PR723: SCIENCE PARK ZONE SUBSTATION
MAJOR PROJECT BUSINESS CASE

Project	Description
Primary Driver	Network Connection
Project Category	GREENFIELD INDUSTRIAL AUGEX
Publish Date	

Approvals	Name	Designation	Date
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Reviewed	Deepak Sahay	Network Planning Engineer	01/02/2018
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Approved			

Revision	Amendment	Date

1.0 Background

The Science Park development is located within NSW Government's Western Sydney Priority Growth Area in an area previously referred to as the Broader Western Sydney Employment Lands. The region is approximately 5km from the Western Sydney Airport site.

The Science Park development is a large mixed development which includes commercial, industrial and residential premises and spreads over approximately 300 hectares of land. The area is located approximately 5km east of Luddenham ZS and south of the Sydney Water Pipeline (refer to Figure 2). The site is also approximately 12km away and north-west of Kemps Creek ZS.

Figure 1 presents an overview of the Western Sydney Priority Growth Area and highlights existing and future investments required. An area plan has been produced for the Western Sydney Priority Growth Area and includes the Science Park project. Figure 2 provides a more detailed view of surrounding assets. Figure 3 provides an overview of the Science Park development.

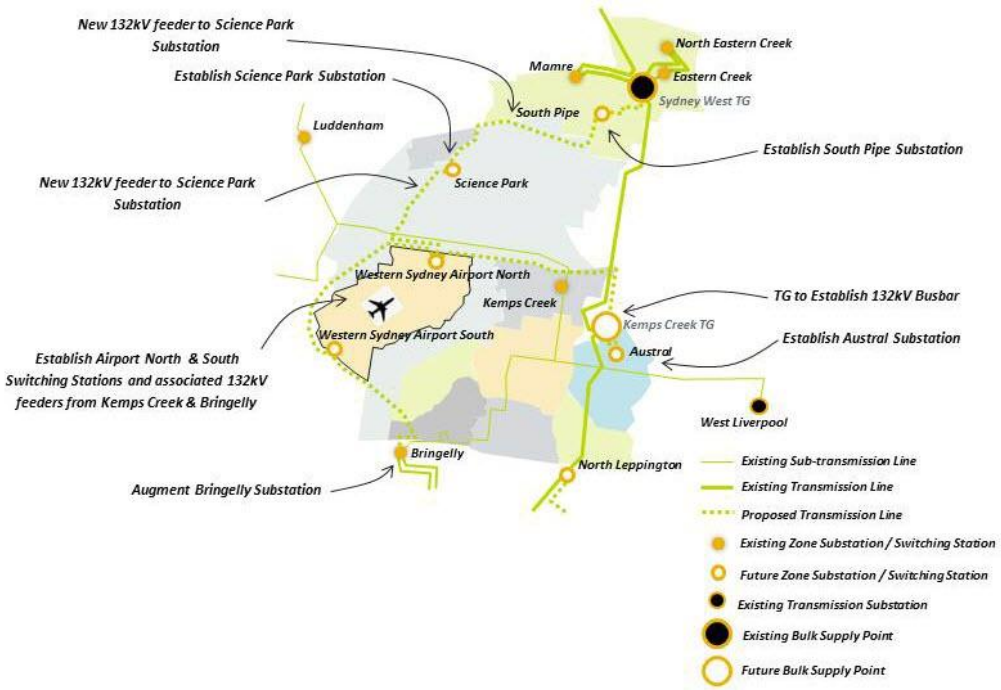

Figure 1 - Western Sydney Priority Growth Area Overview

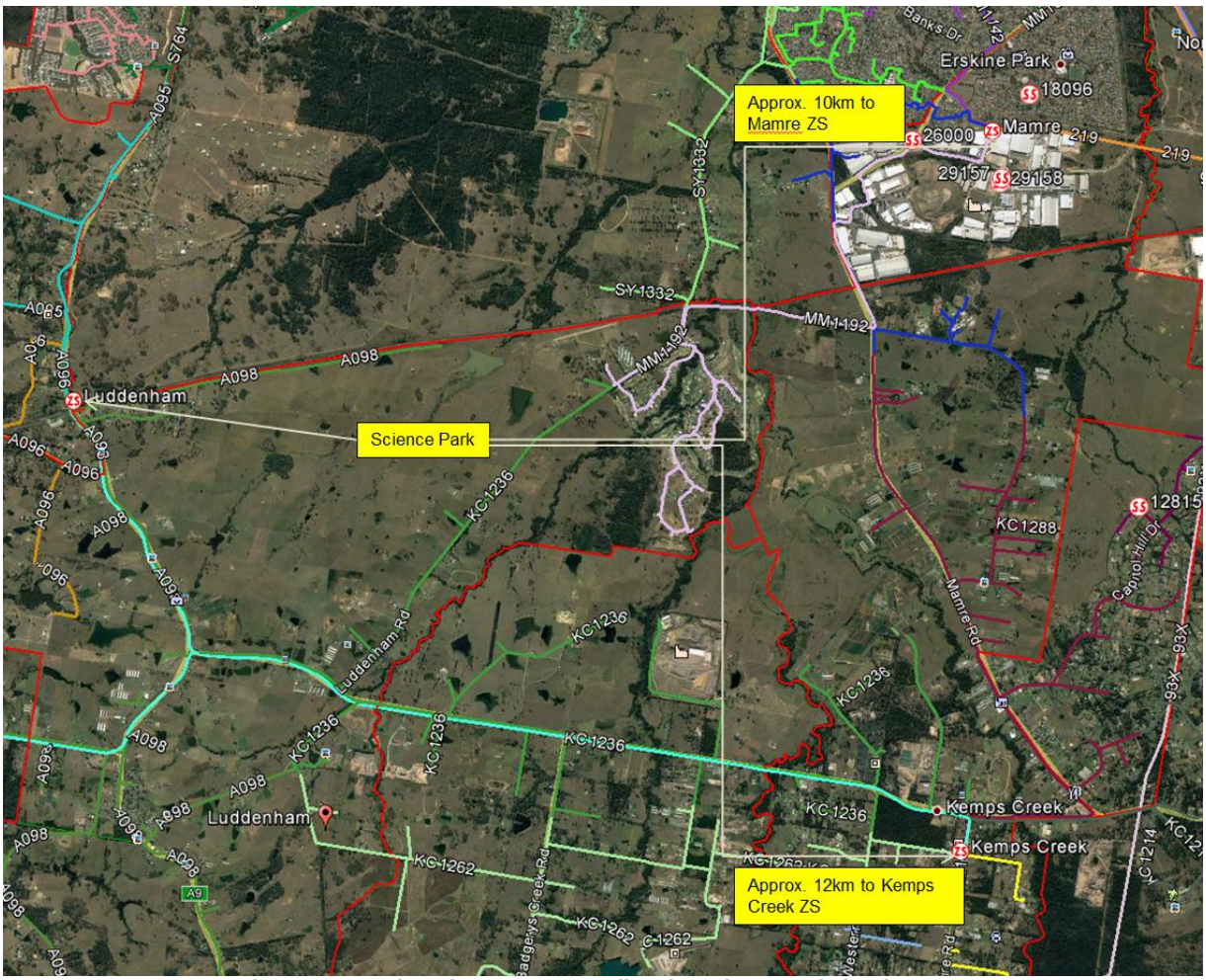

Figure 2 - Location of assets surrounding the Science Park development

Figure 3 - Science Park Development overview

The Sydney Science Park Master Plan aims to provide some 6,300 hectares of additional employment lands, 57,000 new jobs over next 30 years and total of 212,000 new jobs when the area is fully developed beyond 2046.

The Master Plan includes:

- approximately 340,000m^2 of research and development floor area;
- approximately 100,000m^2 of education floor area and associated student accommodation;
- a Town Centre comprising up to 30,000m^2 of retail space;
- 3,400 dwellings;
- a primary school site;
- new roads and infrastructure; and
- landscaped open space, sporting fields and parks.

2.0 Need/Opportunity

The ultimate demand for the development as indicated by the developer is 49MVA (refer to Figure 3). Considering this level of demand, a new dedicated zone substation will ultimately be required.

The demand for Stage 1 of this project is 6.2MVA and will be supplied from Luddenham ZS. Additional load after Stage 1 is likely to exceed the firm capacity of Luddenham ZS, and will require the establishment of further electrical infrastructure.

Endeavour Energy's view of the expected load growth through development of the project is shown in Figure 3. This indicates that a new zone substation will need to be developed and operational by 2021 for developments beyond stage 1.

2.1 Forecast Demand

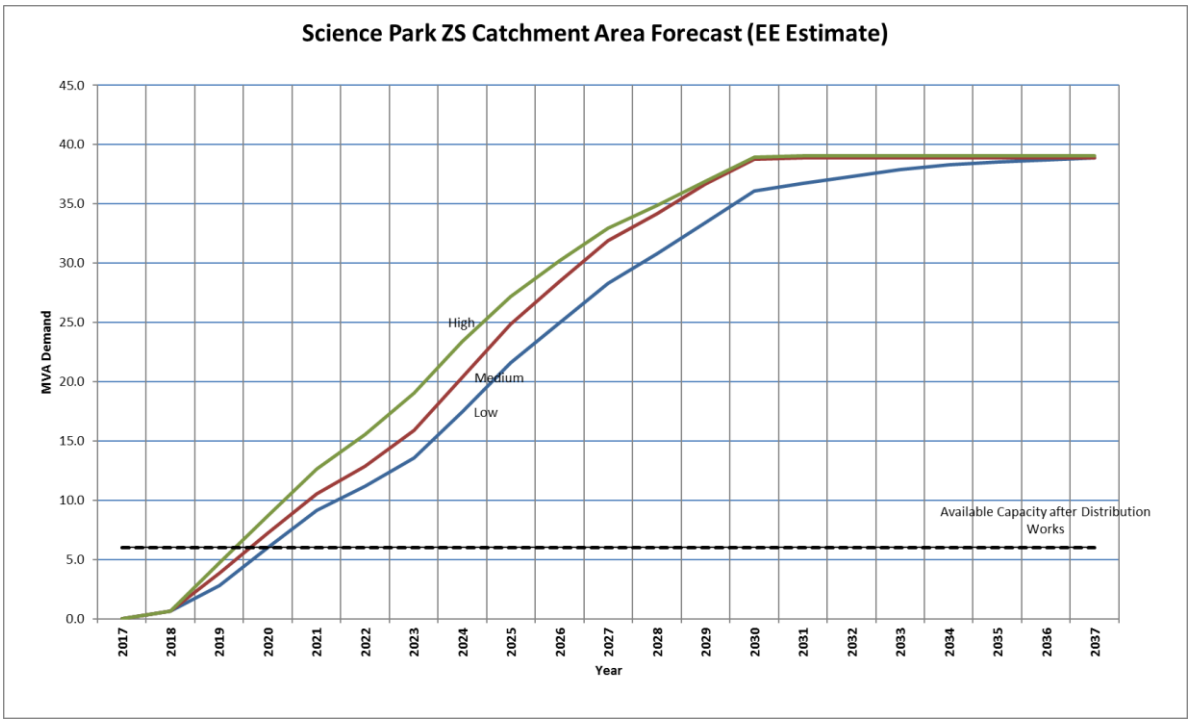

Figure 3 – Maximum demand forecast

2.2 Existing Supply

The closest supply point to the Science Park development is Luddenham Zone Substation approximately 5 km to the west. Mamre and Kemps Creek zone substations are located in excess of 10km away. As the development is presently comprised mainly of farmland, there are no distribution feeders travelling into the precinct. The existing supply around the area consists rural standard 11kV feeders from Luddenham ZS and Kemps Creek ZS. The nearby Twin Creeks residential area is supplied from Mamre ZS.

2.3 Load at Risk and Unserviced Load

On the basis of the load forecast for the new precincts and after taking into account load available from Luddenham ZS to supply Stage 1, unserviced load is shown in the Table 1.

Zone Substation	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Luddenham ZS available capacity after 2MVA load transfer	6.4	3.9	2.2	2.2	2.3	2.3	2.4	2.4	2.4	2.5
Science Park forecast load diversified	0.7	3.8	7.2	10.6	12.8	16.0	24.8	33.7	39.0	39.0
Unserviced load	-	-	5	8.4	10.5	13.7	22.4	31.3	36.6	36.5

Table 1 – Unserviced load (MVA)

2.4 Energy at Risk

Network	2019	2020	2021	2022	2023	2024	2025	2026	2027
Energy at Risk (MWh)	0	44	2651	6356	11101	16585	20343	22386	23969
Energy unable to be supplied (no capacity) (MWh)	0	0	44	740	4219	13310	25914	37226	49617
Sum	0	44	2695	7096	15319	29894	46257	59612	73586

3.0 Project Value

3.1 Modelled Project Benefits (VCR Risk Costs + Risk of Non-Supply)

Table 2 - VCR Risk Costs

Network	PV of VCR Risk + Non supply Risk Costs
Available Distribution Capacity from Luddenham ZS	$355.4m

The VCR benefits are high for this project as connection capacity will be exceeded in 2020 and if no action is taken development will not be able to proceed.

The Science Park requires connections for more than 12,000 new residential customers and multiple commercial customers, who will be entering the electricity market and generating business for market participants. In addition, new transmission mains established in this area (part of BWSEA) can be used as point of connection for future zone substations and major customers.

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 12 distribution feeders will be required to service these precincts and initial estimates indicate that this will cost more than $48 million. It will also preclude the opening up of further development frontiers in adjacent future precincts.

The establishment of 132kV feeders together a 132/11kV zone substation within the precinct is estimated to cost approximately $40.5 million in real terms.

4.0 Supply Options

The Science Park development is in a green-field site, with very limited electrical infrastructure in the vicinity to support the expected growth in demand, as shown in Figure 2.

4.1 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 conjuction 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. 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 unserviced load thus allowing further connections to be made. These opportunities will be further assessed during the RIT-D phase of the project..

4.2 Extension of Distribution Feeders from Luddenham ZS

The extension of two distribution feeders has already been proposed as the initial supply into the development. Further feeders from Luddenham ZS will impose significant constraints on this rural type zone substation. The sub-transmission feeders supplying this zone substation are already constrained and will require augmentation if this option is pursued. In addition, increasing density around existing zone substations will make voltage drop a significant issue for long feeders.

The extension of further distribution feeders from Luddenham ZS will not be cost effective in the medium term in comparison with establishing a zone substation within the Science Park precinct.

This option will also preclude the opening up of further development frontiers in adjacent future precincts – enquiries for which are now being received.

4.3 Establishment of a Zone Substation

The establishment of a zone substation and 132kV transmission feeders to the substation is regarded as the most cost-effective solution once the development commences and development rates reach an appropriate level.

5.0 Conclusion

The preferred option is to establish a new zone substation to minimise unnecessary distribution works once two feeders have been extended from Luddenham Zone Substation. The zone substation establishment will require the establishment of 132kV transmission mains in the area. This will also provide opportunities for major customers seeking to establish within these priority employment lands.

6.0 Appendix

Probabilistic VCR Template v3 - Science Park ZS Option.xlsm			
	PV investments ($m)	PV Market Benefits ($m)	NPV ($m)
Deterministic Assessment	$ 32.8	$ 378.6	$ 345.8
Proabablistic Assessment	**$ 34.9**	**$ 354.5**	**$ 320.6**
PV of Risk Costs (Potential Market Benefits)		**$ 355.4**	
	% Risk		
Risk of Negative Market Benefits	**0%**