

# Project Evaluation Summary

## METRONET: Yanchep Rail Extension

**Proponent** Western Australian Government  
**Evaluation date** 18 October 2018

### Contents

1. Summary .....	1
2. Strategic context .....	2
3. Problem description .....	2
4. Proposal .....	3
5. Options identification and assessment .....	4
6. Economic evaluation .....	4
7. Deliverability .....	6



### 1. Summary

Infrastructure Australia has added the **Yanchep Rail Extension** project to the Infrastructure Priority List as a **High Priority Project**.

Perth’s north-west sub-region is experiencing rapid population growth. At present, the population is relatively evenly distributed between the cities of Joondalup and Wanneroo. After 2021, the north-west sub-region planning framework anticipates that the rate of population growth will be considerably stronger in the City of Wanneroo due to its supply of undeveloped urban zoned land and continuing demand for coastal living. By 2050, the City of Wanneroo is projected to accommodate nearly three quarters of the sub-region’s total population.

Without high-quality public transport services, Perth’s growing, but low-density, northern suburbs risk having high levels of car ownership and travel. This is already placing pressure on the road network and causing congestion. Recognising the nationally significant productivity losses from congestion in Perth, the Perth CBD – North Corridor Capacity Initiative is currently included as a High Priority Initiative on the Infrastructure Priority List.

The Yanchep Rail Extension is a project within the Western Australian Government’s METRONET rail program. It would extend the Joondalup Line from Butler Station to Yanchep, 14.5 kilometres to the north, with new stations at Alkimos, Eglinton and Yanchep. Extending the rail line to this growth area would provide more transport choices for residents and reduce demand on the roads, particularly in the peak periods.

Infrastructure Australia strongly recommends planning for increased density within cities, rather than encouraging people to live in outer urban areas that are far from centres of employment and education. To achieve this, Perth’s northern urban boundary should be maintained to encourage more sustainable development patterns and to avoid the need for further extensions of the Joondalup Line.

The Western Australian Government’s stated benefit-cost ratio for the project is 2.6, with a net present value of \$1,571 million excluding wider economic benefits (using a 7% real discount rate and a P50 capital cost estimate).

The evaluation found limitations in the business case which overstate the benefits estimated by the proponent. However, Infrastructure Australia is confident that the benefits of the project will clearly exceed its costs, supporting economic growth and improving the quality of life for people in the north-west sub-region.

## 2. Strategic context

Perth's population has grown strongly over the past 20 years. In the decade to 2001, the population grew at an average annual growth rate of 1.5%. This increased to 2.6% during the mining investment boom (2002 to 2012), before falling to 0.9% between 2013 and 2016. The population is expected to grow at 1.9% from 2017 to 2050, which compares to around 1.3% across Australia over the same period. Perth's urban footprint stretches along a 150 kilometre north-south corridor along the coast, reflecting lifestyle choices and community preferences. The resulting low density urban environment is a legacy of historical urban planning principles.

Since the 2000s, planning controls sought to encourage greater urban infill and increased density. However, there is still significant growth in outer areas such as Armadale, Belmont, Cockburn, Gosnells, Kwinana, Rockingham, Stirling, Swan, and Wanneroo. Some of these growth areas are far from Perth's CBD and the low-density development patterns have led to high car use compared to other capital cities in Australia.

Greater Perth's metropolitan strategy, *Perth & Peel @ 3.5 million*, forecasts that the metropolitan population will grow from around 2 million people in 2017 to 2.9 million people by 2031, reaching 3.5 million people by 2050. It seeks to encourage greater urban consolidation and to create more integrated and connected transport networks.

Yanchep is located in the north-west sub-region and has been one of the fastest growing areas in Greater Perth over the past decade. The population living to the north of Butler station is forecast to grow by 16.6% each year on average to 2031, due in part to the availability of more affordable land and the demand for coast living.

The north-west sub-region is expected to accommodate an additional 170,000 dwellings between 2011 and 2050, predominantly around the emerging population centres at Butler, Alkimos and Yanchep. High population growth is forecast in this area, with the population increasing from 322,500 people in 2011 to over 740,000 people by 2050 (an average annual growth rate of 2.2%). However, the employment self-sufficiency in this sub-region has been historically one of the lowest across Greater Perth. Strategic plans are seeking to achieve a substantial rate of jobs growth, supported by new activity centres such as Yanchep.

The transport network in the north-west sub-region is primarily road based, with the main routes being Marmion Avenue, Wanneroo Road and Mitchell Freeway. The public transport network is limited, with six bus routes providing feeder services to the rail network at Butler, 14 kilometres south of Yanchep.

Growing urban congestion in the north-west of Perth is recognised as a nationally significant problem on the Infrastructure Priority List through the Perth CBD – North Corridor Capacity High Priority Initiative, which identified the extension of the Joondalup Line from Butler to Yanchep, and an extension of the Mitchell Freeway from Hester Avenue to Romeo Road.

## 3. Problem description

The Yanchep Rail Extension seeks to address three problems:

- Congestion due to a lack of efficient transport alternatives and an urban form that promotes car dependency.
- Continued development of land in a way that is focused on private vehicle use and parking which limits the ability to create higher density locations and meet employment targets.
- Social inequality and lower levels of opportunity for people who do not own or cannot use a private vehicle.

There is also an opportunity to embed public transport into developing growth areas and reduce reliance on cars by integrating transportation with land use planning, given that the precincts around the proposed Yanchep Station are relatively undeveloped.

Travelling between Yanchep and the Perth CBD (around 55 kilometres) currently takes between 50 minutes and 1 hour 15 minutes by car. Congestion on the Mitchell Freeway in the morning peak period results in an average speed of approximately 50 km/h, compared with a posted speed limit of 100 km/h. Using public transport for the same journey takes approximately 1 hour 10 minutes, including a transfer from buses to rail at Butler Station. Even with committed and funded transport investments and increased bus services to Butler Station, the proponent estimates that:

- **For cars:** Travel times will more than double by 2031 in the AM peak, with volumes forecast to reach 50% to 90% of capacity on Marmion Avenue (Yanchep to Butler), and 90% to over 100% of capacity on Wanneroo Road (Yanchep to Perth CBD).
- **For rail:** The Joondalup Line is the busiest rail line in Perth for peak boardings, averaging more than 36,000 weekday passengers each day. Butler Station movements (entries and exits) are forecast to quadruple from the current 1,200 to around 5,000 by 2031 in the two-hour AM peak.
- **For buses:** Crowding on buses between Two Rocks and Butler will exceed capacity in the decade to 2031 despite service frequencies assumed to increase from 13 per hour (one-hour AM peak) to 18 per hour.

The proponent has estimated undiscounted congestion costs over the next 30 years at \$183 million per year using projections from the Strategic Transport Evaluation Model (STEM). The definition of the base case, which mostly includes committed and funded investments<sup>1</sup> and limited bus service improvements, is a key driver of the size of this cost. This is because low bus service frequencies (an additional five services across all routes by 2031) will lead to crowding and wait times, thereby encouraging driving. The increase in traffic volumes would result in unrealistically slow travel speeds. A more appropriate “do minimum” base case could increase bus services slightly to accommodate some of the future demand.

Road access to Butler Station bus interchange is currently provided through a public road that also serves an adjacent suburban shopping centre. The proponent states that it would require an increasingly expensive capital upgrade to manage forecast demand (although capital cost estimates have not been provided to Infrastructure Australia). As the main north-south road servicing the corridor, Marmion Avenue will also come under increasing pressure with further land development. New land sub-divisions will seek to build new direct road connections to Marmion Avenue, resulting in a large number of additional signalised intersections and roundabouts. Together with higher traffic volumes, this will worsen the performance of bus services over time.

## 4. Proposal

The project would extend the Joondalup Line from Butler Station approximately 14.5 kilometres north to Yanchep, with new stations at Alkimos and Eglinton, and terminating at the Yanchep Strategic Metropolitan Centre.

The defined alignment of the railway is a relatively narrow parcel of land between Marmion Avenue and the reservation for the future extension of the Mitchell Freeway. This requires the railway to be in a cutting for the majority of the route, with most of the railway just under five metres below ground level. This allows for roads to connect over the railway, avoids ‘at grade’ level crossings, and shields adjacent developments from some of the noise, vibration and visual intrusion of the rail line.

The scope of the project includes:

- A 14.5 kilometre rail extension from Butler to Yanchep
- New stations at Yanchep, Alkimos and Eglinton, with up to 1,000 parking bays at each station for park-and-ride. Initially, 400 parking bays would be provided at Eglinton station and 600 at Alkimos station
- Grade separations and over-bridges at key road crossings
- Changing the Joondalup Line rail operating plan to provide six train services per hour between Yanchep and Mandurah in the AM peak. A further six train services per hour would operate between Whitfords and the CBD

---

<sup>1</sup> The base case also assumes the uncommitted Mitchell Freeway Extension in 2031, as this was required for the STEM demand model to converge on a solution with relatively high volumes and low speeds. The Infrastructure Australia Assessment Framework recognises that, in high growth areas, incremental capacity enhancements may be needed to obtain realistic future demand estimates.

- Changing the bus network to provide feeder services to Yanchep town centre, Eglinton Station and Alkimos Station. The revised bus network would require 26 new buses in 2021 and an additional 32 buses in 2031
- Expanding the existing bus interchange at Butler
- A travel demand management program to encourage uptake of the new public transport services.

## 5. Options identification and assessment

The proponent identified a long-list of options to address the three problems identified above, which were assessed using a qualitative multi-criteria analysis to select the preferred scope of the project. This was supported by a rapid economic appraisal of the heavy rail option, which was compared to light rail and bus rapid transit options.

The long-list of options was developed by a wide range of stakeholders and included a “do-minimum” option, a regulatory reform option, and nine capital investment options. While the investment options ranged across multiple transport modes, identifying other options based on regulatory reform, governance reform and making better use of existing assets would have improved the rigour of the process.

The proponent used multi-criteria analysis to assess the long-list options against a range of criteria, including reducing road network congestion, improving accessibility and connectivity, and whole of life costs. These criteria reflected the objectives of the project but, in some instances, were not mutually exclusive (such as increasing capacity, compared to improving accessibility and connectivity). Options were also rated against each criterion using an uneven and asymmetric scale of -1 to 3. These limitations could impact on the multi-criteria analysis results, particularly for lower cost options such as increasing bus services to Butler Station.

The multi-criteria analysis process found the following three options to have the highest scores:

1. Extend Joondalup Line from Butler to Yanchep (highest scoring option)
2. Light Rail between Butler and Yanchep
3. Bus Rapid Transit between Butler and Yanchep.

The proponent reviewed each option further to reaffirm that the ‘Extend Joondalup Line from Butler to Yanchep’ was the preferred option. The proponent also completed a rapid cost-benefit analysis of each option to support this finding, with this option resulting in the highest estimated benefit-cost ratio and net present value. This was the option taken forward to the final cost-benefit analysis. However, the rapid cost-benefit analysis also showed that the bus rapid transit option was the next best alternative in terms of both benefit-cost ratio and net present value. This differed from the multi-criteria analysis findings, which scored the light rail option as the next best alternative.

Infrastructure Australia strongly supports the use of rapid cost-benefit analysis to assess a shortlist of options compared to the use of multi-criteria analysis, which often relies heavily on qualitative and subjective scoring. The multi-criteria analysis for the project could have been improved by using more quantitative measures for scoring, and by addressing the issues identified above with overlapping criteria and an unbalanced scoring system.

Infrastructure Australia also recommends that business cases consider at least two options in detail, in addition to the base case, for transparency and comparability.

## 6. Economic evaluation

The proponent’s stated benefit-cost ratio for the project is 2.6 excluding wider economic benefits, with a net present value of \$1,571 million (using a 7% real discount rate and P50 cost estimates). The major benefits of the project are travel time savings for public transport users (38% of total) and road users (30%), as well as lower road vehicle operating costs (12%). Encouraging more public transport use will also reduce car crashes and environmental emissions from cars.

The proponent has estimated that the project could generate an additional \$799 million in wider economic benefits, resulting in a net present value of \$2,370 million and a benefit-cost ratio of 3.4. However, the project could potentially encourage urban sprawl to the north of Perth, and support population centres located away from commercial centres. As the methodology for quantifying wider economic benefits in Australia is still under development, wider economic benefits have been considered as an upside sensitivity to avoid potential double counting.

The proponent’s capital cost estimates in the business case include potential procurement cost savings from combining the Yanchep Rail Extension with the Thornlie-Cockburn Link. However, the proponent has submitted separate business cases for the two projects to Infrastructure Australia. On this basis, each project has been assessed individually on its merits, rather than as part of a program (which would include cost savings and shared benefits).

Infrastructure Australia has also identified issues with how some of the benefits of the project have been estimated. As noted in Section 3, the “do-minimum” base case presented in the business case includes minimal improvements to bus services, which increases wait times and crowding for buses, forcing more people on to the road network and unrealistically worsens road congestion. Adjusting the base case to include more reasonable improvements in bus services would reduce the benefit-cost ratio of the project.

The project would encourage more people to use the rail network instead of driving, which would result in lower vehicle operating costs, crashes and emissions for people who switch modes, and also for people who continue to use the road network (because of lower traffic volumes). However, the cost-benefit analysis attributes a significant proportion of these benefits to commercial vehicles, because of reduced congestion and less vehicle kilometres travelled. This implies that a large number of commercial vehicles are choosing different routes, which is not a typical outcome of public transport projects. Adjusting the commercial vehicle proportion of these benefits would slightly reduce the benefit-cost ratio for the project.

The proponent has included benefits from a travel behaviour change program which encourages people near the link to use public transport. While we support programs which promote public transport use, there is insufficient evidence in the business case to support the size of the benefits claimed in the economic appraisal.

On the other hand, some impacts of the project were not included in the cost-benefit analysis, such as a potential increase in employment self-sufficiency that reduces congestion on routes to Perth’s CBD. Including the impacts of land use changes would provide a more comprehensive view of the project’s costs and benefits. Other unquantified impacts include potential reliability improvements in the bus and train services along the corridor, and the potential to run higher frequency services.

Taking these upside and downside issues into account, and after testing the project against a range of possible scenarios, Infrastructure Australia is confident that the project will provide substantial net benefits to the Australian economy.

A breakdown of the proponent’s reported capital costs and funding is presented in the table below.

### Capital costs and funding

<b>Total capital cost</b>	Pending (see endnote)
Proponent’s proposed Australian Government funding contribution	80% of the estimated project capital costs
Other funding (source / amount / cash flow) (nominal, undiscounted)	The Western Australian Government is funding the balance of the project.

The following table shows the proponent's stated benefits and costs of the project.

### Benefits and costs breakdown by the proponent

Proponent's stated benefits and costs		Present value (\$m, 2017/18) @ 7% real discount rate	% of total
<b>Public transport user benefits</b>			
Public transport travel time savings		\$981	38%
Increase in public transport fare revenue		\$113	4%
Crowding benefit		\$160	6%
Improve amenity		\$31	1%
Benefit of travel demand management		\$8	0%
<b>Road user benefits</b>			
Road user travel time savings		\$760	30%
Reduction in unperceived road vehicle operating costs		\$297	12%
Road crash savings		\$39	2%
<b>Community and broader benefits</b>			
Other externality cost savings (air pollution, noise, etc.)		\$156	6%
Residual capital value		\$4	0%
<b>Total benefits<sup>1</sup></b>		<b>\$2,549</b>	<b>(A) 100%</b>
<b>Total capital and operating costs</b>		<b>\$977</b>	<b>(B) 100%</b>
<b>Core results</b>	<b>Net benefits - net present value (NPV)<sup>2</sup></b>	<b>\$1,571</b>	<b>(C) n/a</b>
	<b>Benefit-cost ratio (BCR)<sup>3</sup></b>	<b>2.6</b>	<b>(D) n/a</b>
<b>Results including Wider Economic Benefits</b>	Wider Economic Benefits (WEBs)	\$799	(E) n/a
	<b>Net benefits – NPV with WEBs<sup>4</sup></b>	<b>\$2,370</b>	<b>(F) n/a</b>
	<b>BCR with WEBs<sup>5</sup></b>	<b>3.4</b>	<b>(G) n/a</b>

Source: Proponent's Business Case

Notes:

(1) Totals may not sum due to rounding.

(2) The net present value (C) is calculated as the present value of total benefits less the present value of total costs (A – B).

(3) The benefit-cost ratio (D) is calculated as the present value of total benefits divided by the present value of total costs (A ÷ B).

(4) The net present value with WEBs (F) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) – B)

(5) The benefit-cost ratio with WEBs (G) is calculated as present value of total benefits with WEBs less the present value of total costs ((A + E) ÷ B)

## 7. Deliverability

The proponent has developed a delivery strategy for the project. The proponent's 'Project Definition Plan' recommends:

- Bundling the main project works for Thornlie-Cockburn Link with Yanchep Rail Extension into a single Competitive Alliance contract
- Design and Construct contracts to procure forward works on each site
- Procuring professional services using the Public Transport Authority Long Form of Consultancy Contract with the option to include additional projects based on performance.

If these projects were not able to be delivered jointly under a single competitive alliance contract, the proponent considers that capital costs could increase slightly due to forgone efficiencies.

It is also noted that capital cost estimates exclude costs for rolling stock and for stabling and maintenance facilities, as they have been already funded under a different business case. The business case also excludes some land acquisition costs as they have been treated as sunk costs in this project. However, it is generally best-practice to include all project related costs and benefits within the project business case.

The capital cost estimates (including risk contingency) have been reviewed on behalf of the Department of Infrastructure, Regional Development and Cities. The review estimated a most likely total outturn capital cost that was 1.8% (P50) to 1.5% (P90) lower than the original estimate. This provides Infrastructure Australia with a relatively high degree of confidence in the rates and contingency in the capital cost estimates.

Planning and delivery of the project would be in accordance with the METRONET Governance Framework. The State Government's proposed joint land development agency and/or the Western Australian Planning Commission would be responsible for working in collaboration with local government, communities and stakeholders to establish detailed planning frameworks for each station precinct.

A number of potential funding sources for the project have been identified by the proponent, including fare box revenue, value capture around new station precincts (development contribution), federal funding and state funding. However, Infrastructure Australia has not been provided with a financial model which demonstrates the viability gap and the impact of different delivery options or funding solutions, and strongly recommends that this be completed before the project proceeds.

The proponent has completed a risk assessment in accordance with the METRONET Risk Management Framework and PTA's Risk Management Procedures. This includes assigning to risk owners the responsibility for identifying mitigation strategies and monitoring completion of these strategies, and probabilistic quantification of risks in capital cost estimates. The most significant risks identified include systemic variations risk from managing a large, multi-disciplinary project, station and platform uncertainty from evolving design and owner's cost risk uncertainty relating to project estimates for costs such as design and subsoil investigations. Overall, the risk assessment and mitigation approach appears appropriate.

Benefits realisation will be managed by the METRONET Office. A Benefits Management Plan has been developed for the project. This includes an overview of benefits and the framework for benefits management, but does not define specific benefit owners or key performance indicators. We strongly recommend that this be completed before the project proceeds, and that demand and policy measures be used to encourage users to switch to public transport and meet the objectives of the project. The proponent should also undertake a post-completion review to understand how the costs and benefits of the project compare to the business case.

Although the project objectives include acting as a catalyst for places of employment and supporting more consolidated (higher density) urban form, the resulting land use and urban renewal benefits have not been quantified or proposed for monitoring and reporting in the Benefits Management Plan. It is critical that urban planning responds to the proposed investment, to enhance walkability and access to public transport, jobs and services.

A Yanchep City Centre Activity Centre Plan and Alkimos City Centre Activity Centre Plan have been developed, which set out dwelling targets and commercial floor space. Development of the equivalent planning documents for the Eglinton Station precinct is at an earlier stage, with ongoing interaction between the METRONET Project Office and relevant land owner. Infrastructure Australia strongly recommends that this is completed before the project proceeds.

The Western Australian Government's metropolitan planning framework should lead to policies which prevent further urban sprawl beyond Yanchep.

---

This evaluation summary was considered by the Infrastructure Australia Board in October 2018.

Following Infrastructure Australia's process of fact and sensitivity checking the summary with the proponent prior to publication, the summary was amended to exclude the capital cost (nominal, undiscounted) pending the Western Australian Government's clearance for publication.