Strategic East-Coast Regional Grain Network

Investigating possible road/rail policy and investment options across QLD, NSW & Victoria, to respond to the operation of Inland Rail

iMOVE Project 2-023

Milestone 4

25 March 2025

Strategic East-Coast Regional Grain Network: Moving Export Bulk Grain from Farm to Port

iMOVE Project 2-023

Milestone 4 – Final

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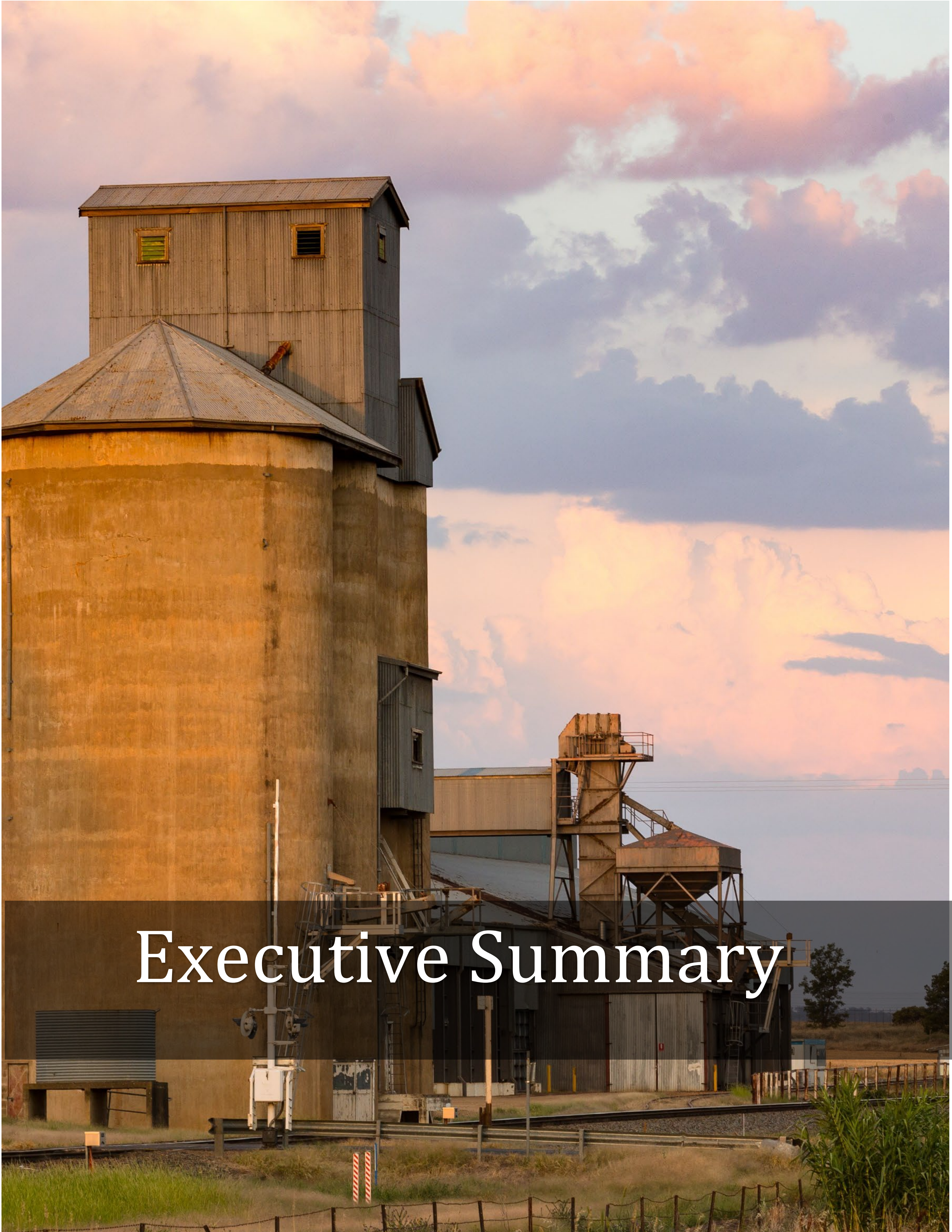
Acronyms

ATAP	Australian Transport Assessment Planning
ATRC	Australian Rail Track Corporation
B/C	Benefit-cost ratio
CRN	Country Regional Network
ECGTS	East Coast Grain Transport System
GHMS	Grain Harvest Management Scheme
GTK	Gross tonne kilometres
GVM	Gross Vehicle Mass (in tonnes)
HDM	Highway Design and Maintenance
IPART	Independent Pricing and Regulatory Tribunal
IR	Inland Rail
IRI	International Roughness Index
LCP	Least Cost Pathway
MoCI	Memorandum of Cooperation for Interoperability
NPV	Net Present Value
NSW	New South Wales
PC	Productivity Commission
SDCR	Social Discount Rate
TfNSW	Transport for NSW
VOC	Vehicle Operating Cost



Executive Summary

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Inland Rail (IR) is Australia's largest freight rail infrastructure initiative. It is a transformative national project expected to change the way some commodities move on the East Coast. This milestone deliverable consolidates the economic assessment and policy development options for reducing least-cost pathway divergence.

This report presents the economic evaluation of 12 grainlines, 10 in NSW and one each in Victoria and Queensland (Part 1). The economic evaluation is based on a cost-benefit analysis of closing or disusing the 12 grain lines or upgrading these to three different track quality standards – where these standards are not already in operation. The report then considers policy considerations for enhancing the modal share of rail for grain transportation (Part 2). These policy considerations go beyond grain line upgrading or operational characteristics.

Benefits and costs associated with grain line operations is a function of the amount of grain being transported and the mode of transportation. When grain lines are closed, or are underserviced by trains, additional trucks are required to transport grain from up-country farms. When grain lines are upgraded trucks are (potentially) removed from up-country roads. The economics assessment is based on the differential resource costs and externalities associated with moving grain by rail and road.

The approach taken in Part 1 is a rapid benefit-cost assessment at a Gate 0/1 level of detail and accuracy. The approach taken in Part 2 is an institutional economics discussion of policy options for aligning commercial and social least-cost pathways.

Tables E1-E3 provide a summary of the benefit-cost (B/C) ratios for four scenarios: rail closure, upgrading to rail line quality class 3, upgrading to rail line quality class 2, and upgrading to rail line class 1. The analysis compares the benefits and costs of shifting existing grain freight from road to rail against transporting the same grain volume by three truck types: Semi-trailers (6-axle), B-doubles (7- axle) and Road Trains (12-axle), **Tables E1**, **E2**, and **E3**, respectively. Baseline result examine scenario impacts between start and end of the respective grain lines. Networked results include scenario impacts (fewer trains, less trucks) extending between grain lines and ports.

Each B/C ratio represents the ratio of scenario specific benefits and costs. A ratio below (above) 1 means that benefits are less (more) than the cost associated with that scenario. When comparing B/C ratios across truck types (scenarios) the impact of High Productivity Vehicles (HPVs), for each investment option, can be assessed.

Tables E1-E3 also include a traffic light system (green, orange and red) that provides a more qualitative assessment of the B/C ratios. Green signifies retain rail or upgrade rail option, orange signifies indeterminate case for retaining or upgrading rail option, red signifies no clear economic case for retaining or upgrading rail option.

The 'Best Economic Benefit' column in Tables E1-E3 provides an overall qualitative assessment of each grain line. This includes results from closure/disuse, upgrade alternatives and break even analysis.

A key consideration across each of the scenarios and variations in analysis is the sensitivity of the results to the volume of grain freight. The outcome of the economic assessments of grain line retention or upgrading is a function of the amount of grain currently transported, and the responsiveness of rail-based freight to upgrading of operational characteristics. No robust measure was found for the latter. The analysis therefore employs a rudimentary rule of thumb – a 10% uplift in rail-based freight for each class upgrade - and complements this with a breakeven analysis – the amount of additional rail-based grain freight required to generate B/C ratios of one. Freight volumes have been triangulated from multiple sources.

Table E1 – Summary networked B/C results, rail and Semi-Trailer options (7% discount rate)

No road uplift – retain existing Semi Trailer access					Best Economic Benefit
Closure (CL) or Upgrade	CL	C3	C2	C1	Rail
Burren J.– Merrywinebone	0.50	0.05	0.10	0.12	Retain as is
Camurra J.–Weemelah	1.73	0.01	0.02	0.02	More analysis required
Nevertire–Warren	49.41	0.00	0.00	0.00	Withdraw Services, subject to non-grain market potential
Bogan Gate–Tottenham	0.53	0.05	0.09	0.11	Retain as is
Ungarie–Lake C.	1.04	0.02	0.04	0.05	More analysis required
Ungarie–Naradhan	0.37	NA	0.17	0.21	Retain as is, subject to market potential
West Wyalong–Ungarie	0.12	NA	1.00	1.28	More analysis required
Griffith–Hillston	0.36	0.07	0.15	0.19	Retain as is
The Rock–Boree Creek	0.25	0.11	0.25	0.31	Retain as is, subject to market potential
Camurra J. – North Star	0.26	NA	NA	NA	Retain as is
Benalla–Oaklands	0.14	0.22	0.37	0.45	Retain as is, subject to market potential
Goondiwindi–Thallon	0.13	0.10	0.21	0.26	Retain as is

Note: CL: Close/disuse, where the B/C ratio indicates the benefits and costs of closing the existing grain lines. C3=Class 3 upgrade, C2=Class 2 upgrade, C1=Class 1 upgrade. A B/C ratio greater than 1 indicates that the economic benefits of upgrading specific grain lines exceed the cost of doing so, and vice versa. The colouring scheme provides a qualitative traffic light approach to the B/C ratios with respect to retaining the train options or investing in rail upgrade. Green indicates a B/C ratio where the train or investment option differs from 1 by at least 0.2 ratio-points in favour of the train/investment option. Red indicates a B/C ratio where the train or investment option differs from 1 by at least 0.2 ratio-points against the train/investment option.

Table E2 – Summary networked B/C results, rail and B-double options (7% discount rate)

Change in Rail Case for B-double road access					
Closure (CL) or Upgrade	CL	C3	C2	C1	Rail
Burren J.– Merrywinebone	0.57	0.04	0.09	0.11	Retain as is
Camurra J.–Weemelah	1.96	0.01	0.02	0.02	More analysis required
Nevertire–Warren	56.15	0.00	0.00	0.00	Withdraw Services, subject to non-grain market potential
Bogan Gate–Tottenham	0.58	0.04	0.08	0.10	Retain as is
Ungarie–Lake C.	1.18	0.02	0.03	0.05	More analysis required
Ungarie–Naradhan	0.42	NA	0.15	0.18	Retain as is, subject to market potential
West Wyalong–Ungarie	0.13	NA	0.89	1.12	More analysis required
Griffith–Hillston	0.40	0.06	0.14	0.17	Retain as is
The Rock–Boree Creek	0.26	0.11	0.25	0.29	Retain as is, subject to market potential
Camurra J. – North Star	0.29	NA	NA	NA	Retain as is
Benalla–Oaklands	0.17	0.19	0.32	0.40	Retain as is, subject to market potential
Goondiwindi–Thallon	0.17	0.08	0.19	0.24	Retain as is

Note: *See Table E1.*

Table E3 – Summary networked B/C results, rail and Road Train options (7% discount rate)

Change in Rail Case for Road Train					
Closure (CL) or Upgrade	CL	C3	C2	C1	Rail
Burren J.– Merrywinebone	0.62	0.04	0.09	0.11	Retain as is
Camurra J.–Weemelah	2.15	0.01	0.02	0.02	More analysis required
Nevertire–Warren	61.66	0.00	0.00	0.00	Withdraw Services, subject to non-grain market potential
Bogan Gate–Tottenham	0.63	0.04	0.08	0.09	Retain as is
Ungarie–Lake C.	1.29	0.01	0.03	0.04	More analysis required
Ungarie–Naradhan	0.47	NA	0.14	0.17	Retain as is, subject to market potential
West Wyalong–Ungarie	0.14	NA	0.82	1.05	More analysis required
Griffith–Hillston	0.44	0.05	0.13	0.16	Retain as is
The Rock–Boree Creek	0.32	0.09	0.22	0.26	Retain as is, subject to market potential
Camurra J. – North Star	0.32	NA	NA	NA	Retain as is
Benalla–Oaklands	0.18	0.18	0.30	0.37	Retain as is, subject to market potential
Goondiwindi–Thallon	0.17	0.08	0.18	0.23	Retain as is

Note: See Table E1.

The economic case for closing the existing grain lines is not compelling. In most cases, the additional negative economic impacts exceed the gains from switching from rail to road. The three grain lines where this is not the case have separate uncertainties. Nevertire to Warren is primarily used for non-grain transportation. Moreover, parts of the line have not been in use since a 2012 fire at the rail bridge at Gunningbar Creek outside Warren. Lake Cargelligo to Ungarie and Weemelah to Camurra Junction analyses are based on low freight volumes and significant periods of no freight.

But the case for rail line upgrade is also not strong in most cases when using a 7% discount rate (SDRC). The analysis shows that incremental changes in the volume of grain shifted from road to rail, while producing appreciable societal benefits, is insufficient to match the estimated cost of providing the upgrade works. One exception West Wyalong to Ungarie where the investment cost for upgrades to Class 2 and 1 largely meet the social benefit. This is most clearly the case when compared to the social cost of Semi-trailers. The B/C ratios become smaller when compared against HPVs, but remain within a margin of +/- 0.2 B/C points. Bracket in the bullet point identify the specific investment scenario for which the qualitative assessment applies.

- West Wyalong to Ungarie: upgrades to Class 2 and 1 (all truck types)

Results in Tables E1, E2 and E3 are sensitive to the choice of discount rate and freight volumes used in analysis. At lower SDRC (3%) the investment case for upgrades improve somewhat, but the qualitative upgrade assessment only changes for one line and requiring further analysis – when compared to the benefit of removing semi-trailers from the road.

- Benalla to Oaklands : upgrade to class 1 (semi-trailers)

Finally, a **breakeven analysis** (grain required to obtain a B/C ratio of 1) suggests that the economic upgrading case for four grain lines hinges on mode shift representing less than a doubling of current rail-based grain freight. These are:

- Ungarie to Naradhan (upgrade to Class 2)
- West Wyalong to Ungarie (upgrade to Class 2 and 1)

- The Rock to Boree Creek (upgrade to Class 3)
- Benalla to Oaklands (Upgrade to Class 3, 2, and 1)

However, rail's competitive advantage declines when the analysis is conducted based on B-doubles and Road Trains. For most of the grain lines and scenarios, this impact does not substantively change the qualitative assessment of the above analysis.

The dependency of the economic assessment of grain line retention and/or upgrading on the separate, or coordinated, actions of other actors in the grain export supply chain (rail operators, receival and storage sites, on-farm storage) suggests that alignment of incentives and coordination (long-term contracting, quasi-reintegration), of bulk grain supply chain operations, can potentially achieve similar or superior outcomes to below-rail investment.

Risk sharing models can better align above and below rail operations, maintenance, investment incentives; distribute risk between public and private actors; and reduce combined costs; thus, facilitating greater utilisation or competitiveness with roads. Subsidies, contracting, investment guarantees, performance-based incentives and asset sharing models provide additional means of managing the distribution of risks related to above and below rail operations, and complementary infrastructure investment and management. Three alternative organisational modes, and the associated re-allocation of risk are examined:

- *Integrated or franchised model* gives the operators exclusive control of above and below rail operations, including the collection of revenue.
- *Service delivery model* gives the operators exclusive control of above and below rail operations, excluding the collection of revenue.
- *Regional infrastructure model* broadens the current track underwriting and subsidised access model to include other public bodies and/or industry stakeholders. Intended to generate a coordinated approach to regional infrastructure spending across either rail or road modes.

Governance reforms can reduce transaction costs associated with coordinating grain transport across jurisdictions/regulatory environments, across different network providers; thus, facilitating greater utilisation or competitiveness with roads. The development of Inland Rail (IR) provides a potential catalyst for developing an East Coast Grain Transport System (ECGTS). An ECGTS might operate along two complementary approaches:

- An East Coast Framework for Grain Transport Policy for enhancing cross jurisdictional governance.
- An asset sharing arrangement for rolling stock, potentially extending to joint investments around additional complementary infrastructure.

An East Coast Framework for Grain Transport Policy might include:

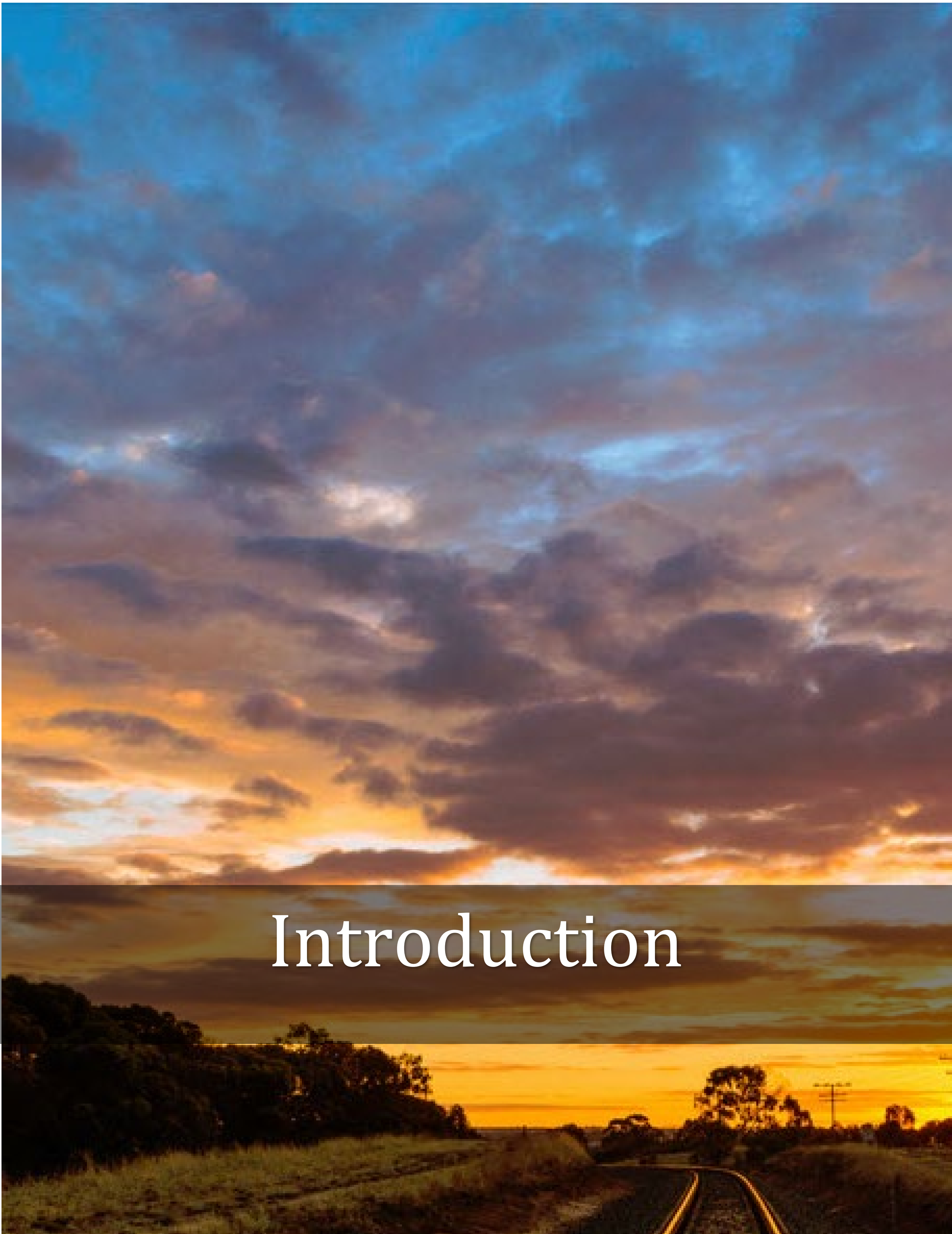
- Enhanced data sharing and transparency between jurisdictions and industry to improve operational planning and coordination, manage risks as well as externalities, and identify commercial and social least-cost pathways. An improved data infrastructure is foundational to support risk sharing, governance reforms and establish reasonable expectations around policy impact/efficacy.
- A streamlining of decision-making processes and clarification of responsibilities, potentially leading to more efficient operations. An east coast policy framework may be particularly appropriate to grain where seasonal variations in harvest patterns and demand for transport options, to a degree, can be mitigated and smoothed by more efficient integration of grain lines under an East Coast Grain Systems approach.

- Standardising regulatory frameworks and operational processes across the east coast states provides a more formalised approach of addressing investment and transaction cost aspects. Any reforms should align with ongoing work under the National Rail Action Plan.

A barrier to an East Cost Framework for Grain Transport Policy and IR as a catalyst for integration or coordination is variation in gauge standards across the three east coast states. In Victoria (except Benalla to Oaklands) and Queensland (including Goondiwindi–Thallon) broad and narrow gauge are the conventional standards. Integration around IR may thus also result in aspects of rail networks in Victoria and Queensland less integrated with their rest-of-state networks.

While the analysis focuses on policy options for enhancing grain rail utilisation, or competitiveness of rail compared to roads it is important to note that **effective and efficient grain rail systems will remain heavily reliant on the availability and integration of trucks**. Policy initiatives to increase the share of rail-based grain freight therefore require systems levels approaches and alignment of incentives across road and rail, below- and above-rail infrastructure and complementary infrastructure to ensure continued economic viability of decarbonising grain transportation (and production) at reduced lower social cost.

A major input to the final analysis of policy options is stakeholder engagement. This report will be updated with insights from stakeholder consultations when these have been completed.



Introduction

Introduction

Inland Rail (IR), Australia's largest freight rail infrastructure initiative, is a transformative national project that is expected to change the way some commodities move on the East Coast. The significance of the project is in its trucks on roads and reduced carbon emissions. potential to shift more goods from road onto rail providing opportunities for faster and more reliable delivery to the country's growing population, and to national ports for export to global markets. The project will also provide an alternative rail route, meaning safer and less congested roads, fewer heavy

Inland Rail is set to increase the commercial appeal of rail for the long-haul task to ports, which rail already dominates for some commodities. What is not well understood, however, is how these commodities would move from farms and consolidation centres onto Inland Rail; and what the impact of those movements could be on regional road and rail networks; and, if so, should governments invest in road or rail options for the modally contested components of the grain haulage task.

Grain production along the Australian east coast is distributed across three state jurisdictions. State-based rail systems are without a common rail track standard and have separate above and below rail operations.[1] Grain transport involves multiple private and public companies or regulatory bodies, separate below- and above-rail operations, and transport by road or intermodal (road and rail) means. This organisational and institutional structure of grain freight emerged out of a series of reforms in the 1990s intended to promote competition and achieve greater levels of efficiency (Abbott and Cohen 2016).

The Australian trend in this respect follows those seen in some international jurisdictions. Post-reform analysis shows that the net effects of separating the components of 'system goods' can lead to a misalignment of incentives (Van de Velde et al 2012). The Productivity Commission similarly concludes that regulatory and organisational fragmentation can inhibit the efficient operation of trains, impede effective competition and coordination, and increase transaction costs and investor uncertainty (PC 2006: p.297). Van de Velde et al (2012: p.5) also concludes that the effects of misalignment (i.e., cost) increase with the density of rail traffic. Low utilisation of rail may thus be a transaction cost-reducing strategy.

In determining what the optimal decision-making by east-coast government(s) may be for their regional road and rail networks that service the export grain task, the Victorian (VIC), New South Wales (NSW) and Queensland (QLD) Governments need an updated evidence-base that factors in the impact of Inland Rail.[2] The current evidence-base for making these regional road or rail investment decisions is dated and precedes not just the Inland Rail business case, but also changes in policy emphasis by governments, particularly the need to reduce transport's contribution to emissions.

Throughout Part 1 the analysis focuses on bulk grain supply chain operations. In this respect the economic assessment is – in some cases – partial in that it only considers the transportation of grain by either rail or road. Where the analysed rail segments also transport other produce and cargo the analysis *underestimates* the value of retaining existing rail infrastructure and the benefits of shifting additional produce and cargo transportation to rail. This is the case, for instance, for the Goondiwindi to Thallon line (QLD) and Nevertire to Warren (NSW).

[1] Throughout this report 'east coast', or 'Australian east coast', refers to New South Wales, Queensland, and Victoria.

[2] Noting that in Victoria the Inland Rail Project only affects the Benalla – Oaklands line.

A key uncertainty throughout the report is the responsiveness of rail-based grain freight to investment in the below-rail infrastructure. The erosion of rail historic advantage over road has many reasons (White et al 2018). These include technology and market changes providing commercial benefits that may be difficult to recapture for rail in general, and with below-rail investment specifically. There is thus a divergence of social and commercial least-cost pathways for grain freight from farm to end-users or port.

Part 2 therefore also considers two institutional aspects of possible least-cost pathway alignment for rail-based grain freight in NSW, Victoria, and Queensland:

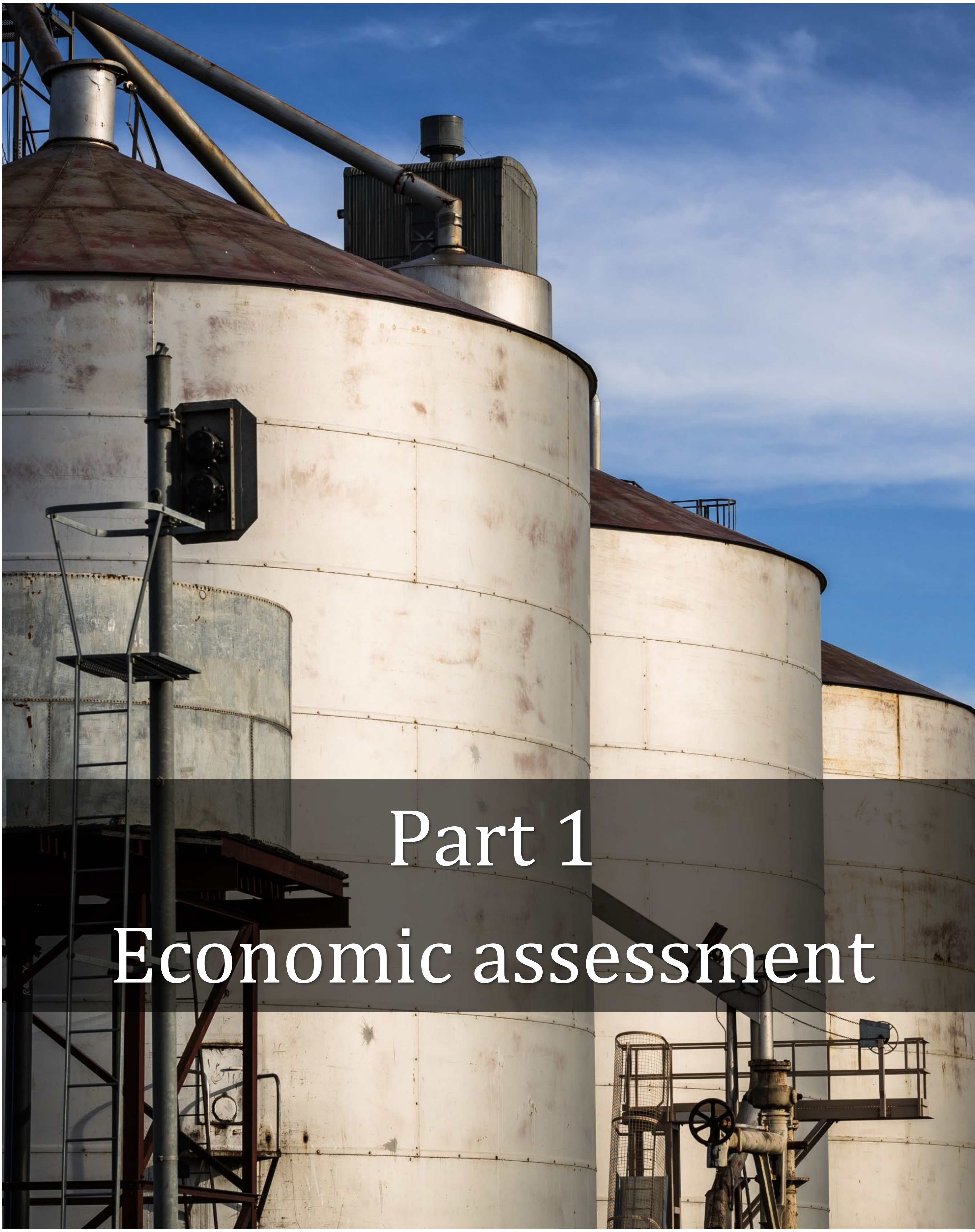
1) There are risk sharing models that seek to align above- and below-rail operations, maintenance, and investment incentives; reduce combined costs; thus, facilitating greater utilisation or competitiveness with roads.
2) Governance reforms that seek to reduce transaction costs associated with coordinating grain transport across jurisdictions/regulatory environments, across different network providers; thus, facilitating greater utilisation or competitiveness with roads.

While this report focuses on policy options for enhancing grain rail utilisation, or competitiveness of rail compared with roads it is important to note that effective and efficient grain rail systems will remain heavily reliant on the availability and integration of trucks. From a transport system perspective, shifting grain from road to rail can produce significant economic, social and environmental benefits. These benefits are socially and politically attractive.

However, the erosion of rail's historic advantage over road has many causes (White et al 2018). These include technology and market changes providing commercial benefits that may be difficult to recapture for rail. The policy development options discussed in this milestone report therefore need to be measured against potentially unintended consequences on other aspects within the grain transport supply chain. For instance, truck operators may rely on a combination of short- and long-haul tasks to ensure that the required trucking infrastructure for increased rail freight remains commercially viable. Substituting rail-based freight on long-haul legs may consequently also affect the viability and costs of short-haul legs.

A regional infrastructure model, as touched upon in this milestone report, provides a vehicle for considering a broader perspective on what constitutes an effective and future proof grain freight system. However, more generally, policy initiatives to increase the share of rail-based grain freight require approaches that consider the grain freight system as a whole. This includes alignment of incentives across road and rail, below- and above-rail infrastructure, and complementary infrastructure to ensure continued economic viability of decarbonising grain transportation (and production) at reduced lower social cost.

The report is structured in two sections, consolidating the outputs from Milestone 3 and Milestone 4 reporting. Part 1 contains the economic assessment. Part 2 contains the policy consideration analysis.



Part 1
Economic assessment

Economic assessment

The aim of the economic assessment is to:

Update and improve the current evidence base available to the VIC, NSW and QLD Governments, for considering future public policy interventions or investments that relate to the optimal use of the regional road and rail networks, used for the export of bulk grain.

From an economic assessment perspective this aim translates into:

> ***RQ1****: Whether public investment should be directed to maintaining or upgrading the existing grain rail infrastructure, or whether it should be directed towards upgrading road infrastructure for grain transport?*
> ***RQ2****: How high productivity road vehicles affect the public policy economic case for maintenance and investment in the grain rail infrastructure?*

The context for the analysis is the construction of Inland Rail that will, for some of the grain lines, enable greater loads per grain wagon to be transported directly, and at faster speeds, from up-country on-rail grain silos to port.[3] However, for the majority of the assessed grain lines, the extent to which this option arises is mitigated by the rail track quality of the main line network that connects grain lines either to Inland Rail, or across Inland Rail to ports.[4] That is, for the 12 examined grain lines, the full effect of Inland Rail is conditional on the operational characteristics of the main lines. Where main lines segments between grain lines and Inland Rail have lower operational characteristics than Inland Rail, the full benefits of Inland Rail (such as heavier trains) depend on both grain lines and main line characteristics.

In this analysis, the public sector investment decision is therefore a function of the amount of grain that is transported by rail and road in the current operating environment, and the amount of grain shifting from road to rail because of upgrading existing grain lines to carry heavier and/or faster trains.

Outline of approach – cost-benefit analysis

This chapter evaluates these investment decisions by comparing the external costs, operating costs (resource basis), infrastructure cost, crash costs and freight travel time saving associated with the volume of grain transported along each grain line, by either rail or truck. Four scenarios are analysed:

1. Closing the grain lines. This would increase the amount of grain transported by trucks. The report examines three truck types (semi-trailer/6-axle, B-double/7-axle, road train/12/axle) with varying loading capacity.
2. Upgrading current track class of grain lines to class 3 grain lines. This would increase the speed with which grain is transported from max 30 km/h to max 70 km/h.
3. Upgrading current track class of grain lines to class 2 grain lines: This would increase the tonne axle load (TAL) from 19 TAL to 21 TAL, and increase the speed with which grain is transported from max 30 km/h to max 80 km/h.
4. Upgrading current track class of grain lines to class 1 grain lines: This would increase the tonne axle load (TAL) from 19 TAL to 23 TAL, and increase the speed with which grain is transported from max 30 km/h to max 80 km/h.

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[3] Inland Rail is currently under construction, with key sections planned for completion in 2027.

[4] In Victoria Inland Rail is the main line between Albury/Wodonga and Beveridge (north of Melbourne).

As noted, a question for assessing the investment decision is the responsiveness of mode share to grain line quality parameters (speed and weight). No robust benchmark was found for determining this responsiveness. In NSW there has been no upgrading of remaining grain only lines since 2004. This issue is therefore approached in two ways. One – each class upgrade (5 to 3, 3 to 2, and 2 to 1) is assumed to result in a 10% increase in the amount of grain being transported by rail. Two – a break-even analysis that estimates the amount of grain that would have to be shifted from road to rail to achieve a benefit cost ratio of one. The break-even analysis is then compared to recent freight history for each grain line.

Table 1 provides an overview of the assessment structure of the benefit-cost analysis. The assessment is based on comparing differences in economic variables under the four scenarios.

Following the rapid benefit-cost analysis structure in IPART (2012) the analysis is conducted over a 1+50-years assessment period. It is assumed that benefits associated with each of the scenarios can only materialise once the entire grain line segment has been upgraded. In modelling, benefits and cost upgrading work is scheduled over 1 year. This is a simplification, as upgrading works in practice potentially may take longer.

For each scenario, changes in the economic variables constitute benefits and costs.

Benefits: For the three upgrade scenarios, benefits arise from the reduction in number of trucks and their associated economic impact, and improvements in rail freight travel time. Under the closure scenario, benefits arise from reduction in public sector fixed maintenance costs and economic impact of rail operations (resource costs).

Cost: For the three upgrade scenarios costs arise from increases in the number of trains and their associated economic impact, as well as infrastructure upgrade costs. For the closure scenario, costs arise from the increase in number of trucks and their associated economic impact.

The decision to maintain or invest (classification upgrades) in the grain line relates to maintaining or altering the operational parameters of the rail track. This economic analysis is primarily geared towards evaluating rail track retention or investment as a function of current and potential future transportation of grain by rail, relative to transportation of grain by truck. As noted in the introduction – where rail lines also provide transportation of other produce or cargo the analysis *underestimates* the benefits of rail.

Table 1: Evaluation basis for 12 grain lines

	Description	Source or note
Assessment timelines	1+50 years (upgrade + operation)	IPART 2012
Assessment year	All $-values are 2023 equivalent	
Economic variable considerations	Operating costs Externalities Variable infrastructure and maintenance costs Crash costs Freight travel time saving Fixed infrastructure costs	See detailed discussion below.
Scenario 1	Closing the grain lines.	Operational implication: current rail-based grain transportation is transferred to road.
Scenario 2	Where relevant, upgrade the grain lines from current track class to Class 3.	Impact: higher quality rail tracks allow for faster transport of grain (max 70 km/h). Some road-based transportation is shifted to rail (10%).
Scenario 3	Where relevant, upgrade the grain lines from current track c to Class 2.	Operational implication: higher quality rail tracks allow for faster (max 80 km/h) and heavier (21 TAL) transport of grain and longer trains (50 wagons). Some road-based transportation is shifted to rail (10%+10%).
Scenario 4	Where relevant, upgrading the grain lines from current track class to Class 1.	Operational implication: higher quality rail tracks allow for faster (max (80 km/h) and heavier (23 TAL) transport of grain and longer trains (50 wagons). Some road-based transportation is shifted to rail (10%+10%+10%).
Assessment structure	Identify change in economic variables for rail- and road-based grain freight, for each scenario, relative to current situation or status quo. Comparative analysis based on semi-trailer (6 axles, GVM 42.5 tonnes), B-doubles (7-axles, GVM 55.5 tonnes) and B-triples/road Trains (12-axles, GVM 82.5 tonnes). GVMs adjusted for GHMS allowable weights in each state.	See detailed discussion below.
Evaluation metric	NPV and B/C ratio, 7% discount rate [3%, 5%,10%]	Central and upper discount rate based on Commonwealth of Australia (COA 2006) and Office of Budget Responsibility (OBR 2020). Lower and 5% social discount rate (SDCR) based on NSW Treasury (2023).

From a transport mode shift perspective there are several additional factors that will determine the competitiveness of individual grain lines. These include:

- Availability of rolling stock: rolling stock includes wagons and locomotives. Higher classed rail tracks can carry locomotives that also can operate on main lines. This can reduce the need for / time required to exchange locomotives where grain lines join main lines. Rolling stock investment and availability is not analysed in this report but is an alternative policy lever to increase the share of grain-rail freight.
- Loading/unloading infrastructure: the time required to load / unload silos onto rail and truck varies significantly by silo. For instance, the upgraded loading facility at Burren Junction reduced the time required to load a 40-wagon train from 13 hours to 4 hours. At 13 hours per 40-wagon train the resource costs required to fully load exceeds the resource cost required to load the equivalently required number of trucks. At 4 hours per 40-wagon train the resource cost required to load the equivalent number of trucks exceeds the resource cost of a fully loaded train.[5] Detailed analysis and variation in loading/unloading infrastructure is not included in this report but is an additional policy lever to increase the share of grain-rail freight *along* the grain lines.
- Port efficiency: Unloading and handling times vary at ports and also affect the time / resource cost of freight. In the networked effect analysis trains and trucks to Port Kembla, Newcastle, Brisbane and Melbourne are included, but no allowance has been made for variation in port efficiency.
- Rationalisation of silos and aggregation sites: investments in rail track may alter the relative competitiveness / attractiveness of existing silos, super sites and consolidation centres. These are adjustment or second order effects and not included in the analysis.

While each of the above four factors will impact the competitiveness of individual grain lines, they warrant separate analysis as investment decisions. Alternatively, they should be included in more detailed CBAs of individual grain lines and evaluation of complete business cases.

[5] The method of analysis in this report is Cost-Benefit Analysis. Cost factors relating to time are therefore considered in terms of their resource cost, rather than procurement cost. A resource cost is the opportunity cost of the resources used, measured from the point of view of society as a whole. It excludes things like taxes and subsidies. Taxes and subsidies are reflected in the price of procurement, but, when included, can distort the perception of societal gains or costs.

Assessment Framework

CBA Assessment Framework

Details of the assessment structure follows discussion and agreement with the project steering committee. Specifically, the economic evaluation only considers benefits and costs directly attributable to the four scenarios and apportioned to the specific grain line segments.

For each of the scenarios the assessment is based on a grain transporter having a choice between:

1. Transporting grain from farm to on-rail silo at the end at the grain line, on-rail silo A in Figure 1. This is the point furthest away from the respective state capitals or relevant export port. Grain is transported by truck to on-rail silo A, then by train on the grain line to on-rail silo B (the start of the respective grain line segments in the analysis; on-rail silo B, for the different grain lines, varies in efficiency, e.g. can also be a super site or consolidation centre). From on-rail silo B, transport continues, in all scenarios, by rail on the main line to port (location C).
2. Transporting grain from farm to on-rail silo B, which is located on a main line or major branch line. This is the receival and storage site at the start of the respective grain lines (Figure 1) and closer to export port. Grain is then loaded onto rail at on-rail silo B and transported by rail on the main line to port (location C).

These two options are illustrated in Figure 1. From an economic assessment perspective this leads to four important implications and/or assumptions that, further to discussions in the steering committee, are driven by data availability considerations.

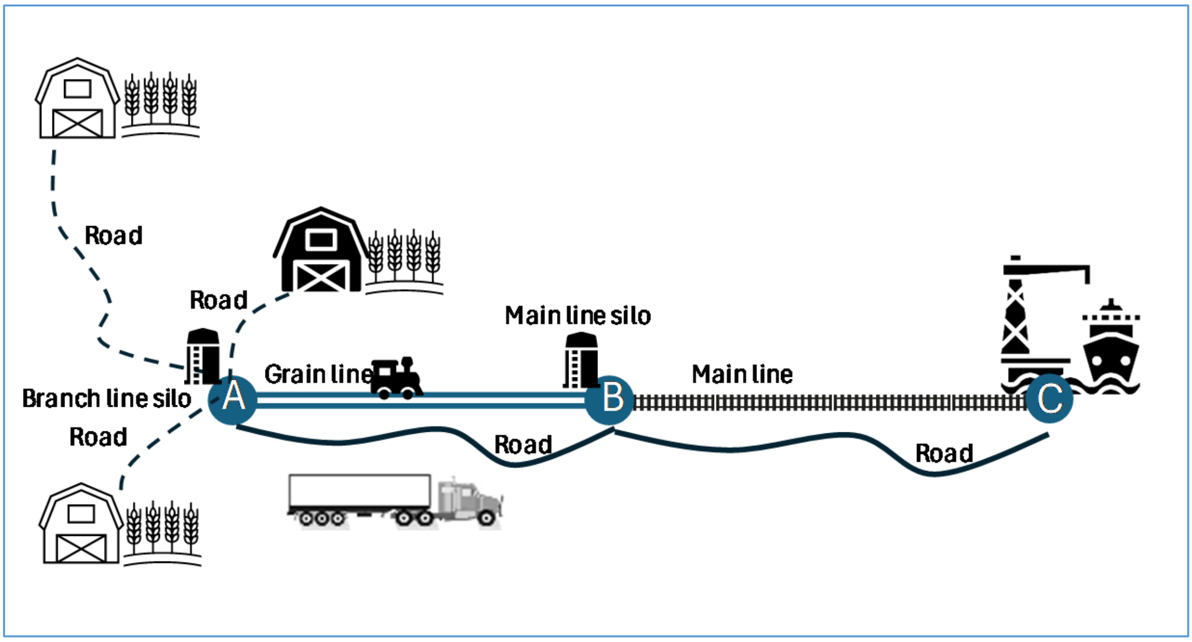

Figure 1: Mode choice and economic assessment

One: transportation of grain from farms to on-rail silo A in Figure 1 is always by truck. It is assumed that the type of truck used for this part of the transport leg is independent of the rail or grain infrastructure at on-rail silo A or B. That is, the choice of using a semi-trailer, B-double or Road Train is independent of the efficiency of the receival and storage site at either location A or B.

Two: it is also assumed that the distance travelled from farms to on-rail silo A is *unchanged* in each of the scenarios. This is a simplification driven by data availability. In Figure 1 the distance from the middle farm (dark icon) to on-rail silo B is potentially shorter (if a separate road exists) than via on-rail silo A. In the absence of detailed farm location data this discrepancy cannot be directly controlled for. For the remaining farms (light icons) the travel distance from farm to on-rail silo B goes via on-rail silo A. From an assessment perspective the distance from farm to on-rail silo A is therefore treated as a constant across the scenarios (the single stipulated lines in Figure 1). When estimating the *change* or *differences* in economic variables across the different scenarios, values related to farm to on-rail silo A transportation are therefore disregarded.

Three: it is assumed that grain trains commencing at on-rail silo A travel to port via on-rail silo B without transferring grain to another train.[6] For road-based grain transportation it is assumed that trucks transfer grain to rail at either on-rail silo A or B. There are a large number of possible variations on this scenario. In some cases, there are alternative silos along the grain lines, in other cases there may be alternative sites with higher performance infrastructure that may take trucks away from the catchment of any given on-rail silo on grain lines. It is difficult to account for each of these variations in a rapid CBA. The approach taken here represents a best-case scenario for rail. If the public sector investment case produces a clear positive B/C ratio in a rapid CBA, then further detailed analysis is warranted. If the public sector investment case does not produce a clear positive B/C ratio in the rapid cost benefit analysis, then further detailed analysis (unless expanding the scope) is likely not warranted.

Three, continued: From on-rail silo B, all grain travels by train to port. In practice therefore the amount of grain being transported from on-rail silo B to port remains constant across all scenarios. From an economic assessment perspective, the distance from on-rail silo B to port C (the hatched line in Figure 1) is therefore treated as a constant across scenarios and disregarded. However, under upgrade to Class 2 and Class 1 the baseline freight task from on-line silo A to B can be performed by a smaller number of trains due to heavier loads per wagon and longer trains. Since under all scenarios trains are assumed to continue past on-rail silo B to port, this in practice means some trains are removed from the line segments between on-rail silo B and port. This reduction in number of trains required for the baseline freight task also results in a reduction in train-based external costs and resource use. In alternative estimations the ensuing net benefits are added to the benefit cost calculations as a direct effect of upgrading specific grain line segments.

Four: on-rail silo loading and unloading times are assumed constant at on-rail silo A and B. Loading and unloading costs are significant components of grain supply chain costs (Stretch et al 2014). While outload costs for major grain receival site operators such as GrainCorp are flat rate (per tonne), the outloading efficiency of different receival and storage sites translates into significant cost differentials in relation to the time / resource costs involved in loading / unloading grain shipments. As these costs are attributable to the efficiency of the loading / unloading infrastructure, rather than the operational attributes of the grain lines themselves, these costs are not included in the baseline or networked analysis. The upgrading of grain lines would have no impact on outloading rates. They may, however, affect the total cost supply chain consideration that applies from farm gate to port.

For instance, the upgrading of grain handling facilities at Burren Junction in 2016 reduced train loading times from 13 hours to approximately 4 hours. The typical travel time from

[6] For many years, typical grain operations on rail in NSW were structured around lighter-axle tonne (smaller) operations occurring on the grain-only lines, and then transfer of the grain to main line (larger) trains for the longer haul to port. Anecdotal evidence suggests that this is considered an atypical movement pattern now, with the movement of the smaller trains directly from grainline to port being more common.

Merrywinebone to Burren Junction is nearly 5 hours (22 km/h). A Class 3 upgraded grainline might reduce the travel time to 1.5 hours (best-case-scenario), but due to the much longer loading times at Merrywinebone grain transporters may nevertheless prefer to truck grain to Burren Junction where the resource cost associated with outloading is substantially less. Since the analysis in this report addresses the public sector retention and upgrade investment case, rather than a full supply chain cost analysis, loading / unloading costs are assumed constant in the baseline and networked analysis. As a sensitivity analysis, the resource cost associated with outloading at on-rail silo A (for trains and trucks) is included.

Key characteristics of rail and road segments for each of the 12 grain lines segments is summarised in **Table 2**. Distance and speed, for both rail and road alternatives, are key inputs in the estimation of economic variables. The rail segment North Star to Camurra Junction is currently being upgraded as part of Inland Rail engineering works. TAL and speed reported in **Table 2** are representative of rail segment standard following completion of these works. Notably, there is a Grain Harvest Management Scheme (GHMS) approved road alternative to each of the grain lines under consideration.[7] The only partial exception is North Star to Camurra Junction where there is only a partially approved GHMS alternative.

[7] The GHMS enables high performance vehicles and additional freight weight on trucks in approved areas and roads.

Table 2: Key characteristics of grain lines

State	Grain line	Length – rail (km)	TAL	Max speed km/h	Rail class	Freight type	Distance Google maps	Speed TAP	GHMS Note
	Rail						**Road**		
NSW	Burren Junction to Merrywinebone	52	19	30	Class 5	Grain	61.7	72.42	Approved/conditionally approved area
NSW	Camurra Junction to Weemelah	85.7	19	30	Class 5	Grain	81.7	87.8	Approved road
NSW	Nevertire to Warren	20.2	19/20.25	20/40	Class 5/3*	**Mixed**	24.7	75.8	Approved road
NSW	Bogan Gate to Tottenham	115.1	20.25	50	Class 5	Grain	112	92	Approved area
NSW	Wyalong to Ungarie	40.4	21	50 (80)	Class 3	Grain	42	89	Approved area
NSW	Ungarie to Lake Cargelligo	71.7	19.5	50	Class 5	Grain	75.3	93.9	Approved area
NSW	Ungarie to Naradhan	60.4	21	50 (80)	Class 3	Grain	67	71.6	Approved area
NSW	Griffith to Hillston	108.1	19	50	Class 5	Grain	110	91.6	Approved road
NSW	The Rock to Boree Creek	57.4	19.5	50	Class 5	Grain	63	88	Approved area
NSW	Camurra Junction to North Star	83.5	23	80	Class 1	Grain	97	78	Partially approved / partially conditionally approved road and area
VIC	Benalla to Oaklands	126	19	30	Class 5	Grain	178	85	Approved/conditionally approved area
QLD	Goondiwindi to Thallon	141.1	15.75	60	Class 5*	**Mixed**	194	90	Approved road

Source: TAL (Tonne Axle Load) and max speed information is based on the UGL Regional Linx Train Operating Conditions (TOC) Manual in NSW,[8] South Western System Information Pack in Queensland (Queensland Rail 2016), and ARTC Route Access Standards in Victoria (ARTC 2024). Road distance and speed is based on google maps, GHMS approvals and TAP.

Note: Mixed and grain use classifications based on examination of grain volumes and 'all commodities' on the National Freight Data Hub (see footnote 5). In some cases, values are incomplete or Nil and augmented with additional information. *Nevertire to Warren consists of two rail segments with different quality classifications. ** All grain lines in this study are standard gauge, except Goondiwindi to Thallon which is narrow gauge. Maps of grain lines and Inland Rail are provided in Appendix B.

[8] UGL TOC: https://www.uglregionallinx.com.au/

Calculation of economic variables

Table 3 provides an overview of *per vehicle* cost parameters for each of the grain lines. In the baseline calculations, grain trains are assumed to consist of 40 wagons with loading conditional on the track classification (see **Table 3**). Trucks are assumed to be fully loaded inclusive of grain harvest management scheme (GHMS) allowances.[9] For both rail and trucks, economic values are estimated on the basis for a full freight cycle (return journey between location A and B, Figure 1). In the networked analysis, reduced train and truck movements from location B to C are estimated on a one-way basis. All vehicles are assumed to carry nil freight on the return journey. Values for trains and trucks are not directly comparable. However, values across trucks show that per vehicle cost increases with truck size, but fewer trucks are needed to move the same amount of grain. **Table 3** also shows the resource cost per tonne of grain for each of the grain lines, and by mode of transportation. Differences in resource cost are a function of length of travel and, in the case of Nevertire to Warren a very low amount of grain being transported.[10]

Operating costs

Operating costs for trains are based on Australian Transport Assessment and Planning (ATAP) (2021, Table 10) apart from crew costs which are sourced from TfNSW (TfNSW 2023, Table 15.3). Train operating costs include train crew costs per hour, locomotive energy costs per 1000 gross tonne kilometre (GTK), mobile locomotive servicing costs per kilometre, stationary locomotive servicing costs per hour, wagon maintenance costs per 1000km, and overhead costs.[11] Trains are assumed to consist of two locomotives pulling 40 and 50 train wagons, class 5 to 3 and class 2 to 1, respectively. Access charges (2023) for the Country Regional Network (CRN) is the UGL Regional Linx pricing schedules.[12]

As noted in the above section, loading times are treated as a constant across baseline and networked scenarios. That is, loading times are assumed to be the same whether loading trains at on-rail silo A or B.[13] Access charges beyond on-rail silo B are based on the ARTC pricing schedule. ARTC charges consist of a flagfall component (per km) and weight component (per '000 GTK). Due to the lower number of trains required to transport the same amount of grain (after upgrading to Class 2 or 1) the overall number of trains beyond on-rail silo B also declines, relative to the baseline. The removal of trains, and their associated cost and externalities, provides an additional and directly attributable benefit to grain line specific investments.

Operating costs for trucks are based on ATAP (2016). Operating costs consist of resource cost of travel time / staffing and Vehicle Operating Costs (VOC). Resource cost of travel time

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[9] GHMS allowable weights vary across the states. Queensland loads are somewhat higher than NSW GHMS loads. Victorian GHMS loads are marginally lower than NSW. https://grains.graincorp.com.au/wp-content/uploads/2023/08/GrainCorp-GTSN-Truck-Chart-September-2024.pdf

[10] Per tonne estimations are not a reflection of the financial cost of transporting but represent the resource cost per tonne of grain. The differential between resource cost per tonne of grain by train or one of the three truck types, represent the basis for the social cost benefit analysis of shifting grain from road to rail.

[11] Crew cost are adjusted with 2 additional hours per train (based on GFR2009). The exemption is journeys <50 km (1 hour added) and Camurra Junction to North Star with no additional time due to recent track upgrades).

[12] https://www.uglregionallinx.com.au/ugl-regional-linx-operations/network-access

[13] Pending data availability this assumption will be updated in the final deliverable.

is non-urban freight time values. VOC in cents for rural freight (uninterrupted) is represented by Equation (1):

$$VOC = BaseVOC * (k1 + k2/V + k3*V^2 + k4*IRI + k5*IRI^2 + k6*GVM) \quad \ldots\ldots\ldots\ldots (1)$$

Where,

BaseVOC = lowest VOC point in curve from raw HDM-4 output

V = Vehicle speed in km/h (see **Table 2**)

IRI = International Roughness Index in m/km (IRI=3).

GVM = gross vehicle mass in tonnes (set at GHML limit for each truck type).

K1 to k6 = model coefficients.

Capital costs related to above rail rolling stock is not included in the evaluation.

Externalities

Trains and trucks generate greenhouse gas emissions as well as other externalities. An economic argument for mode shift is the difference in external costs generated by the two modes of transportation. Externalities are costs (sometimes benefits) that are otherwise not accounted for in the commercial accounting, or market prices, of either rail or road transportation.

Externalities for both trains and trucks are based on ATAP (2021b, Table 5-12 [rail], 5-13 [rail & road]) and include air pollution, greenhouse gas emission, well-to-tank emissions, noise, soil and water pollution, and bio-diversity loss. Notably, externality values in ATAP (2021b) for trucks are primarily based on European research and measurement and not fully adjusted to the size and road conditions of Australian grain freight. As a sensitivity measure, externalities are inflated by 50%.

Infrastructure maintenance cost

Rail infrastructure maintenance costs consist of fixed (routine and scheduled) and variable costs. These are sourced from ATAP (2021a, Table 30 [mid-point value], Table 31). In the rail closure scenarios, the reduction in routine and scheduled costs is a reduction to public sector costs (benefit). In practice some inspection and maintenance costs would remain. This remaining cost is assumed to be $710 per km, per annum. In all remaining scenarios the routine and scheduled costs are unchanged and so discarded in the economic evaluation of upgrade options. Variable maintenance cost is a function of annual gross tonne kilometres. When the amount of grain transported on a grain line increases, variable maintenance costs increase as well.

Road maintenance and construction costs are based on TfNSW (2023, Table 8.1). Unit cost of road maintenance is by vehicle type (semi-trailer, B-double, and Common Road Train/B-triple). Road maintenance costs are a function of vehicle kilometre travelled. Road maintenance costs include costs associated with repair and maintenance (46%) and construction (54%). It is likely that additional road reinforcement work is required to accommodate increased road traffic in the event of rail line closure or disuse. Beyond the construction costs component (TfNSW 2023, note to Table 8.1) these are not included in the analysis and potentially underestimate the cost of rail line closure or disuse.

Table 3: Per vehicle, per return trip economic variable overview (*)

		Burren J.-Merrywin-bone-	Camurra J. - Weemelah	Nevertire-Warren	Bogan Gate-Totten-ham	Ungarie-Lake C.	Ungarie-Naradhan	West Wyalong-Ungarie	Griffith-Hillston	The Rock-Boree Creek	Camurra J. – North Star	Benalla - Oaklands	Goondi-windi-Thallon
Trains	Operating cost	$6,553	$9,439	$2,049	$13,165	$7,331	$7,622	$4,329	$10,196	$6,415	$8,625	$13,215	$11,647
	Externality cost	$571	$909	$172	$1,307	$791	$889	$523	$1,166	$628	$1,297	$1,372	$1,328
	Variable infrastructure maintenance cost	$481	$766	$145	$1,102	$667	$749	$441	$982	$529	$1,093	$1,156	$1,120
	Crash cost*	$63	$99	$19	$148	$88	$103	$60	$128	$70	$156	$150	$129
	Resource cost per tonne grain	$3.5	$5.0	$10.5	$6.5	$4.0	$2.9	$1.7	$5.6	$3.3	$3.1	$7.1	$8.3
Semi-trailer / 6-axle	Operating cost	$405	$501	$155	$674	$450	$444	$256	$664	$385	$619	$1,101	$1,182
	Externality cost	$63	$84	$25	$114	$77	$68	$43	$112	$64	$99	$182	$201
	Variable infrastructure maintenance cost per vehicle	$30	$40	$12	$55	$37	$33	$21	$54	$31	$48	$87	$95
	Crash cost*	$12	$16	$5	$22	$15	$13	$8	$22	$13	$19	$35	$40
	Resource cost per tonne grain	$19.1	$23.9	$7.4	$32.3	$21.6	$20.8	$12.2	$31.8	$18.4	$29.3	$52.5	$54.5
B-double / 7-axle	Operating cost per vehicle	$467	$582	$179	$179	$524	$511	$297	$773	$524	$716	$1,285	$1,384
	Externality per vehicle	$76	$101	$30	$138	$92	$82	$52	$135	$86	$119	$222	$247
	Variable infrastructure maintenance cost per vehicle	$40	$53	$16	$72	$48	$43	$27	$71	$45	$62	$114	$124
	Crash cost*	$16	$22	$7	$30	$20	$18	$11	$29	$19	$26	$49	$56
	Resource cost per tonne grain	$16.7	$21.1	$6.5	$28.5	$19.1	$18.2	$10.8	$28.1	$18.8	$25.7	$44.9	$46.9
Road Train / 12 axle	Operating cost per vehicle	$680	$851	$262	$1,148	$767	$743	$435	$1,131	$654	$1,044	$1,866	$2,013
	Externality per vehicle	$115	$152	$46	$208	$139	$124	$78	$204	$117	$180	$330	$367
	Variable infrastructure maintenance cost per vehicle	$56	$74	$22	$101	$68	$61	$38	$100	$57	$88	$161	$176
	Crash cost*	$27	$35	$11	$48	$32	$29	$18	$47	$27	$42	$77	$87
	Resource cost per tonne grain	$15.1	$19.2	$5.9	$26.0	$17.4	$16.5	$9.8	$25.6	$14.8	$23.4	$42.0	$44.0

Source: authors' calculations. * Crash cost are based on one directional transportation of grain. Resource costs per tonne grain reflect transported volumes – not potential or efficient volumes. Due to very low grain volumes the resource cost of grain transportation on the Nevertire to Warren line exceeds the resource cost of road transportation.

Crash and accident costs

Train crash and accident costs are based on IPART (2012, Table 4.2) and calculated on a net tonne kilometre (ntk) basis.

Road crash and accident costs are based on Deloitte (2020, Table 4.3). Crash and accident costs in IPART (2012) and Deloitte (2020) use different methodologies. The ratio of train to road crash costs from Deloitte is therefore applied to the ntk value from IPART (2012).

Crash costs between rail and road in Table 3 are not directly comparable. Each train replaces multiples of trucks.

Infrastructure upgrade costs

Infrastructure upgrade costs is the expenditure associated with upgrading grain lines to quality classes 3, 2 and 1. Invariably these are general approximations, rather than detailed and line specific assessments of actual costs of works. The values in **Table 4** are based on TfNSW provided heuristics for a gate 0/1 economic assessment. In the assessment, cost estimates are applied cumulatively so that upgrade from Class 5 to Class 1 is $2-3m per kilometre.

Table 4: infrastructure upgrade costs

Upgrade	Cost range	Mid-point	TAL at higher class	Max speed
Class 5 to Class 3	$1-2m per kilometre	$1.5m	19	70 km/h
Class 3 to Class 2	$0.5m per kilometre	Na	21	80 km/h
Class 2 to Class 1	$0.5m per kilometre	Na	23	80 km/h
Additional narrow to standard gauge conversion	$1.5m per kilometre	Na	19	

Note: Allowance has been made for upgrading the existing Goondiwindi to Thallon line to standard gauge. In practice, any alignment with Inland Rail gauge standards would require a dual gauge conversion which would increase investment costs additionally.

Source: TfNSW private correspondence.

Freight time travel saving

Freight time travel savings is included in sensitivity analysis. Under each of the four scenarios the time dimension between on-rail silo A and B is affected. Freight time travel saving is distinct from operating costs (e.g. crew hours) (TfNSW 2022) and reflects willingness to pay for faster delivery. The analysis assumes that changes in travel time under each of the scenarios is carried across the entire supply chain, so that the overall freight task (e.g. on-rail silo A and B to port) is affected in the same way. The willingness to pay measure represents the marginal rate of substitution between travel time and costs. Upgrading of rail lines allows for faster travel times between on-rail silo A and B. At the same time, trucks can travel faster than trains along most of the grain lines. In the analysis, the two effects are netted-out when grain is shifted from road to rail. TfNSW (2022, p.14) guidelines are used to calculate freight time travel saving changes for rail. Unlike remaining economic factors, freight time travel saving does not constitute a resource cost.

Loading cost

In the sensitivity analysis, on-rail silos at location A (Figure 1) are assumed to operate at 750 tonnes per hour for trains (18 minutes per wagon, or 12 hours for a 40 wagon train).[14]

[14] 2x 1000 tonnes per hour outloading at Burren Junction loads a train in 4 hours (includes loading and train adjustment time) (https://www.graincentral.com/cropping/burren-junction-grain-facility-upgrade-cuts-freight-times/). Most sites are operating 500-1000 tonne per hour spouts

Outloading rates at location B are assumed to be of higher productivity with 2x1000 tonnes per hour for trains (6 minutes per wagon or 4 hours for a 40 wagon train).[15] Loading costs are included as sensitivity analysis when considering grain line closures / disuse. In this case the difference between resource cost at location A and B are counted as a closure benefit.

Residual value

Rail assets are long-lived assets. In line with IPART (2012) the evaluation period spans 50 years of operation. Under ATO guidelines for depreciation (economic life assessment of assets) rail tracks are fully depreciated over 50 years.[16] Arguably, the economic life of the examined grain rail tracks is less than 50 years, but IPART (2012, p.25) assesses some upgrades (such as steel sleepers) to have 50 years of economic life. Given the length of the evaluation period no residual value is added to the estimation. Note, routine maintenance and major replacement works are assumed to be relevant for baseline and upgraded scenarios alike. These are therefore excluded from the analysis.

Grain volumes

Essential to an accurate analysis of benefits and costs associated with the grain lines is an estimate of representative freight volumes. Data is fragmented and commercially sensitive. Grain volumes in this analysis primarily draws on annual freight volumes provided by TfNSW and industry for NSW, Queensland and Victoria. The ensuing freight volumes were cross-referenced with data from the National Freight Data Hub, which contains freight information related to ARTC operations. This does not cover all the grain lines.[17] Compared to earlier economic analysis (GIAC 2004, GFR 2009) there are a number of grain lines where freight volumes appear to have declined significantly. Two lines (Camurra Junction-Weemalah, Nevertire-Warren) have had little or no grain freight in the past 10 years. There are others where there appears to have been an increase.

A key consideration in assessing the public sector investment case is the responsiveness of rail-based grain freight to improved performance parameters of rail (rail class upgrades). Since 2004 there have been no rail class upgrades across the analysed rail lines. Benalla to Oaklands was changed from broad to standard gauge. There is thus no historic comparison that can serve as a guide to the elasticity of grain on rail to operating parameters of rail tracks. This issue is therefore approached in two ways. One – each class upgrade (5 to 3, 3 to 2, and 2 to 1) is assumed to result in a 10% increase in the amount of grain being transported by rail. Two – a break-even analysis that estimates the amount of grain that would have to be shifted from road to rail to achieve a benefit cost ratio of one. The break-even analysis is then compared to recent freight history for each grain line. This comparison provides insight on whether required mode shift impacts are within the range of historic (maximum) freight volumes.

Nevertheless, from a public policy decision making perspective this unknown is a significant omission. It cannot confidently be asserted that grain rail upgrades *cause* an increase in freight volumes. In other words, it cannot be asserted whether grain rail volumes predominantly are determined by the operational parameters of the tracks themselves, or other potential intervention levers. E.g. On-rail receival site efficiency, market share / catchment areas of

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(https://grains.graincorp.com.au/were-loco-for-grain-trains/). These load a train in up to 13 hours (https://www.graincentral.com/cropping/burren-junction-grain-facility-upgrade-cuts-freight-times/).

[15] Readers are reminded that the analysis primarily compares the resource and external costs between freight by rail and road for the specific grain line segments, not the entire supply chain cost.

[16] https://www.depreciationrates.net.au/rail

[17] https://datahub.freightaustralia.gov.au/freight-train-interactive-maps

higher productivity receival sites, or the availability of rolling stock and locomotives. Nevertheless, it is clear that line upgrades do enable rail operators to provide more competitive services than would have been possible without the upgrade.

Table 5 provides an overview of which variables are included across the different economic assessments.

Table 5 Variables in analysis

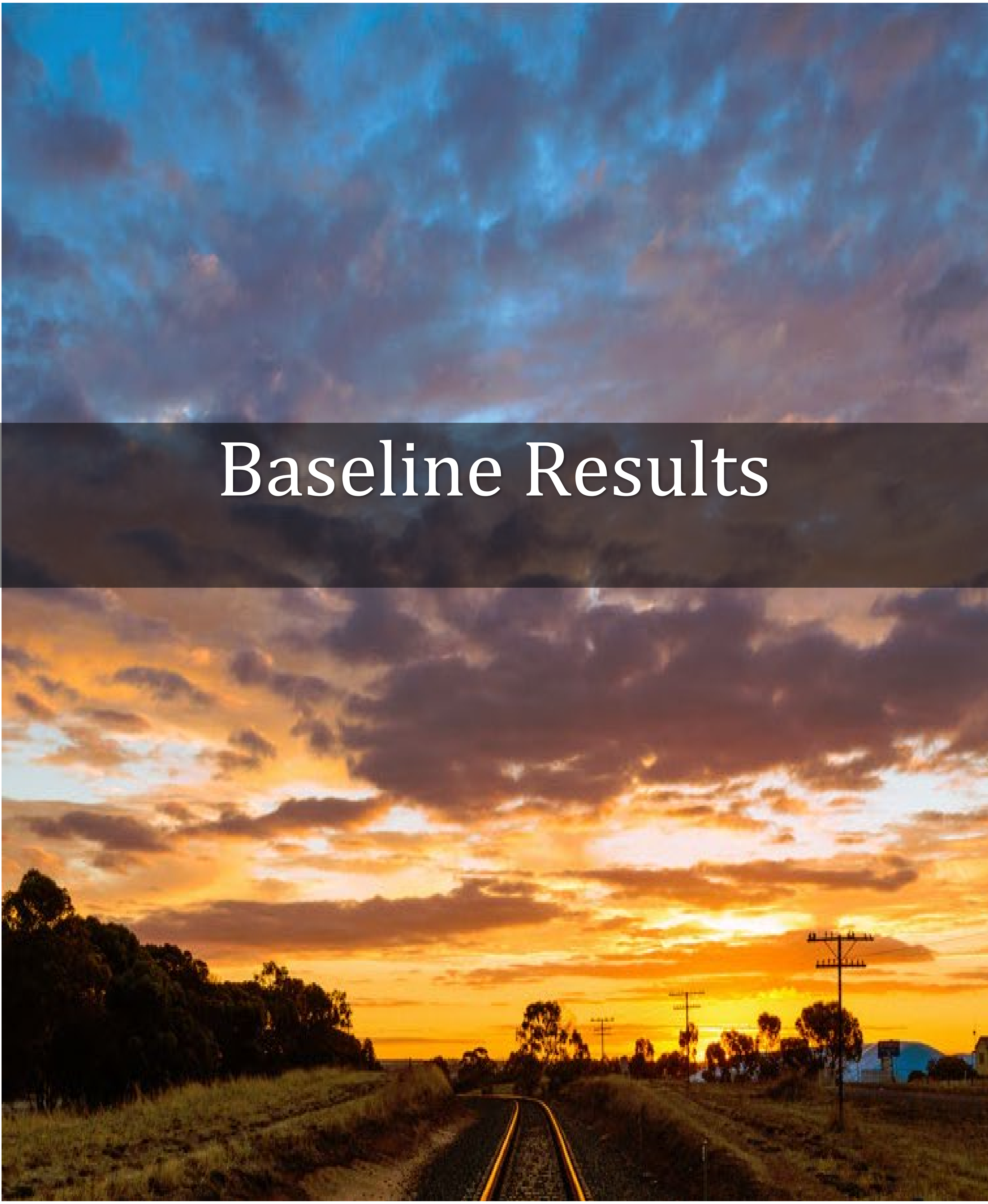
	Baseline	Networked	Breakeven	Sensitivity
Operating costs per vehicle	✓	✓	✓	✓
Externality per vehicle	✓	✓	✓	✓
Infrastructure cost per vehicle	✓	✓	✓	✓
Crash cost per vehicle	✓	✓	✓	✓
Operating costs per vehicle (network)		✓	✓	✓
Externality per vehicle (network)		✓	✓	✓
Infrastructure cost per vehicle (network)		✓	✓	✓
Crash cost per vehicle (network)		✓	✓	✓
Freight time travel saving				✓
Loading cost				✓

Finally, **Table 6** provides detail on the structure of the BCA models used in assessing rail closure / disuse and upgrading scenarios. Each scenario is evaluated based on the change in benefits and costs attributable to changes in the operational characteristics of the respective grain lines. Closing / disusing grain lines reduces train traffic but increases road traffic. Upgrading grain lines allows for heavier and faster trains which reduces rail operating cost (resource cost basis), but increases infrastructure and other rail costs, including upgrading costs. Upgrading grain lines also removes trucks from roads, which is counted as a benefit. A key assumption here is that rail-based freight is a substitute for freight that *otherwise* would have gone on road. As discussed throughout – the accuracy of this assumed substitution remains an uncertainty.

Table 6 Structure of BCA model

Scenarios	Benefits	Cost
Closure / disuse	*Rail* Δ Operating cost Δ Infrastructure cost / maintenance (variable, less annual inspection cost) Δ Externality cost Δ Crash cost Δ Fixed maintenance cost	*Road* Δ Operating cost Δ Infrastructure cost (variable) Δ Externality cost Δ Crash cost
Sensitivity (closure / disuse)	*Train* Δ Loading costs	
Upgrade, Class 3, 2, or 1	*Rail* Δ Operating cost *Road (removed trucks)* Δ Operating cost Δ Infrastructure cost (variable) Δ Externality cost Δ Crash cost	*Rail* Δ Infrastructure cost / maintenance (variable) Δ Externality cost Δ Crash cost + Upgrading cost
Sensitivity (upgrade)	*Train* Δ Freight time travel saving	

Baseline Results



Baseline Results

The following sections summarise the baseline results across the four scenarios The baseline in each case is the current volume of freight and the rail track classification. Each of the upgrade scenarios are calculated against an assumed 10% increase in volume of grain being transported by rail.[18] Increased rail volumes are assumed to reflect an equivalent reduction in road-based transportation. As noted above, the baseline analysis considers the economic impact of change along the on-rail silo A to on-rail silo B segment, with some reduction in trains and trucks between on-rail silo B and port in additional analysis.

The benchmark for assessing each of the scenarios (closing, upgrades) is the benefit-cost ratio (B/C). In addition, Net Present Value (NPV) calculations provide information on the magnitude of economic benefits and costs.

Each of the tables also includes a traffic light system. Traffic light colouring provides a qualitative assessment of the economic evaluation results with respect to retaining a train option and investment to upgrade grain lines. Traffic light colouring also accounts for the sensitivity of calculations to small variations in payload of different trucks and applicability of ATAP parameters for different types of trucks (e.g. 7 axle B-double versus 9 axle B-double). The traffic light approach to the B/C ratios is always with respect to retaining the train options or investing in rail upgrade. Green indicates a positive case for retaining and/or investing in grain line upgrades, orange is more indeterminate, and red indicates a negative case for retaining and/or investing in grain line upgrades. Specifically, green indicates a B/C ratio where the train or investment option differs from 1 by at least 0.2 ratio-points in favour of the train/investment option. Red indicates a B/C ratio where the train or investment option differs from 1 by at least 0.2 ratio-points against the train/investment option.

Scenario 1: Rail line closure/disuse

Table 7 sets out the economic evaluation of closing the existing rail lines and shifting currently transported grain to road instead. Procedures for closing grain lines vary across the three states. In NSW closing a grain line requires acts of parliament, in Queensland and Victoria rail line closure requires ministerial approval. Track closure can therefore be a protracted process, during which relevant transport authorities retain responsibility for annual inspection, monitoring etc. In modelling the closure scenarios, ongoing inspection and monitoring costs have been retained. Moreover, tracks are left in-situ. A B/C value *greater than* 1 indicates that the positive economic impact of rail line closure exceeds the benefits generated by the current grain lines. In this case, a positive economic case for closing rail lines is coloured red as it indicates a qualitative assessment against operating the grain lines. Green indicates that the economic cost of disusing grain lines exceeds the economic benefit.

The baseline results for the grain line closure scenarios are in most cases less than one. That is, there is – based on this rapid benefit cost methodology – little evidence to suggests that the economic impact of closing grain lines would be positive from a societal perspective. There are three exceptions to this.

- Nevertire to Warren: where the B/C ratio substantially exceeds one. It should be noted that the estimations in **Table 7** exclusively consider grain freight. In addition to grain, Nevertire to Warren is used for other containerised transportation. Importantly, parts of the Nevertire to Warren grain line have been closed since the rail bridge at

[18] As noted above, the absence of clear guidance on the responsiveness of rail-based grain freight to grain line operational characteristics remains a weakness of the analysis.

Gunningbar Creek near Warren burned down in 2012. Consequently, the silo at Warren has not been in use. Modelled grain volumes on this line have therefore been miniscule (less than one train) since that time. Given the very low volume of modelled grain the B/C ratio for closure/disuse is high.

- Weemelah to Camurra Junction: where the B/C ratio exceeds one. Grain freight volumes on this line were zero in 6 out of 10 years between 2012-2022. Volumes used in estimation are based on average volumes 2012/13 to 2021/22 and substantially less than historic freight volumes – e.g. GIAC (2004).
- Lake Cargelligo to Ungarie: where the B/C ratio is approximately one when compared against semi-trailers and B-doubles, and exceeding 1.2 when compared to and road trains. Average freight numbers have remained low on this grain line for some time, and zero in 3 out of 10 years (2012-2022). However, freight volumes in 2023 and 2024 were substantially above historic trend, with 2024 being substantially greater than 2023 numbers. Higher freight volumes in recent years are likely related to above-average harvests.[19]

When considering high performance vehicles, the economic case for maintaining the 12 grains lines remains largely unchanged, with B/C ratio marginally strengthening in favour of road options.

Apart from the above three lines the economic case for closing/disusing the remaining grain lines is negative. That is, the societal cost incurred as a result of shifting grain transportation to road-based alternatives exceeds the benefits of doing so. Notably, in each of the scenarios the instrumental variable in the economic evaluation is the amount of grain being transported. While comparisons against different types of trucks does make a difference, the fundamental determinant of the economic assessment is the amount of grain being transported. As the amount of grain transported by rail goes towards zero, the societal benefit of employing trucks, unsurprisingly, increases.

[19] The analysis does not factor any existence value associated with the availability of rail in above-average harvest years. Conducting the analysis based on average transport volumes reflects the argument that the public investment case is a function of the wider social and economic benefit generated in each year. Where the existence of a grain line contributes to regional investment (e.g. expansion of cultivated areas) and rail also provides an over-flow service in above-average years the removal of grain lines may potentially reduce the overall cultivated area and so average (and above-average) harvests in future years.

Table 7: Economic evaluation rail closure, 7% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.– Merrywinebone	$14.7	$29.5	-$14.8	0.50	$14.7	$25.9	-$11.2	0.57	$14.7	$23.6	-$8.9	0.62
Camurra J.–Weemelah	$19.9	$11.5	$8.4	1.73	$19.9	$10.2	$9.8	1.96	$19.9	$9.2	$10.7	2.15
Nevertire–Warren	$3.5	$0.1	$3.5	49.41	$3.5	$0.1	$3.5	56.15	$3.5	$0.1	$0.1	61.65
Bogan Gate–Tottenham	$34.1	$67.8	-$33.7	0.50	$34.1	$59.8	-$25.7	0.57	$34.1	$54.5	-$20.4	0.63
Ungarie–Lake C.	$17.6	$17.0	$0.6	1.04	$17.6	$15.0	$2.6	1.18	$17.6	$13.6	$3.9	1.29
Ungarie–Naradhan	$17.1	$46.4	-$29.3	0.37	$17.1	$40.7	-$23.6	0.42	$17.1	$37.0	-$19.8	0.46
West Wyalong–Ungarie	$18.0	$156.2	-$138.2	0.12	$18.0	$137.6	-$119.6	0.13	$18.0	$125.4	-$107.4	0.14
Griffith–Hillston	$35.3	$100.5	-$65.2	0.35	$35.3	$88.5	-$53.2	0.40	$35.3	$80.7	-$45.4	0.44
The Rock–Boree Creek	$21.1	$83.3	-$62.2	0.25	$21.1	$81.5	-$60.4	0.26	$21.1	$66.9	-$45.8	0.32
Camurra J. – North Star	$24.8	$96.7	-$71.9	0.26	$24.8	$85.0	-$60.2	0.29	$24.8	$77.3	-$52.5	0.32
Benalla–Oaklands	$54.6	$378.4	-$323.8	0.14	$54.6	$323.7	-$269.1	0.17	$54.6	$303.3	-$248.7	0.18
Goondiwindi–Thallon	$49.7	$369.9	-$320.2	0.13	$49.7	$317.9	-$268.1	0.16	$49.7	$298.4	-$248.7	0.17

Note 1: Green = positive economic case for keeping grain lines open (B/C< 0.8). Orange= economic case for either outcome is undetermined (B/C btw 0.8 and 1.2). Red= negative economic case for keeping grain line open (B/C>1.2).

Note 2: Nevertire to Warren is a mixed-freight line. Assessments in **Table 5** only consider grain transportation.

One way the public sector can incentivise the use of rail rather than road is through investment in the operational characteristics of grain lines. The following sections assess the economic case for upgrading existing grain lines from their current track class to class, 3, 2, or 1 – where this is not already the case.

Notably, the availability of improved grain line operational characteristics provides no guarantee that more grain will be transported by rail. While the resource cost per tonne of grain by train and along the specific grain lines (**Table 3**) is substantially less than by road, the decision to use rail rather than road also depends on availability of rolling stock and locomotives for operations along the grain lines, but also for operations to and from ports. Upgrading grain lines from class 5 (19 TAL) would also enable the use of main line locomotives, which in turn might lower coordination costs and asset management considerations for freight operators. As noted earlier, the responsiveness of rail-based freight volumes to grain line characteristics is uncertain. Line upgrades do enable rail operators to provide more competitive services than would have been possible without the upgrade. However, from a public sector investment perspective, below-rail upgrades in isolation, also risk being ineffectual mode-shift mechanisms. Rail upgrades may require more systematic network capacity development to unlock substantial mode changes.[20] (.

Moreover, rationalisation and investment in receival and storage sites at strategic points along the grain line networks (e.g. Burren Junction, Temora, Moree etc) may incentivise grain transporters to utilise higher efficiency road to rail transfer sites, than silos at the start of each of the examined grain lines. It therefore remains an unknown what the responsiveness of freight by rail to operational characteristics in practice will be.

In the rapid cost-benefit analysis conducted here, these additional determinants of rail-based freight volumes are not factored in. In practice, while these are key determinants of how much grain is transported by rail (and thus the social cost and benefits of rail and road options) they are not directly attributable to changes in the operational characteristics of the grain lines.

Scenario 2: Upgrade to Class 3

Table 8 shows the economic evaluation of upgrading – where this is not already the case – the existing rail tracks to Class 3. The upgrade to Class 3 would enable trains to travel at speeds up to 70 km/h. Tonne axle loading would remain unchanged at 19TAL (or at higher TAL where this already is the case, see Table 2) and train length would remain unchanged at 40 grain hoppers. The exemption is Goondiwindi to Thallon, where upgrade to Class 3 would result in a TAL uplift from 15.75 to 19. The results in Table 6 are based on raising estimates of travel time from the current average transport time for each grain line, to the maximum allowable speed. The result thus presents a best-case scenario – or achievable outcome.

From **Table 8** it is evident that, in this baseline evaluation, the economic case for upgrading any of the grain lines is weak. All the B/C ratios are substantially below 1. Moreover, the B/C ratio weakens further when assessing outcomes against higher performance vehicles. While upgrading of lines generate, in some cases, considerable benefits, the cost of providing the upgrade is many times greater.

[20] The issue of responsiveness of grain on rail to track standards is being explored in further work.

Table 8: Economic evaluation rail track upgrades to Class 3

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$3.3	$73.6	-$70.3	0.05	$3.0	$73.6	-$70.6	0.04	$2.7	$73.6	-$70.9	0.04
Camurra J.–Weemelah	$1.3	$117.0	-$115.8	0.01	$1.1	$117.0	-$115.9	0.01	$1.1	$117.0	-$116.0	0.01
Nevertire–Warren	$0.0	$9.3	-$9.2	0.00	$0.0	$9.3	-$9.2	0.00	$0.0	$9.3	-$9.2	0.00
Bogan Gate–Tottenham	$7.7	$160.1	-$152.4	0.05	$6.9	$160.1	-$153.2	0.04	$6.4	$160.1	-$153.7	0.04
Ungarie–Lake C.	$1.7	$99.8	-$98.1	0.02	$1.5	$99.8	-$98.3	0.02	$1.4	$99.8	-$98.4	0.01
Ungarie–Naradhan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
West Wyalong–Ungarie	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Griffith–Hillston	$9.7	$150.3	-$140.6	0.06	$8.5	$150.3	-$141.8	0.06	$7.7	$150.3	-$142.6	0.05
The Rock–Boree Creek	$8.7	$79.3	-$70.6	0.11	$8.5	$79.3	-$70.8	0.11	$7.1	$79.3	-$72.2	0.09
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$39.3	$177.1	-$137.8	0.22	$33.9	$177.1	-$143.3	0.19	$31.8	$177.1	-$145.3	0.18
Goondiwindi–Thallon	$38.4	$395.6	-$357.1	0.10	$33.2	$395.6	-$362.3	0.08	$44.8	$395.6	-$350.8	0.11

Note 1: Green = positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line. NA=already at minimum same rail quality classification.

Table 9: Economic evaluation rail track upgrades to Class 2

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$6.7	$98.1	-$91.4	0.07	$6.0	$98.1	-$92.1	0.06	$5.5	$98.1	-$92.6	0.06
Camurra J.–Weemelah	$2.5	$156.1	-$153.5	0.02	$2.3	$156.1	-$153.8	0.01	$2.1	$156.1	-$154.0	0.01
Nevertire–Warren	$0.0	$16.6	-$16.6	0.00	$0.0	$16.6	-$16.6	0.00	$0.0	$16.6	-$16.6	0.00
Bogan Gate–Tottenham	$14.9	$213.6	-$198.7	0.07	$13.5	$213.6	-$200.0	0.06	$12.4	$213.6	-$201.1	0.06
Ungarie–Lake C.	$3.6	$133.1	-$129.5	0.03	$3.2	$133.1	-$129.9	0.02	$2.9	$133.1	-$130.2	0.02
Ungarie–Naradhan	$4.5	$28.3	-$23.8	0.16	$4.0	$28.3	-$24.3	0.14	$3.6	$28.3	-$24.6	0.13
West Wyalong–Ungarie	$15.3	$16.8	-$1.5	0.91	$13.7	$16.8	-$3.1	0.81	$12.4	$16.8	-$4.4	0.74
Griffith–Hillston	$21.2	$200.4	-$179.2	0.11	$19.0	$200.4	-$181.4	0.09	$17.4	$200.4	-$183.1	0.09
The Rock–Boree Creek	$18.1	$105.8	-$87.7	0.17	$18.0	$105.8	-$87.8	0.17	$14.9	$105.8	-$90.9	0.14
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$81.7	$236.3	-$154.6	0.35	$70.9	$236.3	-$165.4	0.30	$66.6	$236.3	-$169.7	0.28
Goondiwindi–Thallon	$79.9	$461.7	-$381.8	0.17	$69.1	$461.7	-$392.6	0.15	$65.0	$461.7	-$396.7	0.14

Note 1:
Green = positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table 10: Economic evaluation rail track upgrades to Class 1

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$10.5	$122.7	-$112.1	0.09	$9.1	$122.7	-$113.6	0.07	$8.3	$122.7	-$114.4	0.07
Camurra J.–Weemelah	$4.0	$195.1	-$191.1	0.02	$3.5	$195.1	-$191.6	0.02	$3.2	$195.1	-$191.9	0.02
Nevertire–Warren	$0.0	$24.0	-$24.0	0.00	$0.0	$24.0	-$24.0	0.00	$0.0	$24.0	-$24.0	0.00
Bogan Gate–Tottenham	$23.8	$267.0	-$243.2	0.09	$20.6	$267.0	-$246.4	0.08	$18.9	$267.0	-$248.1	0.07
Ungarie–Lake C.	$5.8	$166.4	-$160.6	0.03	$5.0	$166.4	-$161.5	0.03	$4.5	$166.4	-$161.9	0.03
Ungarie–Naradhan	$9.9	$56.5	-$46.6	0.18	$8.4	$56.5	-$48.1	0.15	$7.6	$56.5	-$48.9	0.14
West Wyalong–Ungarie	$33.7	$33.5	$0.2	1.01	$28.6	$33.5	-$4.9	0.85	$26.0	$33.5	-$7.5	0.78
Griffith–Hillston	$34.1	$250.6	-$216.5	0.14	$29.4	$250.6	-$221.2	0.12	$26.8	$250.6	-$223.8	0.11
The Rock–Boree Creek	$29.0	$132.3	-$103.3	0.22	$27.6	$132.3	-$104.7	0.21	$22.7	$132.3	-$109.6	0.17
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$124.9	$295.4	-$170.6	0.42	$109.6	$295.4	-$185.8	0.37	$102.9	$295.4	-$192.6	0.35
Goondiwindi–Thallon	$120.6	$527.8	-$407.2	0.23	$107.3	$527.8	-$420.5	0.20	$100.8	$527.8	-$426.9	0.19

Note 1:
Green = positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Scenario 3: Upgrade to Class 2

Table 9 shows the economic evaluation of upgrading – where this is not already the case – the existing rail tracks to Class 2. The upgrade to Class 2 would enable trains to travel at speeds up to 80 km/h. Tonne axle loading can increase to 21TAL and train length can increase to 50 grain wagons.

The results echo those of upgrading to class 3, with the exception of West Wyalong to Ungarie where the B/C is within 0.2 B/C points of 1, when compared to the use of semi-trailers and B-doubles. In terms of a qualitative assessment (traffic lights) the economic assessment is undetermined (orange). While upgrading of lines generates, in some cases, considerable benefits, the cost of providing the upgrade is many times greater.

Scenario 4: Upgrade to Class 1

Table 10 shows the economic evaluation of upgrading – where this is not already the case – the existing rail tracks to Class 1. The upgrade to Class 1 would enable trains to travel at speeds up to 80 km/h. Tonne axle loading can increase to 23TAL and train length can increase to 50 grain wagons.

The results here too echo those of upgrading to class 3 and 2, although the B/C ratio for West Wyalong to Ungarie now is approximately 1 when compared to the use of semi-trailers, where the B/C is within 0.2 B/C points of 1, when compared to the use of semi-trailers and B-doubles. In terms of a qualitative assessment (traffic lights) the economic assessment for West Wyalong to Ungarie remains undetermined (orange).

Overall, the results in **Table 10** provide no strong economic case for upgrading the current grain lines to higher classes. The exemption is West Wyalong to Ungarie where the B/C ratio approaches 1 and in a qualitative sense is more undetermined.

Networked and sensitivity analysis

The basic analysis framework set out in **Figure 1** considers the economic impacts arising from mode shift between on-rail silo A and B. As noted, upgrading of grain lines can enable longer trains with additional freight volume and at faster speed to travel directly from on-rail silo A to port. Under this event the total number of trains travelling beyond on-rail silo B to port is reduced. Moreover, in each of the east coast states grain is also transported by truck from up-country to port. Shifting grain from road to rail will therefore also have an additional networked effect of removing a fraction of trucks that otherwise would have proceeded from on-rail silo B to port. The fraction of trucks removed between on-rail silo B and port varies across the states. In NSW it is assumed that 1-in-10 trucks otherwise would have proceeded to port. In Queensland and Victoria, the share is much higher and assumed to be 8.5 in 10.[21] [22]

Table 11 shows the economic evaluation based on including the reduced number of trains required to transport grain to port, and removal of trucks between on-rail silo B and port. Longer and heavier trains have higher operational cost, access costs and economic impacts. However, due to lower numbers of these trains, the combined economic impact is reduced. The combined economic impact of change between on-rail silo A and B, plus economic impacts beyond on-rail silo B, are here referred to as networked analysis.

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[21] Share of trucks in grain deliveries to port are based on consultation within the steering committee.

[22] The closure / disuse scenario is assumed unchanged. Trucks deliver to on-rail silo B rather than on-rail silo A. No additional trucks to port are factored.

It is evident from **Table 11** that even though the B/C ratio for each of the classes do increase, they remain well below one. The only exception remains West Wyalong to Ungarie, where the B/C ratio for upgrading to class 1 exceeds 1 by more than 0.2 B/C points, when compared to use of semi-trailers. When compared to B-doubles and Road Trains the B/C ratio is approximately 1, within +/- 0.2 B/C points.

Table 11: Economic evaluation of track upgrade including networked analysis, B/C ratio

	Semi-trailer			B-double			Road Train		
	C3	C2	C1	C3	C2	C1	C3	C2	C1
Burren J.–Merrywinebone	0.05	0.10	0.12	0.04	0.09	0.11	0.04	0.09	0.11
Camurra J.–Weemelah	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02
Nevertire–Warren	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bogan Gate–Tottenham	0.05	0.09	0.11	0.04	0.08	0.10	0.04	0.08	0.09
Ungarie–Lake C.	0.02	0.04	0.05	0.02	0.03	0.05	0.01	0.03	0.04
Ungarie–Naradhan	NA	0.17	0.21	NA	0.15	0.18	NA	0.14	0.17
West Wyalong–Ungarie	NA	1.00	1.28	NA	0.89	1.12	NA	0.82	1.05
Griffith–Hillston	0.07	0.15	0.19	0.06	0.14	0.17	0.05	0.13	0.16
The Rock–Boree Creek	0.11	0.25	0.31	0.11	0.25	0.29	0.09	0.22	0.26
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	0.22	0.37	0.45	0.19	0.32	0.40	0.18	0.30	0.37
Goondiwindi–Thallon	0.10	0.21	0.26	0.08	0.19	0.24	0.08	0.18	0.23

Note: C3= Class 3 upgrade, C2= Class 2 upgrade, C1=Class 1 upgrade.

Table 12: Economic evaluation track upgrade including networked analysis, 50% externality escalation

	Semi-trailer			B-double			Road Train		
	C3	C2	C1	C3	C2	C1	C3	C2	C1
Burren J.–Merrywinebone	0.05	0.10	0.13	0.04	0.10	0.12	0.04	0.09	0.11
Camurra J.–Weemelah	0.01	0.02	0.03	0.01	0.02	0.02	0.01	0.02	0.02
Nevertire–Warren	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bogan Gate–Tottenham	0.05	0.09	0.12	0.05	0.09	0.11	0.04	0.08	0.10
Ungarie–Lake C.	0.02	0.04	0.05	0.02	0.03	0.05	0.02	0.03	0.04
Ungarie–Naradhan	NA	0.19	0.22	NA	0.16	0.19	NA	0.15	0.18
West Wyalong–Ungarie	NA	1.08	1.35	NA	0.96	1.19	NA	0.88	1.11
Griffith–Hillston	0.07	0.16	0.20	0.06	0.15	0.18	0.06	0.14	0.16
The Rock–Boree Creek	0.12	0.26	0.32	0.12	0.26	0.31	0.10	0.23	0.27
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	0.24	0.40	0.48	0.21	0.35	0.42	0.19	0.33	0.40
Goondiwindi–Thallon	0.10	0.22	0.28	0.09	0.20	0.26	0.09	0.19	0.24

Note: C3= Class 3 upgrade, C2= Class 2 upgrade, C1=Class 1 upgrade.

Table 13 Economic evaluation track upgrade including, networked analysis, loading time and freight time saving

	Semi-trailer				B-double				Road Train			
	CL	C3	C2	C1	CL	C3	C2	C1	CL	C3	C2	C1
Burren J.– Merrywinebone	0.61	0.08	0.13	0.15	0.65	0.08	0.12	0.14	0.72	0.07	0.12	0.13
Camurra J.–Weemelah	1.89	0.02	0.03	0.03	2.04	0.02	0.03	0.03	2.23	0.02	0.03	0.03
Nevertire–Warren	52.2	0.0	0.0	0.0	56.3	0.0	0.0	0.0	61.8	0.00	0.00	0.00
Bogan Gate–Tottenham	0.58	0.10	0.13	0.15	0.62	0.10	0.13	0.14	0.68	0.09	0.12	0.13
Ungarie–Lake C.	1.16	0.02	0.04	0.05	1.25	0.02	0.04	0.05	1.37	0.02	0.03	0.05
Ungarie–Naradhan	0.46	NA	0.22	0.23	0.49	NA	0.21	0.21	0.54	NA	0.20	0.20
West Wyalong–Ungarie	0.21	NA	1.05	1.29	0.23	NA	0.99	1.19	0.25	NA	0.91	1.11
Griffith–Hillston	0.43	0.09	0.17	0.20	0.46	0.08	0.16	0.19	0.51	0.08	0.16	0.18
The Rock–Boree Creek	0.35	0.16	0.29	0.34	0.34	0.16	0.29	0.34	0.41	0.14	0.26	0.30
Camurra J. – North Star	0.32	NA	NA	NA	0.34	NA	NA	NA	0.38	NA	NA	NA
Benalla–Oaklands	0.18	0.31	0.44	0.51	0.20	0.29	0.41	0.47	0.21	0.28	0.39	0.45
Goondiwindi–Thallon	0.16	0.19	0.36	0.42	0.18	0.17	0.33	0.39	0.19	0.16	0.32	0.37

Note: CL= closure, C3= Class 3 upgrade, C2= Class 2 upgrade, C1=Class 1 upgrade.

Table 12 re-estimated the networked analysis after escalating the monetary values of externality costs by 50%. The additional cost escalation does, however, have a negligible impact on the qualitative assessment of outcomes.

The networked analysis provides some forward guidance with respect to the impact of Inland Rail on the economic assessment of grain lines. Inland Rail will enable higher TAL and speeds. These translate into fewer required trains to transport the same amount of grain, and faster connections which reduce operational costs. From **Table 11**, accounting for these benefits as direct impacts of grain line upgrades does increase societal benefits, but primarily at the margin and without substantively altering the qualitative assessment of the analysis. That is, in terms of positive, negative or indeterminate BCA outcomes, the networked benefits do not change the overall assessment.

To the extent that Inland Rail enables additional speed, relative to the operational characteristics, modelled here, the combination of main line (if used) locomotives on the grain lines, longer trains and faster speeds (on Inland Rail) will result in additional benefits attributable to grain line upgrades. However, like the networked benefits included in **Table 11,** these are unlikely to substantially change the overall assessment.

Finally, **Table 13** adds two additional variables to the analysis. In CL (closure/disuse) scenarios the benefits of faster rail loading times at on-rail silo B (18 minutes per wagon at on-rail silo A versus 6 minutes per wagon at on-rail silo B) are added. For investment scenarios class 3, 2 and 1 freight time saving as a result of faster and heavier trains is included as an upgrade benefit. While loading time represents an additional resource cost, freight time saving is a willingness to pay (WTP) estimate for faster delivery, rather than a resource cost. This WTP estimate constitutes a private benefit, rather than societal gain.

While the overall substantive interpretation of the results in **Table 13** do not differ with respect to earlier results, the direction of change in the closure/disuse scenario provides a reminder of the additional determinants of achieving or influencing mode shift. In each case the B/C ratio of the closure / disuse scenario is marginally greater than in **Table 7**.

While this impact does not change the qualitative outcomes of the baseline assessment, it highlights the role that factors beyond grain line characteristics play in determining the economic assessment of the grain lines. The assumed availability of shorter loading times at on-rail silo B (a difference of 8 hours) provides an incentive for operators of grain storage and receival sites, and grain growers, to rationalise investment in storage and receival infrastructure. Coupled with increasing on-farm storage infrastructure grain (GFR 2009, White et al 2018) many on-rail silos will likely remain low priority for investment and upgrading. Improvements in the operational characteristics of the grain lines will not change this substantively.

The inclusion of freight travel time savings for the three upgrade scenarios marginally strengthens the B/C ratios for grain line upgrades, though without substantively altering the qualitative assessment which remains well below 1 in all cases apart from the West Wyalong to Ungarie line. Freight time travel saving is a benefit that accrues to grain transporters and growers. While clearly a benefit arising from investment in rail upgrades, the public sector investment assessment remains unaffected as resource costs and externalities remain unaltered. Nevertheless, the direction of change again highlights that rail upgrades will have additional private sector benefits that can serve as the basis for cost sharing approaches to grain line upgrades.

Breakeven analysis

Benefits and costs associated with grain line operations is a function of the amount of grain being transported and the mode of transportation. Based on the current freight volumes the above analysis broadly shows that the negative economic impact of closing the grain lines is greater than the positive economic impacts. This is the case for each of the grain lines in regular use. Three of the NSW grain lines have had, or continue to have, periods of no grain volumes. In the event of no, or very low, freight volumes the economic case for retaining these grain lines operational is negative. However, apart from the West Wyalong to Ungarie grain line the analysis also shows that the positive economic impact of upgrading the grain lines remains less than the negative economic impact.

Table 14 therefore estimates the amount of grain freight that is required to obtain a breakeven benefit-cost assessment. Breakeven is defined as a B/C ratio of 1 and compares rail to the semi-trailer road option.

The analysis assumes that any additional grain transported by rail also constitutes a reduction in the amount of grain transported by road. This is a key assumption as grain harvests also vary from year to year. An increase in freight volume can therefore easily represent annual variations applicable to both road and rail. The results in **Table 14** are therefore not directly related to annual variation in production flows (though this will be a consideration too), but only a function of how many trucks are removed from country roads. Results are presented as tonnes of grain (volume) and relative transport volumes used in analysis.

Table 14: Breakeven freight volume mode shift, semi-trailers

	Break even volume C3	Break even volume C2	Break even volume C1	Break even multiplier C3	Break even multiplier C2	Break even multiplier C1
Burren J.– Merrywinebone	251,750	302,000	348,000	3.7	4.4	5.1
Camurra J.–Weemelah	276,500	352,950	422,750	12.4	15.8	18.9
Nevertire–Warren	30,940	55,900	76,550	135.7	245.2	335.7
Bogan Gate–Tottenham	378,200	459,000	531,000	3.6	4.4	5.1
Ungarie–Lake C.	266,000	335,700	395,100	7.5	9.5	11.2
Ungarie–Naradhan		162,570	219,550		1.6	2.2
West Wyalong–Ungarie		506,300	529,400		1.1	1.1
Griffith–Hillston	419,875	485,200	551,650	2.7	3.1	3.5
The Rock–Boree Creek	401,600	443,900	491,200	2.0	2.2	2.5
Camurra J. – North Star						
Benalla–Oaklands	425,120	464,100	513,175	1.5	1.6	1.8
Goondiwindi–Thallon	358,250	379,825	417,180	2.1	2.2	2.5

Note: Breakeven is defined as a B/C ration =1. C3= Class 3 upgrade, C2= Class 2 upgrade, C1=Class 1 upgrade. Green = required mode shift less than or equal to 2x current average annual freight volumes.

The results in **Table 14** highlight the sensitivity of earlier benefit-cost analysis to transport volumes. For several lines the shift from road to rail required to allow for a breakeven outcome is less than or equal to two times current average annual freight volumes. These grain lines might be considered priority consideration for further analysis. This applies to:

- Ungarie to Naradhan (upgrade to Class 2)
- West Wyalong to Ungarie (upgrade to Class 2 and 1)
- The Rock to Boree Creek (upgrade to Class 3)
- Benalla to Oaklands (Upgrade to Class 3, 2, and 1)

Anecdotally, the required volume changes may be available for several of the examined grain lines. What is unclear though is whether this remains the case when considering end destinations of non-rail grain deliveries. The responsiveness of grain intended for domestic consumption or non-port destinations to grain line upgrades may differ from that of export and port destinations.

The baseline and networked analysis show that when compared to B-doubles and Road Trains the economic case for retention and upgrading is weakened. To achieve a B/C ratio of 1, when compared to these two vehicle types, the amount of grain required would increase further. **Table 15** shows that additional freight volumes would be required to obtain a breakeven analysis based on competition with B-doubles and Road Trains.

Table 15 shows the B/C ratios for grain line upgrades based on the freight volumes in **Table 14**, compared to B-doubles and Road Train options. Overall, higher productivity vehicles necessitate additional volumes of grain being shifted to rail to strengthen the economic case for rail line upgrade works. This is because higher productivity vehicles can move the same volume of grain with fewer trips than semi-trailers, thus reducing operating and externality costs (on a same volume basis).[23]

Table 15: Breakeven freight volumes, truck type comparison

	B-doubles			Road trains		
	C3	**C2**	**C1**	**C3**	**C2**	**C1**
Burren J.– Merrywinebone	0.87	0.88	0.85	0.78	0.79	0.77
Camurra J.–Weemelah	0.87	0.87	0.85	0.78	0.79	0.77
Nevertire–Warren	0.88	0.88	0.83	0.80	0.79	0.76
Bogan Gate–Tottenham	0.87	0.65	0.86	0.79	0.79	0.78
Ungarie–Lake C.	0.87	0.87	0.85	0.79	0.79	0.77
Ungarie–Naradhan		0.87	0.85		0.79	0.77
West Wyalong–Ungarie		0.89	0.89		0.82	0.84
Griffith–Hillston	0.87	0.88	0.86	0.79	0.80	0.78
The Rock–Boree Creek	0.98	0.98	0.95	0.79	0.81	0.79
Camurra J. – North Star						
Benalla–Oaklands	0.85	0.86	0.88	0.80	0.80	0.82
Goondiwindi–Thallon	0.86	0.86	0.89	0.80	0.81	0.84
Burren J.– Merrywinebone	0.87	0.88	0.85	0.78	0.79	0.77

Note: Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line. Bogan Gate to Tottenham and The Rock to Boree Creek currently are classified as Class 5. Their operational characteristics (TAL) exceed those of the benchmark Class 5 (19TAL), hence the structure of the B/C ratios across the upgrade scenarios differs from those of the remaining grain lines.

While the majority of grain transportation registered under the GHMS currently is carried on semi-trailers, the GHMS itself, and further road access improvement policies, is weakening the economic case for grain line upgrades across each of the 12 grain lines examined in this report. While rail-based transportation remains economically (and financially) competitive with road alternatives for longer distances and port / export-based destinations, road-based efficiency gains is eroding some of this competitiveness.

Discount rate variation

The previous analysis applies a 7% discount rate. This is consistent with national guidance for central estimates. NSW Treasury guidance, however, is for a 5% discount rate for central estimates. A lower discount rate means that future costs and benefits gain additional weight when expressed in today's (or present value) dollar values.

[23] There currently is no accepted methodology for calculating externalities for vehicles over 60 tonnes.

Given the variability in grain harvest, a higher discount rate might be appropriate. That is, because costs and benefits vary from year to year as a function of growing conditions and these, from today's vantage point, remain uncertain, a higher discount rate might be appropriate. Similarly, uncertainty about the impact of climate change on growing conditions and future yields may also justify a higher discount rate.

Conversely, there is more consensus around the wider economic impacts of climate change itself, and the likely under-estimation of these impacts as represented by current policy settings and economic parameters for benefit-cost analysis. Moreover, public policy objectives related to mode shift may also justify a lower discount rate.

Sensitivity analysis 5% SDRC

Tables 16-19 repeat the networked analysis using NSW guidance (i.e. central estimate based on 5% discount rate). Appendix 1 repeats this analysis at 3% and 10% discount rates, respectively.

NSW Treasury 5% SDRC: From **Table 16-19** it is evident that typically benefits and costs are somewhat greater. In relative terms, the change in positive economic impacts (benefits) is somewhat greater than the change in negative economic impacts (costs). However, there is overall little qualitative change in the outcomes, with the interpretation of B/C ratios remaining largely as before.

Sensitivity analysis 3% SDRC

Tables A1-A4 in **Appendix A** repeat the networked analysis based on a 3% SDRC. The impact of placing additional weight on future costs and benefits in today's decision making leaves the qualitative assessment of rail closures unchanged.

At the lower SDRC the economic case for upgrading some of the grain lines is also strengthened. In addition to West Wyalong to Ungarie, some of the other grain lines now breakeven or attain B/C ratios close to one. These are:

- Ungarie to Naradhan: upgrade to class 2 (semi-trailers and B-doubles)
- Benalla to Oaklands : upgrade to class 1 (semi-trailers)

Sensitivity analysis 10% SDRC

Tables A5-A8 in **Appendix A** repeat the networked analysis based on a 10% SDRC. Placing less weight on future costs and benefits in today's decision making weakens the economic basis for upgrading any of the grain lines. However, qualitative assessment with respect to closing rail lines remain largely unchanged when compared to the baseline or networked analysis. The key difference being that the economic case for upgrading the West Wyalong to Ungarie becomes more undetermined (orange).

Table 16: Economic evaluation rail closure, networked analysis, 5% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$19.9	$40.2	-$20.3	0.50	$19.9	$35.2	-$15.4	0.56	$19.9	$32.0	-$12.2	0.62
Camurra J.–Weemelah	$26.9	$15.7	$11.3	1.72	$26.9	$13.8	$13.1	1.95	$26.9	$12.6	$14.3	2.14
Nevertire–Warren	$4.8	$0.1	$4.7	49.10	$4.8	$0.1	$4.7	55.80	$4.8	$0.1	$0.1	61.25
Bogan Gate–Tottenham	$46.1	$92.2	-$46.1	0.50	$46.1	$81.3	-$35.2	0.57	$46.1	$74.2	-$28.0	0.62
Ungarie–Lake C.	$23.8	$23.1	$0.7	1.03	$23.8	$20.4	$3.4	1.17	$23.8	$18.6	$5.2	1.28
Ungarie–Naradhan	$23.2	$63.1	-$39.9	0.37	$23.2	$55.3	-$32.1	0.42	$23.2	$50.3	-$27.1	0.46
West Wyalong–Ungarie	$24.4	$212.3	-$188.0	0.11	$24.4	$187.1	-$162.7	0.13	$24.4	$170.5	-$146.1	0.14
Griffith–Hillston	$48.3	$136.6	-$88.3	0.35	$48.3	$120.3	-$72.1	0.40	$48.3	$109.7	-$61.5	0.44
The Rock–Boree Creek	$28.6	$113.3	-$84.7	0.25	$28.6	$110.8	-$82.2	0.26	$28.6	$90.9	-$62.4	0.31
Camurra J. – North Star	$33.6	$131.5	-$97.9	0.26	$33.6	$115.6	-$81.9	0.29	$33.6	$105.1	-$71.5	0.32
Benalla–Oaklands	$73.9	$514.4	-$440.5	0.14	$73.9	$440.1	-$366.2	0.17	$73.9	$412.4	-$338.5	0.18
Goondiwindi–Thallon	$67.3	$502.9	-$435.6	0.13	$67.3	$432.2	-$364.9	0.16	$67.3	$405.8	-$338.5	0.17

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table 17: Economic evaluation rail track upgrades to Class 3, networked analysis, 5% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$4.5	$75.0	-$70.5	0.06	$4.0	$75.0	-$71.0	0.05	$3.7	$75.0	-$71.3	0.05
Camurra J.–Weemelah	$1.7	$119.3	-$117.5	0.01	$1.6	$119.3	-$117.7	0.01	$1.4	$119.3	-$117.8	0.01
Nevertire–Warren	$0.0	$9.4	-$9.4	0.00	$0.0	$9.4	-$9.4	0.00	$0.0	$9.4	-$9.4	0.00
Bogan Gate–Tottenham	$10.5	$163.2	-$152.8	0.06	$9.4	$163.2	-$153.8	0.06	$8.7	$163.2	-$154.6	0.05
Ungarie–Lake C.	$2.3	$101.7	-$99.4	0.02	$2.1	$101.7	-$99.7	0.02	$1.9	$101.7	-$99.8	0.02
Ungarie–Naradhan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
West Wyalong–Ungarie	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Griffith–Hillston	$13.7	$153.2	-$139.6	0.09	$12.0	$153.2	-$141.2	0.08	$11.0	$153.2	-$142.2	0.07
The Rock–Boree Creek	$11.9	$80.9	-$69.0	0.15	$11.6	$80.9	-$69.3	0.14	$9.6	$80.9	-$71.2	0.12
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$53.5	$180.7	-$127.2	0.30	$46.0	$180.7	-$134.7	0.25	$43.3	$180.7	-$137.4	0.24
Goondiwindi–Thallon	$52.2	$403.1	-$350.9	0.13	$45.2	$403.1	-$357.9	0.11	$42.5	$403.1	-$360.6	0.11

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table 18: Economic evaluation rail track upgrades to Class 2, networked analysis, 5% SDRC

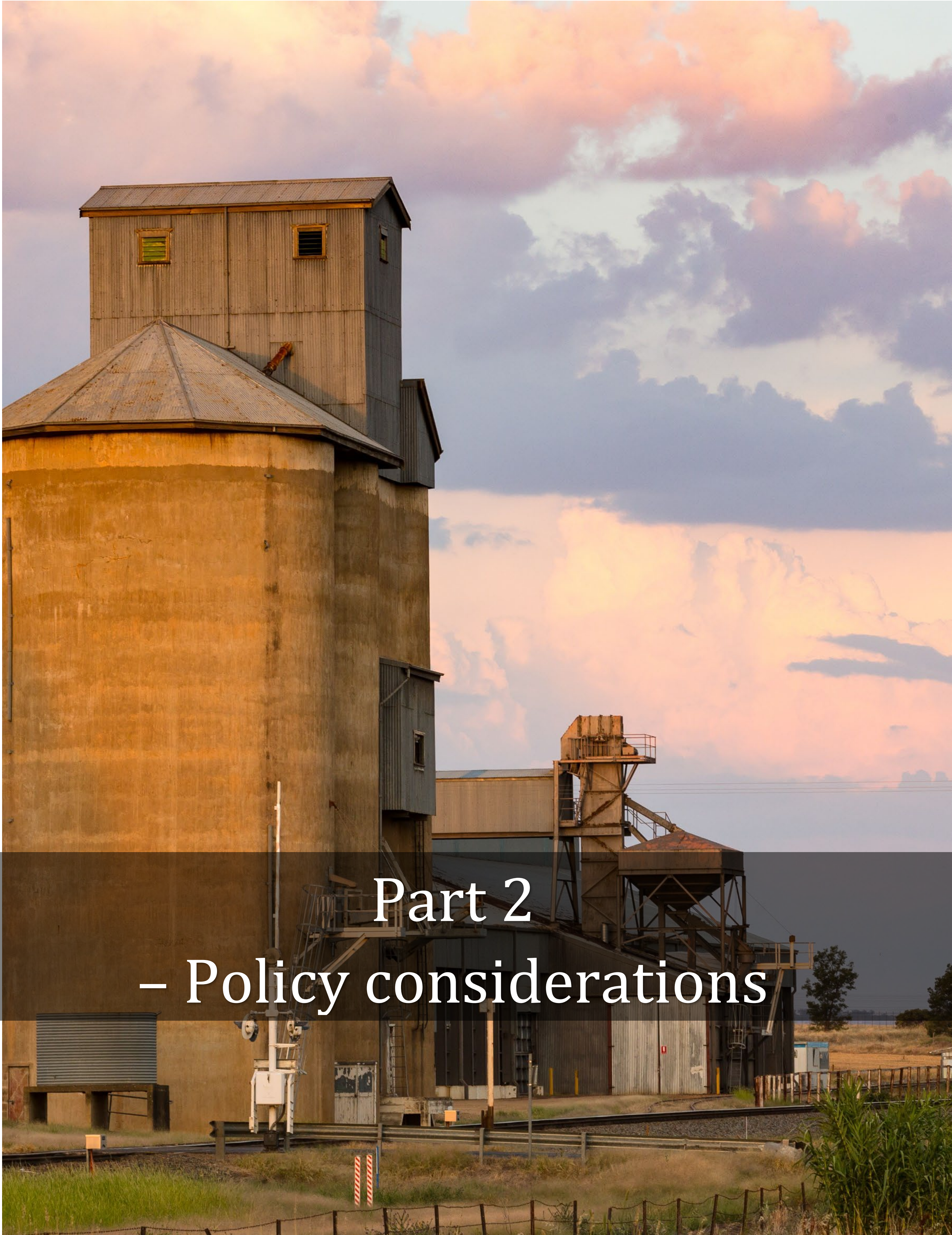
	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$13.1	$100.0	-$86.9	0.13	$12.1	$100.0	-$87.9	0.12	$11.4	$100.0	-$88.6	0.11
Camurra J.–Weemelah	$5.0	$159.1	-$154.1	0.03	$4.6	$159.1	-$154.5	0.03	$4.4	$159.1	-$154.7	0.03
Nevertire–Warren	$0.0	$17.0	-$16.9	0.00	$0.0	$17.0	-$16.9	0.00	$0.0	$17.0	-$16.9	0.00
Bogan Gate–Tottenham	$25.6	$217.8	-$192.2	0.12	$23.3	$217.8	-$194.5	0.11	$21.8	$217.8	-$196.0	0.10
Ungarie–Lake C.	$6.5	$135.7	-$129.2	0.05	$5.9	$135.7	-$129.8	0.04	$5.5	$135.7	-$130.1	0.04
Ungarie–Naradhan	$6.7	$28.9	-$22.2	0.23	$5.9	$28.9	-$23.0	0.20	$5.4	$28.9	-$23.5	0.19
West Wyalong–Ungarie	$22.9	$17.2	$5.7	1.33	$20.4	$17.2	$3.2	1.19	$18.7	$17.2	$1.5	1.09
Griffith–Hillston	$40.9	$204.4	-$163.4	0.20	$37.5	$204.4	-$166.9	0.18	$35.3	$204.4	-$169.1	0.17
The Rock–Boree Creek	$35.7	$107.9	-$72.2	0.33	$35.2	$107.9	-$72.7	0.33	$31.0	$107.9	-$76.9	0.29
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$119.3	$241.1	-$121.7	0.50	$103.7	$241.1	-$137.3	0.43	$97.9	$241.1	-$143.1	0.41
Goondiwindi–Thallon	$130.9	$470.5	-$339.6	0.28	$116.1	$470.5	-$354.4	0.25	$110.5	$470.5	-$360.0	0.23

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table 19: Economic evaluation rail track upgrades to Class 1, networked analysis, 5% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$20.6	$125.1	-$104.5	0.16	$18.6	$125.1	-$106.5	0.15	$17.5	$125.1	-$107.6	0.14
Camurra J.–Weemelah	$6.4	$198.8	-$192.5	0.03	$5.6	$198.8	-$193.2	0.03	$5.2	$198.8	-$193.6	0.03
Nevertire–Warren	$0.0	$24.5	-$24.4	0.00	$0.0	$24.5	-$24.5	0.00	$0.0	$24.5	-$24.5	0.00
Bogan Gate–Tottenham	$40.7	$272.2	-$231.5	0.15	$36.4	$272.2	-$235.9	0.13	$34.0	$272.2	-$238.2	0.12
Ungarie–Lake C.	$11.3	$169.6	-$158.3	0.07	$10.2	$169.6	-$159.5	0.06	$9.6	$169.6	-$160.1	0.06
Ungarie–Naradhan	$15.7	$57.6	-$41.9	0.27	$13.7	$57.6	-$43.9	0.24	$12.7	$57.6	-$45.0	0.22
West Wyalong–Ungarie	$58.1	$34.3	$23.8	1.69	$51.1	$34.3	$16.9	1.49	$47.7	$34.3	$13.4	1.39
Griffith–Hillston	$63.1	$255.6	-$192.4	0.25	$56.7	$255.6	-$198.9	0.22	$53.2	$255.6	-$202.4	0.21
The Rock–Boree Creek	$54.8	$135.0	-$80.2	0.41	$52.8	$135.0	-$82.1	0.39	$46.3	$135.0	-$88.7	0.34
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$179.8	$301.4	-$121.6	0.60	$159.1	$301.4	-$142.4	0.53	$149.9	$301.4	-$151.5	0.50
Goondiwindi–Thallon	$189.9	$538.0	-$348.1	0.35	$171.8	$538.0	-$366.2	0.32	$163.0	$538.0	-$374.9	0.30

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.



Part 2 – Policy considerations

Least-cost pathway alignment

In relation to grain transport, least-cost pathway (LCP) alignment involves policy, regulatory or market innovations with the potential to reduce the costs of transporting grain from farms to end users or export. LCP alignment is centred around minimising (least-cost) the cost of connecting points of grain production with points of value-added production or export. LCP alignment can combine multiple cost factors, including financial factors, wider economic factors, transaction or coordination costs, environmental or climate related factors.[24]

As evident from assumptions and discussions in Part 1, achieving (let alone maximising) benefits from retention or investment in grain line infrastructure remains contingent on several variables that are not directly affected by the public sector / infrastructure manager's decision with respect to below-rail operations.

Similarly, with respect to least-cost pathway alignment, the public sector and rail infrastructure managers can only affect some variables related to cost reduction. The analysis in this section therefore focuses on:

> ***RQ3**: How policy options beyond grain line upgrading may enable least-cost pathway alignment and incentivise more grain on rail?*

The multifactor composition of least-cost pathway alignment means that these may differ for private and public actors. Specifically, the commercial least-cost pathway may differ from the social least-cost pathway. In the presence of externalities and non-trivial transaction costs, the divergence of private and social benefits is a well-known public policy and governance challenge.

In relation to rail-based grain transport, transaction costs are both technology specific and institutional. Rail-based infrastructure is characterised by high asset specificity, which increases the risk of rent extraction in the coordination (through stranded assets) and infrastructure investment process.[25] For instance, the risk that desired policy outcomes (increased grain line utilisation) may not be achieved even after infrastructure investment. Moreover, institutional fragmentation of the grain supply chain raises coordination costs (PC 2006).

Outline of approach – policy considerations

Part 2 focus on two institutional aspects of least-cost pathway alignment for rail-based grain freight in NSW, Victoria, and Queensland.

- **Risk sharing models**: These seek to align above- and below-rail operations, maintenance, and investment incentives; reduce combined costs; thus, facilitating greater utilisation or competitiveness with roads.
- **Governance reforms**: These seek to reduce transaction costs associated with coordinating grain transport across jurisdictions/regulatory environments, across

[24] Transaction costs arise when goods and services are transferred across technologically separate stages of production, or between providers and users. (Williamson 1981). Non-negligible transaction costs give rise to analysis of how alternative organisation of firms and markets economises the costs of planning, adapting, and monitoring task completion.

[25] Assets specificity means that investment in particular assets such as rail have higher value to rail operations than other types of operations. Consequently they cannot easily be adapted to other uses. Road on the other hand is not particularly asset specific, it will have high value from everything ranking from bikes to road trains.

different network providers; thus, facilitating greater utilisation or competitiveness with roads.

These institutional aspects relate to policy developments that *may* address (some) coordination cost and misalignment of incentives resulting (or remaining) from institutional and organisational reforms in the 1990s and 2000s.[26] In considering governance and risk sharing models a key starting point is that there remains an economic case for public sector financial involvement. That is, the divergence between private and social benefits generates a basis and justification for public sector involvement. This is illustrated in the economic analysis, showing that closure/disuse of the grain lines will, in most cases, generate significant negative net social outcomes.

However, both risk sharing models and governance reforms primarily target operation and transaction costs associated with rail-based grain transport. It remains unclear how elastic mode choice is with respect to reductions in either of these cost dimensions. The critical cost dimension, in this respect, is not the absolute value of operation and transaction costs for rail-based transport, but the relative cost of intermodal rail and road operation and transaction costs compared to the outside transport option, i.e., trucks from farm to end-user or port.

Beyond grain line upgrading

In Part 1 the public sector economic case for grain line upgrading rests on the volume of grain that is transported by rail rather than road. That is, the removal of trucks from regional roads is associated with a net decline in externalities and road safety costs that generate a positive societal effect. However, as Part 1 shows these benefits are, for most of the 12 grain lines analysed, not sufficient to offset the cost of grain line upgrading. Moreover, it remains uncertain what the elasticity of truck-removal-from-roads to grain line upgrading is across regional NSW, Victoria, and Queensland. Beyond the technical standards of individual grain lines, regional coordination of grain transport is also determined by:

- Availability of on-farm and on-rail grain receival and storage infrastructure.
- Availability and coordination of locomotives and wagons on individual grain lines, and between grain lines and end-destinations.
- The institutional organisation of grain supply chains from farm to port or end-users, where institutional organisations can include market-based coordination, long-term contractual arrangements, and/or vertical integration of supply chain elements.
- Outside options, e.g. supply chain coordination by truck alone rather than rail and road (intermodal).

These factors also impact the commercial least-cost pathway of grain growers or transporters. Risk sharing models and governance reforms provide mechanisms for addressing *some* of the transaction costs and investment risks arising from the current institutional and organisational structure of grain freight.

In Australia, as is the case internationally, there have been ongoing evaluations and assessments of how institutional and organisational innovation might address incentive misalignment and coordination costs associated with the rail system as it emerged from the 1990s/2000s reforms. Methodologically, this Milestone Report primarily draws Australian and international analysis of how institutional and organisational innovation can address (some)

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[26] Several potential coordination barriers pre-dated the reforms of the 1990s and 2000s, such as variations in rail track standards, or regulatory frameworks.

misalignment and coordination costs arising from rail reforms in the 1990s/2000s. *Stakeholder consultation will then supplement and refine discussion and analysis.*

Risk sharing models.

Rail reforms in the 1990s and 2000s were centred around separation of above- (operation of train and freight services) and below-rail operations (operation of track infrastructure). In relation to the grain lines, each of the three state governments (New South Wales, Queensland, and Victoria) retained, or have subsequently re-acquired, ownership of the rail track infrastructure.[27] Competition, to the extent that it has emerged, is centred on open access and competition between rail operators, as well as competition with road-based transport. Open access is conceptually based on competition between rail operators as the means of driving service level and cost improvements to compete against the road alterative. In practice, access cost for rail-based grain freight is significantly below cost recovery (operating, routine maintenance and renewal and capital upgrades) across much of the regional rail networks in each of the three states. It should be noted that truck road user charges are also well below the level for full road cost recovery.

For instance, Country Regional Network (CRN) access charges recover around 2.3% of the operating and maintenance costs for the grain lines in NSW (IPART 2012, 2023). Cost recovery rates are also low in Queensland and Victoria.[28] However, notwithstanding heavily subsidised access, grain line utilisation remains below desired levels. Moreover, road transportation of grain has become increasingly competitive as technological changes (larger and more cost efficient trucks, on-farm storage), market changes (increased domestic consumption, smaller and more diverse grain shipments), uneven investment in or access to additional system's infrastructure (receival sites, intermodal terminals, port receival coordination) investment in system's infrastructure, and relative road and rail access charges have eroded some of rail's historic advantage (White et al 2018, Bullock and Frost 2021). Given the existing levels of access subsidies, further access subsidisation is unlikely to constitute an effective mechanism for aligning commercial and social least-cost pathways.[29]

Following privatisation and systems unbundling in the 1990s, market mechanisms (such as pricing of fuel, access, utilisation for rail and road) are key mechanisms for coordination of incentives and modal choice. However, these processes and mechanisms are also shown to sometimes generate misalignment of incentives when prices do not appropriately reflect the true social costs of economic activity. For instance, Van de Velde et al (2012: p. 94-95) analysis of vertical separation of railways in Europe concluded that the "potential consequences of misalignments are varied and include held-up investment opportunities in various technical assets, networks not developed in line with market requirements, sub-optimal combinations of assets (rolling stock, track and personnel) leading to excessive costs of production, externalities in the sense of efficiency savings from one party's actions at the disadvantage of the other party's cost and performance and negative impacts on daily operations. The misalignment issues have important technical components and the pivotal point with all these issues is that costs and benefits of various actions can fall apart, and that

[27] Victoria's regional rail network was privatised in 1999 and bought back by the State in 2007.

[28] QLD: https://www.qca.org.au/wp-content/uploads/2019/05/queensland-rail-tender-bundle.pdf

[29] Low / heavily subsidised access charges can contribute to informational deficiency. For instance, Van de Velde et al (2012: p.79) argue in their analysis of European rail reforms that low / heavily subsidised access charges equate to the public sector becoming the infrastructure manager's main 'customer', rather than the rail user. "Such situation bears the risk of a reduced focus on the needs of the [railway undertaking] as customers of the [infrastructure manager] and of a disproportioned focus on political preferences in terms of infrastructure investments that may not be in line with true market needs."

one actor bears the costs whilst the other one gains all or at least a noteworthy share of the benefits.”

Similar issues were also raised by the Productivity Commission in its 1999 report (*Progress in Rail Reform*). This report overall recommended vertical separation of train operations from track infrastructure, but not in markets with limited scope for above rail competition (low transport volumes) or where significant competition from alternative transport modes inhibited profitable market entry (1999: p. xxix). In a 2006 report (*Road and Rail Freight Infrastructure Pricing*) the Productivity Commission reiterated significant misalignment costs associated with coordination and investment arising from vertical integration (2006: p.316).

Separation of systems functions thus places greater demand on developing appropriate incentive structures. Across Europe, hybrid arrangements (joint ventures, long-term contracts)[30] and re-integration (internal coordination) of some activities have emerged as mechanisms for reducing incentive misalignment. Such arrangements can facilitate:

- Long-term above and below rail infrastructure planning. Misalignment can arise between market needs and infrastructure investment, and between infrastructure and rolling stock investments, sizing, specification of technical standards and location.
- Systems perspectives on individual business or infrastructure manager planning. Individual business or infrastructure manager decisions can become suboptimal when systemic costs and benefits are excluded from planning. For ‘system goods’ this is akin to distinction between private and social benefits of goods and services with public good characteristics. Institutional (integration) and/or regulatory innovation *can* unlock additional difficult to realise mutual gains.

Potential policy options relating to risk sharing models centre on organisational changes that distribute existing risks differently across supply chain actors and transport authorities, and thus a realignment of the modal choice incentive structure. The organisation of rail-based grain freight can take alternative forms. Each form is associated with variations in how above and below rail cost and benefit variations are distributed, and consequently shaping mode utilisation decisions. Variations in above and below rail costs and benefits constitute risks that commercially based operators must consider as part of business modelling, and governments must consider as part of constructive appropriate incentive structures to achieve public policy objectives.

In relation to the NSW grain lines, Booz & Co identified six types of risks and their allocation across different forms of organising rail-based grain transport. A brief description of risks is provided in **Box 1**.

[30] Long-term contracts are an institutional feature in some supply chain elements of freight in Australia as well.

Box 1 Above and below rail risk categories.

Volume and Revenue Risk is the risk that the volume of freight that travels on the lines is less than predicted. Low volumes constitute a revenue risk to rail operators (transport fees), and governments alike (access fee). Volume is a key risk for the Government where subsidisation of lines based on the perceived economic benefit of transferring freight from road to rail.

Below Rail Maintenance Risk is the risk that the costs of maintaining and upgrading the lines are higher than expected.

Above Rail Operations Risk is the risk of unforeseen costs in providing rail operations on the lines. This may include higher labour costs, derailments, equipment failures and temporary lines closures. This also includes coordination risk along grain lines, and onwards to ports and end-users.

Asset Condition Risk is the risk of unanticipated deterioration in asset quality which may increase above and below rail costs. For instance, by necessitating slower operating speeds and reduced axle loads on the lines.

Stranded Asset Risk is the risk that infrastructure associated with the lines is stranded because of actions of one or more participants in the grain supply chain. For instance, closure of on-rail receival and storage sites may leave rail tracks stranded; disuse of rail lines similarly reduces asset value of receival and storage sites. In both cases assets can no longer generate an effective or expected return.

Access Price Risks is the risk of unanticipated increases in access prices which may reduce above rail operator profitability.

Complimentary Asset Utilisation Risk is the risk that above rail infrastructure (wagons and locomotives) or receival and storage infrastructure are under-utilised, no longer generating an effective or expected return.

Source: Booz & Co (2011: p. 50), except complimentary asset utilisation risk.

Risk – and so transaction costs associated with rail-based freight – are distributed across different actors. Different organisational forms allow actors to economise associated risk-specific transaction costs differently. **Table 1** provides an overview of the distribution of risk across transport operators and state governments under alternative risk sharing models.[31]

The three alternative models are characterised as:

- *Integrated or franchised model*: give the operators exclusive control of above and below rail operations, including the collection of revenue. Compared to the current structure, below-rail risk associated with maintenance and volume / revenue) is shifted from state governments to transport operators. Operator control of above and below rail operations can enable transaction cost economising through operating synergies and sharing of resources, and coordination with other parts of the rail network (to ports or end users). Conversely, low commercial potential may result in low-capacity utilisation.
- *Service delivery model*: give the operators exclusive control of above- and below-rail operations, excluding the collection of revenue. Also, here operator control of above and below rail operations can enable transaction cost economising through operating synergies and sharing of resources. The model provides clarity and certainty to the

[31] A fully nationalised model is not included. Under such a model, risk sits with the public sector.

market. However, public sector service specification and retention of tactical planning (e.g., frequency, timetabling, and infrastructure requirements) may reduce incentives to achieve synergies and network coordination or respond to market changes.

- *Regional infrastructure model*: to broaden the current track underwriting and subsidised access model to include other public bodies and/or industry stakeholders. This can generate a coordinated approach to regional infrastructure spending and access decisions across either rail or road modes. Grain transport investment decisions can be considered as complimentary rather than competitive. A regional infrastructure model may begin to address the impact of road-based competition on track and complementary infrastructure investment and access management but will only do so where road-based infrastructure is coordinated within the regional model, and where the incentives to use road and rail options are commercially defensible.

  A regional infrastructure model approach can centre on overall task-based efficiency. That is, the movement of grain from farm to end users/port will invariably involve trucks. Trucks can go from farm to end user/port or to a rail-based storage and receival site. Either way, trucks will continue to be required in the foreseeable future. Under a regional infrastructure model, the impact of rail and road (modal choice) incentives can be coordinated to avoid undesirable, or unintended, impacts on systems availability and outcomes of either transport mode. Regions can be considered administratively, but also on a grain systems basis.

  Finally, a regional infrastructure model, and system's perspectives more generally, can also focus on policy initiatives and incentives to enhances truck operators' benefits from altered business models. This can include increased asset utilisation on short-haul trips to substitute for reduction in long-haul trips and labour shortage issues (fatigue management, driver shortage). From a regional economic development perspective, increased short-haul trips may also generate additional local employment.

Table 20 Organisational form and distribution of risks

	Current	Integrated / franchise model	Service delivery	Regional infrastructure model
Volume and revenue risk (above rail)	Transport operators		State governments	State governments
Volume and revenue risk (below rail)	State governments	Transport operators		
Below rail maintenance risk	State governments	Transport operators	Transport operators	Transport operators
Above rail operations risk	Transport operators			
Asset condition risk	Transport operators			
Stranded asset risk	State governments			
Asset price risk	Transport operators		State governments	State governments
Complementary asset utilisation risk	Transport operators			

Source: Booz & Co (2011: p.51-57).

A distinction between the current (open and subsidised track access) and the integrated / franchise or service delivery models is that each of the alternative models in practice represent competition for markets themselves, rather than competition within markets. A regional infrastructure model can be combined with current (open and subsidised track access) and integrated / franchised or service delivery model characteristics alike.

From a mode shift perspective, one way to interpret the comparative distribution of risk is that the commercial decision to transport grain by rail or road depends on the combined labour, capital and transaction costs associated with each mode. To ease the readability of **Table 20**, cells in each of the three alternative risk sharing models are only populated where there is a transfer of risk. For instance, below-rail volume and revenue risk is transferred to an integrated operator / franchise, but not under a service delivery or regional infrastructure model. Conversely, the asset price risk is transferred from the transport operator to state governments under a service delivery or regional infrastructure model, but not under an integrated or franchise model.

Noticeable from **Table 20** is that several types of risks are not directly redistributed under any of the alternative models. A priori, the lack of risk transfer may suggest that, from a commercial operator's perspective, alternative modes do not offer economising opportunities along these risk dimensions.

However, as with more cooperative models emerging internationally, the use of integrated / franchise or service delivery models provide the opportunity to absorb additional risk factors in the franchise price, including negative prices, or fee for service structure. For instance, means by which risk sharing can be managed under integrated/franchise or service delivery models include:[32]

Operational Subsidies: Below-rail access is currently highly subsidised. However, subsidies can also target (additional) ongoing operational costs of rail services, especially on routes that are marginally financially viable without external assistance. For routes that are not financially viable without external assistance, fees for service or negative price bids provides a means of incorporating additional operational subsidisation. Key considerations in designing (or accepting) subsidy structures include:

- *The economic or policy basis for subsidies*. A misalignment in private and social benefits of mode choice (e.g. social >private) provides a public sector rationale for operational subsidies. The economic analysis shows that the external costs associated with road-based grain transport exceeds those of rail-based transport. This differential provides an economic rationale for public sector operational subsidies. Notably, this economic rationale requires assessment against the existing track access subsidy. Considering that road access and usage costs do not reflect their true social costs, low rail infrastructure access charges are also considered a means of levelling the field between rail and road options in Europe (Crozet 2014).[33] Similarly, policy objectives may constitute a rationale for subsidies. That is, subsidies can be applied to achieve policy outcomes that are considered politically desirable. Desirability can be separate from any economic rationale but can also reflect assumptions around hard to capture economic impacts. For instance, the societal impacts of climate change or systems collapse are poorly captured in economic

[32] Based on PC (2006).

[33] The cost of rail undertakings / access remains an important means of maintaining any economic attractiveness of rail transport. However, Crozet (2014: p. 40) also argues that, across Europe, the quality of rail tracks and paths are 'at least as important' to maintain competitiveness (and punctuality) with road-based transport.

analysis. Similarly, the role of rail-based freight within a food and community resilience framework is poorly captured in economic analysis.

- *Targeting of subsidies*. In each of the risk sharing models in Table 1 the stranded asset risk remains unchanged. Rail tracks are asset specific and generate considerable scope for rent extraction in the negotiation or establishment of operational subsidies. In other words, the very existence of tracks generates an incentive to subsidise their increased utilisation (as is the case for road). While economic rationales for subsidies in some cases can be established in a technically more transparent manner, policy rationales provide little technical guidance on benchmarking or evaluation. Moving beyond track-access subsidisation requires mechanisms for ensuring that (other) operational subsidies deliver increased utilisation and avoid low-value for money outcomes. The latter includes crowding-out of private incentive to use synergies, or the transaction costs economising potential enabled by the alternative organisational forms. **Box 2** illustrates the subsidy-value for money consideration further.

Risk Sharing through Contracts: Contracting can specify how risks related to demand fluctuations, maintenance costs, and other operational uncertainties are divided. By contractually clarifying responsibilities, private and public parties can better manage risks and, potentially, encourage investments in rail infrastructure. A key consideration in risk sharing through contracting is that transporters have a competitive outside option – trucks. While transferring above and below rail risk attributes to the private sector may generate technical efficiency (minimisation of combined above and below cost), the outside option (trucks) may place a limit on the attainability of policy objectives (such as utilisation rates). Regional infrastructure models provide a means of enhancing coordination of road and rail alternatives, but without necessarily mitigating the impact of the truck outside option on achievement of policy objectives.

Performance-Based Incentives: ties subsidies or incentives to specific operational outcomes, such as increased freight volumes, utilisation rates or improved service reliability. Performance-based incentives seek to align the interests of the operators with public objectives, with financial or regulatory measures baked in that incentivise transport operators to optimise their operations and invest in infrastructure improvements.

Guarantees for Investment: this can provide financial guarantees for private investments in rail infrastructure. By reducing the perceived risk guarantees can help stimulate capital flows into the rail sector, enabling grain line developments or upgrading that otherwise would not be forthcoming. Guarantees seek to generate private sector investment, thereby increasing the likelihood of delivery of public sector objectives and value for money in terms of public sector subsidies or investment. Several previous reports have argued for the necessity of incentivising private sector investment to ensure a more appropriate distribution of commercial benefits arising from rail-based grain transport, and the costs of maintaining and/or upgrading existing grain line infrastructure (e.g. GFR 2009, Booz and Co 2011). However, investors – whether public or private – in grain lines will need certainty that users are committed to utilisation over long periods of time (below-rail investment horizons span 30-50 years) and with adequate volume. From a vantage point of 2024 and looking ahead to a 30-50 year time horizon, the divergence basis of commercial and social least coast pathways is uncertain as low- and/or zero-carbon road and rail alternatives will likely become available.

Box 2 General and targeted subsidies.

Operational subsidies can shift the supply curve of freight services, illustrated in **Figure 2**. In a general operational subsidy (Panel A), the public sector may also end up subsidising / paying for supply that otherwise would have taken place. The grey area in Panel A represents subsidy payment without additional supply. Subsidy would be paid for each unit of freight service from zero to Q2. In panel B, the subsidy payment does not achieve any increase in freight services, but instead improves the margin of relevant operators. This may happen where operational subsidies create a disincentive to extract synergies or transaction cost economising potential of alternative organisational forms. Or, where service increases in return for subsidies are not enforceable. In Panel C, the subsidy is only paid on each unit of freight service between Q1 and Q2.

Figure 2 relate to both grain line and regional (bundled) organisational forms in **Table 1**. On a per grain line basis, it will likely be difficult to identify, quantify and monitor a targeted subsidy. Train operators will likely consider individual grain lines in their totality. Performance based measures (discussed below) can be used to differentiate any subsidy basis. On a per region basis, bundling of grainlines allows for cross-subsidisation of lines. Targeted subsidies may be difficult where bundles are pre-established. However, the use of price finding mechanisms (such as auctions) can be used to identify individual grain line subsidy requirements.

In both cases, clear performance outcomes will be required to evaluate the value for money of any subsidy.

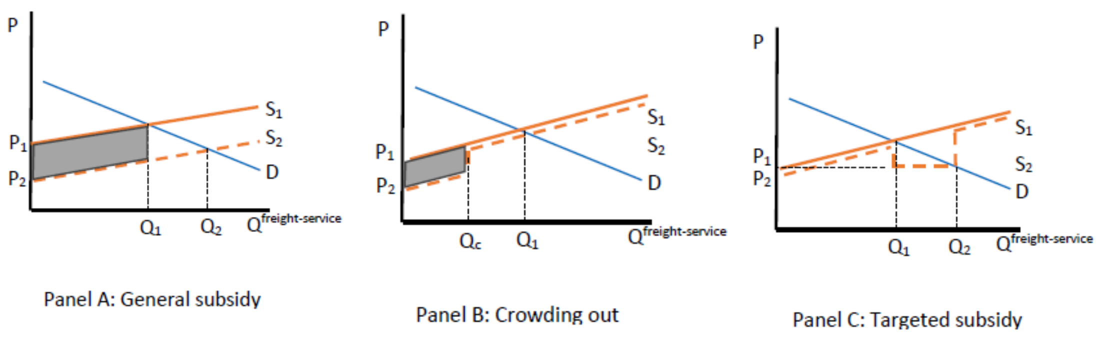

Figure 2 General and targeted subsidies.

Note: D represents demand for rail-based freight services. It is downward sloping on the assumption that demand responds to changes in price, and that the subsidy is passed on to consumers in the form of lower prices. Price (P) changes from P1 to P2. S1 and S2 represent the marginal cost curve of rail-based freight service. The difference between Price (P) 1 and Ps is the level of operational subsidy provided by the public sector. In both panels a subsidy increases the quantity (Q) of rail-based freight services from Q1 to Q2. In Panel A, the grey area represents subsidy payment without expanded supply.

Asset sharing arrangements: this can promote efficiency in resource management for logistics activities (ITF 2020). Availability of wagons and locomotives are key to grain line utilisation. At current operational classifications, locomotives operating on grain lines are lighter than mainline locomotives. For grain transporters / rail operators this means investing in asset specific (grain lines) locomotives, rather than rationalisation of investment around mainline locomotives. Rationalisation of locomotives is, from a grain transport perspective, efficiency enhancing. However, these privately captured productivity gains also generate wider social costs when grain line transport is substituted for road-based transport. A policy consideration is therefore for individual states, or east-coast states combined, to co-invest (or invest) in a shared fleet of locomotives, and potentially wagons that can complement the private sector asset park. A joint east-coast initiative would allow for further risk sharing, the additional locomotives and wagons required in any given year varies in each of the states, in the form of joint asset park.

Notably, this policy model is most effective when the operational characteristics of grain lines are harmonised across states. An asset sharing arrangement would potentially reduce the complementary asset utilisation risk in **Table 20**. At present, differences in gauge standards across the three states is an obstacle to a shared above asset park. For instance, a shared asset park that can operate across the 10 NSW grain lines examined in the economic analysis would only provide limited value to grain transportation elsewhere in Victoria and Queensland. Beyond the Benalla to Oaklands (Vic) line, which has the same gauge standard as NSW, much of the Victorian network is broad gauge. In Queensland, including the Goondiwindi to Thallon line, the grain lines are narrow gauge. In the absence of more general and costly harmonisation of gauge standards across the three states, the benefits of a shared asset park are likely marginal in Victoria and Queensland.

A consideration across each of the alternative organisational forms and risk sharing means is that to evaluate any public sector value for money in maintaining grain lines, upgrading grain lines, or providing operational subsidies they will require:

- Clearly articulated and measurable policy objectives.
- Data and information sharing to assess and monitor performance in relation to operations and investment, but also dynamic changes / strategies (e.g. attain synergies and economise on transaction costs), market demand or market expansion.

Governance reforms

Risk sharing models examined in the above section focus on the organisation of grain-related economic transport activity. Specifically, the extent to which alternative organisational forms can redistribute risk between train operators and the public sector for the purpose of increasing grain line utilisation rates and investment in grain lines to maintain current operational characteristics or improve these. Each of the models provide opportunity to improve the coordination of grain line operations, rail maintenance and investment.

However, the above risk sharing models – as applied to the grain lines included in the economic analysis – do not necessarily address wider systems coordination costs associated with transporting grain from farms to ports (or end users).

This section focuses on public sector institutional reforms or policy options that can address coordination costs beyond individual grain lines or groups of grain lines. Such reforms or policies are not contingent on specific organisational form of grain transport per se. That is, institutional reforms or policy innovations will likely also benefit train operators under the existing structure of grain transport.

Train operators seeking to maximise this potential remain confronted by cost and coordination challenges:

- *Inconsistent Standards and Regulations*: East coast states have varying regulations governing freight transport, which creates a complex environment for freight operators who operate across borders. Fragmented regulations lead to duplicative processes and extended approval times, as operators must repeatedly apply for permits or approvals in each region (PC 2006). Across Australia there are 18 separate rail networks with three railway gauges, 11 separate signalling systems and numerous standards and working rules.[34] This challenge is reproduced across the east coast

[34] https://www.ntc.gov.au/transport-reform/national-rail-action-plan.

states. The National Transport Commission estimates that harmonising approval processes will generate $30 million in industry savings and encourage rolling stock investment and modern technology.

- *Multiple access regimes*: Rail-based grain transport spans multiple and uncoordinated access regimes.
- *Investment certainty*: Regulatory fragmentation increases investor long-term infrastructure uncertainty when returns on investment in one region also are affected by regulation in other regions (PC 2006). Variations in standards and regulations may result in inefficient infrastructure utilisation as freight operators' response to regulatory conditions in one region carries across the entire freight task. Moreover, incentives to maintain and invest in rail track standards are conditional on investment in complementary infrastructure such as rolling stock, receival and storage infrastructure. Investment uncertainty around forms of grain line or complementary infrastructure also reduces investment incentives in the complementary infrastructure. As noted in research by White et al (2018) the erosion of rail historic advantage has been exacerbated by technological changes and investment/access to complementary infrastructure.

IR will facilitate greater north-south integration and, in part by circumventing the Sydney metropolitan area, remove coordination bottlenecks. IR also enables higher yielding train movements and shorter transit times into the Port of Brisbane. Road-based transport has increased market share because it has gradually reduced its monetary costs and benefited from improvements of road infrastructures and significant technical advances. The economic assessment illustrates that also the social least cost pathway advantage of train diminishes with increased truck productivity. Moreover, trucks offer a more flexible, cost-efficient, and speed-efficient delivery solution. Over longer distances and for homogenous products these benefits decline relative to the economics of scale provided by rail-based transport.

While rail-based grain transport is unlikely to emulate the flexibility of road-based transport, increased coordination (and availability of rolling stock), and harmonisation of grain rail standards (Crozet 2014, PC 2006), can be instrumental in raising availability, punctuality, and reliability of rail services (to port).

The development of Inland Rail (IR) provides a potential catalyst for developing an **East Coast Grain Transport System** (ECGTS). An ECGTS might operate along two complementary approaches:

- An East Coast Framework for Transport Policy for enhancing cross jurisdictional governance.
- An asset sharing arrangement for rolling stock, potentially extending to joint investments around additional complementary infrastructure.

Several governance options for enhanced cross-jurisdictional governance were identified by the Productivity Commission in 2006 (PC 2006: Chapter 11). Translated into an ECGTS perspective these include:[35]

An East Coast Framework for Grain Transport Policy: Establishing an east coast integrated framework for grain rail policy would enhance cross-jurisdictional coordination and harmonisation. An East Coast Framework for Grain Transport Policy should link to ongoing rail reform initiatives, such as the National Rail Action Plan, in terms of harmonisation of

[35] The Productivity Commission's 2006 report focused on national governance options. These have been appropriated for ECGTS options.

standards, technology, interoperability, and approval regimes.[36] It should also address grain freight specific aspects such as the ongoing need for public sector subsidisation, seasonality and low volumes, and integrative road-rail planning for grain transport tasks.

Such a framework might be based on relatively loose institutional arrangements, such as memoranda of cooperation. For instance, each of the Australian states and territories are signatories to a Memorandum of Cooperation for Interoperability (MoCI). The MoCI commits industry and governments to *consider* interoperability when investing in rail networks. More formalised institutional arrangements, such as inter-governmental agreements and/or establishment of an east coast grain rail coordination body (see Box 3) can enhance the enforceability of cooperative arrangements.

Box 3 Formalised cross-jurisdictional cooperation models.

Inter-Governmental Agreements: developing formal inter-governmental agreements to foster collaboration among various levels of government. Such agreements can outline shared objectives, responsibilities, and funding arrangements for rail infrastructure projects, reducing the fragmentation that often leads to increased transaction costs. By creating clear lines of communication and shared goals, these agreements can enhance overall coordination.

Establishment of a Grain Rail Coordination Body: A dedicated body or authority could be established to oversee rail operations across jurisdictions. This body would facilitate information sharing, harmonise practices, and coordinate investments in rail infrastructure. By having a centralised organisation, stakeholders can more effectively collaborate and address issues that affect multiple jurisdictions.

Source: adapted from PC (2006).

A key objective of the alternative organisational forms discussed under risk sharing models is to better align above and below rail operations, and generate additional private sector buy-in (investment). To address incentive misalignment and transaction costs around track investment and potential upgrades, a key question of cross-jurisdictional cooperation becomes the extent to which these address any investment uncertainty experienced by private sector operators. An East Coast Framework for Grain Transport might include the following aspects (adapted from PC 2006):

- Enhanced data sharing and transparency to improve operational planning and coordination, and to manage risks as well as externalities. Increased transparency in performance metrics, costs, and service availability can help stakeholders make informed decisions, leading to more efficient resource allocation and reduced transaction costs (for instance, data on freight volumes, infrastructure conditions, and service performance can help identify bottlenecks and inefficiencies that need addressing). Data sharing, and new data collection, will be foundational to any East Coast Framework for Grain Transport. In the absence of data availability and transparency it becomes difficult to measure how an east coast grain system is operating and, crucially, begin to identify the impact of alternative organisational forms and state or cross-jurisdictional governance reforms.

[36] Aspects of the National Rail Action Plan already have a distinct east coast dimension and can provide a basis for additional east coast grain cooperation. E.g. one of five priority areas under the National Rail Action Plan is 'Aligning train control and signalling technology on the eastern seaboard' (https://www.ntc.gov.au/transport-reform/national-rail-action-plan).

To identify commercial and social least-cost pathways, and their alignment, data is required for each of the jurisdictions, and for above and below rail elements, complementary infrastructure, road infrastructure and truck operations. Data is required on the flow of grain for export (ports), but also for domestic consumption. Without data on both rail and road options, least-cost pathway alignment becomes fraught. For instance, grain volume and transport data remains commercially sensitive information across NSW, Victoria, and Queensland. When completing the economic analysis for the current project, access to grain volumes on rail and road was a particular challenge. A proxy means to address the rail-based volumes was eventually found – albeit subject to confidentiality clauses – but equivalent data was not available for road-based transport. Origin-destination data from farm to export or domestic consumption was also not available, nor was operational data on complementary infrastructure.

To enable informed decision-making – and establish reasonable expectations around the efficacy of policy decisions – a foundational element of an East Coast Framework for Grain Transport is therefore availability of an adequate data infrastructure to support risk sharing and governance arrangements.

- A streamlining of decision-making processes and clarification of responsibilities, potentially leading to more efficient operations. An east coast policy framework may be particularly appropriate to grain where seasonal variations in harvest patterns and demand for transport options, to a degree, can be mitigated and smoothed by more efficient integration of grain lines under an East Coast Grain Systems approach. Streamlined decision-making is feasible under both loose and formalised arrangements. However, in terms of addressing investment uncertainty, the absence of more binding, and potentially enforceable, decision-making and responsibility mapping commitments may not significantly alter private sector investment parameters.
- Standardisation of regulatory frameworks and operational processes across the east coast states. This could provide a more formalised approach of addressing investment and transaction cost aspects. This includes creating uniform safety and operational standards, which would allow operators to function seamlessly across different regions without facing variations in regulatory requirements and enable economies of scale for compliance/managerial resources.

Under an ECGTS approach, cross-jurisdictional cooperation might extend to joint investment facilitation (e.g. subsidisation or investment guarantees) in complementary infrastructure. An ECGTS may thus also include investments in select / strategically placed rail nodes. Such investment may contain infrastructure upgrading (e.g. to match Inland Rail), as well as receival, storage and outloading infrastructure. The direct beneficiaries of investments in receival, storage and outloading infrastructure are currently rail operators and grain transporters. Public sector investment in these private-sector-efficiency-generating outcomes should be complemented with appropriately defined and operationalised requirements to supply rail nodes by grain lines.

As shown in the economic analysis, the least-cost social pathway advantage of grain lines is reduced when compared to high productivity vehicles (HPV), i.e. with high payloads. Across each of the east coast states, HPVs can access large grain growing geographies. Moreover, their access to grain regions is continuously enhanced as road infrastructure is improved, or dispensations widened. While increasing heavy vehicle access and road investment has many benefits, these investments are also reducing the competitiveness of rail-based options. The competitiveness of road-based transport currently benefits from wider social costs not being internalised in mode choice decisions. As shown in the economic analysis, shifting grain transport from road to rail is associated with significant benefits based on the differential social costs between rail and road (although these benefits do not match the cost of upgrading grain lines). As noted earlier, while capturing these benefits is important, policy initiatives to attain such value capture require balancing against the overall grain transportation systems' wider social and economic performance and potential unintended consequences.

Internalisation of external costs provides a means of reducing the competitive advantage of road (Tsamboulas et al 2007) and, by levelling out operational benefits, will likely have some impact on modal choice. Notably, levelling out these operational benefits will not change the flexibility or coordination advantages of trucks. An ECGTS approach would likely require coordination (and harmonisation) of GHMS policies and an alignment of these with policy objectives.

While cross-jurisdictional governance reforms do have the potential to reduce operation and transaction costs, as well as reduce some investment uncertainty, the magnitude of these effects is difficult to establish without engagement with industry, or high-quality operational data. Key standardisation aspects – such as rail track standards and parameters – require significant investments. The financial burden of track standardisation looks different in Queensland (where narrow track gauge dominates) to NSW (where standard gauge dominates).

Moreover, it remains uncertain what the elasticity of rail-based grain freight demand to reductions in transaction costs or standardisation will be for individual grain lines, bundles of grain lines or an east coast grain transport system. To achieve policy objectives around increasing grain on rail, the gap between the commercial and social least-cost pathway needs to be closed. The development of a data infrastructure to support coordinated and integrated (rail and road) decision making and resource allocation, in relation to grain transport on the east coast of Australia, would be a foundational step towards enabling an east coast grain transport system and policy framework.

4. Conclusions

Conclusions

Directing current rail freight to road

The results suggest that for most grain lines considered in this report the economic case for closing the lines and shifting current grain freight to road is weak. In most cases the additional negative economic impacts exceed the gains from switching from rail to road. The three exceptions are:

- Warren to Nevertire: It should be noted that the estimations throughout exclusively consider grain freight. In addition to grain, Warren to Nevertire is used for other goods transportation. Moreover, parts of this line have been closed since 2012.
- Lake Cargelligo to Ungarie: This is based on very low freight numbers in the recent past and periods of no transportation. An assessment of whether low numbers are likely to continue would need to be made for firmer conclusion.
- Weemelah to Camurra Junction: Freight volumes on this line have been low in the past 10 years, with multiple years of no grain freight. The volume used in the analysis is low relative to previous studies.

Varying the applied discount rate has little impact on qualitative assessment of the rail closure option.

Directing current road freight to rail

Shifting grain freight from road to rail is associated with substantial social and environmental benefits. On a like for like comparison, shifting grain freight to trains reduces greenhouse gas emissions, improves air quality, reduces safety and crash cost, reduces noise impacts and reduces negative biodiversity impacts. Societal gains from shifting grain freight to rail provides a clear public sector rationale for investing or co-investing in infrastructure and institutional frameworks to enhance the modal share of rail.

However, rail line works is capital intensive and expensive.[37] The analysis conducted in this report focuses on comparing the cost of below-rail upgrading works to the social and economic benefits that arise from above-rail use of the upgraded lines. A weakness in this analysis is that the substitution of rail for road sensitivity is unknown across the different lines. This means that the efficacy (in terms of mode shift) from below-rail investment as well as wider rail-systems productivity enhancing investments (e.g. on-rail silo performance, port performance) is not well captured or accounted for.

The analysis has therefore proceeded along two lines: 1) a rule of thumb mode shift of 10% for each rail class upgrade; and 2) estimating a breakeven freight volume required to give a B/C ratio of 1. Comparisons with previous studies (such as GIAC 2004) suggests that some grain lines have experienced increased freight, while others have experienced a decline. These changes cannot easily be attributed to changes in grain line operational characteristics,

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[37] The same is true for investment in road infrastructure. Additional road wear and construction costs, based on truck classifications (Semi-trailers, B-doubles, Road Trains) is accounted for in the analysis. However, where significant additional truck traffic (such as in the closure / disuse scenarios) require fundamental road upgrades, bridge reinforcement etc the estimates B/C ratio under-estimate the public sector case for retaining current grain lines (notably – the analysis already suggests that grain line retention *is* cost efficient, in most cases).

as the intervening period has primarily focused on stabilising grain line classifications as they were in 2004, rather than upgrading these.

The analysis shows that incremental changes in the volume of grain shifted from road to rail, while producing appreciable societal benefits, is insufficient to match the estimated cost of providing the upgrade works. The exception to this using the rule of thumb approach is West Wyalong to Ungarie where the B/C results are approximately 1 in the baseline and networked analysis. At a lower discount rate (3%) the qualitative assessment of some of the lines begins to change, requiring additional detailed analysis. These are:

- West Wyalong to Ungarie: upgrade to class 2 and 1 (compared to all truck types)
- Benalla to Oaklands: upgrade to class 1 (when compared to semi-trailers)

When considering the breakeven analysis, several grain lines could be considered for upgrades if additional mode shift can *realistically* be attained. These are:

- Ungarie to Naradhan (upgrade to Class 2)
- West Wyalong to Ungarie (upgrade to Class 2 and 1)
- The Rock to Boree Creek (upgrade to Class 3)
- Benalla to Oaklands (upgrade to Class 3, 2 and 1)

The impact of high productivity vehicles

While additional rail freight is associated with reducing environmental and social impacts, the analysis also shows that rails' competitive advantage, in this respect, declines when compared to the impact of high productivity vehicles. While the economic parameters for detailed analysis of the impact of high productivity vehicles in some cases requires additional research,[38] the current analysis shows that high productivity vehicles reduce train retention or investment B/C ratios by approximately 10% for B-doubles and 16% for Road Trains, when compared to semi-trailer B/Cs.

For most of the grain lines and scenarios this impact does not substantively change the qualitative assessment of the above analysis. Nevertheless, it is evident that high productivity vehicles also contribute to narrowing the divergence between commercial and social least-cost pathways of specific grain transportation segments. Future technological developments (including hydrogen and electric trucks) may very well accentuate this convergence.[39] A key consideration for policy makers and transport authorities should therefore be to enable least-cost pathway alignment across the grain transportation task – from farm to end-user or port. This will likely involve policy innovation in relation to intermodal rail- and road-based business models in a grain transportation system's perspective.

Policy options beyond grain line upgrading

Risk sharing models can result in better alignment of above- and below rail operations, maintenance, and investment incentives. A redistribution and/or sharing of risk between public and private actors can reduce combined operational and transactional costs, facilitating greater utilisation or competitiveness with roads.

[38] In Australia, measures and monetisation of external effects of trucks is largely based on European analysis with a maximum loaded weight of 60 tonnes. Trucks on Australian roads, and in this analysis, are considerably larger than this.

[39] These technological trends may of course be modified by technological developments for rail.

Subsidies, contracting, investment guarantees, performance-based incentives and asset sharing models provide additional means of managing the distribution of risks related to above and below rail operations, and complementary infrastructure investment and management.

Notably, the three alternative organisational modes examined in Part 2 vary in their degree of taking an overall grain transportation system's perspective. For instance, *Integrated or franchised model*s and *Service delivery models* are primarily geared to a grain-rail perspective giving rail operators exclusive control of above and below rail operations, but vary in control of revenue collection.

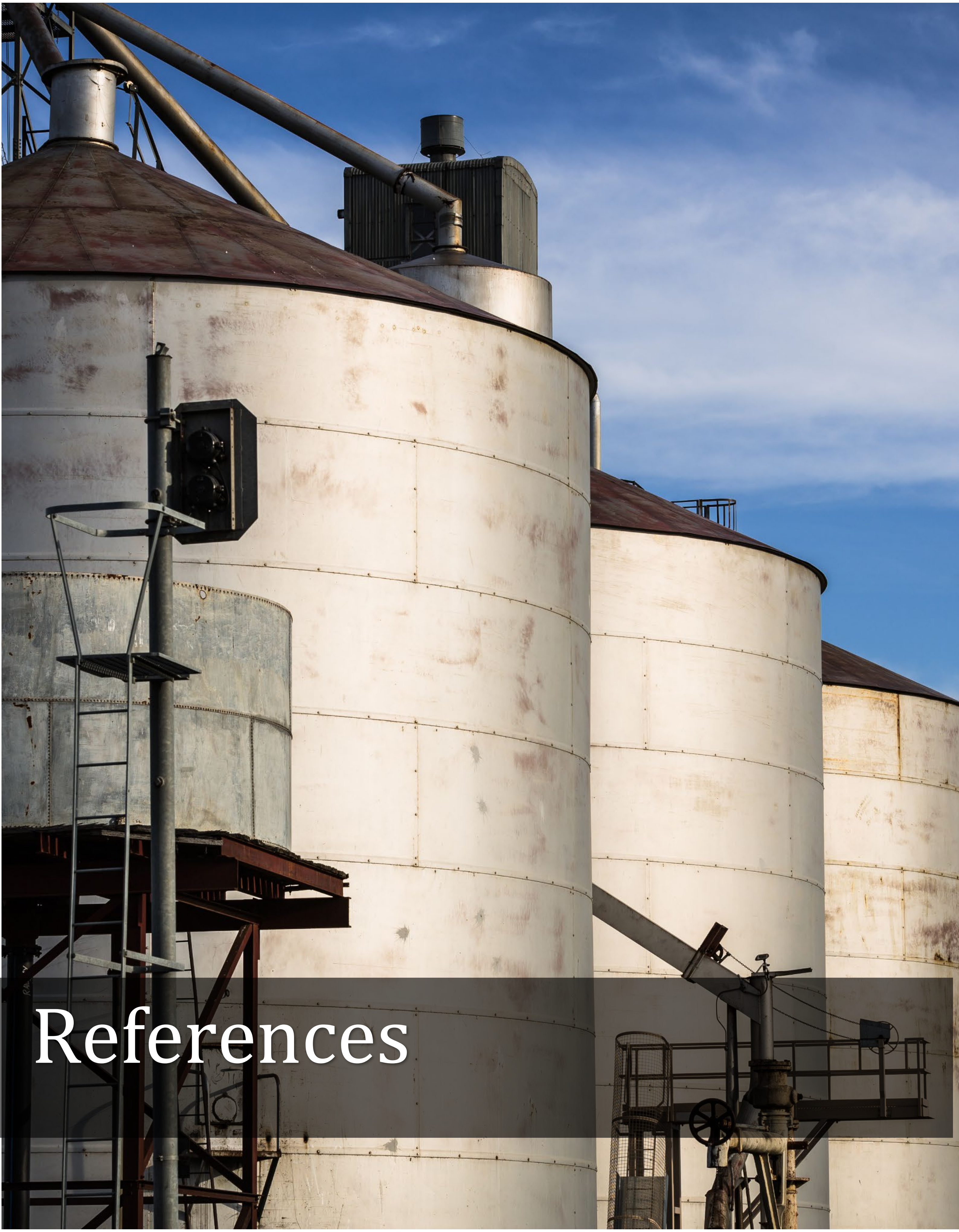
Regional infrastructure models broaden the current track underwriting and subsidised access model to include other public bodies and/or industry stakeholders. Such approaches can take a more expanded system's approach and facilitate a coordinated approach to regional infrastructure spending across both rail and road modes. What constitutes 'natural regions' across east coast Australia can take different meanings but may in practice be constrained by legacy variations in below-rail infrastructure gauge standards.

Nevertheless, governance reforms can reduce transaction costs associated with coordinating grain transport across jurisdictions/regulatory environments, across different network providers; thus, facilitating greater utilisation or competitiveness with roads. The development of Inland Rail (IR) provides a potential catalyst for developing an East Coast Grain Transport System (ECGTS). An ECGTS might operate along two complementary approaches:

- An East Coast Framework for Grain Transport Policy for enhancing cross jurisdictional governance.
- An asset sharing arrangement for rolling stock, potentially extending to joint investments around additional complementary infrastructure.

An East Coast Framework for Grain Transport Policy might include:

- Enhanced data sharing and transparency between jurisdictions and industry to improve operational planning and coordination, manage risks as well as externalities, and identify commercial and social least-cost pathways. An improved data infrastructure is foundational to support risk sharing, governance reforms and establish reasonable expectations around policy impact/efficacy.
- A streamlining of decision-making processes and clarification of responsibilities, potentially leading to more efficient operations. An east coast policy framework may be particularly appropriate to grain where seasonal variations in harvest patterns and demand for transport options, to a degree, can be mitigated and smoothed by more efficient integration of grain lines under an East Coast Grain Systems approach.
- Standardising regulatory frameworks and operational processes across the east coast states provides a more formalised approach of addressing investment and transaction cost aspects. Any reforms should align with ongoing work under the National Rail Action Plan.



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Appendices

Appendix A: Sensitivity Analyses

Sensitivity analysis: 3% SDRC

Table A 1 Economic evaluation rail closure, networked analysis, 3% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$28.7	$58.4	-$29.7	0.49	$28.7	$51.2	-$22.5	0.56	$28.7	$46.6	-$17.9	0.62
Camurra J.–Weemelah	$38.8	$22.8	$16.1	1.71	$38.8	$20.1	$18.8	1.94	$38.8	$18.3	$20.5	2.12
Nevertire–Warren	$6.9	$0.1	$6.7	48.72	$6.9	$0.1	$6.7	55.35	$6.9	$0.1	$0.1	60.74
Bogan Gate–Tottenham	$66.6	$134.1	-$67.5	0.50	$66.6	$118.3	-$51.6	0.56	$66.6	$107.9	-$41.3	0.62
Ungarie–Lake C.	$34.3	$33.6	$0.8	1.02	$34.3	$29.6	$4.7	1.16	$34.3	$27.0	$7.3	1.27
Ungarie–Naradhan	$33.5	$91.7	-$58.2	0.37	$33.5	$80.4	-$46.9	0.42	$33.5	$73.1	-$39.6	0.46
West Wyalong–Ungarie	$35.3	$308.8	-$273.5	0.11	$35.3	$272.1	-$236.7	0.13	$35.3	$248.1	-$212.8	0.14
Griffith–Hillston	$69.8	$198.6	-$128.9	0.35	$69.8	$175.0	-$105.3	0.40	$69.8	$159.7	-$89.9	0.44
The Rock–Boree Creek	$41.3	$164.7	-$123.4	0.25	$41.3	$161.0	-$119.7	0.26	$41.3	$132.3	-$91.0	0.31
Camurra J. – North Star	$48.6	$191.2	-$142.6	0.25	$48.6	$168.0	-$119.4	0.29	$48.6	$152.9	-$104.3	0.32
Benalla–Oaklands	$107.0	$748.0	-$641.1	0.14	$107.0	$640.0	-$533.0	0.17	$107.0	$599.9	-$493.0	0.18
Goondiwindi–Thallon	$97.3	$731.4	-$634.1	0.13	$97.3	$628.6	-$531.3	0.15	$97.3	$590.5	-$493.1	0.16

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table A 2 Economic evaluation rail track upgrades to Class 3, networked analysis, 3% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$6.5	$76.5	-$70.0	0.09	$5.8	$76.5	-$70.7	0.08	$5.4	$76.5	-$71.1	0.07
Camurra J.–Weemelah	$2.5	$121.6	-$119.1	0.02	$2.3	$121.6	-$119.3	0.02	$2.1	$121.6	-$119.5	0.02
Nevertire–Warren	$0.0	$9.6	-$9.6	0.00	$0.0	$9.6	-$9.6	0.00	$0.0	$9.6	-$9.6	0.00
Bogan Gate–Tottenham	$15.2	$166.5	-$151.3	0.09	$13.6	$166.5	-$152.9	0.08	$12.6	$166.5	-$153.9	0.08
Ungarie–Lake C.	$3.4	$103.7	-$100.3	0.03	$3.0	$103.7	-$100.7	0.03	$2.8	$103.7	-$101.0	0.03
Ungarie–Naradhan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
West Wyalong–Ungarie	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Griffith–Hillston	$19.9	$156.4	-$136.5	0.13	$17.5	$156.4	-$138.8	0.11	$16.0	$156.4	-$140.4	0.10
The Rock–Boree Creek	$17.2	$82.5	-$65.3	0.21	$16.9	$82.5	-$65.7	0.20	$14.0	$82.5	-$68.5	0.17
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$77.7	$184.5	-$106.8	0.42	$66.9	$184.5	-$117.6	0.36	$62.9	$184.5	-$121.6	0.34
Goondiwindi–Thallon	$75.9	$410.9	-$334.9	0.18	$65.6	$410.9	-$345.2	0.16	$61.8	$410.9	-$349.0	0.15

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table A 3 Economic evaluation rail track upgrades to Class 2, networked analysis, 3% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$19.0	$102.0	-$83.0	0.19	$17.5	$102.0	-$84.5	0.17	$16.6	$102.0	-$85.4	0.16
Camurra J.–Weemelah	$7.3	$162.2	-$154.9	0.04	$6.7	$162.2	-$155.5	0.04	$6.3	$162.2	-$155.9	0.04
Nevertire–Warren	$0.0	$17.3	-$17.3	0.00	$0.0	$17.3	-$17.3	0.00	$0.0	$17.3	-$17.3	0.00
Bogan Gate–Tottenham	$37.1	$222.2	-$185.1	0.17	$33.8	$222.2	-$188.4	0.15	$31.6	$222.2	-$190.6	0.14
Ungarie–Lake C.	$9.4	$138.3	-$128.9	0.07	$8.6	$138.3	-$129.8	0.06	$8.0	$138.3	-$130.3	0.06
Ungarie–Naradhan	$9.7	$29.5	-$19.8	0.33	$8.6	$29.5	-$20.9	0.29	$7.8	$29.5	-$21.7	0.27
West Wyalong–Ungarie	$33.3	$17.7	$15.6	1.88	$29.6	$17.7	$12.0	1.68	$27.2	$17.7	$9.6	1.54
Griffith–Hillston	$59.4	$208.5	-$149.2	0.28	$54.4	$208.5	-$154.1	0.26	$51.2	$208.5	-$157.4	0.25
The Rock–Boree Creek	$51.8	$110.2	-$58.4	0.47	$51.0	$110.2	-$59.2	0.46	$45.0	$110.2	-$65.2	0.41
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$173.4	$246.2	-$72.8	0.70	$150.7	$246.2	-$95.5	0.61	$142.3	$246.2	-$103.9	0.58
Goondiwindi–Thallon	$190.1	$479.7	-$289.6	0.40	$168.5	$479.7	-$311.2	0.35	$160.5	$479.7	-$319.2	0.33

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table A 4 Economic evaluation rail track upgrades to Class 1, networked analysis, 3% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$29.8	$127.6	-$97.7	0.23	$26.9	$127.6	-$100.6	0.21	$25.4	$127.6	-$102.2	0.20
Camurra J.–Weemelah	$9.3	$202.8	-$193.5	0.05	$8.2	$202.8	-$194.6	0.04	$7.6	$202.8	-$195.2	0.04
Nevertire–Warren	$0.0	$25.0	-$24.9	0.00	$0.0	$25.0	-$24.9	0.00	$0.0	$25.0	-$24.9	0.00
Bogan Gate–Tottenham	$59.1	$277.8	-$218.7	0.21	$52.8	$277.8	-$225.0	0.19	$49.4	$277.8	-$228.4	0.18
Ungarie–Lake C.	$16.4	$173.0	-$156.6	0.09	$14.7	$173.0	-$158.2	0.09	$13.9	$173.0	-$159.1	0.08
Ungarie–Naradhan	$22.8	$58.8	-$36.0	0.39	$19.9	$58.8	-$38.9	0.34	$18.4	$58.8	-$40.4	0.31
West Wyalong–Ungarie	$84.3	$35.1	$49.1	2.40	$74.2	$35.1	$39.1	2.11	$69.2	$35.1	$34.0	1.97
Griffith–Hillston	$91.6	$260.8	-$169.3	0.35	$82.2	$260.8	-$178.6	0.32	$77.1	$260.8	-$183.7	0.30
The Rock–Boree Creek	$79.4	$137.8	-$58.4	0.58	$76.6	$137.8	-$61.2	0.56	$67.1	$137.8	-$70.7	0.49
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$261.4	$308.0	-$46.6	0.85	$231.2	$308.0	-$76.8	0.75	$217.9	$308.0	-$90.1	0.71
Goondiwindi–Thallon	$275.9	$548.6	-$272.7	0.50	$249.5	$548.6	-$299.1	0.45	$236.8	$548.6	-$311.8	0.43

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Sensitivity analysis: 10% SDRC

Table A 5 Economic evaluation rail closure, networked analysis, 10% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$10.3	$20.5	-$10.2	0.50	$10.3	$18.0	-$7.7	0.57	$10.3	$16.3	-$6.1	0.63
Camurra J.–Weemelah	$13.9	$8.0	$5.9	1.74	$13.9	$7.0	$6.9	1.97	$13.9	$6.4	$7.5	2.17
Nevertire–Warren	$2.5	$0.0	$2.4	49.73	$2.5	$0.0	$2.4	56.51	$2.5	$0.0	$0.0	62.08
Bogan Gate–Tottenham	$23.8	$47.0	-$23.3	0.51	$23.8	$41.5	-$17.7	0.57	$23.8	$37.8	-$14.0	0.63
Ungarie–Lake C.	$12.3	$11.8	$0.5	1.04	$12.3	$10.4	$1.9	1.18	$12.3	$9.5	$2.8	1.30
Ungarie–Naradhan	$12.0	$32.2	-$20.2	0.37	$12.0	$28.2	-$16.3	0.42	$12.0	$25.6	-$13.7	0.47
West Wyalong–Ungarie	$12.5	$108.3	-$95.8	0.12	$12.5	$95.4	-$82.9	0.13	$12.5	$86.9	-$74.4	0.14
Griffith–Hillston	$24.8	$69.7	-$44.8	0.36	$24.8	$61.4	-$36.5	0.40	$24.8	$55.9	-$31.1	0.44
The Rock–Boree Creek	$14.7	$57.8	-$43.0	0.25	$14.7	$56.5	-$41.8	0.26	$14.7	$46.3	-$31.6	0.32
Camurra J. – North Star	$17.3	$67.1	-$49.8	0.26	$17.3	$58.9	-$41.6	0.29	$17.3	$53.6	-$36.3	0.32
Benalla–Oaklands	$38.0	$262.4	-$224.3	0.14	$38.0	$224.4	-$186.4	0.17	$38.0	$210.2	-$172.2	0.18
Goondiwindi–Thallon	$34.6	$256.4	-$221.8	0.14	$34.6	$220.3	-$185.7	0.16	$34.6	$206.8	-$172.1	0.17

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table A 6 Economic evaluation rail track upgrades to Class 3, networked analysis, 10% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$2.3	$71.6	-$69.3	0.03	$2.1	$71.6	-$69.5	0.03	$1.9	$71.6	-$69.7	0.03
Camurra J.–Weemelah	$0.9	$113.8	-$112.9	0.01	$0.8	$113.8	-$113.0	0.01	$0.7	$113.8	-$113.1	0.01
Nevertire–Warren	$0.0	$9.0	-$9.0	0.00	$0.0	$9.0	-$9.0	0.00	$0.0	$9.0	-$9.0	0.00
Bogan Gate–Tottenham	$5.3	$155.7	-$150.4	0.03	$4.8	$155.7	-$150.9	0.03	$4.4	$155.7	-$151.3	0.03
Ungarie–Lake C.	$1.2	$97.1	-$95.9	0.01	$1.1	$97.1	-$96.0	0.01	$1.0	$97.1	-$96.1	0.01
Ungarie–Naradhan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
West Wyalong–Ungarie	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Griffith–Hillston	$7.0	$146.1	-$139.2	0.05	$6.1	$146.1	-$140.0	0.04	$5.6	$146.1	-$140.5	0.04
The Rock–Boree Creek	$6.1	$77.1	-$71.1	0.08	$5.9	$77.1	-$71.2	0.08	$4.9	$77.1	-$72.2	0.06
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$27.3	$172.2	-$144.9	0.16	$23.5	$172.2	-$148.7	0.14	$22.1	$172.2	-$150.1	0.13
Goondiwindi–Thallon	$26.6	$384.8	-$358.1	0.07	$23.0	$384.8	-$361.8	0.06	$21.7	$384.8	-$363.1	0.06

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table A 7 Economic evaluation rail track upgrades to Class 2, networked analysis, 10% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$6.7	$95.4	-$88.7	0.07	$6.2	$95.4	-$89.2	0.07	$5.9	$95.4	-$89.6	0.06
Camurra J.–Weemelah	$2.6	$151.8	-$149.2	0.02	$2.4	$151.8	-$149.4	0.02	$2.2	$151.8	-$149.6	0.01
Nevertire–Warren	$0.0	$16.2	-$16.2	0.00	$0.0	$16.2	-$16.2	0.00	$0.0	$16.2	-$16.2	0.00
Bogan Gate–Tottenham	$13.1	$207.7	-$194.6	0.06	$11.9	$207.7	-$195.7	0.06	$11.2	$207.7	-$196.5	0.05
Ungarie–Lake C.	$3.3	$129.5	-$126.2	0.03	$3.0	$129.5	-$126.4	0.02	$2.8	$129.5	-$126.6	0.02
Ungarie–Naradhan	$3.4	$27.5	-$24.1	0.12	$3.0	$27.5	-$24.5	0.11	$2.7	$27.5	-$24.7	0.10
West Wyalong–Ungarie	$11.7	$16.3	-$4.6	0.72	$10.4	$16.3	-$5.9	0.64	$9.6	$16.3	-$6.7	0.59
Griffith–Hillston	$20.9	$194.9	-$173.9	0.11	$19.2	$194.9	-$175.6	0.10	$18.1	$194.9	-$176.8	0.09
The Rock–Boree Creek	$18.3	$102.8	-$84.6	0.18	$18.0	$102.8	-$84.8	0.18	$15.9	$102.8	-$87.0	0.15
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$60.9	$229.6	-$168.7	0.27	$53.0	$229.6	-$176.7	0.23	$50.0	$229.6	-$179.6	0.22
Goondiwindi–Thallon	$66.9	$449.0	-$382.1	0.15	$59.3	$449.0	-$389.7	0.13	$56.5	$449.0	-$392.6	0.13

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Table A 8 Economic evaluation rail track upgrades to Class 1, networked analysis, 10% SDRC

	Semi-trailer				B-double				Road Train			
	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C	NPV Benefits ($m)	NPV Costs ($m)	NPV ($m)	B/C
Burren J.–Merrywinebone	$10.5	$119.3	-$108.8	0.09	$9.5	$119.3	-$109.8	0.08	$9.0	$119.3	-$110.3	0.08
Camurra J.–Weemelah	$3.3	$189.7	-$186.5	0.02	$2.9	$189.7	-$186.9	0.02	$2.7	$189.7	-$187.1	0.01
Nevertire–Warren	$0.0	$23.4	-$23.3	0.00	$0.0	$23.4	-$23.4	0.00	$0.0	$23.4	-$23.4	0.00
Bogan Gate–Tottenham	$20.8	$259.6	-$238.8	0.08	$18.6	$259.6	-$241.0	0.07	$17.4	$259.6	-$242.2	0.07
Ungarie–Lake C.	$5.8	$161.9	-$156.1	0.04	$5.2	$161.9	-$156.7	0.03	$4.9	$161.9	-$157.0	0.03
Ungarie–Naradhan	$8.0	$54.9	-$46.9	0.15	$7.0	$54.9	-$47.9	0.13	$6.5	$54.9	-$48.4	0.12
West Wyalong–Ungarie	$29.7	$32.5	-$2.8	0.91	$26.2	$32.5	-$6.3	0.81	$24.4	$32.5	-$8.1	0.75
Griffith–Hillston	$32.3	$243.6	-$211.3	0.13	$29.0	$243.6	-$214.6	0.12	$27.2	$243.6	-$216.4	0.11
The Rock–Boree Creek	$28.0	$128.6	-$100.5	0.22	$27.1	$128.6	-$101.5	0.21	$23.7	$128.6	-$104.9	0.18
Camurra J. – North Star	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benalla–Oaklands	$91.8	$287.1	-$195.3	0.32	$81.2	$287.1	-$205.9	0.28	$76.5	$287.1	-$210.6	0.27
Goondiwindi–Thallon	$97.0	$513.3	-$416.3	0.19	$87.7	$513.3	-$425.6	0.17	$83.3	$513.3	-$430.0	0.16

Note 1:
Green = clear positive economic case for upgrading grain line. Orange= economic case for upgrade is undetermined. Red= negative economic case for upgrading grain line.

Appendix B: Maps

Figure 3 Map of grain lines

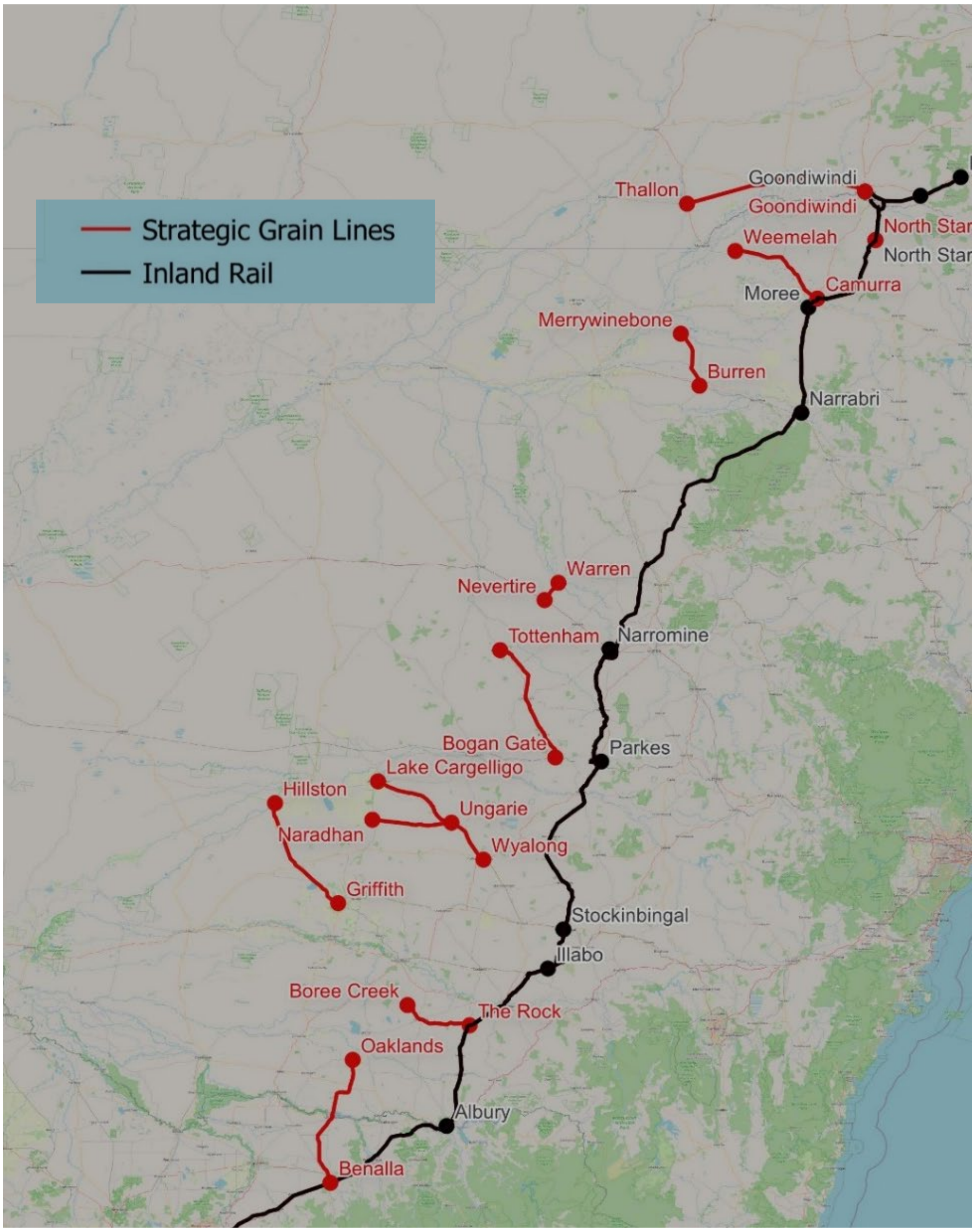

Figure 4 Map of Inland Rail

Source: https://inlandrail.com.au/wp-content/uploads/2024/01/Inland-Rail-Full-Alignment-Map-Updated-24-Oct-2024-Doc-241021.pdf