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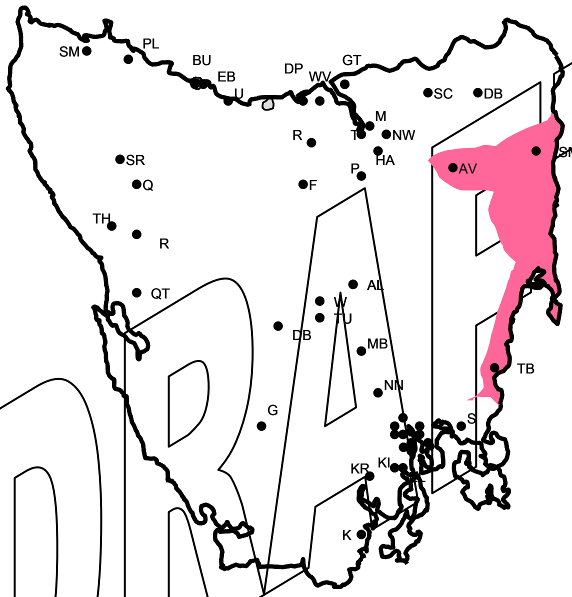

EAST COAST

DEVELOPMENT PLAN

REV NO.	DATE	REVISION DESCRIPTION	APPROVALS	
0		Working Draft	Prepared by	
			Reviewed by	
			Approved by	

Disclaimer

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1. EXECUTIVE SUMMARY

The East Coast (EC) planning area covers the East coast of Tasmania, from Orford in the South to Ansons Bay in the North. It also encompasses the inland towns of Avoca and Campbell Town.

The East Coast is considered a medium growth area, recording growth rates of 1-2% pa for the past three years.

In general the area has a low population density, containing a mixture of low level farming and coastal tourist towns. In particular, the Northern coastal areas are experiencing localised areas of significant residential development.

The coastal area is prone to wind and storm damage and is considered high fire danger, which can cause supply reliability issues.

To facilitate the current and forecast load, the EC planning area maintains a 22kV distribution network supplied by three Transend owned 110/22kV substations. The network supplies 9,421 connected customers via 1,095 km of OH and UG circuit.[1]

The identified or known large constraints are as follows:

-

To address the above constraints the following is being proposed:

-

[1] Data available in NW-#30146137-Feeder Data for Development Plans.

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2. EXISTING SYSTEM

2.1 Substations

Substations supplying this area are list below.

Note: hyperlinks in the section below will display the power circuit one line diagram from Transend's Operational Diagram System.

Transend owned substations

- Avoca (click here to see the 110/22kV single line diagram)
- St Marys (110/22kV)
- Triabunna (110/22kV)

Aurora owned substations

- There are no Aurora owned zone substations in the East Coast Planning Area.

2.2 Supply Network

Distribution within this planning area is at 22kV, supplied by 110/22kV terminal stations.

EC area network statistics [2]

11kV circuit length	1,095	km
Connected customers	9,421	
Connected transformer capacity	124,878	kVA
Customer density	9	per 11kV circuit km
Transformer capacity density	114	kVA per 11kV circuit km

[2] Data sourced from Gtech, query DISTFDR. See NW-#30146137-Feeder Data for Development Plans.

The maps below shows the geographic area referred to as East Coast


Scottsdale
Branxholm
Cuckoo
Legerwood
Ringarooma
Legunia
Alberton
Trenah
Lottah
Goulds Country
Pyengana
The Gardens
Binalong Bay
Priory
Akaroa
St Helens
Dianas Basin
Beaumaris
Scamander
Falmouth
Four Mile Creek
Cornwall
St Marys
Gray
Chain of Lagoons
Seymour
Douglas River
Bicheno
Llandaff
Friendly Beaches
Apslawn
Cranbrook
Dolphin Sands
Freycinet
Coles Bay
Swansea
Freycinet National Park
Rocky Hills
Little Swanport
Pontypool
Ravensdale
Triabunna
Orford
Louisville
Shelly Beach
Rheban
Maria Island National Park
Bream Creek
Gravelly Beach
Mayfield
Launceston
East Launceston
Prospect
Hadspen
Franklin Village
Perth
Evandale
Longford
Upper Esk
Roses Tier
Ben Lomond National Park
Storys Creek
Mangana
Fingal
Frodsley
Rossarden
Tullochgorum
Ormley
Avoca
Epping Forest
Cleveland
Conara
Llewellyn
Royal George
Delmont
Barton
Millers Bluff
Campbell Town
Auburn
Ross
Lake Leake
Lake Sorell
Interlaken
Tunbridge
Woodbury
Antill Ponds
Tooms Lake
St Peters Pass
Pawtella
Lemont
Oatlands
Andover
Swanston
Parattah
Jericho
Bothwell
Stonor
Mt Seymour
Stonehenge
Apsley
Tiberias
Baden
Whitefoord
Melton Mowbray
Rhyndaston
Eldon
Levendale
Yarlington
Colebrook
Bagdad
Brighton
Bridgewater
Richmond
Gagebrook
New Norfolk
Midway Point
Sorell
A8
A3
A4
A5
1
B32

3. LOCAL PLANNING ISSUES

3.1 Long Term System Strategy

EC will continue the development of a radial 22 kV distribution network supplied from Transend's existing substations in the area, St Mary's, Avoca and Triabunna.

As load grows in the area consideration will be given to the establishment of additional substations supplied at 110kV or the introduction of 66kV subtransmission supplying Aurora owned 66/22kV zone substations.

Highly interconnected Low Voltage reticulation will continue to develop at 433V.

Embedded Generation options will be encouraged at the 11 kV and 433V connection points.

Demand Side Management solutions will be encouraged to reduce system peaks and defer large system upgrades where possible.

3.2 Local Government Authorities

For planning purposes, Aurora consults closely with the following local government authorities in the HE planning area:

- Break O'Day Council
- Glamorgan-Spring Bay Council.

Other relevant authorities include:

- Department of Infrastructure, Energy and Resources (DIER); and
- Ben Lomond Water.

Break O'Day Council

The major load areas within the Break O'Day council are the towns of St Marys and St Helens, with the council area having a total population of approximately 6,500.

The major industries in the area are tourism, agriculture, forestry, aquaculture and mining.

Glamorgan-Spring Bay Council

The predominant industries within this council area are aquaculture and fishing, forestry, agriculture and tourism.

The population of the council area is approximately 4,500.

3.3 Existing Critical Loads

EC planning area has a small number of existing critical loads requiring a higher level of supply security or a limit to operational flexibility. Table 1 below details critical loads in the EC planning area:

Load Type	Description	Substation(s)	Feeder(s)	Asset Connection Point(s) - if applicable
Commercial / Major Retail				
Medical				
Rehabilitation Services				
Industrial				
Sewerage Treatment Plants				
Education				

Table 1 - East Coast Critical Loads

Improvements to supply security for the above connections and supply areas are encouraged.

3.4 Future Developments and Restrictions

- Council planning schemes

Vision East Consultation Report 2009 indicates that development will be focussed on the key towns of St Helens, St Marys (within township bounds), Triabunna, Bicheno and Swansea.

3.5 Reliability for the area

The East Coast Area includes the following Reliability communities:

- Urban - St Helens

- High Density Rural – Bicheno, Campbell Town, St Marys, Swansea, Triabunna - Orford
- Low Density Rural - Fingal Valley Rural, Ross Rural, St Helens Rural, Triabunna – St Marys Rural

Details of actual reliability performance in the 09/10 financial year are available in here. (DM ref# 30061377)

On figures for the 9 months to March 2010 the following communities appear likely to have reliability performance worse than target in 2010:

- Fingal Valley Rural
- Ross Rural

The other reliability communities in the East Coast Planning area have shown adequate reliability performance in 2009/10 up to March 2010.

3.6 Asset issues

There are no East Coast substation transformers at or beyond their nominal end of life or in poor condition.

Further information is detailed in the following Asset Management Plans relevant to the HE planning area:

NW30084385 - Management Plan 2010: Ground Mounted Substations

NW30070052 - Management Plan 2010: High Voltage Regulators

NW30084411 - Management Plan 2010: Overhead System and Structures

NW30043361 - Management Plan 2010: Underground System

3.7 Links

LAM Area Management Plans relevant to the East Coast planning area are:

- Midlands North NW-#226271-Area Management Plan Midlands North
- East Coast NW-#229384-Area Management Plan East Coast 09

In addition Transend's Annual Planning Report contains relevant information. It can be found on their website www.transend.com.au.

4. LOAD FORECAST

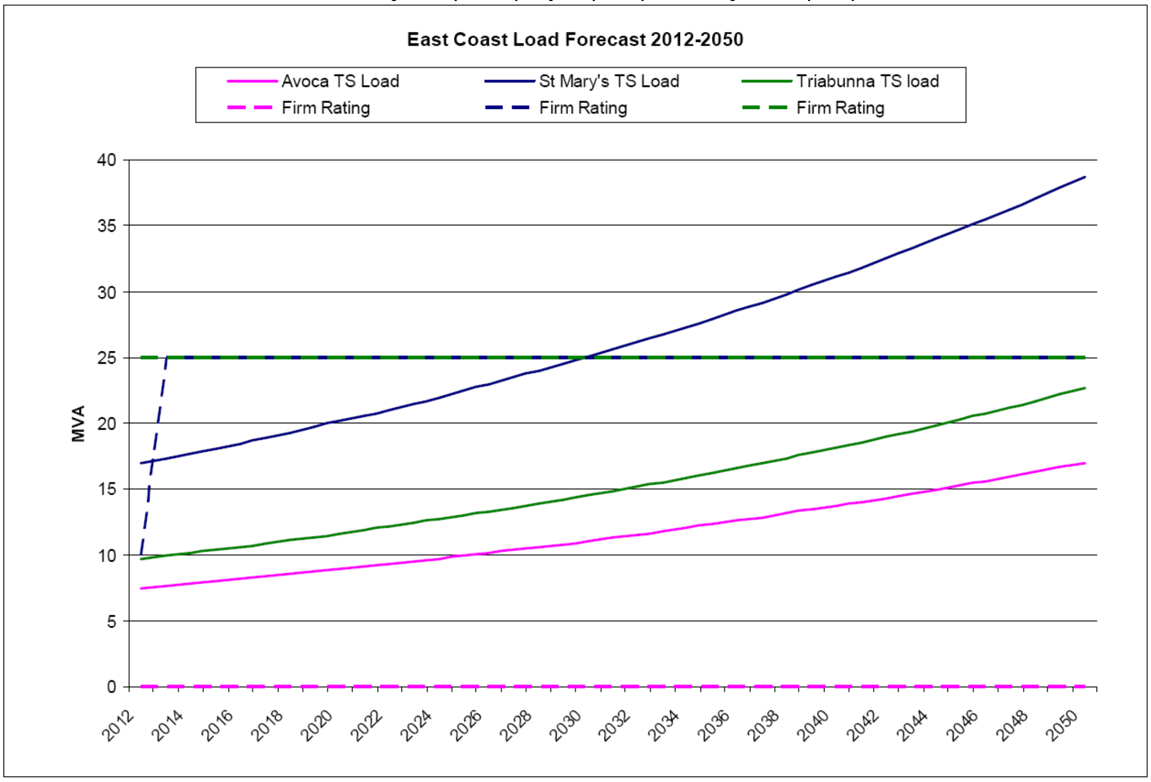
The East Coast is considered a medium growth area, recording growth rates of 1-2% pa for the past three years.

Avoca, St Mary's and Triabunna substations have median growth rates of approximately 2.2%, 0.9% and 1.0% respectively.

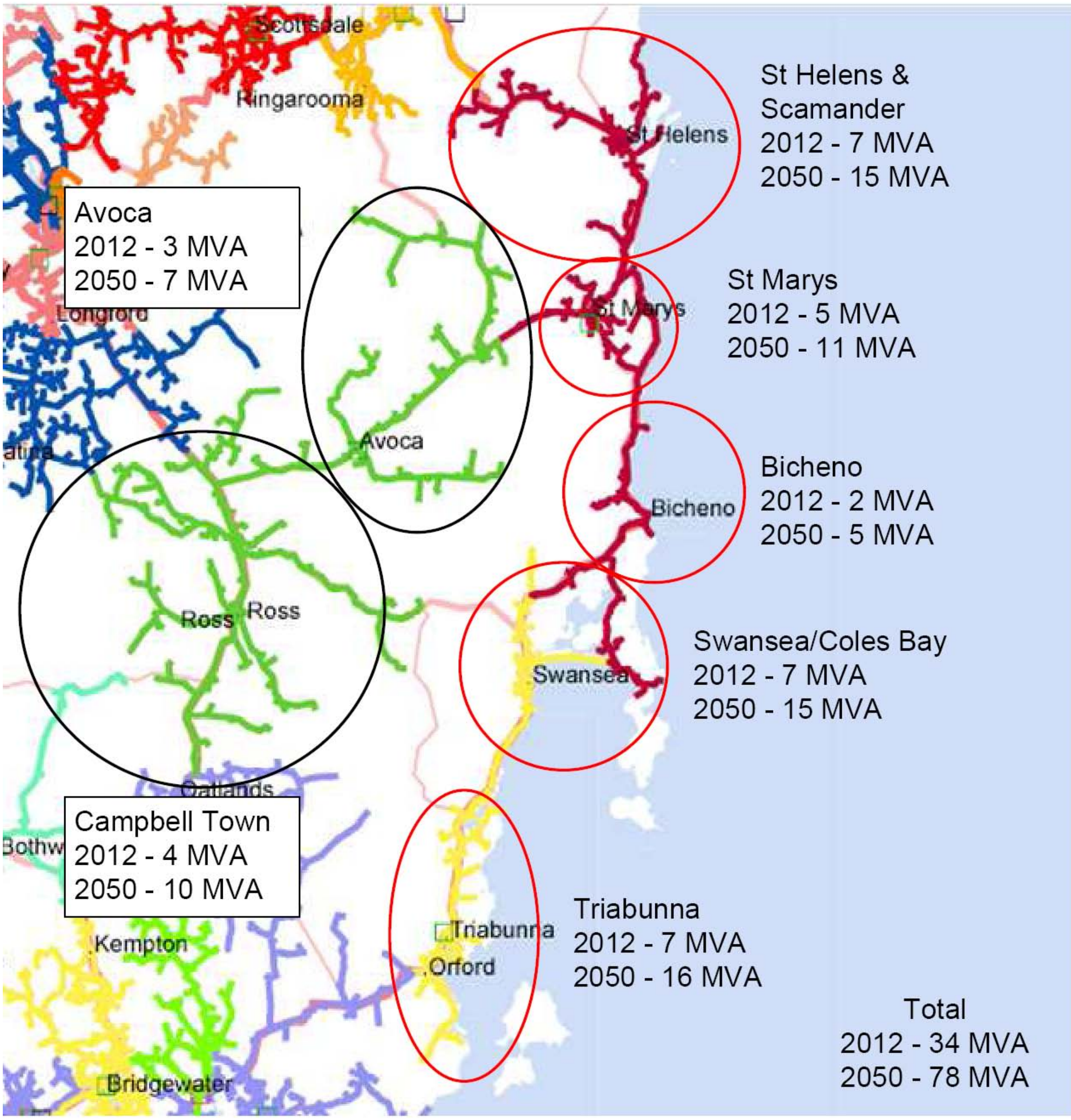
While Avoca substation has experienced significant load growth over the past several years, due to the rural nature of the load, significant growth above this rate is considered unlikely. St Mary's and Triabunna substations on the other hand supply coastal towns including Scamander, Bicheno and Swansea which are seen as attractive tourist and holiday destinations with the potential for higher growth.

As a result, to produce a conservative load forecast medium growth has been applied at Avoca whereas high growth has been applied at St Mary's and Triabunna substations.

The resulting 40 year load forecast and firm ratings for substations of the East Coast planning area are provided below.



The following figure provides a geographic view of the resulting load distribution in 2012 and 2050.



The 2009 10 year load forecast report by UES is used as the basis for this plan. NW30089965 - Aurora 2009 Maximum Demand & Consumption 10 year Forecast Report

Forecast load growth tables are stored in the spreadsheet NW-#30040697-Zone and Area MD and consumption tables 2009

	Planning Area	Connection Point Substation	Forecast Growth pa
	East Coast	Avoca	3.2%
	East Coast	St Marys	3.1%
	East Coast	Triabunna	2.9%

The latest load model spreadsheet is NW-#30069002-East Coast area load model (2009)

Copy of load profile

4.1 Future committed point loads (> 1 MVA)

- None identified

4.2 Possible point loads (> 1 MVA)

- Major Subdivisions (>200 lots)
    - None identified

4.3 Possible point loads to be removed (> 1 MVA)

- None identified

4.4 Possible future embedded generation (> 1 MVA)

- None identified

4.5 Analysis of Load Forecast

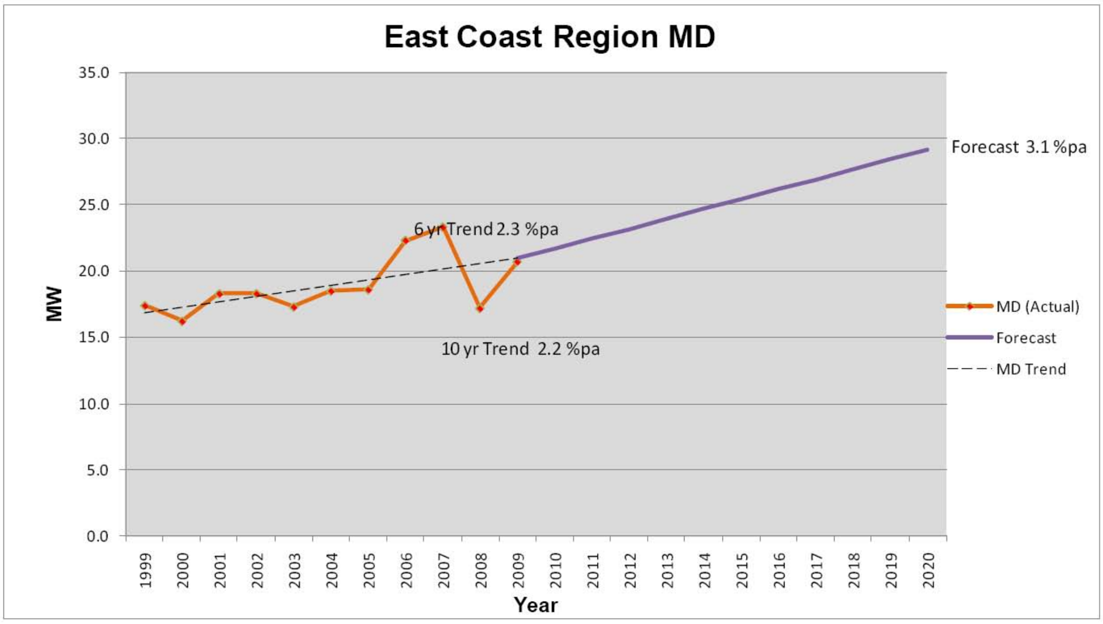
Detailed load forecast data is available in the following documents:

- Load model reference NW-#30069002-East Coast area load model (2009)

The UES 10 year load forecast document can be found at

NW30089965 - Aurora 2009 Maximum Demand & Consumption 10 year Forecast Report

The forecast growth in maximum demand extracted from the UES document for this area is shown below.



5. PLANNING CRITERIA

Planning criteria for the HE planning area are detailed in Aurora's Distribution Planning Manual and is consistent for the all planning areas:

NW102505705 - Distribution Network Planning Manual May 1999

More up to date information is included in this document in Appendix B on page 37.

6. CONSTRAINTS (LIMITATIONS)

6.1 Summary of Constraints

Constraints in the HE planning area are classified under the following management groups:

Constraint	Description	Definition
Capacity	Substation Firm Capacity	Substation Maximum Demand > Substation Firm Capacity (N-1)
	Feeder Tail Capacity	Feeder Maximum Demand > 5 MVA for 11 kV OR 10 MVA for 22 kV
	Feeder Section Capacity	Load through conductor >conductor continuous rating
	Feeder Tie Capacity	Transfer Capacity limited due to undersized conductor/equipment
Fault Level	Substation Bus Fault Level	Maximum 3-phase fault level > 13.1 kA OR Maximum 1-phase > XX.X kA
	Equipment Rating Fault Level	Maximum 3-phase OR 1-phase fault level > equipment rating
Voltage	Normal load Voltage Drop	Voltage drop exceeds ± 6%

	Emergency load Voltage Drop	Voltage drop exceeds ± 10%
Reliability	SAIDI	Reliability community SAIDI performance has or is likely to exceed target
	SAIFI	Reliability community SAIFI performance has or is likely to exceed target

Table 2 - Constraint Definitions

Constraints are managed at the following levels

- Zone Substation
- Subtransmission Feeder
- Distribution Feeder
- Distribution Substation
- LV Systems

This document details constraints at the Zone Substation (inc Rural Zone Substations), Subtransmission Feeder and Distribution Feeder levels only. Refer to XXXXXXXXX for State wide management plans for the Distribution Substation and LV System planning levels

6.2 Summary of Constraints

6.2.1 Substation Constraints

Capacity Constraints				
Substation	**Firm Capacity (MVA)**	**Current Load (MVA)**	**Forecast to exceed (year)**	**Comments**
Avoca Terminal			Already Exceeded	Substation equipped with one transformer only resulting in no firm capacity.
St Marys Terminal			Already Exceeded	Load currently exceeds firm capacity by 8MVA. The installation of 2 x 25MVA transformers by Transend in 2013 will address limitation until approx 2030.

Fault Level Constraints				
Substation	**Fault Level Description**	**Forecast (year)**	**replacement**	**Comments**
				None identified

6.2.2 Subtransmission Constraints

There are currently no subtransmission assets in the East Coast planning area.

6.2.3 Distribution Feeder Constraints

Capacity Constraints				
Substation	**Feeder**	**Capacity constraint type**	**Forecast to exceed (year)**	**Comments**
		Feeder Tail	Already Exceeding	
		Feeder Section	Already Exceeding	
		Feeder Tie		

Voltage Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

Reliability Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
			None identified

6.3 Security

Aurora's zone substations are typically run in N-1 secure mode. This means that in the event of any single outage of a network element all load can still be supplied.

Since there are no Aurora zone substations in the EC area this level of security is not considered. When Transend installs the new transformers at St Mary's N-1 security will be restored for a transformer outage there. Since Avoca substation has only a single transformer, it does not have N-1 security. Transend plan to install a second transformer at Avoca in 2014.

6.4 Transfer and Operational Capability

The table below shows the rating, peak load and transfer capacity. The peak load figures are those forecast for winter 2010. Since Aurora's substations are subject to winter peaks, these are the most onerous.

	MVA				
Substation	**Rating**	**N-1 Rating**	**Peak Load**	**Transfer Capacity (2010)**	**Transfer Substation**

The table shows that.

Details of the analysis carried out on load transfers in the EC area are available in

6.5 Power Factor

- Customer power factor correction
- Network power factor correction

6.6 LV issues

There are no locations in the EC Planning area where widespread LV network issues have been identified.

The table below shows the count of transformers in the planning area and the count of those that are at risk of overloading. This is determined by the count of connected customers indicated a load greater than 130% of nameplate rating. It should be noted that the actual load on a transformer may be much different to its value calculated in this way.

	Total		>130% of rating[3]	
Tx size	**Count**	**Customer Count**	**Count**	**Customer Count**
< 50 kVA	868	1,761	28	256
>= 50 kVA	559	7,860	47	1,924

7. SHORT TERM PLAN (<5YR)

The East Coast Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103833-East Coast strategic plan Rev_3.

A summary of the proposed works from 2010 to 2015 in the East Coast planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes
2014	Install 2nd transformer at Avoca terminal substation	Provide firm capacity at Avoca substation

Details of the constraints, options and possible solutions analysed to arrive at these proposed projects are included in Appendix A on page 24.

8. MEDIUM TERM PLAN (5 TO 10YR)

The East Coast Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30103833-East Coast strategic plan Rev_3.

A summary of the proposed works from 2016 to 2020 in the East Coast planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes
2017	Establish 110 kV transmission line from Derby to St Marys	Address 110 kV N-1 limitations
2020	Extend Avoca 22 kV feeder 56001 to Swansea	Address reliability and capacity limitations on St Marys feeder 57004 and Triabunna feeder 45307

[3] Data sourced from NW-#30075639-Statewide Distribution Transformers Customer Count Nov 09. Transformer data extracted from Gtech in November 2009.

Year	Proposed Project	Proposed Outcomes
2020	Extend St Marys 22 kV feeder 57003 to St Helens	Address reliability and capacity limitations on St Marys feeder 57006
2020	Load transfers from Avoca to Palmerston	Address reliability and capacity limitations on Avoca feeder 56004

Details of the constraints, options and possible solutions analysed to arrive at these proposed projects are included in Appendix B on page 26.

9. LONG TERM PLAN (10YR+)

The East Coast Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: [NW-#30103833-East Coast strategic plan Rev_3]

A summary of the proposed works from 2021 to 2050 in the East Coast planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes
2026	Install fans on Avoca transformer	Increase firm capacity at Avoca substation
2035	Establish Swansea substation	Address capacity limitation at St Marys and 22 kV feeder reliability and capacity in the Swansea, Bicheno and Coles Bay areas
2045	Establish Ross substation	Address capacity limitation at St Marys and 22 kV feeder reliability and capacity in the Campbell Town, Ross and Oatlands areas
2047	Replace Avoca 110/22 kV transformer	Replace ageing transformer

Details of the constraints, options and possible solutions analysed to arrive at these proposed projects are included in Appendix C on page 32.

10. PROGRAM OF WORK DRAFT

Project	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Install UG HV - 6 feeder tails New Norfolk Zone		$ 173,000				
(Project BW 006] Install 0.2 km HV UG Huntingtier Rd PID 221007 to Hardwicks Rd Bagdad PID 390836	$ 80,000					
Augment OH HV - 14 Mile Rd, Tarraleah					$ 210,000	
Augment OH HV - Fdr 37002 stage 1 Gretna Zone associated with Zone replacement					$ 411,000	
Augment OH HV - Fdr 37002 stage 2 Gretna Zone associated with Zone replacement					$ 411,000	
Augment OH HV - Fdr 37002 stage 3 Gretna Zone associated with Zone replacement					$ 206,000	
Derwent Bridge - Install 3rd wire Lyell Hwy (generator stability) 2 kms	$ 40,000					
Derwent Bridge - Install permanent connection point generator	$ 25,000					
Install 1 x 6.6/ 22 kV step up stations at todds corner						$ -
Install 19/3.25 AA OH link Hamilton - F45003 2 kms	$ 130,000					
Install OH HV - Auburn Rd to Macquarie Rd						
Install OH HV - Derwent Bridge to Bronte Link					$ 630,000	
Install OH HV - link Meadowbank 45003 to Wayatinah 49412 to Tunagtinah 49305						$ 420,000
Install OH HV - link to Lake Cresent 3 ph (to assist in removal of SWER)				$ 630,000		
Install OH HV - link Victoria Valley SWER to Tungatinah fdr 49303, Dee Lagoon					$ 124,000	
Install OH HV - new Feeder, Elderside						$ -
Install OH HV - Upgrade SWER, Dee Lagoon Link, Victoria Valley Rd				$ 294,000		
Project BW 004 Reinsulate7.6 k & 8 tx Bridgewater F48 190 to 22 kV and supply from Meadowbank TS	$ 300,000					
Project BW 005 Reinsulate 10.0 k &11 tx Bridgewater F 48 190 to 22 kV and supply from Meadowbank TS		$ 352,000				
Project MB 001 - Westerway 38002 OH conversion to 22 kV (10 km OH and 15 tx's)		$ 400,000				
Project MB 002 - Westerway 38002 OH conversion to 22 kV (12 km OH and 22 tx's)			$ 460,000			
Project MB 003 - Westerway 38002 OH conversion to 22 kV (11 km OH and 15 tx's)					$ 360,000	
Tods corner - Convert 6.6 kv line to 22 kv						$ -
Augment pole sub 300 kVA First Avenue New Norfolk	$ 40,000					
Augment pole sub Fairfax Terrace New Norfolk	$ 40,000					
Install new pole sub George Street New Norfolk	$ 40,000					
Install Substation - new or augment pole type 300 kVA				$ 30,000	$ 30,000	$ 30,000
Augment OH LV - overloaded LV ccts Highlands stage 2		$ 14,000				
Augment OH LV - overloaded LV ccts Midlands South stage 2		$ 14,000				
Augment OH LV - overloaded LV ccts Midlands South stage 3		$ 14,000				
Augment OH LV - overloaded LV ccts Midlands South stage 4				$ 14,000		
	$ 695,000	$ 967,000	$ 460,000	$ 968,000	$ 2,382,000	$ 450,000

11. OPERATIONAL PLANS

- Contingency plans (not at operational level)

Operations Group have developed a number of contingency plans to define operational actions to be taken in the event of substation, busbar and feeder outages. The document NW-#30126392-Contingency Plan Register provides links to contingency plan documents as they are produced.

12. REFERENCE DOCUMENTS

Self explanatory but listed documents for system studies, council plans etc

- Listing of DINIS personal files
- Links to other work documents

13. NOTES

- System development plans identified for the area should link to other plans. Consultation with other work groups, in particular System Performance, Distribution Operations, Area Managers and key external stakeholders e.g. Councils and Government Departments, is essential to ensure optimum outcomes.
- It would be useful to include any details of reference documents and schematic diagrams indicating current substation layout and HV feeder arrangements.

Appendix A. Short Term Plan (<5 years) – Constraints Options and Solutions

A.1 Install 2nd transformer at Avoca terminal substation

A.1.1. Constraints

Avoca terminal substation is equipped with 1 x 10 MVA 110/22kV transformer providing no firm capacity. The transformer was installed in 1997 which implies a nominal end of life in 2047. It is a standard Transend transformer without radiator fans installed, so installation of fans would increase capacity to 25 MVA.

The load at Avoca is forecast to increase from approximately 7.5 MVA in 2012, to approximately 9.5 MVA in 2022. There is approximately 3 MVA transfer capacity from Avoca to St Marys substation in 2012, resulting in 4.5 MVA (peak) of unsupplied load for a transformer contingency at Avoca. This corresponds to greater than 300 MWh of unsupplied load for a single credible contingency, contravening the ESI regulations.

The Palmerston-Avoca 110 kV transmission line is a single circuit which supplies Avoca and St Marys terminal substations. A fault on this line would result in approximately 24 MVA of peak load interrupted in 2012, and well in excess of the 300 MWh allowed by the ESI regulations for a single credible contingency. It is assumed that the proposed Transend project for a 110kV circuit from Derby to St Marys will proceed as soon as possible (tentatively proposed for 2017), thus providing N-1 security for the 110 kV network to Avoca and St Marys.

A.1.2. Options considered

1. Install 2nd transformer at Avoca terminal substation
2. Reinforce 22 kV network to Avoca

Option 1 (recommended option) – Install 2nd transformer at Avoca terminal substation

This option involves the installation of a 2nd 110/22 kV transformer at Avoca in 2014. The transformer may be installed without radiator fans initially, but space should be allowed for the future installation of fans on both transformers.

While the second transformer is required as soon as possible to meet the ESI regulations, the Transend program of works indicates a commissioning date of August 2014 so this is considered the earliest date for practical completion.

Option 2 – Reinforce 22 kV network to Avoca

This option involves the reinforcement of the 22 kV network from St Marys to Avoca in 2014. The project to deload Palmerston feeder 51003 is expected to create transfer capacity between the substations, however it is unlikely to be able to pickup the load in Avoca Township due to the distance from Palmerston.

It is expected that by reconductoring the existing sections of 19/.064 Cu on St Marys feeder 57005 and Avoca feeder 56003 (approximately 15 km), an additional 3-4 MVA of transfer capacity may be established, thus deferring the requirement for the second transformer at Avoca until around 2020.

Technical comparison

Option	Description	Advantages	Disadvantages
1	Install 2nd transformer at Avoca terminal substation	• Increases firm capacity at Avoca by 10 MVA • Better reliability since there is no loss of load for a transformer fault	
2	Reinforce 22 kV network to Avoca	• Improves 22 kV transfer capacity between Avoca and St Marys	• Does not increase firm capacity in the area • Requires significant 22 kV feeder augmentation

The above technical comparison of options indicates that option 1 provides the best technical solution.

Cost comparison

Option	Initial Capital Cost ($M)	Total Capital Cost ($M)	Net Present Value ($M)
1	5.0	5.0	3.9
2	1.5	6.5	3.8

The above cost comparison of options indicates that option 1 provides the lowest cost solution. Details of the NPV analysis are given in appendix B of NW-#30103833-East Coast strategic plan Rev_3.

A.1.3. Possible Solution

Based on the technical and cost comparison, option 1 is considered the preferred option to address the forecast limitations.

Therefore it is recommended to install a second transformer at Avoca Terminal station in 2014.

Appendix B. Medium Term Plan (5 to 10 years) – Constraints Options and Solutions

B.1 Establish 110kV transmission line from Derby to St Marys

Avoca and St Marys terminal substations are currently supplied radially by a single 110 kV teed feeder from Palmerston terminal substation. As a result, a single fault on this feeder will result in a loss of supply to Avoca and St Marys substations with no alternative source of supply.

To address this limitation, Transend are proposing additional 110kV injection into the area. The first stage of works is a proposed new substation in the St Helens area supplied at 110 kV from Derby terminal substation, with 110 kV supply continuing to St Marys from St Helens terminal substation in a subsequent stage. The tentative timing from Transend for this project is 2017.

B.2 Extend Avoca 22kV feeder 56001 to Swansea

B.2.1. Constraints

St Marys 22kV feeder 57004 and Triabunna 22 kV feeder 43507 currently supply the Bicheno, Swansea and Coles Bay areas. The load on 57004 is forecast to increase from 5.9 MVA to 7.1 MVA between 2012 and 2022. The load on 43507 is forecast to increase from 4.2 MVA to 5 MVA between 2012 and 2022. It should be noted that these loads include a block load of approximately 2 MVA, split evenly across the two feeders, to represent the resort development in Coles Bay. Both feeders also currently experience peak loading during the winter months, and this is expected to continue.

Feeders 57004 and 43507 are both long coastal feeders (approximately 60 km) which are vulnerable to faults during the frequent stormy weather in the area.

The Swansea and Coles Bay area is currently experiencing reliability issues. The current round of reliability works in the area is expected to relieve these limitations until approximately 2020.

B.2.2. Options considered

1. Extend 22 kV feeder 56001 from Avoca to Swansea
2. Establish new 22 kV feeder from St Marys
3. Establish new 22 kV feeder from Triabunna

Option 1 (recommended option) – Extend 22 kV feeder 56001 from Avoca to Swansea

This option involves the extension of existing Avoca feeder 56001 along Old Coach Rd to Cranbrook (approximately 15 km) in 2020, thus deloading feeders 57004 and 43507. The resulting feeder would contain sections of 7/.134 AAC and 7/.064 Cu conductor, providing a feeder winter day rating of 4.7 MVA. Reconductoring these sections (approximately 20 km) to 19/3.25 AAC would increase the rating to 12.4 MVA (limited by the remaining sections of 7/.173 AAC).

Option 2 – Establish new 22 kV feeder from St Marys

This option involves the establishment of a new 22 kV feeder from St Marys (approximately 40 km) to split existing feeder 57004 in 2020. The new feeder would follow the same coastal route as 57004, and would split 57004 in the vicinity of Bicheno. The feeder would be terminated on an existing spare 22 kV CB at St Marys.

Option 3 – Establish new 22 kV feeder from Triabunna

This option involves the establishment of a new 22 kV feeder from Triabunna (approximately 50 km) to split existing feeder 43507 in 2020. The new feeder would follow the same coastal route as 45307, and would split 45307 in the vicinity of Swansea.

The existing 22 kV bus at Triabunna would be extended with a new 22 kV CB as part of this option.

Technical comparison

Option	Description	Advantages	Disadvantages
1	Extend 22 kV feeder 56001 from Avoca to Swansea	• Shortest 22 kV feeder run (utilises existing feeder) • Uncongested feeder route • Results in three sources of supply to the Swansea and Coles Bay area • Defers the firm capacity limitation at St Marys substation • Decreases load on the radial Avoca-St Marys and Lindisfarne-Triabunna 110 kV feeders	• Brings forward the firm capacity limitation at Avoca substation

Option	Description	Advantages	Disadvantages
2	Establish new 22 kV feeder from St Marys	• Allows ties between new and existing feeders along entire feeder route, making the supply more tolerant to 22 kV feeder faults • New feeder installation may be staged, with load progressively transferred from the existing feeder to the new feeder	• New feeder must share same route as existing
3	Establish new 22 kV feeder from Triabunna	• Allows ties between new and existing feeders along entire feeder route, making the supply more tolerant to 22 kV feeder faults • New feeder installation may be staged, with load progressively transferred from the existing feeder to the new feeder	• New feeder must share same route as existing

The above technical comparison of options indicates that option 1 provides the best technical solution.

Cost comparison

Option	Initial Capital Cost ($M)	Total Capital Cost ($M)	Net Present Value ($M)
1	3.5	3.5	1.8

2	4.0	4.0	2.1
3	5.1	5.1	2.7

The above cost comparison of options indicates that option 1 provides the lowest cost solution. Details of the NPV analysis are given in appendix B of NW-#30103833-East Coast strategic plan Rev_3

B.2.3. Possible Solution

Based on the technical and cost comparison, option 1 is considered the preferred option to address the forecast limitations.

Therefore it is recommended to:

- Establish a new section of 22kV 19/3.25 AAC feeder from the end of existing feeder 56001 to the spur of 43507 on Old Coach Rd (approximately 15 km). Consideration should be given to fireproofing of this new section of feeder since the area is known to be vulnerable to bush fires.

- Reconductor the 7/.064 Cu section of 43507 on Old Coach Rd to the Tasman Hwy with 19/3.25 AAC (approximately 8 km)

- Reconductor the 7/.134 AAC section of 46001 from Avoca substation along Royal George Rd to 19/3.25 AAC (approximately 12 km)

B.3 Extend St Marys 22kV feeder 57003 to St Helens

B.3.1. Constraints

St Marys 22kV feeder 57006 currently supplies to the St Marys, Scamander, Beaumaris and St Helens areas. The load on 57006 is forecast to increase from 7.9 MVA to 9.8 MVA between 2012 and 2022. The St Helens area is currently experiencing reliability issues, with the current round of reliability works in the area expected to relieve these limitations until approximately 2020.

St Marys 22kV feeder 57003 currently supplies to the St Marys, Scamander and Beaumaris areas. The load on 57003 is forecast to increase from 1.1 MVA to 1.3 MVA between 2012 and 2022.

B.3.2. Options considered

1. Extend 22 kV feeder 57003 from St Marys to St Helens
2. Establish St Helens terminal substation
3. Establish new feeder from Derby to St Helens

Option 1 (recommended option) – Extend 22 kV feeder 57003 from St Marys to St Helens

This option involves the extension of existing St Marys feeder 57003 along the Tasman Highway to St Helens (approximately 11 km) in 2020. The resulting feeder would contain sections of 7/.134, 7/3.75 and 6/1/.144 AAC conductor, and 7/.064 Cu conductor, providing a feeder winter day rating of 4.7 MVA. Reconductoring these sections (approximately 12 km) with 19/3.25 AAC would increase the rating to 13.3 MVA (limited by the 185mm2 Al cable in Scamander).

Option 2 – Establish St Helens terminal substation

This option involves the establishment of a new terminal substation in St Helens in 2020. This option assumes that the 110 kV ring from Derby to St Marys, as proposed by Transend for 2017, has been completed and thus only 25 km of 110 kV feeder works are required as part of the option.

Option 3 – Establish new feeder from Derby to St Helens

This option involves the establishment of a new 22 kV feeder from Derby substation to deload St Marys feeder 57006 in 2020. The feeder would follow the same route as existing feeder 55002 from Derby (approximately 35 km).

Technical comparison

Option	Description	Advantages	Disadvantages
1	Extend 22 kV feeder 57003 from St Marys to St Helens	• Shorter 22 kV feeder run than option 3 • Optimally utilises existing assets • Defers requirement for new St Helens terminal substation	• New feeder must share same route as existing
2	Establish St Helens terminal substation	• Shorter 22 kV feeders than options 1 and 3, resulting in the best reliability	• Requires land acquisition for new substation site
3	Establish new feeder from Derby to St Helens	• Defers requirement for new St Helens terminal substation	• New feeder must share same route as existing

The above technical comparison of options indicates that option 1 provides the best technical solution.

Cost comparison

Option	Initial Capital Cost ($M)	Total Capital Cost ($M)	Net Present Value ($M)
1	2.3	19.8	4.9
2	17.5	17.5	9.2
3	3.5	21.0	5.6

The above cost comparison of options indicates that option 1 provides the lowest cost solution. Details of the NPV analysis are given in appendix B of NW-#30103833-East Coast strategic plan Rev_3.

B.3.3. Possible Solution

Based on the technical and cost comparison, option 1 is considered the preferred option to address the forecast limitations.

Therefore it is recommended to:

- Establish a new section of 22kV 19/3.25 AAC feeder from the end of existing feeder 57003, along the Tasman Hwy to split 57006 in the vicinity of Falmouth St (approximately 11 km).

- Reconductor the 7/.134, 7/3.75 and 6/1/.144 AAC conductor, and 7/.064 Cu conductor sections of 57003, beginning on Esk Main Rd and continuing along the Tasman Hwy to Scamandar, with 19/3.25 AAC (approximately 12 km)

B.4 Load transfers from Avoca to Palmerston

Avoca 22 kV feeder 56004 supplies to the Avoca, Campbell Town and Ross areas and is currently experiencing reliability issues. The current round of reliability works in the area is expected to relieve these limitations until approximately 2020.

Palmerston 22 kV feeder 51003 is also experiencing reliability issues. It is expected that the establishment of Westbury substation in 2017 and Longford substation in 2021 will address the limitations on 51003. This would enable the feeder to supply further towards Campbell Town, thus deloading 56004 and improving reliability in the area.

A new 5 km section of 22kV feeder could subsequently be installed between Ross and Campbell Town to establish a second supply into Ross.

Appendix C. Long Term Plan (>10 years) – Constraints Options and Solutions

C.1 Install fans on Avoca Transformer

The existing Avoca transformer was installed in 1997 and is a standard Transend 17/25 MVA unit without radiator fans installed. Thus the installation of fans can increase capacity to 25 MVA.

It is proposed that a new 25 MVA transformer be installed at Avoca as soon as practical to provide firm capacity at the substation. The installation of the second transformer is currently planned for 2014 by Transend. The existing 10 MVA unit may have radiator fans installed at the same time, or this could be deferred until 2026 when load at Avoca is forecast to exceed 10 MVA.

C.2 Establish Swansea Substation

The load at St Marys substation is forecast to exceed firm capacity in 2035.

At that time there is forecast to be approximately 15 MVA of load in the Swansea area, supplied by three long 22 kV feeders from Avoca, St Marys and Triabunna which are expected to be experiencing reliability issues.

To address these limitations, it is proposed to establish a new substation in the Swansea area with 2 x 25 MVA transformers. The substation would deload Avoca, St Marys and Triabunna substations as well as addressing the reliability issues on the 22 kV feeders into the Swansea area.

66 kV option

Under the 66 kV development path Swansea would be established as a 66/22 kV substation, supplied by a new 66 kV circuit from Avoca (approximately 60 km). At the same time a 110/66 kV substation would be established at Avoca. To defer costs it is proposed to install a single 110/66 kV transformer at Avoca and single circuit to Swansea initially, with the second transformer to follow on establishment of the future Ross zone substation.

It should be noted that if the Avoca site is not suitable for the establishment of 66 kV injection, an alternative may be to establish a new site along the 110 kV Palmerston to Avoca line. The intersection of the Esk Hwy and Midland Hwy would be a possible location as this would provide an alternate route to Swansea via Lake Leake Rd while shortening the future 66 kV feeder to Ross. However this is not the preferred option as it increases the length of the Swansea feeder, and this route does not provide the opportunity to energise at 22 kV initially to support Swansea.

110 kV option

Under the 110 kV development path Swansea would be established as a 110/22 kV substation, supplied by a new 110 kV circuit from Avoca (approximately 50 km).

C.3 Establish Ross Substation

The load at St Marys substation is again forecast to exceed firm capacity in 2045.

At that time there is forecast to be approximately 8 MVA of load in Ross and Campbell town supplied from two 50 km feeders from Avoca and Palmerston. At the same time there is a forecast load of 6-7 MVA in the Oatlands area, supplied by two 60 km feeders from Sorell and an 80 km feeder from Meadowbank. This quantity of load at the end of such long 22 kV feeders is expected to result in reliability issues.

To address these limitations, it is proposed to establish a new substation in the Ross area with 2 x 25 MVA transformers. The substation would deload Sorell, Meadowbank, Palmerston and Avoca and address the reliability issues on the 22 kV feeders into the Ross and Oatlands areas.

66 kV option

Under the 66kV development path, Ross would be established as a 66/22 kV substation, supplied by a new 66 kV circuit from Avoca (approximately 40 km). The second 110/66 kV transformer would be installed at Avoca at this time.

110 kV option

Under the 110 kV development path, Ross would be established as a 110/22 kV substation, supplied by teeing off the existing Palmerston-Avoca 110 kV circuit (approximately 20 km).

C.4 Replace Avoca 110/22kV transformer

The existing Avoca transformer reaches nominal end of life in 2047. However replacement can be deferred until justified by condition assessment, since load is not forecast to exceed firm capacity beyond 2050.

Appendix D. Technical Data

D.1 Substation loading

Gretna			Capacity with all elements in service (N)		Capacity with one element out of service (N-1)		Maxium Demand 2008		Maxium Demand predicted summer 2009		Maximum Demand predicted for winter 2009	
Elements	No	Emergency Rating MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	Winter MVA	Summer MVA	N-1 Load at Risk	Summer MVA	N-1 Load at Risk
Transfomers	2	1	45	45	22.5	22.5			0	0	0	0
Distributed Subtransmission Feeder NNxxx	1	N/a										

Reference master document # 30006462

D.2 Aurora Zone Substation data sheet

None in the East Coast area

D.3 Transend Station data sheet

Planning Area	Connect Point Substation	Connection Company	Connection Voltage kV	No. Of Connection Points	Type
East Coast	Avoca	Transend Networks	22	4	Distribution
East Coast	St Marys	Transend Networks	22	4	Distribution
East Coast	Triabunna	Transend Networks	22	3	Distribution

Reference master document #30040697

D.4 High Voltage feeder loading

2008/09

Planning Area	Station	Feeder Number	Voltage	Sum of MD (MVA)	Planning Std (MVA)	Load in 5 years (MVA)
Central	Fisher	3 (C252)	11	0.9	5	1.0
		4 (D252)	11	0.0	5	0.1
	Meadowbank	45001	22	1.6	10	1.9
		45002	22	2.1	10	2.4
		45003	22	3.2	10	3.6
	New Norfolk (Terminal)	39563	22	7.5	10	8.3
		39565	22	6.2	10	6.9
		39568	22	2.3	10	2.6
		39569	22	0.1	10	0.2
		39570	22	6.1	10	6.8
		39571	22	3.6	10	4.0
	New Norfolk (Zone)	35010	11	2.9	5	3.2
		35011	11	2.3	5	2.7
		35012	11	2.3	5	2.6
	Tungatinah	T8&T9	22	1.4	10	1.6
	Waddamana	202	22	0.6	10	0.7
	Wayatinah	1	0	0.0	0	0.1
		2	0	0.0	0	0.1
		3	0	0.0	0	0.1

Reference master document #30040697

D.5 Transfer Capacity

- MD transfer capacity with other stations (order of)
-
-
- Brief outline of transmission and subtransmission feeder arrangements, ratings and capabilities

Note it would be useful to include any details of reference documents and schematic diagrams

- HV feeder ratings, current summer and winter loads. MD's
- Provide high and low load forecasts i.e. +/- 10% of base load as above for each HV feeder for the next 10 years
- Indicate anticipated summer and winter load growths for each of the existing HV feeders in the area including ratings of the feeder.
- As above for major zones
- Reference Transend Annual Planning Report.

Appendix E. Planning Criteria and Guidelines

E.1 Transmission Planning Criteria

Transend's planning criteria are fundamentally based on:

- the National Electricity Rules (NER);
- the Electricity Supply Industry (Network Performance Requirements) Regulations 2007; and
- good electricity industry practice

The following criteria are used when planning for the transmission system.

Transmission and transformer loading

- Transmission lines and autotransformer loadings for an intact system or for a contingency (N–1) should not exceed their continuous ratings in planning studies. For supply transformers four-hour emergency ratings can be used to defer augmentations depending on the peak duration of the load duration curve.
- Transmission line loading on circuits covered by NCSPS should not exceed 95 per cent of their rating for an intact system when Basslink is exporting. When Basslink is not in service or importing, standard N–1 criteria applies.

Load interruptions

For an intact system, i.e. where no elements are out of service for maintenance the following should apply as per Network Performance Requirements:

- no credible single contingency event will interrupt more than 25 MW load;
- no single asset failure will interrupt more than 850 MW or, in any event cause a system black;
- the unserved energy to loads interrupted as a result of damage to a network element related to a credible contingency event must not exceed 300 MWh; and
- the unserved energy to loads interrupted as a result of a single asset failure must not exceed 3,000 MWh

Single asset failure that would cause large load interruptions is the loss of a double circuit line, a bus section fault or a bus coupler fault. In calculating unserved energy, the ability to transfer load and the time required for load restoration should be taken into account.

Exposure due to maintenance outage

- Where a network element has been withdrawn from service for maintenance, replacement or repair, the energy exposed to interruption by a credible contingency event must not exceed 18,000 MWh.

In calculating unserved energy, the ability to transfer load should be taken into account.

Maximum repair / replacement time

Minimum Performance Requirements state that for the purpose of calculating unserved energy, any replacements or repairs undertaken, should not exceed the following:

- Transmission line repair – 48 hours
- Transformer replacement – 8 days
- Auto transformer replacement – 18 days

E.2 Distribution Planning Criteria

Key planning standards include: -

System Performance

- Voltage regulation range of + 6% and – 6% of the nominal HV voltage and a LV voltage range of 230/400 V +10% and –2%;
- Power quality standards are recognised in accordance with the TEC, NER and applicable Australian Standards; and
- Tasmanian Reliability Performance Standards

Table Appendix B -1 Tasmanian Reliability Performance Standards

Community category	Frequency standard (Maximum average number of supply interruptions per year)		Duration standard (Maximum total time without electricity in a year measured in minutes)	
	For the category	For each community	For the category	For each community
Critical infrastructure	0.2	0.2	30	30
High density commercial	1	2	60	120
Urban and regional centres	2	4	120	240
Higher density rural	4	6	480	600
Lower density rural	6	8	600	720

Source: Tasmanian Electricity Code

Capacity

Maximum average loading considerations for distribution feeders facilitating HV feeder interconnectivity;

- 22 kV – 10 MVA continuous and 15 MVA (typically one hour) emergency;
- 11 kV - 5 MVA continuous and 7.5 MVA (typically one hour) emergency.

Security of supply

Group firm philosophy or a deterministic planning standard, e.g. “N-1”, dependent on elements of security, load and exposure to risk

Schedule 5.1.2.2 (a) of the NER states:

> *“In the* satisfactory operating state*, the* power system *must be capable of providing the highest reasonably expected requirement for* power transfer *(with appropriate recognition of diversity between individual peak requirements and the necessity to withstand* credible contingency events*) at any time.”*