transport for containers unless haul distances are very long (exceeding 1,000 km) or volumes high (exceeding say 2,500 containers per annum). There are no examples of containerised product by rail in Western Tasmania at present, and we are unaware of any in recent times. Use of containers for higher volumes can arise from customer requirements, and from the ability to use the same truck to deliver inwards goods to the mine and remove production.

Grange resources has established a privately owned slurry pipeline to move iron ore from its Savage River mine to its processing plant at the privately owned Port Latta. This has allowed Grange Resources to have complete control over their supply chain. Port Latta is currently only used by Grange Resources, however it has been considered as an alternative to Burnie port by a number of prospective operations as it can accommodate substantially larger ships.

C.1 Bulk product by rail to Burnie port

This supply chain approach is summarised by individual steps in Table C.1. Potential use of this supply chain approach is dependent on proximity to rail infrastructure, or large volumes over a long time period which justify building new rail infrastructure. Individual company's approaches may differ in specific ways according to product, site or customer specific needs.

Table C.1 : Supply chain steps: bulk product by rail to Burnie Port

Origin	Product and format	Activity	Destination	Comments
Concentrator at mine	Base metal concentrate (fine powder) – in bulk (loose)	Move on conveyor or by Front End Loader (FEL)	Mineral storage shed at mine	Could contain rail loading facility at mine
Mineral storage shed[(1)]	*Concentrate in bulk*	*Load truck by FEL or overhead hopper loading system*	*Bulk tip truck with canvas cover*	*Not required if rail loading at mine site*
Truck	*Concentrate in bulk*	*Drive to rail loading facility and unload by rear or side tipping*	*Rail storage and loading facility (eg Melba Flats)*	
Rail storage and loading facility	Concentrate in bulk	Load train with FEL or overhead hopper system	Bulk rail wagon with lid	Rail loading facility could be at mine (eg MMG Rosebery)
Bulk rail wagon at rail loading facility	Concentrate in bulk	Rail journey 2-3 locos and 20 wagons each carrying 44-45 t product – typically around 890 t / train	Burnie port rail arrivals track	
Burnie port rail arrivals track	Concentrate in bulk	Unload train in tippler (inverts pairs of wagons to empty)	Below ground receival hopper	
Below ground receival hopper	Concentrate in bulk	Two stage elevator conveyor with spreader to direct concentrate to required compartment	Bulk mineral shed compartment	Burnie port minerals facility contains 10 compartments with total maximum capacity around 126,000 t
Bulk mineral shed compartment	Concentrate in bulk	Concentrate pushed onto in floor reclaim conveyor by loader or bulldozer	Elevator conveyor to shiploader	Maximum speed typically 1,200 tph Average over whole loading 750 tph
Shiploader	Concentrate in bulk	Load ship	Ship's hold	Largest ship typically Supramax to 45,000 t cargo

(1) Steps in italic and cells shaded may not be required in certain situations

Source: Study team, drawing on discussions and general industry knowledge

C.2 Bulk product by road to Burnie port

This supply chain approach is summarised in individual steps in Table C.2 It is the most obvious choice if rail alternatives are not available nearby (as is the case west of Burnie along the northern Tasmanian coast), for smaller quantities (less than 100,000 to 200,000 tpa) and for shorter haul distances where the usual need to move mineral product to a railhead can make rail transport uneconomic. Many of the identified mining prospects have one or more of these characteristics.

Table C.2 : Supply chain steps: bulk product by road to Burnie Port

Origin	Product and format	Activity	Destination	Comments
Concentrator at mine	Base metal concentrate (fine powder) – in bulk (loose)	Move on conveyor or by Front End Loader (FEL)	Mineral storage shed at mine	
Mineral storage shed	Concentrate in bulk	Load truck by FEL or overhead hopper loading system	Bulk tip truck with canvas cover	
Truck	Concentrate in bulk	Drive to Burnie Port	Burnie Port weighbridge or gate	
Burnie Port weighbridge[(1)]	*Concentrate in bulk*	*Weigh full truck*	*Burnie Port gate*	*Requirement for weighing depends on mining company decision*
Burnie Port gate	Concentrate in bulk	Drive to unloading area as close to storage location as possible inside shed	Bulk mineral shed	Unloading not possible during shiploading from the side of shed from which export product is being sourced
Bulk mineral shed	Concentrate in bulk	Tip to unload truck. For multi trailer trucks, unload rear trailer, then jack-knife truck to unload from section clear of trailer drawbar	Floor of bulk mineral shed	
Bulk mineral shed	Empty truck	Empty truck leaves port, possibly via weighbridge	Next freight task as allocated by trucking company or operator	*Truck may be weighed out, but typically only for vehicles new to the port where weight is not already known*[(1)]
Floor of bulk mineral shed	Concentrate in bulk	FEL moves mineral into required storage compartment	Bulk mineral shed compartment	Burnie port minerals facility contains seven compartments with total maximum capacity 120,000 to 140,000 t concentrate or 100,000 t lump ore
Bulk mineral shed compartment	Concentrate in bulk	Concentrate pushed onto in-floor reclaim conveyor by FEL or bulldozer	Elevator conveyor to shiploader	Maximum speed typically 1,200 tph Average over whole loading 750 tph
Shiploader	Concentrate in bulk	Load ship	Ship’s hold	Largest ship typically Supramax to 45,000 t cargo Most shipments are in the range 5,000 – 25,000 t with the average around 10,000 t

(1) Steps in italic and cells shaded may be omitted in certain situations
Source: Study team, drawing on discussions and general industry knowledge

C.3 Containerised product by rail to Burnie port

This supply chain involves taking empty containers to the mine site, filling them there, and then loading them on container wagons for railing to Burnie port. Unless the mine site is directly rail connected, there will be a need to move containers between the mine site and rail loading point by truck.

There are no examples of this supply chain in Western Tasmania at present, and we are unaware of any in recent times.

Container handling costs can be significant, particularly for loading and unloading trains, unless the container handling machines achieve high utilisation. However it is rare to achieve high utilisations for the minerals best exported in containers, as this product format suits lower volumes (less than say 2,000 tpa). Use of containers for higher volumes is usually due to customer requirements, or through them facilitating using the same truck to deliver inwards goods and remove production.

Further, shipping lines that own and manage containers prefer them to be loaded as close to the port as possible, because it reduces the time the container is required for the total journey and enables the container to complete more journeys per year.

C.4 Containerised product by road to Burnie port

This supply chain involves taking empty containers to the mine site by road, filling them there, and then driving to Burnie port. This approach is generally more cost effective than rail transport unless haul distances are very long (exceeding 1,000 km) or volumes high (exceeding say 2,500 containers per annum).

This supply chain is under consideration by a number of prospects with lower volumes (less than a few thousand tonnes per annum) and where containerising product is likely to suit customers.

Container handling costs for direct road movements are not such an issue, because in most cases, sidelifter trailers are used which can place the empty container on the ground next to the truck for loading, then load the full container onto the truck. In some circumstances, particularly where open topped containers are used, containers can be loaded while still on the truck. Open topped containers are generally only used for domestic movements, as they provide the least level of product containment and most shipping lines do not operate pools of open topped containers. This means that the mining company or their transport company has to acquire these containers, and return empty units for their next trip

Sidelifter trailer with 20’ container

C.5 Bulk product by road to Burnie port, containerised at Burnie

This supply chain involves bringing mineral product to suitable facilities at Burnie for containerising at or near the port.

This suits shipping lines because it reduces the time the container is required for the total journey and may be reflected in slightly cheaper shipping rates.

C.6 Product in slurry format to Port Latta

Grange Resources established a privately owned slurry pipeline to move iron ore in thick liquid from its Savage River mine to its processing plant at privately owned Port Latta, from where exports are despatched. This was built in 1967, and was the world’s first long distance slurry pipeline[17].

[17] http://pipeliner.com.au/news/the_savage_river_slurry_pipeline/054155/ Accessed 23 July 2015

There are no other mineral slurry pipelines that we are aware of in Tasmania, although there are several substantial examples elsewhere in Australia and worldwide[18]. Environmental approval issues are likely to make approval for further pipelines more difficult than was the case historically. The Savage River to Port Latta pipeline route with adjacent Pipeline Road used for maintenance access is clearly visible in aerial imagery.

C.7 Bulk product by road to Port Latta

This option may be considered because Port Latta can accommodate substantially larger ships than Burnie port and the road distance is substantially shorter for some prospects. Most vessels calling at Port Latta are panamax of around 80,000 cargo tonne capacity and shipments up to 100,000 t and 16 m depth have been handled. However there is a need for additional landside infrastructure for truck receivals, stockpile and modifications to shiploading infrastructure in order for Port Latta to accommodate additional products.

This supply chain remains a potentially viable option, subject to agreement between Grange Resources and potential users of the facilities.

[18] Cowper, Norman T, Snr; Cowper, Norman T, Jnr and Thomas, Allan D. Slurry Pipelines: Past, Present and Future [online]. Australian Journal of Multi-disciplinary Engineering, Vol. 7, No. 2, 2009: 189-195 contains a list of examples. http://search.informit.com.au/documentSummary;dn=314978413952768;res=IELENG Accessed 23 July 2015

Appendix D. Land transport capacity to Burnie port

D.1 Rail

D.1.1 Current situation

TasRail's mineral operations on the Melba Line are currently performed by trains of 16 – 20 wagons pulled by three DQ locos. TasRail has 54 new mineral ore wagons and 58 older ones, meaning six rakes of around 18 mineral wagons could be operated. Most of the older wagon fleet is not currently in service due to limited demand, and significant work would be required to return these to reliable ongoing service.

The Melba Line axle load limit is 16 t, so the maximum gross weight of each wagon is 64 t. The tare weight of the bulk mineral wagons is approximately 14 t, resulting in maximum carrying capacity of approximately 50 t per wagon. TasRail reports that bulk mineral wagons are currently loaded to 44 – 45 t, giving a total of 890 t mineral capacity per train, based on 44.5 t average per wagon.

Rail operations to Rosebery for MMG are based on hauling an empty train of 20 wagons to Rosebery, filling this train and returning to Burnie. The one way journey takes five hours; loading plus train turnaround at Rosebery takes around three hours, and tippling a 20 wagon train at Burnie takes two hours. This gives a total round trip time of 15 hours. There is a rail operational curfew at Rosebery permitting operations only between 0600 and 2200.

Rail operations from Melba Flats for CMT were based on hauling an empty train of 16 wagons to Melba Flats, leaving these wagons for filling, transferring locos to the waiting full train and returning to Burnie. The one way journey between Burnie and Melba Flats takes six hours; loading plus train turnaround at Melba Flats is four hours, plus two hours for train emptying at Burnie. This gives a total round trip time of 18 hours. The rail operational curfew at Rosebery limits times trains can pass through Rosebery to between 0600 and 2200.

The Melba Line has a single bi-directional rail track for most of its length, with passing loops of approximately 650 m clear stand at Ridgley, Guildford and Boco, which enable trains heading in opposite directions to pass at these locations. This means that, at any given moment, there could be:

- One train between Burnie and Ridgley
- One train between Ridgley and Guildford
- One train between Guildford and Boco
- One train between Boco and Rosebery (but not arriving or departing Rosebery between 2200 and 0600)
- One train between Rosebery and Melba Flats or loading at Melba Flats (but not departing or arriving Rosebery during the curfew period)
- One train unloading at Burnie
- One train loading at Rosebery (except overnight)

There are two holding tracks at Burnie available for mineral trains.

TasRail's loco fleet consists of 17 x TR class, 9 x DQ and 4 x 2050 locos. Melba Line mineral trains are currently operated with the DQ locos[19].

The current track situation and operating protocols prevent more than four return train services from being operated. The largest single impediment is the eight hour Rosebery curfew, from 2200 to 0600 each day.

[19] There is more information on TasRail's rollingstock in http://www.tasrail.com.au/client-assets/tracking-magazine/Tracking%20Apr%202014.PDF p 13. Accessed 25 October 2015

Taking these operational arrangements and loco and wagon resources into account, the maximum capacity of the Melba Line with current rollingstock availability would be:

- Four trains averaging 20 wagons loaded to current average of 44.5 t each completing one full round trip per day = 4 x 890 t = 3,560 t / day
- 300 working days per annum, to allow for losses from:
  - Days lost to adverse weather (typically two days per year)
  - Track and rolling stock maintenance
  - Track closures due to fallen trees, landslips etc
  - Other breakdowns and inefficiencies
- 3,560 t x 300 days = 1,068,000 tpa, or 1.0 Mtpa in round figures.

It should be noted that this capacity would be higher for any new mine loading north of Rosebery as this section of the line is not constrained by the operating curfew.

This scenario assumes that the necessary refurbishment work would be undertaken to return the older 58 mineral wagons to reliable ongoing operational condition. If only the 54 new mineral wagons were available the capacity would be around 0.68 Mtpa, based on three return trains averaging 18 wagons and 95% wagon availability. However if demand increased, it is assumed the necessary work would be undertaken to return the older wagons to service.

The train unloading tippler can unload a 20 wagon train in two hours. Allowing a further hour for train positioning and separation of product from consecutive trains, at least eight trains could be unloaded each 24 hours, and so the tippler is not a constraint at these volumes.

D.1.2 Current track and operating protocols with unlimited rollingstock and wagon loading to 47.5 t

Even with unlimited rollingstock, the current track situation and operating protocols prevent more than four return train services from being operated. The largest single impediment is the eight hour Rosebery curfew, from 2200 to 0600 each day.

With unconstrained locos and rollingstock, and assuming loading to rail wagon capacity, four trains of 20 wagons loaded to 47.5 t could be operated per day. This assumes that wagon capacity is not constrained by current inabilities to consistently load wagons close to the maximum capacity of just under 50 t.

Under this scenario capacity would be 4 trains x 20 wagons x 47.5 t x 300 days = 1.14 Mtpa.

D.1.3 Upgraded track with existing rollingstock and wagon loading to 44.5 t

This assessment is based on the anticipated position after completion of TasRail's current four year upgrade program for the Melba Line expected to be completed in 2019, and the current loco and rollingstock fleet. TasRail has estimated that the track upgrade will permit six return train movements per day.

TasRail currently has 17 x TR locos, 9 x DQ and 4 x 2050 locos. It is estimated that the maximum loco fleet that could be devoted to mineral trains would be 15 locos. This would enable five mineral trains to be operated per day.

It is assumed that necessary work to return the 58 older mineral wagons not currently in service would be undertaken to ensure reliable ongoing operation. This would provide 54 new + 58 older = 112 wagons. Assuming 5% non availability for maintenance, 106 wagons would be routinely available. This would permit five services each of the maximum 20 wagons per day, with six spare wagons. It is likely that an additional holding track for minerals trains would be required at Burnie.

Rail capacity under this situation would be 5 trains x 20 wagons x 44.5 t x 300 days = 1.34 Mtpa.

D.1.4 Upgraded track with existing rollingstock and wagon loading to 47.5 t

This is identical to D.1.3, except it assumes that wagons can be loaded to 47.5 t.

Rail capacity under this situation would be 5 trains x 20 wagons x 47.5 t x 300 days = 1.425 Mtpa.

D.1.5 Potential future rail capacity

This option includes both committed track upgrades and unconstrained rollingstock availability. TasRail has estimated that the track upgrade will permit six return train movements per day. This option assumes wagons are loaded to the theoretical maximum of 49.5 t.

The capacity would be 6 trains x 20 wagons x 49.5 t x 300 days = 1,782,000 t, or 1.78 Mtpa in round figures.

It appears at least one and possibly two additional holding tracks would be required at Burnie.

D.2 Road capacity to Burnie port

The total capacity of the main route between Western Tasmania and Burnie port is estimated at between 3.4 and 4.7 million tpa. This is based on:

- Truck and dog combination or b-double carrying 38 t and six axle semitrailers carrying 27 t, based on Tasmania's State Road Access Policy[20]
- Maximum 15 trucks per hour in each direction
- 24 hours operation per day (there are no curfews or limitations in place)
- 345 days' operation per year (to provide an allowance for road maintenance, closure due to adverse weather and similar occurrences)
- Thus 38 t x 15 trucks / h x 24 hrs / day x 345 days / year = 4,719,600 tpa (4.7 million tpa in round figures) as the upper limit and 27 t x 15 trucks / hr x 24 h / day x 345 days / year = 3,353,400 t / y (3.4 Mtpa in round figures) at the lower estimate

VicRoads[21] draws upon the Highway Capacity Manual[22], which states that the maximum theoretical capacity for freeways under ideal conditions with free-flow speed in the order of 100 km/hr is 2,300 passenger cars per hour per lane. This translates to approximately 383 trucks per hour based on each truck consuming as much road capacity as six cars based on length and slower acceleration, braking and manoeuvrability. This maximum theoretical capacity needs to be adjusted to take into account the road conditions, other traffic and what is acceptable to enable safe use of Tasmanian roads. This includes consideration of seasonal peaks over summer and a significant number of drivers who are unfamiliar with both Tasmanian roads and the vehicles they are driving (including hired recreational vehicles and unfamiliar towing). Consideration also needs to be given to acceptable truck volumes through townships such as Hampshire and Highclere. Consequently 60 trucks per hour is considered the maximum reasonable capacity, with 30 trucks per hour a possible target. In this assessment, a more conservative figure of 15 trucks per hour per lane has been used, representing one truck in each direction every four minutes on average.

A figure of 30 trucks per hour per lane has been used for the port access road, which is expected to have high truck volumes and few other vehicles. This gives a capacity of between 6.7 and 9.4 million tpa for the port access road.

Mineral transport by road predominantly uses the roads listed in Table D.1 and Table D.2. These tables include the largest vehicle types permitted and an assessment of the typical mineral truck carrying capacity. The classification of maximum vehicle size is explained in Appendix D.3.

[20] Department of State Growth September 2014 http://www.transport.tas.gov.au/__data/assets/pdf_file/0004/109633/State_Road_Access_Policy_for_PBS_Heavy_Vehicles_2.pdf

[21] VicRoads (2013) Freeway Ramp Signals Handbook

[22] US Research Board (2010) Highway Capacity Manual

It can be seen that with the road capacity assumptions listed above the available capacity for mineral traffic on the main route from Zeehan to Burnie port is 2.8 Mtpa.

The largest vehicles which can be used are 9 axle b-doubles up to 26 m length and a maximum GCM of 68.5 t. State Growth will consider applications to operate PBS2B vehicles; however State Growth currently has no plans to develop a PBS2B network or routes in Tasmania.

Table D.1 : Road routes from Western Tasmania to Burnie port

Road	From / to	Maximum vehicle size	Road use by other commodities[23]	Total road capacity available for minerals traffic	Road manager / limitations / comments
A10 Lyell Hwy	Queenstown to Zeehan Hwy	HPV / HML	0.2 Mtpa	4.5 Mtpa	State Growth
A10 Zeehan Hwy	Lyell Hwy to Anthony Main Rd	HPV / HML	0.2 Mtpa	4.5 Mtpa	State Growth
B28 Anthony Main Rd	Zeehan Hwy to Murchison Hwy	HPV / HML	0.1 Mtpa	4.6 Mtpa	State Growth
A10 Zeehan Hwy	Anthony Main Rd to A10 Murchison Hwy	HPV / HML	0.1 Mtpa	4.6 Mtpa	State Growth
B27 Zeehan Hwy	Murchison Hwy junction to Zeehan	HPV / HML	0.1 Mtpa	4.6 Mtpa	State Growth
Trial Harbour Rd	Zeehan to Avebury Mine	HPV / HML	0.1 Mtpa	4.6 Mtpa	West Coast Council
A10 Murchison Hwy	Zeehan Hwy junction to Melba Flats	HPV / HML	0.2 Mtpa	4.5 Mtpa	State Growth
A10 Murchison Hwy	Melba Flats to Renison Bell	General Access	0.2 Mtpa	3.2 Mtpa	State Growth
A10 Murchison Hwy	Renison Bell to Rosebery	General Access	0.2 Mtpa	3.2 Mtpa	State Growth
A10 Murchison Hwy	Rosebery to Anthony Main Rd	General Access	0.2 Mtpa	3.2 Mtpa	State Growth Sterling River Bridge limited to general access masses (50.5 t GVM for truck and dog). Some previous exceptions to this limit under permit
A10 Murchison Hwy	Anthony Main Rd to Ridgley Hwy (& Waratah MR)	HPV / HML	0.3 Mtpa	4.4 Mtpa	State Growth
Pieman Rd	Murchison Hwy to Mt Lindsay	General Access	0.1 Mtpa	3.3 Mtpa	Hydro Tasmania

[23] Based on 2011-2012 Tas Freight Survey Data, supplemented with information from industry discussions

Road	From / to	Maximum vehicle size	Road use by other commodities[23]	Total road capacity available for minerals traffic	Road manager / limitations / comments
C132 Cradle Mountain Development Rd (Belvoir Rd)	Murchison Highway to Moina	HPV / HML	0.1 Mtpa	4.6 Mtpa	State Growth
Waratah Rd	Murchison Hwy to Savage River	General Access	0.1 Mtpa	3.3 Mtpa	State Growth. Some permits for 21 m HML B-double at 57.5 t exist
Corinna Rd	Savage River to Corinna	General Access	0.1 Mtpa	3.3 Mtpa	State Growth
B18 Ridgley Hwy	Murchison Hwy junction to Hampshire	HPV / HML	0.8 Mtpa	3.9 Mtpa	State Growth
B18 Ridgley Hwy	Hampshire to Highclere	HPV / HML	1.5 Mtpa	3.2 Mtpa	State Growth
C102 Upper Natone Rd	Kara Rd to Ridgley Hwy	General Access	0.1 Mtpa	3.3 Mtpa	Burnie City Council. Emu River Bridge replaced in last 10 years and open to GA vehicles (max 19 m semitrailer)
Kara Rd	Upper Natone Rd to Kara Mine.	General Access	0.1 Mtpa	3.3 Mtpa	Owned by FT, maintained by Tasmania Mines.
B18 Ridgley Hwy	Highclere to Ridgley	HPV / HML	1.5 Mtpa	3.2 Mtpa	State Growth
B18 Ridgley Hwy	Ridgley to C112 Old Surrey Rd	HPV / HML	1.9 Mtpa	2.8 Mtpa	State Growth
C112 Old Surrey Rd	Ridgley Hwy to Massy-Greene Dr	HPV / HML	1.6 Mtpa	3.1 Mtpa	Burnie City Council
Massy-Greene Dr	Old Surrey Rd to lower intersection with Old Surrey Rd	HPV / HML	1.9 Mtpa	2.8 Mtpa	State Growth
Massy-Greene Dr	Section from lower intersection with Old Surrey Rd to Bass Highway	HPV / HML	1.9 Mtpa	2.8 Mtpa	Burnie City Council

Road	From / to	Maximum vehicle size	Road use by other commodities[23]	Total road capacity available for minerals traffic	Road manager / limitations / comments
A2 Bass Hwy	Massy Greene Dr junction to Port Rd	HPV / HML	4.2 Mtpa	Capacity 4.7 x 3 (lanes) = 14.1 Mtpa Available capacity = 9.9 Mtpa	State Growth
Edwards St, Bollard Drive Port Rd	Bass Hwy to Burnie port	HPV / HML	3.6 Mtpa	5.8 Mtpa	TasPorts

Source: Study team with input from State Growth

Table D.2 : Road routes to Burnie from the west

Road	From / to	Maximum vehicle classification	Road use by other commodities[24]	Total road capacity available for minerals traffic	Road manager / limitations / comments
Wuthering Heights Rd	Nelson Bay to C214 Heemskirk Road	General Access	0.1 Mtpa	3.3 Mtpa	Forestry Tasmania
Rebecca Road	Wuthering Heights Rd to Blackwater Rd	General Access	0.1 Mtpa	3.3 Mtpa	State Growth Some permits for HPV at 62.5 tonnes exist, with time of day and travel speed conditions.
Blackwater Rd	C214 Heemskirk Rd to Sumac Rd	General Access	0.1 Mtpa	3.3 Mtpa	State Growth Some permits for HPV at 62.5 tonnes exist, with time of day and travel speed conditions.
Sumac Rd	Blackwater Rd to Roger River Rd (Leensons Road Junction)	HPV / HML	0.1 Mtpa	4.6 Mtpa	Forestry Tasmania
Leensons Rd	Hawkes Creek to Roger River Rd	HPV / HML	0.1 Mtpa	4.6 Mtpa	Forestry Tasmania
Roger River Rd	Sumac Rd (at Leensons Road	HPV / HML	0.1 Mtpa	4.6 Mtpa	Forestry Tasmania

[24] Based on 2011-2012 Tas Freight Survey Data, supplemented with information from industry discussions

Road	From / to	Maximum vehicle classification	Road use by other commodities[24]	Total road capacity available for minerals traffic	Road manager / limitations / comments
	Junction) to Buffs Road Junction				
Roger River Rd	Buffs Road Junction to Trowutta Rd	HPV / HML	0.1 Mtpa	4.6 Mtpa	Circular Head Council
B22 Trowutta Rd	Roger River Rd to Edith Creek	HPV / HML	0. 3 Mtpa	4.4 Mtpa	Circular Head Council
B22 Trowutta Rd	Edith Creek to B22 Grooms Cross Rd	HPV / HML	0.4 Mtpa	4.3 Mtpa	Circular Head Council
B22 Grooms Cross Rd	B22 Trowutta Rd to B22 Irishtown Rd	HPV / HML	0.4 Mtpa	4.3 Mtpa	Circular Head Council
B22 Irishtown Rd	B22 Grooms Cross Rd to A2 Bass Hwy	HPV / HML	0.6 Mtpa	4.1 Mtpa	Circular Head Council
A2 Bass Hwy	B22 Irishtown Rd to Edwards St / Bollard Dr	HPV / HML	2 Mtpa	2.7 Mtpa	State Growth PBS 2A under permit (67.5 t)

Source: Study team with input from State Growth

D.3 State Growth vehicle access guide for Tasmanian roads

Masses include steer axle exception (with Front Underrun Protection System FUPS) allowance of 0.5 tonnes.

A 0.3 m length extension beyond 21 m applies only to combinations that have a rear trailer that has a rear load restraining guard that complies with the Forestry Safety Code and is not fitted with more than 7 axles.

General Access [50.5 tonnes max.]:

- 3-axle Truck & 3-axle dog trailer (up to 21.3 m, 6 axles, 48.5 tonnes),
- 3-axle Truck & 4-axle dog trailer (up to 21.3 m, 7 axles, 50.5 tonnes),
- B-double (up to 21.3 m, 7 axles, 50.5 tonnes)

HPV Access (but not HML) [63 tonnes max.]

- 3-axle Truck & 4-axle dog trailer (up to 25m, 7 axles, 56 tonnes),
- 4-axle twin steer truck & 4-axle dog trailer (up to 25m, 8 axles, 61 tonnes),
- B-double (up to 26m, 9 axles, 63 tonnes)

HML Access (but not HPV) [57.5 tonnes]:

- 3-axle Truck & 3-axle dog trailer (up to 21.3 m, 6 axles, 49.5 tonnes),
- 3-axle Truck & 4-axle dog trailer (up to 21.3 m, 7 axles, 57.5 tonnes),
- 4-axle twin steer truck & 3-axle dog trailer (up to 21.3 m, 7 axles, 54.5 tonnes),
- B-double (up to 21 m, 7 axles, 57.5 tonnes)

HPV/HML Access [68.5 tonnes max.]:

- 3-axle Truck & 4-axle dog trailer (up to 25m, 7 axles, 57.5 tonnes),
- 4-axle twin steer truck & 4-axle dog trailer (up to 25m, 8 axles, 62 tonnes),
- B-double (up to 26m, 9 axles, 68.5 tonnes)

PBS 2A (up to 26m) and PBS 2B (up to 30m):

Operation of these vehicles on the State Road network is covered in the State Road Access policy for PBS vehicles. PBS vehicles in certain configurations do offer some opportunity to operate at higher masses compared to the other vehicle combinations outlined above. At higher masses the available network for these vehicles is largely dependent upon the suitability of bridge infrastructure to handle the vehicle.

The Department is currently considering increasing the extent of the PBS 2A network beyond that indicated in the PBS Policy. This is likely to include some routes within the Western Tasmania region.

PBS 2B vehicles of length 26-30m are not currently operating on the Tasmanian road network.

Source: Department of State Growth

Appendix E. Bulk mineral facilities at Burnie port

E.1 Facilities at Burnie port

E.1.1 Overview

Burnie port has facilities for handling many commodities and cargo formats, including containers, liquid bulk (fuel), dry bulk (minerals and woodchip), logs, cruise vessels and break bulk cargoes. The facilities have been progressively developed in response to demand and available resources since the establishment of a small wooden jetty by Henry Hellyer of the Van Diemen's Land Company in 1829[25].

The berths and usage are summarised in Table E.1 and the overall port layout is shown in

25 http://www.burnie.net/files/c7a54de2-c5fe-4e00-841a-a10900d47ae8/Volume-1-Thematic-History.pdf Accessed 2 September 2015

Figure 4.2. The layout of the bulk minerals shed is shown in Figure E.1.

Table E.1 : Burnie port berths

No	Length (m)	Depth (m)	Commodities	Wharf facilities	Utilisation (% time occupied)	Tonnes 2014-15	No ships 2014-15	Typical / maximum ship size
4	183	8.8	Containers and RoRo	RoRo ramp container and mafi trailer storage yard	Dedicated to Toll Shipping	240,000 TEU approx	306	Current vessels 184 m length overall
5	213	10.4	Fuel	Bulk fuel pipework	14.06% YTD	132,679 t import	10	29,335 t
			Bulk minerals	Bulk mineral loader and conveyor in feed	10.88% June 2015	450,385 t export	45	Handy class 25,000 t cap / Supramax 44,000 t cap
			Other			Not reported	Not reported	
						583,064 t	**55**	
6	198	10.5	Logs	Disused container crane	13.07% YTD	224,443	20 (some on B 7)	30,000 dwt
			Bulk cargo		26.38% June 2015	64,153	12	21,000 dwt
			Cruise			--	12	29,258 - 77,441 t
						288,596	**44**	
7	219	11.5	Woodchip	Woodchip loader	20.69% YTD	690,433	13 (some from B6)	Typically 60,000 t shipments (in handymax or supramax class vessels
			Logs		21.32 %June 2015	--		<10,000 t
			Veneer			40,911	4	
			Other			Not reported		
						731,344	**17**	

Source: TasPorts

E.1.2 Port operations

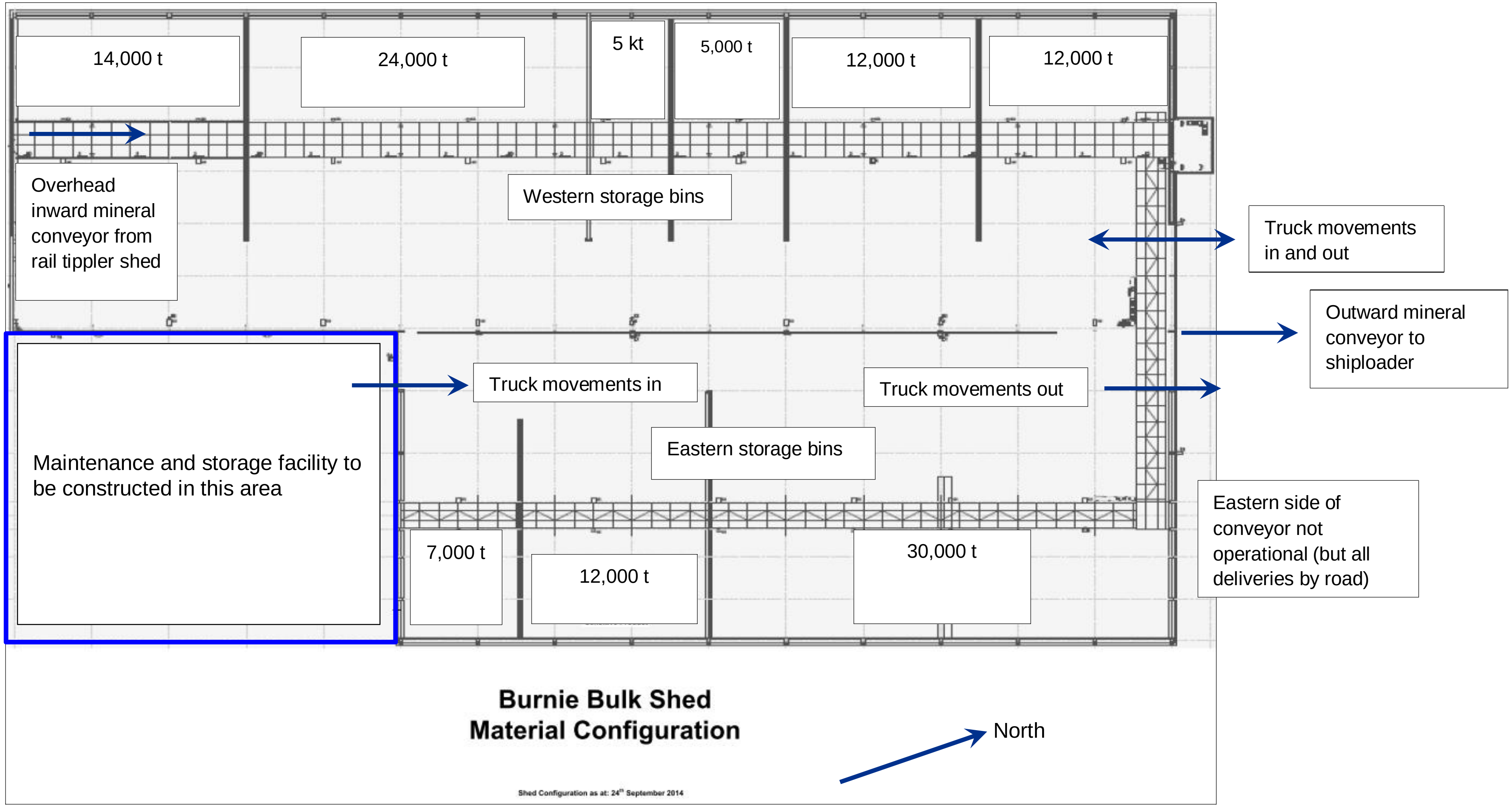
The Port of Burnie operates 24 hours per day, 365 days per year, unless closed due to adverse weather conditions. This is reported as occurring quite infrequently, typically less than one day per year[26].

The minerals berth, No. 5 Berth, is owned by TasPorts and leased to TasRail. TasRail owns the bulk mineral unloading tippler, the bulk mineral shed and mineral shiploader. TasRail offers a variety of service packages to customers from integrated 'pit to port' through to storage and shiploading at the port only. The bulk mineral unloading tippler operates 24 hours per day. TasRail limits the operation of the shiploader to 16 hours per day 0600 – 2200, as demand does not require longer operational hours. However it is understood the shiploader could operate 24 hours per day if there was sufficient demand.

Berth allocation by TasPorts is essentially on a 'first come, first served' basis, with the operational definition being the order of arrival of vessels at the port with a pilot on board. Cruise vessel bookings are made and accepted up to three years in advance, and cruise vessels receive priority access to Berth 6 for the days booked. Cruise vessels generally stay less than 24 hours, and always arrive on the day booked or not at all.

[26] http://www.weatherzone.com.au/news/bad-weather-disrupts-port/20856 Accessed 27 October 2015

Figure E.1 : Bulk mineral shed layout



Source: TasRail

E.1.3 Bulk minerals facilities

The bulk mineral facilities at Burnie port are summarised in sequential order of use in Table E.2.

Table E.2 : Burnie port mineral supply chain facilities

Facility	Quantity, capacity, throughput rate	Comments
Rail delivery		
Rail track entry	Single bi-directional track	Also used by container trains
Rail arrival and departure tracks	2 holding tracks normally used exclusively by mineral trains	Separate tracks for container and other trains
Rail tippler (wagon unloader)	1 – unloads pairs of wagons Unloading rate ~ 450 tph	Current utilisation around 10% Operation 24 / 7 permitted
Elevator conveyor to bulk mineral shed	1 x 2 stage – tippler to transfer tower; tower to overhead conveyor in bulk mineral shed Assume 450 tph – to match tippler	Current utilisation around 10% Operation 24 / 7 permitted
Overhead conveyor system placement in bins on western side of the shed	1 x U shape. Eastern section to 4 bins is not operational at present. Assume 450 tph to match tippler	Inwards minerals to eastern side bins all by road transport at present. TasRail estimated reinstatement of this conveyor system at around $250,000
Road delivery		
Road weighbridge	1 – 26 m (b-double) length and 100 t capacity Typically 3 min per truck weigh	Varying requirements for trucks to weigh in, out, both or not at all. Also used by most log, woodchip, bulk and breakbulk trucks, and by some container trucks
Road unloading area – within bulk minerals shed	Limited to one vehicle at a time, typically 7 mins / vehicle	No road deliveries permitted when shiploading from same side of shed (East or West) underway.
Bulk minerals shed and shiploader		
Front end loader (FEL) reclaiming	2 – capacity depends on bin accessibility and quantity of product held, but typically 1,000 – 1,500 tph in total	The same FELs are used for stockpile loading from road deliveries and reclaiming
Off take conveyors	2 – floor mounted, one from each side of shed, fed by FELs	
Conveyor to shiploader	1 – assume 1,500 tph to match theoretical maximum shiploader rate	
Shiploader	1 – averages 750 tph over whole loading. Based on actuals from 12 months' ship arrival time, departure time, and tonnage data	Average rates lower than maximum is normal, allowing for getting product into corners of hold, trimming at end, etc. Theoretical maximum is 1,500 tph, but routinely performs at 1,200 tph, and averages 800-1,000 tph. Loading rates vary according to product density and particle size. These are for typical mineral concentrates handled in Tasmania.

Source: Study team

E.2 Burnie port mineral supply chain capacity

The current maximum capacity of the Burnie port bulk mineral facilities is estimated at 2.0 million tpa.

The summary capacity estimates for each major component of the supply chains are summarised in Table E.3. The derivation and basis of this is set out in the following sections.

Table E.3 : Burnie port bulk mineral supply chain throughput capacity – major components

<table>
<tr><th>Component group</th><th colspan="2">Realistic maximum achievable capacity</th></tr>
<tr><td>Channel and passage to open water</td><td colspan="2">Essentially unconstrained at maximum volumes of other supply chain components</td></tr>
<tr><td>Tugs</td><td colspan="2">Not a constraint at maximum volumes of other supply chain components</td></tr>
<tr><td>Berth and shiploader</td><td colspan="2">2.9 million tpa</td></tr>
<tr><td>Rail receival at port</td><td>2.7 million tpa</td><td rowspan="2">Rail delivery system to port limited to 1.0 Mtpa by current track and operating protocols</td></tr>
<tr><td>Rail transport system – deliveries of minerals to port</td><td>1.0 Mtpa due to rail curfew in Rosebery, single bi-directional track and three passing loops</td></tr>
<tr><td>Road receival at port (weighbridge)</td><td>4.3 million tpa</td><td rowspan="3">Limit of 2.3 million tpa imposed by road unloading arrangements in bulk mineral shed</td></tr>
<tr><td>Road unloading in bulk mineral shed</td><td>2.3 million tpa</td></tr>
<tr><td>Road transport system</td><td>2.8 million tpa – road capacity between Ridgley and Burnie</td></tr>
<tr><td>Total inwards delivery and receival capacity</td><td colspan="2">Rail 1.0 + road 2.3 = 3.3 million tpa</td></tr>
<tr><td>Mineral concentrate shed</td><td colspan="2"></td></tr>
<tr><td>Rail receival</td><td colspan="2">2.7 million tpa</td></tr>
<tr><td>Road receival</td><td colspan="2">2.3 million tpa</td></tr>
<tr><td>Total receivals</td><td colspan="2">5.0 million tpa</td></tr>
<tr><td>Storage</td><td colspan="2">2.0 million tpa throughput capacity, based on 15 stockturns per annum
Maximum readily handled shipment size 3,000 t to 10,000 t based on loading from accumulated product in bulk minerals shed
2.9 million tpa would be achievable with various relatively minor upgrades to road receival infrastructure</td></tr>
<tr><td>Outloading to shiploader</td><td colspan="2">3.6 million tpa</td></tr>
<tr><td>Shiploader</td><td colspan="2">2.9 million tpa</td></tr>
<tr><td>Total overall system capacity</td><td colspan="2">2.0 million tpa</td></tr>
</table>

Source: Study team

E.2.1.1 Channel and passage to open water

If we assume two vessels of the largest size could leave per high tide and empty vessels could arrive at any time, capacity would be 2 x 365 x 2 x 44,000 t = 64,240,000 t. If we assume average maximum vessel size of

35,000 t, and limitations in tug availability and bad weather reduces capacity by 15%, this gives an annual capacity of over 43 million tpa.

The channel and access to open water do not represent capacity constraints.

E.2.1.2 Tugs

TasPorts towage fleet comprises nine tugs, of which three are ocean tugs based at Port Latta, Burnie and Devonport. These have capacity of 41 t bollard pull, and are capable of moving between ports in open water. The other tugs in the fleet are two ocean tugs based in Hobart, and four harbour tugs split between Hobart and Bell Bay.

There have been no suggestions that a lack of tug availability or capacity is an issue, and so it is concluded that this is not a constraint to mineral export capacity. Towage services are provided on a cost recovery plus margin basis at most ports, and so if additional tugs are required to meet increased demand this should not impose budgetary impacts on TasPorts.

Existing tugs are suitable and satisfactory for the current shipping fleet calling at Burnie, Devonport and Port Latta. However, if Burnie port was redeveloped to accommodate larger vessel sizes, the capacity of the tug fleet would need to be re-examined.

E.2.1.3 Berth and shiploader

There are limitations on the quantity of cargo that can be moved between land and ship at every berth, which stem from:

- The proportion of hours in the year that the berth can be occupied, before delays awaiting berth availability become unacceptable to shippers
- The number of those hours that are available for ships carrying the cargoes of interest to load or unload. The balance will be devoted to other commodities, and to the time required to moor and unmoor vessel.
- The quantity of cargo per available ship working hour that can be loaded or loaded

This analysis assesses the current infrastructure arrangement. Substantial increases in throughput capacity are achievable through larger vessels which can justify substantial investment in faster loading and unloading equipment. By using larger vessels a greater proportion of berthing time is productive, further increasing the berth maximum capacity. The potential for capacity increases from this is considered later in the analysis.

Maximum acceptable berth occupancy

The first of these points is the most challenging to assess, as it relates to how long ships (and those that pay for them) are prepared to wait for the berth required to become available. Arrival timing of charter ships is notoriously irregular, as they are despatched to collect their next cargo independently from each other. This means that there is a substantial element of randomness in arrival patterns.

Ships typically submit a booking form to TasPorts about two weeks ahead of their arrival at the port. Berth allocation by TasPorts is essentially on a ‘first come, first served’ basis, with the operational definition being the order of arrival of vessels at the port with a pilot on board.

Two ships can therefore arrive on the same day, in which case the second ship must wait until the first ship has loaded and departed. This rarely applies to vessels which are part of a regular scheduled service, as these vessels typically follow the same route a week or fortnight apart, and any disruptions are mostly due to bad weather, port equipment breakdown, vessel breakdown or similar occurrence.

The maximum acceptable berth utilisation is driven by how long shippers are prepared to wait for the berth to become available, given that they are paying for ship detention time, known as demurrage. Obviously this delay is not desirable for the shippers and the issue is whether ongoing poor performance would cause them to seek alternatives for the future.

A commonly used assessment for the severity of delays is the ratio of waiting time to loading time[27]. Those who pay to use ships are more likely to accept waiting for two days if it takes four days to fully load (or unload) the vessel, than the reverse.

An assessment of this ratio typically considers various assumptions and factors including:

- Degree of randomness of ship arrival versus degree of planning (based on queuing theory)
- The number of alternative berths available at the port which can perform the same cargo handling function

Another assessment that can be made is to try to balance the costs of constructing additional wharves against the demurrage costs.

These analyses are good from an overall economic efficiency perspective, but generally are unsatisfactory from a direct financial point of view, because the alternatives of construction costs and demurrage costs are nearly always borne by different parties. Shippers will always seek more berths, whereas port authorities will seek to sweat their assets as hard and as long as reasonably possible. For this analysis we have taken as a starting point the proposition that the average ship waiting time should not exceed the average ship working time (that is, a ratio of 1:1).

For Berth 5, handling bulk minerals, the average shipment is approximately 10,000 t (450,385 t in 45 vessel movements in 2014-15), with the largest shipment at 44,000 t. Nearly all mining proponents would prefer to send larger parcels if possible, as the cost per tonne decreases with increasing consignment size. Average consignment size has been increasing consistently, as has average ship size across virtually all commodity types. To provide some degree of future proofing, we have based the calculation of berth utilisation in Table E.4 on an average mineral consignment size of 15,000 t.

With the calculated shiploader performance of 750 tph over all entire loadings in 2014-15, an average loading time of 20 hours results. Allowing 2.5 hours for the combined mooring and unmooring, this gives an average berth occupancy time of 22.5 hours. On this basis, average waiting time should not exceed 22.5 hours.

Table E.4 presents a summary of the berth occupancy versus demurrage time calculations able to be found for non container port terminals with one berth, showing the berth utilisation that results in average ship wait time equalling average ship working time. These are estimates of the maximum berth occupancy that would be acceptable in these circumstances.

Table E.4 : Summary of required berth utilisation where average ship waiting time equals working time: 1 berth

Source	UNCTAD[28]	UNCTAD	Agerschou et al[29]	Agerschou et al
Circumstances	Random ship arrivals	Scheduled ship arrivals	Highly variable ship working time	Limited variability in ship service time
Reference	Table VIII, p 221	Table IX p 222	Table 2.3, p 14, column 5	Table 2.3, p 14, column 6
Berth occupancy where: average wait time = average working time	**58%**	**69%**	**67%**	**50%**
Hours per year	**5,081**	**6,044**	**5,869**	**4,380**
Relevance to this study (see discussion immediately below)	Low relevance	High relevance	High relevance	High relevance

27 Eg Agerschou et al (2004) Planning and design of ports and marine terminals. Thomas Telford, London, 2004
28 United Nations Conference on Trade and Development (1985) Port development
29 Agerschou, H et al (2004) Planning and design of marine terminals. Thomas Telford, London, 2004

Source	UNCTAD[28]	UNCTAD	Agerschou et al[29]	Agerschou et al
Average – % occupancy	**--**	**62.0%**		
Average – hours / year	**--**	**5,431 hours**		

Source: Study team

Of the above circumstances, the first (UNCTAD) is the least relevant, as both the port manager and ship masters will seek to minimise waiting time.

On the basis of this, it is concluded that the maximum acceptable berth occupancy is 62.0% - the arithmetic average of the remaining three calculations, which amounts to 5,431 hours per year.

Berth hours available for mineral ship loading

Berth 5 is also used for petroleum deliveries, with TasPorts provided statistics showing 132,679 t imported petroleum fuels in 10 shipments in 2014-15. It is understood that the average fuel unloading time is around 36 hours, plus four hours for berthing and unberthing the vessels. Thus, (36 + 4) x 10 = 400 hours are not available for mineral loading, leaving 5,031 hours for mineral loading, assuming a steady demand for petroleum.

This analysis assumes that the shiploader can be used 24 hours per day, 7 days per week. It is understood that the present maximum utilisation is up to 16 hours per day, and longer hours are not necessary at current demand levels. We have not reduced shiploader utilisation due to this, because in the event that capacity needs to be maximised, it is assumed that this provision would be renegotiated to enable 24/7 operations.

Cargo quantity handled per hour

From statistics provided by TasPorts for ship arrivals and departures and tonnes loaded, we calculate that the average loading rate for entire typical loadings of 10,000 to 15,000 t is 750 tph. Thus the maximum capacity of the berth and shiploading facilities would be:

- Berth occupancy hours for bulk mineral traffics: 5,031 hours
- Average berth occupancy per vessel: 22.5 hours
- Maximum vessel calls in 5,031 hours: 223.6 ship calls
- Average available loading hours per vessel: 20 hours
- Total available vessel loading hours per year: 4,472 hours
- Average loading rate: 750 t/h
- Maximum total berth throughput per year for minerals: 3,354,000 t

It is commonly stated that shiploader maximum utilisation should not exceed 85%, to allow adequate time for preventative maintenance and an allowance for downtime from breakdown and responsive maintenance. For the Burnie port shiploader, which is commonly (although not universally) stated to be nearing the end of its useful or economic service life, we suggest this should be set at 75%, or 6,570 hours recognising potential for greater maintenance requirements. The 4,472 hours available for mineral loading is substantially lower than this, so there is no need to make an additional allowance for maintenance.

However, to achieve a realistically achievable maximum capacity, we suggest an allowance of 15% should be made for non optimal outcomes, including equipment breakdown, weather disruption to port operation and similar unexpected situations that reduce effective capacity below the theoretical maximum.

- 4,472 hours x 85% = 3,801 hours per year

On this basis, our estimate of Burnie port's berth 5 and shiploader capacity for export of minerals is 2,850,900 tpa – or 2.9 Mtpa in round figures.

E.2.1.4 Mineral concentrate shed

The capacity of the mineral concentrate shed to support export of bulk minerals is a function of three main factors:

- Inwards receival capacity (tph) multiplied by maximum operational hours per year
- Outwards despatch capacity (tph) multiplied by maximum operational hours per year
- Storage capacity – the ability to have sufficient product available for loading when required, supplemented by any ability to receive product to the port and load onto ships by passing the storage facility entirely

  If the despatch rate exceeds the inwards receival rate, then the storage capacity of the facility will also be relevant, considering whether the entire shipment loading can be completed at the maximum despatch speed, particularly when road receivals is limited during shiploading operations

Inwards receival – rail

The rate for rail inloading and receivals is limited by the tippler train unloading rate: 450 tph.

Given there are no reported restrictions on tippler or train operations, theoretically the tippler could operate 24/7, 365 days per year, less allowances for maintenance and non-productive time required for train entry into the tippler facility, clearance at the end of unloading, and facility cleaning if a different product is to be handled next.

Thus, maximum rail receival capacity is:

- Hours per year: 8,760
- Less 15% for maintenance 1,314 hours, leaving 7,446 available hours
- Less 20% allowance (1,489 hours) for non-productive time between trains, leaving 5,957 hours

  This 20% is higher than typical, but provides for the longer time required for system clearout when the product handled changes between trains, such as from copper to zinc concentrate.
- 450 tph for 5,956.8 hours = 2,680,560 tpa

Thus maximum rail receival capacity at Burnie port is estimated at 2.7 Mtpa.

The rail receival volume needs to be summed with estimates of the maximum road delivery capacity to establish the total inwards capacity.

Inwards receival – road

The maximum capacity that road can deliver to the port is affected by the following factors:

- The road system from mines to Burnie port, including maximum truck size on various routes
- The capacity for trucks to pass through the inwards gates of the port, including weighbridge requirements
- The capacity for trucks to unload
- Anything restricting capacity for trucks departing the port, such as requirements for vehicles to be weighed on the way out, for washing or other restrictions

As assessed in section 4.2, the road system is essentially unconstrained in terms of the numbers of trucks that can be accommodated at the mineral quantities under consideration.

There are limitations on truck carrying capacity, which range from around 28 t to 38 t, depending on the route concerned and permits for HPV operations that may be held.

For the purposes of this analysis, we have taken the average truck carrying capacity as 32 t, being a typical carrying capacity for dry bulk trucks visiting the port.

Potential capacity restrictions for bulk mineral trucks from the single weighbridge are assessed in the tables below. Table E.5 shows total weighbridge capacity, with 172,800 weighbridge weighing ‘slots’ per year, or 480 per day.

Table E.5 : Truck weighbridge capacity

Total weighbridge capacity			
Minutes per year	518,400	mins	=360 x 24 x 60
Truck weighing time	2	mins	
Time between trucks	1	mins	
Total time per truck	3	mins	
Total truck weighbridge 'slots' per year			**172,800**
Slots per day			**480**

Source: Study team

Table E.6 shows current weighbridge demand from existing port deliveries and pickups by road, including the number of truck trips made, percentage of each weighed IN and OUT and resulting weighbridge slot demand.

Table E.6 : Current weighbridge demand estimates

Weighbridge current demand						
Commodity	tpa	av truck cargo load (t)	Total truck movements (two way IN	% trucks weighing IN	% trucks weighing OUT	Weighbridge slots required
Fuel	132,679	28	4,739	0%	0%	-
Logs	224,443	32	7,014	100%	25%	8,767
Containers import	119,946	15	7,996	10%	75%	6,797
Containers export	119,308	16	7,457	75%	10%	6,338
Woodchips	690,433	28	24,658	100%	10%	27,124
Veneer	40,911	22	1,860	100%	100%	3,719
Bulk minerals (by road)	241,385	32	7,543	50%	10%	4,526
Bulk minerals (by rail)	209,000					
Bulk minerals (total)	450,385					
Total by road per year	1,569,105		61,267			57,272
Total	**1,569,105**		**61,267**			**57,272**

Source: Study team drawing on TasPorts data

Table E.7 analyses remaining spare weighbridge capacity, considering prime shift (Monday – Friday 0700-1600) and the rest of the week. This split of time was done as it is common that while there may be adequate total capacity in freight infrastructure overall, highly concentrated demand patterns result in lengthy delays in prime times, and substantial periods with very low utilisation at non-prime times.

The conclusion is that an additional 350,000 tpa of bulk mineral deliveries could be handled through the weighbridge during prime shift with the assumptions set out below for the ratio of weighed to unweighed truck deliveries and departures. A further 4.1 Mtpa could be accommodated during non prime times.

This suggests that the weighbridge is unlikely to become a substantial impediment, particularly with the likely move to 24 / 7 operations if volumes increase substantially.

Table E.7 : Current spare weighbridge capacity

Total weighbridge capacity						
Minutes per year	518,400	mins	=360 x 24 x 60			
Truck weighing time	2	mins				
Time between trucks	1	mins				
Total time per truck	3	mins				
Total truck weighbridge 'slots' per year			**172,800**			
Slots per day			**480**			
Weighbridge current demand						
Commodity	tpa	av truck cargo load (t)	Total truck movements (two way IN + OUT)	% trucks weighed IN	% trucks weighed OUT	Weighbridge slots required
Fuel	132,679	28	4,739	0%	0%	-
Logs	224,443	32	7,014	100%	25%	8,767
Containers import	119,946	15	7,996	10%	75%	6,797
Containers export	119,308	16	7,457	75%	10%	6,338
Woodchips	690,433	28	24,658	100%	10%	27,124
Veneer	40,911	22	1,860	100%	100%	3,719
Bulk minerals (by road)	241,385	32	7,543	50%	10%	4,526
Bulk minerals (by rail)	209,000					
Bulk minerals (total)	450,385					
Total by road per year	1,569,105		61,267			57,272
Total	**1,569,105**		**61,267**			**57,272**
Additional available weighbridge capacity						
Total available weighbridge slots:						115,528
Total weighbridge slots Mon-Fri, 0700 - 1600:				=(50 x 5 x 9 x 60) / 3		45,000
Prime time based operations						
Percentage currently used weighbridge slots that are in prime shift:				67%		38,372
Available prime shift weighbridge slots:						6,628
Available slots per hour, M-F 0700-1600 only						2.95
Prime slots available per week				2.14 x 9x5		133
Estimate 50% of IN and 10% of OUT trucks are weighed, so 60% / 2 = 30% all slots are weighed. So for each weighed truck, there are 2.333 mineral truck movements unweighed.				2.333		
Total available prime time mineral movements per week:				96 + 96 x 2.333		442
One way mineral truck movements per week (deliveries) in prime time						221
Available capacity per week at 32 t / truck delivery average						7,069
Available road delivery capacity per year (prime time)				50 weeks		**353,453**
Non prime shift operations						
Available non primeshift weighbridge slots:						108,900
Percentage currently used weighbridge slots that are outside prime shift:				33%		38,124
Available non prime shift weighbridge slots:						70,776
Available slots per hour, M-F 1600-0700 + weekends				5x15 + 2x24		11.5
Non prime slots available per week						1,416
Estimate 50% of IN and 10% of OUT trucks are weighed, so 60% / 2 = 30% all slots are weighed. So for each weighed truck, there are 2.333 mineral truck movements unweighed.				2.333		
Total available non prime time mineral movements per week:				1,398+ 1,398*2.333		4,718
One way mineral truck movements per week (deliveries) in non prime time						2,359
Available capacity per week at 32 t / truck delivery average						75,487
Available road delivery capacity per year (non prime time)				50 weeks		**3,774,343**
Total available road delivery capacity						**4,127,795**

Source: Study team

This shows that at current utilisation patterns for the weighbridge, an additional 133 weighed mineral truck movements could be accommodated in prime time (M-F 0700-1600) and an additional 1,416 movements outside prime time. When unweighed movements at the current estimated ratio of weighed and unweighed movements are added, the following available road deliveries of minerals could be accommodated:

- Current: 241,385 tpa
- Additional capacity for minerals (assuming no change in other trades):
  - Prime shift: 353,453 tpa (0700-1600, M-F)
  - Non prime shift: 3,774,343 tpa
- **Total: 4,369,181 tpa**

This suggests that the weighbridge is unlikely to become a substantial impediment, particularly if there is a move to more 24 hour delivery operations. This is very likely if volumes increase substantially, as it will improve equipment utilisation overall and avoid delays which are more likely during weekday day shift. With increasingly accurate truck based load scales and volumetric loading principles, there is little real need for weighing every load of regular movements when the same fleet of vehicles is routinely used.

On this basis, the weighbridge will be able to accommodate bulk mineral movements up to 4.3 million tpa.

Bulk mineral trucks unload by rear tipping trailer/s inside the bulk mineral shed in front of the stockpile in which the mineral is to be stored. The material is then moved onto the stockpile by FEL to clear the unloading space in preparation for the next truck. For multi trailer trucks such as b-doubles and truck and dog combinations, the rear trailer is tipped first, and the driver then moves the vehicle clear of the unloaded material and reverses to jack-knife the truck, so that the trailer drawbar is out of the way to one side. The front trailer is then tipped to unload. In most cases, the truck can then depart, but in some cases the truck has to wait until the tipped material is moved out of the way by FEL to provide a departure path.

The time to unload two trailer trucks and clear the space for the next truck is typically ten minutes, including FEL clean up time. Two trucks can unload simultaneously, as long as they are not delivering to the same stockpile. This results in a maximum of around 12 unloading movements per hour. For ongoing operations, we have assumed a maximum of 10 unloading operations per hour, as there will be times when simultaneous deliveries will be to the same stockpile. This gives a maximum delivery rate of 350 tph.

During shiploading, truck deliveries are not possible to the side of the mineral shed from which product is being outloaded, because the FELs occupy the space used for unloading, pushing product onto the offtake conveyor. There are also limitations in road receivals to the other side of the shed, as the FELs are busy and have limited time for clearing product from around the delivery trucks and placing into the stock pile. When shiploading is underway, it is estimated that 4 trucks can be unloaded per hour on average, or 140 tph.

We are unaware of any time restrictions on road receivals, so 24 / 7 operations or 8,760 hours per year is assumed. Maximum shiploading hours were assessed at 3,801 hours (see end of section E.2.1.3), so road receival capacity is estimated at:

- 140 tph for 3,801 hours (while shiploading in operation) = 532,140 tpa
- 350 tph for 4,959 hours (the balance) = 1,735,650 tpa
- **Total 2,267,790 tpa**

In round figures, maximum road receival capacity is assessed at 2.3 Mtpa.

E.2.1.5 Implications of bulk mineral shed storage capacity

The bulk minerals shed at Burnie is used to store several commodities for different customers. As shown in Figure E.2, bin sizes range from 5,000 t to 30,000 t. The shed has held up to six different products, with storage volumes ranging from as little as 3,000 t, up to 28,000 t. The total storage capacity is approximately 126,000 t.

This suggests that the maximum shipment size readily handled would range from around 3,000 t to 10,000 t, depending on product, which may be compared with the actual average shipment size of around 10,000 t.

This also supports comments that assembling and loading larger shipments can be problematic, with a need to deliver minerals to be exported while shiploading is underway. As noted earlier, arrangements within the bulk minerals shed mean that road deliveries cannot be made during shiploading to the side of the shed from which product is being outloaded, because FEL activity loading the shiploader outloading conveyor are in the way.

Figure E.2 : Burnie bulk materials shed interior

Storage capacity in the bulk minerals shed also imposes capacity limits due to the need to have export parcels ready for loading when the ship arrives. The current infrastructure has very limited ability to direct load from road or rail receival due to rail receivals being exclusively to storage and road receival to the floor of the shed, where the same FELs operating in the same areas are required to both load outfeed conveyors and manage product into stockpiles from road delivery.

The existing bulk minerals shed has very little flexibility in overall operations, as it is divided into 9 fixed bays, most of which are leased exclusively to specific companies. There are two unallocated bays, each of 12,000 t and these are the only opportunity to cope with peaks from any facility user.

Charging arrangements for bulk mineral facilities are commonly based on throughput, holding quantity or time. Charging based on throughput alone does not impose any penalty for mining companies to hold product at the facility for extended periods, and also acts to limit throughput capacity relative to holding capacity. TasRail may wish to compare current arrangements with industry norms if they are not satisfied with the current charging arrangements for the bulk minerals shed.

We have been unable to locate any relevant benchmarks for throughput capacity relative to holding capacity for multi product, multi fixed storage facilities similar to the Burnie minerals shed. Coal port throughput is typically in the range 10 to 15 times holding capacity, but these are more complicated due to the general need to blend various product types to meet required specification. Also, volumes are much higher, meaning there is relatively less time devoted to establishing and finishing a loading operation. Iron ore stockpiles typically turnover in the range of 30 – 50 times, but this is facilitated by shiploading rates up to 10,000 tph and corresponding rail inloading and reclaiming rates, often by multiple machines working simultaneously. Most mineral shed facilities in Townsville vary between 20 and 50, although there are two which are much lower, due to facility sizing being geared for anticipated volume which did not eventuate. These facilities each hold a few products, and mostly for one company.

Our conclusion is that given the flexibility limitations at the mineral shed and the relatively large number of products and owners relative to holding quantities, the maximum stock turnover achievable will be around 15 times per annum. Given the total storage capacity of 126,000 t, this suggests maximum throughput capacity around of 1.89 Mtpa, or 1.9 Mtpa in round figures.

We also considered this issue from another perspective: to what extent would inefficiencies imposed by the mineral shed facilities and arrangements limit the potential to achieve the maximum upstream and downstream capacities? This limit is 2.9 Mtpa, imposed by berth and shiploader. Our estimates were that inefficiencies and lack of flexibility in storage arrangements would probably reduce effective capacity by between one quarter and one third. This suggests maximum capacity in the range 1.93 and 2.18 Mtpa – just slightly above the stock turn ratio approach above.

On this basis, we have estimated the maximum throughput capacity of the mineral shed as it is currently operated and configured at around 2.0 Mtpa.

E.3 TasPorts 2043 assessment

TasPorts released its 30 year horizon port development plan for all Tasmanian ports it manages in October 2015[30]. The published plan TasPorts 2043 provides a high level over view of the present situation, anticipated port capacity demand, options identified and considered, and strategy conclusions. The conclusions from this assessment are relevant because they examine the same issues with similar objectives – determining what infrastructure investment should be undertaken. The key findings and issues of relevance for the current report include:

- The largest volume recorded passing through all of TasPorts ports in total was in 2008, with 16.2 Mtpa
- The forecast for all ports for 2043 is 17 Mtpa – only marginally more than the largest recorded year
- The unpublished port throughput volumes for the Port of Burnie were 4.457 Mtpa in 2008, of which minerals was 460,997 t
- The forecast minerals volumes for 2043 were based on 2013 volumes, which were 425,211 t
- The expected growth for minerals was estimated at 1%, resulting in the minerals throughput forecast of 573,120 t
- TasPorts concludes that the existing port system will cope with forecast volumes
- The proposed way forward is evolution of the existing multi-port system
- Agriculture and agricultural products will drive growth
- There are no forecast changes in vessel sizes
- There is a strong trend from Hobart in favour of northern ports for most cargoes
- Minerals do not feature highly among issues for consideration, with low growth and volumes expected to remain at Burnie

[30] http://www.tasports2043.com.au/ Accessed 21 October 2015

Appendix F. Dry bulk sea freight rate comparisons by ship class

What are typical sea freight rates for iron ore from Australia to China in capesize (180,000 t), panamax (80,000 t) and supramax (45,000 t) classes of vessel?

The largest dry bulk vessel that can be accommodated at Burnie port is Supramax class. Most world wide iron ore movements are undertaken in much larger vessels.

Recent and current situation

Exporters, particularly those using panamax and handysize dry bulk vessels, have experienced about six years of steady low freight rates.

Capesize rates have occasionally experienced slight increases, as a result of short lived spikes in Chinese iron ore demand. Apart from a few temporary price surges in the winter of 2011-2012 and again in the winter of 2013-2014, daily charter rates for Capes have not averaged above $10,000 per day.

During 2014 these temporary surges have been slightly greater, causing daily rates to average perhaps $15,000. Panamax daily rates, on the other hand, have averaged in the $10,000 range since September 2010 (which was when they last exceeded $20,000).

Volatility

Freight rates are extremely volatile. They reflect the balance of supply and demand and there is currently a glut of shipping, as a result of excessive ship orders being placed during the last boom. The Baltic Dry Index is a measure of freight rates for dry bulk shipping and in February 2015 it reached its lowest point[31] in the 30 years since the Index was first published.

Freight rates have recovered slightly since then, but are still often below the cost of owning and operating the vessels.

One factor causing the reduction in freight rates is the near 50% drop in the oil price and comparable reduction in the price of bunkers (ships' fuel). Fuel makes up approximately 70% of the ship charter cost[32].

Fuel price

Brazil, Australia's principal competitor in the supply of iron ore to China, is about 3 times further away[33]. A key factor in the iron ore market is the difference in transport cost to China between exporters in Australia and Brazil.

The reduction is fuel price and consequent fall in freight rates and transport costs erodes Australia's distance advantage.

Freight rates - Capesize

In early 2014, a capesize vessel was available at around US$35,000 per day[34]. At that time the expectations were that rates would fall, with future rates in the region of US$21,000 per day being anticipated.

The fall in freight rates continued further than that, and by June 2015 the daily rate was barely US$5,000 compared to a break even figure[35] of around US$15,000. In August this picked up, to approaching US$8,000

[31] http://www.zerohedge.com/news/2015-02-18/shipbuilding-orders-slump-baltic-dry-hits-fresh-record-low - accessed 27 October 2015
[32] http://www.platts.com/latest-news/shipping/london/panamax-freight-rates-low-despite-high-brazilian-26120399 - accessed 27 October 2015
[33] http://www.afr.com/business/mining/iron-ore/china-iron-ore-buying-chatter-boosts-shipping-index-20150918-gjqapv - accessed 27 October 2015
[34] http://www.platts.com/latest-news/shipping/singapore/capesize-iron-ore-freight-rates-maintain-downtrend-27792555 - accessed 27 October 2015
[35] http://www.wsj.com/articles/drying-out-1434117374 - accessed 27 October 2015

and in September rose further with figures of US$13,563 and US$14,658 per day being quoted[36], with expectations around US$15,900 for October 2015.

Brazil

These daily rates have resulted in freight rates per tonne which have fallen dramatically over the past two years.

In early 2014, the rate from Brazil to China was around US$27.00 per tonne. By December 2014 the capesize freight rate had fallen to just under US$12.00 per tonne. The rate reached a low of about US$10.00 in May/June 2015 and then rose slowly to US$14.59 by mid-September[37].

Australia

The effects of the collapse in daily vessel rates has also been evident in the per tonne freight rate for Australian iron ore in capesize ships.

From a rate in early[38] 2014 of US$10.75, the rate fell progressively. It was just reported to be just under US$10.00 in November 2014 and down to US$5.12 at the beginning of June[39] 2015. By the end of June it had recovered to just US$5.75.

Freight rates – Capesize, Panamax and Supramax

With such variable freight rates, comparison between different ship sizes is imprecise. Each size of ship carries a variety of different bulk cargoes, and therefore a surge in grain shipments, for example, can cause a surge in demand for panamax vessels and consequent freight rate rise which is not mirrored in the capesize or supramax fleet.

A useful comparison was published in 'Coal Age' magazine[40] on 6 January 2015, which compares the cost of shipping coal from various sources to Rotterdam. The table is reproduced below:

Table 2. Coal Rates to ARA, 2014

Date	PANAMAX			CAPESIZE			
	US Gulf	Puerto Bolivar	Richards Bay, S. Af.	Hampton Roads	Puerto Bolivar	Richards Bay, S. Af.	Newcastle, NSW Aus.
Feb	$ 14.35	$ 12.30	$ 13.00				
Mar	13.35	11.75	12.50				
Apr	11.35	10.65	12.60	$ 8.75	$ 8.25	$ 8.45	$ 10.85
May	15.05	13.00	12.75	9.95	9.05	8.10	10.30
Jun	12.75	11.05	12.25	10.35	9.75	8.40	10.95
Jul	13.10	11.70	12.30	8.80	8.10	8.35	8.25
Aug	11.70	10.75	11.90	8.45	7.85	7.70	8.05
Sep	14.00	12.00	12.00	10.05	9.75	11.10	12.20
Oct (beg.)	13.60	10.60	8.50	9.30	8.70	8.60	12.40
Oct (end)	14.50	11.50	9.20	12.50	12.75	11.80	17.30
Median	**$ 13.40**	**$ 11.55**	**$ 11.70**	**$ 9.75**	**$ 9.30**	**$ 9.05**	**$ 11.30**
Distance to Rotterdam (ARA)							
Kilometers	*8,850*	*8,167*	*13,027*	*6,431*	*8,167*	*13,027*	*21,657*
Naut. Miles	*4,779*	*4,410*	*7,034*	*3,472*	*4,410*	*7,034*	*11,694*

Source: SS&Y

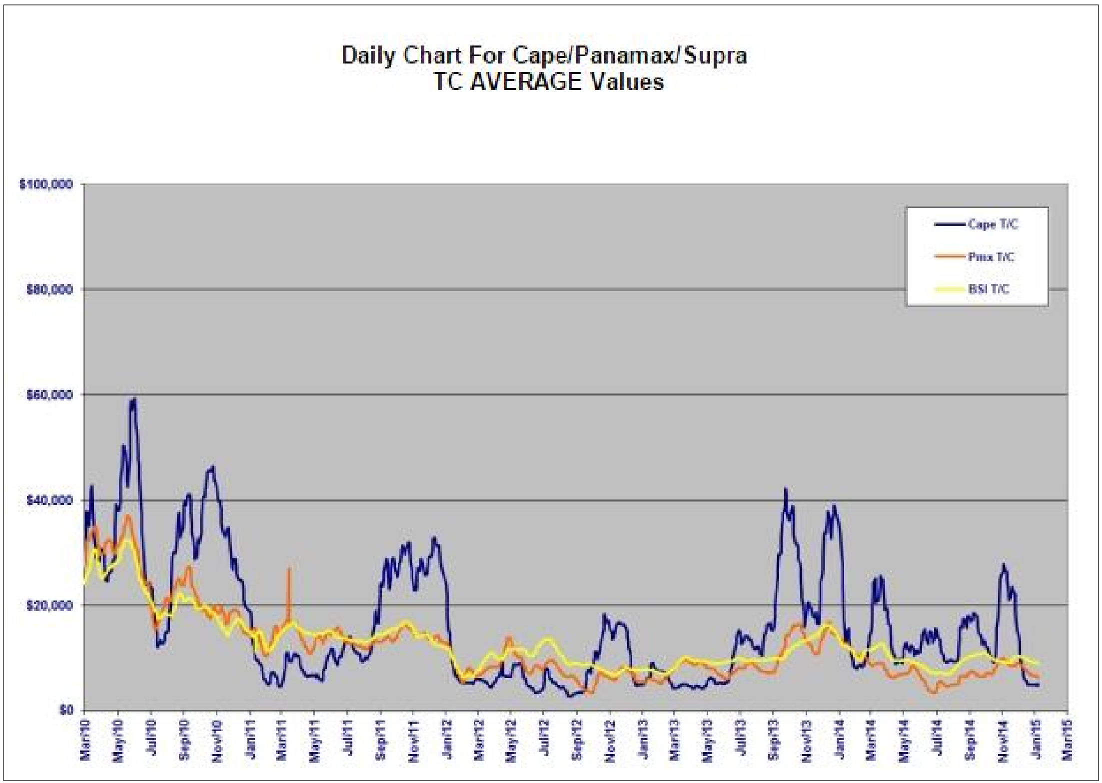
[36] http://www.afr.com/business/mining/iron-ore/china-iron-ore-buying-chatter-boosts-shipping-index-20150918-gjqapv - accessed 27 October 2015

[37] http://www.afr.com/business/mining/iron-ore/china-iron-ore-buying-chatter-boosts-shipping-index-20150918-gjqapv - accessed 27 October 2015
[38] http://www.platts.com/latest-news/shipping/singapore/capesize-iron-ore-freight-rates-maintain-downtrend-27792555 - accessed 27 October 2015
[39] http://www.abc.net.au/news/2015-06-02/shipping-rate-plunge-australia-exporters/6513624 - accessed 27 October 2015
[40] http://www.coalage.com/departments/transportation-tips/4124-ocean-freight-rates-remain-low.html#.Vi7C09-qpBc – accessed 27 October 2015

The associated commentary in the article explaining the table included:

> "Several facts may be noted for the Panamax vessels: same origins rates ran $2.25-$2.65 higher than Capesize, and U.S. Gulf rates ran a disproportionate $1.85 higher than Puerto Bolivar rates. This rate differential may be due to the fact that the initial steaming for U.S. Gulf vessels is on the Mississippi River, where slow travel is combined with very high pilotage fees to cost the shipowner more than a trip originating in Puerto Bolivar.
>
> "By contrast, Capesize loadings at Hampton Roads, Puerto Bolivar and Richards Bay, South Africa, yielded per-ton rates that were very close to each other, even though Hampton Roads is much closer than the other two. Newcastle (Australia) vessels have to transit the Suez Canal, pay high canal tolls, and travel 8,222 miles farther than Hampton Roads vessels, yet their rates were only $1.55 per ton higher. This hardly seems fair to Hampton Roads shippers, but it illustrates the effect of supply and demand on prices. In the Pacific market, there are far more ships available than needed, so the ship owners have to compete through low prices."

Information on supramax freight rates is sparse making comparisons even more difficult. It appears that the daily charter rate for supramax is similar to and often slightly higher than that of panamax, resulting in a per tonne rate significantly more expensive for the smaller ship. The chart and table below[41] show recent trends and spot figures.



[41] http://www.dryships.com/pages/report.php - accessed 27 October 2015

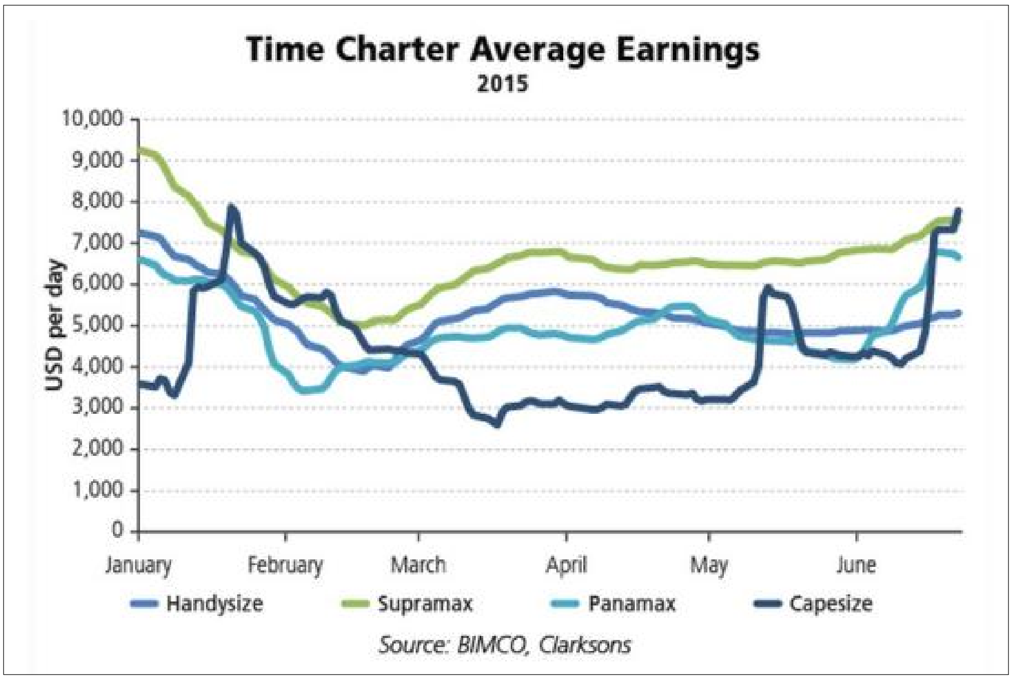
26 October 2015

Baltic Dry Index (BDI) -15 759
Rates

	BCI (Cape index)		BPI (Panamax index)		BSI (Supramax index)	
INDEX	1403	-58	681	-2	646	-2
SPOT TC AVG (USD)	10089	-466	5458	-11	6756	-22
YESTERDAY (USD)	10555		5469		6778	
YEAR AGO (USD)	20988		9102		9404	

Spot TC Average = The Average Value of the Main Shipping Routes applicable for each of the 3 types of Ships
BDI=The Weighted Composite Index of BCI/BPI/BSI

A further chart has been produced by BIMCO and published[42] by Business Insider, shown below, which also shows that supramax day rates are generally higher than for panamax vessels.



Conclusions

The freight rate from Western Australia to China is in the region of US$15.00 per tonne for a capesize vessel. It is likely to be some US$2.50 more for a panamax at about US$17.50 per tonne, while for a supramax the rate may be 50% higher at about US$26.25. Note that these rates are very variable and both the rates may vary and the differential between ship classes may vary significantly, as indicated in the time charter rates chart above.

[42] http://www.businessinsider.com.au/global-shipping-rates-are-on-a-tear-after-hitting-historic-lows-four-months-ago-2015-6 - accessed 27 October 2015

Appendix G. Assessment of mineral supply chain demand

G.1 Introduction

This appendix provides more detail on the estimates for demand for supply chain capacity for mineral movements and exports from Western Tasmania. It is based on:

- Outlooks and forecasts provided by existing and proposed mining operations in discussions held in the context of this project, published on their websites and as assessed by commentators and others with experience likely to produce opinions worth considering
- An overall assessment of the world economic position influencing demand for resource products
- Consideration of the implications for Tasmanian operations and prospects

G.2 The nature of demand for mining and mineral products

Mining and minerals demand is notoriously cyclical with 'booms' and 'busts' that are frequently only recognised in hindsight, despite the amount of time and effort that is devoted to assessment and prediction. This succession of periods of positive sentiment and growth followed by an often sudden negative sentiment, falls in commodity prices and contraction in activity is commonly called the mining cycle[43].

The first generally accepted boom in minerals was in the mid 1800s, when the industrial revolution saw coal replace timber and horses as dominant energy sources, the invention of steel production which produced a much stronger and versatile material than iron for numerous applications[44], and the invention of dynamite, a much safer explosive than earlier alternatives[45]. These changes caused soaring demand for coal and iron, and dynamite made mining and construction of canals and railways safer.

Some of the better known economic downturns which brought often extended periods of growth and optimism to an end included the 'Long Depression' from 1873 to around 1896[46] which included the Australian banking collapse 1892-3[47] and the Great Depression of 1929-32 which culminated with 32% unemployment in Australia[48] and which for many people lasted until the second world war more than a decade later.

Booms in mining industries in more recent times have generally been associated with industrialisation of Asian economies, including Japan from the mid 1950s, Korea from mid 1970s and China from 1990. The spectacular growth in the Chinese economy led to the longest mining boom in living memory, which is generally considered to have lasted until the Global Financial Crisis in 2008[49]. In Australia, the GFC is commonly considered to have had a much less impact on economic activity than in much of the developed world, partly through effective government economic response, but also due to our well developed mineral resources and proximity to strongly growing Asian economies giving advantage over competitors. For this reason, the mining boom is often considered to have lasted until 2011 or 2012 in Australia, when our terms of trade trend changed from improving to declining[50].

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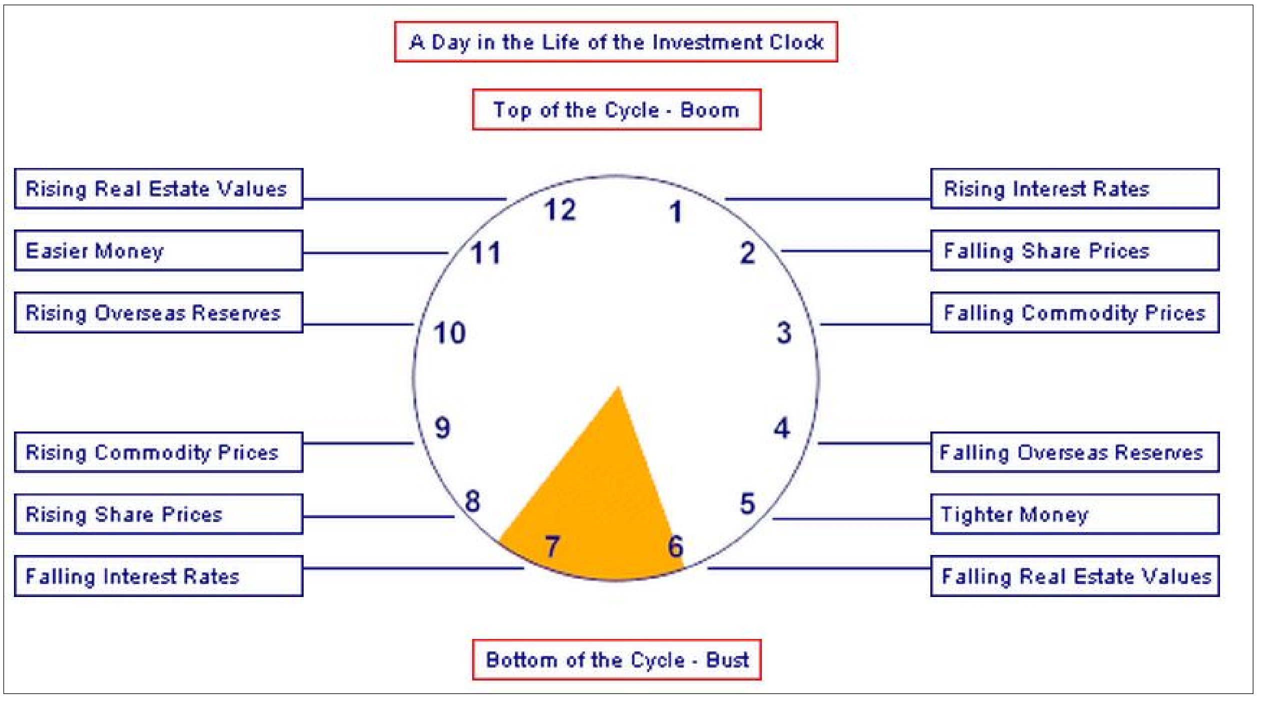
43 http://www.firststateinvestments.com/uploadedFiles/Content/Insights/Articles/Where-are-we-in-the-mining-cycle.pdf Accessed 23 August 2015
44 http://www.victorianweb.org/technology/ir/irchron.html Accessed 23 August 2015
45 http://www.madehow.com/Volume-2/Dynamite.html Accessed 23 August 2015
46 Rosenberg, Hans (1943). "Political and Social Consequences of the Great Depression of 1873-1896 in Central Europe". The Economic History Review. 13 (Blackwell Publishing) (1/2): 58–73.
47 http://www.rba.gov.au/publications/rdp/1999/pdf/rdp1999-06.pdf Accessed 23 August 2015
48 http://www.rba.gov.au/publications/rdp/1999/pdf/rdp1999-06.pdf Accessed 23 August 2015
49 http://symposium.net.au/blog/october-2013-lionanalyst-paper-mining-investment-cycles/ Accessed 23 August 2013
50 For example http://grattan.edu.au/report/the-mining-boom-impacts-and-prospects/ http://www.smh.com.au/business/some-fear-the-mining-boom-will-turn-to-bust-20130329-2gz2o.html and http://www.macrobusiness.com.au/2013/07/how-australia-wasted-the-mining-boom/ Accessed 23 August 2015

G.3 The investment cycle clock

The cyclic trend in mining has often been portrayed as a clock face to show the repeating cyclic nature of the steps commonly encountered, with an example in Figure G.1. This was first published in London's Evening Standard in 1937[51], and is one of the tools commonly used by many investment advisors to this day.

Figure G.1 : Investment cycle clock



Source: http://www.businesscycles.biz/business.htm Accessed 23 August 2015

The biggest challenges with this clock tool are determining where the economy is on it at any given point, and how long the overall cycle takes.

At the time of writing, evidence can be seen for many points on the diagram above. For example:

- 11 – easier money (lower interest rates in past year or so)
- 12 – rising real estate values (certainly in large cities but not mining towns)
- 3 – falling commodity prices
- 4 – falling overseas reserves
- 5 – tighter money (rising interest rates as suggested by RBA as the next change)
- 6 – bottom of the mining cycle – the number of projects placed in care and maintenance or failing to gain investor support to commence

The ASX August 2015 investor newsletter[52] summarises its views on this as follows:

> **"Where are we?**
>
> "We are still around 17 per cent below the record market high achieved in November 2007 of around 6,800 points. In 125 years of share market history the index has never failed to get back to, and then surpass, its previous high.

[51] http://www.asx.com.au/education/investor-update-newsletter/201508-what-time-on-the-investment-clock.htm Accessed 23 August 2015
[52] http://www.asx.com.au/education/investor-update-newsletter/201508-what-time-on-the-investment-clock.htm Accessed 23 August 2015

"Frustratingly, it is certainly taking some time to achieve this in the current cycle. We are now in the seventh year of the market rebuilding process since the index high point was reached. It will be eight years this November if we have still not reached it.

"The seeds of the recovery are now well and truly sown and eventually share prices will rise further as unemployment, which is often regarded as a lagging economic indicator, begins to fall. Share prices move through a period of gradual to rapid increases from 6 o'clock until about 11 o'clock, as commodity prices could start to increase again, overseas reserves are rebuilt and money remains easier.

"Will 2016 be the year we hit the Boom Phase? It often takes years (five to seven) to get to the Boom Phase of the cycle. Because of the digital age and the power of the information age, the old norms of a cyclical market have been rewritten for the 21st century.

"When we get to the Boom Phase, all the usual signals are there to tell investors they are on borrowed time. This is a time of maximum optimism, a feeling of real and sometimes imagined wealth, where investors have accumulated significant assets and have an attitude that favourable conditions will continue indefinitely".

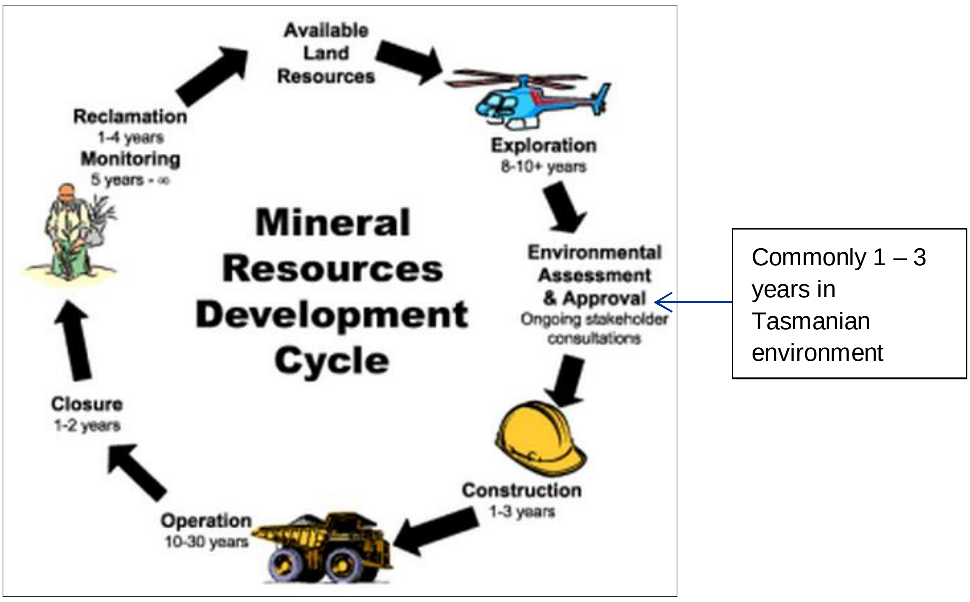
Given that there is general agreement that Australia is past the top of the market associated with the last boom phase, which probably ended around 2012, the ASX commentary of 2016 to hit boom and taking five to seven years to reach that point are contradictory, unless the last boom ended earlier. This assessment would suggest that the change to positive sentiment of a boom is more likely in 2017 or 2018.

Many analysts have examined the length of the cycle, and five to 10 years is a common estimate[53]. This would support a return to the positive sentiment later, possibly 2017 – 2020.

G.4 The mining project life cycle

When the cycle of development of mining projects is then factored in, it is easier to understand how long it can take for hoped for developments to achieve reality. The Mining and Metallurgical Society of America depicts the mining life cycle as shown in Figure G.2

Figure G.2 : Mining life cycle



Source: http://miningfactsmmsa.com/how-mining-works/mining-life-cycle/ Accessed 23 August 2015

53 For example http://www.lionselection.com.au/investor-centre/lion-research/ October 2013

Applying this to the Tasmanian mining prospects identified, most have completed adequate exploration to understand the potential of the reserves held. Those that are attempting to get projects underway and generally facing challenges from one or more of:

1. Raising investment funds – challenges from negative investor sentiment in current market
2. Demonstrating project financial viability – inadequate commodity prices
3. Achieving environmental approval and licensing

It would appear that the timeframe implications from these may be as follows:

1. Raising investment funds is likely to be linked to the investment cycle summarised in Figure G.1, which suggests in the range 2017-2020
2. Demonstrating project financial viability is tied to commodity price cycles, examined below
3. Achieving environmental approval and licensing: nearly all project proponents we held discussions with stated that these activities were generally underway and would be undertaken concurrently with other financial assessment and project planning work. This is thus likely to end in the period 2017-2020 also.