RIT-D Draft Project Assessment Report

Westmead Zone Substation

29 June 2022

Endeavour Energy

Contents

1. Executive summary

This Draft Project Assessment Report (DPAR) was prepared by Endeavour Energy in accordance with the requirements of clause 5.17.4 of the National Electricity Rules (NER).

The purpose of this report is to demonstrate the basis for selection of the preferred option to address the network limitations in the Westmead Health Precinct and other surrounding suburbs.

Westmead zone substation (ZS) was commissioned in 1978 to supply the Westmead Health Precinct and other surrounding loads. This health precinct accounts for approximately two thirds of the entire Westmead ZS load. The other third is made up of residential and commercial loads in the surrounding area. The precinct is currently undergoing a significant expansion that will result in a large increase in demand in coming years. Specifically, we expect demand in the development area to reach 38 MVA by 2023/24, after which it will grow to 67MVA in 2030/31 before continuing to increase in subsequent years. This will lead to rapidly increasing risks of customers losing supply from unplanned outages as firm capacity is exceeded. As these risk levels increase, intervention in the form of investment in additional electricity infrastructure or alternative non-network solutions is required. Other contributors to load growth include the adjacent Western Sydney University campus (currently under construction) and Parramatta Light Rail (a NSW government project expected to open in 2023).

The identified need for this investment is 'reliability corrective action' since investment is required to comply with our NER obligations to connect customers. The timing of the identified need for this RIT-D is determined by when the expected load requiring connection will exceed the existing network capacity. This is currently anticipated to be 2023/24, based on the connection enquiries received to date.

This report follows publication of a Non-Network Options Report (NNOR) to seek submissions from interested parties for non-network solutions that is both commercial and technically feasible to defer or avoid the preferred network option. However, no submissions were received.

Five options were assessed and four were determined to be credible in addressing the network need. The options assessed are listed below:

- Do Nothing : Base case;
- Option 1 : Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section;
- Option 2 : Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard;
- Option 3 : Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard; and
- Option 4 : Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation

The 'Do Nothing' option is not considered credible as it will result in significant expected unserved energy in the precinct which would prevent the connection of new loads.

The economic assessment of the credible options is shown in Table 1. Option 3 presents the greatest net present value (NPV) of the market benefits considered in the evaluation. The assessment period for calculating the NPV is 30 years. Market benefits are based predominantly on expected unserved energy which is monetised by using Value of Customer Reliability (VCR).

Table 1: Summary of Credible Options

Option	Description	Project capex nominal ($M)	PV of market benefits ($M)	PV of Costs ($M)	NPV ($M)	Rank
1	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section	20.3	60.2	13.7	46.5	4
2	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard	19.6	60.2	13.1	47.1	3
3	Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard	12.5	60.2	10.7	49.5	1
4	Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation	15.2	60.2	12.0	48.3	2

Sensitivity analysis was undertaken across a range of assumptions including forecasted load growth, discount rate, VCR and Capex. In each scenario considered, Option 3 remained the preferred option, indicating there is a very high degree of confidence in this result.

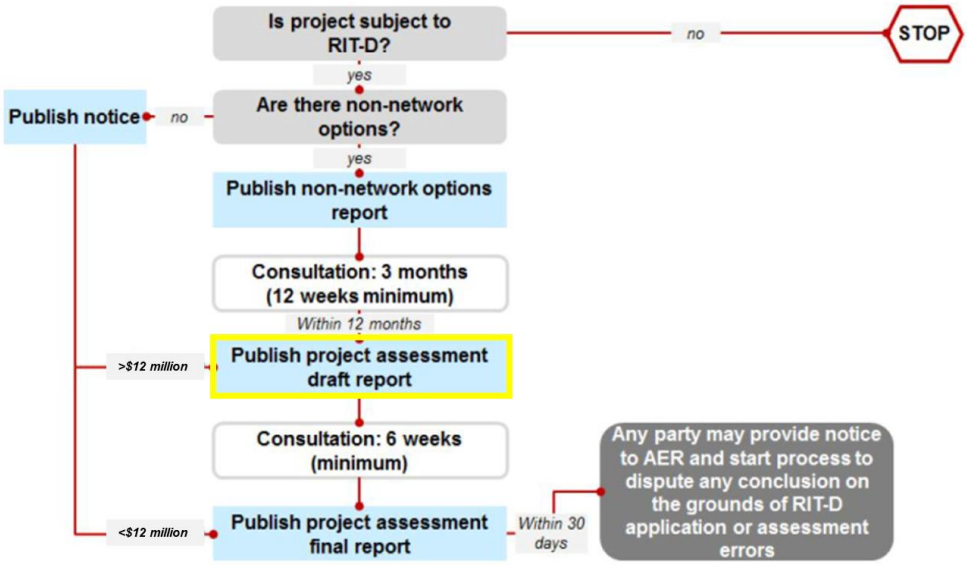
Endeavour Energy seeks written submissions from interested parties in relation to the preferred option outlined in this document. Submissions are due on or before 10 August 2022. All submissions and enquiries should be directed to Endeavour Energy's Head of Portfolio Management Office at consultation@endeavourenergy.com.au.

2. RIT-D Process

This DPAR was prepared by Endeavour Energy in accordance with the requirements of clause 5.17.4 of the National Electricity Rules. This report describes the application of the Regulatory Investment Test – Distribution (RIT-D) for addressing network limitations in the Westmead Health Precinct and other surrounding suburbs.

Endeavour Energy adopts a process of exploring feasible methods of supply in assessing the ability to supply development applications. Endeavour Energy needs to balance timely investment with the ramping up of demand as the development progresses. This is required to mitigate the risks of stalling developments due to delayed supply of power to the area which has an adverse impact on the supply of land for housing, as well as commercial and employment needs.

Figure 1 – The RIT-D Process



2.1 Submissions requested to the DPAR

Endeavour Energy seeks written submissions from interested parties in relation to the preferred option outlined in this document. The consultation period is 6 weeks and submissions are due on or before 10 August 2022. Submissions and any subsequent response by Endeavour Energy may be published.

2.2 Contact details

All submissions and enquiries regarding this DPAR should be directed to Endeavour Energy's Head of Portfolio Management Office at consultation@endeavourenergy.com.au.

3. Context of the Project

Westmead ZS was commissioned in 1978 to supply the Westmead Health Precinct and other surrounding loads.

The Westmead Health Precinct includes:

- Westmead Hospital;
- Westmead Children's Hospital and supporting departments; and

- research facilities and accommodation.

This health precinct accounts for approximately two thirds of the entire Westmead ZS load. The other third is made up of residential and commercial loads in the surrounding area.

The Westmead Health Precinct is a high voltage customer currently supplied via four dedicated 11 kV feeders and, being the primary supply of a vital regional health facility, supply security of Westmead ZS is extremely important.

The precinct is currently undergoing a significant expansion that will result in a large increase in demand in coming years. Specifically, we expect demand in the development area to reach 38 MVA by 2023/24, after which it will grow to 67MVA in 2030/31 before continuing to increase in subsequent years. This will lead to rapidly increasing risks of customers losing supply from unplanned outages as firm capacity is exceeded. As these risk levels increase, intervention in the form of investment in additional electricity infrastructure or alternative non-network solutions is required.

Figure 2 below shows the planned development included in the Westmead Health Precinct expansion. Other contributors to load growth include the adjacent Western Sydney University campus (currently under construction) and Parramatta Light Rail (a NSW government project expected to open in 2023).

Figure 2: Westmead Precinct Master Plan

Source: Westmead Redevelopment Plan (2016)

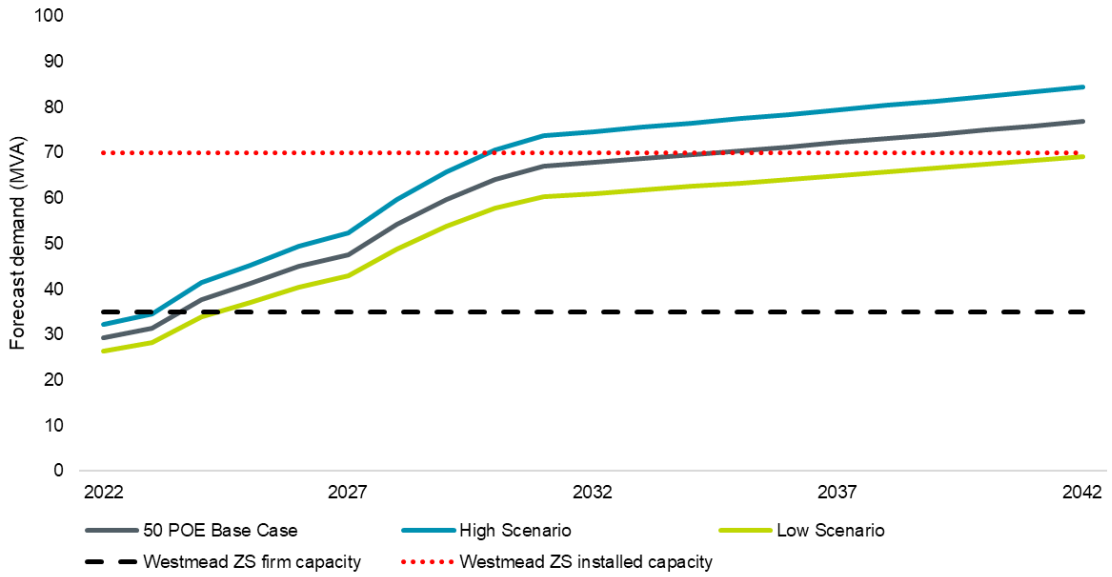
4. Network Need

The identified need arises because of the large increase in demand arising from the ongoing expansion at the Westmead Health Precinct, coupled with demand growth from the Western Sydney University and Parramatta Light Rail.

The existing network has insufficient capacity to supply the increase in demand and additional capacity into the area as demand is expected to continue growing up to 2050/51 and beyond.

Figure 3 below shows our peak summer load forecasts under a central, low and high demand forecasts for the Westmead ZS.

Figure 3: Westmead ZS demand forecasts, 2022-2042



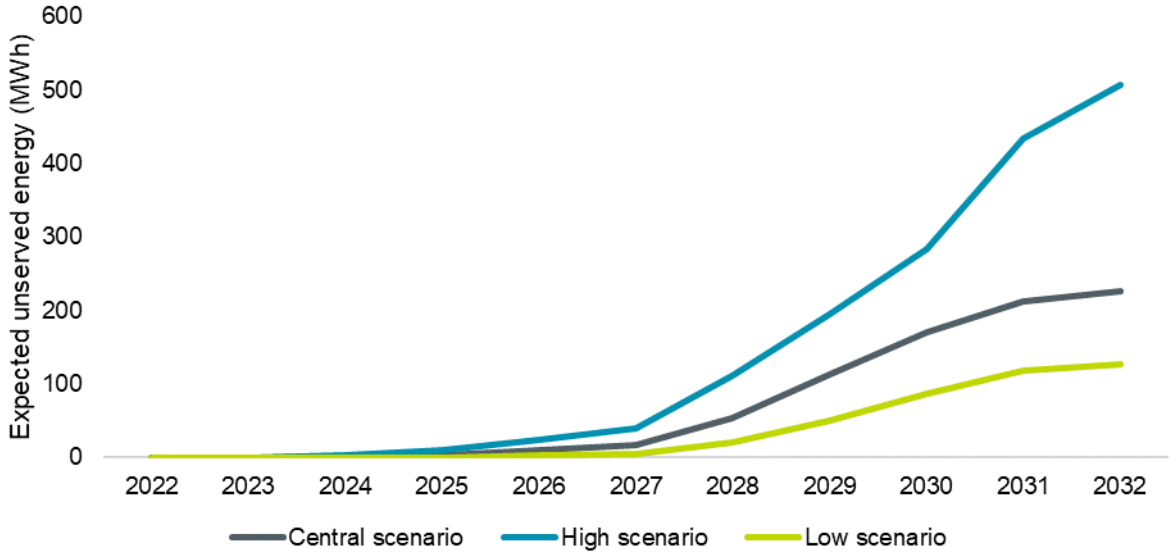
The three demand forecasts investigate different assumed load uptake rates. There is not expected to be significant uncertainty regarding the timing of load connecting and so this remains constant across the three forecasts.

Figure 3 shows that demand is expected to exceed the capacity at Westmead ZS in 2023/24 under the base and high demand forecasts. Under the low scenario, demand is expected to exceed capacity in 2024/25.

The existing distribution network is insufficient to meet the supply needs of the new load from 2023/24 under the central and high demand forecasts (and 2024/25 under the low forecast). If network augmentation is not undertaken, there will therefore be significant unserved energy in the next few years.

Figure 4 below presents the estimated unserved energy if no action is taken under each of the three demand forecasts. We have only presented the next ten years to enable the differences to be clearly seen in the initial years (but we note that the unserved energy forecasts are expected to continue to increase significantly after 2031/32).

Figure 4 – Expected unserved energy under the base case (ie, with no investment)



We propose to cap the expected future unserved energy, in MWh, as part of the NPV assessment, as the uncapped value of unserved energy will otherwise become unrealistically high (since, in reality, we would undertake investment to avoid widespread customer outages). Using the very large uncapped values have the potential to distort the comparison of net market benefits between credible options. The approach of capping USE in the base case is in-line with other RIT-Ds (and RIT-Ts) and does not affect the ranking of the overall options.

'Identified need' for this Regulatory Investment Test for Distribution (RIT-D)

We have initiated a Regulatory Investment Test for Distribution (RIT-D) to investigate, and consult on, how to most efficiently facilitate the connection of the new major loads in the Westmead Health Precinct and other surrounding suburbs.

Endeavour Energy is required to connect customers under section 5.2.3(d) of the NER, which state that "A Network Service Provider must:

(1) Review and process applications to connect or modify a connection which are submitted to it and must enter into a connection agreement…

(6) Permit and participate in commissioning of facilities and equipment which are to be connected to its network in accordance with rule 5.8;"

We therefore consider the identified need for this investment to be a 'reliability corrective action' under the RIT-D since investment is required to comply with the above NER obligations.

The timing of the identified need for this RIT-D, and so the required timing for credible options to address the need, is determined by when the expected load requiring connection will exceed the existing network capacity. This is currently anticipated to be 2023/24, based on the connection enquiries received to date.

The preliminarily preferred distribution network augmentation to support the development of the Westmead ZS was included in our most recent Distribution Annual Planning Report (DAPR), released in December 2021.

A NNOR has been published in accordance with NER clause 5.17.4(c), to seek submissions from interested parties for non-network solutions that is both commercial and technically feasible to defer or avoid the preferred network option. However, no submissions were received. This DPAR represents the next formal stage of the RIT-D process and provides information and outcomes from economic assessment of network-based options for the precinct.

Endeavour Energy applies a probabilistic planning methodology to evaluate the network constraints and value of expected unserved energy in order to determine the appropriate timing for network augmentation projects. The timing of the need is based on a cost benefit analysis which is when the annualised cost of the unserved energy is greater than the annualised cost of the investment.

Importantly, no construction on new distribution investments will commence until there is a high degree of certainty that the anticipated loads will be seeking connection to our network at the timing indicated. Further, we note that new customers will contribute to the costs of the investment (as well as the cost of the wider network), via their 'Distribution Use of System' tariffs.

5. Preferred option

The option that presents the greatest net market benefit and thus considered as the preferred option, is Option 3. This option involves installing a third 132/11kV 45MVA transformer that would be tail ended onto a new 132kV feeder from West Parramatta ZS. The 11kV side of the transformer would be directly connected to Westmead Hospital's 11kV switchboard. Details on the preferred option is provided in Section 6.3 including the scope of works, costs and timing.

The total cost of the preferred option is estimated to be $12.5 million including a contingency amount of approximately 10% of the project cost to cover unforeseen costs which may arise during construction. The construction expenditure will occur from 2021/22 to 2023/24, with commissioning in 2023/24.

6. Credible options considered

We have identified four potential network options for supplying the Westmead Health Precinct, namely:

- Option 1 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section;
- Option 2 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard;
- Option 3 – Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard; and
- Option 4 – Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation

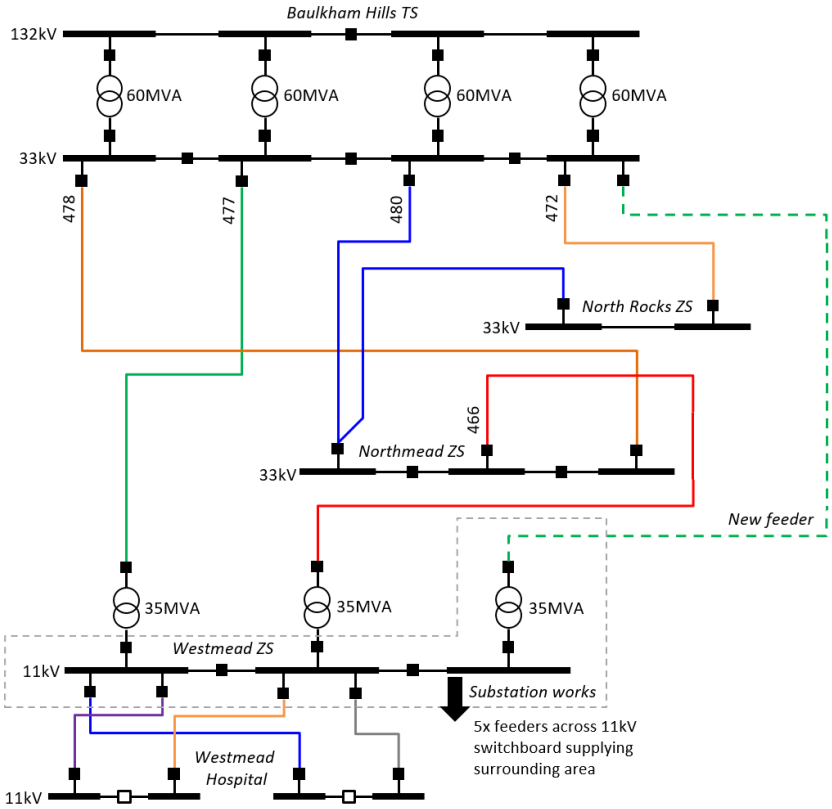
Option 1 and Option 2 require a new 132 kV feeder from West Parramatta ZS in the future to supply the planned second Westmead ZS (currently expected to be in 2034/35). This second Westmead ZS is not related to the identified need for this RIT-D and, instead, is required to meet ongoing load growth in the area and its timing does not differ across the credible options, or demand forecasts, for this RIT-D.

6.1 Option 1 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section

This option involves installing a third 33/11kV 35MVA transformer that would be tail ended onto a new 33kV feeder from Baulkham Hills terminal station. The 11kV side of the transformer would be connected to a new 11kV bus section.

A line diagram for Option 1 is shown in Figure 5.

Figure 5: Option 1 line diagram



While this option addresses the load at risk, it is nevertheless a 33kV option, meaning that a 132kV feeder from West Parramatta ZS would still be needed to supply the future second Westmead ZS in 2034/35. This requirement is intended to be modelled in the DPAR economic assessment for this option.

The 33/11kV 35MVA transformer, 11kV bus section, and 33kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $11.5 million.

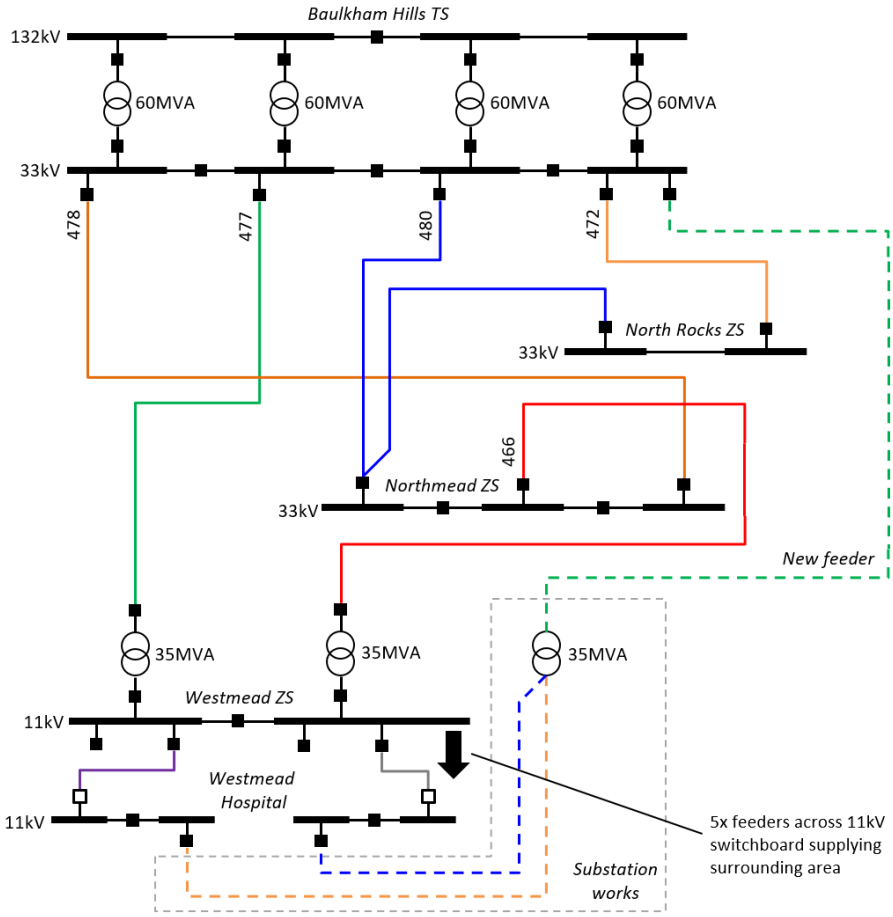
The 132kV transmission feeder from West Parramatta ZS will be built over two years at a capital cost of $8.85 million, and will be commissioned in 2034/35.

6.2 Option 2 – Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard

As with Option 1, this option involves installing a third 33/11kV 35MVA transformer that would be tail ended onto a new 33kV feeder from Baulkham Hills terminal station. However, different to Option 1, the 11kV side of the transformer would be directly connected to Westmead Hospital's 11kV switchboard.

The line diagram for Option 2 is shown in Figure 6.

Figure 6: Option 2 line diagram



Similar to Option 1, this option also addresses the load at risk, but since it is a 33kV option, a 132kV feeder from West Parramatta ZS would still be needed to supply the future second Westmead ZS in 2034/35. This requirement is intended to be modelled in the DPAR economic assessment for this option.

The 33/11kV 35MVA transformer and 33kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $10.8 million.

As with Option 1, the 132kV transmission feeder from West Parramatta ZS will be built over two years at a capital cost of $8.85 million, and will be commissioned in 2034/35.

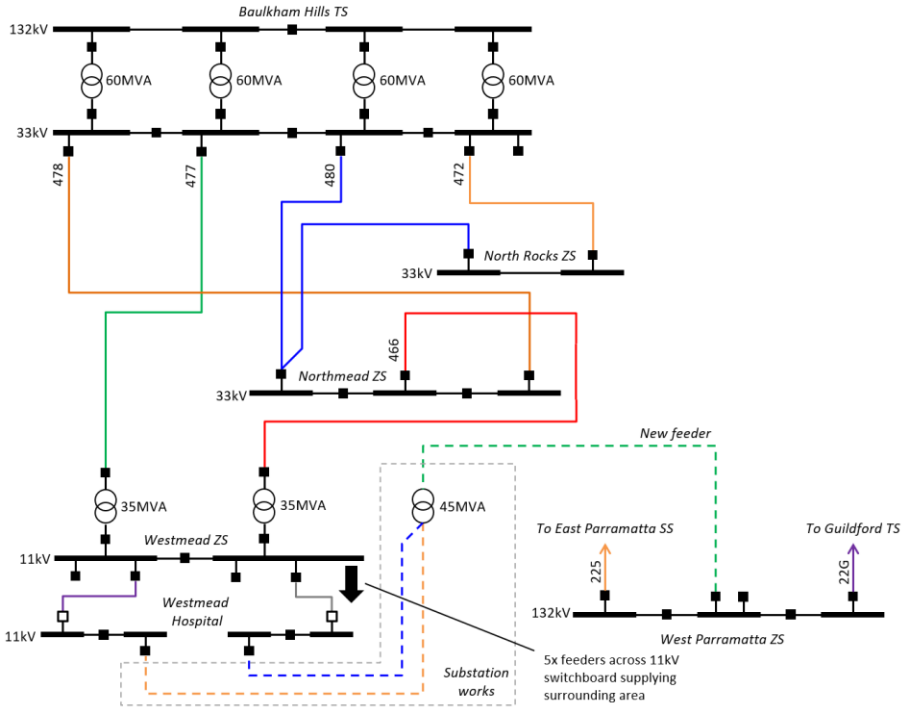
6.3 Option 3 – Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard

This option involves installing a third 132/11kV 45MVA transformer that would be tail ended onto a new 132kV feeder from West Parramatta ZS. The 11kV side of the transformer would be directly connected to Westmead Hospital's 11kV switchboard.

This option addresses the load at risk and the 132kV feeder can be utilised in the future to supply the second zone Westmead substation.

The line diagram for Option 3 is shown in Figure 7.

Figure 7: Option 3 line diagram



The 132/11kV 45MVA transformer and 132kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $12.5 million.

Unlike Options 1 and 2, there is no need to construct another 132kV transmission feeder in the future.

Further, this option has the benefit of providing the hospital with primary and backup supplies from two separate bulk supply points (Holroyd BSP and Sydney West BSP).

This option may require a section of the proposed 132kV feeder to be relocated if developments result in road layout changes in the Cumberland Hospital area. This potential relocation cost is considered speculative at this stage and sensitivity assessment in the DPAR suggests that it does not affect the outcome of the assessment.

6.4 Option 4 – Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation

This option involves establishing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS. This will allow a total of 10MVA load to be transferred from Westmead ZS to the two other zone substations.

The load transferred under this option would allow the installation of the third transformer under Option 3 to be deferred by two years from 2023/24 to 2025/26 under the central demand forecasts.

The three new 11kV feeders will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $2.72 million, after which the 132/11kV 45MVA transformer and 132kV transmission feeder for Option 3 will be constructed over three years (2023/24 to 2025/26) at a total capital cost of $12.5 million. As with Option 3, there is no need to construct another 132kV transmission feeder in the future after the 132/11kV 45MVA transformer and 132kV transmission feeder have been built.

6.5 Options considered but not progressed

There are no other network options that have been considered but not progressed.

7. Modelling & Assumptions

The RIT-D states that the preferred option is the credible option that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the National Electricity Market (NEM).

The market benefit of a credible option is calculated by comparing the state of the system with the credible option in place with the state of the system in the base case. The emphasis in this situation is differences in the risks of involuntary load shedding.

The market benefits that can be considered under the NER are:

- Changes in voluntary load curtailment (considered a negative benefit);
- Changes in involuntary load shedding and customer interruptions caused by network outages;
- Changes in costs to other parties (timing of new plant, capital costs, operating and maintenance costs);
- Differences in timing of expenditure;
- Changes in load transfer capacity and the capacity of embedded generators to take up load;
- Option value;
- Changes in electrical energy losses; and
- Any other class of market benefit determined to be relevant by the Australian Energy Regulator (AER).

Endeavour Energy is currently seeking further engagement with the AER on matters to support new technology solutions under the RIT-D framework. Particularly, we are seeking advice to consider new classes of market benefits and guidance on the method to quantify these benefits.

The time period chosen for the NPV analysis was 30 years.

7.1.1 Energy at risk and expected unserved energy

A core justification for this project is based on load at risk and energy not able to be supplied to customers waiting to connect. This is different to a situation where already connected customers risk losing supply. The same VCR value has been applied as a default position to the energy at risk values established from the proposals received. For development such as this, where the forecast demand rapidly exceeds the available capacity in the network, the VCR benefits to be captured from implementing a project to address network constraints can quickly rise to extremely large amounts.

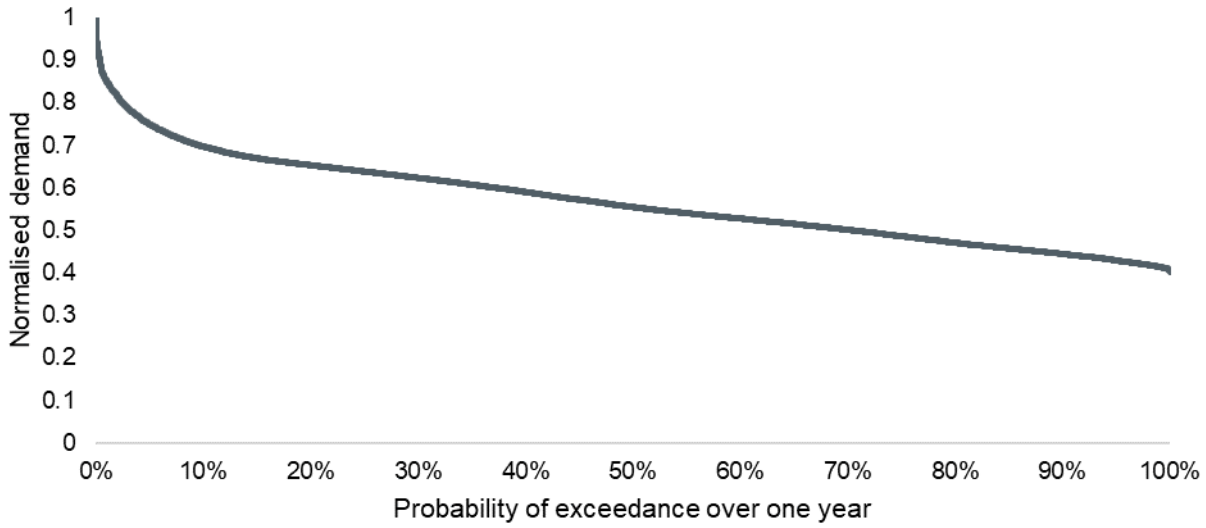
The energy at risk has been estimated from the annual peak demand forecasts and load duration curves.

7.1.2 Load profile characteristics

Since the forecast loads are yet to connect, we have assessed the identified need by scaling the existing load profile for the Westmead ZS.

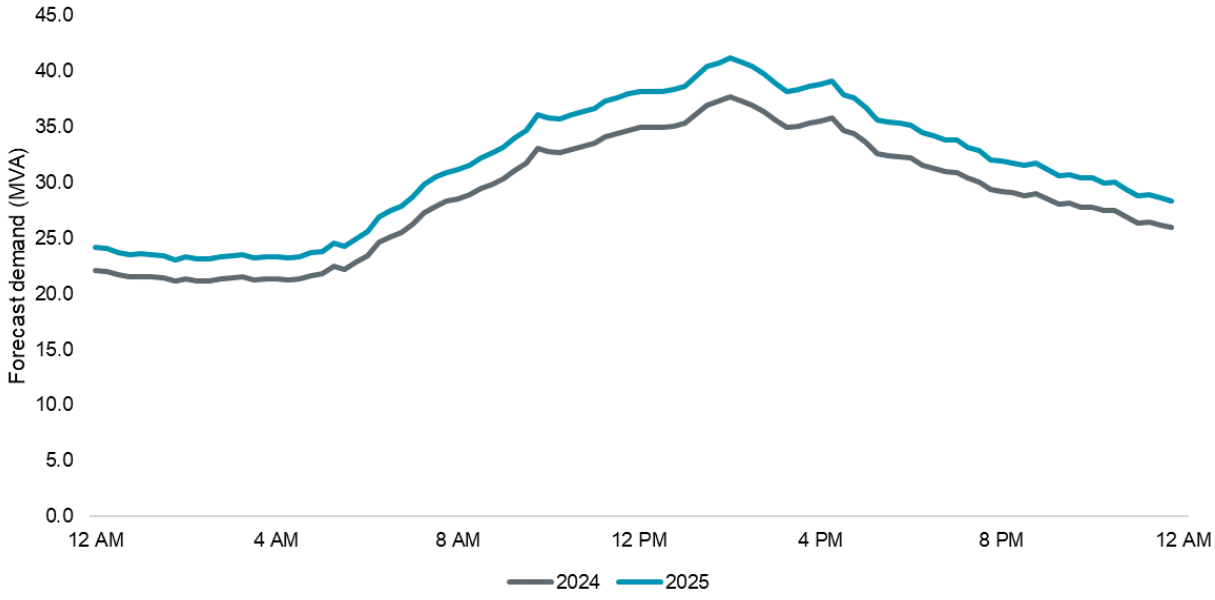
Figure 8 presents the normalised load duration curve (LDC) assumed for the Westmead ZS load demand profile.

Figure 8 – Normalised LDC assumed for Westmead ZS



Similarly, Figure 9 presents the assumed forecast peak day profile for the Westmead ZS load in 2023/24 based on the current demand profile. Specifically, we have scaled the peak day profile observed in 2020/21, such that the peaks in 2023/24 and 2024/25 correspond to 37.7 MVA and 41.2 MVA, respectively.

Figure 9 – Peak summer day profile assumed for Westmead ZS



7.1.3 Plant failure rates

As this project involves, as the base case, utilisation of existing network capacity to facilitate new customer connections, the most significant risk is the failure of the feeders supplying the area. There is limited backup capacity in the area to service the existing loads, and any further connections will be subject to the risk of extended outages in the event of failure of the feeders supplying the area. However, this is not a dominant issue in expected unserved energy as the underlying problem is the lack of capacity that is required to connect new loads to the network. The distribution feeder failure rate is shown in Table 2.

Table 2 – Distribution feeder failure rates

Major Plant Item: Distribution Feeder	
Distribution feeder failure rate	7 failures per 100 km of line per annum

7.1.4 Plant Ratings

Endeavour Energy's standard ratings have been employed for the purposes of this evaluation.

7.1.5 Value of customer reliability

The value of unserved energy is calculated using the VCR. This represents an estimate of the value electricity consumers place on a reliable electricity supply. Endeavour Energy used a VCR of $38.805 per kWh in the evaluation which is based on the 2021 VCR values provided by the AER, weighted in accordance with the composition of the commercial, industrial and residential load within the constituent connections.

7.2 Classes of market benefit considered

The classes of market benefits that are considered material and have been quantified in this RIT-D assessment are:

- Changes in involuntary load shedding and customer interruptions caused by network outages; and
- Differences in the timing of expenditure

7.2.1 Changes in involuntary load shedding

Increasing the supply capability in the Westmead area increases the supply available to meet the growth in demand within the Westmead Health Precinct and other surrounding suburbs. This will provide greater reliability for this area by reducing potential supply interruptions and consequent risk of involuntary load shedding. The present rules only allow for consideration of changes in involuntary load shedding for connected customers. The establishment of supply in a development precinct where potential customers would otherwise have to go without supply is therefore captured using changes in involuntary load shedding.

7.2.2 Differences in timing of expenditure

The difference in the timing of expenditure for the options considered is shown in Table 3 below.

Table 3 - Comparison of Option Capital Cost Schedules

Option	Description	2022-2024 ($M)	Beyond 2024 ($M)
1	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section	11.5	8.8
2	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard	10.8	8.8
3	Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard	12.5	0
4	Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation	4.6	11.6

7.3 Classes of market benefit not considered to be material

The classes of market benefits that are not considered material are listed below:

- Changes in voluntary load curtailment
- Option value
- Changes in load transfer capacity.
- Changes in costs to other parties
- Changes in electrical losses.

7.3.1 Changes in voluntary load curtailment

Voluntary load curtailment is when customers agree to reduce their load to address a network limitation in return for a payment. A credible demand side option to enlist such customers could lead to a reduction in involuntary load shedding, that is, increase in voluntary load reduction.

Endeavour Energy has not estimated any market benefits associated with changes in voluntary load curtailment as there is insufficient capacity in the existing customer base to deliver sufficient voluntary demand reduction.

7.3.2 Option Value

Endeavour Energy notes that the AER's view is that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change and the credible options considered by the RIT-D proponent are sufficiently flexible to respond to that change.

Due to the committed connections there is little uncertainty about the need and use of the assets and each option is considered equivalent in that respect. Option Value has therefore not been considered in the economic analysis.

7.3.3 Changes in costs to other parties

In this instance, Endeavour Energy has not identified any changes in costs to other parties from developing the credible options identified in this document.

7.3.4 Changes in electrical losses

Endeavour Energy recognises that there would be small changes in the loss profile for customers serviced out via the options considered but given they are all 11kV feeders that these are negligibly small in each case. Changes in electrical losses have not been modelled.

7.4 Scenarios and sensitivities

The capital and operating cost assumptions for each credible option are summarised in Table 4.

Table 4 – Base Case Capital and Operating Cost Assumptions

Variables	Values
Maximum demand forecasts	Base (expected) growth scenario presented in Section 4
Capital costs	Estimates provided in Section 1
O&M costs	0.4% of capital spend unless otherwise stated.
Value of customer reliability	Base estimates provided in Section 7.1.5

7.4.1 Demand forecasts

The maximum demand forecasts have been derived from a projection of the connection and growth of new loads. Notionally, this is on an approximate 50% probability of exceedance basis. For sensitivity analysis, the base forecast has been varied by ± 10% and included variable customer growth rate assumptions, as shown in the earlier table.

7.4.2 Capital costs

Capital cost estimates have been based on standard planning cost estimates of the detailed scope of work including a high-level scope of work. For sensitivity analysis, these estimates have been varied by ± 25%.

7.4.3 Value of customer reliability

This analysis adopts the value of customer reliability values published by AER to calculate the expected unserved energy. The ratio of load types has been estimated and used to calculate the weighted aggregate VCR value and then applied to the energy at risk. Based on the estimated load composition of the subject area, a volume weighted VCR value of $38.805 per kWh has been derived and used in the RIT-D analysis. A variation of ±30% has been used for sensitivity testing in accordance with AER guidelines.

7.4.4 Discount Rate

The discount rate used in the financial analysis will impact the estimated present value of net market benefits and may affect the ranking of credible options. Endeavour Energy has employed a real, pre-tax discount rate based on the latest AER determination as the low case. For sensitivity analysis, a symmetrical application was used to determine the high case.

7.4.5 Summary of sensitivities

Table 5 below describes the variations in input parameters used for the purpose of defining various scenarios.

Table 5 – Variables for Sensitivity Testing

Parameter/ scenario	Central scenario	High benefits	Low benefits
Capex	Central estimates	-25%	+25%
Demand	Central demand forecast	High demand forecast	Low demand forecast
VCR	Load-weighted AER VCR	+30%	-30%
Discount rate	3.26%	2.22%	4.30%

8. Results of analysis

This section describes the results of the NPV modelling for each of the credible options considered in this RIT-D assessment.

8.1 Central case results

The economic analysis of the options under the Central case scenario is shown in Table 6. This shows Option 3 has the highest NPV of all the credible options, thus considered the preferred option.

Table 6 – Central case results

Option	Description	Project capex nominal ($M)	PV of market benefits ($M)	PV of Costs ($M)	NPV ($M)	Rank
1	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section	20.3	60.2	13.7	46.5	4
2	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard	19.6	60.2	13.1	47.1	3
3	Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard	12.5	60.2	10.7	49.5	1
4	Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation	15.2	60.2	12.0	48.3	2

8.2 Sensitivity and scenario assessment

Endeavour Energy has carried out sensitivity analysis in the RIT-D assessment based on variations of key parameters. Specifically, Endeavour Energy has investigated changes in relation to:

- Forecast demand, and hence quantity of involuntary load shedding
- Investment costs
- Discount Rate

Detailed in Figure 10 are the scenarios used in sensitivity testing and their relative weightings.

Figure 10 – Summary of Scenarios used in sensitivity testing

Scenarios	
Scenario selection	
Scenario	Scenario 1

Scenario weighting			
	Scenario 1	Scenario 2	Scenario 3
Weighting	0.50	0.25	0.25

General inputs							
General	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Commercial discount rate	Percent	3.26%	Central	Central	High	Low	Central

Cost inputs							
Cost	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Capital cost	Percent	100%	Central	Central	High	Low	Central
Planned routine maintenance and refurbishment	Percent	100%	Central	Central	High	Low	Central
Unplanned corrective maintenance	Percent	100%	Central	Central	High	Low	Central
Decommissioning costs	Percent	100%	Central	Central	Central	Central	Central
Non-network option provider costs	Percent	100%	Central	Central	High	Low	Central

Benefit inputs							
Avoided 'risk cost' benefits	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Reliability and security risk costs	Scenario	NA	Central	Central	Low	High	Central
Safety and health risk costs	Scenario	NA	Central	Central	Low	High	Central
Environmental risk costs	Scenario	NA	Central	Central	Low	High	Central
Legal/regulatory compliance risk costs	Scenario	NA	Central	Central	Low	High	Central
Financial risk costs	Scenario	NA	Central	Central	Low	High	Central

Market benefits	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Involuntary load shedding - VCR	$/MWh	38,805	Central	Central	Low	High	Central
Involuntary load shedding - MWh	Scenario	NA	Central	Central	Low	High	Central
Difference in timing of unrelated expenditure	Scenario	NA	Central	Central	Low	High	Central
Difference in timing of unrelated expenditure	Percent	100%	Central	Central	Low	High	Central
Voluntary load curtailment - VCR	$/MWh	38,805	Central	Central	Low	High	Central
Voluntary load curtailment - MWh	Scenario	NA	Central	Central	Low	High	Central
Costs for non RIT-D proponent parties	Percent	100%	Central	Central	Central	Central	Central
Electricity energy losses	$/MWh	100	Central	Central	Central	Central	Central
Change in load transfer capacity and the capacity for embedc	Percent	100%	Central	Central	Central	Central	Central
Other classes of market benefits	Percent	100%	Central	Central	Central	Central	Central

Detailed in Table 7 are the results of the sensitivity analysis.

Table 7 Sensitivity and Scenario Assessment

Option	Description	Scenario 1 Rank	Scenario 2 Rank	Scenario 3 Rank	Weighted Scenario Rank
1	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and new 11kV bus section	4	4	4	4
2	Third 33/11kV 35 MVA transformer, connected to new 33kV feeder from Baulkham Hills and directly to Westmead Hospital's 11kV switchboard	3	3	3	3
3	Third 132/11kV 45MVA transformer, connected to new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard	1	1	1	1
4	Installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation	2	2	2	2

The results show that Option 3 maximises the net market benefit in the base case as well as the weighted scenarios considered for sensitivity analysis.

8.3 Economic timing

The economic timing of the proposed preferred option may be taken to be the point where network capacity is insufficient to connect new customers.

The Westmead Health precinct requires connection capacity to be made available as soon as the existing available capacity in the network is exhausted. Based on current demand forecast, this is expected to occur in 2023/24. Consequently, this date is seen as the economic timing for this project.

9. Conclusion

Westmead ZS was commissioned in 1978 to supply the Westmead Health Precinct and other surrounding loads. This health precinct accounts for approximately two thirds of the entire Westmead ZS load. The other third is made up of residential and commercial loads in the surrounding area. The precinct is currently undergoing a significant expansion that will result in a large increase in demand in coming years. Specifically, we expect demand in the development area to reach 38 MVA by 2023/24, after which it will grow to 67MVA in 2030/31 before continuing to increase in subsequent years. This will lead to rapidly increasing risks of customers losing supply from unplanned outages as firm capacity is exceeded. As these risk levels increase, intervention in the form of investment in additional electricity infrastructure or alternative non-network solutions is required. Other contributors to load growth include the adjacent Western Sydney University campus (currently under construction) and Parramatta Light Rail (a NSW government project expected to open in 2023).

The existing distribution network is insufficient to meet the supply needs of the new load from 2023/24 under the central and high demand forecasts (and 2024/25 under the low forecast). If network augmentation is not undertaken, there will therefore be significant unserved energy in the next few years.

An NNOR was published to seek submissions from interested parties for non-network solutions that is both commercial and technically feasible to defer or avoid the preferred network option. However, no submissions were received.

This DPAR has identified four credible network-based options that can technically meet the required network demand. Three options involve establishing a third 33/11kV transformer with different connection alternatives. Option 1 proposes to connect a 35 MVA transformer to a new 33kV feeder from Baulkham Hills and new 11kV bus section. Option 2 is the same as Option 1 but connecting directly to Westmead Hospital's 11kV switchboard instead of a new 11kV bus section. Option 3 proposes to connect a 45 MVA transformer to a new 132kV feeder from West Parramatta ZS and directly to Westmead Hospital's 11kV switchboard. Option 4 involves installing two new 11kV feeders from Northmead ZS and one new 11kV feeder from West Parramatta ZS then augmenting the zone substation.

The economic assessment of the credible options resulted in Option 3 as having the greatest NPV of the market benefits considered in the evaluation. This option addresses the load at risk and the 132kV feeder can be utilised in the future to supply the second zone Westmead substation.

The 132/11kV 45MVA transformer and 132kV transmission feeder will be constructed over three years (2021/22 to 2023/24) at a total capital cost of $12.5 million. This option has the benefit of providing the hospital with primary and backup supplies from two separate bulk supply points (Holroyd BSP and Sydney West BSP).

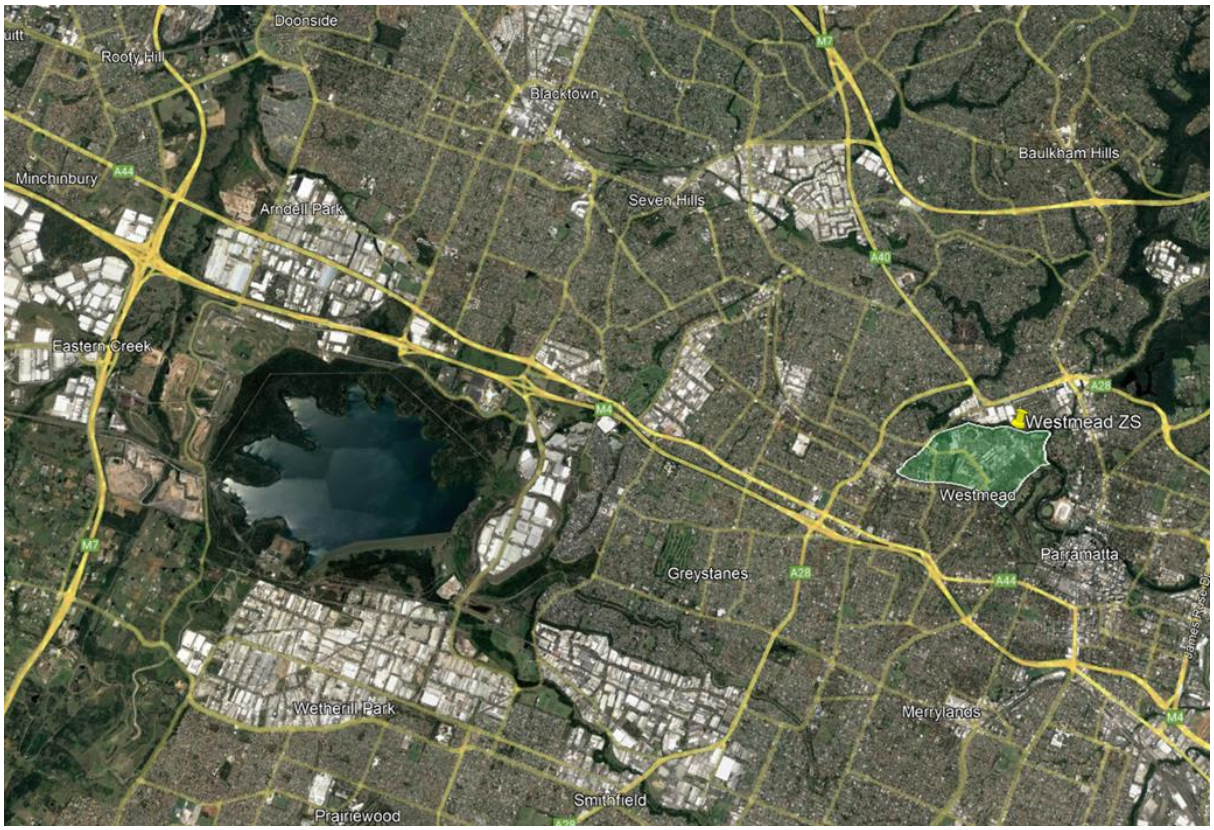
10. Appendix – Further Details on Network need

10.1 Existing Network Overview

Westmead ZS was commissioned in 1978 to supply the Westmead Health Precinct and other surrounding loads. The Westmead Health Precinct includes Westmead Hospital, Westmead Children's Hospital and supporting departments, research facilities, and accommodation. The health precinct accounts for approximately two thirds of the entire Westmead ZS load, with the remaining third made up of load from residential and commercial loads in the surrounding area.

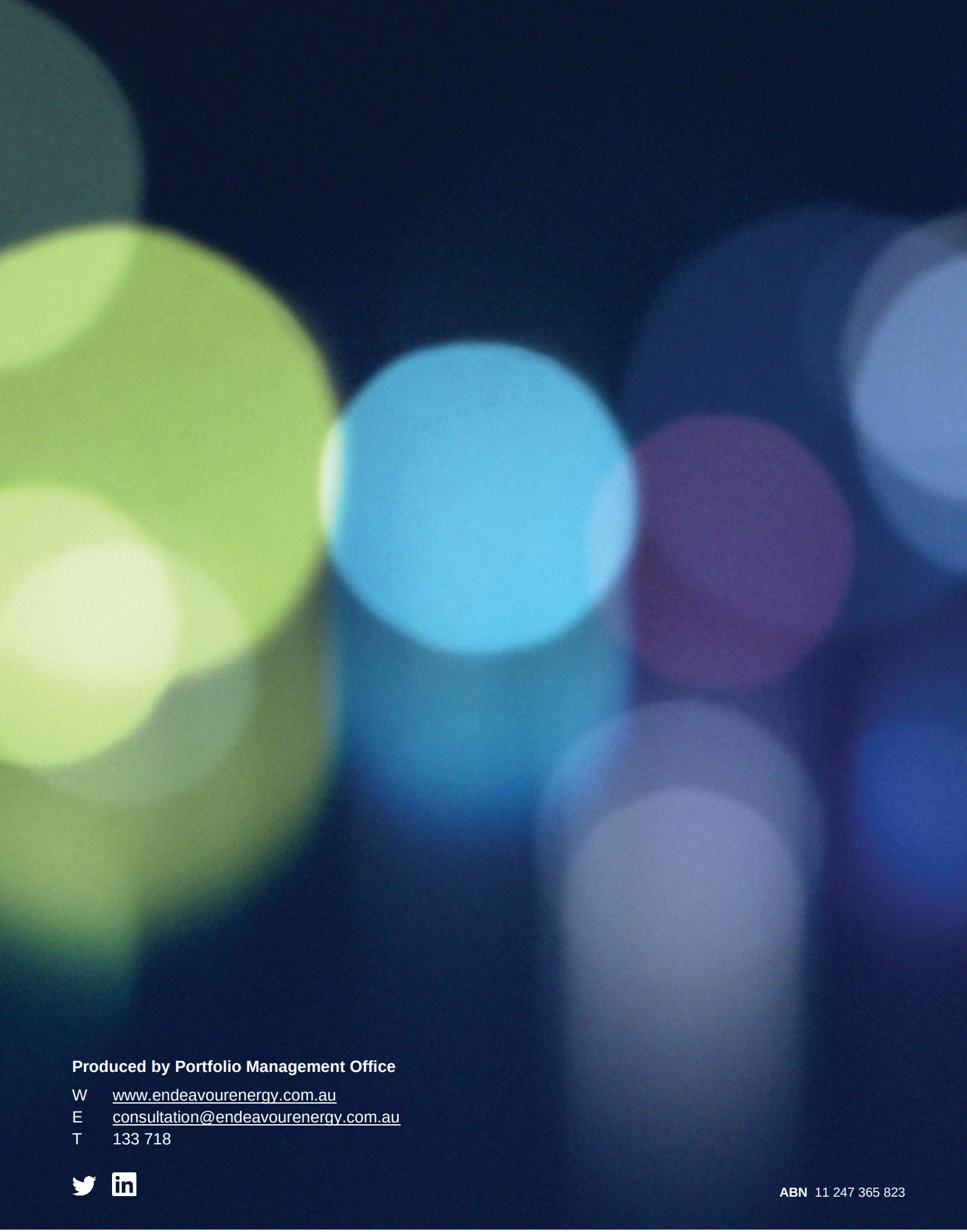
Figure 11 below shows the location of the existing Westmead ZS in our network.

Figure 11: Westmead ZS location in our network



The Westmead Health Precinct is a high voltage customer supplied via four dedicated 11 kV feeders.

The precinct is currently undergoing a significant expansion that will result in a large increase in demand. Specifically, more than $3 billion has been committed by government, universities and the private sector to upgrade and expand the precinct's health services, education and medical research facilities over the coming years. Other contributors to load growth include the adjacent Western Sydney University campus (currently under construction) and Parramatta Light Rail (a NSW government project expected to open in 2023).



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