

PR700: RIVERSTONE EAST ZONE SUBSTATION

MAJOR PROJECT BUSINESS CASE

Project	Description
Primary Driver	Network Connection
Project Category	
Publish Date	

Approvals	Name	Designation	Date
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Reviewed	Deepak Sahay	Network Planning Engineer	12/02/2018
Endorsed			
Approved			

Revision	Amendment	Date

1.0 Background

The precincts of Riverstone East and Vineyard are emerging residential development frontiers that form part of the NSW Government's North West Priority Growth Area. In addition, there are a number of new greenfield developments around Riverstone that form part of the priority growth area. The Precincts of Riverstone and Riverstone West have already been rezoned from rural to urban and will provide 9,000 new dwellings as well as an employment hub providing a mix of commercial industrial lots that will have the capacity for 12,000 jobs. Growth in Riverstone is presently addressed by capacity available at the existing Riverstone Zone Substation which was originally configured to provide supply to a semi-rural customer base

In addition to Riverstone and Riverstone West, the Department of Planning & Environment has rezoned stages 1 and 2 of the Riverstone East precinct with following stages delayed due to lack of sewer and electricity infrastructure. Stages 1 and 2 of Riverstone East will provide an additional 5800 dwellings. Stage 1 of the Vineyard precinct was rezoned in December 2017 and is expected to provide a further 3400 dwellings. Riverstone East and Vineyard Stage 1 together will provide 9200 dwellings in total.

Figure 1 below presents an overview of the North West Priority Growth Area and highlights existing and future investments required to service the growing number of businesses and dwellings requiring connection to grid services. Figure 2 provides alternative views from the Housing Industry Association and the Department of Planning in relation to dwelling forecasts for the region. The HIA data indicates the trend in dwelling commencements whereas the Department of Planning data displays the trend in dwelling completions, hence the lag between the two trends.



Figure 1 - Overview

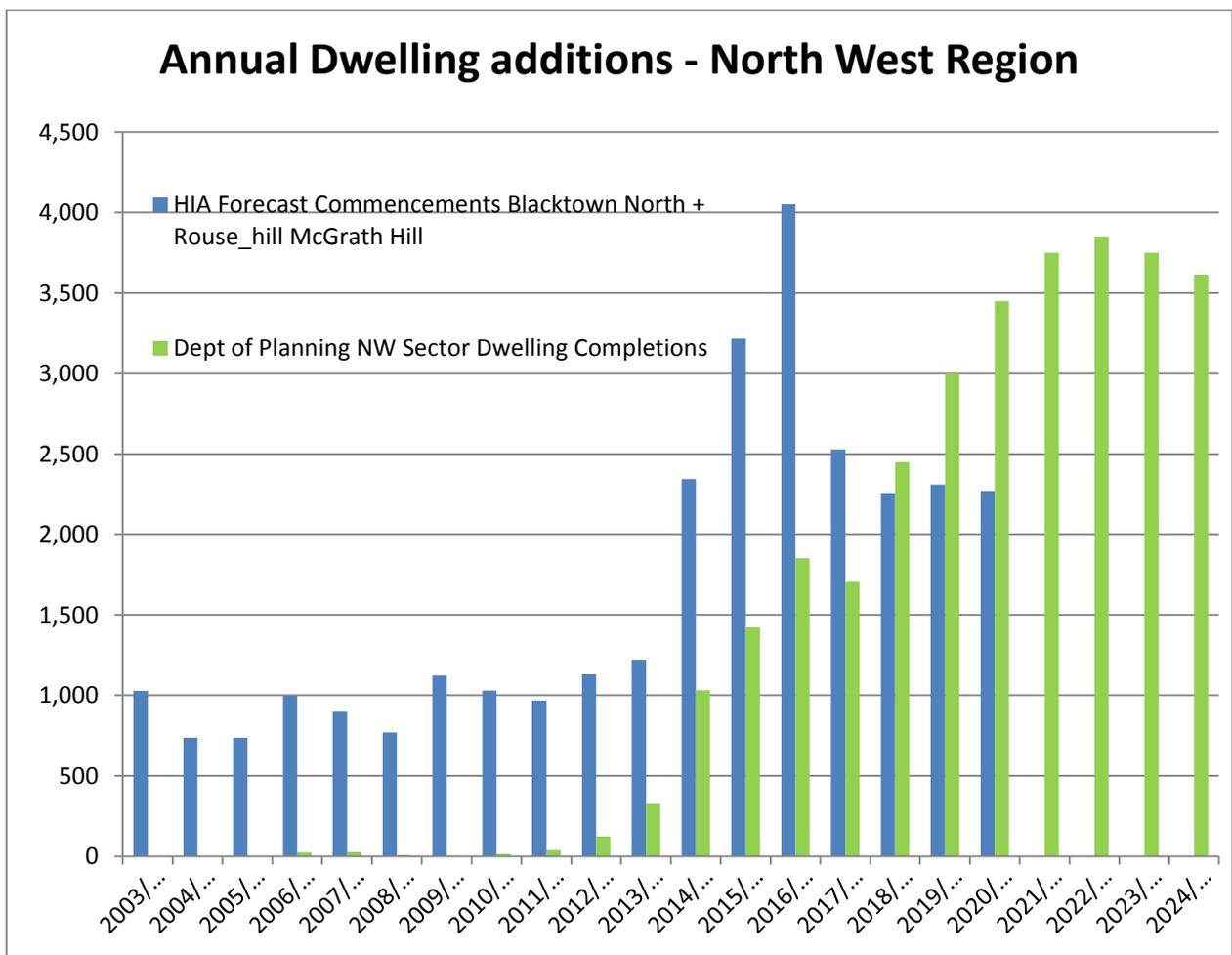


Figure 2 - Trends in residential dwelling commencements and completions. (Source: HIA, Department of Planning)

2.0 Need/Opportunity

Supply to the precincts of Riverstone and Riverstone West have been managed through capacity available at Riverstone and Schofields Zone Substations. However, the addition of Riverstone East and Vineyard precinct stages is projected by the Department of Planning and Environment to add an additional 3900 dwellings by 2024. Given the projected dwelling numbers, significant investment in additional distribution feeder capacity is comparable to establishing a zone substation closer to the load within these precincts. Whilst short term supply issues are able to be managed using existing assets, in order to cater for the ultimate development, timely construction of an appropriately situated zone substation will minimise investments in what would become redundant distribution assets.

2.1 Forecast Demand

Forecast demand for the new precincts of Riverstone East and Vineyard are indicated in Figure 5. Initial development in these precincts will be supplied from the existing Riverstone Zone Substation and Schofields Zone Substation south of the precinct. Figure 6 indicates the impact of these initial developments on demand at Riverstone ZS and Figure 7 indicates the impact on Schofields ZS. The forecast is derived from actual subdivision load applications from developers and known lot releases. Recent actual connections activity has grown exponentially over the past 5 years.

The construction of the new Sydney Metro North West Rail Link (Figure 3), significant commercial developments at Sydney Business Park in Marsden Park and major road upgrades have been a catalyst for growth and are considerable drivers for demand for the housing market for the area.



Figure 3 - The construction of the Sydney Metro North West Rail Link is a major catalyst for growth in this region.

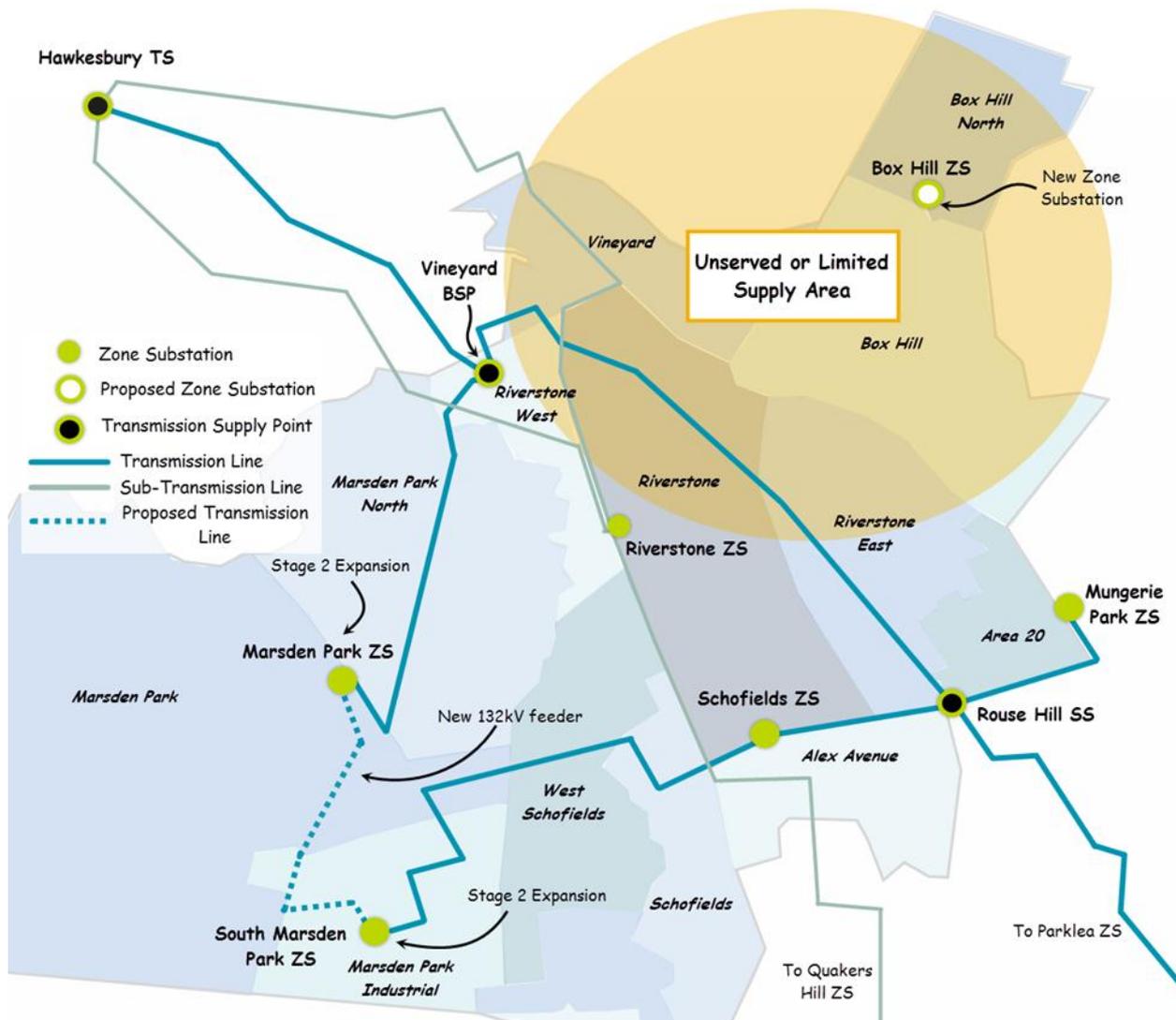


Figure 4 - Map showing un-served areas

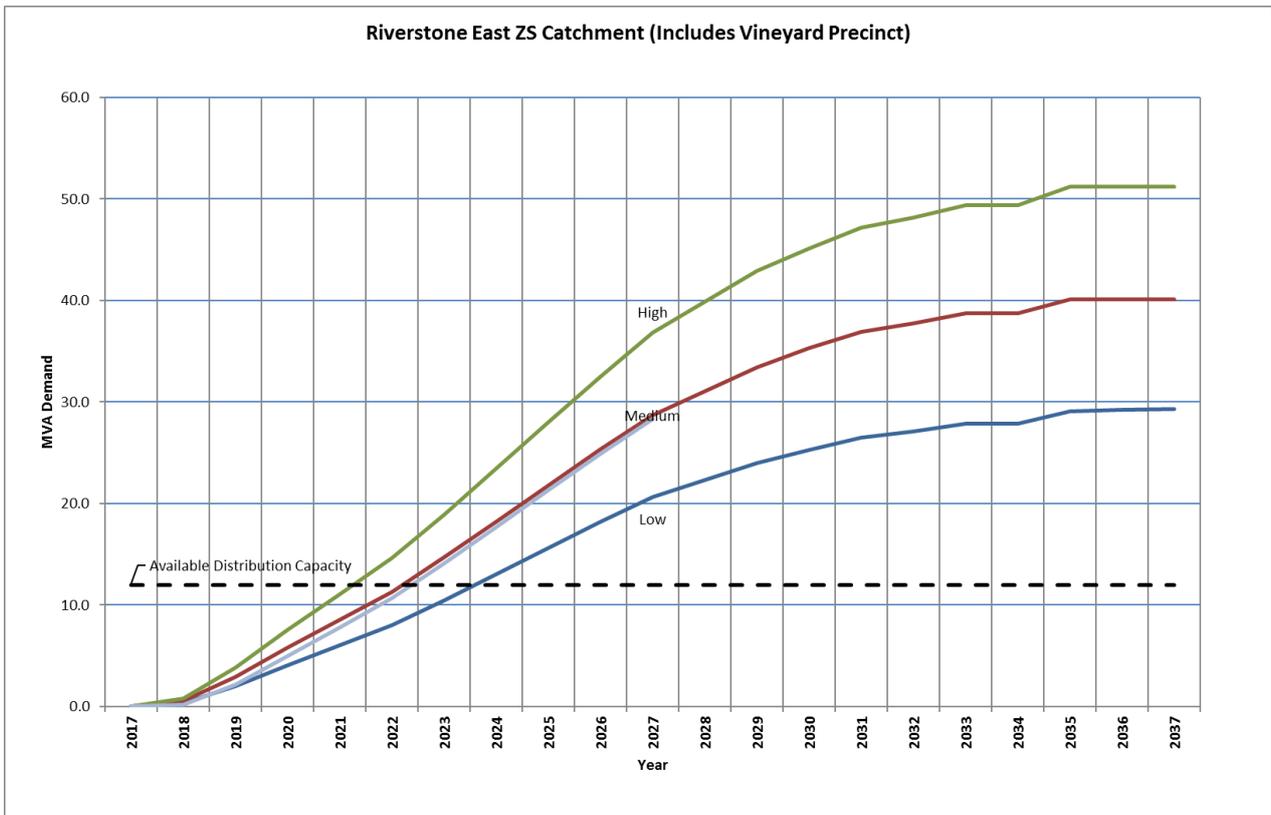


Figure 5 - Riverstone East and Vineyard Precincts - Forecast residential load

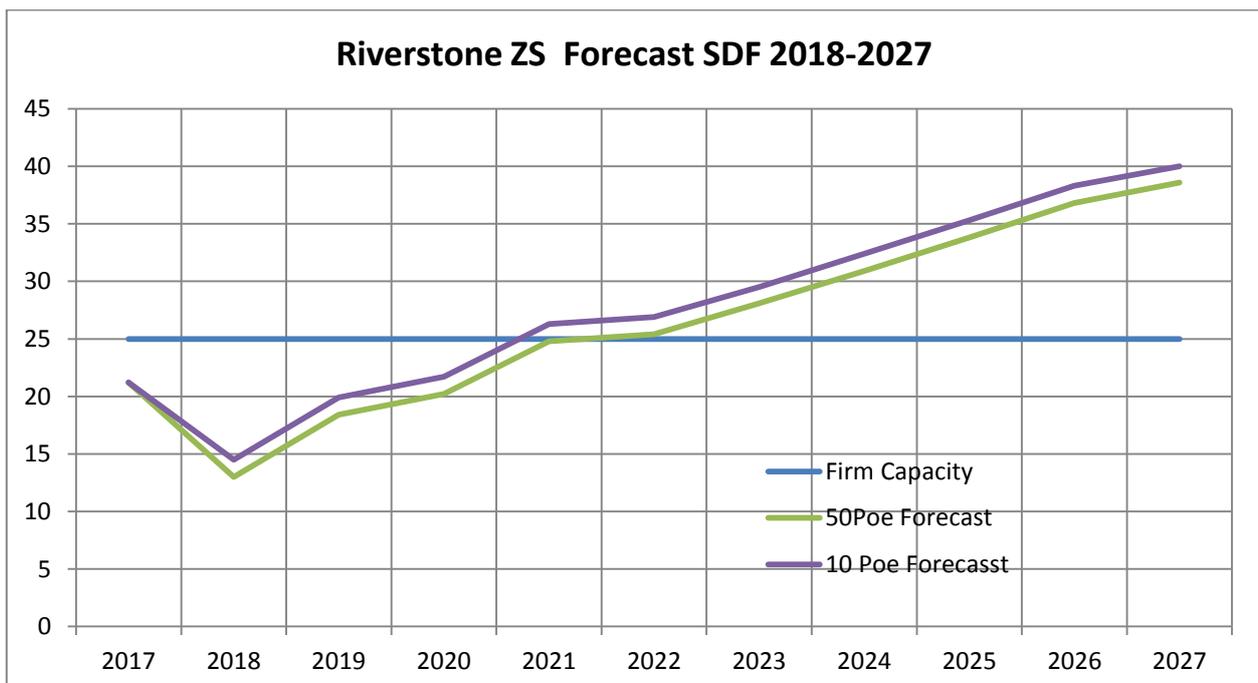


Figure 6 - Riverstone ZS Summer Forecast including load in the subject area

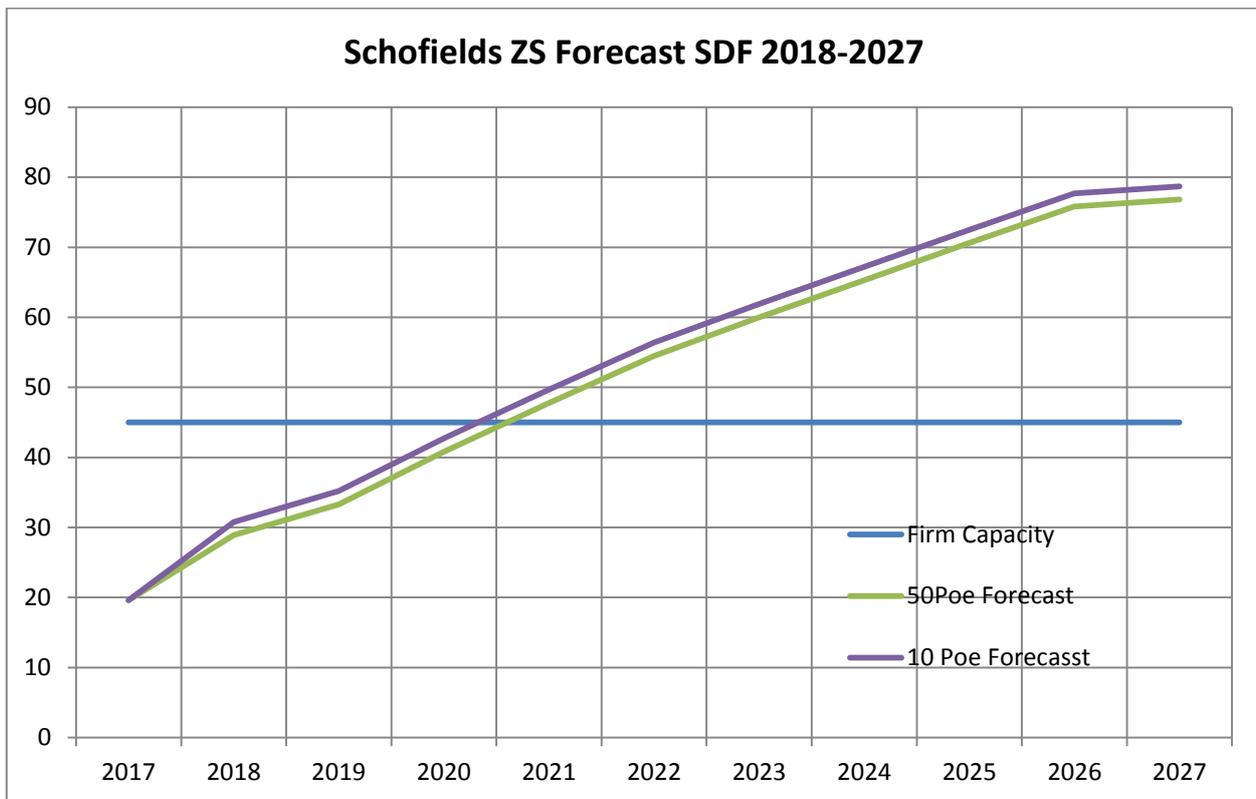


Figure 7 - Schofields ZS Summer Forecast including supply into the subject area

2.2 Existing Supply

The closest supply point to the new precincts of Riverstone East and Vineyard is Riverstone Zone Substation. The substation will also supply the developing precincts of Riverstone and Riverstone West.

Following planned load transfers away from Riverstone ZS, Riverstone ZS will have approximately 12 MVA of firm capacity available. This capacity will be utilised to provide supply to the initial Riverstone East. Schofields ZS is further south of Riverstone ZS and can provide initial limited supply to the south of the Riverstone East and Riverstone Precincts.

2.3 Load at Risk

On the basis of the load forecast for the new precincts and after taking into account supply to existing precincts, by 2024, Schofields Zone substation will have load at risk of 20 MVA and Riverstone Zone substation will have 6 MVA of load at risk.

Table 1 - Load at risk (MW)

Zone Substation	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Riverstone ZS	-	-	-	-	0.4	3.1	5.9	8.8	11.8	13.6
Schofields ZS	-	-	-	2.8	9.5	15.0	20.3	25.6	30.8	31.8

2.4 Energy at Risk

Based on supply to initial developments within the new precincts, energy at risk over the forecast period is estimated as follows:

Table 2 - Energy at Risk (MWh) Riverstone ZS

Riverstone ZS	2019	2020	2021	2022	2023	2024	2025	2026	2027
Energy at Risk	0	2	89	146	535	1312	2810	5197	7039
Energy not able to be supplied	0	0	0	0	0	0	0	0	1
Sum	0	2	89	146	535	1312	2810	5197	7039

Table 3 - Energy at Risk (MWh) - Schofields ZS

Schofields ZS	2019	2020	2021	2022	2023	2024	2025	2026	2027
Energy at Risk	0	21	152	460	845	1531	2681	3806	4218
Energy not able to be supplied	0	0	0	0	0	0	4	13	17
Sum	0	21	152	460	845	1531	2685	3819	4236

3.0 Project Value

The precinct requires connections for 9200 new customers who will be entering the electricity market and generating business for market participants. In addition, by establishing additional subtransmission, capacity to facilitate these connections, the following VCR risk costs would be addressed and available as benefits to the project proposal.

3.1 Potential Project Benefits (VCR Risk Costs only)

Table 4 - VCR Risk Costs

Zone Substation	PV of VCR Risk Costs
Riverstone ZS	\$49.2m
Schofields ZS	\$14.7m
Total VCR Risk Costs (Potential Project Benefit)	\$63.9m

3.2 Project Costs

Distribution feeders from existing zone substations will have to traverse distances more than 10 km to service the precincts. Increasing density around existing zone substations will make voltage drop an issue for long feeders. Assuming voltage drop remains within acceptable limits, a minimum of six new distribution feeders will be required to service these precincts and will cost more than \$24million. It will deter further extension of the network into adjacent future precincts.

A new zone substation at Riverstone East is estimated to cost \$ 20.6 million in real terms.

4.0 Indicative Options

4.1 Option 1 – Establishment of Distribution Feeders

Generally, the establishment of initial distribution feeders from adjacent substations in such greenfield areas may be considered as credible options subject to a number of factors including:

- Available transformer capacity at adjacent zone substations
- Available circuit-breakers and switchboard capacity at zone substations
- the availability of suitable routes and established road layouts to establish feeders.

Further extension of the network will allow the Vineyard Precinct to the North of Riverstone ZS to develop.

In this case the use of the existing 11kV network option is already in implementation with approximately 3000 dwellings out of the total of 9200 will be supplied from existing 11kV feeders from Riverstone ZS and Schofield's ZS following some minor augmentation and rearrangement. This has deferred the requirement for a zone substation, but it is still required within the regulatory period.

Schofield ZS is further south and it is not practical to run long distribution feeders to the Vineyard Precinct. The net market benefits for the option to augment Schofield's ZS and extend distribution feeders from Schofield's ZS is -\$4.4 million which suggests that this is not a viable option to pursue.

The development of additional feeders from Riverstone ZS will require significant augmentation works at Riverstone ZS including the addition of a third transformer and a control room building. The net market benefits for this option is \$36.6million.

4.2 Option 2 – Establishment of a 132/11kV Zone Substation

Following the establishment of initial supplies from the existing zone substations, once this capacity is used up, the establishment of a 132/11kV Zone substation ultimately becomes the preferred option due to the scale of the development. This option will also remove potential load at risk at Riverstone and Schofield's Zone Substations and allow the regions in the immediate vicinity of these substations to develop further.

Based on removing load at risk from Schofield's ZS and Riverstone ZS and the foregone need to build long distribution feeders, the estimated net market benefits from this option has been evaluated to be \$45.3 Million (\$38.1m + \$7.2m).

A new zone substation at Riverstone East is estimated to cost \$ 20.6 million in real terms inclusive of associated 132kV and 11kV costs.

4.3 Option 3 – Non-Network Options

The principal contributors to the peak demand in this area are the existing rural area along with growth in demand from the new residential development. For demand management to be successful, peak demand on the existing feeders will need to be reduced as well as managing the demand growth in the development areas. However, given that surrounding areas are also developing and connections to these feeders are likely to increase, the available capacity to supply the developing areas reduces and obtaining sufficient demand reduction becomes more challenging. A demand reduction or energy efficiency program is unlikely to achieve the required levels of demand reduction from an existing customer base for this greenfield development area.

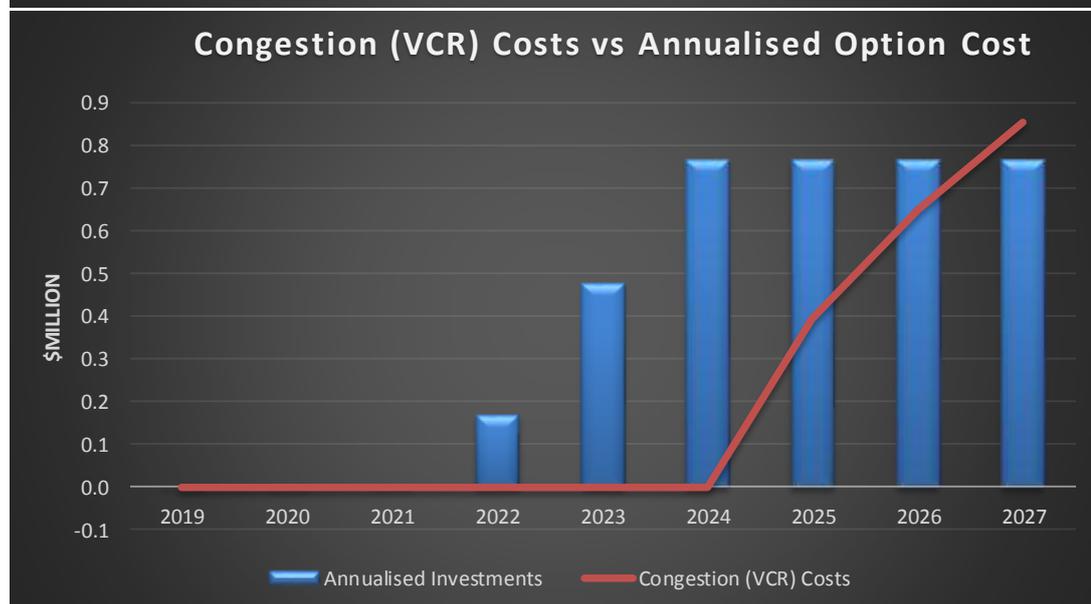
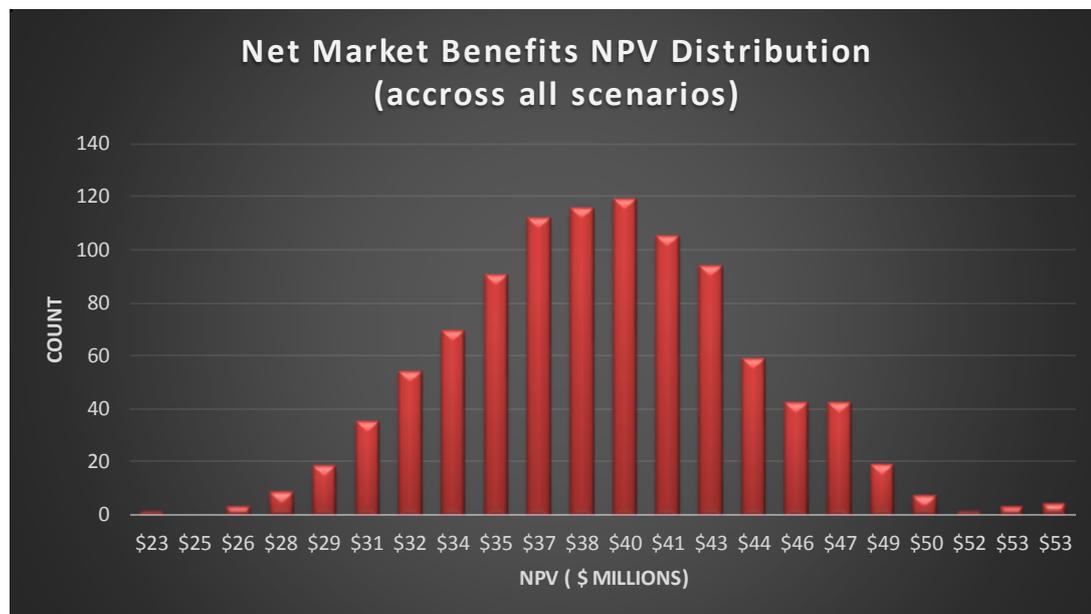
Non-network solutions may be feasible for the new planned developments in conjunction with the developer where sufficient demand reduction exists within the existing customer base in conjunction with the initiatives within the development areas such as distributed energy resources. Newly constructed dwellings within the development areas are built to high energy efficiency standards. This has the potential to influence timing of network build options. The associated demand reduction has been built into the demand forecast for these areas. Non-network solutions may also be feasible in managing the risks of unserved load thus allowing further connections to be made. Subject to a DM screening test, this option will be explored further as part of the RIT-D process for this project. These opportunities will be further assessed during the RIT-D phase of the project.

5.0 Conclusion

Based on the rates of growth and limited existing capacity, a zone substation of appropriate capacity needs to be established within the Riverstone East Precinct within the 2018/19-2023/24 regulatory period.

6.0 Appendix

Probabilistic VCR Template v3 Riverstone New Riverstone East ZS Option.xlsm				
	PV investme nts (\$m)	PV Market Benefits (\$m)	NPV (\$m)	
Deterministic Assessment	\$ 9.9	\$ 45.3	\$	35.4
Proabablistic Assessment	\$ 10.5	\$ 48.5	\$	38.1
PV of Risk Costs (Potential Market Benefits)			\$	49.2
		% Risk		
Risk of Negative Market Benefits			0%	



Probabilistic VCR Template v3 Schofields New Riverstone ZS East Option.xlsm

	PV investme nts (\$m)	PV Market Benefits (\$m)	NPV (\$m)
Deterministic Assessment	\$ 4.9	\$ 8.7	\$ 3.8

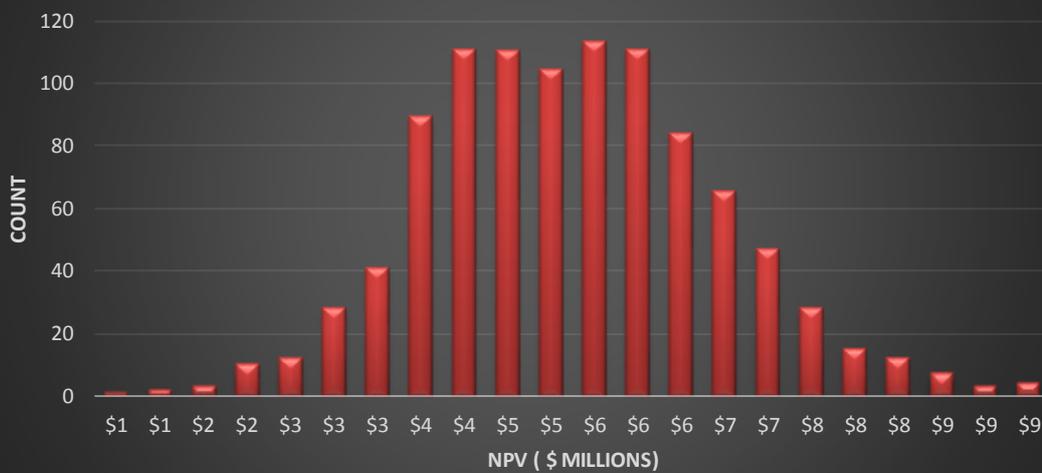
Proabablistic Assessment	\$ 5.2	\$ 12.4	\$ 7.2
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PV of Risk Costs (Potential Market Benefits) \$ 14.7

% Risk

Risk of Negative Market Benefits	0%
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**Net Market Benefits NPV Distribution
(across all scenarios)**



Congestion (VCR) Costs vs Annualised Option Cost



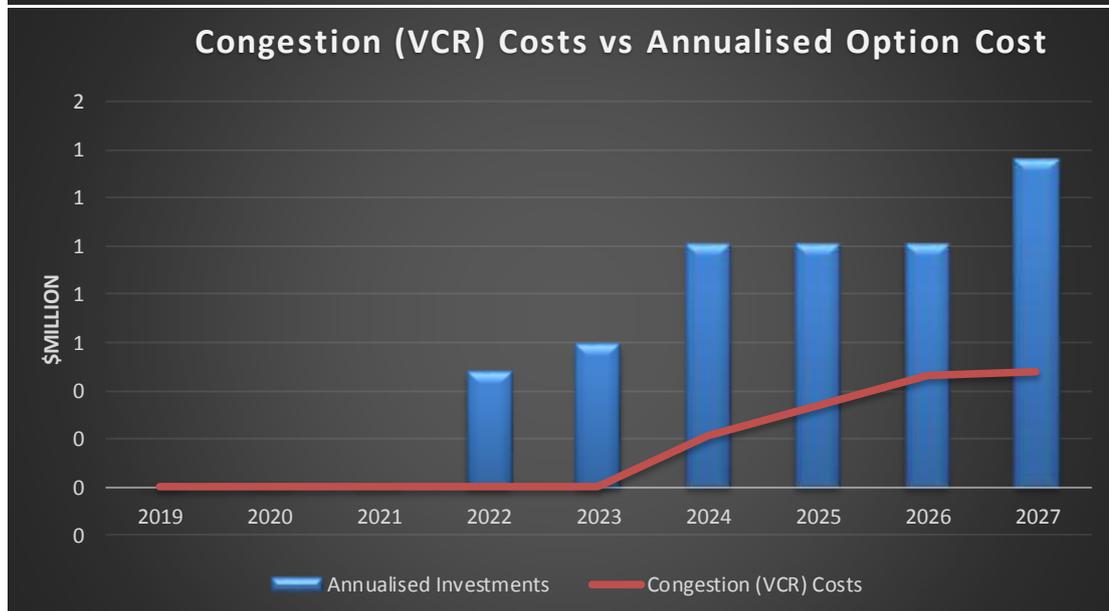
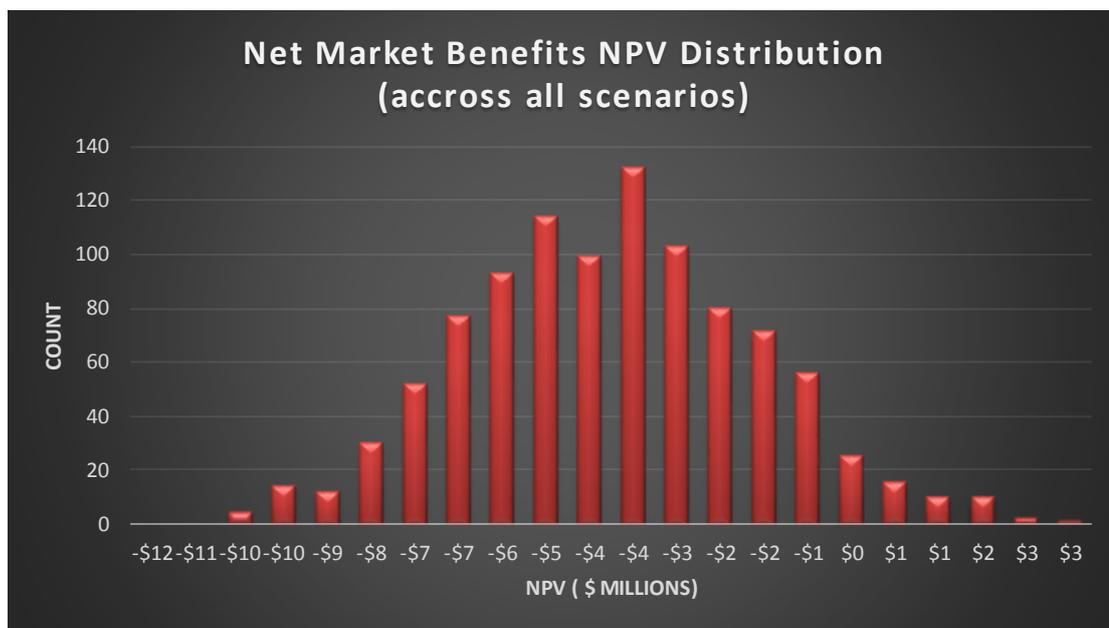
Probabilistic VCR Template v3 Schofields Augment plus Fdrs.xlsm

	PV investme nts (\$m)	PV Market Benefits (\$m)	NPV (\$m)
Deterministic Assessment	\$ 17.4	\$ 11.8	-\$ 5.6

Proabablistic Assessment	\$ 18.5	\$ 14.1	-\$ 4.4
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PV of Risk Costs (Potential Market Benefits) \$ 14.6

	% Risk
Risk of Negative Market Benefits	9640%



Probabilistic VCR Template v3 Riverstone Augment plus Fdrs.xlsm

	PV investme nts (\$m)	PV Market Benefits (\$m)	NPV (\$m)
Deterministic Assessment	\$ 10.0	\$ 44.2	\$ 34.2

Proabablistic Assessment	\$ 10.7	\$ 47.2	\$ 36.6
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PV of Risk Costs (Potential Market Benefits) \$ 49.6

% Risk

Risk of Negative Market Benefits	0%
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