Regulatory Investment Test for Distribution

Draft Project Assessment Report (DPAR)

Addressing Reliability Requirements in the Planella Network Area

This document describes the *identified need* for investment at Planella, including the preferred option to address the identified need.

Publication Date: **15 November 2019**

Consultation Period Starts: **15 November 2019**

Consultation Period Closes: **27 December 2019**

Executive Summary

Ergon Energy Corporation Limited (Ergon Energy) is responsible (under its Distribution Authority) for electricity supply to the Mackay northern beaches area in North Queensland.

Planella (PLAN) 33/11kV Zone Substation is located in the suburb of Rural View on the northern beaches of Mackay, and the substation services the Mackay northern beaches suburbs of Shoal Point, Bucasia, Eimeo, Dolphin Heads, Blacks Beach and Rural View. This area is primarily a residential area, and the surrounding suburbs are highlighted in the Mackay Regional Council regional planning scheme strategic framework for growth over the next 15 years.

Planella Substation presently supplies 6,316 customers and has two 33/11kV OLTC transformers which have both an N-1 transformer cyclic and long term emergency cyclic rating of 15.3MVA. The substation is presently supplied via a single circuit radial 33kV sub-transmission line which is teed off the line from Glenella (GLEL) 66/33/11kV Substation to North Mackay (NOMA) 33/11kV Substation just outside North Mackay Substation.

Planella does not have N-1 security and is reliant on the 33kV radial feeder between North Mackay and Planella. Currently a fault on this section of line will result in an outage for all Planella customers which combine for a peak load at risk of approximately 15.85MVA.

Planella does not comply with the Safety Net requirements based on credible contingencies benchmarked against 50% PoE load in the present configuration.

Under most circumstances, the wood poles of the 33kV Planella tee – Planella sub-transmission line are accessible; however in the event of periods of heavy rainfall and/or king tides, sections of the line passing through mangrove wetlands become virtually inaccessible. For the loss of the incoming 33kV feeder, resulting from a pole failure or wires on ground in an inaccessible location, the customer outage duration would be greater than 12 hours hence supply restoration is not Safety Net compliant for this scenario.

The identified need for investment is to remediate the supply reliability risks currently associated with the single 33kV overhead timber pole feeder supplying Planella Substation in order to maintain a safe, reliable supply of electricity to customers in the supply area.

Ergon Energy published a Non-Network Options Report for the above described network constraint on 24 June 2019. No submissions were received by the closing date of 19 September 2019.

Three potentially feasible options have been investigated:

- **Option A:** Rebuild a 1.5km section of the existing 33kV feeder in the storm tide inundation flood zone using concrete pole construction, obtain easements & develop additional 11kV feeder ties.
- **Option B:** Construct a new single circuit 33kV mixed overhead & underground feeder from Glenella to Planella.
- **Option C:** Construct a new double circuit 66kV mixed overhead & underground feeder from Glenella to Planella and convert Planella Substation to 66/11kV.

This is a Draft Project Assessment Report, where Ergon Energy provides both technical and economic information about possible solutions. Ergon Energy's preferred solution to address the

identified need is Option A – Rebuild a 1.5km section of the existing 33kV feeder in the storm tide inundation flood zone using concrete pole construction, obtain easements & develop additional 11kV feeder ties.

Submissions in writing (electronic preferably) are due by **27 December 2019** and should be lodged to Ergon Energy's "Regulatory Investment Test for Distribution (RIT-D) Partner Portal". The portal is available at:

https://www.ergon.com.au/network/network-management/network-infrastructure/regulatory-test-consultations

For further information and inquiries please refer to the "Regulatory Investment Test for Distribution (RIT-D) Partner Portal".

Table of Contents

List of Figures and Tables

1. Introduction

This Draft Project Assessment Report has been prepared by Ergon Energy in accordance with the requirements of clause 5.17.4(i) of the National Electricity Rules (NER).

This report represents the second stage of the consultation process in relation to the application of the Regulatory Investment Test for Distribution (RIT-D) on potential credible options to address the identified limitations in the distribution network that supplies the Mackay northern beaches area. On the 24 June 2019, Ergon Energy (EE) published the first stage of the RIT-D, which was the release of the Non-Network Options Report.

This report:

- Provides background information on the network capability limitations of the distribution network supplying the Mackay northern beaches area.
- Identifies the need which Ergon Energy is seeking to address, together with the assumptions used in identifying and quantifying that need.
- Describes the credible options that are considered in this RIT-D assessment.
- Quantifies costs and classes of material market benefits for each of the credible options.
- Describes the methods used in quantifying each class of market benefit.
- Provides details of classes of market benefits that are not considered material to this RIT-D assessment and provides explanations as to why these classes of market benefits are not considered material.
- Provides the results of Net Present Value (NPV) analysis of each credible option and accompanying explanatory statements regarding the results.
- Identifies the proposed preferred option, including detailed characteristics, estimated commissioning date, indicative costs, and noting that it satisfies the RIT-D.
- Provides contact details for queries on this RIT-D.
- Is an invitation to registered participants and interested parties to make submissions.

In preparing this RIT-D, Ergon Energy is required to consider reasonable future scenarios. With respect to possible future loads and development, Ergon Energy has, in good faith, included as much detail as possible while maintaining necessary customer confidentiality. At the time of writing, Ergon Energy considers the most probable future scenario to be that there will be significant future development in the Mackay northern beaches area and has developed this Draft Project Assessment Report principally on this basis. It is noted that customer activity can occur over the consultation period and may change the timing and/or scope of any proposed solutions.

Submissions in writing (electronic preferably) are due by **27 December 2019** and should be lodged to Ergon Energy's "Regulatory Investment Test for Distribution (RIT-D) Partner Portal". The portal is available at:

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For further information and inquiries please refer to the "Regulatory Investment Test for Distribution (RIT-D) Partner Portal".

2. Background

2.1. Geographic Region

The geographic region covered by this RIT-D is the Planella Substation and surrounding 33kV sub-transmission network.

Planella (PLAN) 33/11kV Zone Substation is located in the suburb of Rural View on the northern beaches of Mackay. Planella Substation services the Mackay northern beaches suburbs of Shoal Point, Bucasia, Eimeo, Dolphin Heads, Blacks Beach and Rural View. This area is primarily a residential area, consists of approximately 6,316 customers and is located in the Mackay area of the Northern Region of Ergon Energy's Network.

The geographical location of Ergon Energy's 33kV sub-transmission network and substations in the Mackay northern beaches area is illustrated in the Google Earth image below.

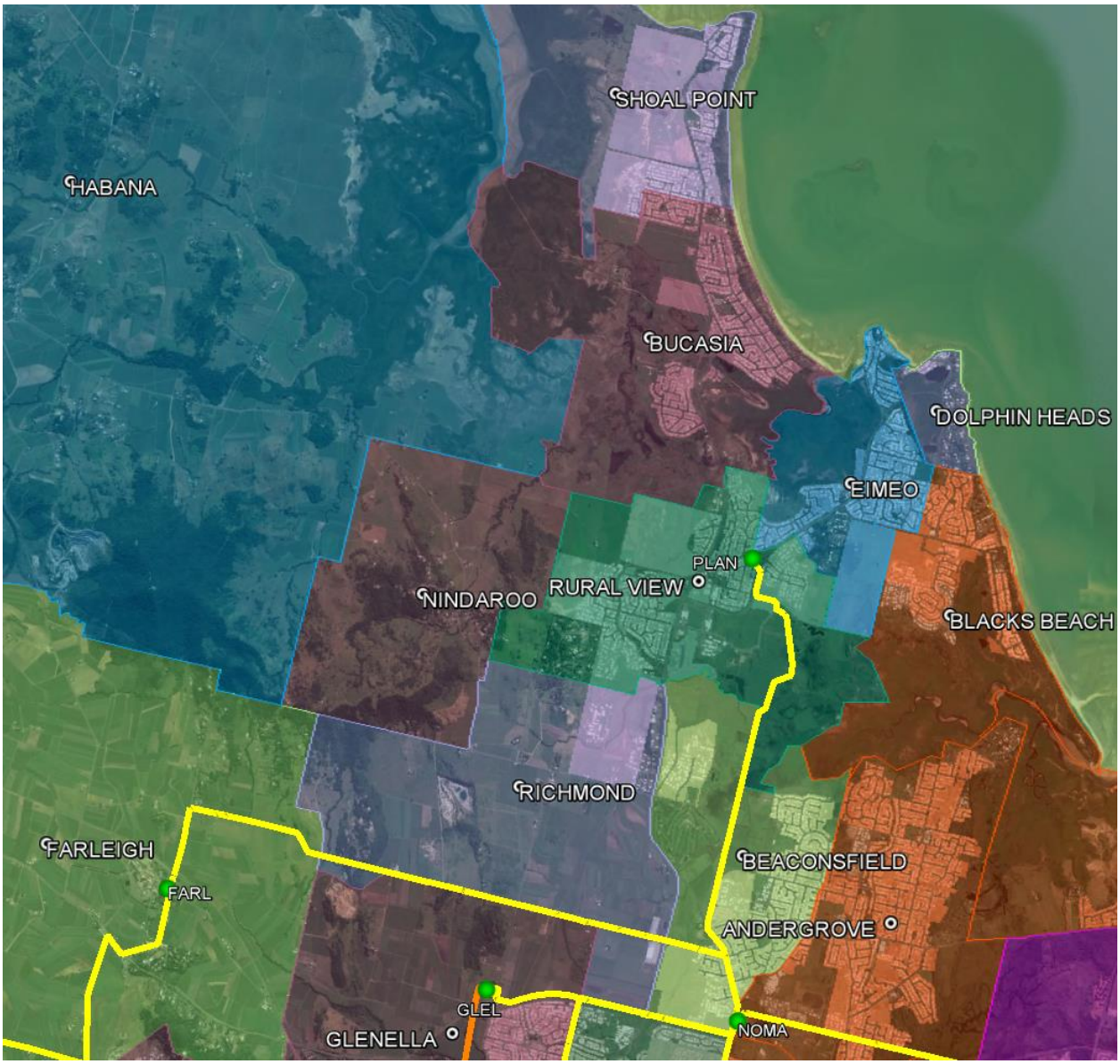

Figure 1: Mackay Northern Beaches 33kV Sub-transmission Network

The Mackay northern beaches area and the surrounding suburbs are highlighted in the Mackay Regional Council regional planning scheme strategic framework for growth over the next 15 years. There are a number of approved large subdivisions in various stages of implementation such as Plantation Palms Estate, Richmond Hills Estate, Royal Sands Estate and Kerrisdale Estate. The concentration of building activity in the area represents significant load growth to the network over the next 15 years.

Illustrated below is a map showing the areas that are currently zoned for residential development in the northern beaches area. It can be noted that the majority of the new development areas for residential growth are in the vicinity of Planella Substation.

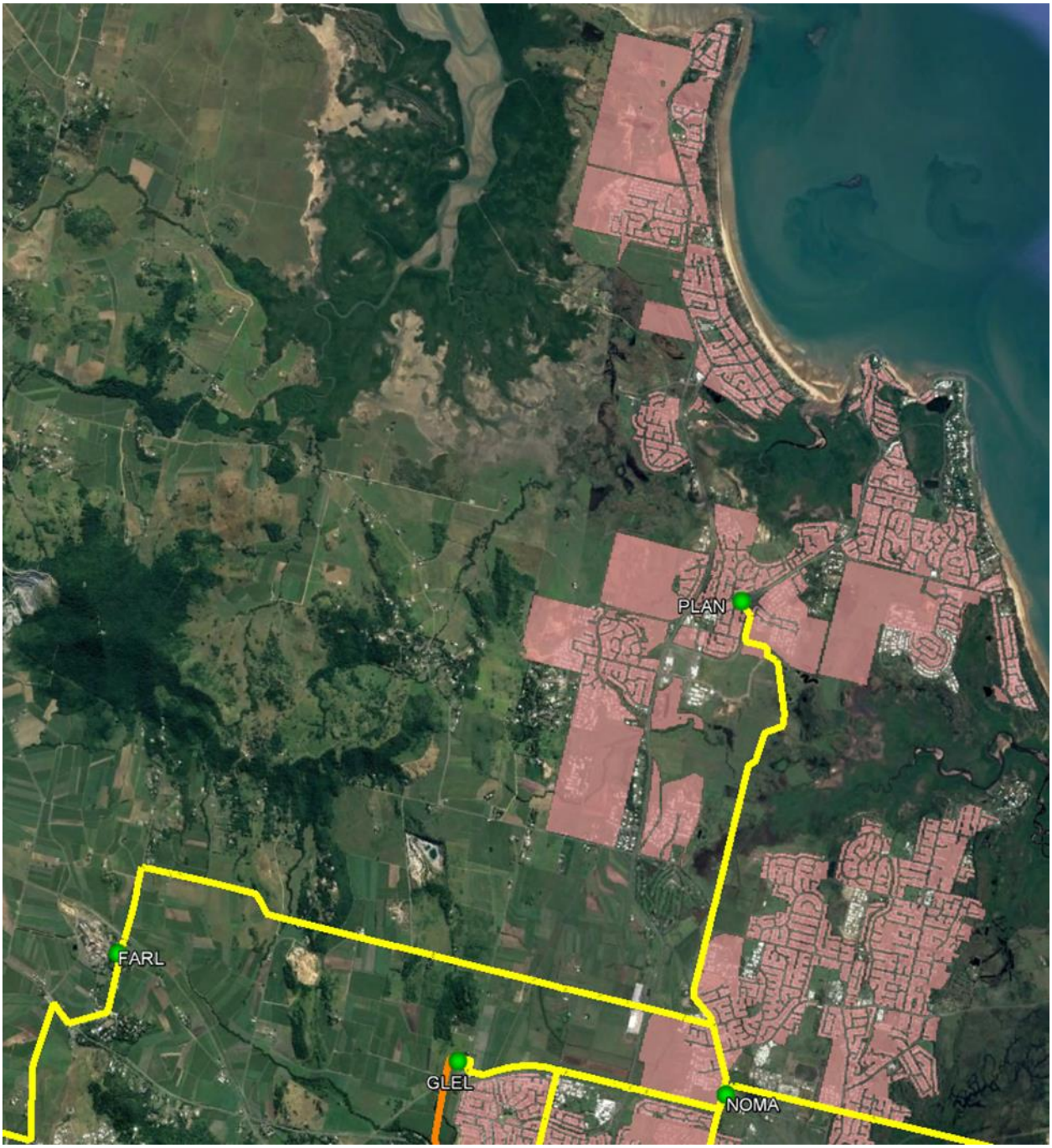

Figure 2: Residential Land Zoning in the Mackay Northern Beaches Area

2.2. Existing Supply System

The Mackay northern beaches area is supplied from Planella (PLAN) 33/11kV Zone Substation.

Planella (PLAN) Substation presently supplies 6,316 customers and has two 33/11kV transformers which both have an N-1 transformer cyclic and long term emergency cyclic rating of 15.3MVA. Planella Substation supplies six 11kV distribution feeders which contain four existing 11kV feeder ties to 11kV feeders supplied from North Mackay 33/11kV Substation (NOMA).

Planella Substation is supplied via a single circuit radial 33kV sub-transmission line (FDR 340) which is teed off the line from Glenella (GLEL) 66/33/11kV Substation to North Mackay (NOMA) 33/11kV Substation (FDR 422) just outside North Mackay Substation. There is also an additional tee-off, approximately 7.7km in length, to Farleigh (FARL) 33/11kV Substation that is operated with a normally open gas switch near the tee-off point. The tee-off is located approximately 800 m from North Mackay Substation.

The 3.3km 33kV section from Glenella to North Mackay is predominantly 630mm^2 Cu XLPE cable with a single span (64 m) of Pluto 19/3.75 AAC conductor adjacent to North Mackay Substation. The rating of this section is limited by the span of Pluto conductor which has a summer day rating of 35.8MVA.

The 6.1km 33kV section from North Mackay to Planella is predominantly timber pole construction with no overhead earth wire. The feeder section predominantly consists of approximately 0.66km of Jasper 7/4.75 AAAC conductor, 4.46km of Cherry 6/4.75-7/1.60 ACSR/GZ conductor and 0.87km of Iodine 7/4.75 AAAC conductor. The rating of this section is limited by the Cherry conductor which has a summer day rating of 21MVA.

The existing 33kV network arrangement is shown schematically in the figure below.

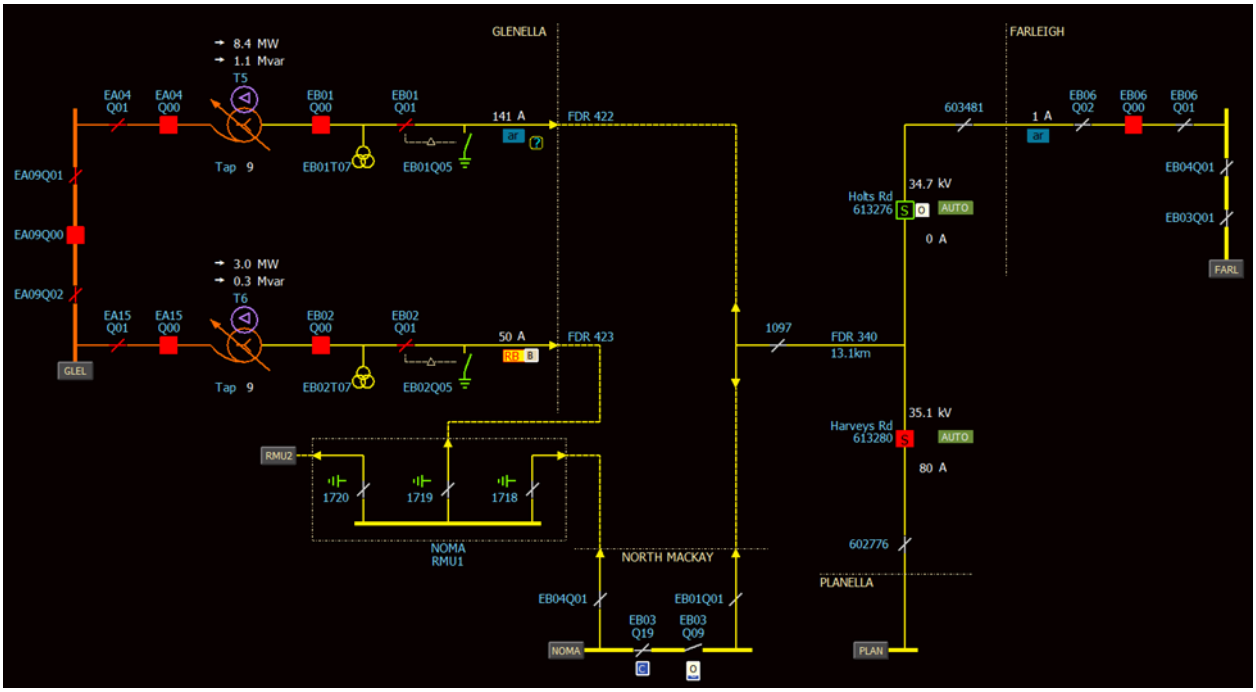

Figure 3: Existing 33kV Sub-transmission Network

3. Identified Need

3.1. Description of the Identified Need

3.1.1. Safety Net Non-Compliance

Due to the existing sub-transmission network configuration, Planella does not have N-1 security and is reliant on the 33kV radial feeder between North Mackay and Planella. Currently a fault on this section of line will result in an outage for all Planella customers which combine for a peak load at risk of approximately 15.85MVA.

Planella does not comply with the Safety Net requirements based on credible contingencies benchmarked against 50% PoE load in the present configuration.

3.2. Quantification of the Identified Need

3.2.1. NOMA-PLAN 33kV Feeder Route (Flood Zone)

The existing radial 33kV wood pole line between North Mackay and Planella currently runs through a low lying area that is prone to flooding due to storm tide inundation. During periods of heavy rainfall and/or king tides, sections of the line route are inaccessible and normal restoration times for credible contingencies are not achievable.

The figure below shows the area along the feeder route that is affected by storm tide inundation.

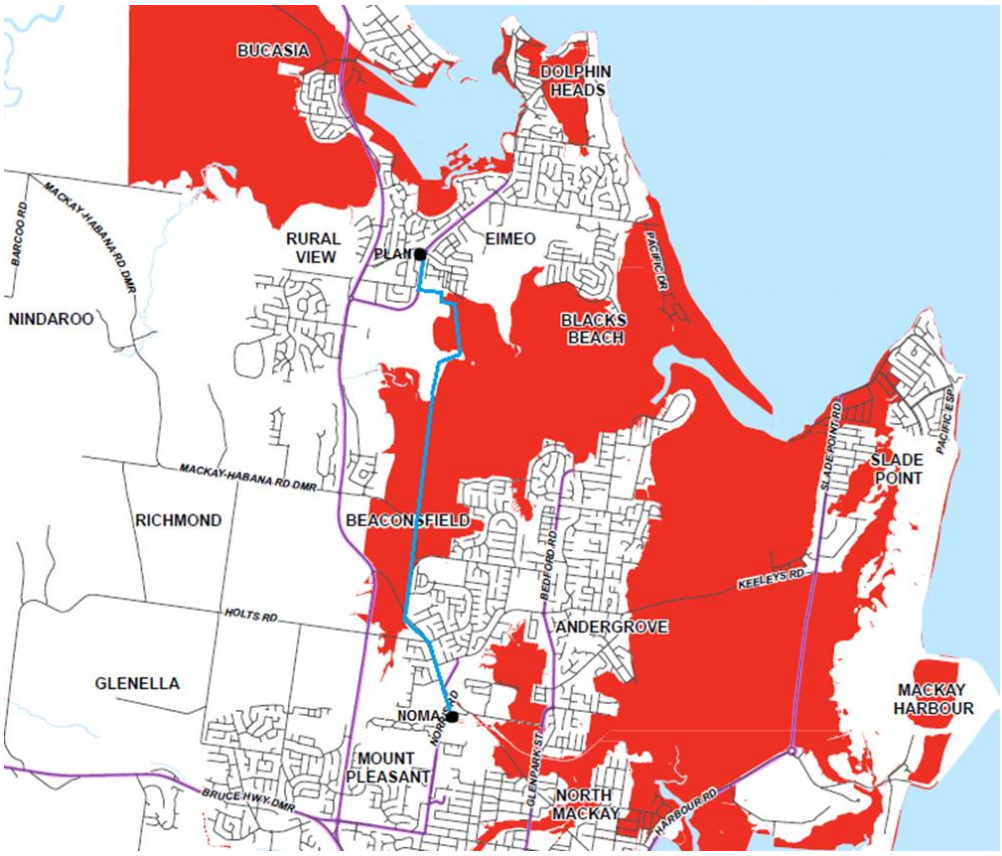

Figure 4: North Mackay Storm Tide Inundation Map

3.2.2. Safety Net Non-Compliance

Under most circumstances, the wood poles of the 33kV Planella tee – Planella sub-transmission line are accessible; however in the event of periods of heavy rainfall and/or king tides, sections of the line passing through low lying areas become inaccessible.

For the loss of the incoming 33kV feeder, resulting from a pole failure or wires on ground in an inaccessible location, the customer outage duration would be greater than 12 hours hence supply restoration is not Safety Net compliant for this scenario.

Under this scenario it is possible to transfer up to 2.3MVA of load to NOMA via Celeber Drive feeder via manual field switching within 2 to 3 hours. Fault finding, switching, repairs and restoration would be expected to take up to 48 hours depending on the type of fault and the fault location.

This is reflected in the figure below.

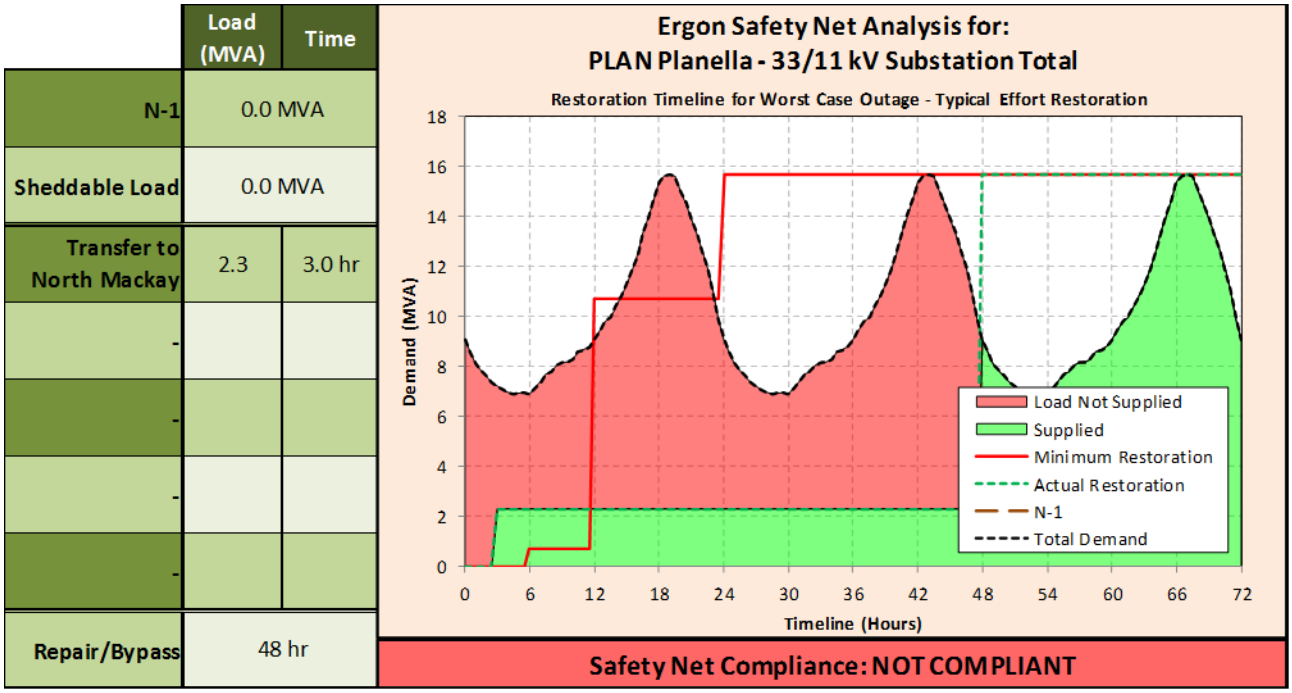

Figure 5: Safety Net Analysis for PLAN (Loss of 33kV Feeder in Inaccessible Location)

4. Load Profiles

4.1. Planella (PLAN) 33/11kV Substation

The load at Planella comprises a mix of residential (predominantly) and commercial customers. Daily peak loads generally occur in the late afternoon and evening. The load is summer peaking, and annual peak loads are predominantly driven by air-conditioning.

4.1.1. Historical Load Growth

The historical load of Planella Substation for the summer day (SD), summer night (SN), winter day (WD) and winter night (WN) periods since 2003 is shown in the figure below.

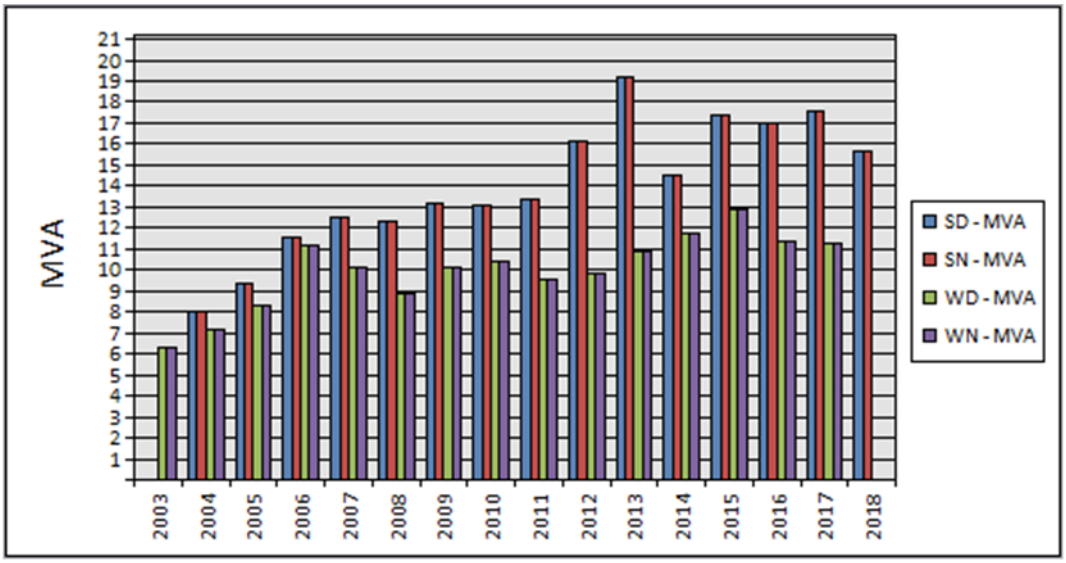

Figure 6: Historical Load of Planella Substation (Since 2004)

It should be noted that the reduction from the peak of 2013 (19.2MVA) to the peak of 2018 (15.85MVA) was due to a combination of reduced housing occupancy, increased energy efficiency by the customers, a significant increase in rooftop solar PV and the establishment of additional 11kV feeder ties which enabled the permanent transfer of load across to North Mackay (NOMA) Substation.

4.1.2. Rooftop Solar PV Capacity Growth

The figure below shows the forecast rooftop solar PV capacity growth in the Planella supply area under low (5.8%), moderate (9.4 %) and high (13.3 %) growth rates. From this it is evident that load growth will continue to be somewhat held back by the growth of connected PV in the region.

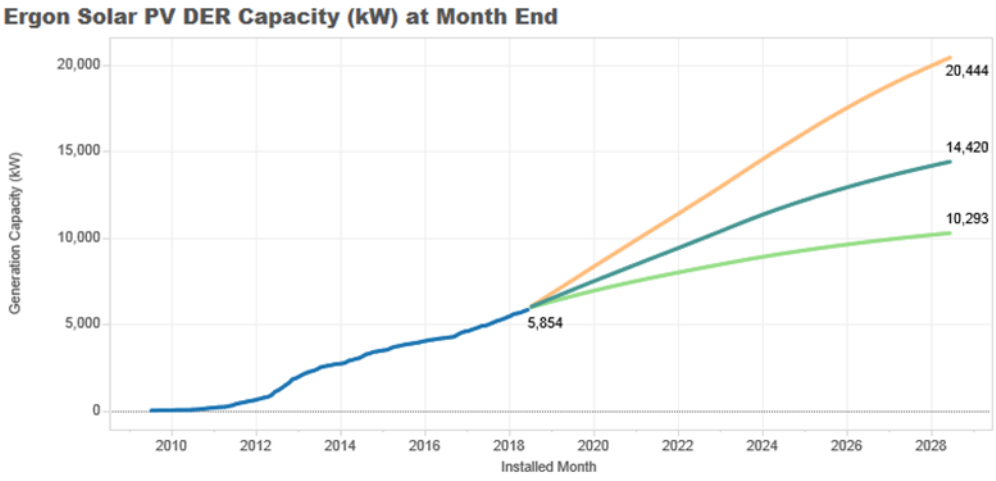

Figure 7: Forecast Rooftop Solar PV Capacity for Planella Substation

4.1.3. Base Growth Scenario Forecast

The 50% POE load forecast for the base growth scenario for Planella Substation out until 2028 is illustrated in the figure below.

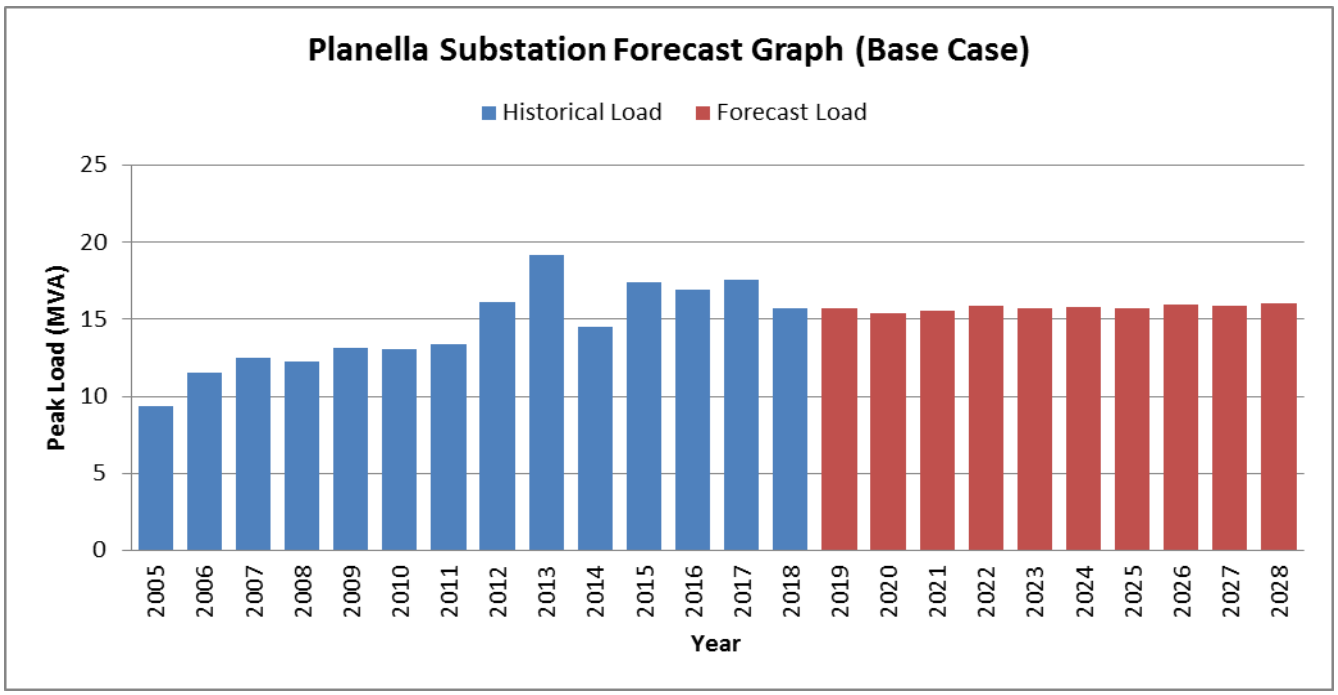

Figure 8: Forecast 50% POE Load for Planella Substation (Base Case Scenario)

4.1.4. High Growth Scenario Forecast

The 10% POE load forecast for the high growth scenario for Planella Substation out until 2028 is illustrated in the figure below.

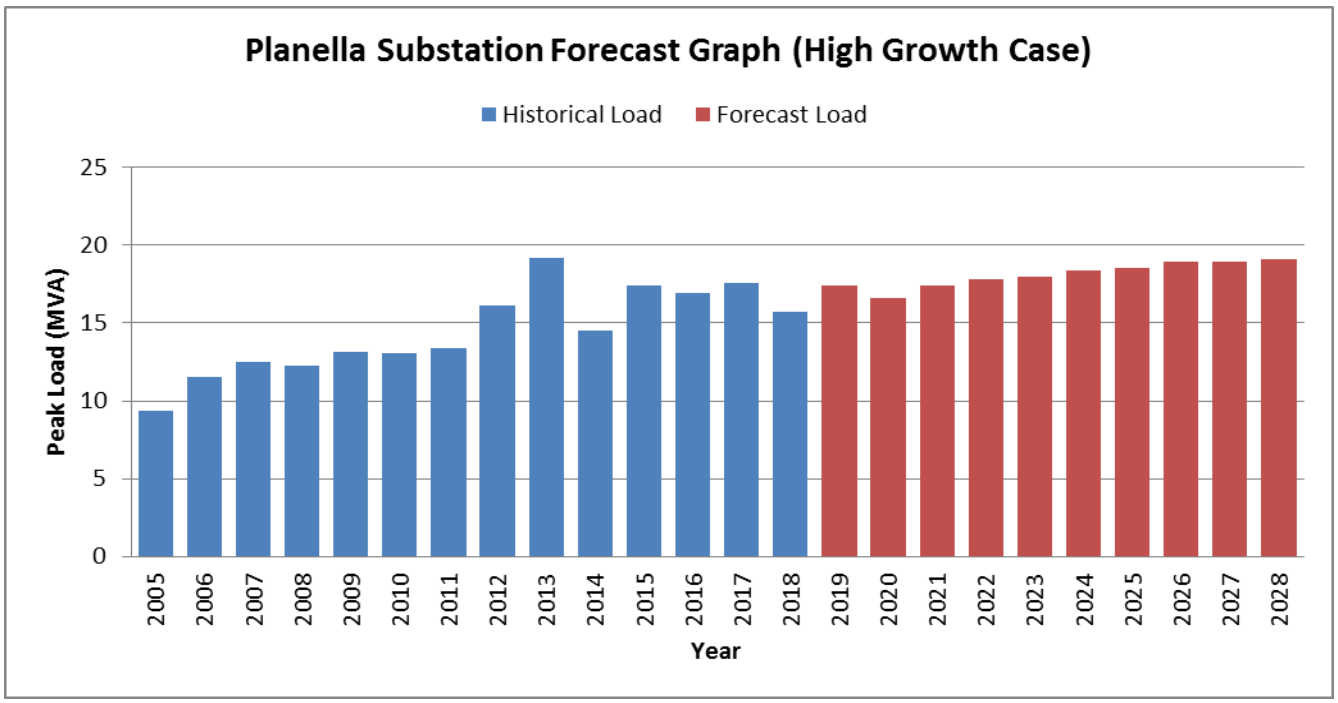

Figure 9: Forecast 10% POE Load for Planella Substation (High Growth Scenario)

4.1.5. Full Annual Load Profile for Planella Substation

The full annual load profile for Planella Substation is illustrated in the figure below. It should be noted that peak load occurs during summer at Planella Substation.

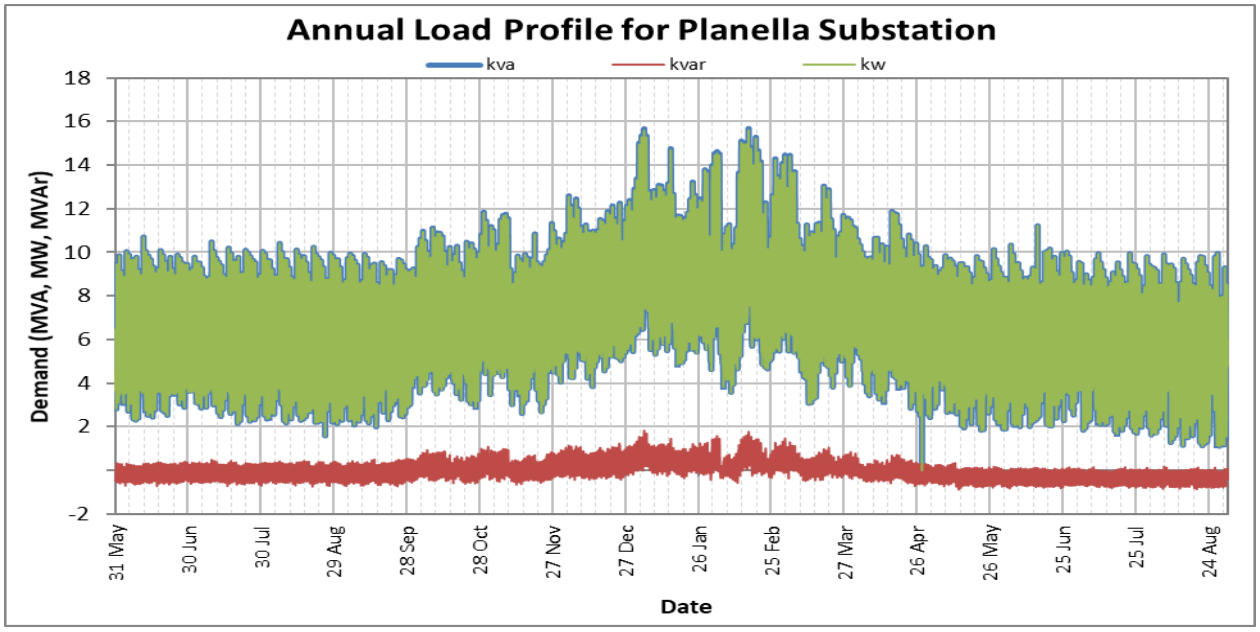

Figure 10: Full Annual Load Profile for Planella Substation

4.1.6. Average Peak Weekday Load Profile (Summer)

The daily load profile for an average peak weekday during summer at Planella Substation is illustrated in the figure below. It should be noted that the Planella Substation summer peak loads were being experienced in the late afternoon and evening.

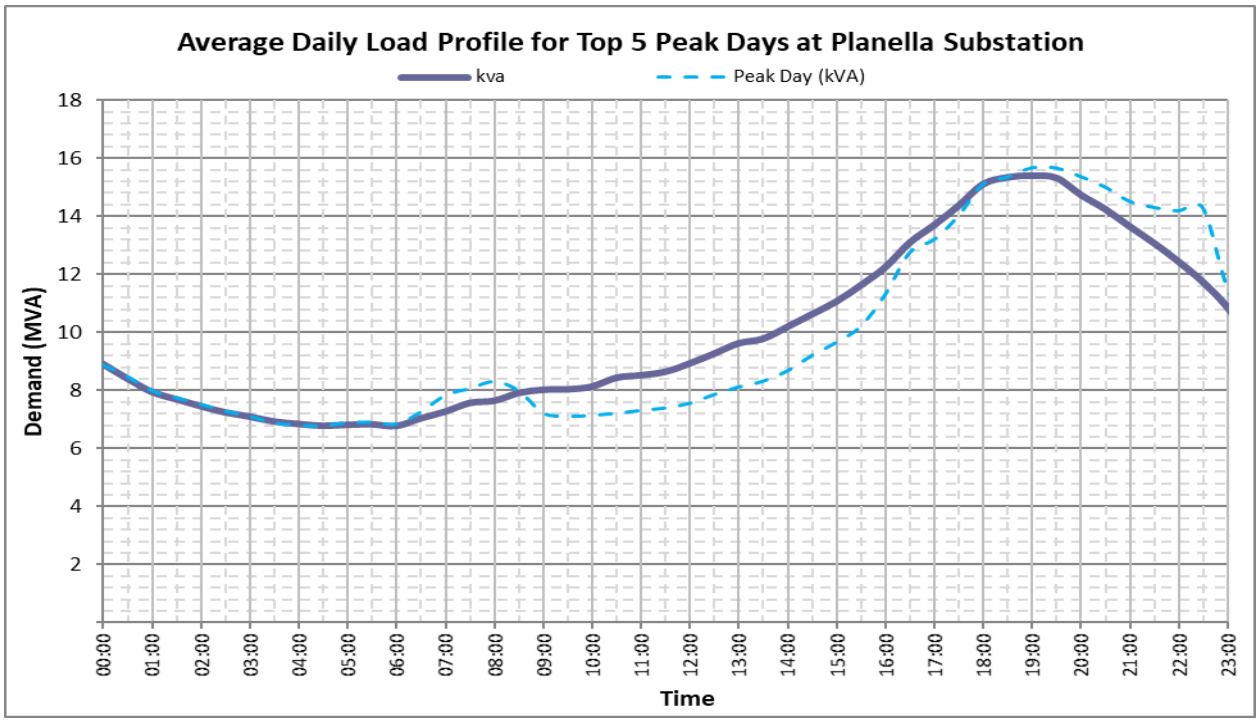

Figure 11: Average Peak Weekday Load Profile (Summer)

4.1.7. Load Duration Curve for Planella Substation

The load duration curve for Planella Substation is illustrated in the figure below.

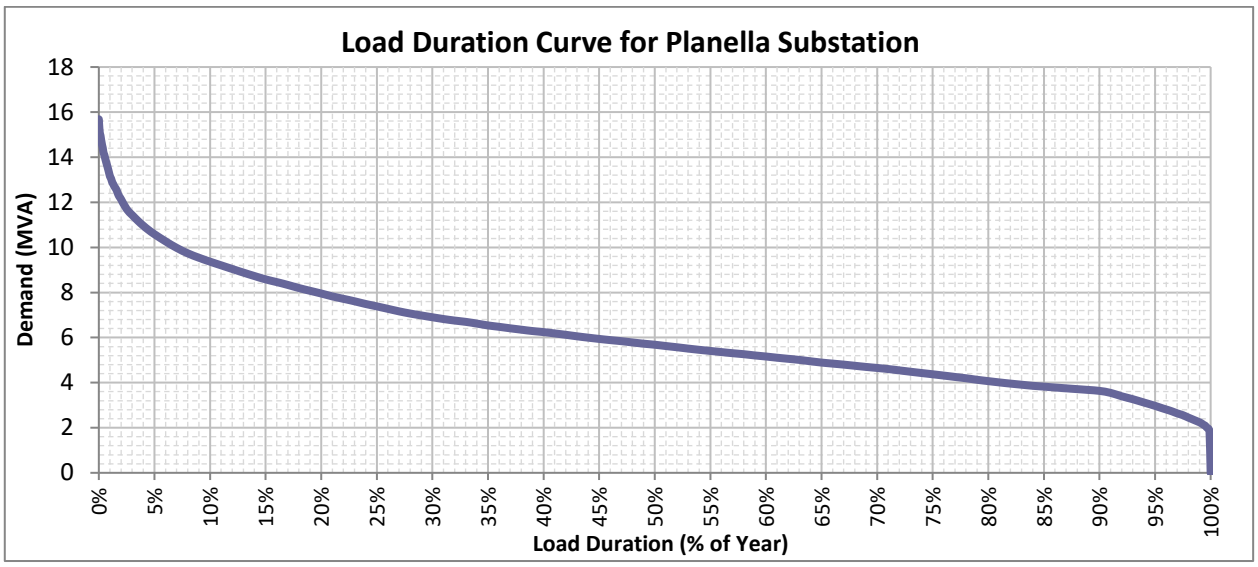

Figure 12: Load Duration Curve for Planella Substation

5. Assumptions in Relation to Identified Need

Below is a summary of key assumptions that have been made when the Identified need has been analysed and quantified.

It is recognised that the below assumptions may prove to have various levels of correctness, and they merely represent a 'best endeavours' approach to predict the future identified need.

5.1. Forecast Maximum Demand

It has been assumed that peak demand at Planella Substation will grow as per the base case load forecast.

Factors that have been taken into account when the load forecast has been developed include the following:

- load history
- known future developments (new major customers, network augmentation, etc.)
- temperature corrected start values (historical peak demands)
- forecast growth rates for organic growth

5.2. Load Profile

Characteristic peak day load profiles shown in Section 5 are unlikely to change significantly from year to year, i.e. the shape of the load profile will remain virtually the same with increasing maximum demand.

5.3. System Capability – Line Ratings

The 33kV line from North Mackay to Planella is predominantly timber pole construction with no overhead earth wire. The rating of this line is limited by the Cherry conductor which has a summer day rating of 21MVA.

The thermal ratings of the sub-transmission line that supplies Planella have been calculated based on the main parameters listed in the table below.

Table 1: Line Rating Parameters

Parameter	Summer Day (9am – 5pm)	Summer Evening (5pm – 10pm)
Ambient Temperature	35°C	31°C
Wind Velocity	1.3 m/s	0.8 m/s
Wind Angle to Conductor Axis	45°	45°
Direct Solar Radiation	910 W/m^2	200 W/m^2
Diffuse Solar Radiation	210 W/m^2	20 W/m^2

6. Summary of Submissions

On 24 June 2019, Ergon Energy published the Non-Network Options Report providing details on the identified need on the sub-transmission network that supplies Planella. This report sought information from Registered Participants, AEMO and Interested Parties regarding alternative potential credible options or variants to the potential credible options presented by Ergon Energy.

In response to the Non-Network Options Report, Ergon Energy received no submissions by 19 September 2019, which was the closing date for submissions to the Non-Network Options Report.

7. Assessment of Non-Network Solutions

7.1. Demand Management

Ergon Energy's Demand & Energy Management (DEM) team has assessed the potential non-network alternative (NNA) options required to defer the Network option and determine if there is a viable demand management (DM) option to replace or reduce the need for the network options proposed.

Planella (PLAN)

The DEM team has completed a review of the Planella customer base and considered a number of demand management technologies. Reliability of supply and Safety Net compliance are the key project drivers (i.e. the need) at Planella. It has been determined that there are no credible NNA's that will address the identified need at Planella.

There are 6063 residential customers and 253 business customers connected to PLAN (refer Figure 13).

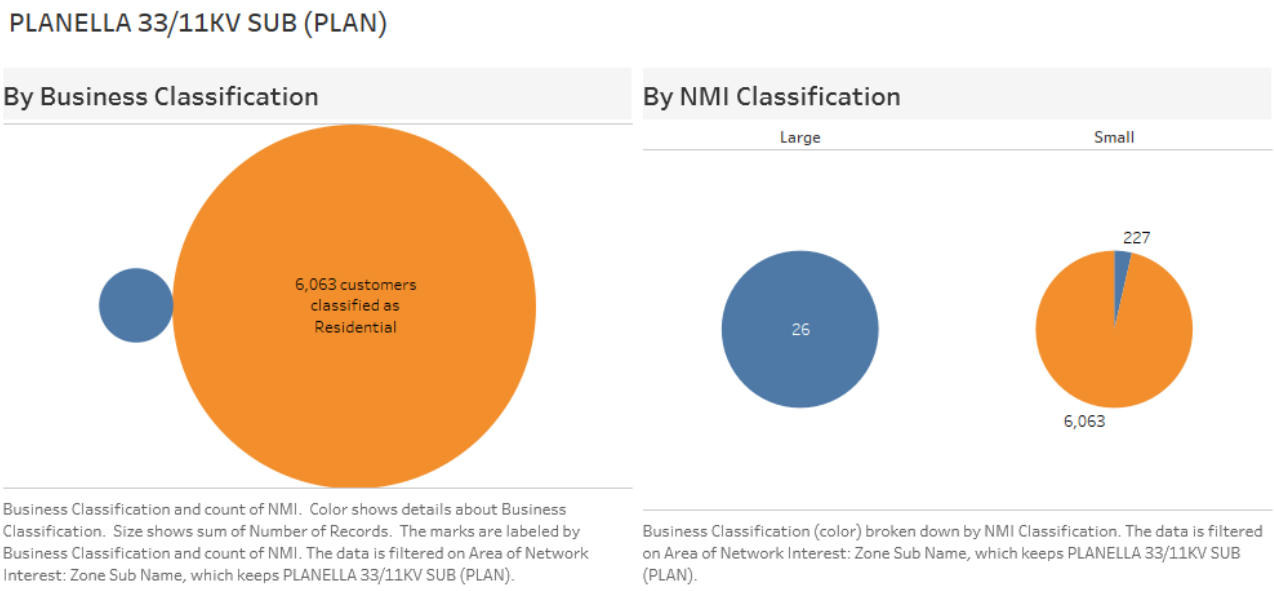

Figure 13: PLAN Customer Classification

Residential

The residential customers appear to drive the daily peak demand which occurs generally between 5:00 – 9:00 pm.

PLAN has 3395 customers on tariff T31 and T33 hot water load control (LC). An estimated demand reduction value is available of 2037kVA[1]. Planella Substation LC signals are controlled from Pioneer Valley 132/66kV Bulk Supply Substation. The Tariff 33 and 31 hot water LC channels are dynamic (that is, it responds to exceedance settings not on a timetable) and the current control strategy only calls LC when the load at Pioneer Valley exceeds 59.1MVA. This strategy does not directly address peaks experienced at Planella. Tariff 33 air-conditioning channels are under manual control of the operational control centre and are used as required.

Business

Annual consumption of customers classified as Business (seen in Figure 14) is typically less than 200,000kWh's p.a. with many having consumption and demand similar to residential customers.

[1] Hot water diversified demand saving estimated at 0.6kVA per system

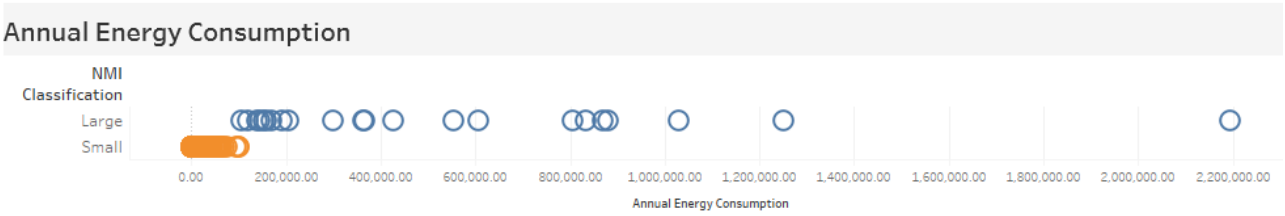

Figure 14: PLAN Annual Energy Consumption

Solar

A total of 1371 customers have solar PV systems for a connected inverter capacity of 6170kVA. Blacks Beach, Rural View, Eimeo and Bucasia feeders are registered as at risk of experiencing reverse power flows[2].

Summary

A total of 6170kVA of customer PV on the Planella Network is reducing the summer and winter daytime peaks, and four 11kV feeders are registered as at risk of experiencing reverse power flow.

2037kVA of potential hot water load control is available but currently not utilised. This could be used as an option to de-load the zone substation (ZS) with a change to the LC protocol for the T31 and T33 hot water load. The current shedding hierarchy is set at Pioneer Valley BSP when 59.1MVA is exceeded.

If the reverse power flows caused by PV was part of the problem we could investigate strategic use of the HW LC to “soak up” some of this flow.

7.1.1. Demand Management (Demand Reduction)

Planella (PLAN)

The customer base is largely residential and small business. Demand savings in these customer market segments are characterised by very small demand saving increments with a slow rate of uptake. The most cost effective demand reduction measure for this market in a short timeframe could be increased utilisation of the existing LC by Ergon Energy.

7.1.2. Demand Response

Demand response through customer embedded generation, call off load and load curtailment contracts have been assessed as technically not viable as:

- it will not address reliability and Safety Net compliance issues (the need) at Planella Substation; and
- customer types supplied from Planella Substation are predominantly residential and small business. The demand reduction potential of these customers is not of sufficient value to be attractive enough to contract to “call off” or curtail.

[2] Using the total installed capacity of Micro EG Units (with 20% diversity) and Estimated Light Load (20% of Daily Maximum Demand) a rough estimate can be made as to whether generation will exceed the consumption on a feeder.

7.1.3. Large Scale Customer Generation (LSG)

LSG sites such as renewable energy generation, solar or wind farms of multiple MW's capacity constitute an opportunity to support ZS investment by reducing demand on, and potentially providing reactive power support for substation assets.

This option could potentially reduce future demand, but has been assessed as technically not viable as there is no known existing or proposed LSG demand response available.

8. Credible Options Included in this RIT-D

Ergon Energy investigated a number of network options to address the identified need at Planella Substation. Details of the three credible options are presented in the following sections.

8.1. Option A: Rebuild 1.5km Section of Existing 33kV Feeder in Flood Zone with Concrete Poles

Option A involves rebuilding the 1.5km section of the existing 33kV feeder in the flood zone using concrete pole construction, obtaining easements and developing additional 11kV ties between PLAN, NOMA and GLEL to cater for network contingencies.

According to Ergon Energy's Safety Net Application, Evaluation and Economic Investment Manual, the failure of a concrete sub-transmission pole not in proximity to a roadway is considered to be a non-credible contingency in the assessment of Safety Net compliance.

The full scope of works to be covered by Option A is as followed:

Sub-transmission Line Works

- Construct 1.5km of new SCCT 33kV concrete pole line in the existing 33kV NOMA-PLAN line easement (adjacent to the line from pole 4023960 to pole 4023968)
- Cut across the existing conductor from pole 4023960 and pole 4023968 to the new concrete pole line
- Decommission and recover existing wood poles and conductor between pole 4023960 and pole 4023968

Distribution Network Works

- Construction of addition 11kV feeder ties between PLAN, NOMA and GLEL.
    - Establish feeder tie (approximately 450 m) between spare switch 596537S at Richmond Hills RMU 4 (GLEL – Richmond feeder) and spare switch 608501F at SS608503 Dawson Bvd (NOMA – Beaconsfield Rd feeder) using 400mm^2 Al Triplex TR-XLPE UG cable. Following construction of this tie, the transfer capacity from PLAN to NOMA and GLEL is expected to be increased from approximately 2.3MVA to 4MVA.

The estimated capital cost of this option excluding overheads is $3.56m, and inclusive of interest, risk, contingencies and overheads is $5.036m. Annual operating and maintenance costs are anticipated to be 0.5 percent of the capital cost. The estimated project delivery timeframe has design commencing in late 2021 and construction completed by mid 2023.

8.2. Option B: Construct New 33kV Mixed OH & UG Feeder from GLEL to PLAN

Option B involves maintaining 33kV supply to Planella Substation. This option involves the establishment of a new 33kV feeder out of Glenella Substation, constructed as a mixed overhead and underground feeder, to Planella Substation.

Sections of the feeder using the existing 66kV easement and road easements are to be constructed as 66kV DCCT but energised at 33kV until the Planella 66kV conversion goes ahead.

Ostensibly it would seem that this approach should have a lower capital cost than converting Planella to 66kV; however to reduce costs when Glenella Substation was established, no 33kV switchyard or switchboard was installed at Glenella Substation. Instead two 33kV circuit breakers (CBs) act as both transformer CBs and feeder CBs for the 33kV underground feeders to North Mackay Substation. Consequently, Option B requires the installation of a 33kV switchboard complete with one transformer bay and two feeder bays.

The full scope of works to be covered by Option B is as followed:

Sub-transmission Line Works

- Convert 3.35km of existing 11kV overhead line to SCCT 33kV overhead with 11kV underslung, utilising the existing 11kV line easements.
- Construct 1.6km of new DCCT 66kV concrete pole line in the previously acquired 66kV GLEL-PLAN line easements – to be energised at 33kV and 11kV initially.
- Install 3km of 66kV 630mm^2 Cu 1 core XLPE underground cable (energised at 33kV) from the end of the DCCT concrete pole line to Planella Substation
- Terminate the new cable on the new 33kV incoming feeder bay at Planella Substation.

Substation Works

- Install a new 33kV switchboard in a demountable control building at Glenella Substation.
- Recover the existing outdoor 33kV switchgear from the North Mackay No.2 feeder bay at Glenella Substation.
- Construct a new 33kV feeder exit from the new 33kV switchboard for the Planella feeder at Glenella Substation
- Construct a new 33kV feeder bay at Planella Substation
- Install a 33kV bus isolator (to be operated normally open) at Planella Substation

Protection / Communications Works

- Implement appropriate protection schemes for the new Planella 33kV feeder at GLEL
- Implement 33kV bus protection scheme at GLEL
- Review existing 66/33kV transformer 6 protection schemes at GLEL
- Review existing protection schemes on the North Mackay No.2 33kV feeder at GLEL

The estimated capital cost of Option B is $11.8m. Annual operating and maintenance costs are anticipated to be 0.5 percent of the capital cost. The estimated project delivery timeframe has design commencing in late 2021 and construction completed by mid 2023.

8.3. Option C: Construct New DCCT 66kV Mixed OH & UG Feeder from GLEL to PLAN and Convert PLAN to 66/11kV

Option C involves the establishment of two new 66kV feeders out of Glenella Substation, constructed as a mixed overhead and underground DCCT feeder, to Planella Substation; and the conversion of Planella Substation from 33/11kV to 66/11kV.

The Glenella 66/33/11kV Substation is planned to eventually be converted into a 132/66/11kV BSP to supply all north Mackay zone substations via a 66kV network. To achieve this, each of the zone substations in the area will be converted to 66/11kV when justified, and the 33kV feeders rebuilt as 66kV in a future staged programme of projects.

Glenella 66/33/11kV Substation has provision for additional feeder bays to be installed in the existing 66kV switchyard. The switchyard has two 66kV bus sections with a connecting bus tie. A new 66kV feeder bay should be constructed on each bus section to connect to the proposed 66kV Glenella-Planella circuits.

A redevelopment of Planella Substation in 2004 delivered a new control building and 11kV switchboard, and also redeveloped the 33kV switchyard to prepare it for conversion to 66kV. It is understood all insulation and clearances have been designed for 66kV, and all CBs, CTs and other plant (excluding VTs and surge diverters) are rated for 66kV operation.

The full scope of works to be covered by Option C is as followed:

Sub-transmission Line Works

- Construct 5km of new DCCT 66kV concrete pole line from Glenella Substation to the end of the line easement adjacent to the water reservoir.
- Install 3km of dual circuit 66kV 630mm^2 Cu 1 core XLPE underground cable from the end of the DCCT concrete pole line to Planella Substation
- Terminate the new cables on the new 66kV incoming feeder bays at Planella Substation.
- Recover (or redeploy at 11kV) the 33kV line from Farleigh Tee to Planella Substation.

Substation Works

- Construct two new 66kV feeder bays at Glenella Substation
- Redevelop the sub-transmission switchyard at Planella Substation to provide two 66kV feeder bays, two 66kV transformer bays and one 66kV bus tie bay.
- Replace the existing 33/11kV transformers with two new 32MVA 66/11kV transformers

Protection / Communications Works

- Implement appropriate protection schemes for the new Glenella-Planella 66kV feeders
- Review and upgrade protection and communication schemes at PLAN to suit the new 66/11kV substation
- Review existing protection schemes on the North Mackay No.1 33kV feeder at GLEL

The estimated capital cost of Option C is $24.4m. Annual operating and maintenance costs are anticipated to be 0.5 percent of the capital cost. The estimated project delivery timeframe has design commencing in late 2021 and construction completed by mid 2023.

9. Market Benefits

The purpose of the RIT-D is to identify the option that maximises the present value of net market benefits to all those who produce, consume and transport electricity in the National Electricity Market (NEM).

In order to measure the increase in net market benefit, Ergon Energy has analysed the classes of market benefits required to be considered by the RIT-D.

9.1. Classes of Market Benefits Considered & Quantified

The following classes of market benefits are considered material, and have been included in this RIT-D assessment:

- Changes in involuntary load shedding
- Changes in load transfer capability
- Changes in network losses

9.1.1. Changes in Involuntary Load Shedding

Involuntary load shedding is where a customer's load is interrupted from the network without their agreement or prior warning. Ergon Energy has forecast load over the assessment period and has quantified the expected unserved energy by comparing forecast load to network capabilities under system normal and network outage conditions. A reduction in involuntary load shedding expected from an option, relative to the base case, results in a positive contribution to the market benefits of the credible option being assessed.

Involuntary load shedding of a credible option is derived by the quantity in MWh of involuntary load shedding required assuming the credible option is completed multiplied by the Value of Customer Reliability (VCR). The VCR is measured in dollars per MWh and is used as a proxy to evaluate the economic impact of unserved energy on customers under the RIT-D.

Ergon Energy has applied a VCR estimate of $26/kWh, which has been derived from the AEMO 2014 Value of Customer Reliability (VCR) values. In particular, Ergon Energy has weighted the AEMO estimates according to the make-up of the specific load considered.

In addition, Ergon Energy has investigated how assuming different load forecasts going forward changes the expected net market benefits under the options. In particular, we have investigated two future load forecasts for the area in question; namely a central forecast using our 50 percent probability of exceedance (POE50) data and a high forecast using the 10 percent probability of exceedance (POE10) data. This is important as the Ergon Energy Safety Net criteria looks at the magnitude of unserved energy and the duration of the supply interruption.

The figure below shows the assumed levels of unserved energy under each of the two underlying demand forecasts investigated over the next ten years. For clarity, this figure illustrates the MWh of unserved energy assumed under each load forecast if no credible option is commissioned.

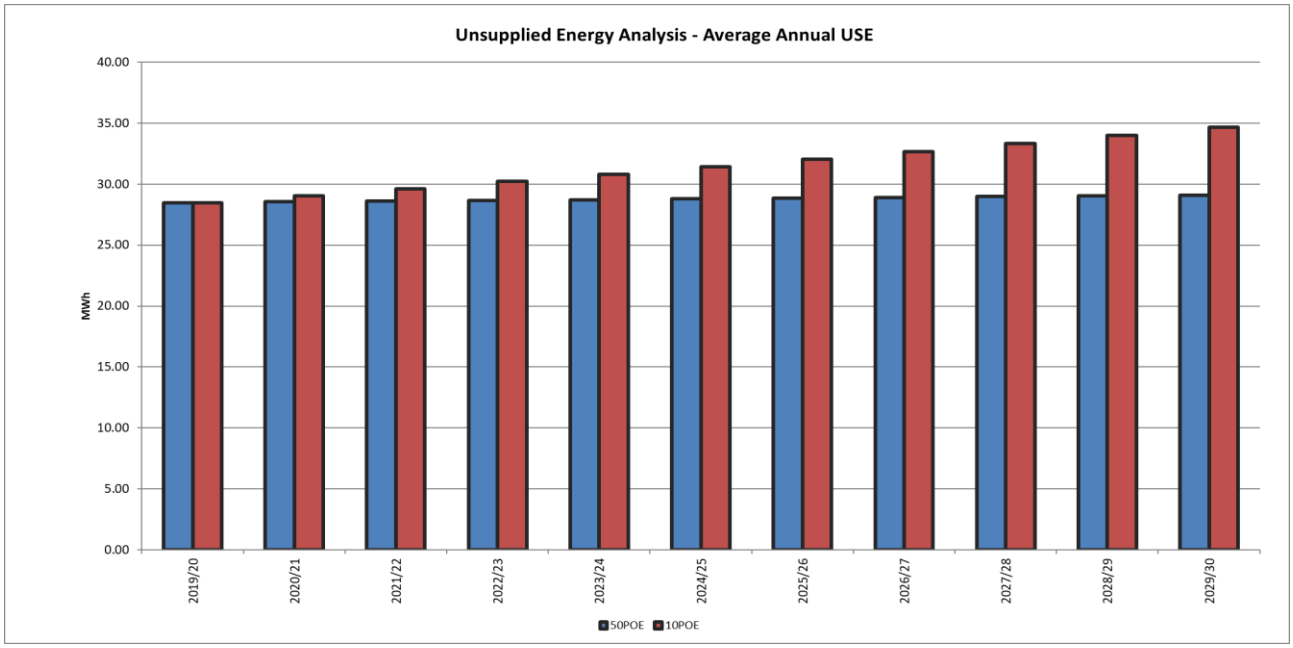

Figure 15: PLAN Unsupplied Energy Analysis

9.1.2. Changes in Load Transfer Capability

Option A will increase the load transfer capability between Planella Substation and adjacent zone substations by 2MVA through the development of an additional 11kV feeder tie. This is a market benefit as backed-up power supplies can service end-users in the event of an applicable network contingency.

9.2. Classes of Market Benefits not Expected to be Material

The following classes of market benefits are not considered to be material for this RIT-D, and have not been included in this RIT-D assessment:

- Changes in voluntary load curtailment
- Changes in costs to other parties
- Changes in timing of expenditure
- Changes in network losses
- Option value

9.2.1. Changes in Voluntary Load Curtailment

Because none of the credible options include any voluntary load curtailment, and because there are no customers on voluntary load curtailment agreements in the Planella area at present, any market benefits associated with changes in voluntary load curtailment have not been considered.

9.2.2. Changes in Costs to Other Parties

Ergon Energy does not anticipate that any of the credible options included in this RIT-D assessment will affect costs incurred by other parties.

9.2.3. Changes in Timing of Expenditure

None of the credible options included in this RIT-D assessment is expected to affect the timing of other distribution investments for unrelated identified needs.

9.2.4. Changes in Network Losses

Ergon Energy does not anticipate that any of the credible options included in the RIT-D assessment will lead to any significant change in network losses.

9.2.5. Option Value

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[3].

Ergon Energy does not consider that the identified need for the options included in this RIT-D would be affected by uncertain factors about which there may be more clarity in future.

10. Economic Analysis

10.1. Net Present Value (NPV)

Net Present Values of the three credible options are presented in Table 5 below. The NPV analysis demonstrates that Option A has the lowest Net Present Cost.

Note that the figures in the table below are the discounted present values evaluated over a 20 year period. These direct costs are preliminary estimates which are subject to change as costs are refined, and do not include any interest, risk, contingencies or overheads, but does include residual life values at the end of the 20 year period. Operating and maintenance costs and market benefits are assumed to be similar for the three options.

Table 2: Net Present Value Analysis

$ Millions	Option A	Option B	Option C
Capex	(5.50)	(10.76)	(17.10)
Opex	(0.07)	0.00	0.00
Direct Benefits	0.00	0.00	0.00
Commercial NPV	**(5.57)**	**(10.76)**	**(17.10)**
Ranking	*1*	*2*	*3*
Indirect/Risk	0.68	4.09	3.78
Commercial + Risk	**(4.89)**	**(6.67)**	**(13.32)**
Ranking	*1*	*2*	*3*

[3] AER "Regulatory Investment Test for Distribution Application Guidelines", Section A6. Available at: http://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/regulatory-investment-test-for-distribution-rit-d-and-application-guidelines

11. Proposed Preferred Option

The previous section has presented the results of the NPV analysis conducted for this RIT-D assessment.

The NER requires the Draft Project Assessment Report to include the preferred option under the RIT-D. This should be the option with the greatest net market benefit and which is therefore expected to maximise the present value of the net market benefits to all those who produce, consume and transport electricity in the market.

This RIT-D assessment has clearly demonstrated that Option A maximises the present value of net market benefits under all reasonable scenarios considered. The preferred option is therefore Option A: Rebuild a 1.5km section of the existing 33kV feeder in the storm tide inundation flood zone using concrete pole construction, obtain easements & develop additional 11kV feeder ties.

This option satisfies the RIT-D.

12. Submissions & Next Steps

12.1. Request for Submissions

Ergon Energy invites written submissions on this report from registered participants and interested parties.

Ergon Energy will not be legally bound in any way or otherwise obligated to any person who may receive this RIT-D report or to any person who may submit a proposal. At no time will Ergon Energy be liable for any costs incurred by a proponent in the assessment of this RIT-D report, any site visits, obtainment of further information from Ergon Energy or the preparation by a proponent of a proposal to address the identified need specified in this RIT-D report.

All submissions and queries should be lodged to Ergon Energy's "Regulatory Investment Test for Distribution (RIT-D) Partner Portal". Submissions in writing are due by **27 December 2019**. Ergon Energy is not obliged to consider submissions after this date without prior agreement. The portal is available at:

https://www.ergon.com.au/network/network-management/network-infrastructure/regulatory-test-consultations

Inquiries about this RIT-D may be sent to:

E: demandmanagement@ergon.com.au
P: 13 74 66

12.2. Next Steps

Following Ergon Energy's consideration of submissions received in response to this report, the preferred option, and a summary of and commentary on any submissions received will be included as part of the Final Project Assessment Report (FPAR). The FPAR represents the final stage of the consultation process in relation to the application of the RIT-D.

Ergon Energy intends to publish the FPAR no later than **17th January 2020**. Ergon Energy will use its reasonable endeavours to publish the FPAR by the above date. This may however not be achievable due to changing power system conditions or other circumstances beyond the control of Ergon Energy.

At the conclusion of the consultation process, Ergon Energy intends to take steps to progress the recommended solution(s) to ensure any statutory non-compliance is addressed and undertake appropriately justified network reliability improvement(s), as necessary.

Appendix A: Ergon Energy's Minimum Service Standards and Safety Net Targets

The legislated System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) limits from Ergon Energy's Distribution Authority are detailed in Table 3.

Table 3: SAIDI (minutes per customer) and SAIFI (interruptions per customer) limits

Feeder Category	SAIDI MSS Limits	SAIFI MSS Limits
Urban	149	1.98
Short Rural	424	3.95
Long Rural	964	7.40

The legislated Safety Net Targets from Ergon Energy's Distribution Authority are provided in Table 4. Planella is considered a 'Regional Centre'.

Table 4: Ergon Energy Safety Net Targets

Area	Targets (for restoration of supply following an N-1 Event)
Regional Centre	Following an N-1 event, load not supplied must be: ○ Less than 20MVA (8000 customers) after 1 hour; ○ Less than 15MVA (6000 customers) after 6 hours; ○ Less than 5MVA (2000 customers) after 12 hours; and ○ Fully restored within 24 hours.
Rural Areas	Following an N-1 event, load not supplied must be: ○ Less than 20MVA (8000 customers) after 1 hour; ○ Less than 15MVA (6000 customers) after 8 hours; ○ Less than 5MVA (2000 customers) after 18 hours; and ○ Fully restored within 48 hours.
Note: All modelling and analysis will be benchmarked against 50 POE loads and based on credible contingencies. 'Regional Centre' relates to larger centres with predominantly urban feeders. 'Rural Areas' relates to areas that are not Regional Centres.	