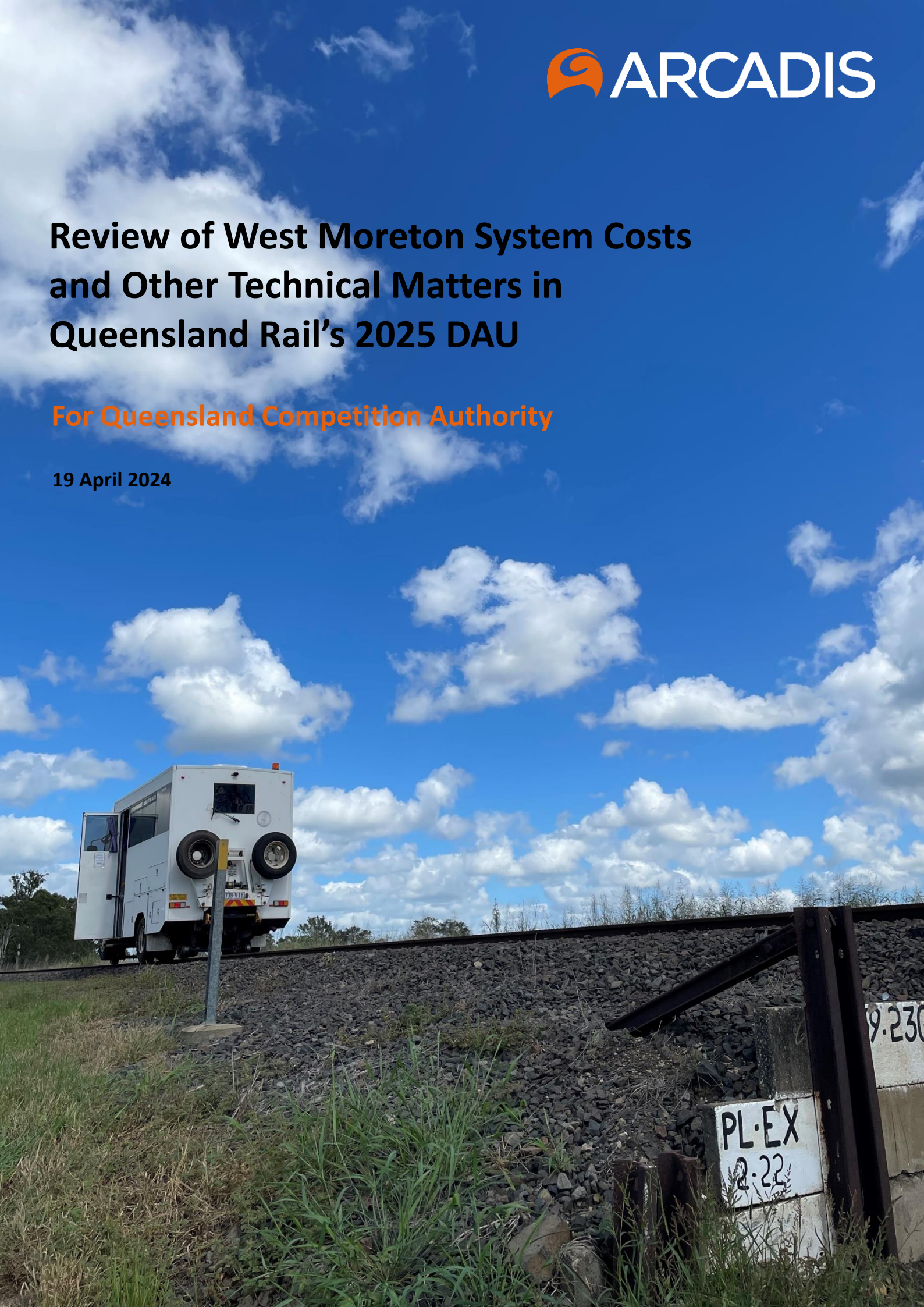
Review of West Moreton System Costs and Other Technical Matters in Queensland Rail's 2025 DAU

For Queensland Competition Authority

19 April 2024



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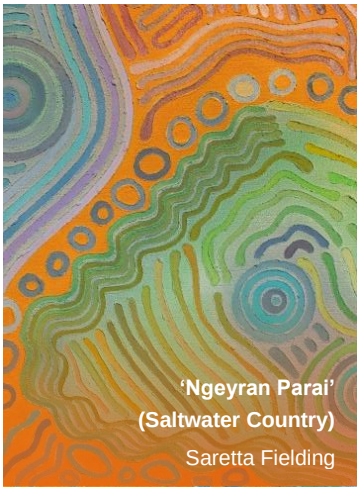

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Arcadis is committed to driving inclusion and diversity across our business. This includes specific and actionable policies that aim to make a positive impact on Aboriginal and Torres Strait Islander employment, education and a broader cultural change. Approved by Reconciliation Australia, Arcadis' Reconciliation Plan contains detailed and transparent strategies, targets and measurable actions. We continue to build respect, support education and create employment opportunities with Aboriginal and Torres Strait Island employees within our business.

Further information is available here.

REVISIONS

Revision	Date	Details	Prepared by	Reviewed by	Issued to
A	19/04/2023	Draft for review	V Thayananthan	C Owen	QCA
B	07/05/2024	Draft for review	V Thayananthan	C Owen	QCA
C	05/06/2024	Draft for review	V Thayananthan	C Owen	QCA

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Arcadis has relied on information provided to it by Queensland Competition Authority and Queensland Rail to produce the report and arrive at its conclusions. The report is based upon information obtained on or before the report's completion (date above). Circumstances and events may occur following this date beyond our control and may affect the findings or projections contained in the report. We may not be held responsible for such circumstances of events and expressly disclaim any responsibility, therefore.

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EXECUTIVE SUMMARY

Background

The Queensland Competition Authority (QCA) is an independent statutory body responsible for implementing competition policy in Queensland. As part of this role, it regulates third-party access to rail infrastructure operated by Queensland Rail. QCA has appointed Arcadis to review Draft Access Undertaking 3 (DAU3) which was prepared by Queensland Rail (QR) for years 2025-2030. DAU3 relates to the West Moreton System, which is one of seven networks within the QR network. It consists of mainline and loop track and is divided into three sections:

- Rosewood to Toowoomba
- Toowoomba to Jondaryan
- Jondaryan to Miles

The West Moreton System is multi-use, with coal, bulk freight and passenger train services using its track. Currently, it has three coal customers. From Rosewood to Toowoomba, coal dominates traffic on the system and is the key driver for asset strategies in the wider system.

Reasonableness Assessment

The assessment defines reasonableness as a rational, justifiable decision-making approach supported by professional judgment and data. It entails differentiating between maintenance and capital expenditure based on specific criteria, evaluating their impact on asset functionality and value. Our assessment of reasonableness considers compliance requirements, strategic objectives, and performance criteria to ensure investment decisions optimise asset value, align with risk considerations, and meet customer needs. Drawing on insights from QCA and Queensland Rail, our industry expertise, and benchmarked processes, we deliver a tailored and thorough evaluation of reasonableness for the West Moreton system.

Objective

The key objectives of this report include:

- Providing robust technical advice and assessment to assist QCA with making an informed decision regarding the approval of the 2025 DAU and efficiency of the reference tariff.
- Conducting an independent and well-informed assessment of West Moreton system costs, considering commercial and performance needs while remaining adaptable to accommodate future changes and transparency in our modelling approach. We have applied engineering expertise and industry knowledge to ensure a technically sound and valuable reasonableness assessment for the benefit of all relevant stakeholders.
- Assess the reasonableness of the capital, maintenance and operating expenditure proposed by QR for the DAU3 period. The basis of the assessment of expenditure will be according to the proposed maximum hauling of 9.6mtpa.

Asset lives and Value Framework

Queensland Rail faces the challenge of harmonising asset risk, operational safety, and user needs when making strategic investment decisions for its capital and operational plans. Open communication with users is essential to grasp their expectations and establish an asset value framework that addresses all stakeholders' requirements. The proposal for an accelerated depreciation period raises concerns about asset longevity, warranting further assessment to understand user risk and investment preferences crucial for determining

reliability and service levels. While Queensland Rail adheres to industry standards, aligning these with user needs and economic factors should be considered. Decisions on asset renewal must factor in asset life, service levels, and user value, emphasising the importance of balancing risk, service, and investment. Arcadis recommends evaluating the design and management decisions against whole-life design and functionality requirements. Additional discussions are necessary to address the balance between these considerations, particularly amid uncertainties in forecasted tonnage and potential risks of stranded assets. Moreover, effective asset management strategies are pivotal in meeting reliability requirements and accommodating user risk preferences. As details on the asset management strategy were not provided, Arcadis suggests that Queensland Rail revises its value framework in collaboration with users to adapt a more predictive, performance-oriented asset management approach that aligns with stakeholder needs in the current economic environment.

DAU3 submission

Queensland Rail is proposing the following spend forecasts across 2025-2030:

- Capital expenditure: $346.9m[1] (excluding interest during construction)
- Operating expenditure: $85.3m
- Maintenance expenditure: $172.5m

This funding is driven by an expected increase in coal tonnage during the DAU3 period of 9.6 mtpa at most, compared to the significantly lower tonnage hauled during DAU2 (2.17mtpa in 2022-23).

Assessment Summary

West Moreton System

Arcadis assessed the Queensland Rail submission for maintenance and capital funding for the West Moreton System under one scenario of a maximum of 9.6 mtpa commissioned in 2026/27 based on Queensland Rail's advice from the West Moreton System miners, i.e. Yancoal (Cameby Downs mine), New Wilkie Energy (New Wilkie mine) and New Hope (New Acland Stage 3 mine) of volumes they wish to contract and/or renew. Arcadis notes that since the commissioning of this analysis in February 2024, New Wilkie Coal Mine has officially been put under administration.

In our assessment, Arcadis has recommended certain amendments to the maintenance approach and highlighted important considerations for the long-term management of rail assets, which are crucial for achieving the 9.6 mtpa scenario. While our engineers believe that the scenario is theoretically achievable, the demanding nature of this rail network, with high tonnage and operational utilisation, will present significant challenges despite the proposed expenditure. Consequently, we recommend that Queensland Rail will need to make several adjustments to its asset management strategy.

Additionally, although we requested information on the approach taken by Queensland Rail to assess operational reliability and the operational (i.e. train path) capacity identified, it was not provided. Therefore, while we believe that the proposed works are reasonable to improve the infrastructure capability to accommodate the tonnages specified, we cannot evaluate whether there is sufficient contingency between reliable operational capacity and infrastructure capability to enable the required maintenance to be undertaken without undue

[1] All dollar values are denoted in FY2025-26 dollars unless specified otherwise.

impact to the availability and reliability of the network. This raises concerns about the potential impact of maintenance and other events on the network's reliability and capability to deliver the specified tonnage.

In principle, key adjustments and considerations include:

- **Alignment with Standards and Good Practice:** Queensland Rail must meet the minimum, mainly prescriptive, requirements of the Civil Engineering Track Standards (CETS) and Civil Engineering Structures Standards (CESS). To ensure that these standards are abided by, whilst preparing the track for an increase in tonnage, it is recommended that a review and update of these standards be undertaken to address specific constraints, opportunities and contemporary asset management practices to optimise efficiencies.
- **User Requirements Consensus**: From the information provided it was not confirmed whether Queensland Rail has aligned its planned program with the reliability and level of service requirements of its users to ensure an optimum balance or reliability, availability and affordability as outlined in the DAU3 drivers. In cases where investments may not yield sufficient value or lifecycle return on investment, strategic adjustments to the level of service or reliability requirements may be considered as a viable alternative.
- **Comprehensive Asset Management Strategy**: Arcadis requested information on the Asset Management Strategy for the entire West Moreton system. However, Arcadis was only provided information covering Far West Moreton System, which excludes the Toowoomba Range. By not providing a complete asset management strategy, Arcadis were unable to make a full assessment of their strategy. Arcadis assesses this is critical in combination with the capex (capital expenditure) and opex (operating expenditure) program to ensure delivery of the 9.6 mtpa. This strategy should leverage existing resources, optimise operational engineering processes, and incorporate technologies that enable streamlined maintenance procedures and predictive maintenance. This will enhance the network's capability to handle increased tonnage efficiently and maximise the return on the proposed capital investment for network users.
- **Asset Value Framework**: the asset value framework serves as a cornerstone for guiding investment decisions that balance user requirements and asset management strategies effectively. We believe that this document is critical to demonstrate that the investment decisions align with the dynamic demands of users while fostering efficient asset management practices. Throughout this assessment we were not provided with the information to provide the assessment team with confidence on the integrity of this framework and recommend that Queensland Rail collaborate further with its users to revise the value framework to adapt to the evolving landscape of the West Moreton operations.

In consideration of the above Arcadis recommends that, in addition to the infrastructure capability to carry the proposed tonnages, that QCA assess the operational capacity and performance of the system in relation to the proposed tonnages and opex and capex program being proposed.

Table 1-1 demonstrates the values that Arcadis deems as reasonable as per our review of DAU3, when tonnage reaches 9.6mtpa during the DAU3 period. Activities that we deem not reasonable in capital expenditure have been recommended to be moved into QR's maintenance program. Table 1-2 and 1-3 provide a view of capital and maintenance expenditure per year. Operating expenditure breakdown was provided for 2025-26 only. However, this extrapolates to the full DAU3 cost of $85.3m as outlined in table 1-1.

Table 1-1 – Summary of DAU3 submission and Arcadis' findings

Expenditure Type	DAU3 Value ($2025-26 million)	Arcadis Value ($2025-26 million)
Capital Expenditure	346.9	225.8
Operating Expenditure	85.3	69.4
Maintenance Expenditure	173.1	128.0

Source: QR DAU3, Arcadis

Table 1-2 – Summary of Capital Expenditure per year as per Arcadis findings ($FY2025-26 million)

Section	FY25-26	FY26-27	FY27-28	FY28-29	FY29-30	Total
Rosewood- Jondaryan	66.6	70.0	10.1	15.4	7.5	**169.6**
Jondaryan - Macalister	16.2	17.0	4.3	5.3	3.2	**46.0**
Macalister - Columboola	0.0	0.0	1.5	1.6	6.9	**10.0**
Total	**82.8**	**87.0**	**16.0**	**22.3**	**17.6**	**225.8**

Source: QR DAU3, Arcadis

Table 1-3 – Summary of maintenance and operating expenditure per year as per Arcadis findings ($FY2025-26 million)

Expenditure type	FY25-26	FY26-27	FY27-28	FY28-29	FY29-30	Total
Maintenance	24.5	26.1	26.1	25.9	25.5	**128.0**

Source: QR DAU3, Arcadis

Table 1-4 shows the differences found between QR capital expenditure and Arcadis' review of this capital expenditure. Due to insufficient detail of QR's maintenance expenses, we were unable to estimate the cost of maintenance as a replacement of these capital works programs. We have instead removed these items from capital expenditure proposed by QR. We note that QR has been maintaining these assets in previous periods and therefore should be able to provide the basis for its estimates for the cost of maintenance.

Table 1-4 – Capital Expenditure – QR and Arcadis differences

Capital Expenditure Activity	Arcadis adjustments to capital expenditure ($2025-26 million)	Arcadis commentary
Total QR capex balance	**346.9**	
Track Reconditioning	(93.7)	Reallocate track conditioning capex from Koomi to Dalby, Dalby to Macalister and Macalister and Columboola to maintenance.
Re-sleepering	(6.9)	Reallocate capex costs relating to Macalister and Columboola section to maintenance.
Bridge Pier Replacement	(20.5)	By replacing only very poor condition elements under a capital program of works, the remaining elements could be returned to the ongoing predictive maintenance program.
Total capex balance with Arcadis adjustments	**225.8**	

Source: Arcadis

We have found categories in operating expenditure and maintenance expenditure that we do not deem reasonable. Due to insufficient further breakdown of these costs, we were unable to propose a revised amount for this expenditure. Refer to table 1-5 for reasoning behind our decision.

Table 1-5 –Operating and maintenance expenditure deemed not reasonable

Expenditure Type	Operating or maintenance expenditure	Arcadis commentary
Corporate Overhead	Operating	Unable to ascertain reasonableness with current information. Discussion of 'revised allocator' included in QR DAU3, without provided methodology.
Repairs	Maintenance	In light of all rail replacement in the capital works, this amount is too high.

Renewals	Maintenance	Insufficient information to understand renewals. Structural renewals are not included in this amount and may be missing in maintenance expenditure.
Turnout maintenance	Maintenance	We would expect that turnout maintenance would be higher due to their high maintenance requirements.
Lubrication	Maintenance	We would expect higher lubrication costs, particularly as tonnage increases.
Other maintenance costs	Maintenance	Due to insufficient information, we are unable to deem this as reasonable.

Source: Arcadis

In addition to the above, our assessment has identified the following recommendations:

- Inclusion of initiatives to enhance Operational Capacity in addition to infrastructure capital expenditure schemes such as improving headways, increasing passing opportunities, and boosting linespeeds to address the identified needs and support the system's growth.
- Assessment of the operational capacity and performance consumption of the system to ensure alignment with proposed tonnages and financial programs, especially concerning the historical origins and construction challenges of the West Moreton System.
- Consider the need for a revised maintenance access regime to address challenges associated with increased traffic, track utilisation, and maintenance demands, while exploring new maintenance techniques to optimise asset maintenance and reliability.
- Review the asset management strategy and plan for the entire network to adapt a more predictive, performance-oriented approach aligning with user needs, economic circumstances, and network requirements.
- Revise the value framework to include enhanced coordination between asset owners and users to ensure the balance between risk, service levels, and investment is optimised, taking into account the potential risks of stranded assets and the need for reliable maintenance practices.
- Explore opportunities for smart cost-saving measures, such as reallocating capital expenditure based on asset condition and tonnage requirements, focusing on areas with higher tonnage to achieve cost efficiencies without compromising operational effectiveness.

1 INTRODUCTION

1.1 Background

The West Moreton System is a multi-use, multi-operator rail system with operations covering coal, bulk freight, and passenger train services. Originally, the West Moreton System was designed to cater for non-coal traffic but since 1982, investment in infrastructure improvements and substantial maintenance effort has been required to accommodate coal services. It is vital that fit for purpose maintenance and capital programs are in place to handle coal tonnage levels and ensure a safe and reliable network. This report will review the capital expenditure as well as the operating and maintenance costs of West Moreton system, as per DAU3, and discuss whether these components are reasonable. We note that these costs impact the West Moreton system reference tariff and it is QCA's objective to regulate and promote efficiency this tariff.

Queensland Rail is a state-wide provider and operator of rail services and infrastructure throughout Queensland and is a wholly owned subsidiary of Queensland Rail Limited. Queensland Rail incorporates both passenger and freight rail lines and services and is responsible for the upkeep and maintenance for the Mount Isa, North Coast, Western, West Moreton, South Western, and Central Western rail lines, totalling over 7000kms of track (Figure 1-1).

Figure 1-1 Queensland Regional Network and Freight
Source: Queensland Rail

Specific branches and sections of the Queensland Rail network have been classified to allow for use from independent third-party freight services, for which Queensland Rail charges these third-parties tariffs. The use of Queensland Rail's below rail network is currently a 'declared service', except for the Tablelands System, under the Queensland Competition Authority Act 1997 (QCA Act). Third party access to the declared network is subject to 'Queensland Rail's Access Undertaking 2' (AU2), which was approved by the Queensland Competition Authority (QCA) on 1 July 2020 and expires on 30 June 2025. Once declared, the QCA can require Queensland Rail to submit a 'Draft Access Undertaking' to it for approval, and have it approved by the QCA in accordance with the QCA Act. Queensland Rail may also submit a 'Voluntary Draft Access Undertaking' to the QCA. On 1 November 2023, Queensland Rail lodged a Voluntary Draft Access Undertaking (DAU3) to the QCA. Queensland Rail proposes to replace AU2 with DAU3, effective from July 1, 2025, to June 30, 2030.

The QCA regulates the reference tariff for coal-carrying services on Queensland Rail's West Moreton and Metropolitan networks. The reference tariffs are determined from Queensland Rail's Regulatory Asset Base (RAB), which is governed by the cost of maintenance, restorations and upgrades of their infrastructure. To ensure that these tariffs are charged fairly and for works deemed necessary, Queensland Rail is subject to regulation under the Queensland Competition Authority Act 1997 (QCA Act) and the Queensland Competition Authority Regulation 2007 (QCA Regulation).

Using our technical expertise and rail experience, this report completes the following activities:

- Consider potential commercial changes on the West Moreton Line, such as tonnage changes
- Review forecast capital expenditure to ensure reasonableness in sustaining the capacity of the infrastructure taking into account forecasts
- Assess the reasonableness of Queensland Rail's operating and maintenance costs

1.2 Objectives

The key objectives of this report include:

- Providing robust technical advice and assessment to assist QCA with making an informed decision regarding the approval of the 2025 DAU and efficiency of the reference tariff.
- Conducting an independent and well-informed assessment of West Moreton system costs, considering commercial and performance needs while remaining adaptable to accommodate future changes and transparency in our modelling approach. We have applied engineering expertise and industry knowledge to ensure a technically sound and valuable reasonableness assessment for the benefit of all relevant stakeholders.
- Assess the reasonableness of the capital, maintenance and operating expenditure proposed by QR for the DAU3 period. The basis of the assessment of expenditure will be according to the proposed maximum hauling of 9.6mtpa.

1.3 Methodology

Arcadis has conducted a comprehensive analysis of Queensland's proposed capital program and maintenance and operating expenditure. This analysis was performed in the context of the information provided to us on Queensland Rail's commercial forecasts and performance requirements. Additionally, we considered Queensland Rail's Civil Engineering Track Standards (CETS), Civil Engineering Structural Standards (CESS), approaches by other rail agencies, and good asset management and engineering practice. Furthermore, we leveraged our expertise in rail asset management, drawing on insights and best practices from our own Rail Performance Maintenance Contract AssetRail - a company formed by Arcadis to operate and maintain the Dutch train network.

2 WEST MORETON SYSTEM OVERVIEW

2.1 General

The West Moreton System has a length of 314km connecting Columboola in the west and Rosewood in the east (Figure 2-1). The system further extends to Queensland's Western System at Columboola and joins the South East Queensland urban rail networks via Rosewood. Historically, the line was constructed to connect Brisbane to the agricultural districts of Darling Downs (via Toowoomba), as well as cater for passenger, livestock and freight. Currently the traffic in the system is predominately generated by coal exports from Camby Downs Mine, New Acland Mine and Wilkie Creek Mine. Being a critical railway servicing western Queensland, the West Moreton System railway provides a much-needed, crucial service to industry and agricultural rich regions in Western Queensland. The line is used for the freight of livestock and agricultural goods as well as to connect many of the state's mines, particularly coal, with the Port of Brisbane.

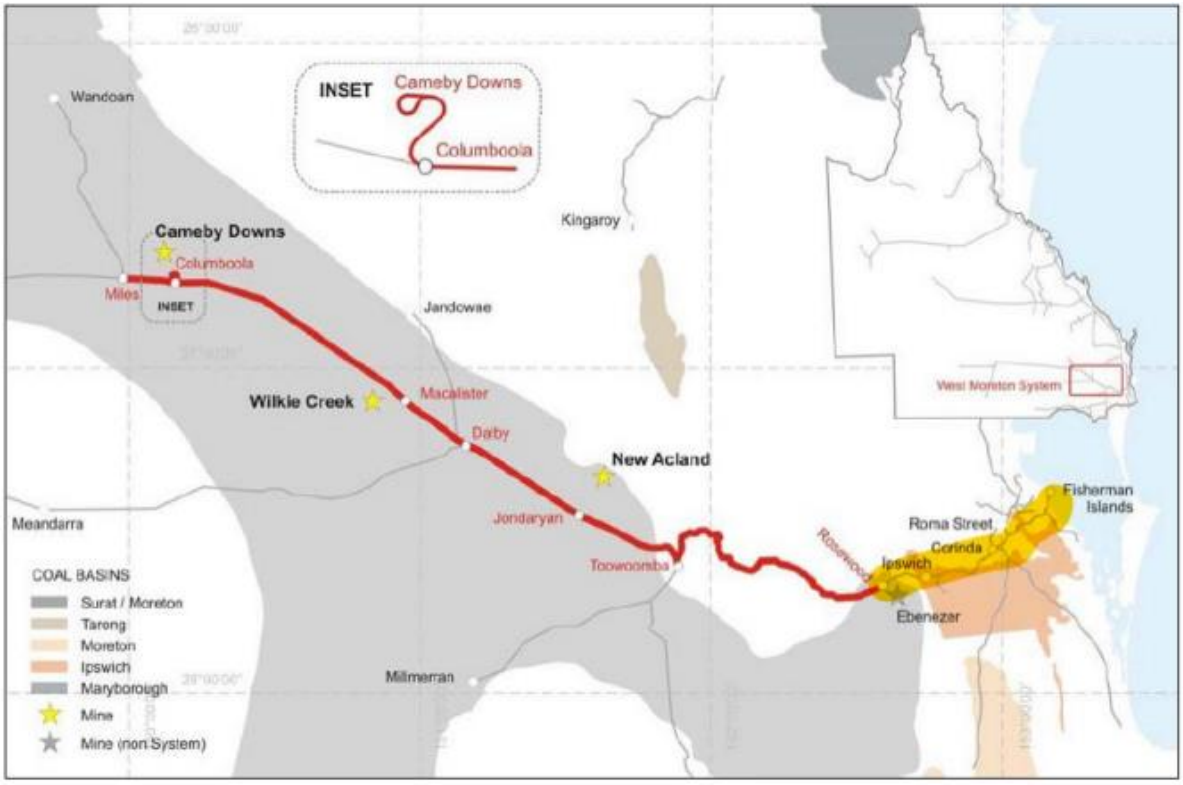

Figure 2-1 Map of rail loop and mines
Source: Queensland Rail DAU3

2.2 Asset configuration

All systems are predominantly designed for 15.75 tal wagons with a maximum allowable speed of 80km/h across the West Moreton System. Table 2-1 below summarises notable characteristics of the system.

Table 2-1 Summary of system characteristics

Characteristic	Summary
Total track length (km)	314km
Maximum axle load	15.75 tonne axle load (tal)
Maximum train length	675m
Electrified	No
Main line sleepers	Concrete, interspersed steel and timber sleeper
Maximum operating speed	80km/h
Control System	RCS from Rosewood to Willowburn, then DTC. All current systems installed in the West Moreton System include Remote Level Crossing Monitoring Systems, Dragging Equipment Detectors, Hot Bearing Detectors, Environmental Monitoring Stations, and Overload and Imbalanced Detectors.
Telecommunication	The infrastructure supports Train Control Radio (TCR), Maintenance Supervisory Radio (MSR) and signalling throughout the West Moreton System.

3 REVIEW OF DAU METHODOLOGY

3.1 Overall methodology

Arcadis has implemented a five-stage process to assess Queensland Rail's 2025 DAU. Figure 3-1 identifies the key milestones with brief descriptions below.

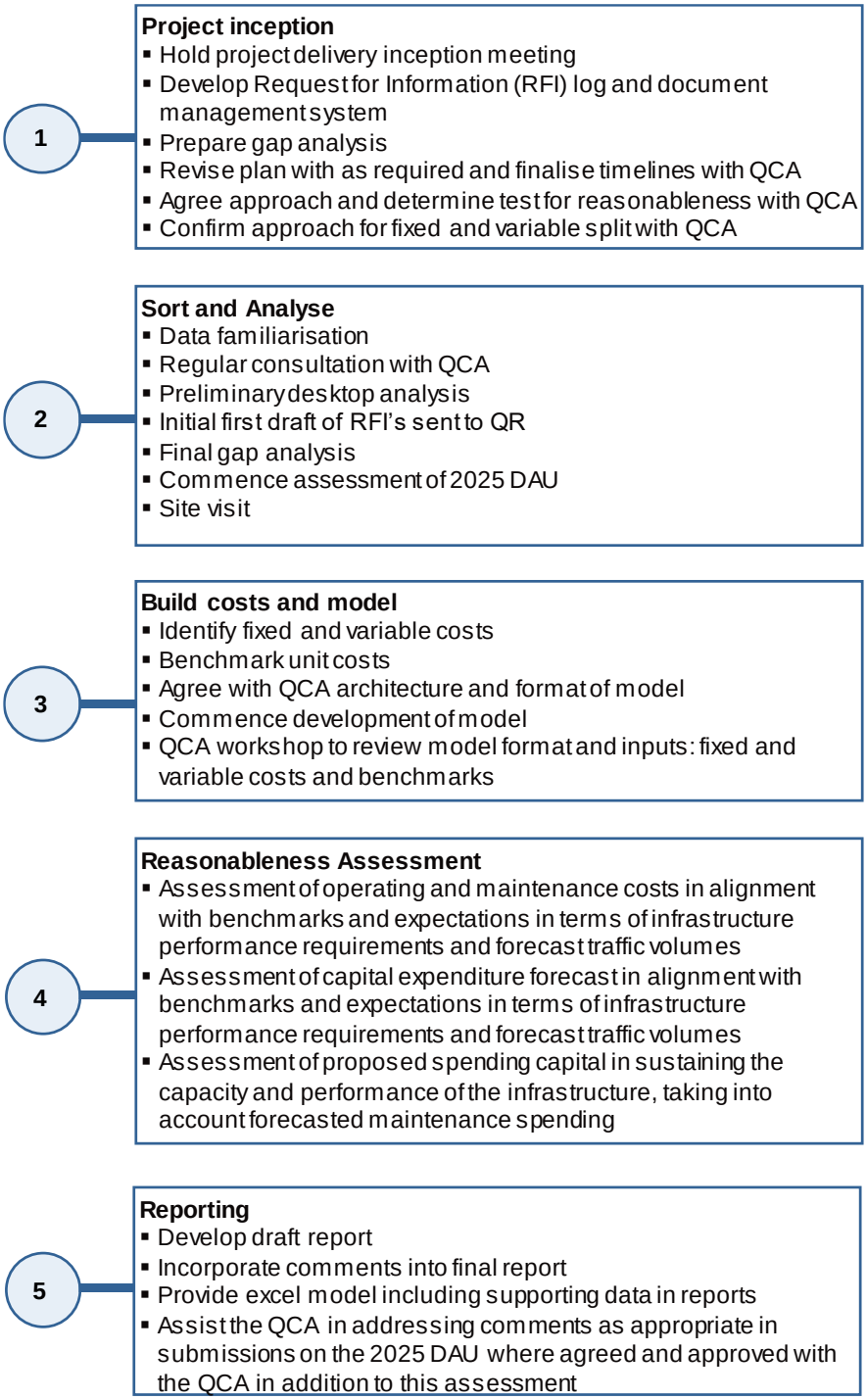

Figure 3-1 Summary of the process for the review of Queensland Rail's DAU

3.1.1 Stage 1 – Preparation

The Arcadis team conducted an internal kick-off meeting to formalise the handover of information/resources required to perform the assessment. During this meeting, the following were confirmed:

- Confirmation of the Request for Information (RFI) process and agreement by all parties
- Communication channels were formalised and agreed
- Queensland Rail staff provided a background summary of the project
- Date was confirmed for the site visit

Table 3-1 lists the initial documentation submitted for assessment; it is noted that additional documents were requested and acquired for clarification through the RFI process, with a final list of RFI's sent on 3 April 2024 (Appendix B).

Table 3-1 List of preliminary documentation provided

Check list	Documentation Type	Name of document
Essential documents		
Partial	Project Management Plan	Far West Moreton Asset Strategy
Y	Breakdown of costs	Queensland Rail's Draft Access Undertaking 3 (DAU3) Explanatory Document AU3 Model 31.10.23 (QR 9.6mtpa)
Y	Business Case Justification (IAR)	Review of Queensland Rail's West Moreton Capital Investment Plan for DAU3
Other documents provided		
Refer Appendix B		

3.1.2 Stage 2 – Site Visit

A site visit by representatives of QCA and Arcadis was undertaken on 6 and 7 March 2024. During this two-day site visit, we travelled from Rosewood to Dalby to inspect the current condition of WMS, understand the maintenance work undertaken and discussed upcoming opportunities and constraints relating to the expected increased tonnage. We focused our attention on the Rosewood to Jondaryan section where 48% of capital expenditure is proposed to be spent in DAU3. The Arcadis and QCA teams walked significant lengths of the track and observed timber and concrete sleepers, inspected 41kg rail and witnessed coal trains crossing bridges.

Figure 3-2 Coal train on WMS

The site inspections provided the technical review team with an opportunity to develop an interactive platform to enable quick and efficient clarification on several items, which we consider more efficient than multiple email correspondence. Arcadis would like to thank Queensland Rail for their time and commitment to our team during the site inspections.

The site visit facilitated the assessment process by providing visual verification of the compliance of the works with industry standards and safe operations. It was easier, after reviewing documentation, to have a targeted approach to visually verify items. For example, project designs and drawings were adequately reviewed and approved by Registered Professional Engineer of Queensland (RPEQ) before construction had been achieved whilst visual site inspection assured that operations were safely undertaken.

During the site visit the condition of the track, formation and significant earthworks were showcased. Arcadis observed that the assets do not meet the expected condition required to accommodate modern freight and traffic standards. This is typical of aging railways that have been in operation for decades. The efforts of maintenance crews and their ability to keep the railway operating were observed. These crews possess an intimate understanding of the WMS and its challenges, noting that QR as an organisation has managed this challenging system for decades whilst maintaining a service to their customers.

Field workers suggested that the anticipated arrival of ARTC's Inland Rail program in Queensland has had a detrimental effect on the pace of QR's maintenance program over the past few years. It is likely that Inland Rail's proposed route within Queensland would result in coal traffic being moved away from the existing West Moreton System to utilise the new lines for a more efficient route to access the port of Brisbane with a reduced interaction with Queensland Rail suburban passenger services. This would have resulted in a decrease of tonnage carrying requirements on the WMS between Toowoomba and Rosewood. As a result of this, QR anticipated that assets along this route would effectively have been superseded by the Inland Rail program. In addition to this, QR anticipated that select assets along this route would be replaced by the Inland Rail program. These two factors resulted in QR scaling back their maintenance activities. With uncertainty now surrounding the timing of the arrival of Inland Rail in Queensland, those lagging maintenance activities have returned to the program. This situation necessitates an acceleration of works in specific sections of the system.

3.1.3 Stage 3 – Analysis

Reasonableness assessment

In this assessment, reasonableness is defined as a rational, justifiable, and logically based approach using professional judgment and informed decisions supported by available data. It considers compliance requirements such as CETS, CESS, and safety, as well as the organisation's strategic objectives and performance requirements. When distinguishing between maintenance and capital expenditure, reasonableness involves applying sound judgment to determine if an activity aligns with the criteria for each category. This includes assessing the nature, scope, and impact of the expenditure on the asset's functionality and value. Evaluating the necessity, frequency, extent, and potential benefits to the asset's useful life, productivity, and revenue generation capacity is also part of reasonableness.

In summary, our assessment of reasonableness involves considering the pertinent financial, regulatory, and strategic aspects of the submission investment. Overall reasonableness entails that investment decisions must consider a balance between Queensland Rail's strategic objectives, forecasts, asset condition and life expectancy, operational risk and safety, and customer needs synergistically Our assessment of reasonableness in line with the above has drawn upon:

- The information provided to us from QCA and Queensland Rail
- Our expertise in similar projects, extensive knowledge of industry best practices, and deep understanding of the West Moreton system

Benchmarked processes and cost split analysis derived from our AssetRail business, which has the responsibility of operating and maintaining 75% of the Dutch freight and passenger railway network under a Performance Maintenance contract

Tonnage analysis

Queensland Rail's DAU3 forecasts that the West Moreton System coal volumes will build up to 9.6 mtpa during the term of DAU3. Their estimate of 9.6 mtpa is based on the inputs provided by West Moreton System mining companies, which have outlined the following coal capacities as per Appendix A, table A-1.

Figure 3-3 demonstrates the historic tonnage that WMS has previously hauled. This shows that it reached more than 7mpta in 2012, however, since then, tonnage has fallen significantly to be just over 2 mtpa in 2023. This historical tonnage is substantially lower when compared to the projected tonnage of up to 9.6 mtpa anticipated to be hauled during 2024-2030.

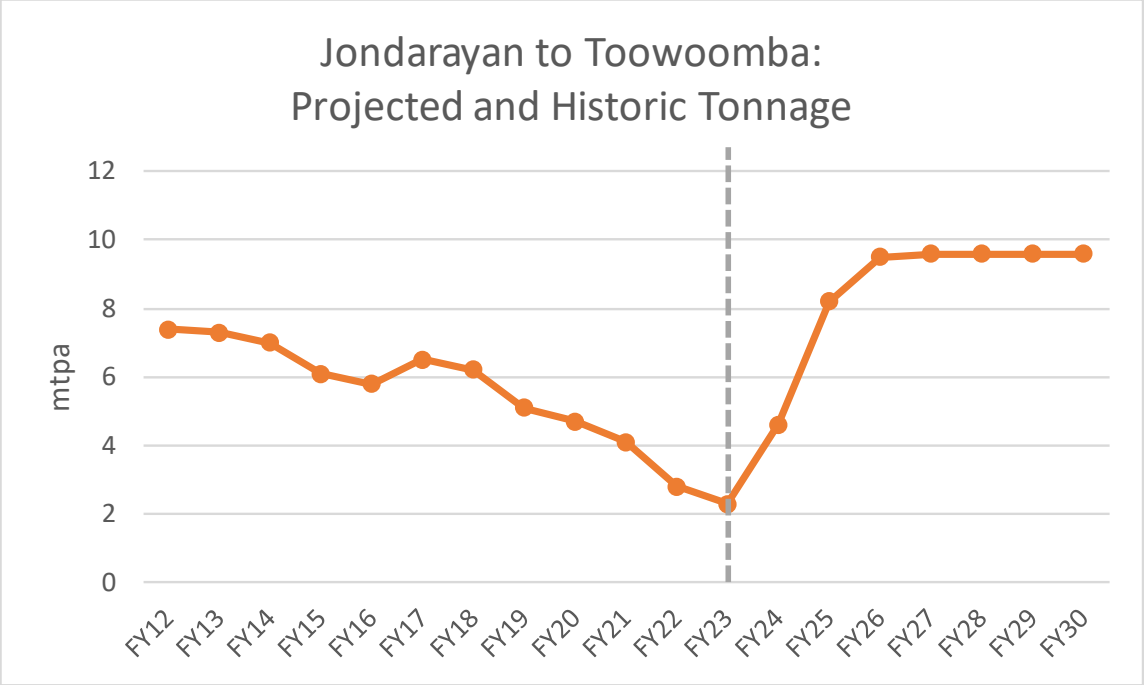

Figure 3-3 – Projected and Historic Tonnage

Source: Queensland Rail DAU3

Note: Grey dotted line is the distinction between historic tonnage (left hand side) and projected tonnage (right hand side).

We note that the Toowoomba Range is where the largest capacity constraint exists as all mines haul their product through this area as well as traffic from other routes. Queensland Rail state in their DAU3 documentation that there is a maximum capacity of 113 return paths per week across the Toowoomba Range. This comprises of 14 non-coal paths, 2 Westlander passenger train paths, and 97 paths that are not preserved, where coal mines can contract.

We have made our assessment of the tonnage by considering the following factors:

- Demand
- Capacity (Engineering, Operational and Reliability)
- Paths
- Impacts on maintenance

For the purposes of this analysis, we have used set terminology in order to separate out distinct elements of the considerations and avoid utilising the same terms to address multiple concepts.

Operational Capacity – is the term used for the train path capacity of the rail network as a function of the track layout and signalling infrastructure capabilities. Including performance considerations arising from driver behaviour, train set performance and service interactions but excluding the impact of weather, temporary speed restrictions, animal incursions etc.

Infrastructure Capability – the ability of the infrastructure to carry a certain tonnage over time, this determines the cumulative tonnages able to be carried on the network and may result in a cap being placed upon the number of the identified train paths able to be utilised by operators.

Possession – a specific type of track access utilised to allow the Infrastructure Manager to undertake maintenance or capital works upon the rail network. Possession access typically involves train services being suspended or amended for its duration.

Network Availability – generally expressed in hours per day or week, this is the time that the rail network is available to be utilised by train operators.

Reliability – the overall expected performance of the network taking into account operations, weather events, infrastructure issues, timetable performance etc.

Demand

From a demand perspective, QR require the rail network to be capable of handling 9.6mtpa of coal tonnage in addition to that required for other traffic. This tonnage will occur if all three mines produce their maximum forecasted tonnage per year. It is noted that none of the mines have historically reached 100% of their contracted volumes. In addition to this, one mine is currently in administration, and this could impact the demand for the network.

Wilkie Creek is facing challenges after only just restarting after being in care and maintenance from 2014 to 2023, being under administration and, being in the thermal coal industry, face declining coal prices.

Infrastructure Capability

The Infrastructure Capability (sometimes referred to as Engineering Capacity) typically refers to the maximum tonnage capability of individual items of rail infrastructure or the overall rail system. Often derived from design specifications and physical limitations of assets, it focuses on the theoretical or calculated potential of a system or infrastructure.

It is noted that due to the West Moreton System's historical origins and years of construction the Infrastructure Capability presents challenges in terms of its operation. Initially constructed on black soils and to track standards lower than those seen in more modern heavy haul networks, the system requires a higher level of intervention than would be required for a contemporary, stand-alone railway.

To understand the Infrastructure Capability constraints of the West Moreton System, we reviewed their most recent information pack. According to the 2016 published *WM System Information Pack*, the allowable gross tonnage of the Rosewood to Toowoomba section is only **7 mtpa.** The remainder of the system to Dalby has even lower allowable gross tonnes of up to **4.5 mtpa**. We requested, however did not receive, more recent information from QR.

Reliability

Reliability and operational capacity pertain to the actual performance and dependability of a system during real-world operational scenarios.

The infrastructure layout of single track with passing loops on the Toowoomba range presents the operational bottleneck of the system and we envisage significant difficulties in transporting 9.6 mtpa from this section per year. The train-speeds, run-times (the current Toowoomba to Helidon coal journey can take up to **169 minutes**), reliability considerations arising from weather events such as high rainfall and increased temperatures, and high-maintenance demands will always present a limitation. Even if QR could safely permit trains to descend the range at a higher speed, the trains would exert increased forces on the track, giving rise to additional and possibly previously unencountered maintenance requirements. In this situation it is likely that there would need to be a revised maintenance access regime, further impacting on the Network Availability and operational costs.

QR track workers suggested that rolling-stock availability would also be a constraint to the ability to move the anticipated tonnages. Whilst Narrow Gauge (NG) wagons may be available, NG diesel-electric locos would need to be resourced. [redacted]. The lead times for locomotive procurement activity can be measured in years, especially when considering the limited market elsewhere for NG Locomotives of similar capabilities to those needed in Queensland and the approvals process for new locomotive designs. The purchase of additional rolling stock would be highly dependent on a forward pipeline of utilisation and on achieving higher-tonnages continually to provide a return on investment. If tonnages fluctuate, then having under-utilised rolling-stock is an unsustainable business model. A further consideration is the need for additional maintenance and storage facilities for an increased, or new, fleet which would need to be constructed if not available in an appropriate location.

With so much of the WMS consisting of a single-track with passing-loops, the potential for incidents to have substantial knock-on operational impacts is high, especially in a scenario where the network is being required to operate the number of paths needed to transport 9.6 mtpa of coal. This would be seen as a reduced reliability level of train services on the system. In this situation the assets would

be highly-utilised, potentially above the 'sweet-spot' for permitting reliable operation of traffic, but also to the point of having sufficient retained capacity to enable maintenance and to recover quickly from incidents such as train failures, derailments and weather events. It should also be anticipated that increased traffic would also impose a higher burden on the track assets, wearing them-out more quickly and thus leading to in increased need for maintenance, both in terms of physical activity but also in terms of numbers of possessions. However, and increase in rail traffic would also see there be a reduction in track access available to undertake that maintenance, presenting a cycle of diminishing returns. Eventually, if maintenance struggles to keep-up, more and more issues will arise, leading to operational interventions such as temporary speed restrictions, interventions and other incidents which will render the system unreliable and result in a reduction of hauled-tonnes as a result of availability limitations.

Paths

We undertook an assessment of the train paths available in the West Moreton System as presented in Queensland Rail's Master Train Plan (MTP) publicly available on their website[2]. This review of the current MTP shows there are 43 paths included in the timetable which originate from the three mines west of Toowoomba (see Figure 3-4 below). Taking the tonnage of 2,008 tonnes per train as quoted by Queensland Rail in the supplied DAU documentation (described as (2,008 tones net or 2,835 tonnes gross) this would equate to approximately 4.4mtpa of train capacity in the MTP. This does not include any additional paths added on an ad-hoc basis through the daily timetable team at QR.

Origin	MTP Paths on Miles - Toowoomba section							Total
	M	T	W	Th	F	S	Su	
Cameby Downs Balloon	4	4	3	4	4	4	4	**27**
Macalister Coal Siding	2	2	2	2	2	3	3	**16**
Jondaryan Coal Siding	0	0	0	0	0	0	0	**0**
Total	**6**	**6**	**5**	**6**	**6**	**7**	**7**	**43**

Figure 3-4 – MTP paths

As a part of undertaking this assessment, we noted that none of the capital expenditure schemes proposed explicitly call out that they are required to increase the Operational Capacity of the railway, either through improving headways, increasing passing opportunities or increased linespeeds. It may be that some of these outcomes arise as secondary benefits of the proposed works, but they are not called out as being required to meet the number of paths identified.

Furthermore, in our assessment of the MTP, we have not attempted to revalidate the Queensland Rail Train Planning activities and assume that each path is valid in terms of operational interactions with other services and being able to perform in accordance with Queensland Rail's performance metrics. Noting that we have not undertaken an assessment of the technical, nor operational, path capacity of the WMS, we submitted an RFI to Queensland Rail requesting detail of the timetabling exercise undertaken to arrive at the overall capacity of 113 paths quoted in the DAU but did not receive a response. We also requested information about the performance considerations and the delta between the technical path capacity of the network and the operational capacity that Queensland Rail are willing to provide for train paths but did not receive a response.

In our assessment of the MTP, we noted that the paths have undergone a validation exercise, and that some paths have been removed from the system prior to publication, this is supported by the difference in the number of coal paths between that quoted in the DAU documentation (97) and

[2] Queensland Rail (2020), Master Train Plans, https://www.queenslandrail.com.au/forbusiness/access/master-train-plans

those present in the MTP (43). It is also noted that whilst this exercise has solely looked at the MTP for the West Moreton System, the paths will also need to navigate the Brisbane Metropolitan system where they compete with QR suburban passenger traffic, Cross River Rail engineering works and Intermodal Traffic accessing Port of Brisbane.

From our experiences with Operational Planning and Performance on rail networks elsewhere in Australia and internationally, it is normal practice to retain a level of technical capacity in order to support reliable day to day operation, but it is not clear from the information available the extent that this has been considered on the WMS. Therefore we recommend that the QCA assess the operational capacity and performance capacity consumption of the system in relation to the proposed tonnages and OPEX and CAPEX program being proposed.

Utilising the same tonnes per train calculation as above, to move 9.6mtpa at 2,008 tonnes of coal per train would require 93 loaded train paths per week. The 93 paths required to move 9.6mtpa of coal is lower than the 97 coal paths quoted by QR as being available, therefore, based upon QR's, implied process, they are likely correct that they have the path capacity to move the quoted tonnages.

As mentioned in the section on demand above, the allowable Gross Tonnage detailed in the publicly available System Information Pack[3] is 7mtpa which, as a Gross Tonnage value, includes the combined weight of trains and locomotives as well as the product carried. Therefore, to avoid breaching this tonnage limitation, fewer than 47 paths per week will be available for moving coal with the exact number dependent upon the weight assigned to passenger and agricultural services also utilising the line.

By taking the components of train weight described in the DAU documentation and multiplying it by the number of paths required to move 9.6mtpa of product ((835x93)x52 = approximately 4mtpa) and adding it to 9.6mtpa, we can create a ballpark figure of the minimum allowable gross tonnes the railway infrastructure will need to be capable of supporting on an annual basis as approximately 13.6mtpa which is greater than the quoted 7mtpa identified by a substantial margin. This means that QR would need to undertake capital investment on the route to cater for the difference between the two numbers.

In short, whilst the paths QR have quoted as being available in the timetable will provide the train capacity to carry 9.6mtpa, they would exceed the tonnage allowance of the railway as identified above presenting the need to undertake Infrastructure Capability upgrades.

Impact on maintenance

Increasing the tonnage carries a risk of disrupting QR's established maintenance practices for the following reasons:

- Increased tonnage leads to increased required maintenance
- Increased tonnage leads to decreased available paths, leading to decreased track availability for maintenance

An increase in traffic will impact track utilisation and high utilisation will compete with maintenance activities for access to the tracks. If a reduction in maintenance access opportunities occurs then the remaining opportunities become more critical to the overall performance of the network. Without reliable maintenance access, the assets will further deteriorate and become less reliable, thereby increasing costs to maintain functionality. Eventually availability and reliability of the planned train paths will suffer if maintenance cannot complete its allotted tasks.

Whilst QR predicts a honeymoon period for 5 years, after that maintenance requirements will creep-up (on those new assets) maintenance will still be required on older assets. Possibly new maintenance needs will also emerge due to the increased tonnes, that QR currently haven't

[3] Queensland Rail (2016), West Moreton System Information Pack, p.13 https://www.queenslandrail.com.au/business/acccess/Documents/West%20Moreton%20System%20Information%20Pack%20-%20Issue%203.1%20-%20October%202016.pdf

anticipated. All those deferred, ongoing and potentially new maintenance activities will then have to be undertaken in the new environment where possession windows are effectively halved.

Therefore, unless QR create new and alternative maintenance techniques that require less track possession, they could experience great difficulty accessing their assets in order to maintain them.

Asset lives and value framework

Queensland Rail faces the challenge of balancing the risk of stranded assets, operational safety, and user requirements when making reasonable investment decisions for its capital and operational plan. Continuous transparent discussion with users is crucial to comprehend their needs and expectations and build the asset value framework from which the asset management plans will hang. The suggestion of an accelerated depreciation period of 19 years for some of the assets raises concerns regarding the perceived long-term functional requirement of the assets and challenges the value framework principals that appear to have been applied. In order to establish the desired reliability and level of service requirements, it is essential to evaluate both the risk appetite and investment appetite of users, access payers, and Queensland Rail itself. This assessment should be a fundamental aspect of developing the asset value framework.

While Queensland Rail adheres to design life and maintenance standards applicable in normal operations, it is crucial to consider that these standards may limit cost efficiencies where assets may face limited future necessity or potential obsolescence. However, based on the information available for assessment, it is unclear whether these standards have been challenged to better align with user needs, network requirements, and economic circumstances.

When considering asset renewal or repair, the balance between asset life expectancy, level of service, and operational requirements must be weighed against the value of the asset to the user. If the user seeks long-term reliability and is willing to invest accordingly, decisions can lean in that direction. However, if there are risks associated with the asset's short-term requirement and potential stranded asset concerns, the user may be more inclined to accept higher risk for better returns in access fees. The value of the asset and the level of risk should be discussed between the asset owner and user before making any decisions.

Based on the information provided, there appears to be a need for further discussion regarding the balance between these various factors. While we acknowledge the limited information available on the planning justification and business case for the expenditure, it seems that the consideration of this balance may have been overlooked. Additionally, the uncertainty surrounding forecasted tonnage introduces a certain level of risk. Although the investment may be necessary to achieve the required capacity for the proposed high tonnage, there is a notable risk of stranded assets in the current economic and political environment. Furthermore, it is important to ensure that appropriate strategies and asset management practices are in place to support the reliability requirements. It is crucial to question whether this risk and the user's appetite for balancing risk, service, and investment have been adequately taken into account in the development of this submission.

Capital Expenditure Analysis

Key Findings

Overall, Arcadis has deemed 14 of the 17 capital expenditure projects as reasonable. We have proposed adjustments to 3 projects within the capital expenditure section of the DAU3. This is outlined in table 3-2 below. Arcadis has suggested reallocating these capital expenditure programs from capital expenditure to maintenance expenditure. QR are aware of the cost of maintaining the assets below. We suggest that QR estimate the maintenance costs for these reallocations of works.

Table 3-2 – Capital Expenditure – QR and Arcadis differences

Capital Expenditure Activity	Arcadis adjustments to capital expenditure ($2025-26 million)	Arcadis commentary
Total QR capex balance	**346.9**	
Track Reconditioning	(93.7)	Reallocate track conditioning capex from Koomi to Dalby, Dalby to Macalister and Macalister and Columboola to maintenance.
Re-sleepering	(6.9)	Reallocate capex costs relating to Macalister and Columboola section to maintenance.
Bridge Pier Replacement	(20.5)	By replacing only very poor condition elements under a capital program of works, the remaining elements could be returned to the ongoing predictive maintenance program.
Total capex balance with Arcadis adjustments	**225.8**	

Source: Arcadis

Capital Expenditure Analysis

Arcadis has assessed the capital expenditure proposed for the DAU3 period of five years. It is noted that a draft amending access undertaking (DAAU) has not been provided for 2024 and 2025, which would have established baseline capital expenditure for the DAU3 period.

Uncertainty surrounding the lifespans and tonnes to be railed by the three key customers on the WMS makes it difficult to respond with a rightsized capital and maintenance program. However investment is required to accommodate the anticipated tonnages otherwise the existing track assets will deteriorate rapidly, leading to temporary speed restrictions (TSRs), closures and increasing the risk of derailments. Even when new assets are installed, their defect-free period can only be measured by a few years before maintenance requirements begin to reappear, this is the natural lifecycle of railway assets operating under traffic. As a mature organisation, QR has already anticipated this and it is reflected in their maintenance forecasts.

QR provided insight into their project approvals processes which are understandably diligent but appear to require the timeframe of up to 18 months for a >$10m project. If such a large capital program as DAU3 is to be embarked upon, the approvals process should be revisited in order to ensure projects can navigate it as quickly as possible because their larger budgets are going to introduce new risks to the organisation. External factors such as labour market constraints could delay capital expenditure. Currently, there are multiple potential rail projects within Australia, such as Inland Rail, Cross River Rail and Sydney Metro. It may be difficult to source specialise labour to undertake the capital works program across the proposed five years, should many rail related projects be mobilised during the same period.

Table 3-3 is a summary of the capital works proposed within DAU3. We have assessed each project item below.

Table 3-3 Reasonableness assessment of capital expenditure in DAU3

No.	Project name	Difference between Arcadis and QR Amount	Arcadis assessment on capex	Arcadis commentary
1	Slope Stabilisation	-	✓	Slope instability on a railway poses significant risks. The geological formation of the Toowoomba slope coupled with increasing inclement weather events and increasing rail traffic load increase the risk of this occuring Arcadis assess that this is reasonable allowance based on a assessment of the Range conditions.
2	Culvert Renewals	-	✓	Arcadis assesses that this is reasonable for an aging system and the 9.6 mtpa scenario.
3	Track Reconditioning	-93.7	x	Reallocate track conditioning capex from Koomi to Dalby, Dalby to Macalister and Macalister and Columboola to maintenance.
4	Formation Strengthening	-	✓	Part of on-going track renewal program. In consideration of the geological formation, aging sub-standard track system and increased performance and reliability requirement under 9.6 mtpa Arcadis has assessed this is reasonable allowance.
5	Curve Transitions	-	✓	Curve transition is an accepted good practice in optimising maintenance and performance on curved track. Assessed as reasonable.
6	Re-sleepering	-6.9	x	Arcadis recommends QR adopt a policy of continuing maintenance and monitoring in selected sections. Reallocate capex costs relating to Macalister and Columboola section to maintenance
7	Re-railing	-	✓	Replacement of rail that reached end of life and is sub-standard. Arcadis acknowledged rail defects and breaks which increase risks of derailment. In consideration Arcadis assesses that for the 9.6 mtpa tonnage this is a reasonable allowance to address safety and operational risk.
8	Level Crossing Transitions	-	✓	Arcadis assesses this is reasonable in consideration of the 9.6 mtpa and to address safety critical level crossing issues.
9	Ballast Undercutting	-	✓	Ongoing program and necessary to address track stability. However, it is noted that this practice of track lowering is potentially an outcome of unsustainable practices and where possible, should be phased out in in lieu of track formation and more sustainable solutions. Noting the geological and historical legacy of the system, the level of expenditure is aassessed as reasonable.

10	Bridge Pier Replacement	-20.5	x	By replacing only very poor condition elements under a capital program of works, the remaining elements could be returned to the ongoing predictive maintenance program.
11	Signalling Cables	-	✓	By replacing only very poor condition elements under a capital program of works, the remaining elements could be returned to the ongoing predictive maintenance program.
12	Digital Telemetry	-	✓	Arcadis assesses that this is reasonable for an aging system potentially unserviceable asset and the 9.6 mtpa scenario
13	SER/PER Upgrade	-	✓	Life expired analogue based system Assessed as reasonable.
14	LED Upgrade	-	✓	Life expired again asset. Assessed as reasonable.
15	Re-signalling	-	✓	Assessed as reasonable to replace obsolete and ensure reliability of the asset.
16	Interlocking Renewal	-	✓	Life-expired and potentially obsolete system which will impact reliability. Assessed as reasonable for the 9.6 mtpa.
17	Refurbishment	-	✓	Replacement of end of life equipment. Assessed as reasonable for the 9.6 mtpa.
	Total	-121.1		

Source: Queensland Rail DAU3, Arcadis

1 – Slope Stabilisation

The works aim to address the remaining two highest embankments between Spring Bluff and Harlaxton. The WMS is acknowledged as being a challenging alignment through difficult terrain and poor geomorphology, this is particularly the case on The Range where access is difficult and construction space can be limited, often requiring specialised skills and equipment. These factors combine to make for high unit-costs. The WMS has experienced many slope failures on The Range over the centuries, some significant enough to lead to track closures, sometimes lasting months. From a system perspective, The Range is the 'bottleneck' and requires particular attention to increase its capacity and maintain its availability. The slopes continue to demonstrate mobility and represent a high priority, warranting timely attention. QR has previously invested significant resources into stabilising its slopes and these works are a continuation of those efforts. Without these works, The Range's slopes remain a risk to operations.

The amount allocated over a period of two years is a reasonable amount, considering the terrain, the risk of unforeseen ground conditions and scopes of work which include reshaping and reinforcing embankments, installing drainage and scour protection and ongoing monitoring requirements. Construction access will be limited and difficult to install, requiring specialised skills and equipment, which will also be required for the works themselves. These works are required regardless of the tonnages railed. One benefit to tonnes railed during weather events, is that trains have a greater likelihood of making it up the Range to stow in Willowburn, should the system further west be closed, thus freeing up paths to the east.

Figure 3-5 QCA and Arcadis staff conducting an inspection of previously stabilised slope on the range during site visit

2 – Culvert Renewals

The works are to replace end-of-life culverts identified through regular track inspections. Culverts are an essential element to linear infrastructure, railways in particular, where water must be removed from the corridor at the earliest opportunity. Without adequate lateral drainage, flowing water can lead to erosion and scour, standing water can lead to embankment deterioration and a loss of capacity. Water is one of the key threats to a railway's capability.

Culverts in the later stages of their lifecycle (e.g. older culverts) are sensitive to the tonnes being railed across them. Older culverts were often designed for lower tonnes and if tonnes increase, their degradation can be accelerated due to the heavier loads they experience. Insufficient cover is also a factor in accelerated degradation. Older culverts are also likely to have smaller cross-sectional-areas than modern standards would accept and are therefore more sensitive to flooding events, more prone to blockage. These assets are maintenance intensive.

These end of life assets are being managed through maintenance and temporary speed restrictions (TSR's) both of which can impact path availability, particularly if a culvert fails during an event, leading to erosion of the formation, which then requires a closure to repair.

The WMS still contains cast-in-situ drains and corrugated metal pipes (CMP). Whilst those assets are appropriate in certain circumstances (e.g. short-lived assets like a haul road) they are unsuitable for long-term assets and are no longer specified by engineers. Wherever these assets remain, now likely in the last stages of their lifecycle, they should be replaced with modern equivalents.

The amount allocated over a period of three years is a reasonable amount. 100 year design life reinforced concrete box culverts (RCBC) and reinforced concrete pipes (RCP's) are being specified and are an appropriate modern solution.

The 100-year design life requirement, in accordance with AS5100, sets a standard for typical operations. However, given the specific requirements and the current economic and political environment impacting the West Moreton system, it would be considered prudent to reassess the efficiency of adhering to a standard design life of 100 years. The information provided does not indicate that a comprehensive whole-life cost-benefit analysis and risk assessment have been conducted to determine if an alternative design life would be more efficient and aligned with user needs and future forecasts. Despite requesting further information on the asset management strategy from Queensland Rail, it was not provided, leaving the question unanswered regarding whether challenging this requirement could lead to a more cost-effective and sustainable solution for the network and its users.

Where required, aprons, headwalls and handrails will also be installed. The works will require the tracks to be closed, the track hardware to be removed, the formation to be excavated and new drainage structures installed. The track will then need to be reinstated correctly before traffic can resume.

These works are required in order to accommodate the increased tonnages. Without the works, culvert maintenance and failure would increase due to the increase in railed tonnes, leading to a loss of availability and reliability.

3 – Track reconditioning

The works are to remove sections of 41kg/m rail on timber and steel sleepers, reconstruct the formation using engineered materials and reinstate the track with 50 kg/m rail on concrete sleepers. The existing assets are subject to a number of factors which affect their availability, primarily heat in the summer days which cause TSR's and sometimes closures. This is managed by allowing traffic during cooler hours. Wet weather impacts availability due to the black-soil being dispersive and which also erodes ballast, consuming it as it seasonally shrinks and swells. QR have managed these issues for decades through their well-established maintenance practices. The 41 kg/m rail is supported on a mixture of timber and steel sleepers, utilising a variety of jewellery such as fasteners, clips and spikes, which makes maintenance onerous though not impossible.

QR have gradually replaced 41 kg/m rail in the past but now wish to accelerate the program, in anticipation of increased tonnages and '*to reduce the risk of taking possessions for track upgrades at a time when maximum railings are required*'.

It is noted that a section of track between **Macalister to Columboola** has been proposed to be re-sleepered as part of a separate capital project.

The cost allocated to track reconditioning over a period of five years is **not** considered a reasonable amount.

An allocation for track reconditioning for Koomi to Dalby (15km) has been made in the first year. This section of track has an allowable gross tonnage of 4.0 mtpa and is primarily utilised by two customers. One submission stated that 'the proposed tariffs are unaffordable and economically unviable for West Moreton coal producers'. The tonnage forecast in this section, would exceed the 4.0 allowable gross tonnage.

A case could be put forward that the track has been successfully operating for many decades using QR's current maintenance practices and that a continuation of those practices would yield similar results. However, the likelihood is that the predicted increase in rail traffic will not only accelerate the degradation of the track, it may also introduce new failure-mechanisms not yet experienced (or not experienced during the preceding years of low tonnes).

In this section of the track, there are a number of available paths for maintenance. Therefore, it could be argued that an increased maintenance regime could be applied to counteract any effects of increased tonnages, as opposed to a capital program. This supports QR's own strategy of 'increasing the number of crew members or teams deployed during track works, crews working

parallel during track closures will allow for the required trackwork to be completed within the possession window'. Supporting QR's strategy would allow capital projects to be focussed further east on sections of track where more benefit can be achieved. This would relieve pressure for QR to deliver multiple capital works projects over the five years. The inconsistency of allowable gross tonnes versus predicted tonnes would need to be resolved. We suggest half the allocation for track reconditioning for Koomi to Dalby to be included in the capital works program in DAU3.

Similarly, an amount has been allocated to Dalby to Macalister (25km) during the first and second years. The same argument for the Koomi to Dalby section above can be applied to this section of track. We suggest half the allocation for track reconditioning for Dalby to Macalister to be included in the capital works program in DAU3.

An allocation for Macalister to Columboola (90km) is made during the third, fourth and fifth years. This section of the system has an allowable gross tonnage of 4.0 mtpa and is primarily utilised by one customer, who has expressed concern that the mine is already operating at 'fairly marginal' rates of profit. In consideration of the relatively low tonnes, the OTCI score of 'on or better than target' and the low utilisation which makes for accessible maintenance, it is difficult to justify these works. We suggest to remove the capital works for this section entirely, and suggest to instead apply an ongoing maintenance program, which has been successfully applied to this track for many decades. This would allow resources to be utilised further east on sections of track where more benefit can be achieved.

4 - Formation strengthening

The works are part of an ongoing track renewal program, which aims to reconstruct sections of track experiencing top and line issues and availability limitations due to the presence of black soils.

Historically the track has been constructed directly on black soils which exhibit undesirable characteristics, particularly during hot and inclement weather. Despite replacing 41kg/m rail in certain sections many years ago, the issues persist and so a reconstruction of the formation is required. The works aim to release inherent capacity of the track that is currently unrealised.

QR have previously tried constructing a 2m wide 'backbone' of engineered soil and geofabrics (not necessarily in these locations) but the results appear to be below expectations. The proposed works will now remove a 4m wide 700mm deep layer and replace it with engineered soils, geofabrics and geogrids, before reinstating the track.

The amount allocated over a period of two years is a reasonable amount. An allocation for **Rosewood to Toowoomba** and **Toowoomba to Jondaryan**, are both scheduled for the first two years of the program. These sections of track serve all three mining customers and will experience the total predicted tonnes.

It could be argued the **Rosewood to Toowoomba** section is most important, since the removal of any constraints on the system east of Toowoomba (i.e. Willowburn) should be a priority, allowing trains to transit more freely between the port and Willowburn marshalling yards provides operational flexibility. This is because Willowburn's marshalling yards contain a number of stow-roads owned by both QR and Aurizon, that can potentially accommodate trains during times when train paths are unavailable, due to events such as flooding or excessive heat.

The **Toowoomba to Jondaryan** could be considered a lower priority relative to Rosewood to Toowoomba. However, the New Acland mine has the highest production capacity and improving the availability between the port and Jondaryan will enable New Acland trains to reach the mine on more occasions than it currently does under the heat and wet weather restrictions.

Figure 3-6 Previous formation strengthening works

5 – Toowoomba Range curve transitions

The works apply to 7km of The Range between Murphy's Creek to Toowoomba. Transition curves are sections of track designed to facilitate smooth transitions between two distinct curves, preventing the train from experiencing excessive instability. Ideally, longer transition curves are preferred as they enable trains to navigate the change more seamlessly. However, the Toowoomba Range poses a challenge with its limited space between curves, necessitating slower train speeds to navigate these short sections. Transition curves play a crucial role in ensuring safe and stable train operations, particularly in navigating complex rail routes like the Toowoomba Range. Steep grades, sharp curves and unsuitable transitions combine to impede train speed and safety. This results in a reduction of Operational Capacity and an associated reduction in railed-tonnes.

Gauge-widened sleepers were previously installed on tight curves but have not met expectations and are being replaced. The concentration of forces on tight curves is leading to premature wear of track components, leading to instability. This requires increased maintenance with all the limitations on access presented by the terrain.

Whilst maintenance has been effective in the past, it is unlikely to do so for the predicted increased tonnages. As the tonnes increase, the effects of tight curves become more apparent and issues will arise more frequently. These issues will, in turn, demand more maintenance, which will itself become more difficult due to the increased traffic.

The amount allocated over a period of two years is a reasonable amount. The Range is the capacity bottleneck on the WMS and an initiative to improve capacity constraints and reduce interruptions will ensure the timeliness of haulage. If as a result of these works, line speed and perhaps sectional running-times across these sections of track can be lifted and less TSR's imposed, the ability for loaded trains to descend The Range sooner, may also allow unloaded trains to return sooner. Shorter journey-times may provide opportunities for customers to optimise their crew-changes and introduce new efficiencies.

6 - Re-sleepering

The works consist of the replacement of some 25% of the timber sleepers on the unloaded Up road between Yarongmalu and Helidon and between Macalister and Columboola with new timber sleepers. As timber sleepers reach the end of their useful life, they display defects which impact upon top and line and the Overall Track Condition Index (OTCI). Where clusters of defective sleepers occur, the gauge can spread, leading to derailment risks. QR try to address this by replacing timber sleepers with steel sleepers at regular intervals, with some success. Whilst sleeper replacement is typically undertaken as part of routine maintenance, it appears the predicted tonnages have highlighted the need to accelerate their replacement. The accelerated rate of replacement has pushed the works from a maintenance activity into a capital activity.

The amount allocated over a period of one year is a conditional reasonable amount. QR argue that replacing the sleepers over a longer period of time has the potential to increase costs. However, sleeper replacement is an ongoing maintenance activity and costs over a period of time are generally inflationary. Therefore it may not necessarily be a reason for initiating a large capital works program when maintenance appears to be an effective current solution. Further, a capital works program is contingent on the increased tonnage being realised.

The section of track between Yarongmalu and Helidon would be the priority since this is where the highest combined tonnages would occur and these works should proceed. However, between Macalister and Columboola only one mine hauls and therefore the tonnages are lower. Possessions are also relatively unchanged in the increased tonnage scenario. According to QR, the OTCI scores are 'on or better than target' suggesting the current maintenance regime is effective.

We suggest that QR adopt a policy of continuing with their existing monitoring and maintenance regime between Macalister and Columboola instead of applying a capital works program for this area. We estimate that this would potentially reduce the re-sleepering program by $6.9m.

7 - Re-railing

The works replace some of the 41 kg/m rail with 50 kg/m rail and also replace some 50 kg/m rail which is at the end of its life. Rail life is calculated in terms of gross tonnages and any increase in tonnes will bring the end of life forwards, often by many years. QR have presumably predicted where these rails will reach the end of life during DAU3 and are proposing to replace accordingly.

Rail breaks and gauge widening have the potential to cause derailments, which any railway will try to avoid at all costs. QR has obligations as the RIM to mitigate these risks. The ability to predict end of life assets and replace them in a timely manner is the maintenance regime that should be encouraged, a reactive fix on fail maintenance regime is undesirable.

The amount allocated by QR over three years is considered reasonable. If they have not already done so, QR should consider the option of recycling 50kg/m rail that still has residual life remaining (just not enough for the combined increased tonnages on the eastern sections) and reinstalling it further west to replace 41 kg/m rail where it will not experience a significant increase in tonnes.

8 - Level crossing transitions

The works are to improve the transitions at level crossing to a minimum of 20 concrete sleepers and 50kg/m rail in light-track areas (41kg/m rail on wooden and steel sleepers).

Transitioning from a railway formation to a road formation presents challenges in terms of ground stiffness. Whenever stiffness differs between the railway and the road, there is the risk of differential movement which can lead to operational and maintenance issues. QR are experiencing these issues in the form of junction weld failures. These failures affect availability and reliability but can also lead to derailment across a level crossing which would also impact road traffic. The proposal to increase the number of sleepers would push the transition point further away from the road and allow forces to dissipate over a greater length, thus reducing the 'shock' between rail and road formations.

Road rail interfaces are one of the most sensitive and high-risk elements of any railway, they are the only places where public traffic directly interacts with train traffic. Measures to improve the safety and reliability of road rail interfaces are important investments and fundamental to the obligations of a Rail Infrastructure Manager.

The amount allocated by QR over three years is a reasonable amount. These works are required in order to accommodate the increased tonnages. Without the works, weld failures would increase due to the increase in railed tonnes, leading to a loss of availability and reliability and also increase the likelihood of a derailment on a level crossing.

9 - Ballast undercutting

The works are part of an ongoing maintenance program, spread over five years, the majority of expenditure being in the first year.

Ballast undercutting (also termed track lowering) reduces excessive ballast depth before it affects track stability. Ballast depth gradually increases over time due to normal track maintenance activities until it reaches a point where the depth has to be corrected using a ballast undercutting machine. The amount suggested by QR over five years is a reasonable amount.

It is however noted that the practice of lowering a track with excessive ballast because of excessive ballasting over time, can be considered an inefficient maintenance activity due to the excessive time, effort, and resources required to perform the task. Moreover, this process may not address the root cause of the issue, leading to repeated maintenance cycles and increased costs over time. Arcadis recommends that the asset management strategy implement proactive measures to minimise the risk of necessitating these works in the first place and transfer the investment to address the root cause of the issue in order to decrease overall maintenance costs over whole of life of the system.

10 - Bridge pier replacement

The works are an acceleration to the ongoing timber bridge and pier elimination program. Ageing timber bridges require intensive maintenance and incur significant costs far exceeding those of their steel and concrete counterparts.

Whilst timber structures are still very much a viable option for low tonnage scenarios, they are subject to environmental and climatic stresses unique to their material. Queensland's climate is particularly harsh on timber and pest infestation, notably termites, all contribute to a reduced material life. With the changing environmental culture, the availability of appropriate timbers has also diminished, meaning it is harder and more expensive to source the woods traditionally used in timber structures.

Whilst individual bridge elements can be replaced almost indefinitely (at significant cost) the piers and other substructure elements embedded in the ground are less easy to inspect and difficult to replace. Piles and piers erode other time due to several factors and gradually lose their cross-sectional area. This loss leads to reduced bearing capacity, eventually the bridge will begin to pump under traffic and elements will move more vigorously than intended, the structure will literally shake itself into a premature end of life. During this process, bridges become less reliable and TSR's are often imposed to mitigate, reducing sectional run-times.

To mitigate, QR are proposing to replace timber piers and bridges with steel or concrete alternatives, these will have a 100-year design life. The works vary from replacing only the piers, to fully replacing the structure, particularly where headstocks, transoms and girders are life-expired. Where required, longer transitions will also be installed to reduce the longitudinal loads imparted onto the structure plus reduce rail-creep.

An allocation over five years is conditionally a reasonable amount, split evenly between Rosewood to Jondaryan as a priority for the first two years, followed by Jondaryan to Columboola over the last three years. However, depending on where the bridge is located, it's operational life could continue to be extended through maintenance, as it has been for the past century or more. Possessions in

the Jondaryan to Miles sections are not predicted to be impacted significantly by the 9.6 mtpa scenario. For example, if bridges to the west of Macalister are only to experience traffic from Cameby Down, provided their piers are competent, they could continue to operate, even under TSR and provide sufficient capacity for the mines' needs.

Similarly, where a bridge is tabled for complete replacement, if the anticipated tonnages don't require it, the piers could be replaced whilst the superstructure remains timber. An argument could be made that whilst the substructure is being replaced, it is cost effective to replace the superstructure too but QR have successfully demonstrated that they can replace substructures with minimal impact to the bridge (see figure 3-5).

If the anticipated tonnages are realised and the timber superstructure demonstrates an inability to accommodate those tonnes, provided the design has considered future upgrade, it is possible that a new superstructure can then be added to the already upgraded substructure at a later date. This would be the most efficient approach to ensure that capital works undertaken is reasonable.

Overall, although at a high level these costs appear reasonable, we believe it would be most efficient to only replace elements that are in very poor condition. Based on QR's NIB, there are 1717m of timber bridge between Rosewood and Toowoomba and 482m between Toowoomba and Dalby. There are 2101m between Dalby and Miles. Therefore total timber bridge length is 4300m. Arcadis does not have the latest information to show how many of those timber bridges were replaced with a concrete design, how many have been repaired since 2016 or how many are short or long-span structures. Therefore, we have assumed that 38% of capex of bridge pier replacement could be reduced and moved into maintenance. We have focused this reallocation of capex on areas with lower tonnage, which are sections Jondaryan to Macalister and Macalister to Columboola. This would lead to a reduction of $20.5.

Figure 3-7 Replacement of substructure without impacting superstructure

11 – Signalling Cables

Renewal of this cabling is required before it becomes unserviceable, in order to enable continued operational reliability for West Moreton and the serviceability of the signalling systems. Therefore, this project is deemed reasonable and efficient. The cabling works will improve reliability and maintainability of the signalling infrastructure on the West Moreton System – copper to fibre etc. as well as reduce maintenance interventions and impact on overtime.

12 – Digital Telemetry

The Universal Traffic Control (UTC) system is used to manage train movements within Queensland Rail's remote controlled signalling territory. For the West Moreton network, UTC is used from Rosewood to Willowburn. The existing telemetry used to provide communications between the UTC system and the signalling system is based on a life-expired analogue based system that requires an upgrade. This project includes development of the core UTC system to support the new telemetry system. It will replace end of life Siemens S2 SOF and Scanner hardware with a digital telemetry product operating over Ethernet/IP. This is deemed reasonable.

13 – SER/PER upgrades

The existing signal and power equipment rooms at Rangeview passing loop are identified as outdated with several assets reaching end-of-life. The replacement building and equipment will be more reliable, have improved access and increased levels of safety for maintenance staff. This project will replace the existing wooden station building containing vital signalling equipment with a

new Signalling Equipment Room (SER) and Power Equipment Room (PER). A new alternator will also be installed with the PER. This is deemed reasonable.

14 – LED Upgrades

Incandescent lamps have become obsolete and have a number of inherent failure modes that the LED signal module system has designed out. The train driver signal interface relies on the signal aspect indicating a clear and unambiguous indication. LEDs have far greater intensity than incandescent signals and have a greater life expectancy therefore improving signal sighting and driver response. This project involves the replacement of incandescent signals with LED signals. Project work includes installing LEDs and necessary location changes including relays. This is deemed reasonable.

15 – Re-signalling works

Dalby Yard and Occupational Level Crossings Increased fault, repair, and performance issues are encountered as this equipment exceeds service life. Signalling and communications equipment can become unserviceable once supplier support and spares cease. Renewal of signalling equipment before it becomes unserviceable will enable continued operational reliability for West Moreton and the serviceability of the signalling systems will be maintained. This is deemed prudent and efficient.

16 – Interlocking Renewals

The signal interlockings are a key component of the RCS system and are located in Gatton. Relay interlockings have a planned service life of 35 to 45 years. There is potential to extend these interlockings through refurbishment programs. Processor-based interlockings have a planned service life of 10 to 15 years, though a mid-life upgrade can generally be employed to extend this to 25 years. This project renews life expired Westrace Mk1 interlocking at Gatton. This is deemed reasonable.

17 – Refurbishment

The maintenance depot at Chinchilla contains assets in a state of deterioration which will require refurbishment. Low levels of repair and maintenance will be implemented in order to maintain the assets at a level which is fit for purpose and also compliant. This is deemed reasonable.

3.1.4 Stage 4 – Operating and Maintenance Expenditure Reasonableness Assessment

Arcadis has drawn on its international experience to determine the reasonableness of the operating and maintenance expense forecasts submitted by QR. Our experience is based on the combination of the following rail operating expense projects:

- Qatar Rail Opex Estimation Project
- AssetRail Performance Based Rail Contract (Arcadis O&M of Dutch freight and passenger rail network)
- Qatar Rail Opex Estimation Project
- Experience built on US (Class 1), UK (Network Rail) and Brazil (Vale) projects

It is observed that QR operates as a state-owned entity within a regulated environment, encountering distinct environmental challenges such as landslides during extreme rain events, black soils, steep grades, and tight curves, setting it apart from rail systems in other countries. Despite our efforts to obtain historic detailed cost information from Queensland Rail, the lack of such data prompted us to draw upon this international expertise (refer to table 3-4) to offer the best estimate and cost analysis possible under the circumstances.

Table 3-42 Arcadis Operating and Maintenance Expenditure Experience

Project	Description
Qatar Rail Opex Estimation Project (2015-2016)	Arcadis built a cost model for the client's newly built high speed rail, existing metro and heavy rail. The client was able to apply different weights, as loading was variable and understand the impact on maintenance figures across a timeframe of 20 years.
Asset Rail Performance Based Rail Contract	Arcadis formed a company, Asset Rail, to operate and maintain 75% of the Dutch train network (passenger and freight). Asset Rail calculates impacts due to changes in weight of rail. ProRail, a Dutch government organisation responsible for the management of the national railway network infrastructure, commissioned Asset Rail to operate and maintain their network.
Performance based maintenance (Asset Rail, Netherlands, 2009 - ongoing)	Arcadis (as Asset Rail) is the performance based maintainer for ProRail. We are responsible for the entire maintenance for 75% of the National Network for the last 15 years. We are therefore responsible for changes in the asset costs and therefore have developed detailed cost models to better understand the impact of operational changes on its behaviour as asset deterioration and capital and maintenance requirements and expenses adapt. The model was originally built to inform the performance based maintenance regime. This was then refined to inform the maintenance impact to a major passenger line which would need to carry the redirected freight from a dedicated heavy haul route from Germany to Rotterdam port as part of our costing and development of our maintenance program. The redirection of freight on the passenger line would double the traffic and load over the 8 months during when works were being undertaken on the freight line.

Using the experience from these projects, Arcadis assessed the split between fixed and variable costs for maintenance and operating expenditure provided by QR. The following section discusses the operating and maintenance costs and fixed percentage observed by both QR and Arcadis.

The following costs are defined as follows:

- Fixed costs do not vary with usage but are costs that remain unchanged and are critical to the running of the entire network.
- Variable costs are based on the direct impact of volume forecasts and vary with usage.

Operating Expenses

Key Findings

Overall Arcadis has found 8 of 9 operating expense activities deemed reasonable. Due to insufficient information of the build up of corporate overhead, paired with a significant increase in overhead relative to previous years, we are unable to deem this cost of $3.2m per year as reasonable. Table 3-5 below shows the reconciliation between QR and Arcadis's operating expenditure per year during DAU3.

Table 3-5 – Operating expenditure summary

Operating expense type	Difference between Arcadis and QR amount	Arcadis commentary
Total QR opex balance	**17,068**	
Corporate Overhead	-3,179	Unable to ascertain reasonable with current information. Discussion of 'revised allocator' included in QR DAU3, without provided methodology. Due to insufficient information, we are unable to deem this cost as reasonable.
Total opex balance with Arcadis adjustments	**13,889**	

Source: QR DAU3, Arcadis

Fixed and variable cost split

QR is a mature organisation and we expect that they are aware of the fixed and variable cost split as well as their costs for WMS. The operating expenditure fixed rate was provided in DAU3. We have assessed these and proposed our own fixed and variable cost split based on the methodology and experience highlighted above. The impact of our assessment of the fixed and variable cost split is not highlighted in the scenario where 9.6 mtpa is realised. However, if this tonnage changes, its operating costs will change relative to these percentages. Table 3-6 outlines our fixed rate and our justification for our build up of these rates, as per operating cost type.

Table 3-6 Assessment of operating expenditure – fixed and variable rates

Operating cost type	Arcadis fixed rate	Arcadis Commentary
Train Control	90%	For moderate tonnage changes (i.e. more trains) no additional train controlling staff is required. In case of more extreme increase of train frequencies a step-increase for an additional controller might become required, to decrease the span of control of each controller. However, this is a non-linear process. Without such a step increase the rate is almost completely fixed.
Planning & Systems	80%	System costs are generally not influenced by having more trains. User licenses for specific software tools might increase when more planning staff is deployed (dependent on contractual conditions). More planning staff required to handle unforeseen circumstances and deal with a more complicated basic timetable / train path allocations.
Operations Administration	80%	Comparable to train control rate and planning/systems rate.
Monitoring Systems	90%	Analysis become slightly more complicated because of increased interdependencies and data, however no fundamental change in process is expected.
Engineering Support	80%	There can be a small portion of variability in project demand and specific maintenance activities due to increase of train frequency and tonnage. This potentially leads to a more rigorous engineering industry has led to cost increases.
Management Support	80%	Similar to engineering support, there can be a small portion of variability in project demand.
Network Infrastructure Material Logistics	80%	There can be a small portion of variability in project demand. Spares in material depots might be used more frequently and therefore require a higher stock level to maintain availability levels.
Assurance and Capability (Asset Maintenance)	80%	Expect a relatively fixed amount of assurance costs. Assurance processes shall not change fundamentally with tonnage changes.
Regional Asset Delivery	80%	There can be a small portion of variability in project demand.
QCA Fees	100%	Fully fixed amount.
Program on Costs	80%	We assume these are overhead costs such as employee on costs, banking costs, legal costs.
Other regional costs	100%	We assume that this relates to remote storage that is not on land QR owns.

Operating cost type	Arcadis fixed rate	Arcadis Commentary
Telecommunications Backbone	95%	Almost entirely fixed, independent of usage (assuming that the current telecoms network has sufficient capacity for increased number of trains on the network and train-based equipment is not covered by this figure).
Corporate Overhead	80%	In line with cost increase due to increase of technical costs.
Return on buildings, plant, software and inventory	N/A	Out of scope

Source: QR DAU3, Arcadis

Operating costs analysis

Arcadis has assessed the operating costs by expense type (table 3-7). QR provided a methodology for how it forecasted its operating expenditure. Train control is built up on a bottom's up approach. Its network customer service and regional asset delivery costs were escalated costs of historical figures. We considered the historical figures provided to us, which include one year's costs – FY2021-22. For the remaining categories that relate to operating expenditure, forecasts were based on escalation of historical figures, as well as cost allocation determined by a 'Revised Allocator'. We have not assessed the revised allocator and cannot confirm the methodology of this section. However, we have assessed the reasonableness of these operating costs based on previous knowledge and experience.

Table 3-7 Assessment of operating expenditure – cost

Operating expense type	DAU3 Amount 2025 ($FY2025-26 000s)	Arcadis assessment on opex	Arcadis commentary
Train Control	[redacted]	✓	We expect that this has decreased relative to 2021-21 due to a more streamlined process. We have assessed the bottom's up FTE table proposed as per DAU3 (table 24, p. 53) and note that the rates and number of FTE are reasonable.
Planning & Systems	[redacted]	✓	We have assessed the FTEs proposed as per DAU3 (table 24, p. 53) and note that the rates and number of FTE are reasonable.
Operations Administration	77	✓	Consistent with prior year
Network business	4,220	✓	We note that this has increased by 1.7m compared to previous year. This is attributable to an increase in tonnage. New wayside equipment is likely to be included in this line item, which would not have been included in previous years. Engineering support of $1.1m may be due to increased regulation and more scrutiny.
QCA Fees	0	-	
Program on Costs	1,090	✓	This amount is in line with 21-22 which has lower tonnage compared to DAU3. Reasonable to increase the output for this – would require further breakdown to ascertain figure. We note that fixed rate is 79% and therefore anticipate that this amount would increase relative to previous years. Overall this line item is reasonable.
Other regional costs	248	✓	Although further breakdown is not present, we recognise that this is in line with previous year and has a 100% fixed

Operating expense type	DAU3 Amount 2025 ($FY2025-26 000s)	Arcadis assessment on opex	Arcadis commentary
			rate therefore deem this as reasonable.
Telecommunications Backbone	1,666	✓	In line with previous year and industry expectations. Deem as reasonable.
Corporate Overhead	3,179	x	Unable to ascertain reasonable with current information. Discussion of 'revised allocator' included in QR DAU3, without provided methodology. Due to insufficient information, we are unable to deem this cost as reasonable.
Return on buildings, plant, software and inventory	1,926	N/A	Out of scope
Total Operating Expenses	**17,068**		

Source: QR DAU3, Arcadis

Overall, operating expenses are deemed reasonable, with the exception of corporate overhead. Corporate overheads have increased by 87% relative to FY20-21. Arcadis requested but did not obtain additional details on these costs. Therefore we are unable to support the increase based on current documentation.

Maintenance expenditure

Key findings

Overall Arcadis has found 13 of 19 maintenance expense activities deemed reasonable. Table 3-8 details the reasoning behind deeming maintenance expense activities as not reasonable.

Table 3-3 - Maintenance expenditure summary

Maintenance expense type	Difference between Arcadis and QR Amount	Arcadis reasonable-ness assessment	Arcadis commentary
Total QR maintenance expenditure balance	**173,100**		
Repairs	19,938	x	In light of all rail replacement in the capital works, Arcadis assess that this amount is too high and that the budget be reduced for these works.
Maintenance Ballasting	9,332	x	Considering the topology such as black soil, Arcadis has assessed partially assessed this as reasonable.

Maintenance expense type	Difference between Arcadis and QR Amount	Arcadis reasonable-ness assessment	Arcadis commentary
			However Arcadis requests further clarification on this item
Renewals	2,651	x	Insufficient information to understand renewals. Structural renewals are not included in this amount and may be missing in maintenance expenditure.
Turnout Maintenance	1,061	x	This figure appears low. We would expect that turnout maintenance would be higher due to their high maintenance requirements. These costs may be embedded elsewhere in maintenance. We do not deem these reasonable as these costs are lower than expected. Insufficient information to provide estimate.
Lubrication	-	x	We would expect higher lubrication costs, particularly as tonnage increases. Deem this as not reasonable.
Other	12,090	x	Due to insufficient information, we are unable to deem this as reasonable.
Total	**128,028**		

Source: QR DAU3, Arcadis

Fixed and variable cost split

We obtained QR's maintenance expenditure fixed and variable split through two methods:

- QR's provided fixed and variable split of maintenance expenditure
- Recalculating fixed and variable split by dividing fixed maintenance expenditure by total maintenance expenditure.

The provided maintenance fixed and variable split differed from the maintenance activities provided in DAU3. Therefore, we were unable to accurately tie these fixed and variable percentages to the maintenance activities provided in the DAU3. Instead, we used recalculated fixed and variable percentages. Table 3-9 compares our own results of this split, to the fixed and variable percentages calculated through DAU3. Although these differences do not make an impact on the costs of maintenance expenditure when tonnage is 9.6mtpa, if this tonnage changes, the maintenance cost will change as well.

Table 3-9 Assessment of maintenance expenditure – fixed and variable rates

Maintenance cost type	DAU3 fixed rate	Arcadis fixed rate	Arcadis Commentary
Mechanised Resurfacing	0%	25%	Required to keep track within designed parameters. QR have an end-to-end knowledge of this track and we expect that they have corporate knowledge that they can draw upon. Therefore, we do not expect QR to be 100% reactive. Assumed to refer to restoring track geometry preventatively. Most geometry defects are being caused by the tonnage passing over the tracks, notably black soil, transition to fixed assets (bridges, etc). However not all geometry defects are related to train impact, e.g. loss of stability due to rainfall, subsoil water levels, etc.
Rail Stress Adjustment	0%	50%	Increased train numbers can cause excessive stresses to build up faster on slopes or in braking areas. However, the need for stress adjustment is also partially caused by load-unrelated mechanisms such as temperature induced rail shrinkage/expansion and maintenance activities like rail replacement, tamping, resleepering, etc. Whilst some of these maintenance activities might be performed more often when loads increase, it is not a linear mechanism, therefore rail stress adjustment costs cannot be considered fully fixed. As per the site visit, field workers have a good understanding of problem areas and can apply preventative maintenance to these areas. For example, the Toowoomba Range is a well understood track that has a clear set of problems where they can do predictive work, which would be the fixed portion of this expense type. Timber bridges are also a known problem area where predictive maintenance could be applied.
Repairs	17%	30%	As per the site visit, field workers have a good understanding of problem areas and can apply preventative maintenance to these areas. Many preventative maintenance activities, such as crack repair are independent of tonnage. QR know where the problem areas are, so they can focus their inspection resources there and apply preventative maintenance as required. However, as tonnages increase, so will the requirement for rail-repairs.
Sleeper Management	0%	30%	We note that there is an element of uncertainty due to an increase in tonnage in DAU3. However, we expect that there is baseline of knowledge that they can apply to sleeper management, based on usage. Timber sleepers: Many failure mechanisms are load-based (e.g. gauge tolerances, wood compaction, loose bolts), however, in an aging network, the age of the timber sleepers should be considered, independent of tonnage change (cracking due to sun/moisture, wood rot, insects, etc). Concrete sleepers: Most failure mechanisms for concrete sleepers are solely tonnage-based, especially in curves. Assuming there are no underlying structural defects (“hidden

			failure mechanisms) that allow for sudden progressive deterioration.
Maintenance Ballasting	0%	50%	With regular track inspections, QR can apply predictive maintenance for this maintenance activity. We assume this work can be converted to ballast cleaning whilst retaining the current track position, which is useful to prevent vegetation, preserve track geometry and retain timber sleeper remaining life. Part of this activity is due to tonnage-induced deterioration of ballast stones, tonnage-induced repeated tamping actions, but part is also caused by environmental circumstances, such as sand blown into the ballast, moisture and freezing temperatures.
Rail Joint Management	0%	25%	With regular track inspections, QR can apply predictive maintenance for this maintenance activity. Higher loads mean faster wear which happens progressively without doing proper and timely maintenance.
Top & Line Spot Resurfacing	0%	25%	With regular track inspections, QR can apply predictive maintenance for this maintenance activity. Assumed to refer to restoring track geometry preventatively. Most geometry defects are being caused by the tonnage passing over the tracks, notably black soil, transition to fixed assets (bridges, etc). However not all geometry defects are related to train impact, e.g. loss of stability due to rainfall, subsoil water levels, etc.
Signalling	100%	90%	We expect the relays will have a heavier workload and the more they move, the quicker they wear out. This would lead to a variable component relating to signalling. Whilst most electrotechnical systems will not deteriorate faster when more trains are passing, this does not fully apply to electromechanical assets such as level crossing gate motors, switch motors, etc which might fail sooner or have to be replaced sooner.
Assets Comp Insp/Svc	100%	95%	QR have a well-established asset base and it is unlikely that there are unpredictable components relating to these assets.
Fire & Vegetation Management	100%	100%	These are preventative measures that are therefore fixed. It is highly unlikely that there are unpredictable components relating to these assets.
Renewals	100%	100%	This relates to the activity of maintaining a database of rail condition, populated through various inputs including inspections, in order to accurately predict the timely replacement of worn rail. QR have a well-established condition monitoring program and therefore these works should be predictive maintenance.
Asset Inspections Non Compliance	100%	80%	This is most fixed, however due to increased tonnage, there may be uncertainty relating to the increase of inspections required in weak areas, such as black soil, turnouts, tight curves, old wooden sleeper segments, etc.

Consulting/ Technical Advice	100%	80%	Mainly fixed, however a portion may be variable due to uncertainty.
Telecoms	100%	100%	We do not consider telecommunication asset maintenance to be tonnage dependent, assuming train-based communication equipment and handsets are not to be included under this cost category.
Earthworks – non formation	100%	80%	Based on recent weather events, slopes may be unpredictable. However, in general there is sufficient warning of failure given by earthworks. Remainder is not tonnage dependent
Turnout Maintenance	100%	100%	All activities relate to predictive maintenance.
Electrical	100%	100%	All activities relate to predictive maintenance.
Lubrication	0%	N/A	No costs included in DAU3.
Other	23%	-	Insufficient breakdown to understand underlying costs.

Source: QR DAU3, Arcadis

Maintenance cost analysis

Arcadis has assessed the maintenance costs for DAU3. QR provided their Maintenance Expenditure Submission (2023) which provided a background and driver of forecasted costs and a breakdown of fixed and variable costs for the period 2025-2030. QR provided historical figures for fixed maintenance costs for FY21-23 (represented in FY24 dollars). We have escalated all figures to FY25-26 dollars. We assessed total fixed maintenance costs as per Figure 3-8 by comparing projected fixed maintenance expenses to historic figures. We note that projected yearly fixed maintenance costs are $0.12m higher than the average of FY21-23 actuals. This reflects that QR have projected relatively consistent fixed maintenance costs for DAU3.

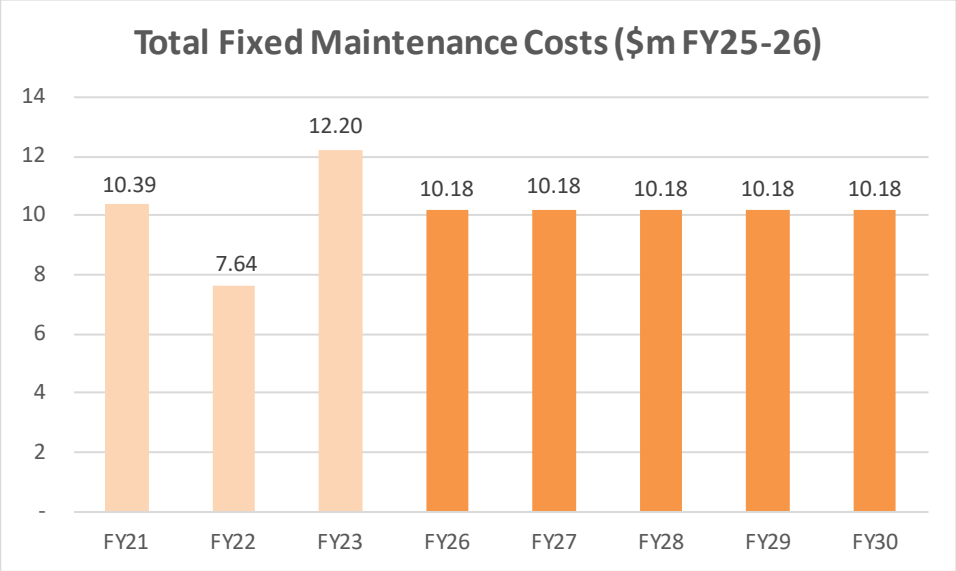

Figure 3-8 Fixed maintenance costs, historical and projected
Source: QR DAU3

Maintenance costs were also provided according to cost type. Table 3-8 reflects our assessment of maintenance expenditure for the total DAU3 amount. We used the figures from DAU3, instead of the detail provided through the RFI, as DAU3 provided historical figures for FY2021-23. We requested

for a further breakdown of historical figures for FY2021-23. Since these were not provided, it was difficult to ascertain a recent comparison of actual figures to the granular detail provided for projected maintenance expenses as per RFI.

From the assessment in table A-3 as per Appendix A, we are unable to deem the following maintenance expenses reasonable:

- Repairs
- Renewals
- Turnout Maintenance
- Lubrication
- Other

In addition to this, we did not identify structural repairs as a maintenance cost within these forecasts. We would expect that structural repairs such as timber bridges, would be required as these would deteriorate over time due to change in tonnage, climatological circumstances, temperature effects and/or rotting of wood.

4 CONCLUSION

Arcadis has based its reasonableness assessments on information provided by QR as well as information gained during the site visit. We did not receive all requested information, particularly relating to breakdowns and granular detail of maintenance and operating expenses (both historical and forecasted). We based our assessment on the WMS being able to handle tonnage of a maximum of 9.6mtpa during DAU3 period 2025-2030.

Our final capital expenditure amount that we deem reasonable for the 9.6 mtpa scenario is $224.8m (table 4-1). Table 4-2 reflects the capex that will be spent across the DAU3 period. We have proposed to significantly reduce capital expenditure three areas:

- Track reconditioning
- Re-sleepering
- Bridge pier replacement

We have removed the capital expenditure cost from these areas. However, we have not reallocated these activities into maintenance as we have suggested in our analysis. We do not have enough information to approximate the cost of maintenance. However, we anticipate that QR will have a view on this, as they have maintained these sections in prior periods.

We have suggested to reallocate spend from capex and into maintenance expenditure for the following reasons:

- Current maintenance programs are successful
- Sections of track where capex has been removed are sections with lower forecasted tonnage relative to other sections of track (Toowoomba Range)
- A capex program of $346.9m over five years may be difficult to achieve, should labour constraints and internal approval processes hinder the process

Table 4-1 – Summary of DAU3 submission for years 2025-2030 and Arcadis' findings

Expenditure Type	DAU3 Value ($2025-26 million)	Arcadis Value ($2025-26 million)
Capital Expenditure	346.9	225.8
Operating Expenditure	85.3	69.4
Maintenance Expenditure	172.5	128.0

Source: QR DAU3, Arcadis

Table 4-4 – Summary of Capital Expenditure per year as per Arcadis findings ($FY2025-26 million)

Section	FY25-26	FY26-27	FY27-28	FY28-29	FY29-30	Total
Rosewood- Jondaryan	66.6	70.0	10.1	15.4	7.5	**169.6**
Jondaryan - Macalister	16.2	17.0	4.3	5.3	3.2	**46.0**
Macalister - Columboola	0.0	0.0	1.5	1.6	6.9	**10.0**
Total	**82.8**	**87.0**	**16.0**	**22.3**	**17.6**	**225.8**

Source: QR DAU3, Arcadis
Note: Rounding

Total reasonable operating costs sum to $69.4m across the DAU3 period, or $13.9m per year. We deemed $128.0m of maintenance expenditure reasonable for the entire DAU3 period.
The categories in operating expenditure and maintenance expenditure that we do not deem reasonable are as follows:

- Corporate overhead
- Repairs
- Renewals
- Turnout maintenance
- Lubrication
- Other maintenance costs

Our assessment also recognises that structural repairs was not included in the maintenance expenditure and may be missing from these costs. Table 4-3 shows our reasoning behind our final maintenance and operating expenditure numbers and table 4-4 shows the maintenance spend across the DAU3 period.

Table 4-3 –Operating and maintenance expenditure deemed not reasonable

Expenditure Type	Operating or maintenance expenditure	Arcadis commentary
Corporate Overhead	Operating	Unable to ascertain reasonableness with current information. Discussion of 'revised allocator' included in QR DAU3, without provided methodology.
Repairs	Maintenance	In light of all rail replacement in the capital works, this amount is too high.
Renewals	Maintenance	Insufficient information to understand renewals. Structural renewals are not included in this amount and may be missing in maintenance expenditure.
Turnout maintenance	Maintenance	We would expect that turnout maintenance would be higher due to their high maintenance requirements.

Lubrication	Maintenance	We would expect higher lubrication costs, particularly as tonnage increases.
Other maintenance costs	Maintenance	Due to insufficient information, we are unable to deem this as reasonable.

Source: Arcadis

Table 4-4 – Summary of maintenance and operating expenditure per year as per Arcadis findings ($FY2025-26 million)

Expenditure type	FY25-26	FY26-27	FY27-28	FY28-29	FY29-30	Total
Maintenance	24.5	26.1	26.1	25.9	25.5	**128.0**

Source: QR DAU3, Arcadis

In conclusion, our evaluation revealed discrepancies in proposed capital expenditure plans, notably the lack of explicit references to enhancing Operational Capacity by addressing crucial factors like improved headways, increased passing opportunities, or higher linespeeds. These oversights raised concerns regarding the system's ability to effectively achieve the projected tonnages despite the significant investment in capital and maintenance activities.

When considering the West Moreton System (WMS), it is vital to acknowledge the need for paths to navigate the Brisbane Metropolitan system, where they intersect with QR suburban passenger and intermodal traffic bound for the Port of Brisbane. Drawing on our expertise in Operational Planning and Performance within rail networks across Australia and globally, it is standard practice to maintain a certain level of technical capacity to ensure consistent day-to-day operations. However, the extent to which this aspect has been addressed within the WMS remains unclear based on the available information. Therefore, we recommend that the QCA evaluate the system's operational and performance capacity vis-à-vis the proposed tonnages and the OPEX and CAPEX programs under consideration.

The historical origins and construction challenges of the West Moreton System underscore the necessity for a higher level of intervention due to operational constraints. The review of the 2016 published Western Moreton System Information Pack revealed limited allowable gross tonnages for different sections, indicating the need for updated information to align with current tonnage projections. Significant operational hurdles are anticipated in transporting the projected tonnage through the Toowoomba Range due to infrastructure limitations, maintenance demands, and potential reliability issues.

Arcadis recommends implementing proactive asset management strategies, including the adoption of predictive maintenance with leading indicators to minimize inefficient maintenance practices and enhance long-term maintenance cost efficiency. It is crucial to develop and propose such strategies for implementation to optimise performance, mitigate risks, and manage investments effectively. As part of this approach, we suggest revising the asset management strategy, evaluating reliability capacity, and engaging stakeholders to understand the value framework. By consulting with stakeholders and aligning with industry best practices, QR can optimise the balance between performance, risk, and investment. Leveraging QR's comprehensive knowledge of the track, proactive measures can be taken to address operational challenges and ensure the system's sustained efficiency and reliability over time.

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APPENDICES

A. TABLES

Table A-1 - West Moreton System Tonnage by Mine

Mine	Company	Tonnage Capacity
Cameby Downs	Yancoal	2.5mtpa
Wilkie Creek	New Wilkie Energy	[redacted] mtpa
New Ackland	New Hope	[redacted] mtpa

Source: Queensland Rail's DAU3

Table A-2 – Capital expenditure DAU3 figures compared to Arcadis findings

No.	Project name	DAU3 Amount ($FY2025-26 million)	Arcadis Amount ($FY2025-26 million)	Arcadis assessment on capex	Arcadis commentary
1	Slope Stabilisation	[redacted]	[redacted]	✓	Slope instability on a railway poses significant risks. The geological formation of the Toowoomba slope coupled with increasing inclement weather events and increasing rail traffic load increase the risk of this occuring Arcadis assess that this is reasonable allowance based on a assessment of the Range conditions.
2	Culvert Renewals	[redacted]	[redacted]	✓	Arcadis assesses that this is reasonable for an aging system and the 9.6 mtpa scenario.
3	Track Reconditioning	[redacted]	[redacted]	x	Reallocate track conditioning capex from Koomi to Dalby, Dalby to Macalister and Macalister and Columboola to maintenance.
4	Formation Strengthening	[redacted]	[redacted]	✓	Part of on-going track renewal program. In consideration of the geological formation, aging sub-standard track system and increased performance and reliability requirement under 9.6 mtpa Arcadis has assessed this is reasonable allowance.
5	Curve Transitions	[redacted]	[redacted]	✓	Curve transition is an accepted good practice in optimising maintenance and performance on curved track. Assessed as reasonable.

6	Re-sleepering	[redacted]	[redacted]	x	Arcadis recommends QR adopt a policy of continuing maintenance and monitoring in selected sections. Reallocate capex costs relating to Macalister and Columboola section to maintenance
7	Re-railing	[redacted]	[redacted]	✓	Replacement of rail that reached end of life and is sub-standard. Arcadis acknowledged rail defects and breaks which increase risks of derailment. In consideration Arcadis assesses that for the 9.6 mtpa tonnage this is a reasonable allowance to address safety and operational risk.
8	Level Crossing Transitions	[redacted]	[redacted]	✓	Arcadis assesses this is reasonable in consideration of the 9.6 mtpa and to address safety critical level crossing issues.
9	Ballast Undercutting	[redacted]	[redacted]	✓	Ongoing program and necessary to address track stability. However, it is noted that this practice of track lowering is potentially an outcome of unsustainable practices and where possible, should be phased out in in lieu of track formation and more sustainable solutions. Noting the geological and historical legacy of the system, the level of expenditure is aassessed as reasonable.
10	Bridge Pier Replacement	[redacted]	[redacted]	x	By replacing only very poor condition elements under a capital program of works, the remaining elements could be returned to the ongoing predictive maintenance program.
11	Signalling Cables	[redacted]	[redacted]	✓	By replacing only very poor condition elements under a capital program of works, the remaining elements could be returned to the ongoing predictive maintenance program.
12	Digital Telemetry	[redacted]	[redacted]	✓	Arcadis assesses that this is reasonable for an aging system potentially unserviceable asset and the 9.6 mtpa scenario
13	SER/PER Upgrade	[redacted]	[redacted]	✓	Life expired analogue based system Assessed as reasonable.
14	LED Upgrade	[redacted]	[redacted]	✓	Life expired again asset. Assessed as reasonable.
15	Re-signalling	[redacted]	[redacted]	✓	Assessed as reasonable to replace obsolete and ensure reliability of the asset.

16	Interlocking Renewal	[redacted]	[redacted]	✓	Life-expired and potentially obsolete system which will impact reliability. Assessed as reasonable for the 9.6 mtpa.
17	Refurbishment	[redacted]	[redacted]	✓	Replacement of end of life equipment. Assessed as reasonable for the 9.6 mtpa.
	Total	**346.9**	**225.8**		

Source: Queensland Rail DAU3, Arcadis

Table A-3 – Assessment of maintenance expenditure – costs

Maintenance expense type	DAU3 Amount 2025-2030 ($FY2025-26 000s)	Arcadis reasonable-ness assessment	Arcadis commentary
Mechanised Resurfacing	[redacted]	✓	Maintaining track geometry is tonnage and speed dependent. We note that this comprises of 19% of maintenance expense and costs have doubled relative to historic actuals. Arcadis deems this as high and would recommend that part of this cost be relocated to formation repairs, which is considered a more sustainable solution, especially to address areas which are being repeatedly resurfaced
Rail Stress Adjustment	[redacted]	✓	Arcadis notes that there is not a significant increase considering the tonnage increase. This is a significant item in maintenance and is a safety critical item, which Arcadis assesses as reasonable.
Repairs	[redacted]	x	In light of all rail replacement in the capital works, Arcadis assess that this amount is too high and that the budget be reduced for these works.
Sleeper Management	[redacted]	✓	Arcadis notes the availability and unsuitability of modern timbers which comes with an associated cost. Due to increased tonnage and availability of resources Arcadis has assessed this amount reasonable.
Maintenance Ballasting	[redacted]	x	Considering the topology such as black soil, Arcadis has assessed partially assessed this as reasonable. However Arcadis requests further clarification on this item
Rail Joint Management	[redacted]	✓	Considering the presence of black soil and the Range alignment, this work is reasonable. However Arcadis

Maintenance expense type	DAU3 Amount 2025-2030 ($FY2025-26 000s)	Arcadis reasonable-ness assessment	Arcadis commentary
			proposes Queensland Rail consider a more sustainable approach in transitioning to CWR and implementation of efficient joint designs that minimise stress concentrations and maximise joint durability.
Top & Line Spot Resurfacing	[redacted]	✓	Considering the presence of black soil and the Range alignment, Arcadis assesses this reasonable for the 9.6 mtpa.
Signalling	[redacted]	✓	Maintenance of signalling equipment is mainly driven by safety and legislative compliance drivers. As per our analysis and using our professional experience, Arcadis assess this budget reasonable.
Assets Comp Insp/Svc	[redacted]	✓	This is 6% of total maintenance across the DAU3 period. We note that blocking track entails coordination, paperwork and time which are all associated with costs. Arcadis assess the inspection frequency as compliant we deem it reasonable.
Fire & Vegetation Management	[redacted]	✓	This figure is consistent with prior year actuals This is a predictive maintenance expense. Therefore, we deem it reasonable.
Renewals	[redacted]	x	Insufficient information to understand renewals. Structural renewals are not included in this amount and may be missing in maintenance expenditure.
Asset Inspections Non Compliance	[redacted]	✓	Arcadis assess the track inspection as consistent with CETS requirement and the budget reasonable for the 9.6 mtpa. However, we have been unable to locate structural inspections (CESS).
Consulting/Technical Advice	[redacted]	✓	Although difficult to measure or benchmark this item, considering the requirements of a functional railway of the size and complexity of WMS Arcadis assess this proposal reasonable for our scenario.
Telecoms	[redacted]	✓	Arcadis understand that this relates to upgrading train-based communications on a yearly basis. This figure is consistent with prior year actuals and note that much of the

Maintenance expense type	DAU3 Amount 2025-2030 ($FY2025-26 000s)	Arcadis reasonable-ness assessment	Arcadis commentary
			assets are reaching end of life. Arcadis assesses the proposed as being reasonable to ensure the safe operation of the railway.
Earthworks - Non Formation	[redacted]	✓	This figure is consistent with prior year actuals. This is an indicator of required maintenance and excludes any capital works. Arcadis assesses this as reasonable in consideration of the topology and age of the system.
Turnout Maintenance	[redacted]	x	This figure appears low. We would expect that turnout maintenance would be higher due to their high maintenance requirements. These costs may be embedded elsewhere in maintenance. We do not deem these reasonable as these costs are lower than expected. Insufficient information to provide estimate.
Electrical	[redacted]	✓	Considering the low level of electrical complexity associated with WMS, Arcadis assesses the proposal is reasonable.
Lubrication	-	x	We would expect higher lubrication costs, particularly as tonnage increases. Deem this as not reasonable.
Other	12,090	x	Due to insufficient information, we are unable to deem this as reasonable.
Total	**173,100**		

Source: QR DAU3, Arcadis

B. LIST OF DOCUMENTS PROVIDED

The following is a list of all documents provided by Queensland Rail for this review:

Initial submission

- DAU3 Explanatory Document
- AU3 Model 31.10.23 (QR 9.6mtpa) v1.0 for QCA
- HoustonKemp – Coal Throughput Analysis 2023
- OTCI Detailed Data

Fixed and Variable information

- AU1 B&H review (section of report) – fixed variable maintenance proportions (section of report)
- AU1 B&H review (section of report) – fixed variable other operating proportions
- Maintenance fixed and variable components
- Operating costs - fixed and variable components

Management plans and programs

- Far West Moreton Asset Strategy (Jondarayan to Columboola) (2020)
- Service Investment Plan (Rosewood to Miles)

Capex project documents

- Timber resleepering business case example
- Range track relay business case example
- West Moreton Reconditioning 21-23 business case
- Rerail Kingsthorpe-Oakey Summary
- Toowoomba Range slope stabilisation strategy
- Toowoomba Range slope stability business case
- Toowoomba Range stabilisation risk considerations and action plan
- Formation repair treatment and considerations
- Telecommunications maintenance standard
- Bridge renewal business case

Paths

- TSR Speed Restriction system details (2023)
- West Moreton Pathing high level

Standards

- Hot weather precautions for track stability
- Pole inspection and assessment
- Toowoomba range wet weather guidelines
- Telecommunications equipment room and site maintenance
- Signalling maintenance
- CESS
- CETS
- Network operations south cold weather precautions for track

Other

- 2018-19 Below Rail Financial Statements
- 2019-20 Below Rail Financial Statements
- 2020-21 Below Rail Financial Statements
- AU1 Final decision – fixed variable maintenance proportions
- AU2 Final decision – fixed variable maintenance proportions
- West Moreton system information pack
- West Moreton Curves

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