

## PR748: CATHERINE PARK ZONE SUBSTATION

### MAJOR PROJECT BUSINESS CASE

| Project          | Description        |
|------------------|--------------------|
| Primary Driver   | Network Connection |
| Project Category | GREENFIELD AUGEX   |
| Publish Date     |                    |

| Approvals | Name         | Designation               | Date       |
|-----------|--------------|---------------------------|------------|
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| Approved  |              |                           |            |

| Revision | Amendment | Date |
|----------|-----------|------|
|          |           |      |
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|          |           |      |
|          |           |      |

## 1.0 Background

The precincts that comprise the Catherine Fields area are part of the NSW Government's South West Priority Growth Area. The southern portion of the area, the 'Catherine Fields (Part)' precinct was rezoned in 2013 and development is well underway. The rest of the Catherine Fields area ('Catherine Fields' precinct) to the north has not yet been released. However, multiple developers have expressed interest in initiating development in the area. The precinct is expected to be rezoned in 2018 under a 'precinct acceleration protocol' and a single large developer has proposed to begin development on an initial 2000 lots in 2019. These factors will contribute to higher growth in the 'Catherine Fields Precinct'.

The 'Catherine Fields (Part)' and 'Catherine Fields' precincts will have final dwelling yields of 4,943 and 12,428 respectively. Additionally, the 'Catherine Fields' and precinct will include 0.55 km<sup>2</sup> of employment land. Furthermore, Narellan ZS to south of Catherine Fields will likely exceed its firm capacity within the next regulatory period. The 50% POE forecast for Narellan will exceed the 70MVA firm capacity in 2021 and the 10% POE forecast will exceed the firm capacity in 2018.

Catherine Park ZS is a part of the overall South West Priority Growth Area Plan. **Error! Reference source not found.** presents an overview of the area and highlights existing and future investments required.

## Forecast Dwelling Completions - Developer Numbers

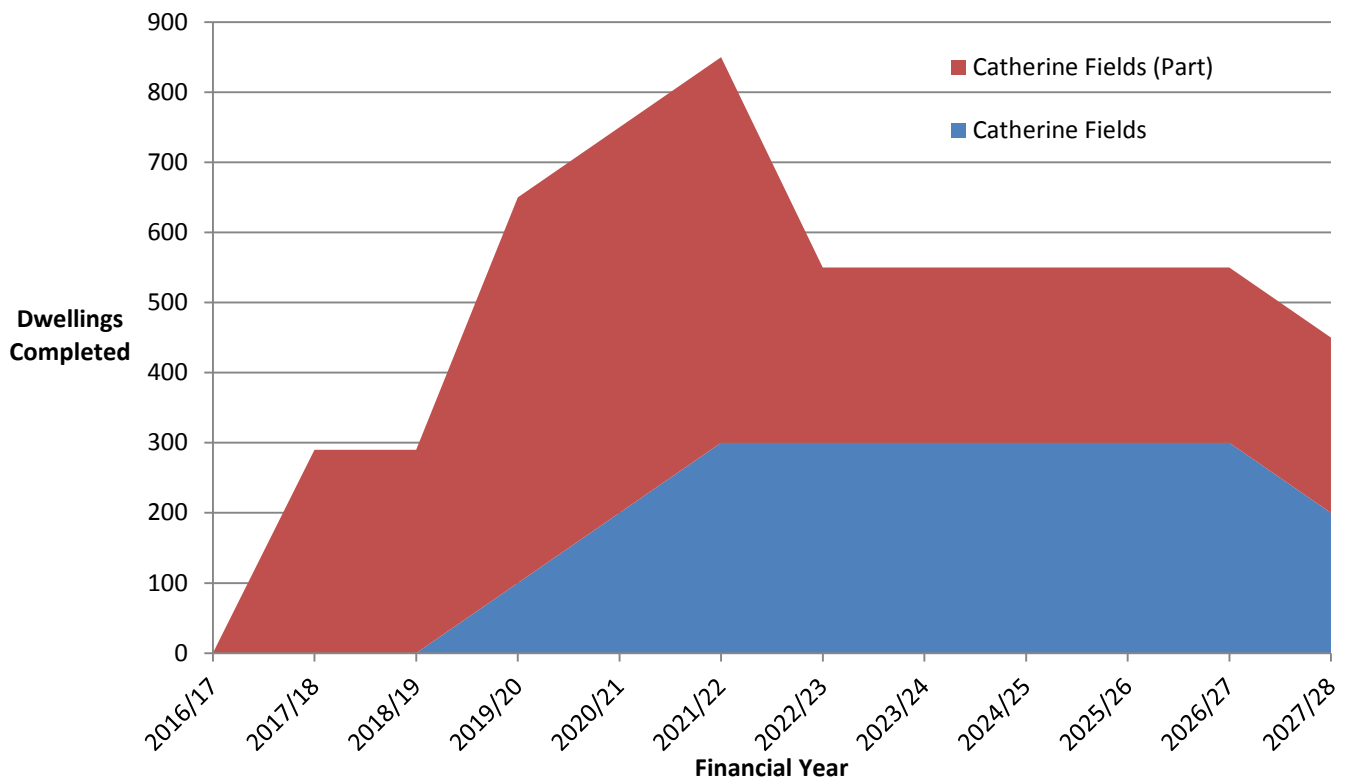


Figure 2 and 3 show the Department of Planning and Environment's forecast for dwelling completions in the 3 precincts. The figures show consistently high number of dwelling completions beginning in the 2016/17 financial year.

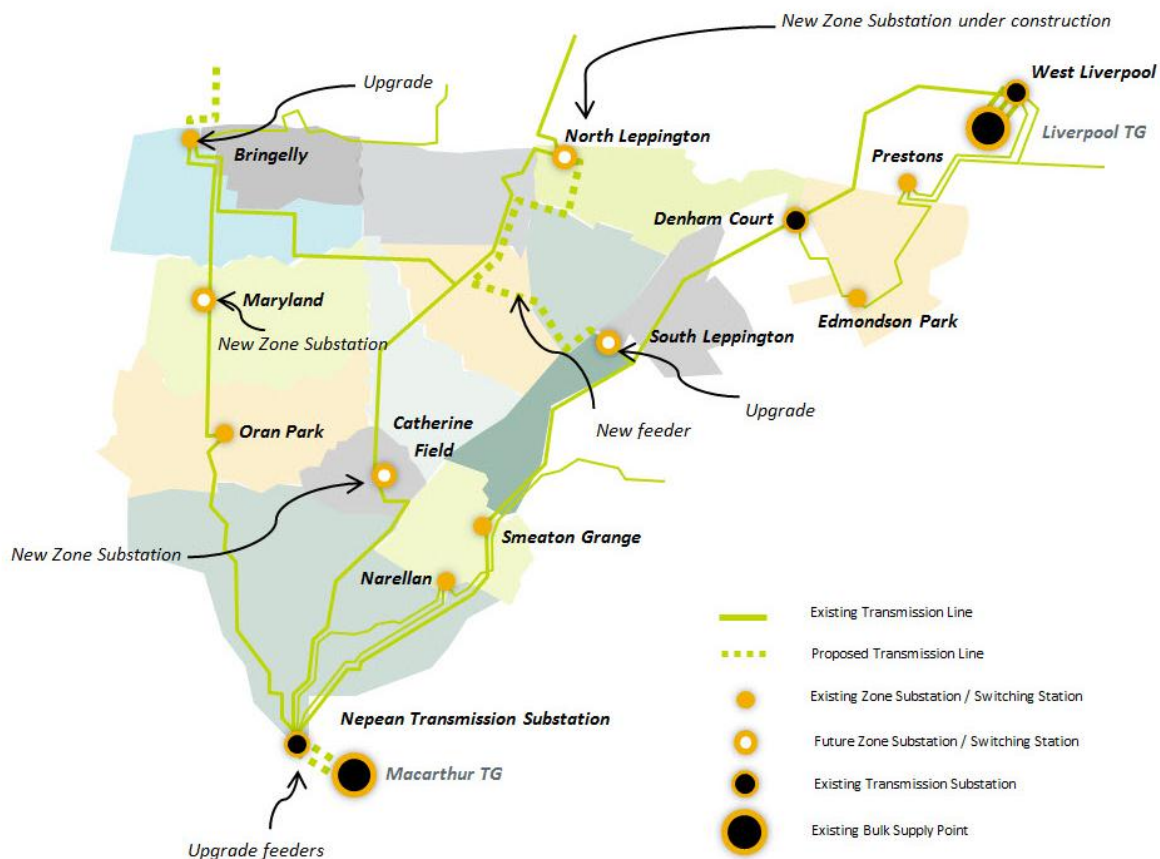


Figure 1 – Overview

## Forecast Dwelling Completions - Developer Numbers

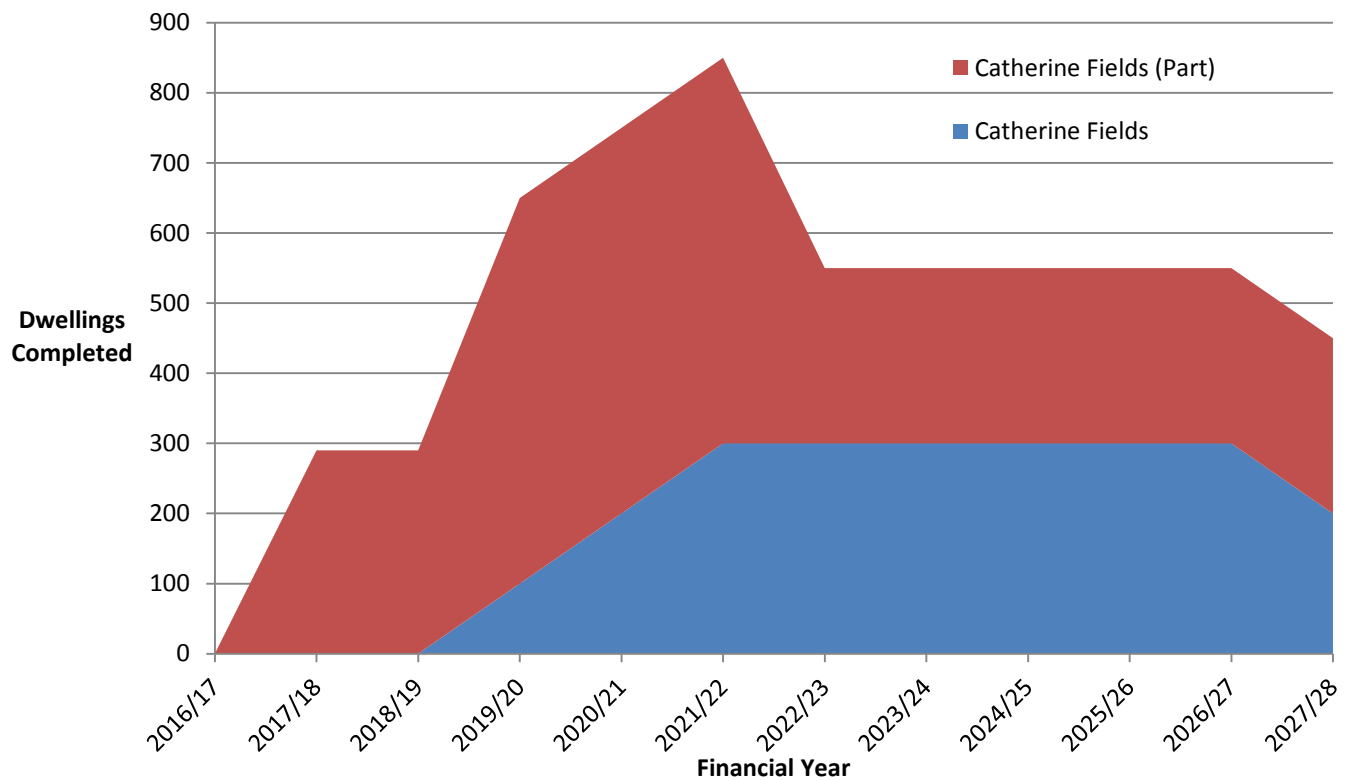


Figure 2 - Dwelling Completions Forecast (Source: NSW Government Department of Planning and Environment)

## Forecast Dwellings (Cumulative)

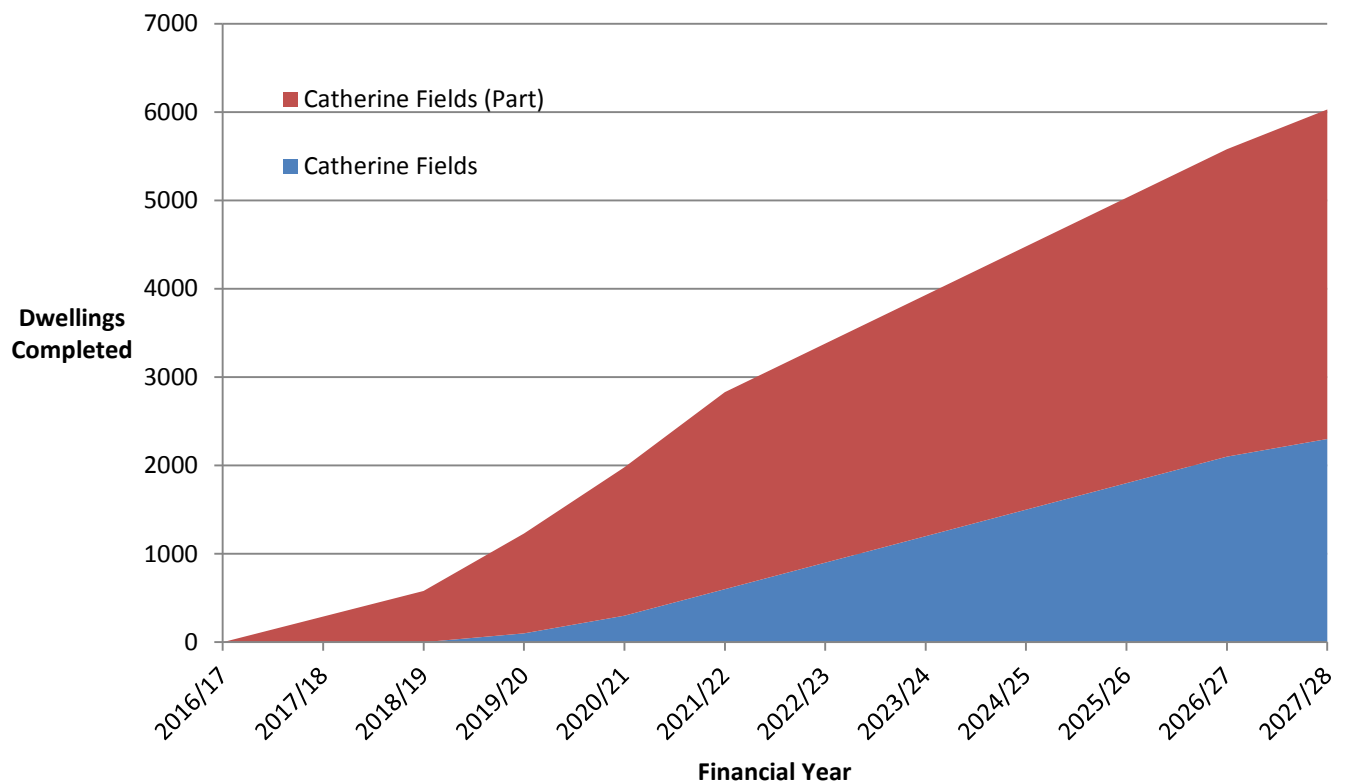


Figure 3 - Forecast Dwelling Numbers (Source: NSW Government Department of Planning and Environment)

## 2.0 Need/Opportunity

The NSW Government has begun to release and rezone identified precincts as part of the South West Priority Growth Area, the precincts included within the Catherine Park ZS catchment area are 'Catherine Fields (Part)' and 'Catherine Fields'. The 'Catherine Fields (Part)' precinct was rezoned in 2013 and 1200 dwellings have been built with 600 already sold and the remaining to be sold within 2 years. The existing development will continue at 300 dwellings per year for 4 years and there will also be an additional 1800 lots developed at a rate of 250 dwellings per year beginning in 2018/19. The release and rezoning of the 'Catherine Fields' precinct is likely to be fast tracked by the precinct acceleration program due developer interest in the area. The developer has indicated that they intend to begin developing 2000 lots in 2019.

The significant growth in these precincts and also the surrounding areas in the Priority Growth area will result in the available distribution capacity being exceeded within the next regulatory period. The combined available capacity from the adjacent zone substations is decreasing rapidly due to the high rates of growth in the respective areas. This capacity will likely be exceeded by 2021. The current stage 1 supply option for the Catherine Fields area is 3 feeders from Oran Park ZS, the construction of these feeders began in June 2017. The capacity of these feeders is limited and given the current rates of growth, there will be unserved energy from 2023 onwards.

As a secondary consideration, Narellan ZS's firm capacity was exceeded in 2017 and 50% POE forecast will exceed the firm capacity in 2021. The increase in demand at Narellan is driven by high growth in the area, particularly in the 'Turner Road' precinct which was rezoned in 2007 and has an expected dwelling yield of 7,506. The construction of a zone substation at Catherine Park would alleviate the load at risk at Narellan by allowing some distribution load to be transferred to the new substation. Narellan ZS also has operational constraints with fault levels requiring a split bus operation. The loss of one 66kV feeder or transformer will result in load shedding until the operators switch the network, resulting in an effective operational firm capacity of 52MVA as opposed a firm capacity of 70MVA based on transformer capacity.

Given the projected dwelling numbers in Catherine Fields precincts, the investment in additional distribution feeder capacity and additional substation capacity at the adjacent zones to satisfy the final demand will be similar to the investment required to establishing a new zone substation closer to the load within these precincts. Therefore, the timely construction of an appropriately situated zone substation will be the more efficient solution for supplying the Catherine Fields precincts.

### 2.1 Forecast Demand

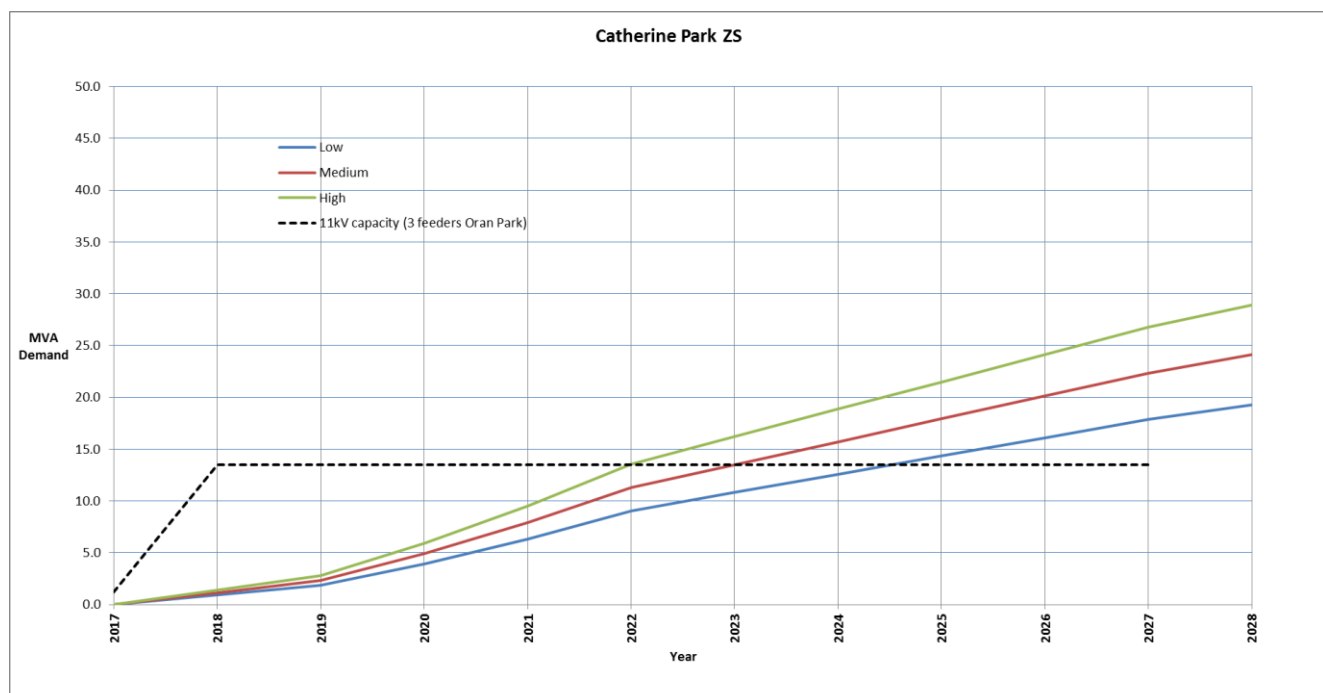


Figure 4 – Catherine Park - Forecast residential load

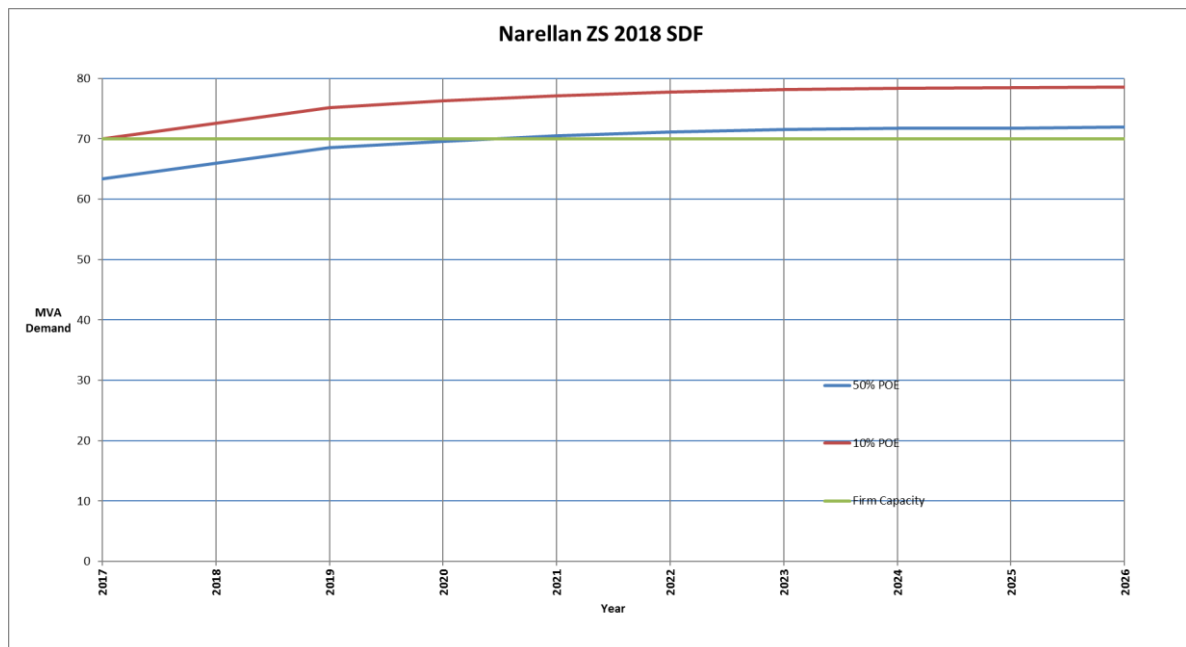


Figure 5 – Narellan ZS – Summer Demand Forecast 2018 – 2027

The ultimate dwelling yields for ‘Catherine Fields (Part)’ and ‘Catherine Fields’ are 4,943 and 12,428 respectively. Additionally, there is 0.55 km<sup>2</sup> of developable employment land within the ‘Catherine Fields’ precinct. The resultant final load for the new substation is approximately 67MVA. If the load at risk at Narellan ZS were to be transferred to the Catherine Park the final load will increase, but should be below 90MVA, the standard firm capacity of a 3 transformer 132kV zone substation.

## 2.2 Existing Supply

The two closest supply points to the Catherine Fields precincts are Oran Park Zone Substation and Narellan Zone Substation. Oran Park ZS is approximately 3.3km to the North West and Narellan ZS is approximately 3.5km to the South. The area is currently supplied by feeder 27031 from Narellan and feeder OP1162 from Oran Park. The spare capacity available on these feeders is 2MVA and 1.1MVA respectively, the combined spare capacity of 3.1MVA will allow for approximately 775 dwellings. This capacity will quickly be exceeded. Therefore, an interim supply option began construction in June 2017, the works include 3 feeders supplied from Oran Park ZS and will provide enough capacity for an additional 3375 dwellings until the construction of a permanent zone substation.

It should be noted that these new precincts will be at the further extents of the ideal catchment areas for Narellan ZS and Oran Park ZS. Portions of the area will be more than 3km from either zone substation. Supplying the ultimate Catherine Fields precincts from the existing adjacent zone substations would require a large investment in additional distribution feeder capacity. The high final dwelling yield and subsequent high load density will further compound the issues related to supplying the areas with the existing substations. Furthermore, a significant amount of growth is forecast for the areas supplied by Oran Park and Narellan ZS. There will be difficulty in meeting the demands of these current areas as well as the new Catherine Fields precincts with the existing zone substations without significant investments in substation capacity.

## 2.3 Load at Risk

The maximum available distribution capacity provided by the interim supply option is 13.5 MVA. Continued connection of new dwellings beyond 2022 will lead to load at risk on the distribution network, leading quickly to an inability to supply new dwellings.

Table 1 - Load at risk Catherine Park (MW)

| Network                                     | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|------|------|------|------|------|------|------|------|------|------|
| Distribution Capacity LAR (Adjacent Zones ) | -    | -    | 2.12 | 4.32 | 6.52 | 8.72 | 10.9 | 13.1 | 14.9 | 16.1 |

Additionally, the failure to offload Narellan ZS will lead to load at risk as the substation begins to exceed its firm capacity.

Table 2 - Load at risk Narellan ZS (MW)

| Network                             | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|-------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Substation Capacity LAR Narellan ZS | -    | 0.5  | 1.1  | 1.6  | 1.8  | 1.8  | 2    | 2.2  | 2.2  | 2.2  |

## 2.4 Energy at Risk

On the basis of supply to initial developments within the Catherine Fields precincts, energy at risk over the forecast period is estimated as follows:

Table 3 - Energy at Risk Catherine Park (MWh)

| Network                                    | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|--|------|------|------|------|------|------|------|------|------|------|
| Energy at Risk                             | 0    | 2    | 85   | 314  | 726  | 1500 | 2565 | 4111 | 5933 | 7138 |
| Energy unable to be supplied (no capacity) | 0    | 0    | 0    | 2    | 19   | 75   | 183  | 383  | 675  | 891  |
| Sum  | 0    | 2    | 85   | 316  | 745  | 1575 | 2749 | 4494 | 6608 | 8029 |

The energy at risk in the case that Narellan ZS is not offloaded is as follows:

Table 4 - Energy at Risk Narellan ZS (MWh)

| Network                                    | 2020 | 2021 | 2022 | 2023  | 2024  | 2025  | 2026  | 2027  | 2028  | 2029  |
|--|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| Energy at Risk                             | -    | 4.38 | 9.63 | 14.00 | 15.75 | 15.75 | 17.50 | 19.25 | 19.25 | 19.25 |
| Energy unable to be supplied (no capacity) | -    | -    | -    | -     | -     | -     | -     | -     | -     | -     |
| Sum  | -    | 4.38 | 9.63 | 14.00 | 15.75 | 15.75 | 17.50 | 19.25 | 19.25 | 19.25 |

### 3.0 Project Value

Continued connection of new customers to the small capacity available within the local distribution network will result in unacceptably high values for expected unserved energy and consequently VCR risk costs.

The precincts require connections for 17,371 new customers who will be entering the electricity market and generating business for market participants. In greenfield projects the VCR costs are strictly only applicable if supply is available. In this instance, capacity for new connections is only available for the first 3375 of these customers, resulting in 13,996 new customers remaining unconnected unless further investment in the network is made. Application of the VCR to all of these unconnected customers is arguably not appropriate. Hence for the purpose of economic evaluation VCR has only been applied to a small proportion of forecast demand above the available installed capacity, and for the remaining portion of forecast demand, an indicative value closer to retails costs for energy has been applied to the energy that is not able to be served. This represents the value that market participants will be deprived of if these unconnected customers remained unconnected. This is considered extremely conservative as the economic costs of customers remaining unconnected are great, but arguably not as high as the connected cost customers would be willing to pay in the event of an outage.

Hence, by establishing additional zone substation or distribution capacity to facilitate these connections, the following risk of non-supply costs would be addressed and available as benefits to the project proposal.

#### 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 |
|--|--|
| Distribution Capacity from Oran Park ZS for Catherine Park | \$52.5m                                |
| Narellan ZS firm capacity exceeded                         | \$1.3m                                 |

The connection capacity will be exceeded in 2022 and if no action is taken development will not be able to proceed.

#### 3.2 Project Costs

Distribution feeders from existing zone substations will have to traverse distances of more than 3 km to service the precincts.

### 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 many 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.

In this case, the establishment of additional distribution feeders from Oran Park Zone Substation has already been used to defer the construction of the proposed Catherine Park ZS. The establishment of additional distribution feeders is not feasible because available capacity at Oran Park Zone substation will be constrained by 2025 based on connections within its own catchment area.



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

The establishment of a 132/11kV Zone substation is the ultimate network solution that will achieve the desired network outcomes. This option also removes potential load at risk at Oran Park Zone Substation and addresses constraints on Narellan ZS.

At this point in time, however, the estimated net market benefits from this option has been evaluated to be \$35.4 Million.

## **4.3 Option 3 – Establishment of a Staged 132/11kV Zone Substation**

The staging of the zone substation is possible with a single transformer temporary substation and will allow connections to proceed without stalling. However, with this option there will be load at risk which will eventually be addressed when the final stage of the substation is built. Given that the project has previously been deferred through the establishment of a number of additional distribution feeders from Oran Park, the establishment of a staged solution will be partly backed up by these feeders. At this point in time, due to lower costs, this option is the preferred network build option. This option will address constraints on Narellan ZS.

The estimated net market benefits from this option has been evaluated to be \$41.5 Million.

## **4.4 Option 4 – 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. 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.

Given that surrounding areas are also developing and connections to these feeders are likely to increase, potential for reduction in forecast peak demand is limited to efficiency measures and technology take-up associated with new houses. This has the potential to influence timing of network build options. 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**

A project to construct a new zone substation in the 2014-2019 regulatory period was deferred with the establishment of three distribution feeders from Oran Park ZS. A Final Project Assessment Report for the establishment of the feeders was published in 2017. This business case establishes the requirement for the next stage involving the construction of the zone substation. The opportunity exists to stage the build of the zone substation and the proposed capex of \$9.6m (FY19 real) only allows for a single transformer substation with a temporary switchgear building. Based on the rates of growth and limited



existing capacity, the construction of the first stage of a new zone substation at Catherine Park will be required during the 2018/19-2023/24 regulatory period.

## 6.0 Appendix

| Probabilistic VCR Template v4 Catherine Park Interim ZS.xlsm |                             |                                |           |
|--|-----------------------------|--------------------------------|-----------|
|  | PV<br>investme<br>nts (\$m) | PV Market<br>Benefits<br>(\$m) | NPV (\$m) |
| Deterministic Assessment                                     | \$ 10.1                     | \$ 49.9                        | \$ 39.9   |
| Proabablistic Assessment                                     | \$ 10.8                     | \$ 52.2                        | \$ 41.5   |
| PV of Risk Costs (Potential Market Benefits)                 |                             | \$ 52.5                        |           |
|  | % Risk                      |                                |           |
| Risk of Negative Market Benefits                             | 0.00%                       |                                |           |

