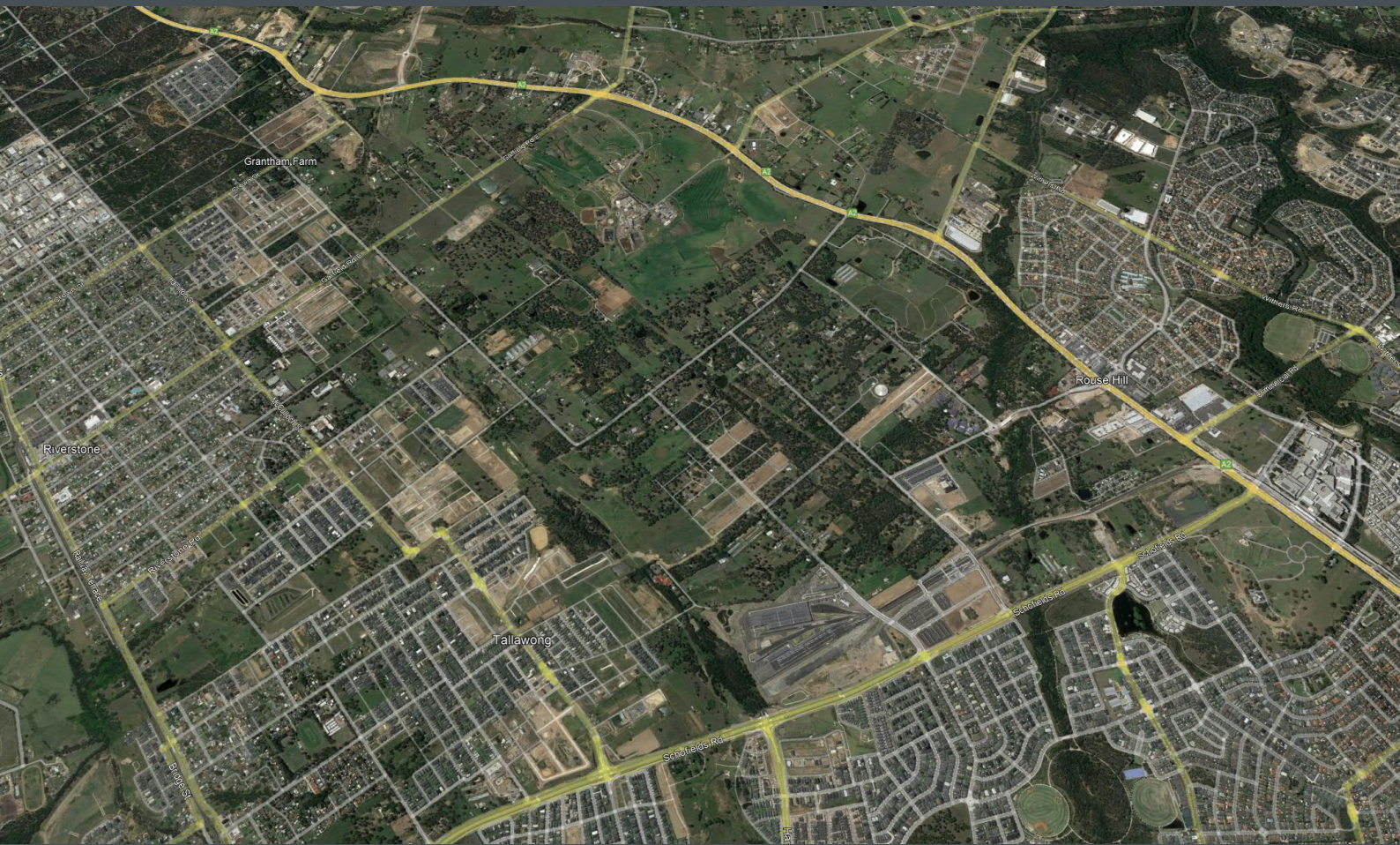


-
- **CASE FOR INVESTMENT (CFI):**
- **NPR-000048**
- **CAPACITY INCREASE FOR**
- **RIVERSTONE EAST &**
- **SCHOFIELDS DEVELOPMENT**
- **AREAS**



January 2023

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Investment Title	Capacity Increase for Riverstone East & Schofields Development Areas
<< project # / code >>	NPR-000048
Portfolio	Augex
CFI Date	January 2023
Pre RIT-D	<input checked="" type="checkbox"/>
Final CFI	<input type="checkbox"/>
Other	<input type="checkbox"/>

Version Control and Approvals

Table 1 below is updated detailing key changes made between versions. The table is populated in descending order.

Table 1: Version Control

Version	Date	Comments
1	17 Jan 2022	Final Approval

Prepared by:

Endorsed by:

Warren Thai

Lead Capacity Planner

Peter Langdon

Head of Asset Planning and Performance

1. Executive Summary

The North West Priority Growth Area has been identified by the NSW Department of Planning and Environment (DPE) as an area of substantial growth. DPE's Land Use and Infrastructure Implementation Plan for this area stated that this area is forecasted to contribute approximately 12% of the homes needed to meet demand over the next 20 years. This growth area consists of Riverstone East, Riverstone, Schofields, Alex avenue and West Schofields. These are vital development areas that are currently supplied by Schofields and Riverstone zone substations (ZS).

This Case for Investment (CFI) includes options to address the growing demand, which will exceed the firm capacity of Schofield ZS and Riverstone ZS. As a result, there will be load at risk commencing in FY24 and reaching in excess of 40 MVA in FY27. The BAU counterfactual option will result in significant unserved energy. This will result in customers not being able to connect to the network, which contravenes Endeavour Energy's obligation to provide connection services. A project is required to service future customers in these development areas.

Figure 1 below is the decision rule from Endeavour Energy's Growth Servicing Strategy. The identified need is such that it is sub-optimal for Endeavour Energy to do nothing because:

- Investment is classified as **greenfield**.
- Identified need based on the consequence of no action for the greenfield development is **reliability corrective action**¹.

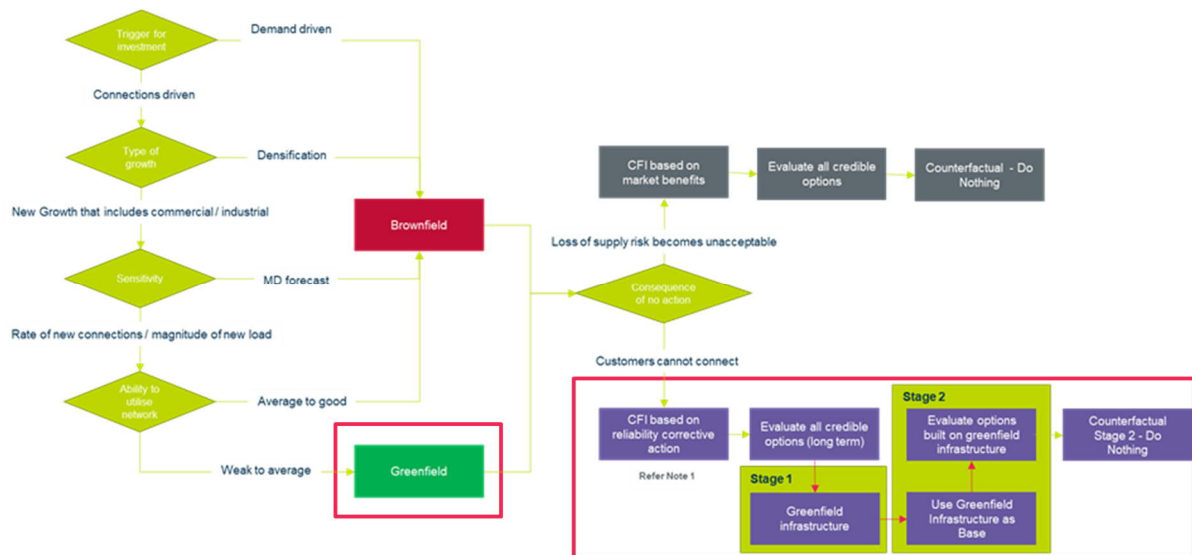


Figure 1: Decision Rule from Endeavour Energy's Growth Servicing Strategy

¹ Refer to Growth Servicing Strategy for definitions of greenfield and brownfield sites.

1.1 Considered Options

1.1.1 Long Term Network Options

Based on the demand forecasts for Schofields ZS and Riverstone ZS, which includes new load growth in the abovementioned development areas, there is ultimately a need for two substation projects in two respective stages in order to continue servicing all the developments in this entire area.

The two projects required are:

- Augmentation of Schofields ZS to increase firm capacity by 45MVA by installing a third 132/11kV 45MVA power transformer.
- Establishment of 132/11kV firm 45MVA Riverstone East ZS to establish additional firm capacity by 45MVA.

The options proposed in this CFI are based on the staging of these two projects.

Option 1 proposes:

- Stage 1 – Establishment of Riverstone East ZS commissioned in FY27.
- Stage 2 – Augmentation of Schofields ZS commissioned in FY31.

Option 2 proposes:

- Stage 1 – Augmentation of Schofields ZS commissioned in FY27.
- Stage 2 – Establishment of Riverstone East ZS commissioned in FY32.

Table 2 below shows that Option 1 represents the highest value (economic benefit), being NPV positive of \$48.9 Million compared to Option 2. Therefore, **Option 1** is the preferred network option for the project's overall scope.

Table 2: Options for the Total Scope

Option	Description	Solution Type	NPV ¹ \$M	NPV Rank	Comments
1	Establish Riverstone East ZS by FY27 Augment Schofields ZS by FY31	Network solution	48.9	1	Greatest NPV, Preferred Option
2	Augment Schofields ZS by FY27 Establish Riverstone East ZS by FY32	Network solution	45.9	2	Technically feasible, lower net benefits

1: The NPV is based on the central scenario.

1.1.2 Non-Network Options

The New Technology Master Plan (NTMP) tool was used to evaluate credible non-network options against the constraints in the existing distribution network. The NTMP tool and the subsequent qualitative analysis found that non-network options are unlikely to be feasible. However, Endeavour Energy will proceed with the RIT-D process to explore and investigate any opportunities.

1.2 Recommendation and Next Steps

It is recommended that:

- A Non-Network Options Report be issued seeking submissions for non-network options prior to proceeding to the Draft Project Assessment Report (DPAR), given that there are credible non-network options available.
- If a feasible non-network option submission is received, the economic evaluation for this project will be revised to assess whether the non-network option will defer the preferred network option.
- The CFI will be finalised at the completion of the RIT-D process and a final approval will then be submitted to confirm if the scope will include a non-network option and if the recommended timing of investment of the preferred network option will change.
- If a feasible and cost-effective non network option is not received, the best NPV network solution is the **establishment of a new Riverstone East 132/11kV 45MVA zone substation (Option 1)** to be commissioned in FY27 followed by **augmentation of Schofields ZS** in the following Regulatory Period. Currently, this option represents a highest value (economic benefit) being NPV positive \$48.9 Million and represents the best option to connect customers. Stage 1 of this option is estimated to cost \$23.0 Million and is expected to be spread over three years from FY25 to FY27.
- It is recommended as developments are realised, the economic evaluation be updated to reflect load uptake in order to determine the optimal timing for Stage 2.
- It is recommended that the project value of \$23.0 Million be approved for consideration in the FY25-FY29 Regulatory Period.

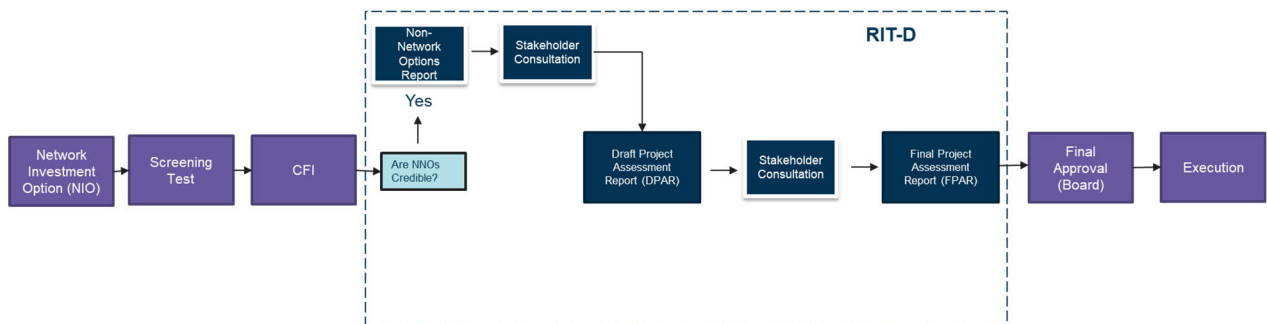


Figure 2: Endeavour Energy's RIT-D Process for this Project

2. Project Proposal

2.1 Identified Need or Opportunity

The North West Priority Growth Area has been identified by the NSW Department of Planning and Environment (DPE) as an area of substantial growth. DPE's Land Use and Infrastructure Implementation Plan for this area stated that this area is forecasted to contribute approximately 12% of the homes needed to meet demand over the next 20 years. Figure 3 shows the overview of the North West Priority Growth Area.

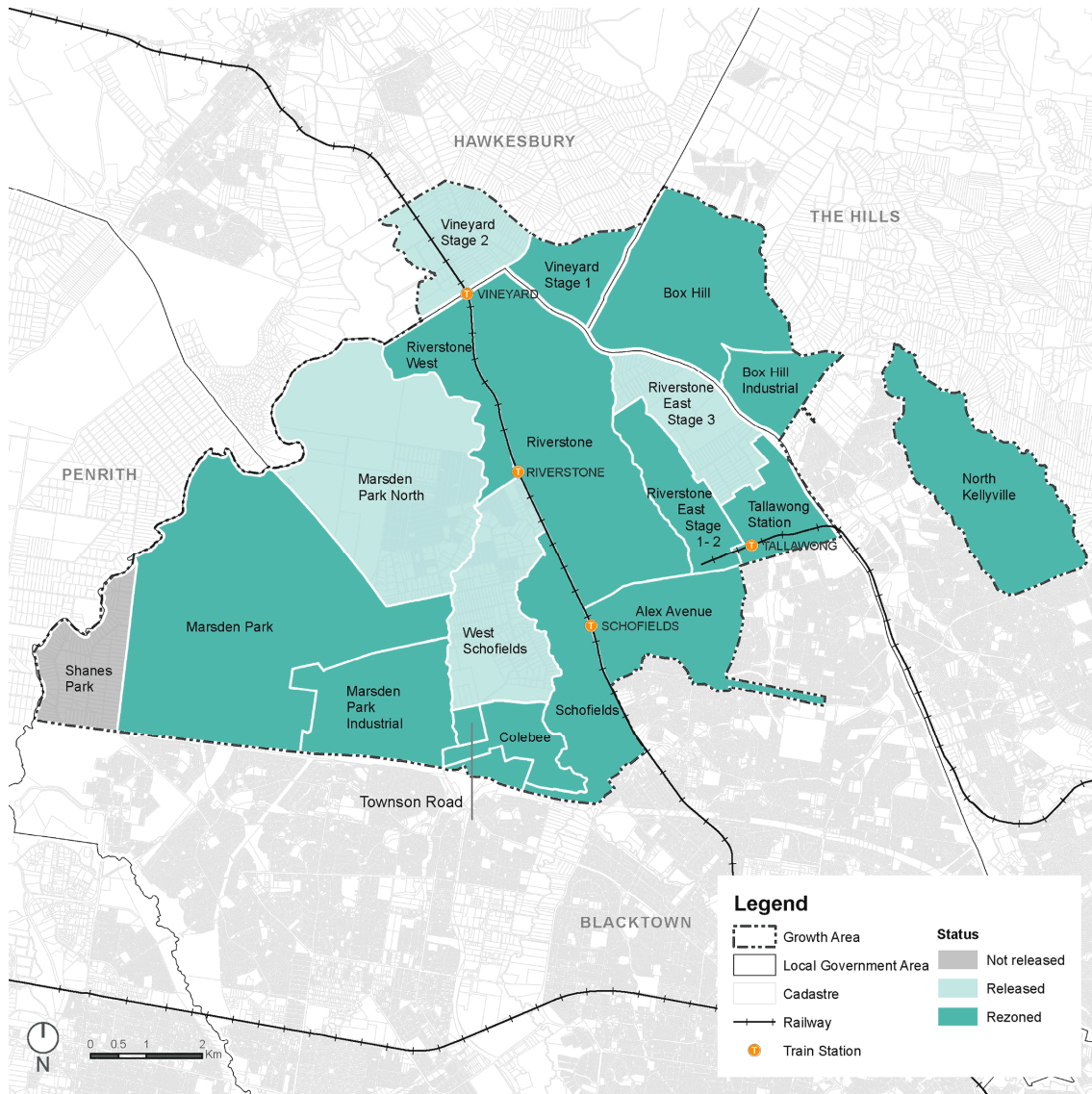


Figure 3: Map of North West Growth Area²

² Image obtained from DPIE, <https://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-and-Precincts/North-West-Growth-Area>

The Riverstone East, Riverstone, Schofields, Alex Avenue and West Schofields precincts within the North West Growth Area are currently supplied by Schofields ZS and Riverstone ZS. The developments are shown in Figure 4. More than 50,000 dwellings are being constructed within the next 10 years in the Northwest Growth Priority Precinct, with more than 20,000 dwellings within the Schofields ZS and Riverstone ZS catchment area. In the Riverstone East precinct alone, DPIE has proposed significant growth, with a potential of 5,800 additional new homes along with 281,000m² of Industrial/employment land and some small commercial development. Stage 1 and 2 of the Riverstone East Development has commenced. The small industrial developments and 3,500 residential homes are expected to be completed within the next 10 years.

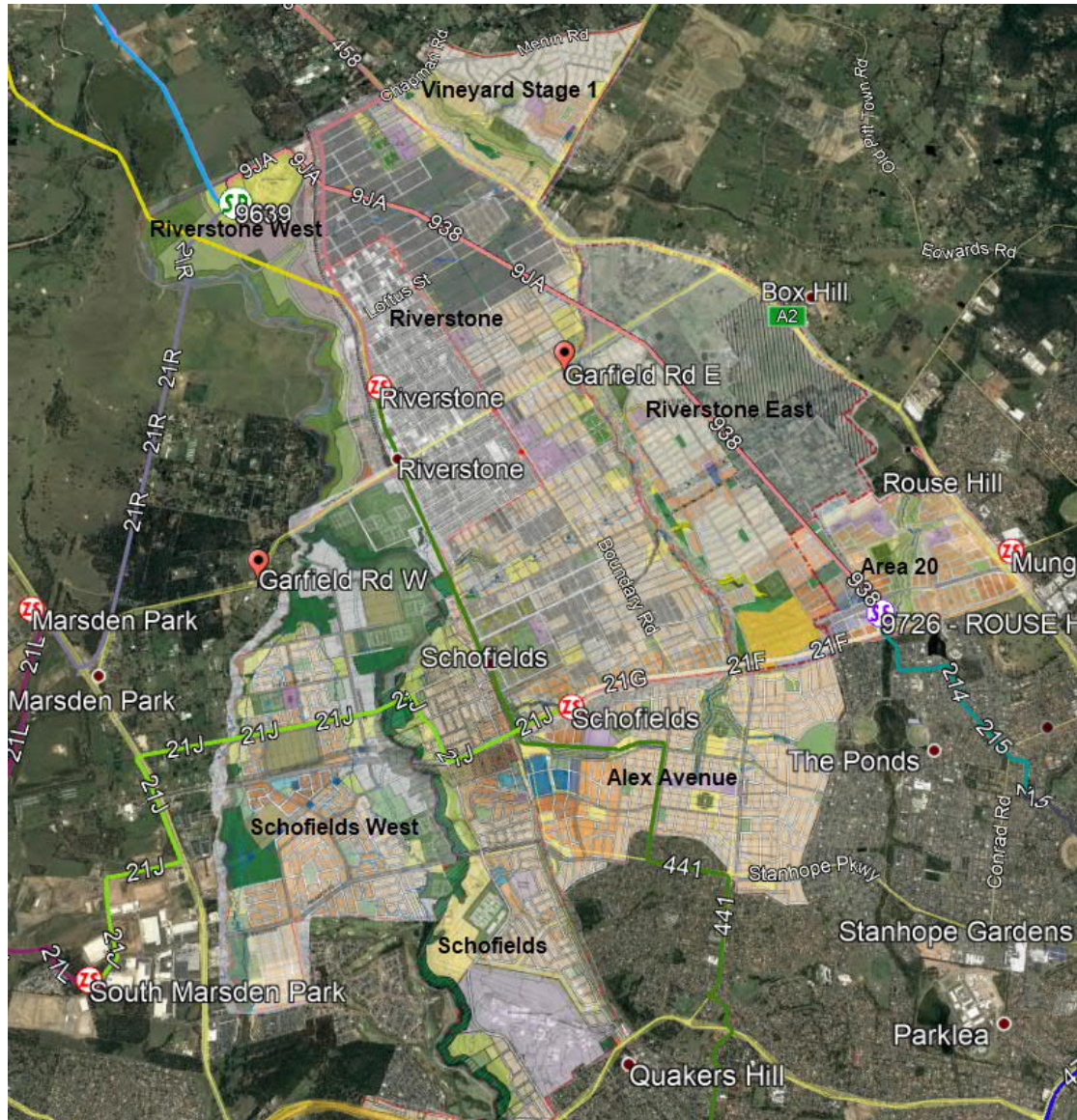


Figure 4 : Growth precincts in Riverstone ZS and Schofields ZS catchment area

2.2 Existing Infrastructure

Currently, the Riverstone East and Schofield development areas are supplied by Schofields ZS and Riverstone ZS. Schofields ZS is a 132/11kV 45MVA firm substation. Riverstone ZS is a 33/11kV 25MVA firm substation. Combined, the two substations have a total firm capacity of 70MVA to supply the area.

The Riverstone and Riverstone East development areas are supplied by 11kV feeders from both Riverstone ZS and Schofield ZS. Currently there are three new proposed 11kV feeders to be established to supply the Riverstone East development area. Two of these feeders will come from Schofields ZS and the other from Riverstone ZS.

The Schofields development areas are supplied by 11kV feeders from Schofields ZS. Additional feeders that are required will also be established from Schofields ZS in the future.

2.2.1 Limitations of existing infrastructure

The following two limitations of existing infrastructure that will result in unserved energy have been identified.

- **Insufficient capacity at Riverstone ZS:** Riverstone ZS has a total capacity of 50MVA and a firm (N-1) capacity of 25MVA under a contingent event such as a transformer failure. When the forecasted load is greater than the firm capacity, it will lead to load at risk leading to unserved energy.
- **Insufficient capacity at Schofields ZS:** Schofields ZS has a total capacity of 90MVA and a firm (N-1) capacity of 45MVA under a contingent event such as a transformer failure. When the forecasted load is greater than the firm capacity, it will lead to load at risk leading to unserved energy.

2.2.2 Demand Forecast

The demand forecast for both Riverstone ZS and Schofields ZS, considering the major new connections and network constraints listed above, is detailed in Table 3 and Figure 5. Based on this data, Schofields ZS and Riverstone ZS will have combined load at risk from 2025 onwards. At this point all the existing capacity from these zone substations are fully utilised which will result in unserved energy without additional electrical capacity investment in the area. This will result in customers not being able to connect to the network, which contravenes Endeavour Energy's obligation to provide connection services. An investment into additional electrical capacity in this area is required to meet these requirements. Consequently, this investment is considered a reliability corrective action in accordance with Clause 5.2.3(d) of the NER.

Table 3: Demand Forecast

Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Riverstone ZS	19.3	22.4	32.3	34.5	36.9	39.3	39.9	40.5	41.1	41.8	43.9	46.2
Schofields ZS	32.4	50.8	61.3	67.7	74.4	80.9	86.2	89.6	93.0	96.3	101.2	106.4
Total Load	51.7	73.2	93.6	102.2	111.3	120.2	126.1	130.1	134.1	138.1	145.1	152.5
Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
High Forecast	56.9	80.5	103.0	112.4	122.4	132.2	138.7	143.1	147.5	151.9	159.7	167.8
Central Forecast	51.7	73.2	93.6	102.2	111.3	120.2	126.1	130.1	134.1	138.1	145.1	152.5
Low Forecast	46.5	65.9	84.2	92.0	100.2	108.2	113.5	117.1	120.7	124.3	130.6	137.3
Combined Capacity Riverstone ZS & Schofields ZS (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Total capacity	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Firm capacity	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Load at risk	0.0	3.2	23.6	32.2	41.3	50.2	56.1	60.1	64.1	68.1	75.1	82.5

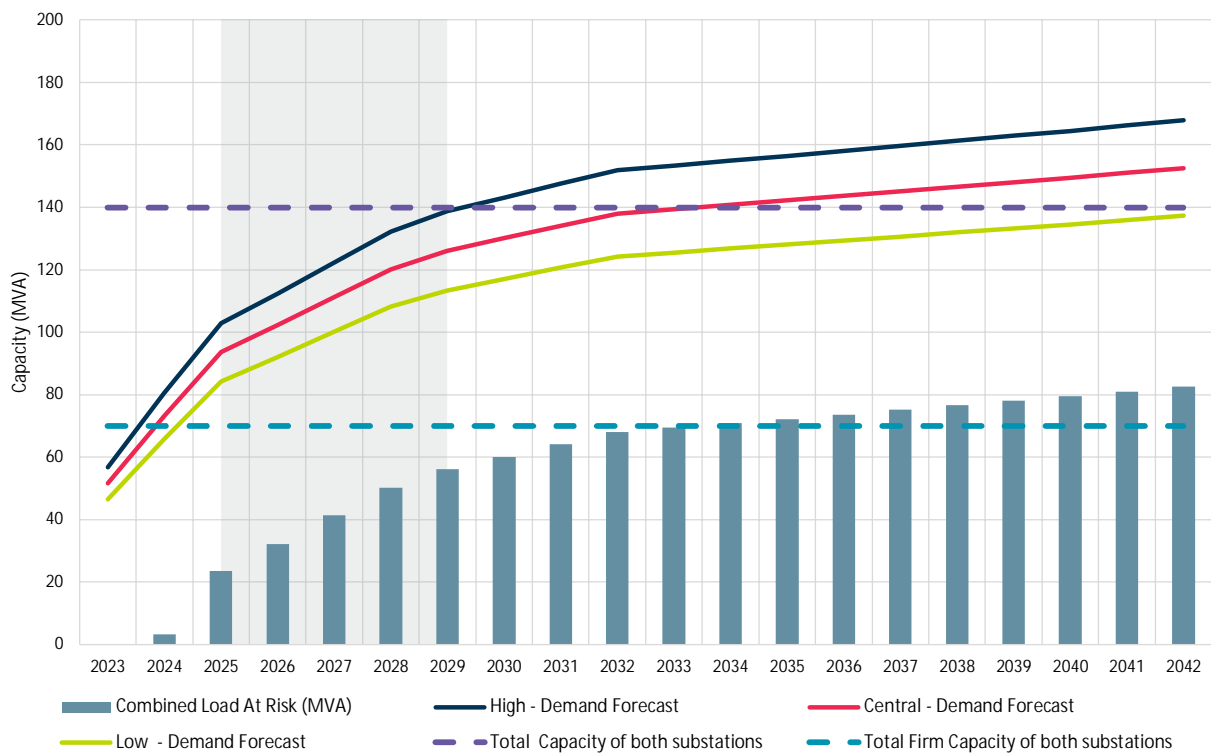


Figure 5: Demand Forecast

2.2.3 Related Projects

Project NLP-000035 for the purchase of land for the establishment of Riverstone East ZS.

3. Options Considered

Based on the decision rule outlined in the Growth Servicing Strategy, the following are the characteristics of the area:

- Investment is classified as **greenfield**.
- Identified need based on consequence of no action for the greenfield development is **reliability corrective action**³.

Figure 6 below (subset of the decision rule included in the Growth Servicing Strategy) has been utilised to outline the options.

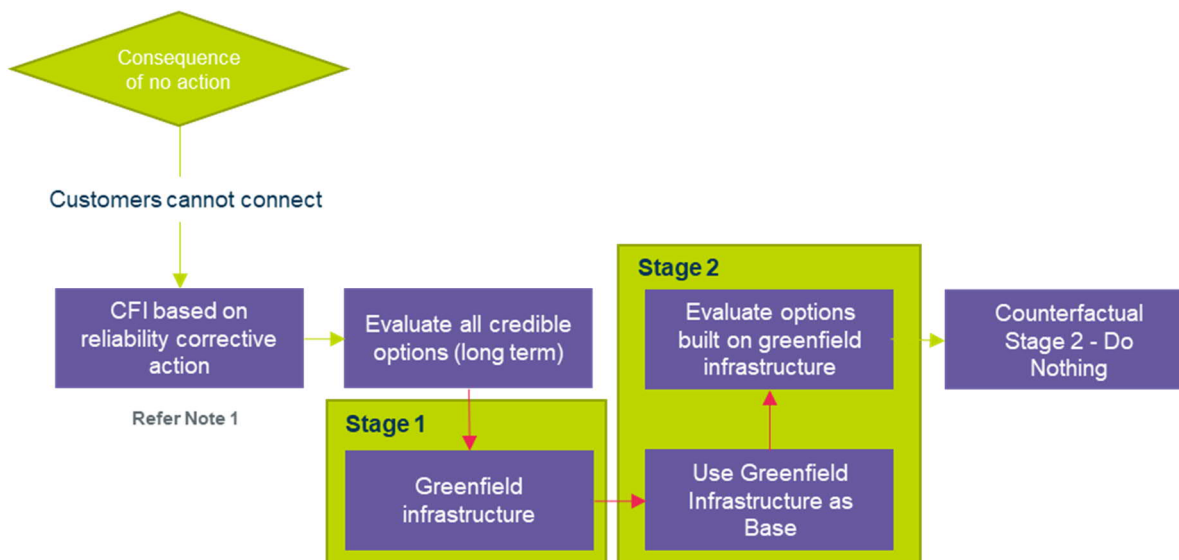


Figure 6: Decision Rule from Endeavour Energy's Growth Servicing Strategy

3.1 BAU Base Case - counterfactual

The consequence of not proceeding with the investment in a network option for the Riverstone East and Schofields Development Areas results in significant unserved energy due to the existing supply network being constrained and incapable of supplying the forecasted demand for the area. The expected unserved energy for these development areas is the total of the expected unserved energy for Schofields ZS and Riverstone ZS, which was calculated separately and summated.

In terms of Risk Cost assessment, the BAU counterfactual option provides a base case where the risks are valued by applying a Value of Customer Reliability (VCR) to the forecast expected unserved energy. The VCR values used by Endeavour Energy in its modelling are the same as those published by AER. The AER endorsed this approach during the determination process.

For a 30-year review period, a counterfactual intervention equates to a PV cost of \$82.3 Million, which is an unacceptable high-risk position and is therefore non-preferred. There would be substantial reputational risks of negative media coverage and NSW Government dissatisfaction if Endeavour Energy cannot meet supply requirements for this area.

³ Refer Growth Servicing Strategy for definitions of greenfield and brownfield sites

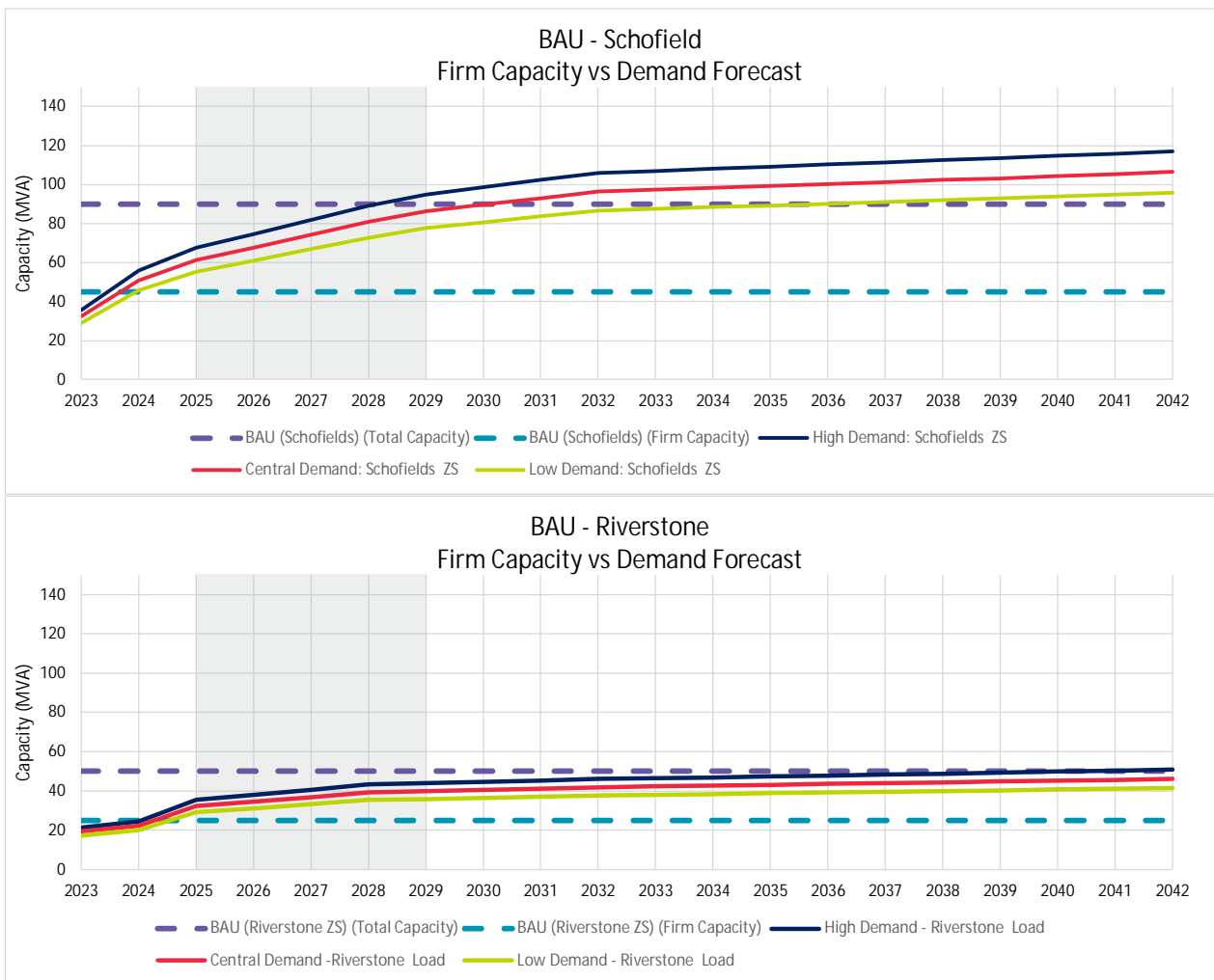


Figure 7: Capacity vs Demand for Schofield ZS & Riverstone ZS

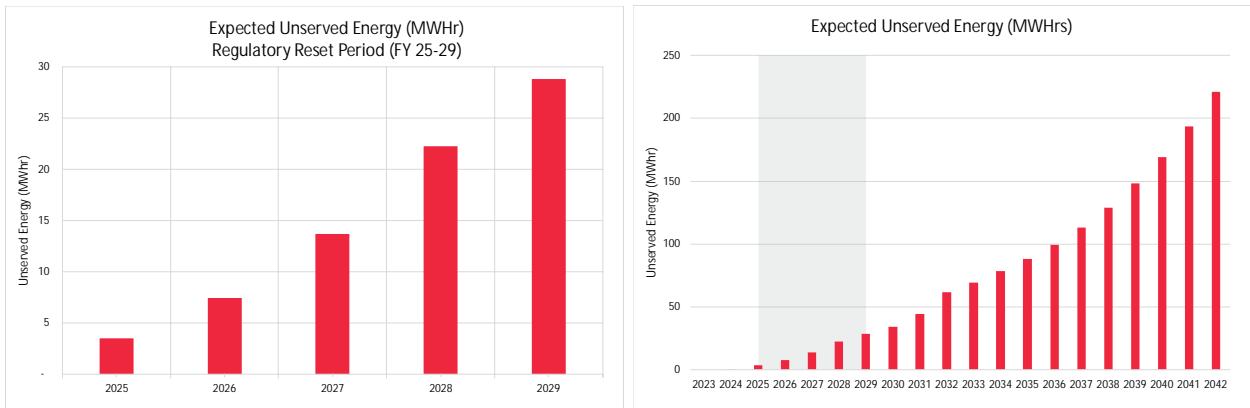


Figure 8: Expected Unserved Energy as a result of counterfactual intervention

Table 4: Value of Expected Unserved Energy as a result of counterfactual intervention

	2025	2026	2027	2028	2029	2030	2031	2037	2042
Total Expected Unserved Energy (MWh)	4	7	14	22	29	34	44	113	221
Value of Unserved Energy (\$M)	0.1	0.3	0.5	0.8	1.0	1.2	1.5	3.8	7.5

3.2 Credible Network Options (Long Term)

The National Electricity Objectives (NEO) as stated in the National Electricity Law (NEL) require Endeavour Energy to operate the networks in the long-term interests of consumers. The options in this section sets out the **credible options** that were considered, together with a counterfactual option to assist the overall comparison. These include all substantially differing commercially and technically credible options, including non-network solutions. Credible options (or a group of options) are those that meet the following criteria:

- addresses the identified need
- is (or are) commercially and technically feasible
- can be implemented in sufficient time to meet the identified need

Each credible network option is further elaborated in the subsequent chapter.

Ultimately, there is a need for two substation projects in two respective stages in order to continue servicing all the developments in this entire area. The two projects required are:

- Augmentation of Schofields ZS to increase total firm capacity by 45MVA
- Establishment of Riverstone East ZS to increase total firm capacity by 45MVA

Figure 9 shows that both projects are ultimately required. As a result, the options proposed are based on the staging of these two projects.

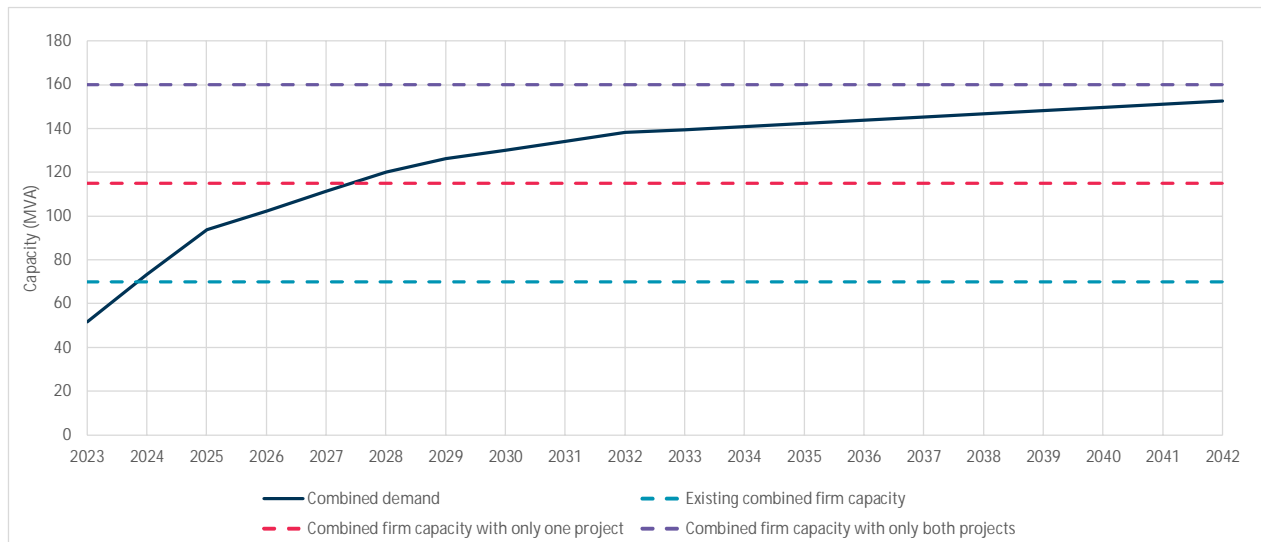


Figure 9: Combined demand vs firm capacity

3.2.1 Scope of Stages

3.2.1.1 Establishment of Riverstone East ZS to increase total firm capacity by 45MVA

The scope of this stage includes:

- 2 x 132/11kV 45MVA power transformers
- 2 x 132kV modular buildings for 132kV GIS consisting of 2 x feeder, 2 x bus section and 2 x transformer circuit breakers
- 2 x 11kV modular buildings with 14 x 11kV circuit breakers on 2 x bus sections
- 2 x tee connections with 132kV cables to overhead feeders 938 and 9JA
- 2 x AFIC cells

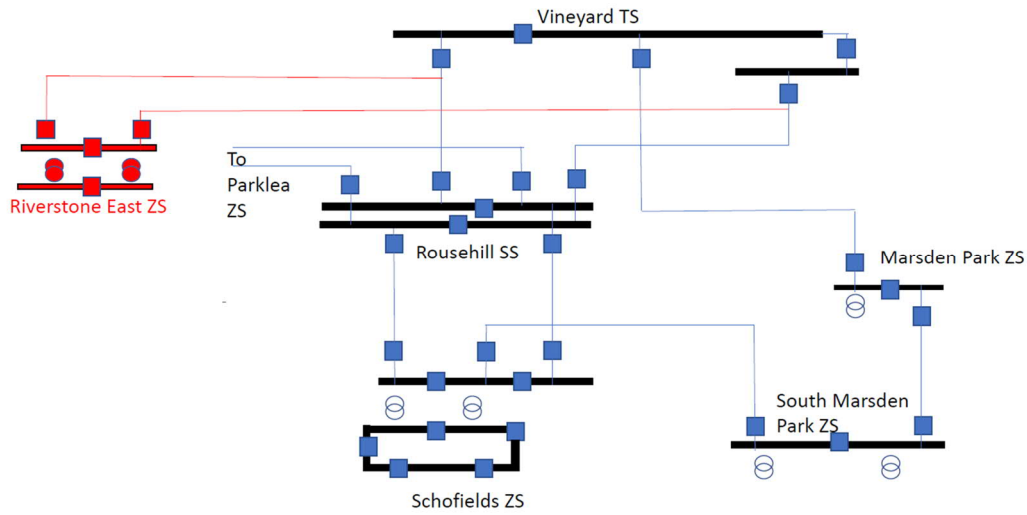


Figure 10: Riverstone East ZS Single Line Diagram

3.2.1.2 Augmentation of Schofields ZS to increase total firm capacity by 45MVA

The scope of this stage includes:

- 1 x 132/11kV 45MVA power transformer
- 10 x 11kV feeder, 1 x 11kV transformer and 1 x 11kV bus section circuit breakers
- Associated 132kV and 11kV cabling

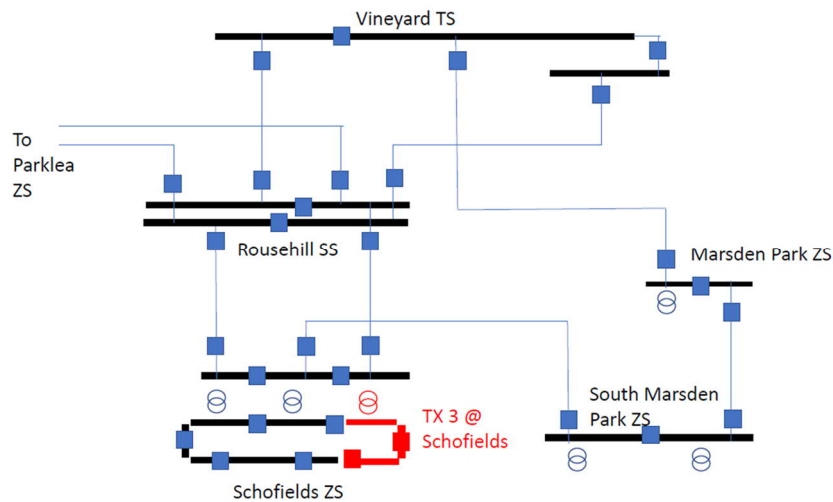


Figure 11: Schofields ZS Augmentation Single Line Diagram

3.2.2 11kV Distribution Feeder Establishments

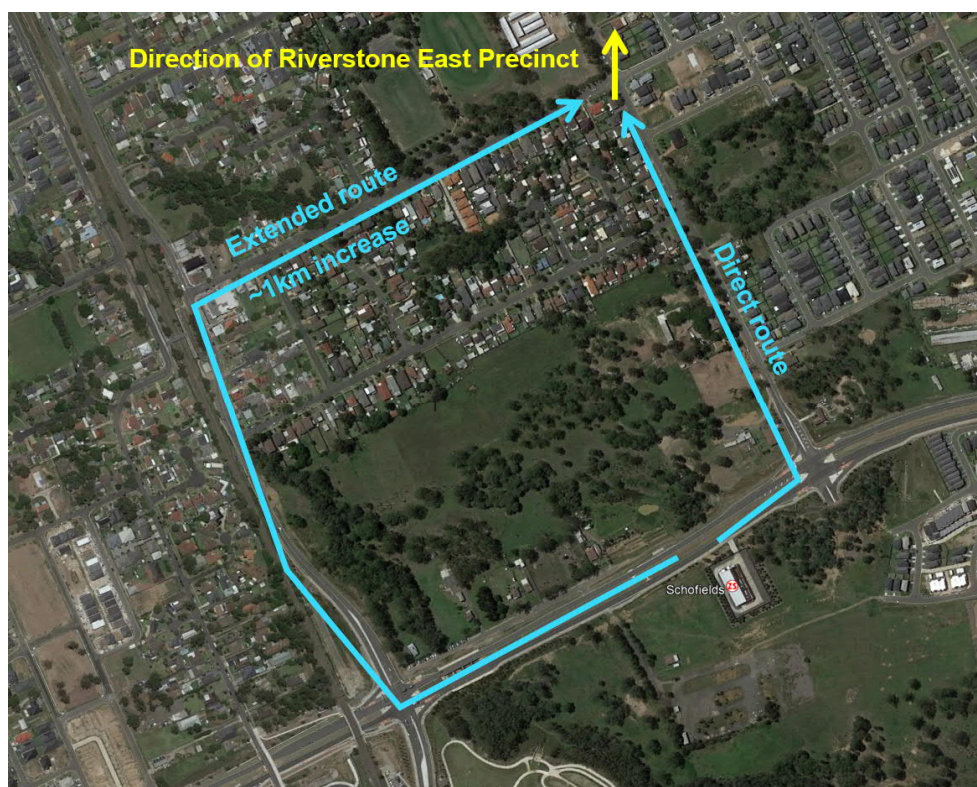
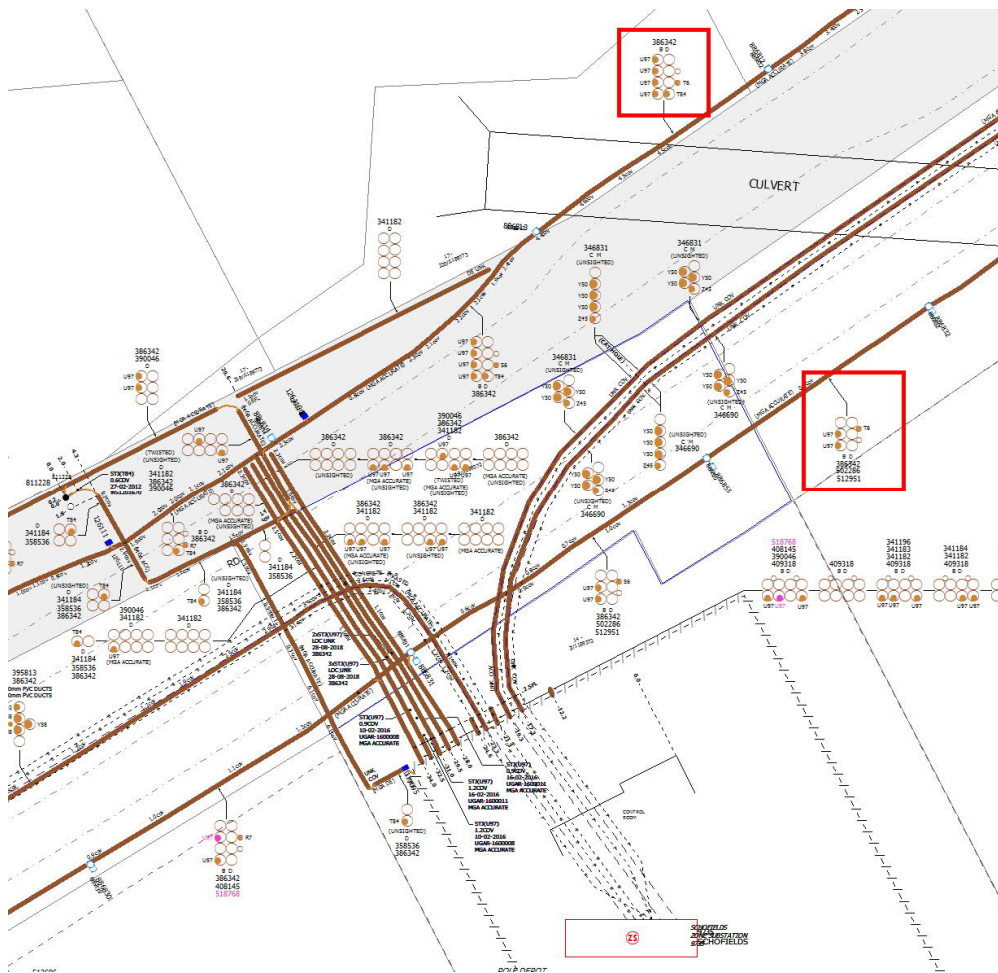
In order to compare the proposed options for this project, the cost for establishing 11kV distribution feeders has been incorporated into the economic evaluation in both options. These costs cover the works required to establish feeders to supply the Riverstone East precinct from Schofields ZS.

It is noted that there are a limited number of ducts exiting Schofields ZS shown in



that can be utilised for running new feeders heading to the Riverstone East precinct. Once these ducts are utilised (estimated to be from 2027), there will be additional costs for all feeders running to Riverstone East due to the need to head West along an extended route.

The establishment of additional feeders from Riverstone ZS has not been considered due to constrained availability of circuit breaker connection points.



3.2.3 Option 1 – Establish New 132/11kV 45MVA Firm Riverstone East ZS in 2027 and Establish 3rd 132/11kV 45MVA Schofields ZS Third Transformer in 2031

3.2.3.1 Scope

This option includes the following staging.

- Stage 1 – Establish new 132/11kV 45MVA Firm Riverstone East ZS commissioned in FY27.
- Stage 2 – Establish third 132/11kV 45MVA transformer at Schofields ZS commissioned in FY31.

This option results in a 45MVA increase in capacity in FY27 followed by another 45MVA increase in FY31.

This option enables load transfer capabilities between the proposed East Riverstone ZS and Schofields ZS to supply loads depending on where they realise. This option results in less works being required to establish new feeders since feeders would no longer need to run to Schofields ZS. This has been incorporated into the economic assessment.

The figures below show the resultant capacities and unserved energy under this option. It is noted that Endeavour Energy accepts a small amount of unserved energy risk under this option. The second stage under this option has been deferred to the following Regulatory Period and its timing can be reviewed in the future when more development loads are realised in order to determine its optimal timing.

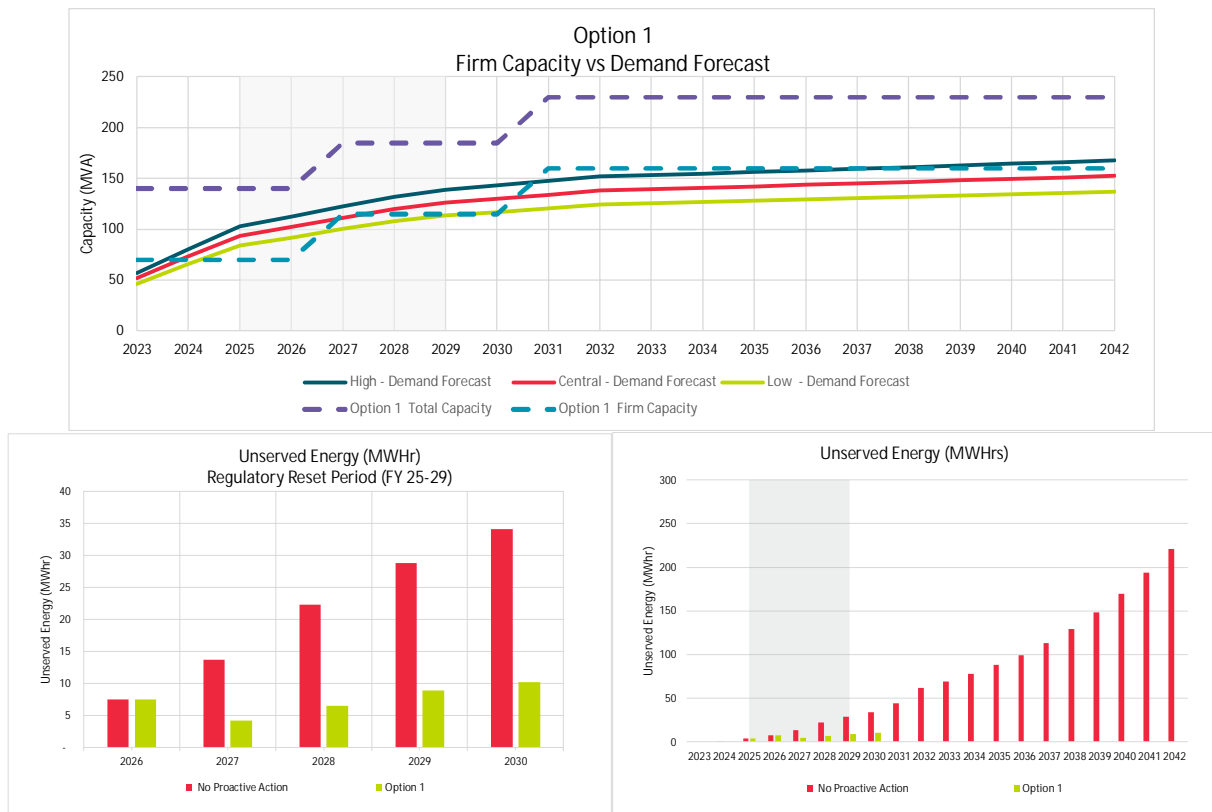


Figure 14: Summary of Option 1. Expected Unserved Energy based on central case demand forecast

This option requires feeders to supply the Riverstone East development area to be established from Schofields ZS until Stage 1 is completed. The costs to establish these feeders has been incorporated in the economic evaluation.

3.2.3.2 Cost

The total estimated capital cost of Option 1 for the FY25-29 Regulatory Period is \$23.0M and covers Stage 1. Stage 2 has been deferred to the following Regulatory Period. A summary of the capital costs are

shown in The total present value of costs for both stages and feeder establishments for Option 1 is \$36.5 Million (excluding associated operating costs and terminal values).

Table 5.

The total present value of costs for both stages and feeder establishments for Option 1 is \$36.5 Million (excluding associated operating costs and terminal values).

Table 5: Option 1 – Capital cost summary

Stage	2025-2029 Regulatory Period					2030	2031
	2025	2026	2027	2028	2029		
Stage 1 Est Riverstone East ZS	3.45	10.35	9.20			2.00	2.00
Stage 2 Aug Schofields ZS						2.00	2.00
Feeder establishment	8.70	2.90					

3.2.3.3 Benefits & NPV

The NER states that quantifiable economic market benefits (needs) include changes in involuntary load shedding. The costs and benefits analysis described in the following section included this benefit in determining the best option. Endeavour Energy's Unserved Energy Template was used to estimate the involuntary load shedding that can be prevented because of proactive action. The HK model utilised the involuntary load shedding along with a Value of Customer Reliability to calculate a market benefit. There were no other identified risks that were included in the costs and benefits analysis.

The assumptions used in the HK model are stated below, and the NPV summary is provided in Table 6.

- A study period of 30 years.
- The commercial discount rate was set to 4.25% and $\pm 1\%$ for low and high sensitivities.
- A VCR of \$34,001/MWh was used based on a weighted average of VCRs for Riverstone ZS and Schofields ZS.
- The benefits of options are based on the avoided unserved energy.
- NPV based on the central scenario.

Table 6: NPV Summary – Option 1 (Central Scenario)

PV "Market Benefits" (\$M)	PV Costs (\$M)	NPV (\$M)
81.1	32.2	48.9

3.2.4 Option 2 – Establish 3rd 132/11kV 45MVA Schofields ZS Third Transformer in 2027 and Establish New 132/11kV 45MVA Firm Riverstone East ZS in 2032

3.2.4.1 Scope

This option includes the following staging.

- Stage 1 – Establish third 132/11kV 45MVA transformer at Schofields ZS commissioned in FY27.
- Stage 2 – Establish new 132/11kV 45MVA Firm Riverstone East ZS commissioned in FY32.

This option results in a 45MVA increase in capacity in FY27 followed by another 45MVA increase in FY32.

Similar to the BAU option, this option results in some feeders requiring extended route lengths until the second stage is established where feeders can be established from Riverstone East ZS. This has been incorporated into the economic assessment.

The figures below show the resultant capacities and unserved energy under this option. It is noted that Endeavour Energy accepts a small amount of unserved energy risk under this option. The second stage under this option has been deferred to the following Regulatory Period and its timing can be reviewed in the future when more development loads are realised in order to determine its optimal timing.

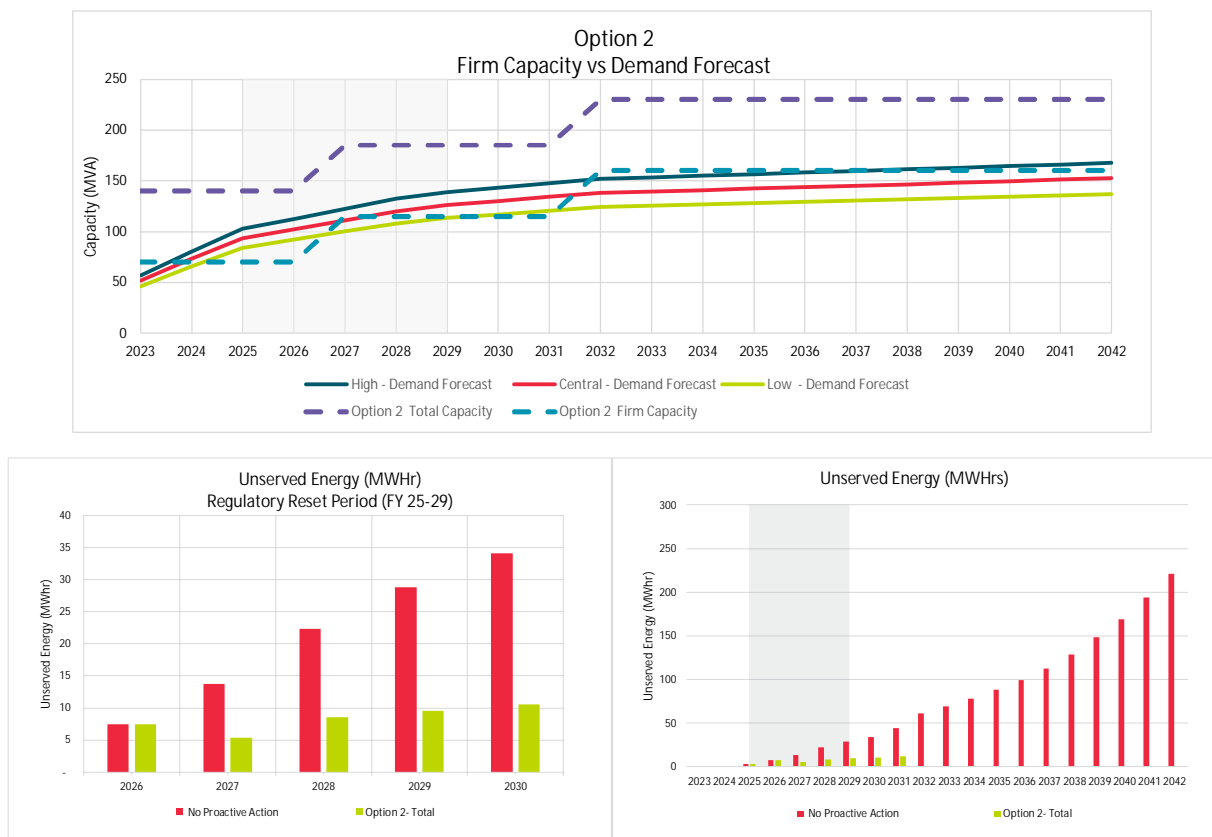


Figure 15: Summary of Option 2. Expected Unserved Energy based on central case demand forecast

This option requires feeders to supply the Riverstone East development area to be established from Schofields ZS until Stage 2 is completed. The costs to establish these feeders has been incorporated in the economic evaluation. Additional costs have also been factored in to cover the extended route lengths due to availability of ducts as discussed in Section 3.2.2.

3.2.4.2 Cost

The total estimated capital cost of Option 2 for the FY25-29 Regulatory Period is \$4.0M and covers Stage 1. Stage 2 has been deferred to the following Regulatory Period. A summary of the capital costs is shown in Table 7.

The total present value of costs for both stages and feeder establishments for Option 2 is \$41.2 Million (excluding associated operating costs and terminal values).

Table 7: Option 2 – Capital cost summary

Stage	2025-2029 Regulatory Period					2030	2031	2032
	2025	2026	2027	2028	2029			
Stage 1 Aug Schofields ZS	2.00	2.00						
Stage 2 Est Riverstone East ZS						3.45	10.35	9.20
Feeder establishment	8.70	2.90	2.90	3.50		3.50		

3.2.4.3 Benefits & NPV

The NER states that quantifiable economic market benefits (needs) include changes in involuntary load shedding. The costs and benefits analysis described in the following section included this benefit in determining the best option. Endeavour Energy's Unserved Energy Template was used to estimate the involuntary load shedding that can be prevented because of proactive action. The HK model utilised the involuntary load shedding along with a Value of Customer Reliability to calculate a market benefit. There were no other identified risks that were included in the costs and benefits analysis.

The same assumptions used for Option 1 also apply to this option in the HK model as specified in the previous section. The NPV summary is provided in the table below.

Table 8: NPV Summary – Option 2 (Central Scenario)

PV "Market Benefits" (\$M)	PV Costs (\$M)	NPV (\$M)
80.7	34.8	45.9

3.2.5 Recommended Network Option

The options table below sets out the credible options that were considered, together with a BAU counterfactual option to assist the overall comparison. Option 1 represents the highest value (economic benefit), being NPV positive of \$48.9 Million compared to Option 1, even with the sensitivity & scenarios considered in Section 3.4.

For these reasons, Option 1 is the preferred network option for the project's overall scope.

Table 9: Option summary table

Option	Description	Solution Type	PV Cost ¹ \$M	PV Benefits ²	NPV ³ \$M	NPV Rank
1	Establish Riverstone East ZS by FY27 Augment Schofields ZS by FY31	Network solution	32.2	81.1	48.9	1
2	Augment Schofields ZS by FY27 Establish Riverstone East ZS by FY32	Network solution	34.8	80.7	45.9	2

Notes:

1: PV of total costs, both Capex and Opex and incorporates terminal values of options

2: PV of total quantified benefits, both risk mitigated, and any forecast decrease in Capex or Opex arising as a result of undertaking the investment (opportunities).

3: PV Benefits less PV Investment Costs.

3.3 Options Considered But Not Progressed

3.3.1 Establish staged 132/11kV 45MVA Firm ZS in Riverstone East

This option involves a staged establishment of Riverstone East ZS. The first stage would establish the substation with 1 x 45 MVA transformer with a tee connection to Feeders 938 and 9JA commissioned in FY27. The second transformer would be deferred to the following Regulatory Period. This option would not have a firm transformer capacity until the second transformer is installed, estimated to be around 2030.

This option did not progress as the table below shows that by 2030, the forecasted load is approximately 35 MVA. By only having a single transformer, the entire load is at risk, resulting in high unserved energy. Given the load at risk, this configuration does not align with Endeavour Energy practices as well as other industry practices. Furthermore, a staged option would only defer a small fraction of the total project cost.

Table 10: Riverstone East Precinct Forecast

Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Riverstone East Precinct	2.3	4.4	16.2	21.0	25.8	30.4	32.6	34.8	37.0	39.2

3.3.2 Augmentation of Riverstone ZS

Riverstone ZS is a space constrained site. Whilst there is space for a third transformer, major works would be required to establish an additional 11kV switchboard. Furthermore, the upstream 33kV does not have adequate capacity to supply an additional transformer and would require mains augmentation.

Currently, Riverstone ZS will not have sufficient circuit breakers for additional feeders to supply the Riverstone East development area. There are 10 circuit breakers at Riverstone ZS of which 6 are already double cabled and 2 earmarked for double cabling. The remaining 2 circuit breakers can be double cabled to establish new more feeders from Riverstone ZS however these are being held for developments that to the North West since there are no other zone substations to run feeders from in that direction.

For these reasons discussed, options relating to Riverstone ZS were not progressed.

3.4 Sensitivity and Scenario Analysis

3.4.1 Sensitivity Analysis

Sensitivity tests and analysis have been applied to the economic evaluation in the Houston Kemp model and results are shown below.

To confirm the robustness of the economic evaluation and to demonstrate the results over a range of variation in some of the key variables, the sensitivity analysis was conducted on all of the credible network options.

The variables included in the sensitivity analysis and shown below in Figure 16 were:

- Discount rate used for the discounted cashflow in the evaluation.
- Capital cost estimates.
- Value of customer reliability

The results show that Option 1 to establish Riverstone East ZS first remains the most favourable option in all sensitivity tests. Table 11 shows there are no tipping points found for variations to Discount Rate, Capital Cost or VCR. Furthermore, it is shown that these variables would need to reach unlikely values in order for the investment to be economically viable.



Figure 16: Sensitivity analysis

Table 11: Sensitivity tipping points

Parameter	Tipping Point	For Preferred Option NPV < 0
Discount rate	No tipping point	9.3%
Capital cost	No tipping point	258.88%
VCR	No tipping point	\$13,502

3.4.2 Scenario Analysis

Scenario analysis has been carried out by the model. The parameters of the scenario analysis are presented below.

Scenario settings				
Parameters		S1	S2	S3
General parameters	Unit	Central	High	Low
Commercial discount rate	Percent	4.25%	3.25%	5.25%
VCR for involuntary load shedding	\$/MWh	34,001	44,201	23,801
VCR for voluntary load curtailment	\$/MWh	34,001	44,201	23,801
Cost parameters	Unit	Central	High	Low
Capital cost	Factor	1.00	0.75	1.25
Planned routine maintenance and refurbishment	Factor	1.00	0.75	1.25
Unplanned corrective maintenance	Factor	1.00	1.25	0.75
Decommissioning costs	Factor	1.00	1.25	0.75
NNO proponent charges	Factor	1.00	0.75	1.25
Cost X	Factor	1.00	1.00	1.00
Risk cost parameters	Unit	Central	High	Low
Reliability and security risk costs	Factor	1.00	1.25	0.75
Safety and health risk costs	Factor	1.00	1.25	0.75
Environmental risk costs	Factor	1.00	1.25	0.75
Legal/regulatory compliance risk costs	Factor	1.00	1.25	0.75
Financial risk costs	Factor	1.00	1.25	0.75
Benefit parameters	Unit	Central	High	Low
Avoided involuntary load shedding	Factor	1.00	1.25	0.75
Avoided voluntary load curtailment	Factor	1.00	1.00	1.00
Avoided costs for non-RIT-D proponent parties	Factor	1.00	1.00	1.00
Differences in the timing of unrelated network expenditure	Factor	1.00	1.00	1.00
Changes in load transfer capacity	Factor	1.00	1.00	1.00
Additional option value	Factor	1.00	1.00	1.00
Changes in electrical energy losses	Factor	1.00	1.00	1.00
Scenario weightings	Unit	Central	High	Low
Weightings	%	0.50	0.25	0.25

Figure 6: Houston Kemp model scenario parameters

Table 12: Summary of scenarios investigated

Variable	Scenario 1 - baseline	Scenario 2 – high benefits	Scenario 3 – low benefits
Capital cost	Estimated network capital costs	25% decrease in the estimated network capital costs	25% increase in the estimated network capital costs
Value of customer reliability (VCR)	\$34,001/MWh	\$44,201/MWh 30% higher than baseline	\$23,801/MWh 30% lower than baseline
Discount rate	4.25% (WACC)	3.25% 1% below baseline	5.25% 1% above baseline
Scenario weighting	50%	25%	25%

The scenarios have been weighted as 50% for Scenario 1 (Central) being the most likely with Scenarios 2 (High) and 3 (Low) being given a weighting of 25%. Table 13 shows that Option 1 is still the preferred option having the highest weighted NPV in all scenarios.

Table 13: Weighted net present value of options

Option	Scenario 1 NPV (\$M)	Scenario 2 NPV (\$M)	Scenario 3 NPV (\$M)	Weighted NPV (\$M)	Option ranking
Option 1	48.9	434.9	-30.3	125.6	1
Option 2	45.9	431.1	-33.0	122.5	2

3.5 Optimal Timing

- The optimal timing for the investment using the AER's 'crossover' method is 2027 as per Figure 17. This is the first year when net operating benefits are larger than the annualised cost of an option.
- Due to the method of calculation in the HK model, a separate model was created for the purpose of determining optimal timing. In this model, the costs associated with establishing feeders was transferred from the options costs to the BAU and thus being factored into the net operating benefit calculation.

Annualised cost and optimal commissioning year for RE		
Option name	Annualised cost	Optimal year
RE ZS then SC TX3	1,311,121	2027

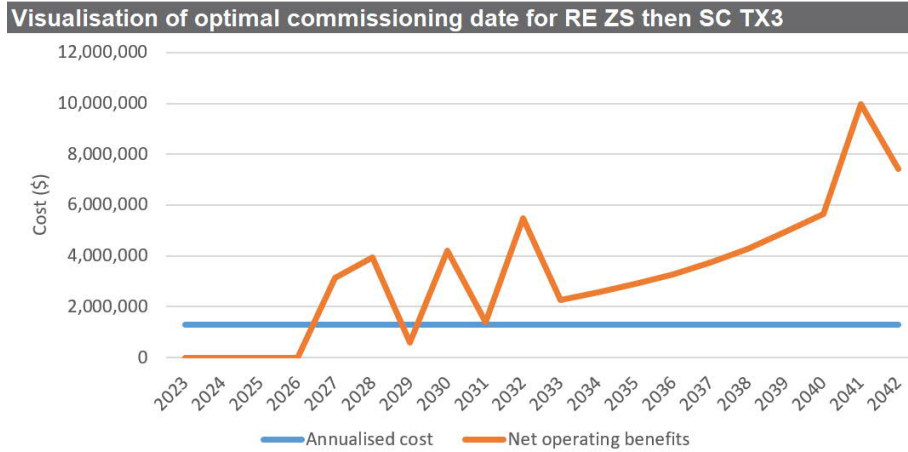


Figure 17 - Houston Kemp optimal timing output

3.6 Non-network Options to Defer Network Investment

3.6.1 Scope

Electricity Distributors in NSW operate under the licence requirement (under the NSW Electricity Supply Act 1995) to investigate non-network alternatives to network augmentation for specific capital expenditure projects. The National Electricity Rules (NER) require Distribution Network Service Providers (DNSP) to investigate non-network options by utilising a consultation process as part of planning for major network augmentations.

The New Technology Master Plan (NTMP) tool was used to evaluate credible non-network options with the constraint of Schofield ZS⁴. Figure 18 shows the comparison of non-network solutions and network solutions against the base case, while Figure 19 compares non-network solutions against the network solution.

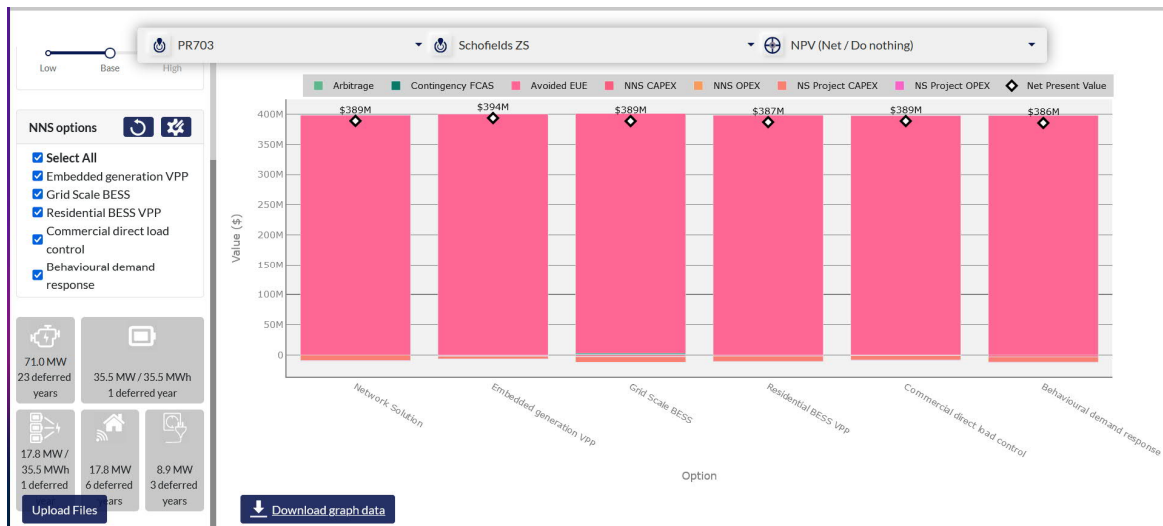


Figure 18: NTMP Output for Non-Network Options when compared to the Base Case

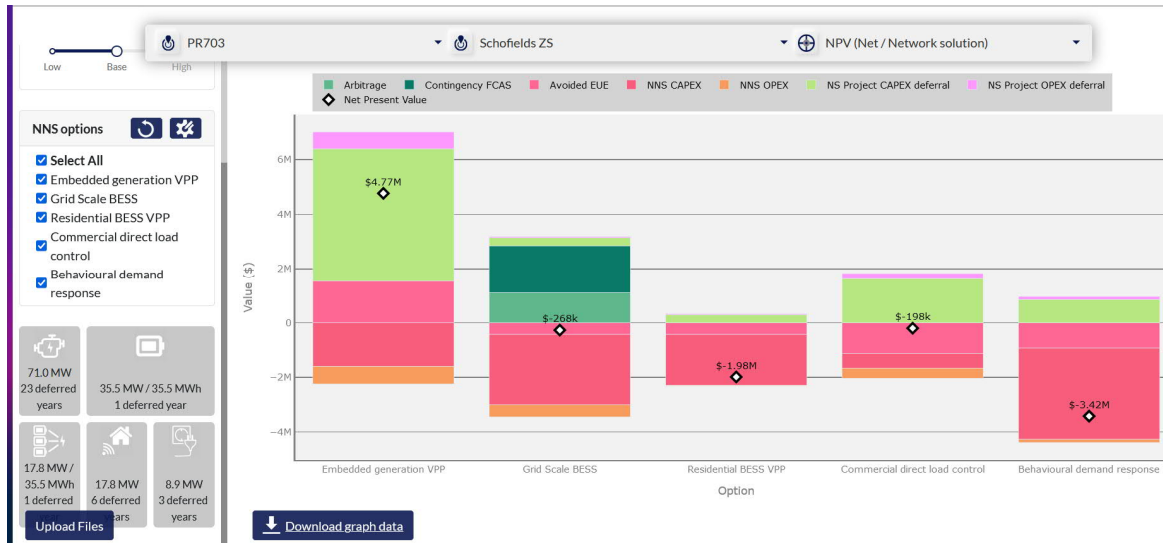


Figure 19 :NTMP Output for Non-Network Options when compared to the Network Solution

⁴ Schofield ZS was chosen as the constraint, as it contributes to the majority of the unserved energy.

Table 14 provides an overview of the outputs from the NTMP tool and overlays with qualitative assessment.

Table 14: Non-Network / New Technology Options

Non-Network Options	Outcomes	Qualitative Assessment	Comments
Grid-Scale Storage (35.5MW /35.5 MWh)	Potentially defer the network investment by 1 year	✗	Not feasible due to lack of greenfield infrastructure. Additionally, it is NPV negative when compared to the network option
VPP (71 MW)	Potentially defer the network investment by 23 years	✗	Not a feasible as the proposed capacity is large for a new technology and this uptake from customers is unlikely to occur.
Residential BESS VPP (17.8 MW /35.5 MWh)	Does not defer network investment	✗	Not a feasible option as this is a new development. Additionally, the proposed capacity is large for a new technology and this uptake from customers is unlikely to occur. Additionally, it is NPV negative when compared to the network option
Commercial Direct Load Control (17.8 MW)	Potentially defer the network investment by 6 years	?	This option is shown to NPV negative when compared to the network option. It is unlikely that this option would be feasible due to majority of load in these areas being residential. However, Endeavour Energy can investigate feasibility further as part of the RIT-D process.
Behavioural Demand Response (8.9 MW)	Potentially defer the network investment by 3 years	?	This option is shown to be NPV negative when compared to the network option. However, Endeavour Energy can investigate feasibility further as part of the RIT-D process.

3.6.2 Summary

The NTMP tool and the subsequent qualitative analysis found that non-network options are unlikely to be feasible. However, Endeavour Energy will proceed with the RIT-D process to explore and investigate opportunities if any.

4. Recommendations and Next Steps

It is recommended that:

- A Non-Network Options Report be issued seeking submissions for non-network options prior to proceeding to the Draft Project Assessment Report (DPAR), given that there are credible non-network options available.
- If a feasible non-network option submission is received, the economic evaluation for this project will be revised to assess whether the non-network option will defer the preferred network option.
- The CFI will be finalised at the completion of the RIT-D process and a final approval will then be submitted to confirm if the scope will include a non-network option and if the recommended timing of investment of the preferred network option will change.
- If a feasible and cost-effective non network option is not received, the best NPV network solution is the **establishment of a new Riverstone East 132/11kV 45MVA zone substation (Option 1)** to be commissioned in FY27 followed by **augmentation of Schofields ZS** in the following Regulatory Period. Currently, this option represents a highest value (economic benefit) being NPV positive \$48.9 Million and represents the best option to connect customers. Stage 1 of this option is estimated to cost \$23.0 Million and is expected to be spread over three years from FY25 to FY27.
- It is recommended as developments are realised, the economic evaluation be updated to reflect load uptake in order to determine the optimal timing for Stage 2.
- It is recommended that the project value of \$23.0 Million be approved for consideration in the FY25-FY29 Regulatory Period.

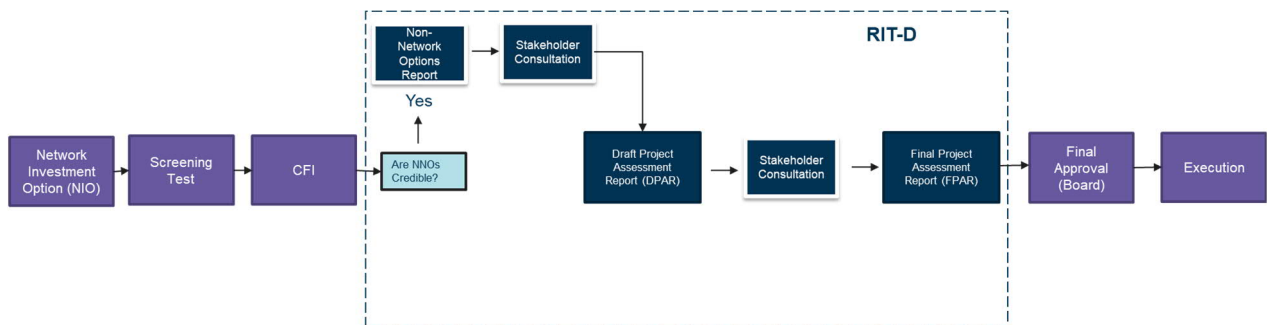


Figure 20: Endeavour Energy's RIT-D Process for this Project

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Appendices

A. Summer Demand Forecast

3.2.1.2 Riverstone East Zone Substation

The proposed Rivestone East ZS does not have a stand-alone entry in the detailed network demand forecast section. Confirmed load applications and known lot releases from this area have been depicted as being supplied from existing zone substation:

- Schofield ZS
- Riverstone ZS

In the 10-15 year horizon, the proposed zone substation will service parts of the precincts of:

- Vineyard Stage 2
- Riverstone East Stage 1
- Riverstone East Stage 2
- Riverstone East Stage 3

The following table Table 8 is the contains the existing zone substation(s) and the anticipated load applications for the new (greenfield precincts) over a ten-year period. Table 9 shows the forecast load on the proposed Zone Substation.

Table 15- Proposed Riverstone East ZS forecast Connections included in detailed network forecasts

Schofields Forecast	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Schofields SDF23 50% PoE	32.4	50.8	61.3	67.7	74.4	80.9	86.2	89.6	93	96.3
Riverstone East - 400 residential dwellings							1.7	1.7	1.7	1.7
Riverstone East - 550 residential dwellings (1/2)						1.2				
Riverstone East - 600 residential dwellings (1/2)			1.3	1.3	1.3					
Riverstone Precinct - 400 residential dwellings (1/2)			0.9	0.9	0.9	0.9				
UML10036 Units Rivo east area New Feeder			0.8							
Riverstone East Load currently shown on Schofields ZS			3.0	5.2	7.3	9.4	11.1	12.8	14.6	16.3
Schofields w/o Riverstone East Load	32.4	50.8	58.3	62.5	67.1	71.5	75.1	76.8	78.4	80.0
Riverstone Forecast	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Riverstone SDF23 50%PoE	19.3	22.4	32.3	34.5	36.9	39.3	39.9	40.5	41.1	41.8
Riverstone East - 550 residential dwellings (1/2)						1.2				
Riverstone East - 600 residential dwellings (1/2)			1.3	1.3	1.3					
Riverstone Precinct - 400 residential dwellings (1/2)			0.9	0.9	0.9	0.9				
Riverstone West - 88 hectares of employment land			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
URS19294 Off Windsor Rd		0.5								
URS19295 Off Windsor Rd		0.4								
URS20274 Garfield Rd East 35 lots			0.2							
URS20316 Edmund St			0.2							
URS20833 231 Garfield Rd East Riverstone		0.1								
URS21299 Garfield Rd East			0.2							
URS21416 Crown st development		0.0								
URS21885 161 Crown St, Riverstone			0.2							
URS23064 Regent st Riverstone			0.2							
URS23322 Regent st riverstone			0.1							
URS24221 69 lots 70 Riverstone rd		0.3								
URS26190 Rivo east dweelings		0.8								
URS26599 Edmund St			0.3							
UUL1964 Syd water			4.8							
UUL1964 Sydney water	2.3									
Riverstone East Load currently shown on Riverstone ZS	2.3	4.4	13.2	15.9	18.5	21.0	21.5	22.0	22.5	23.0
Riverstone ZS w/o Riverstone East Load	17.0	18.0	19.1	18.6	18.4	18.3	18.4	18.5	18.6	18.8

Table 16 – Prospective forecast for proposed Riverstone East ZS Forecast

Riverstone East Forecast Low	2.1	4.0	14.6	18.9	23.2	27.4	29.4	31.3	33.3	35.3
Riverstone East Forecast Central	2.3	4.4	16.2	21.0	25.8	30.4	32.6	34.8	37.0	39.2
Riverstone East Forecast High	2.5	4.8	17.8	23.1	28.4	33.5	35.9	38.3	40.7	43.2

B. Detailed Cost Estimate



SUBSTATION DESIGN ESTIMATE SUMMARY Design Branch (NPR-000048 – Riverstone East ZS & Schofield ZS)

PROJECT SUMAMRY			
Project ID:	NPR-000048	Sites:	Riverstone East ZS & Schofield ZS
Revision No:	0	Date:	15/7/2022
PROJECT DESCRIPTION			
The estimates stated in this document are for two (2) feasible options as follows:			
<ul style="list-style-type: none"> Option 1 – New Riverstone East Indoor GIS 132kV/11kV Zone Substation including: <ul style="list-style-type: none"> 2 x tee connections from overhead lines 938 and 9JA 2 x 132kV/11kV 45 MVA power transformers 2 x 132kV modular buildings for 132kV GIS consisting of two (2) incomers, two (2) bus sections and two (2) transformer feeders. 2 x 11kV modular buildings with seven (7) 11kV CBs on each bus section 2 x AFIC cells Option 2 – Schofield Zone Substation Augmentation including: <ul style="list-style-type: none"> 1 x 132kV/11kV 45MVA 62dBA power transformer 11kV switchgear upgrade for 1 x 11kV transformer CB, 10 x 11kV feeder CBs and 1 x 11kV bus section CB 			
EXCLUSIONS			
Nil			
ASSUMPTIONS			
Nil			
COST ESTIMATE			
Options	Estimate	Contingency	Total
Option 1	\$23,000,000	\$2,500,000	\$25,500,000
Option 2	\$4,000,000	\$450,000	\$4,450,000
Completed by: Farzad Kavehnia			
Signature:		Date:	15/7/2022
ENDORSED			
Endorsed by: Blake Christian			
Signature:		Date:	15/07/2022
COMMENTS			

Produced by Asset Planning & Performance

W Endeavourenergy.com.au
E news@endeavourenergy.com.au
T 131 081



ABN 11 247 365 823