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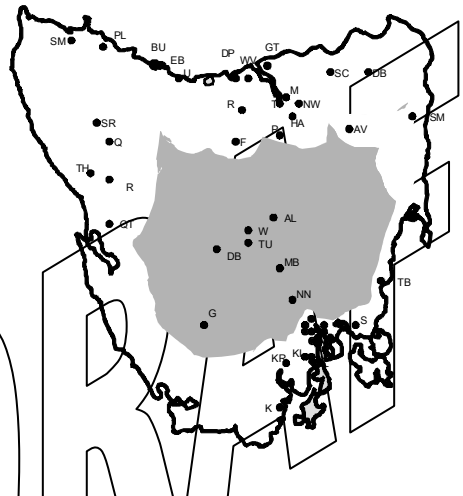

CENTRAL AREA

DEVELOPMENT PLAN

REV NO.	DATE	REVISION DESCRIPTION	APPROVALS	
0		Original Issue	Prepared by	
			Reviewed by	
			Approved by	

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1. EXECUTIVE SUMMARY

The Central area is characterised by low customer density but requiring a widespread rural system to service its customers. In general terms the individual substations have power transformers typically 5 MVA and below.

It has rugged terrain, which is frequently inaccessible during winter storms. This area once required significant investment in substations and general infrastructure to meet the capacity and reliability requirements. Now the general highlands area has small loads but with significant tourist and economic industries, for example a fingerling hatchery at Wayatinah.

The growth for these areas is now generally low and as such requires little investment to meet capacity criteria. The compelling issues are now of reliability and security.

To facilitate the current and forecast load, the Central planning area maintains a distribution network at 22 kV and 11kV, incorporating a number of local distributing zone substations. The network supplies 9,591 connected customers supplied by 4 11 kV substations and 8 22kV substations. A total of 1,876 km of OH and UG circuit distribution network at 11 and 22 kV supplies the area..[1]

The identified or known large constraints are as follows:

- Wayatinah and New Norfolk are aged substations with severely deteriorated transformers and general infrastructure.
- Gretna and Westerway are small rural zones supplying the local district at 11 kV. These stations have severely deteriorated transformers. Analysis has shown that it is uneconomic to replace them. Their respective 11 kV distribution networks will be augmented to 22 kV thus allowing these minor stations to be removed. The primary drivers for undertaking this program are aged replacement of the zone equipment and the network constraints associated with limited interconnectibility with the adjacent 22 kV distribution network.
- Derwent Bridge provides ongoing challenges with supply security. This area has significant tourist industry. Derwent Bridge is a single transformer station. The station does not meet Transend criteria for a second transformer. Thus, any maintenance on the transformer or its circuit breaker causes system difficulty. It has been general practice to provide firm support by mobile generation. There are minor issues of voltage stability and generator connection.
- Oatlands and surrounding areas continue to exhibit signs of reliability stress. Whilst being adequately backed up from three separate stations;

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

Meadowbank, Avoca and Sorell, some ongoing reliability issues give cause for concern.

- The areas around Kempton and Melton Mowbray have overloaded feeders and acknowledged high voltage power quality problems. In general this area is being seen as having significant potential for irrigation, e.g. Clyde Irrigation Project, and as a consequence high use of electric water pumping. This network voltage is 11 kV, which is particularly intolerant to large motor starting which gives rise to ongoing power quality issues.
- Tungatinah will have potential security issues. Transend is proposing in its rebuild of this station to replace the two units with a single unit. This will give rise to concerns with the areas security. Aurora does not have mobile generation capability to match the load profile.

To address the above constraints the following is being proposed:

- Gretna, Westerway and Hamilton analyses have shown that it is not warranted to replace these stations like for like. Their respective 11 kV distribution networks are to be augmented to 22 kV thus allowing these minor stations to be decommissioned.
- Wayatinah substation is to be replaced in 2009/10 at a budget cost of $2.9M.
- New Norfolk substation is to be replaced by 2010/11 at a budget cost $3.5M. Of note this will be using ex Sandy Bay and East Hobart power transformers to defer costs.
- At Derwent Bridge minor expenditure to provide a ‘plug in’ generator connection is planned in 2009/10 along with minor augmentation to manage the unsymmetrical load.
- For Oatlands, a Targeted Reliability Improvement Program (TRIP) will commence in 2009/10 with commissioning in 2010/11.
- The areas of Melton Mowbray and north of Kempton will be progressively augmented from 11 kV to 22 kV and transferred to Meadowbank supply. The first stage, new connection at 22 kV, near Bothwell, is nearly complete with further 11/22 kV augmentations to be constructed in 2009/10 at a budgeted cost of $300k. There will be further work, possibly in 2010/12, to complete the conversion. This work has a conceptual cost of $400 k. This will also have the benefit to reduce load on Bridgewater Substation and in particular feeder 48190.
- Further discussions are being held with Transend as to the feasibility of a second transformer at Tungatinah. Investigations are being conducted into the acquisition of a mobile generator of sufficient size as an alternative option.

TABLE OF CONTENTS

2. EXISTING SYSTEM

2.1 Substations

The Central planning area has a number of Transend owned Injections Points and Aurora owned substations as follows:

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

Transend owned substations

- Arthur's Lake – *(click here to see the 110 / 6.6 kV single line diagram)*
- Derwent Bridge - *(110 / 22kV)*
- Meadowbank – *(110 / 22kV)*
- Tungatinah - *(110 / 22kV)*
- Waddamana - *(single line diagram not available electronically)*
- New Norfolk 22 kV – *(110/ 22kV)*

Aurora owned substations

- Gretna Zone
- Hamilton Zone
- Todd's Corner Zone
- Wayatinah Zone
- Westerway Zone. – nomenclature for distributed zone substations
- New Norfolk Zone 11 kV

Hydro Tasmania owned substations

- Gordon
- Wayatinah station

Embedded Generators

- Tods Corner

2.2 Supply Network

There is a mixture of distribution voltages within this planning area. The terminal substations within the Central area have 22 kV distribution networks, with the exception of Arthur's Lake, which supplies a pump station at 6.6 kV.

The zone substations have 11 kV distribution networks, with the exception of Tod's Corner and Wayatinah. This poses reliability issues due to the difficulty of transferring load between the interspersed 11 kV and 22 kV networks, as well as transferring load with between neighbouring planning areas.

Wayatinah takes supply at 11 kV from local hydro generation and steps up to 22 kV for distribution.

Tod's Corner is supplied from a 1.6 MVA 6.6 kV generator which recovers energy from the water pumped from Arthur's Lake pump station. This generator only operates while Arthur's Lake is pumping, and it generates into Arthur's Lake terminal substation station through a 6 km 6.6 kV feeder.

2.3 Network Statistics

Central area network statistics [2]

11kV:

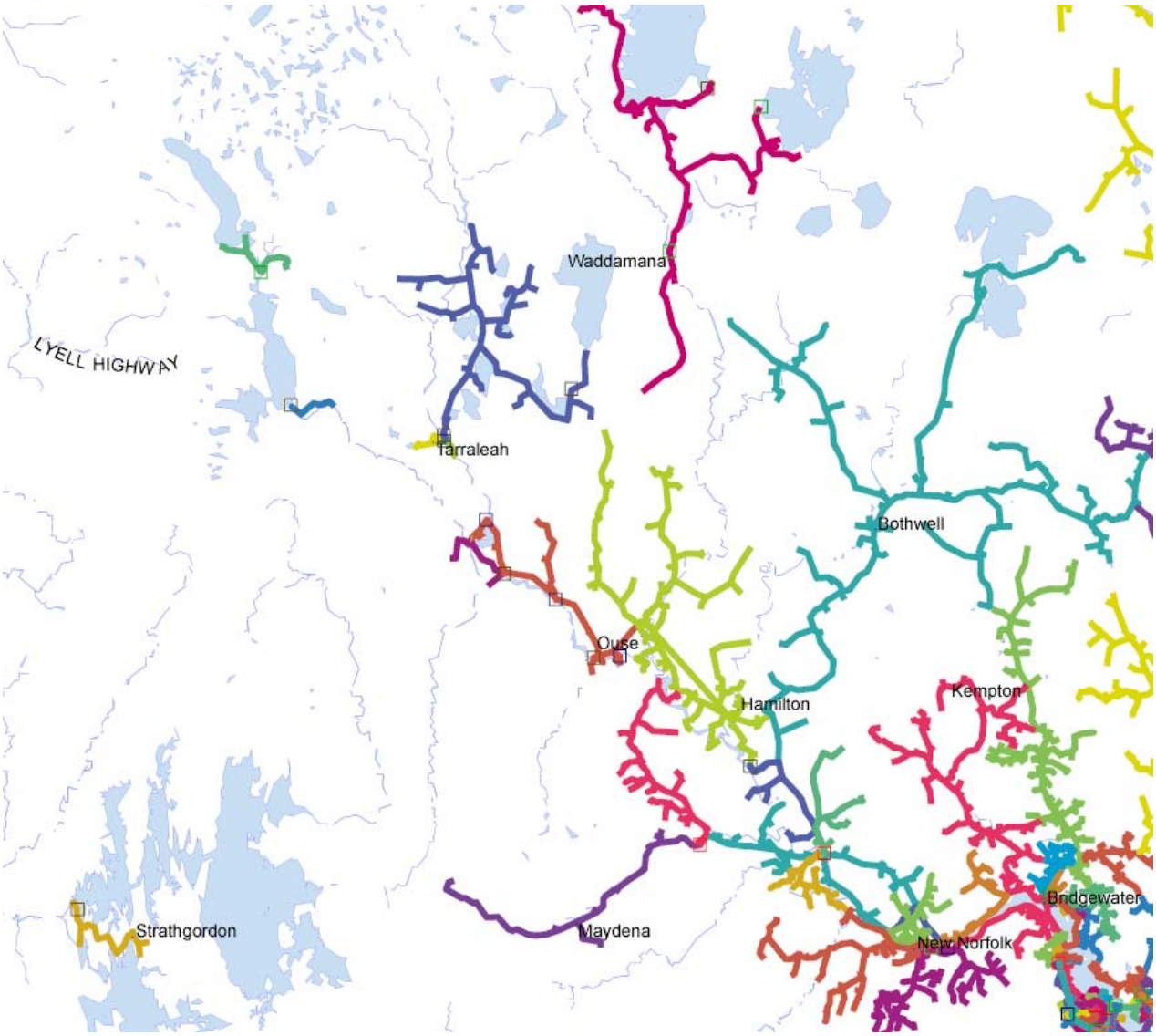
11kV circuit length	300	km
Connected customers	2,895	
Connected transformer capacity	41,310	kVA
Customer density	10	per 11kV circuit km
Transformer capacity density	138	kVA per 11kV circuit km

22kV:

22kV circuit length	1,576	km
Connected customers	6,696	
Connected transformer capacity	130,806	kVA
Customer density	4	per 22kV circuit km
Transformer capacity density	83	kVA per 22kV circuit km

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

The maps below show the geographic are referred to as Central.



3. LOCAL PLANNING ISSUES

3.1 Long Term System Strategy

Central planning area will continue the development of a 22 kV distribution network and an 11 kV distribution network where it is economic. Where existing 22/11kV zone substations reach their end of life, conversion of the 11kV networks to 22kV and retirement of the zone substation will be considered.

The existing distribution arrangement of both 11 kV and 22kV distribution networks will co-exist for the foreseeable future.

Embedded Generation options will be encouraged where technically feasible at 22, 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

The Central planning area encompasses the.

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

- Central Highlands Council
- Northern Midlands Council
- Southern Midlands Council and
- Derwent Valley Council

The joint land use planning strategy for all four councils implies that growth will be via infill and surrounding existing infrastructure.

Other relevant authorities include:

- Department of Infrastructure, Energy and Resources (DIER); and
- Southern Water Tasmania.

3.3 Existing Critical Loads

Central 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 Central 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 – Central Critical Loads

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

3.4 Future Developments and Restrictions

- Council planning schemes
- Irrigation systems

3.5 Reliability for the area.

The Central Planning Area includes the following Reliability communities:

- Urban - New Norfolk
- High Density Rural - Brighton Rural, Granton – Magra, Oatlands, Wayatina
- Low Density Rural – Bothwell, Derwent Valley Rural, Highlands

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

On figures for the 8 months to February 2010 the following communities appear likely to have reliability performance worse than target in 2010:

- Bothwell SAIDI and SAIFI
- Highlands SAIDI

- Oatlands SAIFI

The reliability communities in the Central Planning area have shown adequate reliability performance in 2009/10 up to February 2010.

3.6 Asset issues

There are a number of asset issues throughout the central area. Zone substation transformers are at or beyond their nominal end of life or in poor condition at the following zone substations:

- Gretna
- Hamilton
- Westerway
- Wayatinah
- New Norfolk

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

NW30084386 - Management Plan 2010: Zone Substations

3.7 Links

LAM Area Mangement Plans relevant to the Central planning area are:

- Highlands NW-#229385-Area Management Plan Highlands 09
- Midlands South NW-#164938-Area Management Plan Midlands South
- Midlands North NW-#226271-Area Management Plan Midlands North

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 2009 10 year load forecast report by UES is used as the basis for this plan. NW-#30083791-(pdf version) Aurora 2009 10year Load forecast - Draft
- Connected kVA (from Web map) customer connections)
- Description

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

	Planning Area	Connection Point Substation	Forecast Growth pa
	Central	Arthurs Lake	#N/A
	Central	Derwent Bridge	0.9%
	Central	Gordon	4.8%
	Central	Meadowbank	3.7%
	Central	New Norfolk	1.9%
	Central	Tungatinah	3.2%
	Central	Waddamana	4.2%
	Central	Wayatinah	3.0%

Although the table above shows relatively high forecast load growth, these are all from a low base. The long term plan for the area addresses projected capacity constraints at Meadowbank and New Norfolk. The other substations in the Central area are not expected to meet capacity constraints in the long term planning horizon till 2050.

Copy of load profile

4.1 Future committed point loads (> 1 MVA)

- None identified

4.2 Possible point loads (> 1 MVA)

- None identified

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

- None identified

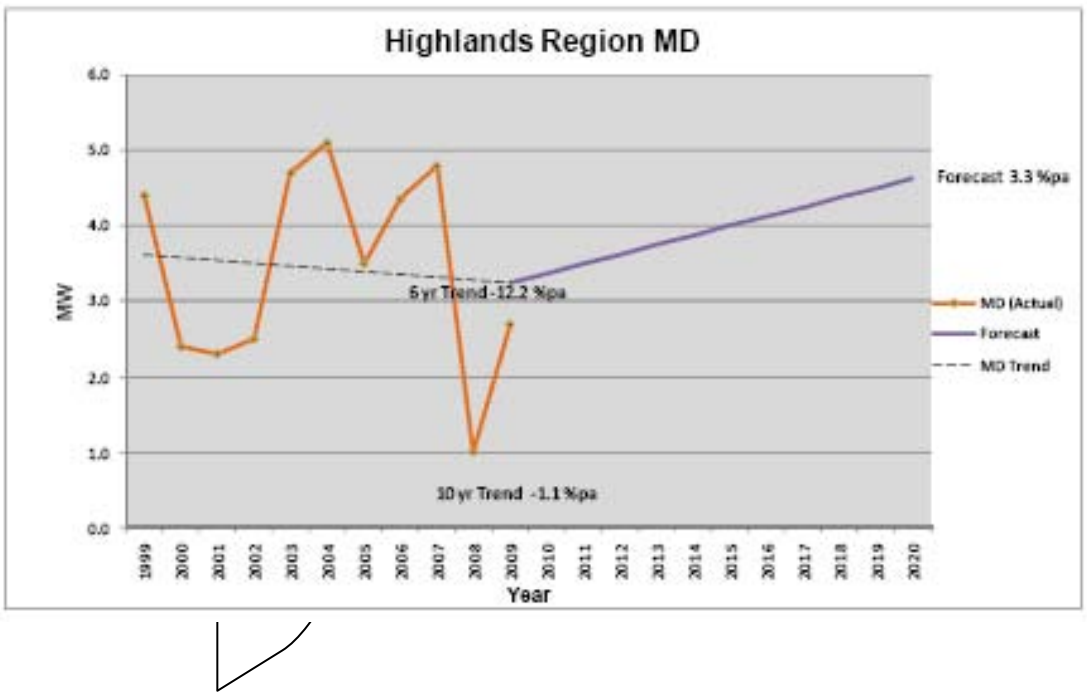
4.4 Possible future embedded generation (> 1 MVA)

- None identified

4.5 Analysis of Load Forecast

Detailed load forecast data is available in the following documents:

- Load model hyperlink / reference NW-#30069003-Central area load model (2009)
- Copy of load forecast graph NW-#30083791-(pdf version) Aurora 2009 10year Load forecast - Draft



5. PLANNING CRITERIA

Aurora's Distribution Network Planning Manual issued in May 1999 is available in DM, ref NW10250570.

More up to date information is included in this document in Appendix E on page 38.

6. CONSTRAINTS (LIMITATIONS)

Constraints in the Central 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

6.1 Summary of Constraints

6.1.1 Zone Substation Constraints

Capacity Constraints				
Substation	**Firm Capacity (MVA)**	**Current Load (MVA)**	**Forecast to exceed (year)**	**Comments**
Gretna				Operational & Aged assets: Rural Zone 22/11kV in poor condition
Westerway				Operational & Aged assets: Rural Zone 22/11kV in poor condition
Derwent Bridge				Security: Single transformer substation

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

6.1.2 Subtransmission Constraints

Capacity Constraints				
Substation	**Feeder**	**Capacity constraint type**	**Forecast to exceed (year)**	**Comments**

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

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

6.1.3 Distribution Feeder Constraints

Capacity Constraints				
Substation	**Feeder**	**Capacity constraint type**	**Forecast to exceed (year)**	**Comments**
Meadowbank	45002	Feeder Section	Already Exceeding	Lake Crescent SWER

Voltage Constraints			
Substation	**Feeder**	**Forecast to exceed (year)**	**Comments**
Bridgewater	48190	Already exceeding	11kV feeder voltage and power quality problems near Kempton

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

6.2 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. Due to the low load in the Central area, in many cases the extra expense required to provide for N-1 secure operation cannot be justified.

- Derwent Bridge provides ongoing challenges with supply security. This area has significant tourist industry. Derwent Bridge is a single transformer station. The station does not meet Transend criteria for a second transformer. Thus, any maintenance on the transformer or its circuit breaker causes system difficulty. It has been general practice to provide firm support by mobile generation. There are minor issues of voltage stability and generator connection.
- Wayatinah and New Norfolk are aged substations with severely deteriorated transformers and general infrastructure.
- Tungatinah will have potential security issues. Transend is proposing in its rebuild of this station to replace the two units with a single unit. This will give rise to a lower security. Aurora do not have mobile generation capability to match the load profile. .

6.3 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**	**Transfer Substation**
Meadowbank					
New Norfolk					

The table shows that…

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

- Operational requirements Gretna and Westerway are small rural zones supplying the local district at 11 kV. These stations have severely deteriorated transformers. Analysis has shown that it is uneconomic to replace them. Their respective 11 kV distribution networks will be augmented to 22 kV thus allowing these minor stations to be removed. The primary drivers for undertaking this program are aged replacement of the zone equipment and the network constraints associated with limited interconnectibility with the adjacent 22 kV distribution network.

6.4 Power Factor

6.5 LV issues

The Great lake shack areas has widespread low voltage issues due to load growth and system configuration.

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	1,178	2,263	32	221
>= 50 kVA	861	7,120	16	798

7. SHORT TERM PLAN (<5YR)

The Central Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30141787-Central strategic plan Rev_5_2010 final report.

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

Year	**Proposed Project**	**Proposed Outcomes**
2013	Arthurs Lake Transformer replacement by Transend	Existing single phase transformers at end of life to be replaced

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

8. MEDIUM TERM PLAN (5 TO 10YR)

The Central Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30141787-Central strategic plan Rev_5_2010 final report.

A summary of the proposed works between 2016 and 2020 in the Central planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes
		None identified

9. LONG TERM PLAN (10YR+)

The Central Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30141787-Central strategic plan Rev_5_2010 final report.

A summary of the proposed works beyond 2020 in the Central planning area is outlined in the following table.

Year	Proposed Project	Proposed Outcomes
2023	Install second transformer at Meadowbank	Increase firm capacity at Meadowbank
2029	Replace New Norfolk 110/11kV transformers at end of life	May involve upgrading 11kV distribution network to 22kV

Further details of these and other potential long term projects in the Central area are discussed in Appendix C below.

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 eg Councils and Government Departments, is essential to ensure optimum outcomes.
- Iit would be useful to include any details of reference documents and schematic diagrams indicating current substation layout and HV feeder arrangements.

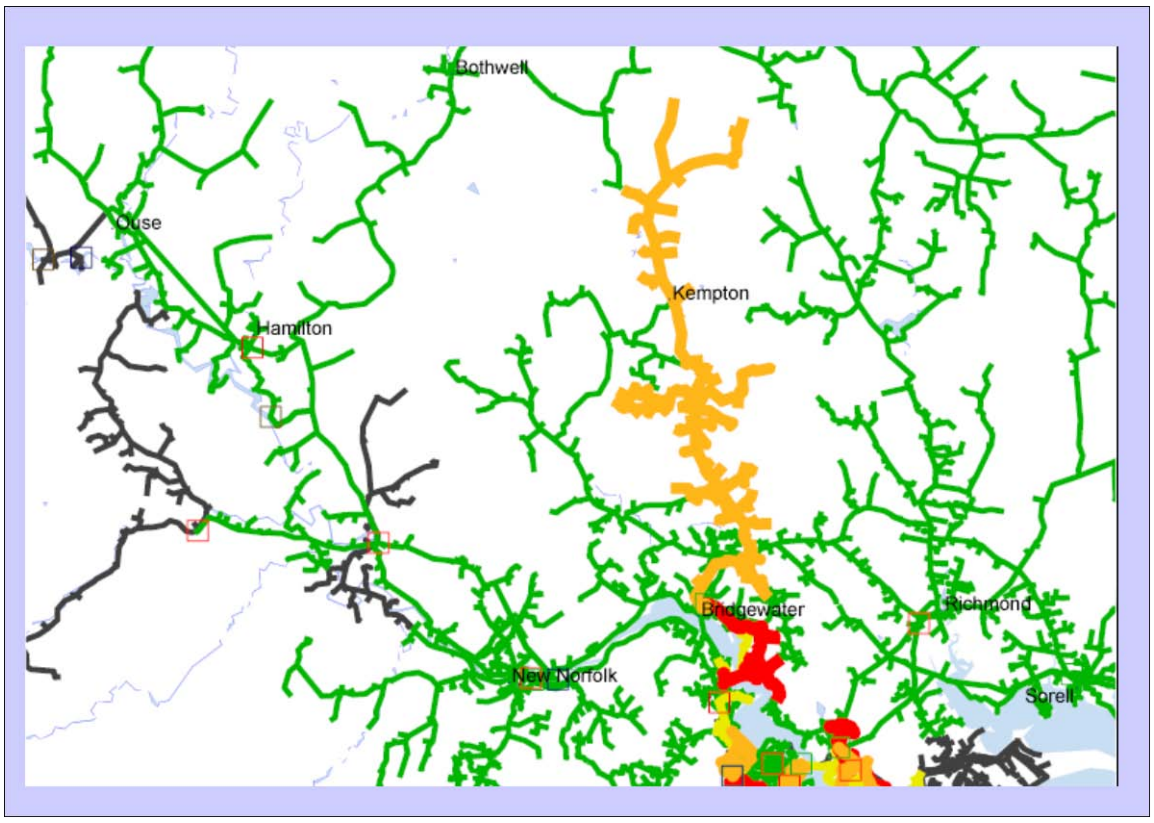
Appendix A. Short Term Plan (<5 years) - Constraints Options and Solutions

A.1 Arthurs Lake terminal substation

The transformers at Arthurs Lake terminal substation were installed in 1964 which implies a nominal end of life in 2014. Transend have indicated that the three single phase transformers will be replaced with a single 12 MVA 110/6.6 kV unit in 2013.

A.2 Kempton / F48190

- The areas around Kempton and Melton Mowbray (F48190) have overloaded feeders and acknowledged high voltage power quality problems. In general this area is being seen as having significant potential for irrigation, eg Clyde Irrigation Project, and as a consequence high use of electric water pumping. This network voltage is 11 kV, which is particularly intolerant to large motor starting which gives rise to ongoing power quality issues.



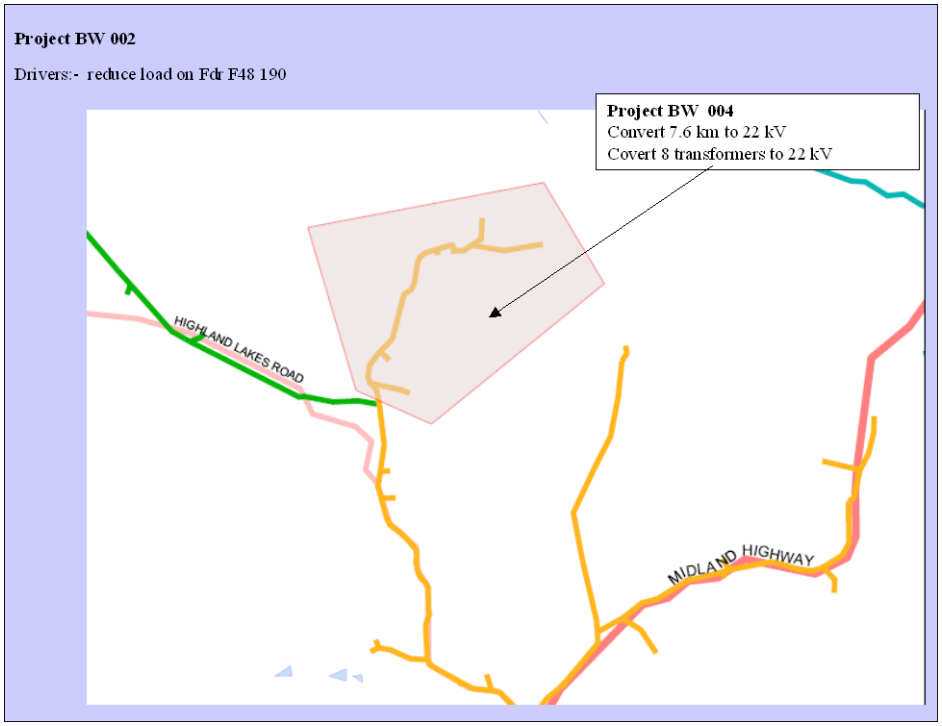
A.3 Bridgewater F48195 (Northern 11kV network- Kempton)

A.3.1. Options considered

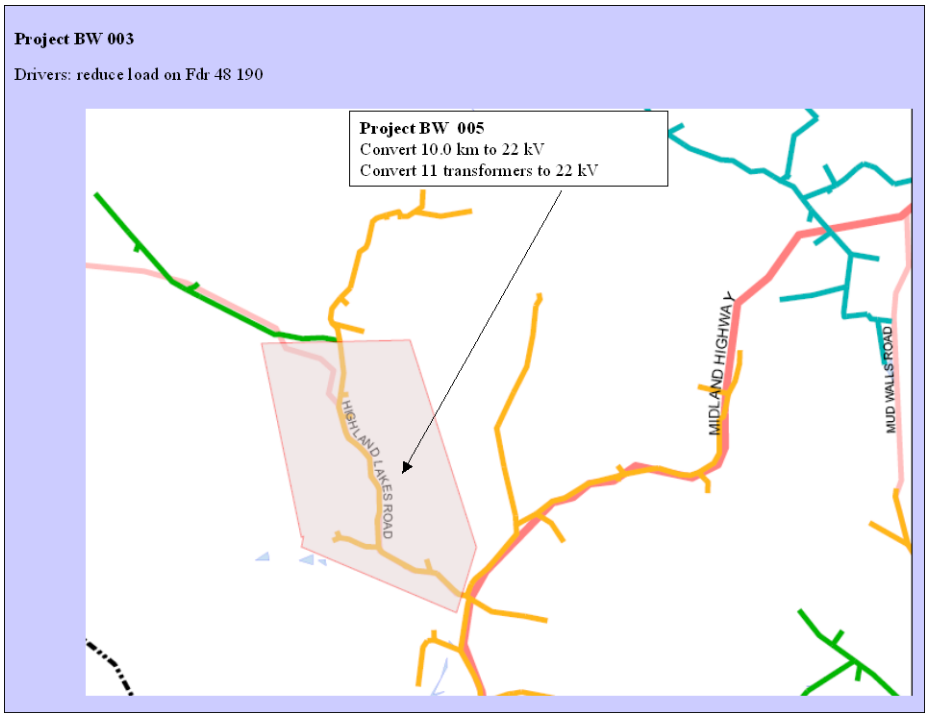
- Maintain 11 kV network
- Augment to 22 kV network
- Do nothing

A.3.2. Possible Solution

- The areas of Melton Mowbray and north of Kempton will be progressively augmented from 11 kV to 22 kV and transferred to Meadowbank supply. The first stage, new connection at 22 kV, near



Bothwell, is nearly complete with further 11/22 kV augmentations to be constructed in 2009/10 at a budgeted cost of $300k. There will be further work, possibly in 2010/12, to complete the conversion. This work has a conceptual cost of $400 k. This will also have the benefit to reduce load on Bridgewater Substation and in particular feeder 48190.



- Further discussions are being held with Transend as to the feasibility of a second transformer at Tungatinah. Investigations are being conducted into the acquisition of a mobile generator of sufficient size as an alternative option.

A.4 Gretna and Westerway Zone substations

Both Gretna and Westerway zone substations are in poor condition and approaching the end of its useful life. It is proposed to decommission both the substations and augment the existing 11kV distribution network to 22kV to be supplied from Meadowbank terminal substation. This work is expected to be completed in 2013/14.

The nearby Hamilton 22/11 kV rural zone substation was decommissioned in 2009.

A.4.1. Options considered

- Replace Zone substations on a like for like basis.
- Augment 11kv to 22 kV to negate need of substations.
- Do nothing

A.4.2. Possible Solution

Gretna and Westerway analyses have shown that it is not warranted to replace these stations like for like. Further action has to be undertaken to address the likely failure of the zone transformers equipment. Further the embedded nature of 11 kV in a predominately 22 kV system does not allow for easy transfer of load for maintenance and emergency needs.

- Reference to existing studies / approved studies

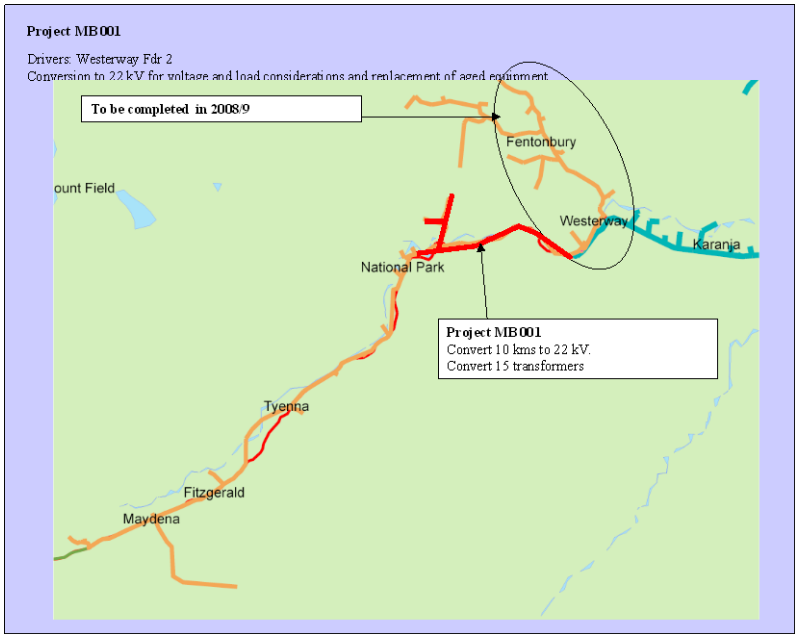
- The respective 11 kV distribution networks are to be augmented to 22 kV thus allowing these minor stations to be decommissioned.
  - Gretna is in the first stage of a number of major stages. Stage 1 work is being conducted in 2009/10 at a budgeted cost of $100k

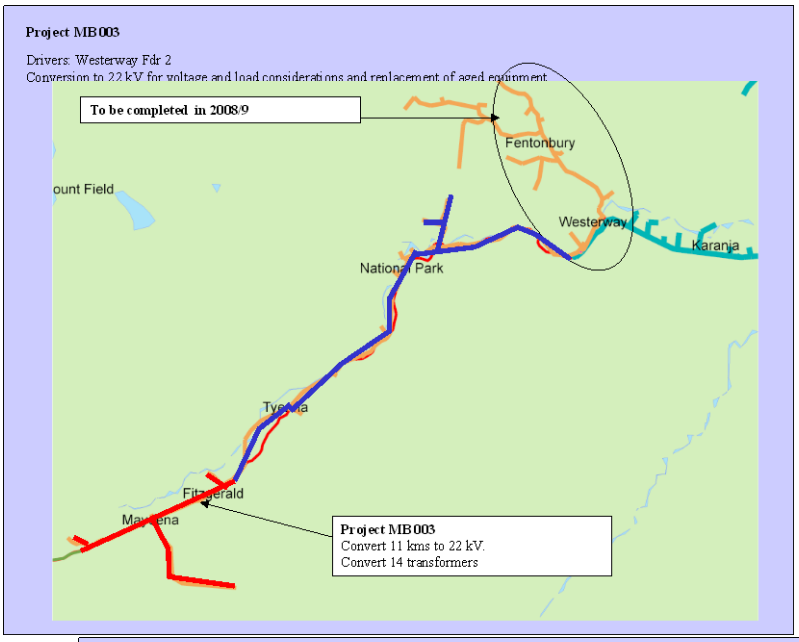
Diagram

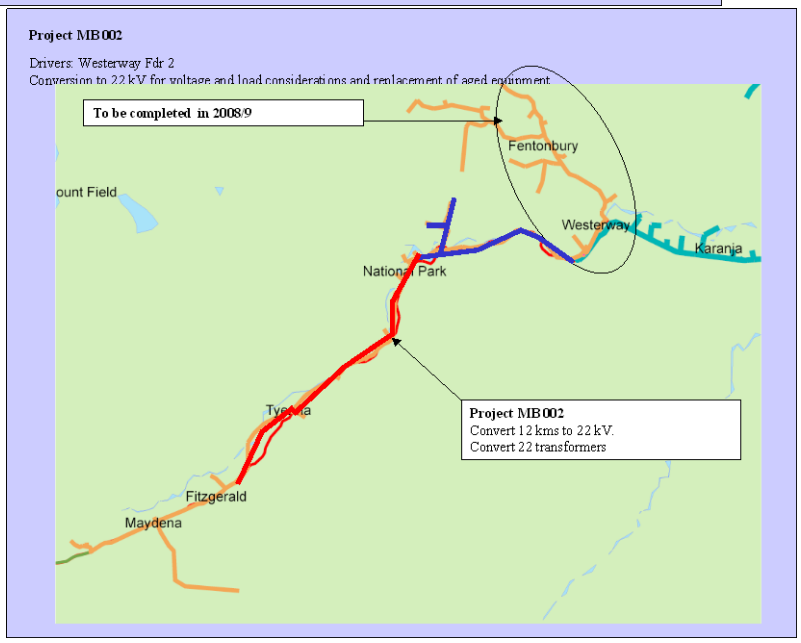
  - Gretna remaining stages are to commence in 2012/13 and to be completed by 2013/14 at a budget cost of $1.6M.

Diagram

  - Westerway is to be 60% completed in 2009/10 at a cost of $2.8M. Further work to finalise 11 kV to 22 kV augmentations is planned in 2011/12 at a nominal cost of $400k

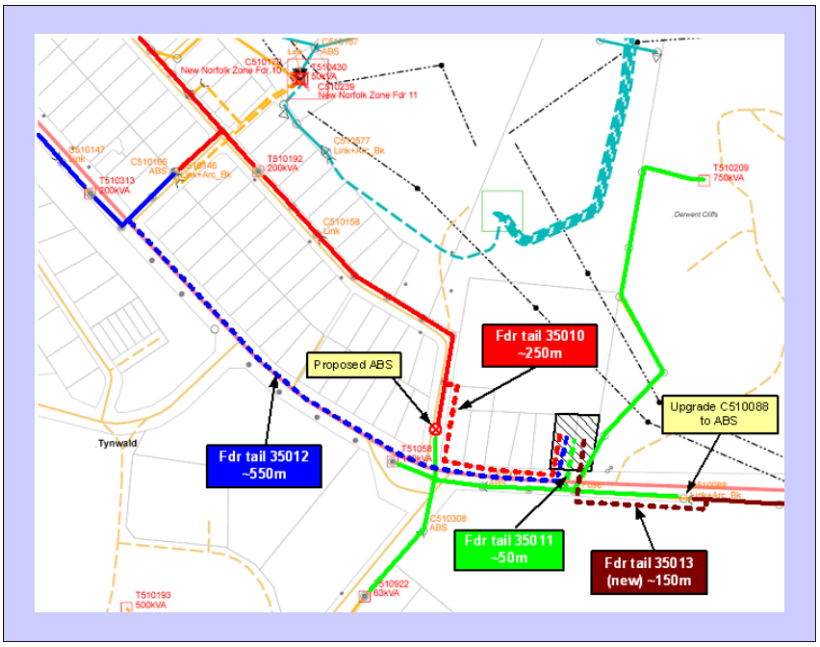






- Wayatinah substation is to be replaced in 2009/10 at a budget cost of $2.9M.

- New Norfolk substation is to be replaced by 2010/11 at a budget cost $3.5M. Of note this will be using ex Sandy Bay and East Hobart power transformers to defer costs.



A.5 Lake Crescent SWER system / F45002

- Blah blah blah

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

B.1 Derwent Bridge Security

B.1.1. Options considered

- Do Nothing
- Install remedial works to allow connection of mobile generator

B.1.2. Possible Solution

At Derwent Bridge minor expenditure to provide a ‘plug in’ generator connection is considered the appropriate solution. Do nothing does not address the issue and the remedial action is relatively inexpensive

It is intended to install prove a ’plug in’ generator solution and minor augmentation (2 wire to 3 wire) of the existing 22kV network to manage the unsymmetrical load.

B.2 Tungatinah Security

B.2.1. Options

- Have Transend install a 2nd transformer.
- Maintain existing transformers
- Do nothing.
- Provide 22 kV link between Tungatinah substation and Wayatinah substation

B.2.2. Solutions

- Keep old transformers, as load is low and manage these into their twilight years.
- Link high level design at $3M is prohibitive.
- Reference to existing studies / approved studies

B.3 Lake Crescent SWER system

B.3.1. Options

- Embedded generator
- Replace SWER from Bothwell
- Install 3 phase link from Ross

B.3.2. Solutions

mmmmm

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

C.1 Derwent Bridge terminal substation

Derwent Bridge terminal station has a single 10 MVA 110/22kV transformer installed in 2008. It supplies a single 22 kV distribution feeder with no ties to any adjacent substation.

With a peak load at Derwent Bridge of approximately 0.2 MVA, the lack of firm capacity is not considered a serious limitation, and certainly not justification for a second transformer or costly feeder works. No major developments are expected for the Derwent Bridge network in the foreseeable future.

C.2 Gordon terminal substation

Gordon terminal station has a single 10 MVA 110/22kV transformer installed in 1978. It supplies a single 22 kV distribution feeder with no ties to any adjacent substation.

With a peak load at Gordon of approximately 2.0 MVA, the lack of firm capacity is not considered a serious limitation, and certainly not justification for a second transformer or costly feeder works. No major developments are expected for the Gordon network in the foreseeable future.

C.3 Meadowbank terminal substation

Meadowbank terminal substation is equipped with a single 10 MVA 110/22kV transformer. Due to load growth on Meadowbank and the neighbouring New Norfolk terminal substation, it is expected that a second transformer will be required at Meadowbank in 2023. In conjunction with this work increased 22kV load transfer capacity from New Norfolk will be required to allow it to be off loaded.

Further detail and discussion on this project is included in The Central Area Strategic Plan provides the background to much of the planning information in this document. It can be found at: NW-#30141787-Central_strategic_plan Rev_5_2010 final report.

C.4 New Norfolk Zone substation

The existing 2 x 15 MVA 22/11kV transformers at New Norfolk zone substation were installed around 1970. Transend's New Norfolk terminal substation is expected to exceed firm capacity in 2029.

A number of options have been identified which may address the loading issue on the Transend station and the likely age and condition issues at the New Norfolk zone substation by 2029. Options identified are:

- Convert the New Norfolk 11kV network to 22 kV and decommission New Norfolk zone substation
- Establish a New Norfolk 110/11kV substation

These options are discussed in detail in NW-#30141787-Central strategic plan Rev_5_2010 final report.

C.5 New Norfolk terminal substation

The existing New Norfolk 110/22 kV transformers were installed in 1987 and so are nominally end of life by 2037. Therefore it is expected that these transformers will be replaced in 2037. The nameplate rating to be installed will depend on whether or not the 11kV New Norfolk network has been retained.

C.6 Tods Corner zone substation

The existing 2 x 22/6.6 kV transformers at Tods Corner substation have been deemed to be end-of-life by 2020. Therefore it is proposed that the transformers be replaced with a new 22/6.6 kV unit in 2020 and the existing 6.6 kV line between Tod's Corner and Arthur's Lake is retained.

This project and other options considered to address this issue are discussed in detail in NW-#30141787-Central strategic plan Rev_5_2010 final report.

C.7 Tungatinah terminal substation

Transend are proposing to replace the two 5MVA 110/22kV transformers at Tungatinah with a single transformer once justified by condition assessment. There is currently no indication from Transend when this will be required, however this will cause security of supply issues to the Aurora 22 kV network supplied from Tungatinah. The option to connect to the Wayatinah 22 kV network by installing 11km overhead feeder at a cost of $3M has been ruled out as being too expensive. Discussions with Transend are ongoing regarding installation of a second transformer at Tungatinah.

Peak load on Tungatinah is less than 2 MVA, so capacity issues are not expected for the foreseeable future.

C.8 Waddamana terminal substation

Waddamana terminal substation is equipped with a single 5 MVA 110/22 kV transformer, providing no firm capacity. The transformer was installed in 1997. Waddamana has a peak load of approximately 1.2 MVA, which is adequately backed up by the

Arthur's Lake and Tod's Corner substations. No capacity issues are expected at Waddamana for the foreseeable future.

C.9 Wayatinah zone substation

Wayatinah is expected to remain a single transformer 110/22 kV substation up to 2050. The backup supply from Meadowbank will provide sufficient backup for the foreseeable future.

Due to the low load growth in the area, and the backup supply provided by Meadowbank, the Wayatinah feeder network is not expected to require augmentation for the foreseeable future.

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										

New Norfolk			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	?	45	45	22.5	22.5			0	0	0	0
Subtransmission Feeder 39563												
Distributed Subtransmission Feeder 39565												

Wayatinah			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	4	1	45	45	22.5	22.5			14.6	0	30	7.5
Subtransmission Feeder 1												
Subtransmission Feeder 2												

Westerway			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			14.6	0	30	7.5
Distributed Subtransmission Feeder NNxxx												

Reference master document # 30006462

D.2 Aurora Zone Substation data sheet

Planning Area	Zone Substation	Type	Primary Voltage (kV)	Secondary Voltage	No of Feeders In Service
Central	Gretna	Rural - minor	22	11	2
Central	Hamilton	Rural - minor	22	11	0
Central	New Norfolk	Rural - minor	22	11	3
Central	Todds Corner	Rural - minor	6.6	22	1
Central	Wayatinah	Rural - minor	11	22	3
Central	Westerway	Rural - minor	22	11	2

Reference master document #30040697

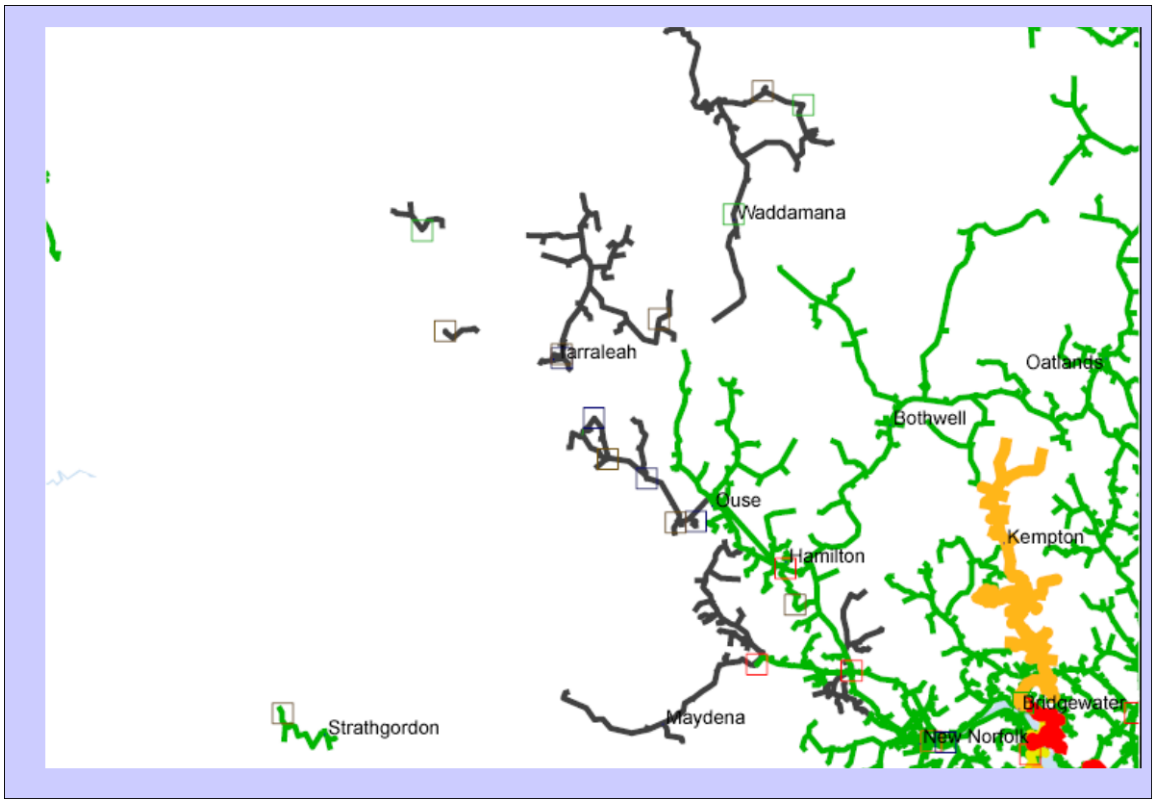
D.3 Transend Station data sheet

Planning Area	Connect Point Substation	Connection Company	Connection Voltage kV	No. Of Connection Points	Type
Central	Arthurs Lake	Transend Networks	6.6	1	Distribution
Central	Derwent Bridge	Transend Networks	22	1	Distribution
Central	Gordon	Hydro Tasmania	11	1	Distribution
Central	Meadowbank	Transend Networks	22	3	Distribution
Central	New Norfolk	Transend Networks	22	8	Distribution & subtransmission
Central	Tungatinah	Transend Networks	22	4	Distribution
Central	Waddamana	Hydro Tasmania	22	1	Distribution
Central	Fisher	Hydro Tasmania	22	1	Distribution
Central	Wayatinah	Hydro Tasmania	11	4	Distribution

Reference master document #30040697

D.4 High Voltage feeder loading

2008



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 ie +/- 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, ie. 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 are 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 E -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.”*