



# Kingston South Planning area strategy

**Area Strategies for Tasmania's Electricity Network**

**Version Number 2.0**

**October 2017**

## Authorisations

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Review cycle	2 Years		

## Document control

Date	Version	Description	Author	Approved by
February 2016	1.0	Approved	Network Planning	Network Planning Team Leader
Oct 2017	2.0	Update and structure modification for R19 submission	Network Planning	Network Planning Team Leader

## Responsibilities

This document is the responsibility of the Network Planning Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299.

Please contact Network Planning with any queries or suggestions.

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The end user is expected to implement any practices which may not be stated but which can be reasonably regarded as good practices relevant to the objective of this document.

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# Record of revisions

Section number	Details
Version 2.0	
Whole document	Update and structure modification for R19 submission

## Executive summary

The Kingston South planning area covers the most southern part of Tasmania, from the Kingston to Southport, including Bruny Island and the Huon Valley. The area is supplied through the peripheral 110 kV network, supplied from Chapel Street substation via a 110 kV double circuit single tower line.

The area contains the mix of coastal, rural and urban townships as well as moderate agriculture and aquaculture commercial developments. Issues presented are predominately those where it is difficult to maintain adequate supply and reliability to townships and the end of long distribution feeders.

The long term network development plan for the Kingston South planning area is small in terms of network augmentation requirements to 2050. A possible project identified is the upgrade of Knights Road supply transformers, which may be required to meet forecast demand growth in the Huon Valley area. Additionally, the establishment of a third 110 kV circuit to the Kingston South area from Creek Rd is considered.

Within the 15-year planning period, the network development plan for the transmission and distribution networks are minimal. The proposed development plan for the planning period is listed in Table 1 and detailed within this strategy.

**Table 1: Network development plan for the Kingston South planning area**

Location	Proposed development	Investment need	Estimated cost (\$m)	Forecast completion
Knights Road Substation	Construct new feeder from Knights Road to relief loading on 30603 and 30608	Capacity	0.9	June 2019
Kermandie Substation	Replace supply transformers	Asset condition	3.1	June 2024

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# 1 General

## 1.1 Introduction

TasNetworks prepares a suite of eight area strategies for Tasmania. These area strategies drive the development strategies for each of the seven planning areas, based on a geographic breakup of the network. The development strategies ensure that the network remains adequate under forecast demand, generation and performance scenarios.

## 1.2 Purpose

The purpose of this document is to identify the development strategy to establish and maintain a safe and efficient electricity network in the Kingston South planning area.

## 1.3 Scope

The area strategy addresses the transmission and distribution electricity networks within the Kingston South planning area.

## 1.4 Objectives

The objectives of this area strategy are to:

- provide an overview of the Kingston South planning area, and the electricity network within it
- present the long term transmission and sub-transmission network vision based on generation and maximum demand forecast to 2050
- present the long term distribution network vision based on improved operability and development opportunities
- identify existing and forecast limitations based on the maximum demand forecast, security and reliability requirements and other factors
- present proposed developments to address the forecast limitations and other planning considerations such as asset retirements, operational constraints, and other factors
- identify opportunities for new network load connections at a transmission-distribution connection point level

## 1.5 Strategic context

The TasNetworks vision is to be trusted by our customers to deliver today and create a better tomorrow. The area strategies support this vision by ensuring the network continues to be adequate to cater for the demands on it (generation, load, reliability, performance and so on). The strategies also support the changing operation of the network to integrate more distributed energy resources and identifying opportunities to increase utilisation of the network, ensuring the lowest sustainable prices.

Strategic documents which the area strategies support include:

- TasNetworks Corporate Plan
- TasNetworks Business Plan
- TasNetworks Transformation Roadmap 2025
- Strategic Asset Management Plan
- Network Development Management Plan

## 2 Area overview

The Kingston South planning area covers the most southern part of Tasmania, from Kingston to Lune River and extending inland to Mountain River, Lonnavele and Huon River. The area also includes Bruny Island. The area is reticulated through an isolated 110 kV network, supplied via a 110 kV double circuit single tower line from Chapel Street substation in Glenorchy (Hobart). The Kingston South planning area is shown in Figure 1.

**Figure 1: Geographic diagram of the Kingston South Planning area**

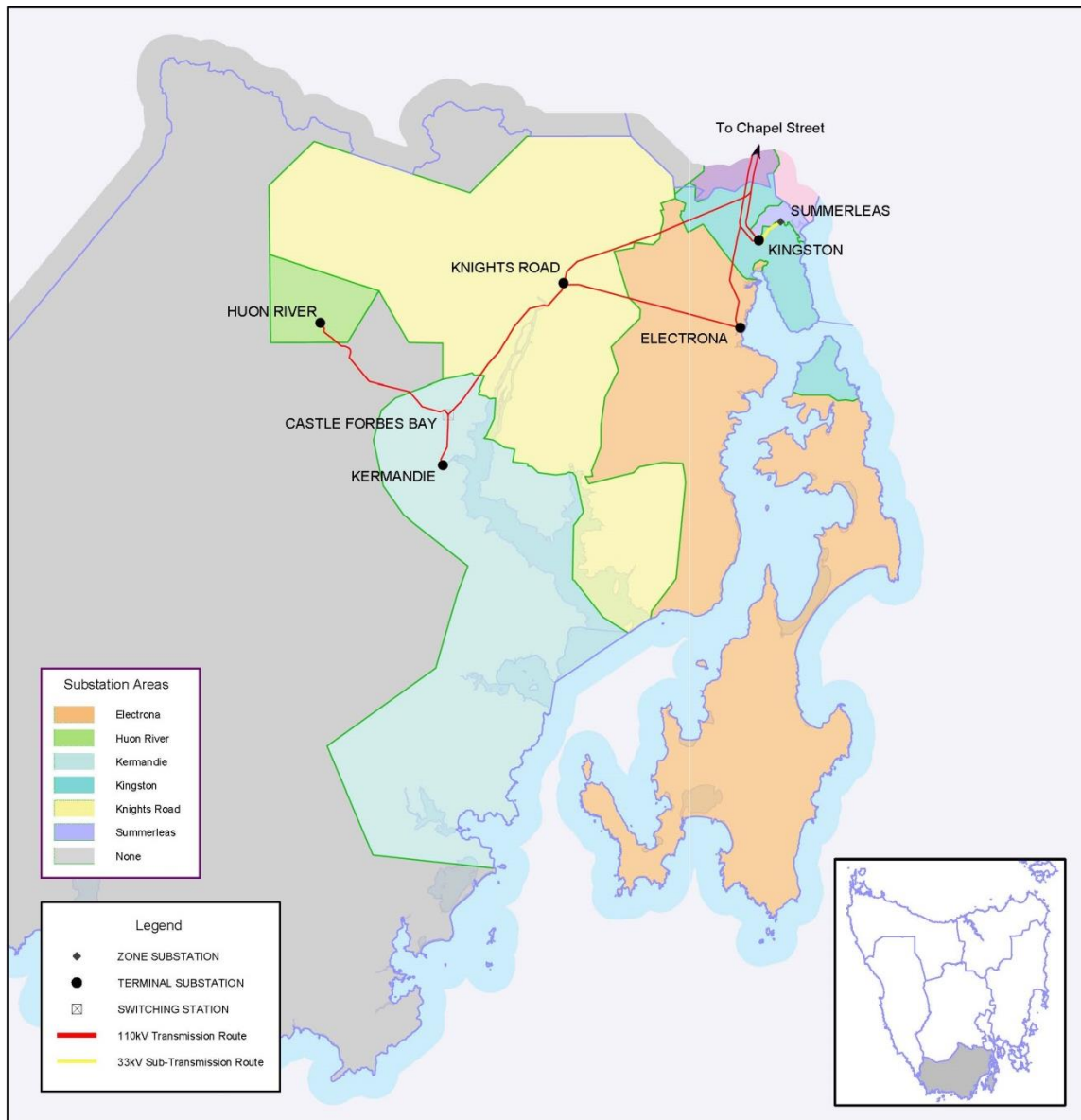


### 2.1 The network

The Kingston South planning area encompasses transmission and distribution networks south of Kingston, supplied via the Chapel Street – Kingston 110 kV transmission line. The area includes five 110/11 kV substations (Kingston, Electrona, Knights Road, Kermandie and Huon River), one 110/33 kV terminal substation (Kingston) and one 33/11 kV zone substation at Summerleas Road. These substations supply 35 primary 11 kV distribution feeders. There is no major generation in the area. The area is supplied via the Chapel Street – Kingston double circuit 110 kV transmission line.

The transmission network and substation supply area is shown in Figure 2. Detail on the existing assets and transfer capability at the substations is presented in Appendix A.

**Figure 2: Kingston South distribution substation supply areas**



### 2.1.1 Transmission network

The Kingston South area transmission network includes four 110 kV transmission line circuits for the purpose of area planning. As presented in Figure 3.

- **Chapel Street – Kingston network:** supplied via the double circuit Chapel Street – Kingston, one circuit tee off as single circuit Knights Road Spur 110 kV transmission lines and another circuit tee off as single circuit Electrona spur 110 kV transmission lines.
- **Knights Road – Electrona network:** supplied via single circuit Knights Road – Electrona 110 kV transmission lines.
- **Knights Road – Kermandie network:** supplied via single circuit Knights Road – Kermandie and single circuit Huon River Spur 110 kV transmission lines.

There have been one significant development in the Kingston South planning area transmission network since publication of the previous Kingston South area strategy in October 2015, and there are none committed.

- Upgrade of Castle Forbes Bay switching station to remotely controlled operation to remove operational constraints and hence improving the reliability of the area

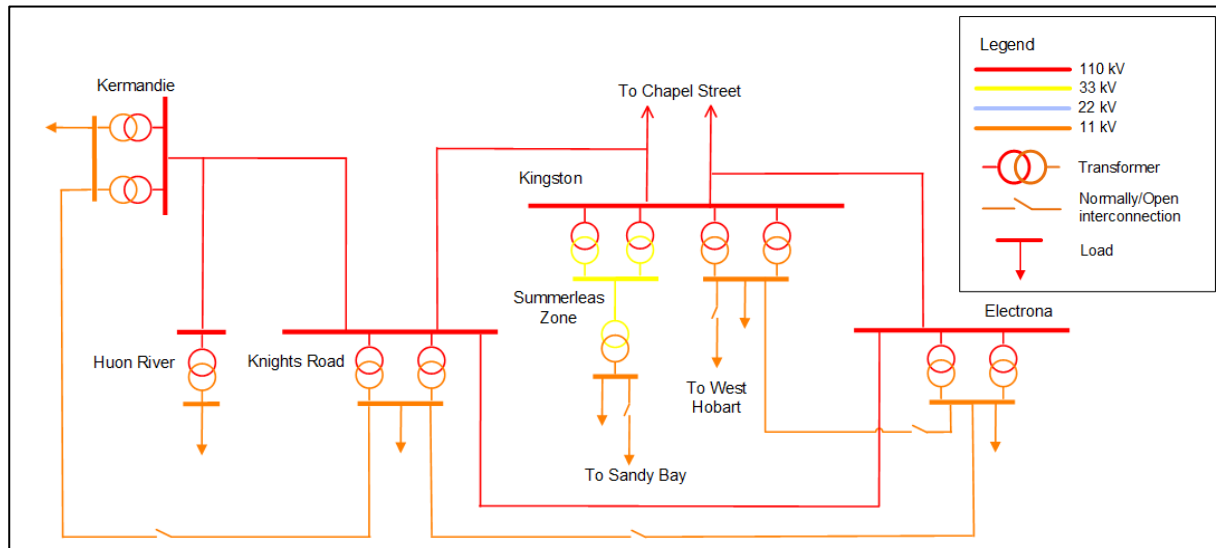


### 2.1.2 Sub-transmission network

The Kingston South area sub-transmission network includes one 33 kV sub-transmission circuit as presented in Figure 3.

- **Kingston – Summerleas network:** supplied via single circuit Kingston – Summerleas 33 kV underground cable.

**Figure 3: Kingston South planning area simplified one line diagram**



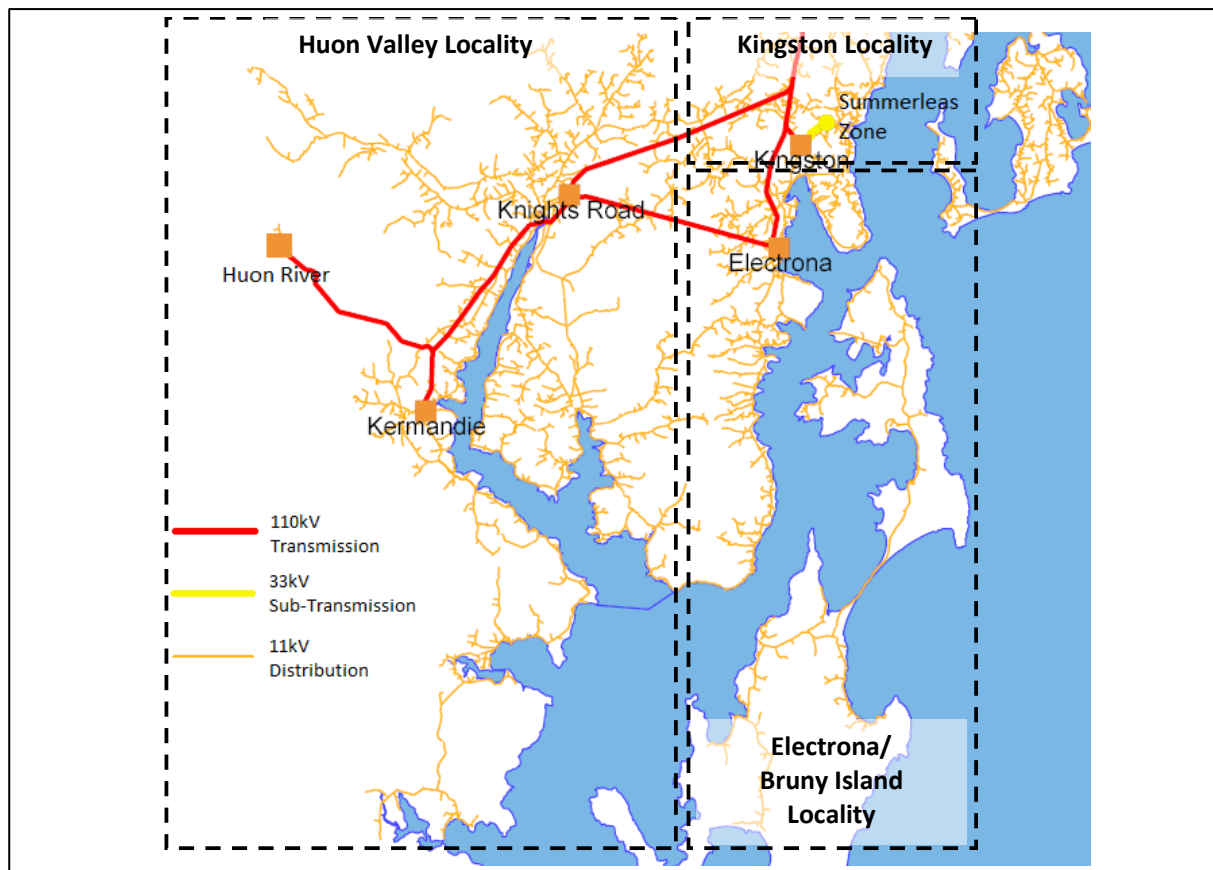
### 2.1.3 Distribution network

The distribution network is supplied from the five transmission – transmission connection points: Electrona, Huon River, Kermadie, Knights Road and Kingston substations, and one sub transmission connection point: Kingston 33 kV substation. The entire distribution network supplied from these substations operates at 11 kV. The substation supply areas are presented in Figure 2 above.

The distribution network supplies multiple urban areas via highly interconnected urban feeders as well as low and high density rural area via long distribution feeders. For the purposes of area planning the distribution network is considered as three separate localities, as shown in Figure 4, including:

- **Kingston Locality:** supplied via 14 feeders from Kingston substation (11 feeders) and Summerleas zone substations (3 feeders) most of which supplies Kingston Blackmans Bay Urban area with high interconnectivity between feeders. Partial Backup supply available from Electrona, Sandy Bay and West Hobart substations. Kingston Locality load is nearly half of the total Kingston South area supply.
- **Electrona Locality:** supplied via six feeders from Electrona substation, five of which are long feeders and one feeder from Kingston substation. This locality includes the Bruny Island supply via two 11 kV submarine cable. The bulk of the island network is supplied from Electrona Substation.
- **Huon Valley Locality:** supplied via eight long feeders, six from Knights Road substation and four from Kermadie Substation with limited backup capability. With the exception of the Hounville township, the majority of this locality is considered regional. This locality includes isolated 11 kV reticulation from the Houn River Substation. Prior to 1 July 2016, Huon River substation supplied a single transmission direct connect customer to the transmission network. The distribution network is now owned by TasNetworks, providing multiple Low Voltage distribution connections to the industrial customer.

**Figure 4: Distribution network and Localities within Kingston South planning area**



Significant developments within the Kingston South planning area distribution network since publication of the last Kingston South area strategy in October 2015 include:

- Ownership of Huon River distribution network from previously transmission connected customer. The customer has changed their connection point from one transmission connection point to multiple distribution connection points.
- Ongoing Consort Bruny Island battery trial<sup>1</sup> as part of 3 year research project partially funded by ARENA. This will help manage submarine cable load and reduce diesel generator use by purchasing energy from customer owned battery systems at times of peak load on the island.
- Distribution phase balancing on Bruny Island network has progressed, resulting in reduce unbalanced peak loading and hence reduce diesel fuels due to generator operation<sup>2</sup>.
- The 11 kV Reyrolle type LMT switchgear at Kingston Substation has recently been replaced with modern vacuum interrupters.

There is only one significant project committed or underway in the distribution network in the Kingston South planning area since publication of the last Kingston South area strategy in October 2015:

- Establishment of new feeder from Knights Road substation: supplying mainly Huonville and Ranelagh area so that relief thermal constraint on feeder 30603 (feeds towards Judbury) and improve operational flexibility of the area.

<sup>1</sup> <http://brunybatterytial.org/> - The Australian Government, through the Australian Renewable Energy Agency (ARENA), is providing \$2.9m towards the \$8m CONSORT project under its Research and Development Programme.

<sup>2</sup> Bruny Island Phase Imbalance Report 2017 – R0000715774 (<http://reclink/R0000715774>)

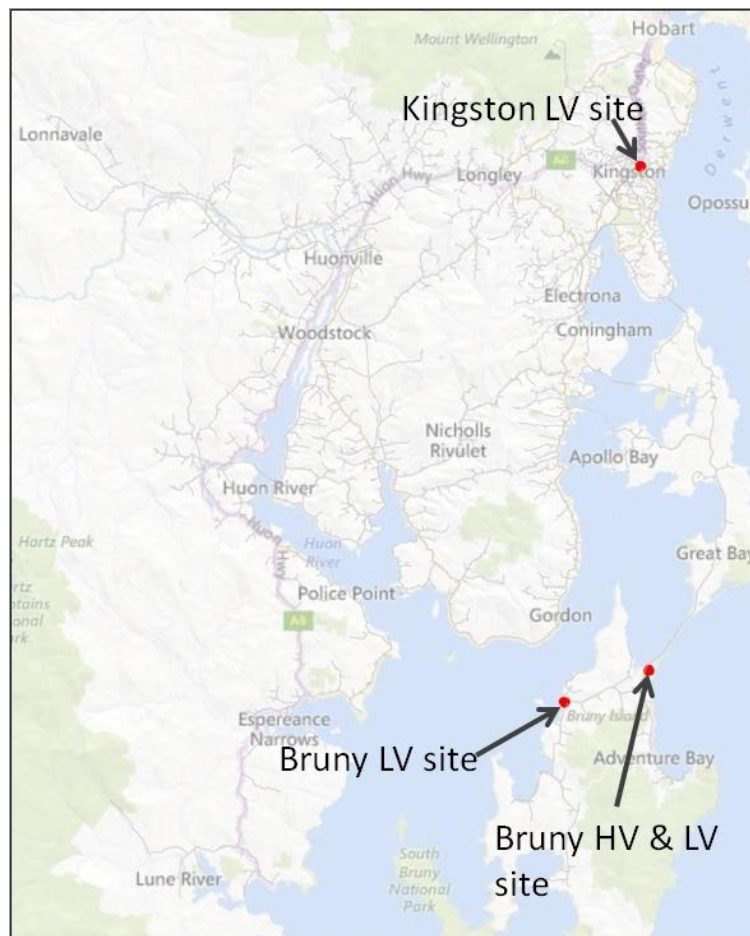
## 2.2 Customers

This section details the material existing and proposed generation and load customers in the Kingston South area.

### 2.2.1 Generation

With the exception of a 300 kW commercial roof top solar system at the Antarctic Division in Kingston, there is no material existing embedded generators connected in the Kingston South planning area networks. However, there are one TasNetworks' mobile generator connection point near Summerleas substation and two TasNetworks' mobile generation connection points on Bruny Island. A 550 kVA diesel generator is deployed on Bruny Island during Christmas and Easter Periods for peak shaving to lower demand on fixed assets.

**Figure 5: TasNetworks' mobile generator connection sites in Kingston South planning area**



### 2.2.2 Load

There are no transmission-connected customers nor material customers connected to the distribution network within the Kingston South planning area.

Recent change in the network is that private distribution network from Huon River Substation was transferred ownership to TasNetworks as of 1 July 2016. Previously transmission connected customer is now a distribution connected customer with multiple LV connections. The total maximum demand of the Huon River substation remains unchanged.

## 2.3 Reliability

Kingston South planning area consists of three Urban supply reliability communities at Kingston-Blackmans Bay, Margate-Snug and Huonville, one High Density Commercial reliability communities at Kingston commercial area and like most of Tasmania, Low Density Rural supply reliability communities, with pockets of High Density Rural supply reliability communities around local townships. There are 11 supply reliability communities in the area.

## 3 Long term network development

The long term network development presents the load and generation scenarios to 2050 and the likely state of the network required to support them. This long term network development has not been justified economically or deeply considered against alternative options, but provides a reasonable assessment of the solutions forecast in the long term if met by network development.

The long term network development plan informs the path that developments in the transmission and sub-transmission network 15-year planning horizon should follow to ensure that network development remains efficient in the long term.

A distribution network supply vision is also presented. This vision is largely driven by existing network and operational limitations and development opportunities. There are no specified triggers for this vision and it has not been justified.

### 3.1 Scenarios

We consider planning scenarios for load and generation as a basis for the long term network vision.

#### 3.1.1 Load

The scenario considered in the load change to 2050 is the extrapolated AEMO connection point forecast<sup>3</sup>. This connection point forecast is provided to 2026 and has been extrapolated to 2050.

The forecast for Huon River connection point was flat demand continue to 2050.

The forecast for Kingston 11 kV connections was declining rapidly to 2021 and continued to decline with slower rate to 2026<sup>4</sup>. The rapid decline could be the result of Summerleas Zone substation commissioned in 2014. In extrapolating the forecast, 2021 was used as the base year with decline factor between 2021 and 2026 used to extrapolate the forecast to 2050. The overall forecast for the Kingston locality however shows small growth over the period.

The forecast for the rest of connection points in general is flat or declining to 2021 before recovering. In extrapolating the forecast, 2021 was used as the base year with the growth factor between 2021 and 2026 used to extrapolate the forecast to 2050. The assumption being that this recovering demand growth will continue. This assumption aligns with AEMO's 2016 National Electricity Forecasting Report (NEFR), which provides a regional (state) forecast for Tasmania, which forecasts a decline in early 2020s before recovering and continuing to grow to 2037, the end of the forecast.

AEMO's 2016 National Electricity Forecasting Report, including a regional (state) forecast for Tasmania, contains Neutral, Strong, and Weak economic scenarios. The connection point forecast is only provided under the Neutral scenario. Hence, the load scenario presented here is only provided under this single Neutral scenario.

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<sup>3</sup> 2017 AEMO Transmission Connection Point Forecasts for Tasmania (connection point forecast)

<sup>4</sup> Early commercial and residential developments, including 470 lot subdivision at Whitewater Park and Spring Farm, Bunnings, and the relocated high school precinct are excluded from the forecast.

**Table 2: 2050 maximum demand forecast**

System	2016 maximum demand (MW)		Maximum demand forecast for 2050 (MW)
	Actual	Weather corrected	
Kingston 11 kV	24.7	26.0	19.1
Summerleas Zone Substation (Kingston 33 kV)	10.8	11.3	25.1
Knights Road	17.8	18.3	33.1
Kermandie	6.4	6.4	6.3
Electrona	13.8	13.8	12.9
Huon River	1.9	1.9	1.9

### 3.1.2 Generation

The long term network development plan is also driven by generation scenarios within the area. With available development proposals, there are no identified grid-scale potential generation development in the Kingston South planning area.

Continuation to a low emissions future in the NEM means future renewable energy development in Tasmania is highly likely. As there are currently no specific identified opportunities or any level of certainty, this scenario is not included in the long term network development plan identified here.

There will be a continued increase in embedded generation within the distribution network, including small-scale photovoltaic and batteries, with the effects of this reflected in the demand forecast. We expect that increasing photovoltaic and batteries will increase bi-directional power flows within the distribution network, but this will not be sufficient to material affect flows with the transmission and sub-transmission networks part of this long term network development plan.

## 3.2 Long term network development plan

A number of network augmentations are expected to be required to meet the load and generation scenario requirements to 2050, presented in Section 3.1. This section presents the long term network development plan forecast requirement under these scenarios.

As discussed the long term network development plan has not been justified economically or deeply considered against alternative options, but provides a reasonable assessment of the solutions forecast in the long term if met by network development.

The long term network development plan of the transmission and sub-transmission network is displayed in Figure 6 and summarised below.

### 3.2.1 Knights Road substation supply transformer

The demand on Knights Road substation is forecast to exceed the rating of the supply transformers firm capacity of 20 MVA by 2027 and 4 hour rating of 24 MVA by 2035. Dynamic Rating Monitoring Control Communication (DRMCC) units were installed on transformers to provide dynamic ratings. The dynamic rating of the transformers is scheduled to be commissioned in early 2018. With these, supply transformers upgrade will be deferred beyond 2032 planning period. If the forecast load growth eventuates, upgrading these transformers to higher rated standard 25 MVA (30 MVA for 4 hours) units will provide sufficient firm capacity to meet the expected demand to 2050.

### 3.2.2 Kingston and Electrona Area development

Summerleas Zone currently has a single supply transformer of 25 MVA. The maximum demand forecast for Kingston 11 kV and Summerleas Zone exceed 40 MVA in 2042. This may trigger the need to install a second 33 kV sub-transmission feeder and supply transformer at Summerleas Zone before 2050 that will provide adequate supply security<sup>5</sup> with the increase in demand.

If load growth eventuates in the Kingston locality and Electrona locality, a continuation of the southern 33 kV sub-transmission network is proposed including new zone substations at Blackmans Bay and Margate. These developments are not required to 2050 based on the connection point forecast.

A number of commercial and residential developments not included in the forecast have recently progressed, including:

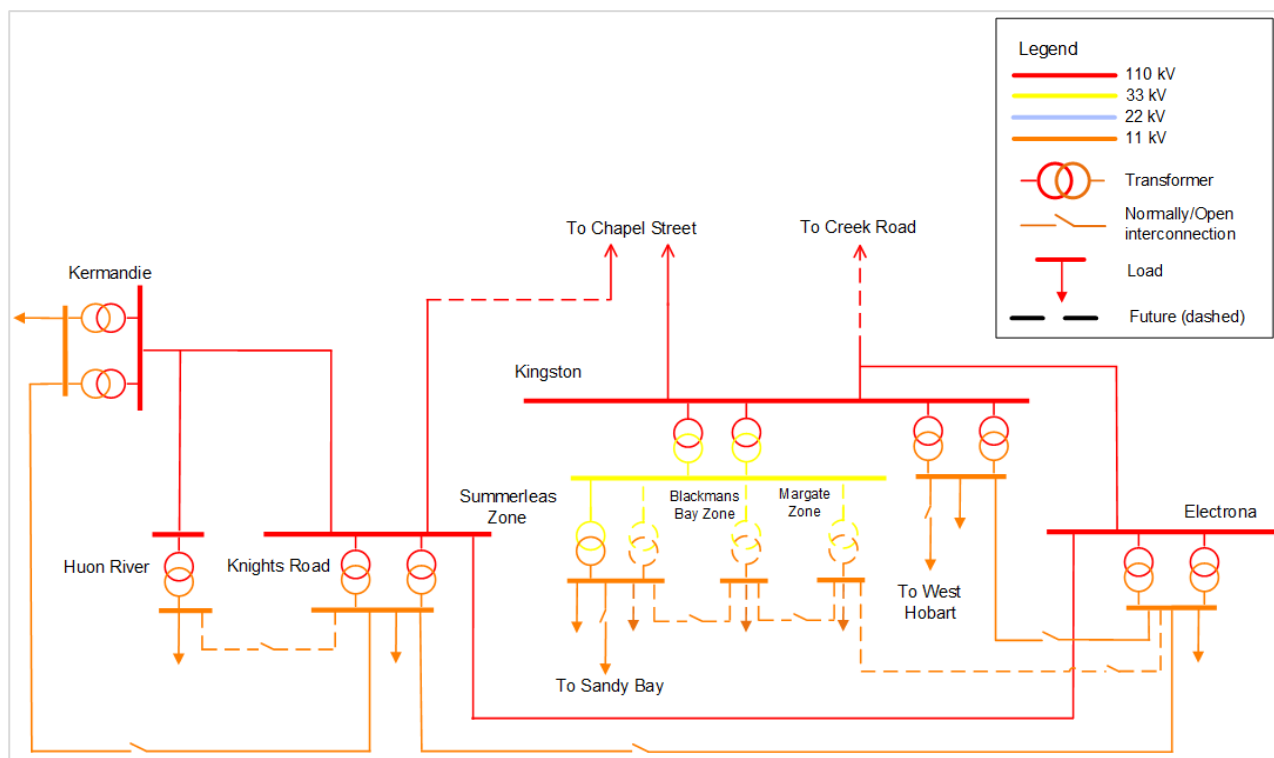
- the first stages of a 270 and 200 lot subdivision at Whitewater Park and Spring Farm respectively; and
- commercial warehouse development near Mertonvale circuit.

Additionally, the vacant Kingston high school precinct may see development within the next five years.

As such, TasNetworks anticipates a considered approach towards land acquisition for future 33 kV developments in the Kingston locality.

Figure 6 shows the long term vision of Kingston South network development.

**Figure 6: Long term network development plan**



<sup>5</sup> *Electricity Supply Industry (Network Planning Requirements) Regulations 2007*  
<https://www.legislation.tas.gov.au/view/whole/html/inforce/2013-11-13/sr-2007-114>

### 3.2.3 Kingston 110 kV circuit (Kingston Augmentation)

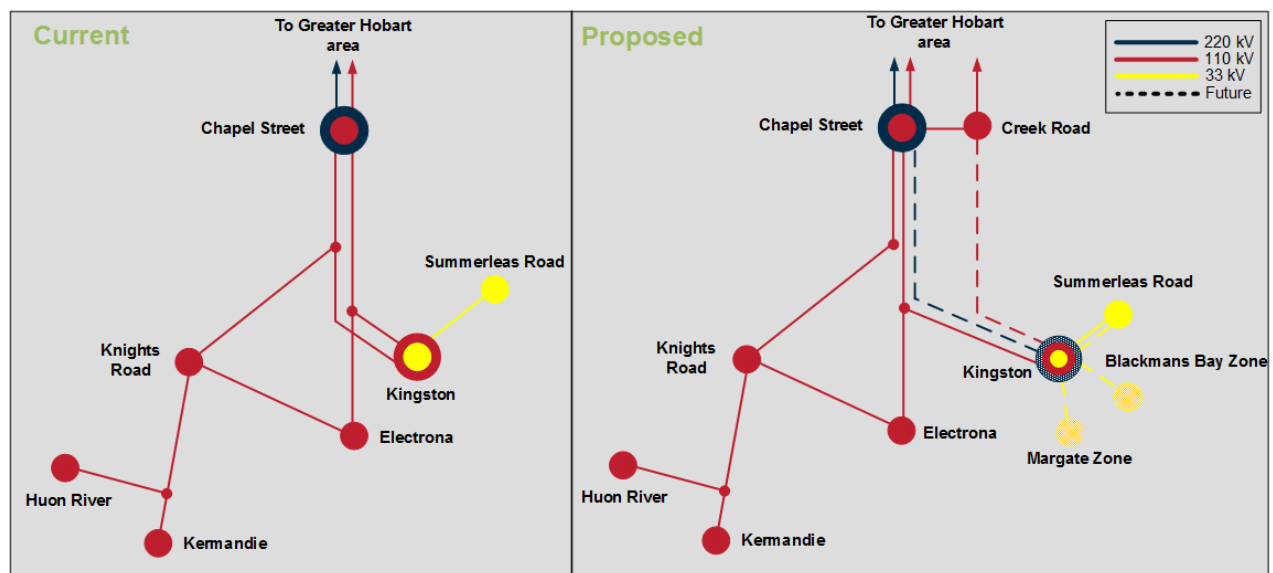
If the forecasted load growth for the Kingston South Area eventuates, a contingency on the double-circuit Chapel Street–Knights Road 110 kV transmission line will result in more than 3000MWh of unserved energy<sup>6</sup> in future beyond 2050 (based on AEMO load forecast and a 48-hour period to restore supply via at least one 110 kV circuit).

To manage this constraint it is proposed to construct a third 110 kV circuit to the Kingston South network between Creed Rd Substation and Kingston Substation. This will result in two 110 kV circuits from Chapel Street and one from Creek Road as shown in Figure 6. With the acquisition of some land and easements, it is proposed to utilise the existing corridor that contains the decommissioned Chapel St-Electrona 88 kV transmission line in aerial storage.

### 3.2.4 Transmission network vision for Kingston South Area

As part of strengthening the transmission network backbone, a new 220 kV circuit from Chapel Street substation to Kingston substation is proposed introducing 220 kV injection point in Kingston South area. This is a longer term vision if Kingston South area becomes significant and critical load centre and therefore no timeline has been established. The 220 kV network vision has not been justified economically or considered against alternative options.

**Figure 7: Transmission Network vision**



<sup>6</sup> *Electricity Supply Industry (Network Planning Requirements) Regulations 2007*, Section 5.1.a (iv) and (v).  
<https://www.legislation.tas.gov.au/view/whole/html/inforce/2013-11-13/sr-2007-114>



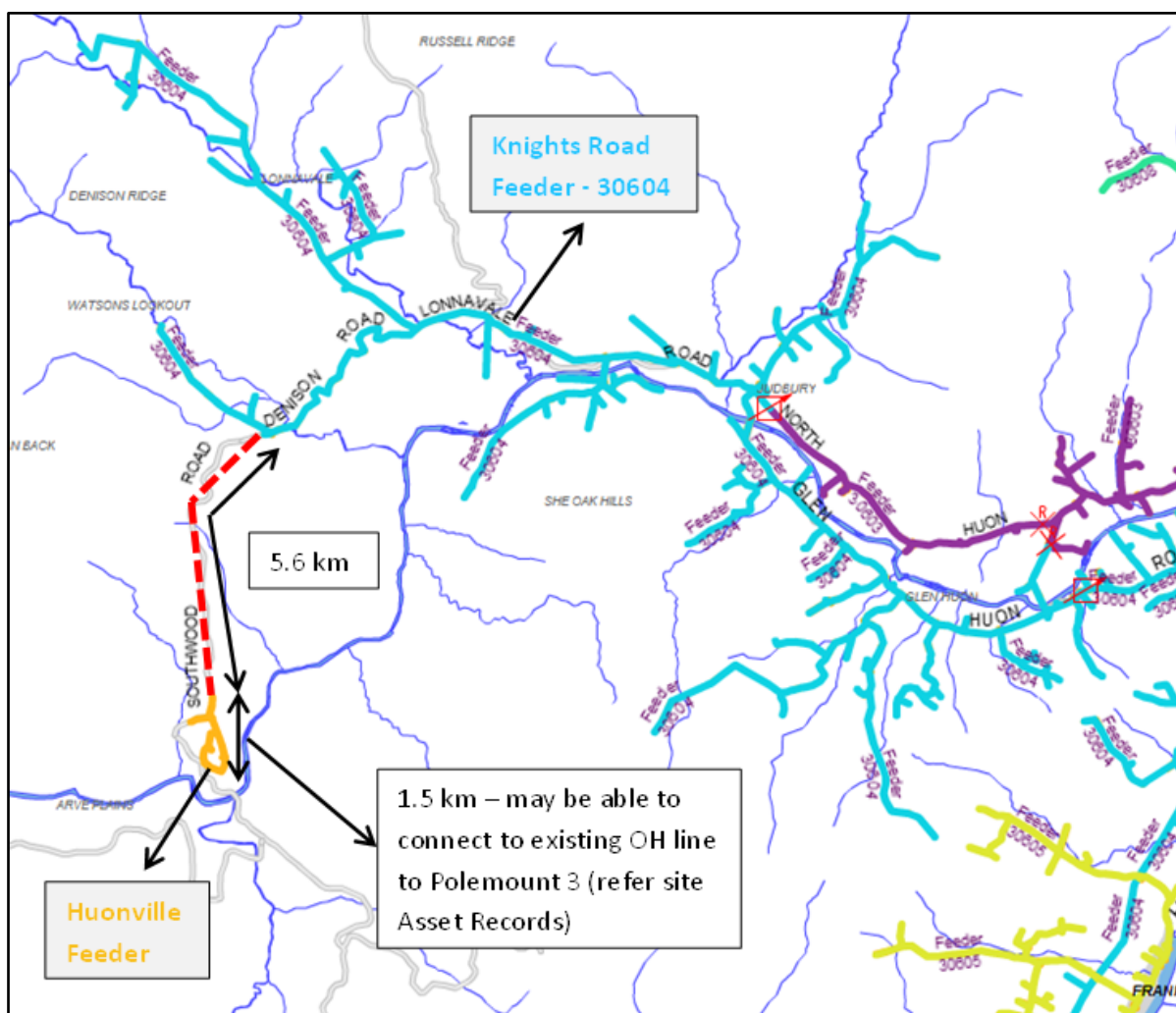
### 3.3 Distribution network supply vision

A distribution network supply vision is presented for those supply areas within the distribution network where relevant. The vision is largely driven by existing network and operational limitations and development opportunities, and provided where these will likely drive material changes to the distribution network. There are no specified triggers for the vision and the vision has not been justified. In the Kingston South planning area, the identified distribution network supply visions are as below.

#### 3.3.1.1 Huon River Substation

The vision for the Huon River substation is to form interconnection with Knights Road substation. This would support load on Knights Road substation, improve the reliability in the area, allow for load growth on feeder fed from Knights Road and reduce the cost of the Huon River substation for the industrial customer with minimal overall impact on the rest of the customer base.

**Figure 8: Huon River - Knights Road feeders interconnection conceptual plan**

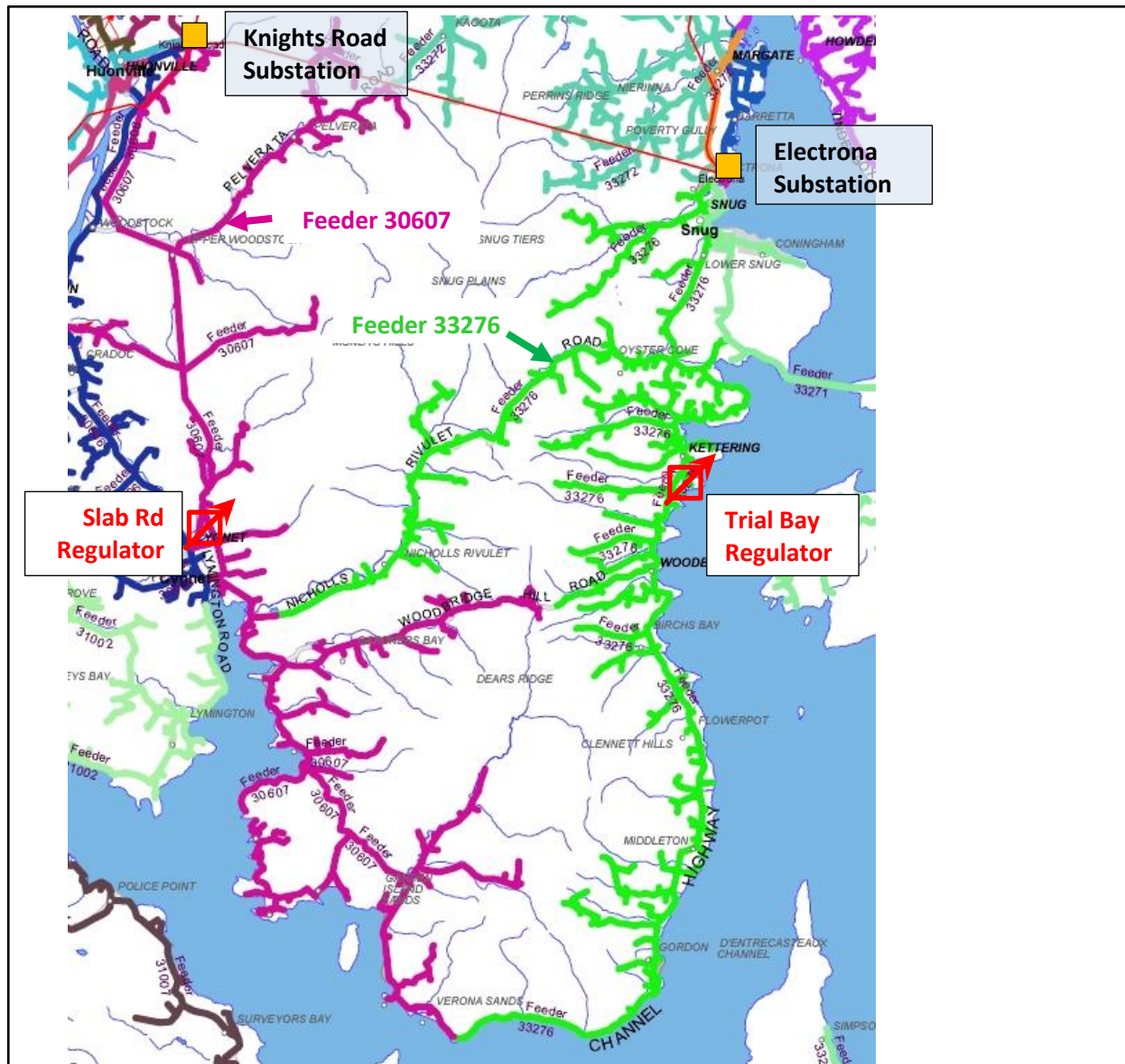




### 3.3.1.2 Knights Road feeder 30607

The coastal area along north of Snug to Woodbridge through to Verona Sands and Cygnet is supplied by two long distribution feeders from Electrona 33276 and Knights Road 30607. To manage the transfer limitations between these two feeders during contingency events, additional voltage regulation is proposed<sup>7</sup> on Knights Road feeder 30607. This will improve supply performance and operational flexibility to the area.

**Figure 9: Geographical view of supply to Woodbridge, Gordon and Cygnet along Channel Highway**



<sup>7</sup> Voltage Regulator Case Study - R0000792598

### 3.3.1.3 Bruny Island supply

Bruny Island is supplied via two submarine cables (as shown in Figure 11) installed in 1959 and 1949 are approaching their end of life. TasNetworks strategy is to keep them in service till end of life, and hence TasNetworks tests the condition of these cables every 5 years. Last testing is performed in 2014 and assessment has concluded both cable will achieve at least another 15 years of service<sup>8</sup>. The longevity of the existing cable is maximised by deploying a diesel generator on the island for peak shaving to keep the cables loading under continuous firm rating of 80 amps.

The long term strategy is to replace the cables when they reach the end of life unless on-island generation is sufficient to supply the entire island load. University of Sydney investigation is underway on various scenarios for increasing the amount of on-island generation and reducing dependence on the mainland Tasmania.

## 4 Planned investments and forecast limitations

This section presents the planned investments and forecast limitations in the Kingston South planning area for the 15-year planning horizon to 2032. The planned investments present the investment need, timing, deferral opportunity and proposed solution with expected cost and other options considered. Forecast limitations present the location and timing of limitations, requirements to defer the limitation, and potential options to alleviate them.

### 4.1 Planned investments

This section presents the planned investments within the network during the next 15 years. These projects have been identified as the preferred solutions through technical and economic analysis.

#### 4.1.1 Knights Road new feeder

##### **Limitation overview**

The main trunk section of Knights Road feeder 30603 has approached 100% of its summer thermal rating (continuous) based on 2016 loading and distribution line rating<sup>9</sup> and neighbouring feeder 30608 is forecasted to exceed its summer thermal rating in 2017/2018 summer. Both feeders are predominantly overhead network with main conductor type being 19/3.25 AAC (Neptune) rated at 414 Amps and 238 Amps in winter and summer respectively. Due to the cyclic nature of the load on these feeders, the network is currently running within their cyclic rating.

Due to the limited interconnection between feeders and availability of transfer capacity in neighbouring feeder, Network Operation has indicated the difficulty keeping the electricity supply during unplanned outages and also prolonged outage hours in the area. Even in normal configuration, all the neighbouring feeders have limited transfer capability and available capacity.

This presents the immediate issues of the thermal overloading of the existing infrastructure. Loading in the area is forecasted to grow steadily over next 10 years.

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<sup>8</sup> *Bruny Island 11kV Power Cables Condition Assessment Report – R0000109792*

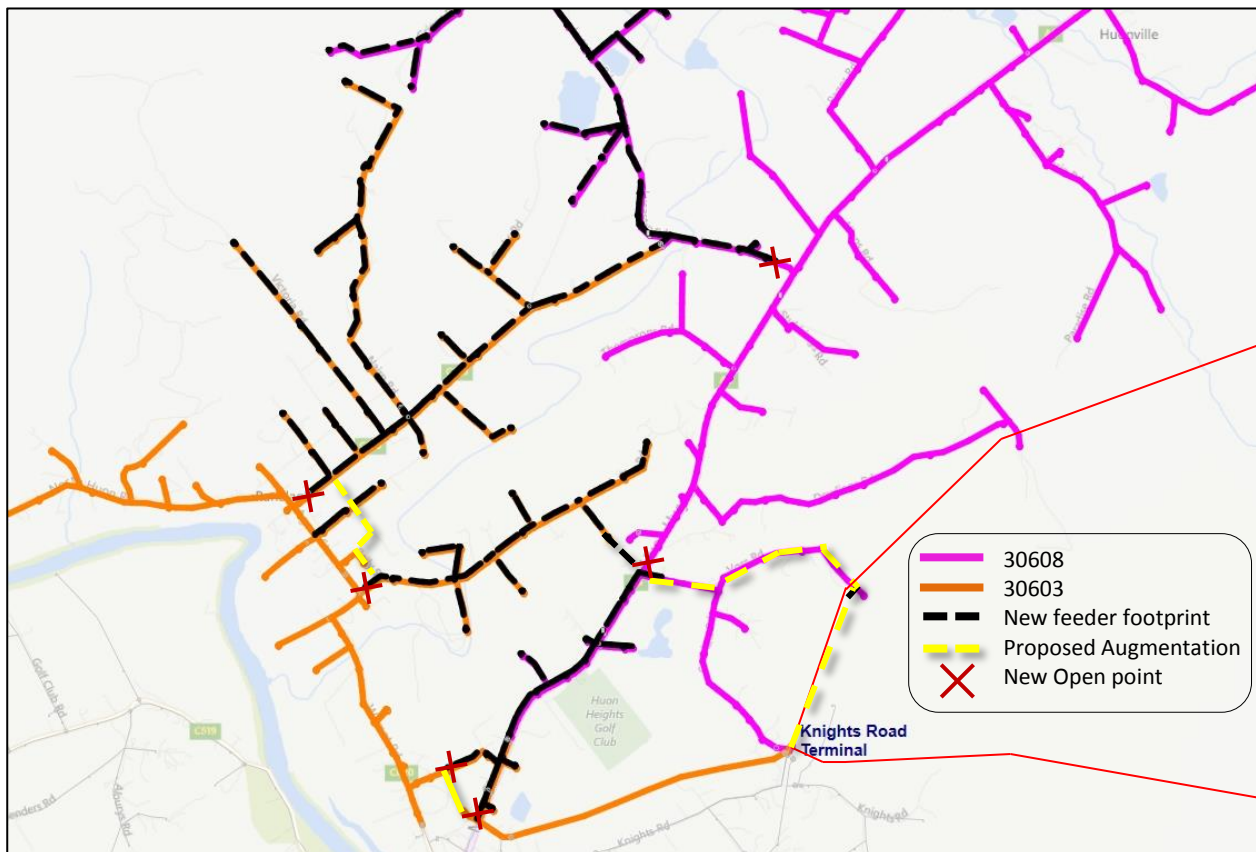
<sup>9</sup> *Distribution Network Planning Manual (1999) – Section 4 Ratings*

### Potential solution

We propose an additional feeder from Knights Road substation in order to relieve the thermal constraints from feeder 30603 and 30608, using the spare breaker in the substation. We anticipate the new feeder to be constructed and commissioned by 2019. This will separate the Huonville and Ranelagh (Urban and High Density Rural) area supply from low density rural area supplies, improving the reliability and power quality performance in the area.

The estimate cost of the project is \$0.9 million and it is planned to be operational by June 2019.

**Figure 10: Knights Road new feeder proposed configuration**



### 4.1.2 Kermandie Substation supply transformers replacement

#### Limitation overview

Kermandie Substation comprises two supply transformers, manufactured in 1961 and commissioned at Kermandie Substation in 1962. Condition assessment indicates their condition is deteriorating and they are approaching the end of their service life.

The supply transformers are 110/11 kV 10 MVA units, with a short term rating of 12MVA. The substation is currently operating under short term firm rating. However, these transformers have a number of design issues which impact on their expected life span and usability in the transmission system.

### Potential solution

We propose to replace these transformers with two standard 110/11 kV 25 MVA units in the 2019-24 regulatory period. We assessed that risk of deferring replacement past 2024 by maintaining these in service units are too great. The report prepared by Sinclair Knight Mertz<sup>10</sup> specifies that the economic life of a transformer is 45 years. Hence, it is more economical to replace them in the 2019-24 regulatory period. The capacity of the new supply transformers will be sufficient to transfer some loads off Knights Road Substation, relieving some of capacity constraint in future.

The estimate cost of the project is \$3.1 million and it is planned to be operational by June 2024

We do not propose any investment to address the capacity limitation in the mean time because it is not economical to do so. However we will maintain operation of the load shedding scheme. If we were to address the capacity limitation, potential solutions further to the load shedding scheme include:

- demand management activities, including embedded generation or contracted load shedding;
- strengthening the distribution network to provide either post-contingent (automated) or permanent load transfers away from St Marys Substation;
- real-time (dynamic) rating of the transformers;
- replacement of the transformers with larger units; and
- establishment of a new transmission-distribution connection point.

## 4.2 Forecast limitations

This section presents the forecast limitations, not addressed by a planned investment in Section 4.1, within the network during the 15 year planning period. These limitations identify the points in the network that are currently inadequate to cater for the future demand on the network due to the following considerations:

- demand forecast
- asset refurbishment replacement or retirement requirements
- security and reliability requirements
- regulatory and jurisdictional requirements
- power quality
- fault levels
- generation, demand-side and other developments
- operational constraints
- national transmission network development plan
- power system risk review
- market benefits assessment

The limitations identified here are those in the transmission network and those in the distribution network that are likely to have a material effect on operation of the network.

### 4.2.1 Bruny Island Rural reliability community performance

#### Identified need

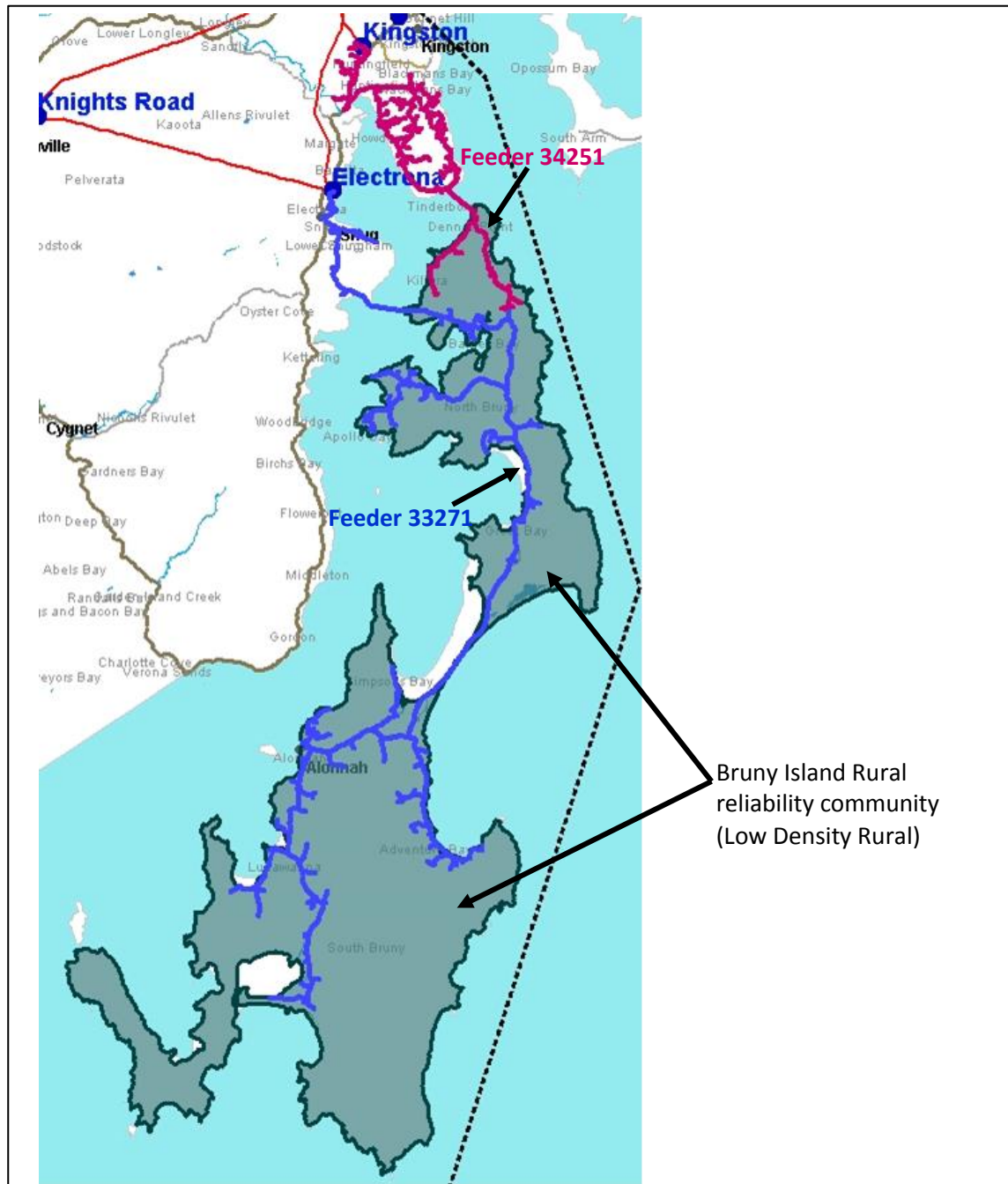
The Bruny Island is supplied via two 11 kV submarine cables from Kingston Substation and Electrona Substation. The whole of Bruny Island is identified as low density rural reliability community. The feeders have limited geographical diversity being an island and also limited transfer capability between two. A 550 kVA diesel generator is deployed on the island during Holiday season for peak shaving. Additional mobile generator connecting point is established for additional back up capability when require.

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<sup>10</sup> *Assessment of Proposed Regulatory Asset Lives – Sinclair Knight Mertz - 2013 (R192773)*

Figure 11 shows the supply arrangement to Bruny Island. The two supply feeders from Kingston Substation 34251 (pink) and Electrona Substation 33271 (blue).

**Figure 11: Bruny Island Rural reliability community supply**



The Bruny Island low density rural reliability community is marginally better performing than the SAIDI thresholds, on average since 2012-13. Figure 12 presents the SAIFI (frequency) and SAIDI (duration) yearly and five-year average reliability performance against the relative standards for these reliability communities.<sup>11</sup>

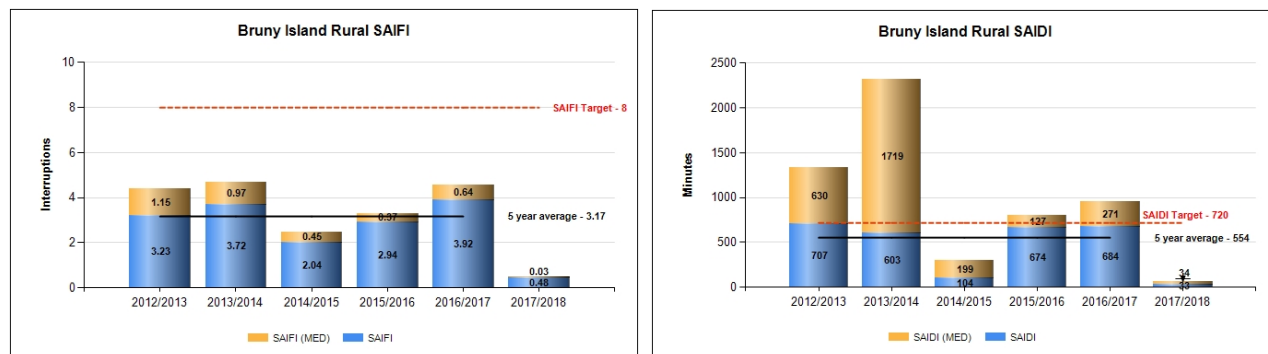
<sup>11</sup> Service Performance - Community list by customer, retrieved 13 July 2017.

[http://reportzone.tnad.tasnetworks.com.au/bi/ layouts/15/ReportServer/RSViewerPage.aspx?rv:RelativeReportUrl=/bi/ASP/Performance%20Report%20-%20Internal/Service%20Performance%20by%20Community%20\(Customer\).rdl](http://reportzone.tnad.tasnetworks.com.au/bi/ layouts/15/ReportServer/RSViewerPage.aspx?rv:RelativeReportUrl=/bi/ASP/Performance%20Report%20-%20Internal/Service%20Performance%20by%20Community%20(Customer).rdl)



The five-year average does not include the contribution from outages on major event days (MED); however outages on MEDs have had a significant impact on the duration measure (SAIDI) to supply reliability in 2012–13 and 2013–14. The dominant contributor to SAIDI in this period was from outages caused by vegetation or weather, as typically experienced on MEDs and access limitation to the island (Furry operating hours and weather conditions).

**Figure 12: Bruny Island Rural reliability community performance**



### Proposed solution

We propose to continue to monitor the Bruny Island Rural reliability community performance. It is difficult to identify any reasonable initiatives to improve supply reliability to these communities. Bruny Island residential battery trial is currently in progress as part of ARENA funded research project and the University of Sydney was asked to investigate various scenarios for the increasing the amount of on-island generation, reducing dependence on the mainland.

We may review the reliability management plan for Bruny Island reliability community should the five-yearly average reliability performance deteriorate.

## 4.2.2 Electrona and Kingston Substation 11 kV fault level

### Limitation overview

The maximum allowable fault current contribution at transmission-distribution connection points in the network is 13 kA. This is stated in connection agreements that must exist between the transmission and distribution network service providers, despite TasNetworks being both. Clause 5.2.3 (e1)(2) of the Rules states that "a network service provider must arrange for operation of its network such that the fault level at any connection point ... does not exceed the limits that have been specified in a connection agreement".

The maximum three-phase fault level on the 11 kV busbar at Electrona Substation is 16.9 kA. To meet the connection agreement, a circuit breaker is opened to remove a supply transformer from service. With this arrangement, the maximum fault level is reduced to 10.0 kA. An auto-close scheme is in place to immediately close the circuit breaker and maintain supply for the loss of one of the in-service transformers. Despite the auto-close scheme, some sensitive customer will have their supply interrupted.

The maximum three-phase fault level on the 11 kV busbar at Kingston Substation is 14.6 kA. To meet the connection agreement, a circuit breaker is opened to remove a supply transformer from service. With this arrangement, the maximum fault level is reduced to 8.0 kA. An auto-close scheme is in place to immediately close the circuit breaker and maintain supply for the loss of one of the in-service transformers. Despite the auto-close scheme, some sensitive customer will have their supply interrupted.

### Proposed solution

We propose to continue the current solution and auto-close scheme. A detailed study is required to provide the technical and economic justification to again operate the substation with all elements in service. To ensure sufficient fault rating in the distribution network, primary and secondary equipment in the high fault level zone will need to be reviewed and upgraded as necessary, with possible new technology deployed such as intelli-routers.

## 5 Network opportunity

The Kingston South planning area has a number of load connection points with sufficient capacity such that new loads could connect with minimal or no augmentation to the connection point substation to accommodate it. Note that although capacity at the substation may be available, the new load may result in other augmentation work required for capacity increases deeper in the transmission network or for network security or reliability reasons.

Knights Road substation is forecast to exceed the firm capacity by 2026. However, four hour rating of the transformers is 24 MVA. The dynamic rating for the transformer is expected to be in operation by early 2018 and the load demand does not expect to exceed the new dynamic rating of the transformers by 2032. New significant loads connecting to Knights Road substation may result in major substation upgrade.

Table 3 shows the available firm capacity at each connection point substation now and at the end of the planning period where redundancy is available, and the non-firm capacity at single transformer substations.

**Table 3: Available substation capacity (MVA)**

Substation	Firm capacity	Existing		2032	
		Demand	Available capacity	Forecast demand	Available capacity
Electrona	25	13.8	11.2	12.3	12.7
Knights Road	20*	17.8	2.2	23.1	0
Kermandie	20	6.4	13.6	6.0	14.0
Huon River	25 (non-firm)	1.9	23.1	1.9	23.1
Kingston 11 kV	35	24.7	10.3	21.6	13.4
Kingston 33 kV	60	10.8	49.2	15.3	44.7
Summerleas Zone	25 (non-firm)	10.8	14.2	15.3	9.7

\* Transformer name plate capacity (Dynamic rating has not applied yet)

## Appendix A – Area capability information

This appendix provides information on the network capability in the Kingston South planning area. The supply transformer capacity at each substation is provided in Table 4. The transfer capability from each substation is provided in Table 5.

**Table 4: Substation supply transformer capacity**

Substation	Number of transformers	Transformer capacity (MVA)	Transformer primary/secondary voltage
Electrona	2	25	110/11
Knights Road	2	20	110/11
Kermandie	2	20	110/11
Huon River	1	25	110/11
Kingston	2	35	110/11
Kingston	2	60	110/33
Summerleas Zone	1	25	33/11

**Table 5: Transfer capability**

Kingston South Area		From					
		Electrona	Kermandie	Kingston	Knights Road	Summerleas Road	Huon River
To	Electrona			7.8	1.7		
	Kermandie				3.4		
	Kingston	8.0			1.7	4.9	
	Knights Road	3.0	4.4	3.1			
	Summerleas Road			1.6			
	Huon River						