Economic Regulation Authority

Technical Advice for Regulatory Assessment of Baldivis Substation

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Ampere Labs

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Revision History

Revision No	Date	Author	Reviewer	Revision Description
1.0	27/02/2026	J. Bryant	J. Susanto	Draft report
2.0	27/03/2026	J. Bryant	J. Susanto	Final report
2.1	02/04/2026	J. Bryant	J. Susanto	Minor revisions to final report

Executive Summary

This report supports the Economic Regulation Authority's regulatory test assessment of Western Power's proposed Baldivis zone substation by providing commentary and investigations relating to the technical aspects and net benefit of the preferred and proposed options, the underlying demand forecasts and cost estimates, and the completeness of viable alternative options.

Based on Western Power's application documents and subsequent discussions throughout the course of this review, our view is that:

- The preferred option—building a new zone substation at 60 Pike Rd, Baldivis—appears to be technically reasonable and maximises the net benefit. Primarily, this option reduces delivery time, risk, and cost, as Western Power already owns the land at the proposed site, and it is appropriately zoned. Given the rapid population growth in the Baldivis area, which has led to existing feeder utilisation exceeding the planned capacity, delivering a solution in the shortest timeframe is a key consideration. Western Power is confident in its ability to manage risks associated with reliability, non-compliance, and reputation in the near term (2026-2030) via numerous operational measures.
- The technical aspects of the proposed options and any inadequacies identified by Western Power as they relate to the net benefits appear to be reasonable. None of the alternative options for alleviating the network capacity issue at the Waikiki zone substation appears to be feasible of being delivered faster than the proposed Baldivis zone substation. Moreover, the non-network options were found to provide only temporary relief, and we agree with Western Power's assessment that non-network options would not be suitable as a viable long-term solution.
- Western Power has identified numerous alternative options and considered other suggestions from interested parties. Justification has been provided as to why these options are either unable to deliver the maximum net benefit compared to the preferred option or have been deemed infeasible.
- The cost estimates provided by Western Power appear to be reasonable and broadly align with the Australian Energy Market Operator's Transmission Cost Database (noting that like-for-like comparisons are difficult owing to the database's assumptions and the nature of Western Power's proposed work).
- The underlying methodology for the demand forecast appears to align with industry standards. As the actual Waikiki substation utilisation observed in 2025 is greater than its planned capacity, the sensitivity of the forecast's outcomes to changes in its inputs

(e.g., population forecasts) does not have any impact on our overall assessment of Western Power's proposal.

- The consideration of market development scenarios is not considered relevant for this assessment given the existing strain on the electrical infrastructure in the Baldivis area owing to its rapid population growth.
- As Western Power owns the appropriately zoned land at 60 Pike Rd, Baldivis, and it is in proximity to the existing 22 kV distribution feeders supplying the Baldivis area from the Waikiki zone substation, the delivery timeline (end of 2030) appears to be reasonable since the planning is already at a relatively mature stage.

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1 Introduction

1.1 Scope

The Economic Regulation Authority (ERA) engaged Ampere Labs to supply technical advice to support the regulatory test assessment of Western Power's proposed Baldivis Zone Substation. The engagement's scope includes commentary and investigations related to nine (9) key areas, viz.

1. The technical aspects of Western Power's preferred option—the proposed Baldivis zone substation (covered in Section 2).
2. Whether the preferred option maximises the net benefit after considering all reasonable alternative options (Section 2).
3. The technical aspects of any other alternative options considered (Section 2).
4. Whether Western Power has used reasonable demand forecasts, and if not, how this would affect the decision on the preferred option (Section 3).
5. Whether Western Power fully identified and considered all viable alternative options (Section 4).
6. Whether proposed alternatives submitted by interested parties, if any, are superior or inferior to the preferred option (Section 4).
7. Whether Western Power has used reasonable cost estimates for each option, and if not, how this would affect the decision on the preferred option (Section 4).
8. Whether Western Power has used reasonable market development scenarios (Section 4).
9. Whether Western Power has used reasonable timings for project commissioning dates and construction timetables for the preferred option and for alternative options (Section 4).

This report documents the outcomes concerning the above scope items.

1.2 Glossary

Table 1 lists the acronyms, terms and abbreviations used throughout the report.

Table 1: Glossary of terms

Term	Meaning
BOM	Bureau of Meteorology
BVS	Baldivis

Term	Meaning
CICO	Cut-In Cut-Out
DLPH	Department of Planning, Lands and Heritage
EVT	Extreme Value Theory
MH	Mandurah
ML	Machine Learning
MSS	Meadow Springs
MTF	Medium Term Forecast
PGF	Priority Growth Front
PoE	Probability of Exceedance
RO	Rockingham
RRST	Rapid Response Standby Transformer
SWIS	South West Interconnected System
TSP	Transmission System Plan
WAI	Waikiki

2 Proposal Motivation and Options

This section introduces Western Power's motivations for the proposal and its considered options, addressing scope items 1-3 (as detailed in Section 1.1).

2.1 Context and motivation for the work

Baldivis is a fast-growing area in the southern outskirts of the broader Perth metropolitan area, forming part of the South West Interconnected System's (SWIS's) Mandurah (MH) load area. The majority of the area's loads are currently distribution connected via the Waikiki (WAI) zone substation. Moreover, a small southern portion is fed from the Meadow Springs (MSS) substation.

Figure 1 provides a high-level illustration of the existing electrical arrangement, which includes a 132 kV north-south transmission corridor between WAI and MSS, and 22 kV feeders supplying the Baldivis (BVS) loads. The BVS feeders constitute approximately 50% of 2025 peak WAI feeder load.

Western Power's options paper[1] presents five (5) potential pathways for handling the increased load from projected future population growth in the BVS area, which are summarised below in Table 2. One of the core motivations for undertaking the proposed body of work is the historical and projected future population growth of the City of Rockingham (which includes the BVS area). Discussions with Western Power personnel have identified that the nature of the population growth, and the associated strain on the existing electrical infrastructure, has been rapid.

Table 2: Summary of identified options.[2]

Option No.	Option Description	Net Present Cost	Solution Type
1	Business-as-usual (BAU)	-	Operational
2	Additional transformer at Waikiki Zone Substation	$110.60m	Network
3	Build a new substation at Baldivis (BVS) in 2030	$81.69m	Network
4	Contract network support services cost for deferral of BVS for 3 years	$102.68m	Non-network hybrid
5	Contract network support services cost for deferral of BVS for 5 years	$127.08m	Non-network hybrid

[1] Western Power, "Options Paper Capacity Expansion Project – Proposed Baldivis Zone Substation," accessed online, 2025.
[2] Ibid.

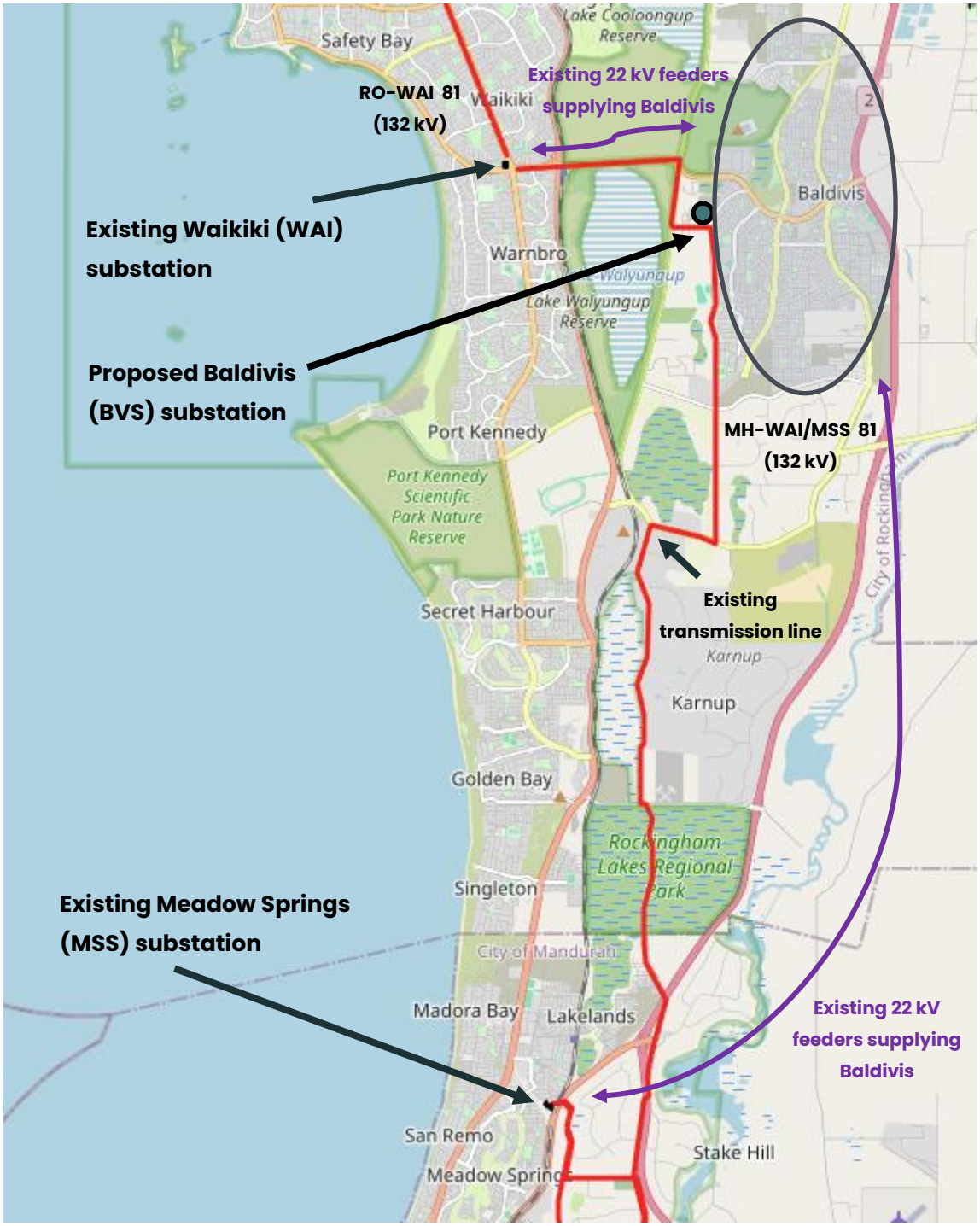

Figure 1: Existing and proposed electrical arrangement for supplying Baldivis loads.

Moreover, the Transmission System Plan 2024 (TSP2024) was based on an earlier demand forecasting methodology that did not encapsulate the rapid growth in factors like population, housing activity, and load growth across the southwest metropolitan region.[3] For example, the

[3] Western Power, "Regulatory Test Query – Baldivis Substation Project ERA-BVS#02 – Responses," 2026.

city's population is now forecast to increase by approximately 91,000 persons between 2021 and 2046 (64% total growth with an average 2% growth per annum). That is, the North Baldivis and South Baldivis areas are projected to experience 5.6% and 1.8% average annual population growth, respectively.[4]

Under the TSP2024, the Baldivis substation was assumed to relieve capacity constraints at WAI, MSS, and MH substations. However, the most recent draft transmission system plan for 2025 reflects that the construction of a new substation at BVS is required solely to address the capacity constraints at WAI, with MSS and MH requiring separate future network solutions.[5]

Hence, the options paper recommends the third option (constructing a new substation at BVS in 2030) on the basis that it provides an appropriate solution at least cost. The proposed project work would establish a new substation at 60 Pike Road, Baldivis, and include the following high-level work scope:[6]

- Installation of 2 x 132 kV line circuits in a cut-in cut-out (CICO) arrangement of the existing MH-WAI/MSS 81 line (refer to
- Figure 1 for the location of the proposed substation).
- Installation of 132 kV busbars for connection of electrical equipment and the provision of future expansion.
- Installation of 22 kV electrical equipment.
- Installation of a new relay room.
- Provision of new structures to accommodate the CICO of the existing line.
- Replacement of overhead conductors and re-routing of existing Baldivis distribution feeders.
- Overall site preparation and development work for the zone substation.

2.2 Proposed options

2.2.1 Business-as-usual

The first option considers deferring any remedial actions for existing operational issues and continuing to implement business-as-usual practices in the face of increased population growth (and thus increasing load in the BVS area and its surrounds). While there is no capital cost associated with this option, the options analysis identifies growing network risks associated with increased network demand. Moreover, ongoing operational expense will result from faults

[4] Western Power (n 1) 2025.
[5] Western Power (n 3) 2025.
[6] Western Power (n 1) 2025.

or outages from overloads.[7] Hence, this option was not recommended by Western Power in the analysis as it was deemed to not satisfactorily resolve the issues associated with reliability, or the operational and reputational risks. It also does not support future load growth or align with the long-term Mandurah load area planning strategy.

2.2.2 Additional transformer at Waikiki substation

The second option proposes installing a new (fourth) 33 MVA transformer at WAI. Since WAI only has three (3) transformer bays, the site must be extended to accommodate the additional transformer and new feeders to Baldivis while maintaining adequate clearances and site access.[8] Hence, the options analysis identifies high cost and complexity with the delivery of this option.

A few pertinent points for this option include: [9]

- With an additional WAI transformer installed in 2028, the WAI PoE10 demand forecast estimates that demand will exceed the new capacity by 2030 (refer to Figure 2 below), thus requiring BVS by the end of 2030. Hence, the new WAI transformer does not resolve the Baldivis load-driven constraints at WAI.
- Three (3) new feeders will be required to transfer the three (3) existing highly loaded feeders from WAI. Each feeder would need to be around 10 km in length and the short-term relief provided by this option may only be provided for as little as 12-18 months.

This option was not recommended by Western Power since it was deemed to only provide short-term relief for the current constraints in the Baldivis area, and at high cost ($110.60m—refer to Table 2) with limited scalability and high implementation complexity.

[7] Ibid.
[8] Ibid.
[9] Ibid.

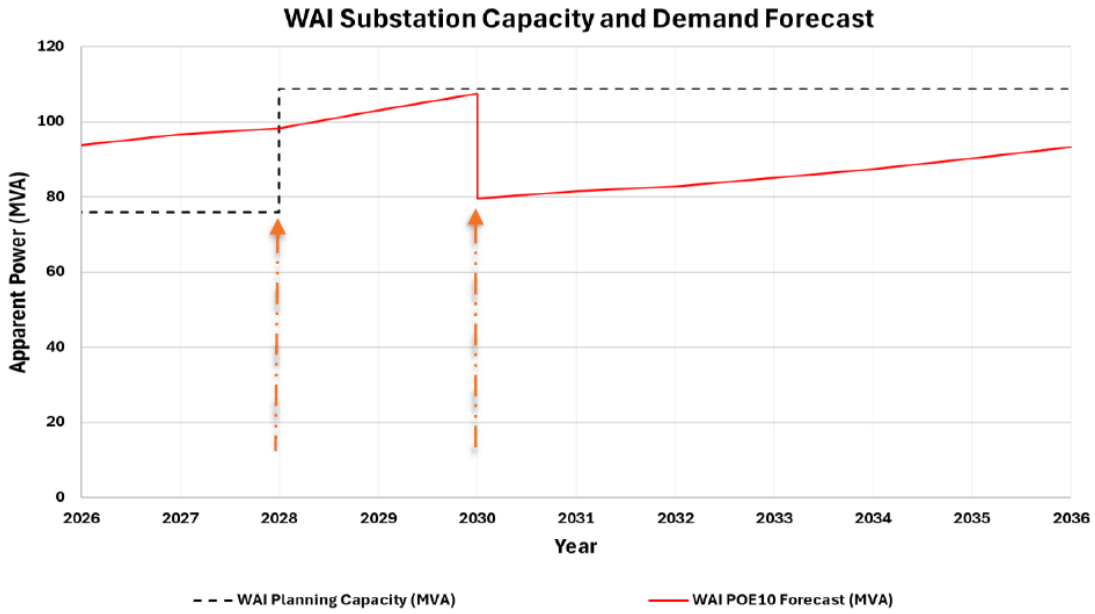

Figure 2: Forecasted WAI substation capacity with additional transformer versus demand.[10]

2.2.3 Build a new substation at Baldivis in 2030

The third option considers building a new zone substation at BVS to address the emerging capacity constraint at WAI and support future load growth in the Baldivis area. The proposed location for the new substation is on an existing parcel of land owned by Western Power at 60 Pike Road, Baldivis, which is already zoned for use as a substation and is in proximity to the existing 132 kV MH-WAI/MSS 81 transmission line (i.e., within 50 metres). The substation would connect into this line via a CICO arrangement (refer to Figure 3 for an illustrative example), and the existing feeders would be rerouted accordingly.[11]

Western Power recommends this option in its analysis, with some of the distinct benefits compared to the other options being:

- Western Power owns the land at 60 Pike Road, Baldivis.
- The feeders are physically closer to the loads that they serve, which reduces losses and helps to make the distribution in this part of the network more efficient.
- The cost of transferring the distribution feeders to the new BVS substation is also lower given the proximity of the feeders to the proposed new substation location.
- This option's net present cost ($81.69m) is the cheapest of all the proposed options (refer to Table 2).

[10] Ibid.

[11] Ibid.

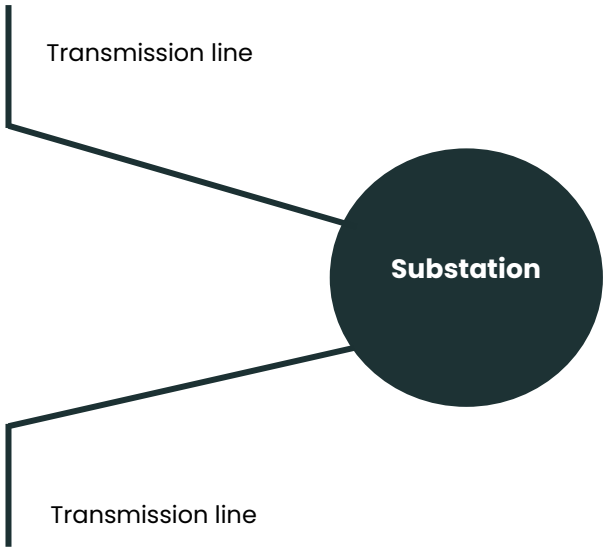

Figure 3: Illustrative example of a CICO arrangement.

2.2.4 Non-network solutions

Various non-network solutions were also considered as part of the options analysis. For example, demand-side management (DSM) was found to be unviable for addressing the scale and timing of the capacity constraints in the WAI supply area.[12] Analysis showed that a significant proportion of demand supplied by WAI during last summer's peak day was for residential customers. Hence, contracting DSM from large customers was deemed to be limited and the implementation of large-scale DSM in predominantly residential areas is challenging owing to:

- A limited peak controllable load at the individual customer level.
- A low uptake of suitable enabling technologies.
- Difficulties in achieving and sustaining reliable peak demand reduction across a large and diverse customer base.

It is our view that, given the demand characteristics in the WAI supply area and the practical challenges associated with large-scale DSM orchestration, this conclusion is sensible at the current time.

Recent expressions of interest by Western Power for non-network solutions in various locations were found to be insufficient to mitigate the level of risk due to the increase in demand.[13] Hence, the options analysis considered contracting network support services via battery energy

[12] Western Power (n 3) 2026.

[13] Ibid.

storage systems (BESSs), deferring BVS for 3 years and 5 years, respectively. However, these options were deemed to not be economically viable (refer to Table 2 net present costs of $102.68m and $127.08m, respectively).

In general, non-network solutions were found to be unable to provide sufficient, predictable capacity relief suitable for deferring or replacing the required network investment while maintaining network reliability, compliance and reputational risks.[14]

2.3 Summary with respect to scope item(s)

- **Scope items 1 & 2:** We consider the **preferred option** to be technically reasonable. The site's proximity to the existing 132 kV transmission line is helpful for facilitating the proposed CICO arrangement, as is its proximity to the feeders which require rerouting. Given the rapid population growth in the Baldivis area and the resulting strain on the surrounding electrical infrastructure, the need for a suitable long-term solution is paramount. It is our view that the preferred option maximises the net benefit as it provides longevity, can be delivered in a timely manner, and is cost-effective (with Western Power already owning the appropriately zoned parcel of land at the proposed site).
- **Scope item 3:** While the other **proposed options** also appear to be technically feasible, we consider the justifications provided by Western Power regarding their net benefits and/or shortcomings with respect to the need for the provision of a long-term cost-effective solution that can be delivered in a timely manner to also be reasonable.

[14] Ibid.

3 Peak Demand Forecast Review

This section examines Western Power's forecasting methodology and provides commentary regarding historical forecast outcomes, addressing scope item 4.

3.1 Forecasting methodology

Western Power currently utilises various forecasting models across distinct time horizons, including short-term, medium-term, and long-term forecasts.[15] The medium-term peak demand forecasts underpin the options analysis since it focuses on a timeframe within the next 4-5 years. The underlying forecasting methodology considers various network levels and customer groups. Meanwhile, the maximum and minimum demand forecasts utilise data including, but not limited to, meteorological information, renewable energy generation, and predicted population growth.[15] Statistical and data-driven methodologies are applied in the development of these forecasts. These methodologies also underpin forecast customer connections, energy usage, and demand across the aforementioned network levels and customer groups.

The end-to-end data engineering process reviewed as part of this body of work appears to be robust. The process aligns with good industry practice, utilising data validation, benchmarking, and plausibility testing. Moreover, the inputs to the modelling and forecasting process, e.g., historical and projected population data and meteorological data, are based on assumptions from credible sources such as the Department of Planning, Lands and Heritage (DPLH) and the BOM, respectively.[16]

It is our view that the methodology for the medium-term peak demand forecast (MTF25), which underpins the options analysis, is robust and in line with industry standards.

3.2 Review of forecasting outcomes

Figure 4 shows the WAI feeder demand forecasts. The utilisation levels of these feeders have been quickly increasing in recent years and are nearing, or will soon exceed, their rated capacity. This rapid uptick in WAI peak demand was not forecast in either TSP2023 or TSP2024. For example, TSP2023 WAI utilisation was forecast to increase by 4% between 2023 and 2025 (PoE

[15] Western Power, "Electricity Medium-term Forecasting Methodology," 2025.

[16] Since the forecasting process applies statistical and data-driven methodologies to develop forward-looking estimations of demand, the data's quality and nature greatly affects each model's outputs (results). Hence, forecasts exhibit sensitivity to each model's inputs and underlying assumptions.

10), as shown in Table 3. Moreover, TSP 2024 (refer to Table 4) generally shows more modest growth compared to TSP2023 over the 2025-2033 period and does not reflect a rapid uptake of utilisation in the near term.

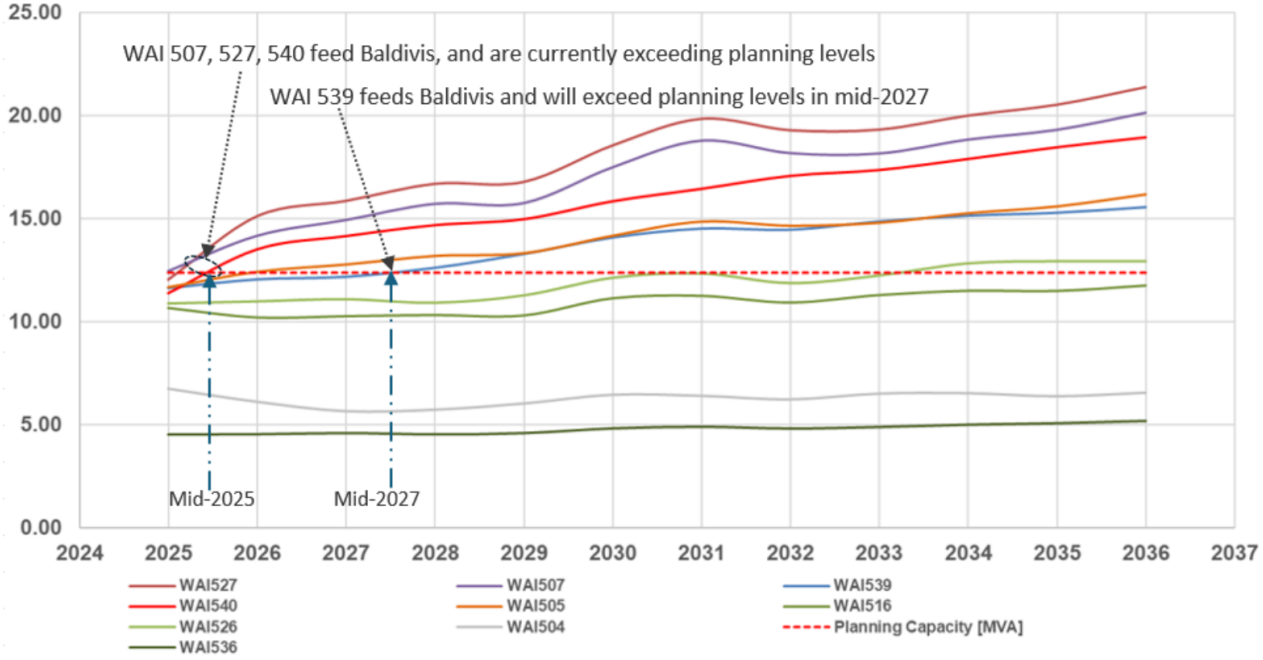

Figure 4: WAI feeders demand forecast against planning capacity.[17]

We acknowledge that the summer peak demand days in 2024 and 2025 were both all-time records for the SWIS, breaking a record set back in 2016, so it is arguable that these were of lower probability of exceedance than PoE10.

In any case, the rapid increase in peak demand values in 2024 and 2025 appear to have been unexpected. Hence, the actual utilisation level of WAI is greater than its planning capacity, which necessitates investment in a solution (or solutions) to solve and/or manage the issue. The forecast's sensitivity to its input data (e.g., population growth) do not have any impact on this assessment given the actual utilisation level that has already materialised.

The revised forecasts in MTF25 are now reflected in TSP2025 (refer to Table 5) and suggest that the forecast peak demand will continue to grow and exceed the substation planning capacity by 22% in 2030.

[17] Western Power (n 1) 2026.

3.3 Summary with respect to scope item(s)

- **Scope item 4:** The medium-term peak demand forecast (MTF25) methodology appears to be robust and in line with industry standards. The demand forecast outcomes and their sensitivity to any input data and assumptions do not have any impact on the assessment of Western Power's proposal since actual WAI substation utilisation is already greater than its planning capacity (i.e., a solution is required regardless of any future projections).

Table 3: Forecast utilisation from TSP2023.[18]

Substation	Existing Capacity [MVA]	Actual Utilisation [%]	Forecast Utilisation [%]																			
		2023	2024		2025		2026		2027		2028		2029		2030		2031		2032		2033	
			PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50	PoE 10	PoE 50
Mandurah	76	108	112	102	114	104	116	106	118	108	120	110	122	112	124	115	127	117	129	119	132	122
Meadow Springs	86	89	97	90	99	91	101	94	104	97	108	101	112	105	115	108	118	111	121	114	126	119
Waikiki	80	99	101	88	103	90	106	93	110	96	114	101	119	105	122	109	125	112	129	116	135	122

[18] Western Power, "Transmission System Plan – 2023," accessed online, 2023.

Table 4: Forecast utilisation from TSP2024.[19]

	Substation	Existing Capacity [MVA]	Forecast Utilisation [%] PoE 10									
			2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Metro South	Amherst	84.56	88.52	91.06	93.33	95.32	96.78	98.11	99.61	101.27	103.58	105.80
	Bibra Lake	55.76	114.76	116.66	118.61	120.82	122.87	124.69	126.36	128.08	131.00	134.12
	Byford	76.96	125.50	108.27	111.17	114.59	117.82	120.72	123.30	125.76	129.17	132.70
	Gosnells	77.25	91.77	93.43	94.77	96.54	98.31	100.36	102.69	104.97	107.86	110.42
	Maddington	25.98	116.46	116.95	118.27	120.96	123.63	125.64	127.06	128.51	131.58	135.30
	Mandurah	**76.02**	**93.89**	**96.12**	**98.05**	**100.02**	**102.04**	**104.29**	**106.71**	**109.10**	**112.19**	**115.08**
	Meadow Springs	**86.31**	**96.33**	**97.06**	**98.99**	**102.24**	**105.40**	**107.69**	**109.23**	**110.79**	**113.83**	**117.61**
	Medina	80.74	78.01	79.77	81.84	84.73	87.71	90.58	93.28	95.86	99.03	102.23
	Pinjarra	52.51	83.71	84.86	86.22	88.06	89.90	91.53	92.96	94.40	96.57	98.94
	Riverton	81.02	92.89	93.86	94.86	96.39	97.92	99.45	100.97	102.50	104.92	107.37
	Rockingham	75.16	87.11	86.62	86.47	88.00	89.86	91.24	91.91	92.34	93.81	95.81
	Southern River	85.16	118.21	87.45	88.10	90.22	92.94	95.36	97.06	98.42	100.88	103.77
	Waikiki	**80.48**	**103.49**	**104.00**	**105.24**	**107.84**	**110.15**	**111.73**	**112.75**	**113.86**	**116.33**	**119.41**
	Willetton	26.29	111.29	98.59	99.97	101.74	103.46	104.89	106.04	107.14	108.86	110.78

[19] Western Power, "Transmission System Plan – 2024," accessed online, 2024.

Table 5: Forecast utilisation from TSP2025.[20]

Substation	Existing Capacity [MVA]	Forecast Utilisation [%]									
		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Metro South											
Amherst	85	91	94	96	100	104	107	108	108	109	111
Australian Paper Mills	46	85	85	87	91	96	100	102	104	107	109
Belmont	72	71	72	73	75	78	80	83	85	88	91
Bentley	56	85	85	87	89	91	92	94	95	97	98
Bibra Lake	55	108	109	111	114	119	121	121	121	121	121
Byford	77	144	133	140	145	154	162	166	171	176	183
Canning Value	93	80	80	82	84	86	86	86	86	87	89
Cockburn Cement	77	77	79	82	86	91	94	96	98	100	102
Collier Street	69	75	76	76	78	80	81	82	84	86	88
Gosnells	77	97	99	101	104	108	112	114	117	120	124
Maddington	26	124	126	128	130	133	136	138	140	142	145
Mandurah	**76**	**110**	**117**	**121**	**126**	**134**	**140**	**144**	**148**	**155**	**160**
Meadow Springs	**86**	**112**	**115**	**119**	**124**	**130**	**136**	**140**	**144**	**148**	**152**
Medina	84	87	88	88	89	94	96	96	99	101	101
Murdoch	54	86	87	87	88	89	90	90	91	92	93
O'Connor	70	81	82	84	86	88	90	92	93	94	96
Pinjarra	53	87	87	87	89	90	91	93	94	96	96
Riverton	81	100	100	102	106	109	110	110	112	114	116
Rivervale	83	87	87	88	90	94	95	96	97	98	99
Rockingham	75	94	95	96	98	100	103	104	106	108	110
Southern River	87	121	118	98	103	109	113	116	119	123	128
Waikiki	**87**	**108**	**111**	**113**	**117**	**122**	**127**	**130**	**133**	**137**	**142**
Welshpool	90	76	77	79	81	84	87	89	92	95	98
Willetton	26	105	89	91	97	101	104	107	109	111	114

[20] Western Power, "Transmission System Plan 2025: Appendix E – Zone Substation Utilisation," accessed online, 2026.

4 Review of Western Power's Options Analysis

This section examines the consideration of viable alternative options by Western Power, the development and application of any cost estimates and market development scenarios, and the timings of construction and commissioning dates, addressing scope items 5-9.

4.1 Assessment of alternative options

We did not identify any potential alternative options that Western Power have omitted from their options analysis. Through correspondence with Western Power, we note that potential locations proposed via submissions were also considered. Western Power stated that these locations were further from the BVS load centre and existing transmission infrastructure while presenting environmental challenges, resulting in greater costs, longer distribution feeder lengths (increasing losses and reducing efficiency), and increased delivery and approval risks (e.g., land re-zoning and planning approvals).[21] Hence, Western Power considers that there is no material improvement in the overall outcomes beyond those achieved by its recommended option at 60 Pike Rd, Baldivis.[22]

We are satisfied that Western Power's application documents and subsequent discussions have demonstrated that there are no feasible alternative zone substation locations, based primarily on the following factors:

- The identified need to provide additional network capacity to accommodate rapid load growth in the Baldivis area is urgent.
- Western Power already owns appropriately zoned land at the proposed Pike Rd site. This will help reduce delivery times and project costs compared to if re-zoning was needed. Moreover, the existing 132 kV MH-WAI/MSS 81 transmission line runs along Pike Rd (refer to Figure 1) and no additional transmission line easements / rights-of-way are required.
- The 22 kV distribution feeders supplying Baldivis from Waikiki substation run along Safety Bay Rd, approximately 1.5 km from the Pike Rd site.[23]
- Any alternative locations would require additional planning activities including land acquisition, permitting and securing transmission line rights-of-way. With these

[21] Western Power, "Regulatory Test Query – Baldivis Substation Project ERA-BVS#04 – Responses," 12 March 2026.

[22] Noting that the site at 60 Pike Rd, Baldivis, was suggested as being preferable by the City of Rockingham as part of the overall site selection process, resulting in the site's selection as opposed to the original site at 780 Eighty Rd, Baldivis.

[23] Western Power (n 23) 2026.

additional activities, it is doubtful that a new substation could feasibly be delivered by 2030.

- The nearest appropriately zoned site owned by Western Power is on Paganoni Rd in Karnup, ~13 km south of the Pike Rd site. This is a material distance and would be a prohibitively high-cost solution, particularly to re-route the 22 kV distribution feeders supplying Baldivis from Waikiki zone substation.[24]

4.2 Review of cost estimates

Where possible, major components of the cost estimates like the procurement, installation, and associated site works for transformers and buildings have been compared to AEMO's Transmission Cost Database.[25] Table 6 lists some of the pertinent items from the database. The Western Power costs provided as part of this review appear to broadly align with the AEMO database's indicative costs for similar items (i.e., generally within ±20-30%).[26]

Table 6: Indicative transmission construction costs from AEMO database.[25]

Database Apparatus	AEMO Transmission Cost Database Value	Description
2 winding transformer (3 phase) 80 MVA, 132/22 kV	$4,832,500	Includes transformer, surge arrester, civil and structural works, electrical works, control panels, design and surveys.
132 kV air insulated switchgear switch bay – 2CB diameter 2 CBs	$1,810,000	Construction of 2 new air insulated switchgear switch bays with only 2 circuit breakers and secondary system
132 kV gas insulated switchgear switch bay – 2 circuit breaker diameter 2 circuit breakers	$2,716,026	Construction of 2 new gas insulated switchgear switch bays with only 2 circuit breakers and secondary system
132 kV line diversion – Type 1 (2x conductor/phase single circuit steel tower)	$1,466,702	Based on the AEMO (Victoria planning) standard drawing specification for a specific diversion type based on a general arrangement (span length, tower type, and route/conductor length)

[24] Western Australian Planning Commission, "Metropolitan Region Scheme Amendment 1417 – Karnup Station Precinct," accessed online, 2024.

[25] AEMO, "Transmission Cost Database," accessed online, 2025.,

[26] Noting that not all items are like-for-like owing to the nature of the projects proposed by Western Power and the assumptions used to develop the items in AEMO's database.

Database Apparatus	AEMO Transmission Cost Database Value	Description
132 kV underground direct buried cable – 412 MVA, 1000mm^2 single circuit	$3,616,585 per 0.5 km	In trench with joint pits and reinstated easement within/alongside
Gas insulated switchgear site infrastructure – Small area 100m x 100m	$3,920,796	Civil site infrastructure including substation common ancillary system

4.3 Review of market development scenarios and project timelines

As highlighted in Section 3.2, the Baldivis area's rapid population growth is straining the surrounding electrical infrastructure, which is characterised by WAI zone substation's utilisation exceeding its planning capacity. Hence, market development scenarios are not considered relevant for this assessment given the issue has already materialised.

Moreover, the project construction and commissioning timelines examined as part of this review appear to be sensible. In the case of the preferred option, where a new zone substation is proposed to be constructed and instated at 60 Pike Rd, Baldivis, the end of 2030 timeline appears reasonable given Western Power already owns the appropriately zoned parcel of land, the existing 132 kV transmission line and feeders are in proximity to the site, and planning is already at a mature stage.

4.4 Additional commentary

4.4.1 Quantification of benefits

Having reviewed the options analysis and the broader application documents, it is our view that the regulatory test submission provides a heavy focus on selecting the option with the lowest net present cost. This is evidenced by the main quantitative metric being the net present cost, with little quantitative analysis reserved for the calculation and valuation of benefits (e.g., the value of near-term risk mitigation).

For example, not all the options have the same benefits. While option 2 has a higher net present cost compared to option 3 ($110.60m vs $81.69m), the increased capacity furnished by having an additional WAI transformer from 2028 mitigates risk 2 years earlier (i.e., 2028 vs 2030). Figure 2 illustrates how this risk would be mitigated owing to the step change in capacity in 2028 from the additional transformer, ensuring that the planned capacity is greater than the forecasted demand from 2028-2030. Meanwhile, option 3 provides continued risk exposure for Western Power from 2026 until BVS is built in 2030. Figure 5 shows that forecasted demand is expected to be greater than the planned capacity during this period. We believe that quantification around the value (cost) of this risk would have been helpful for better justification of the options, including any short-term measures that may need to be considered as part of the organisation's broader risk mitigation strategy. Nevertheless, Western Power is confident in its ability to manage risks associated with reliability, non-compliance, and reputation in the near-term (2026-2030) via numerous operational measures.[27]

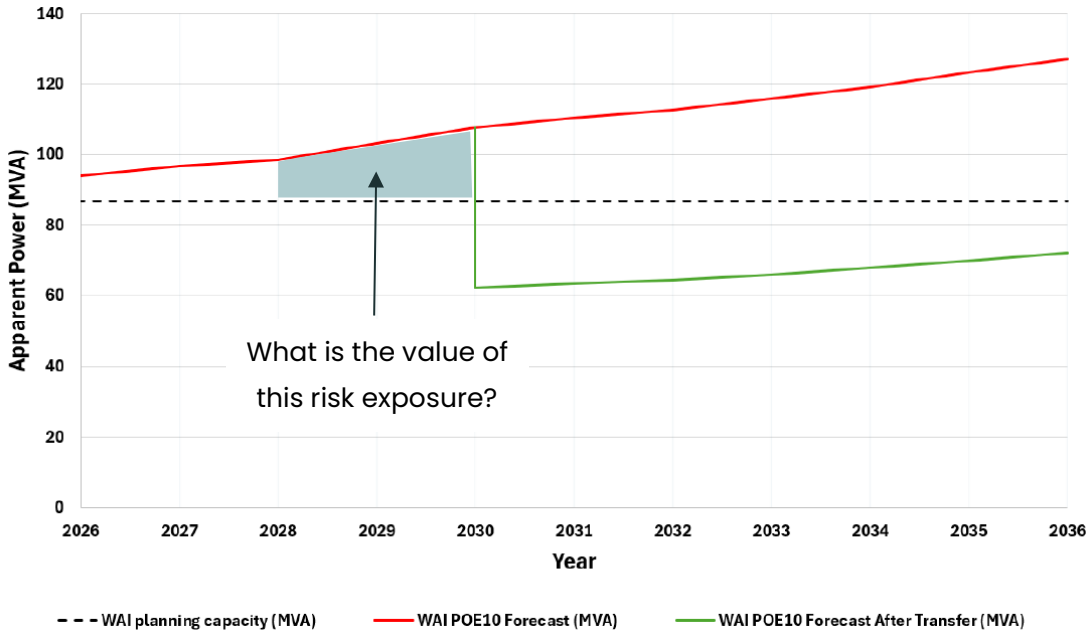

Figure 5: Forecasted WAI demand pre- and post-BVS.[28]

[27] Western Power, "Regulatory Test Query – Baldivis Substation Project ERA-BVS#03 – Responses," 23 February 2026.
[28] Western Power (n 1) 2025.

4.4.2 Broader transmission network strategy

In this section, the preferred option of building the new Baldivis substation is assessed in the context of the broader transmission network strategy for the South Metro region and the Mandurah load area.

In response to queries regarding the transmission network strategy for this area, Western Power noted that the strategy "*focuses on maintaining compliance with Technical Rules Planning criteria at the relevant zone substations, whilst enabling sustainable supply arrangements as demand grows. The proposed BVS substation contributes to this strategy by allowing load to be transferred from WAI and supporting the significant growth occurring in the Baldivis area*".[29] However, Western Power were unable to provide any documentation to support the strategy, for example, a high-level load area plan including, but not limited, to the following items:

- Drivers of change and needs for the load area
- Expected future developments in the area (e.g., Karnup development)
- Existing supply arrangements and bottlenecks
- Strategic concepts to supply the load area over the medium and long term, indicating how the preferred option aligns with the overall supply strategy for the area

A good example of a high-level network strategy is Endeavour Energy's Western Sydney Aerotropolis Area Plan. In follow-up discussions with Western Power, it was indicated that a strategic planning document was still under development and not presently available, but that the BVS substation was fully aligned with the strategy and was considered a "no regrets" investment.

Without documentary evidence, we cannot fully confirm the validity of this claim, but our assessment of the available planning documents supports Western Power's case that the BVS substation is a prudent investment, due to:

- The urgency of the identified need based on actual peak demand data,
- Relative maturity of the planning for BVS substation, and
- Lack of alternative supply options that can feasibly be delivered in the near term.

4.4.3 Option value of deferral

The option value of deferring the BVS substation was also assessed, for example, to align transmission planning with the future Karnup development by building a more central substation to serve both load areas.

[29] Western Power (n 3) 2026.

Western Power remarked that they were in discussions with the DPLH regarding the Karnup Priority Growth Front (PGF) area development and noted that while it is in very early stages of planning, the Karnup PGF area is "expected to experience substantial growth, potentially exceeding 100 MVA" of demand, including industrial loads.[29] This is expected to require a dedicated zone substation (notionally planned for the Western Power-owned site on Paganoni Rd) to ensure long-term network capacity adequacy.

In our view, this reasoning is sensible and there is limited (if any) value in deferring the proposed BVS substation.

4.4.4 Near-term risk management

As noted above in Section 4.4.1, the preferred option carries a near-term risk exposure between 2026 and 2030 when the BVS substation is expected to be commissioned. In particular, there is a reliability risk of unserved energy during peak demand periods if there is an outage on one of the three existing WAI transformers.

In the near-term between 2026 to 2030, Western Power is confident in its ability to manage risks associated with reliability, non-compliance, and reputation via numerous measures, including:[30]

- Deployment of Rapid Response Standby Transformers (RRSTs) pre- or post-contingency to meet potential or actual unserved energy needs
- Operational mitigations such as feeder reconfiguration for managing outage impacts
- Distribution Transfer Capacity and summer-ready planning

Furthermore, Western Power considers the risk of a transformer outage when loads exceed planning capacity to be relatively low over the near-term between 2026 to 2030, and that the costs of risk mitigation outweigh the benefits.[31]

At a high level, Western Power's risk assessment appears reasonable, but it remains our view that the near-term risk exposures could be better quantified, for example with an expected value calculation:

$$\begin{aligned} &Expected\ Risk\ Cost\ (\$) \\ &\quad = P(Transformer\ outage\ \cap Loads\ exceeding\ planning\ capacity) \times Load\ at\ risk\ (MWh) \\ &\quad \times Value\ of\ customer\ reliability(\$/MWh) \end{aligned}$$

[30] Western Power (n 27) 2026.

[31] Ibid.

This would better facilitate the assessment of near-term risk mitigation, e.g., with a non-network solution or other pre-emptive measures, especially if near-term peak demand growth exceeds forecasts or BVS substation delivery is delayed.

4.5 Summary with respect to scope item(s)

- **Scope item 5:** It is our view that Western Power has fully identified and considered all viable options, including those from interested parties. Moreover, we are satisfied that Western Power's application documents and subsequent supplied materials and discussions have demonstrated that there are no feasible alternative zone substation locations given i) the need for the swift deployment of a long-term solution that addresses the current issues in the Baldivis area and ii) the benefits associated with the site at 60 Pike Rd (e.g., land parcel already owned and appropriately zoned, proximity to the existing high-voltage transmission line and feeders).
- **Scope item 6:** Western Power have considered alternative options from interested parties, noting that these options have been deemed inferior to the preferred option on the basis that the locations are further from the BVS load centre and existing transmission infrastructure while presenting environmental challenges. These points would negatively impact delivery risk and timelines as well as project costs. We note that the site of the preferred option was proposed by the City of Rockingham as being preferable as part of the overall site selection process, resulting in the site's selection as opposed to the original site at 780 Eighty Rd, Baldivis.
- **Scope item 7:** The cost estimates for Western Power's options analysis were compared to AEMO's Transmission Cost Database (where applicable). The costs appear to broadly align with AEMO's indicative costs for similar items (i.e., generally within 20-30%, noting that not all items are like-for-like owing to the nature of the Western Power projects and the assumptions used to develop the items in the database).
- **Scope item 8:** The Baldivis area's rapid population growth is straining the surrounding electrical infrastructure, resulting in WAI zone substation's utilisation exceeding its planning capacity. Hence, the use of alternative future market development scenarios is not relevant given the issue has already materialised.
- **Scope item 9:** Given Western Power already owns the appropriately zoned parcel of land at 60 Pike Rd, Baldivis, and the site is in proximity to the existing high-voltage transmission line and distribution feeders, the project construction and commissioning timeline (instatement by the end of 2030) appears to be reasonable, particularly given planning is already at a relatively mature stage.