



FINAL REPORT

DEVELOPMENT OF NEW TOMAREE 33/11kV SUBSTATION and A SECOND I32kV FEEDER TO NELSON BAY (to address capacity constraints on the Tomaree Peninsula)

27th March 2009

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EXECUTIVE SUMMARY

This paper has been prepared to report on upgrade work that is proposed to develop the electricity supply network in the Tomaree Peninsula supply area in accordance with Clause 5.6.2 (h) of the National Electricity Rules. The work proposed by this report is classified as a new large distribution asset.

A Consultation Paper on the projected limitation and options for corrective action was published on 12th November 2007. This Consultation Paper included a preliminary application of the Regulatory Test to options that had been identified to address the projected limitations. Two submissions were received in response to the consultation paper. The submissions and EnergyAustralia's response are summarised in Section 5 of this report.

There are various capacity and voltage issues at Nelson Bay zone substation, its 11kV network and 33kV network in the area. To ensure a safe and reliable electricity supply for existing customers, EnergyAustralia is providing additional capacity to meet forecast load demands and facility to retire or refurbish aging infrastructure.

The provision of additional capacity is required to meet network performance requirements set by EnergyAustralia in accordance with Schedule 5.1 of the Rules.

This report covers the following issues:

Section 1 provides a background of the Tomaree Peninsula supply area and the need for augmentation.

Section 2 describes the capacity, voltage, aged asset and other issues in the Tomaree Peninsula supply area. The concept of service standard, as implemented by EnergyAustralia, is discussed.

Section 3 describes the proposed augmentation in relation to the National Electricity Rules (the Rules). The proposed investment of new Tomaree 33/11kV zone substation and second 132kV feeder to Nelson Bay area are classified as large distribution system assets by the Rules.

Section 4 presents the submissions to the Consultation Paper and EnergyAustralia's response to these submissions.

Section 5 describes the strategy options that were considered, including Demand Management as well as:

- Option 1 – New Tomaree 132/11kV zone substation and completion 2nd 132kV feeder (904 Stage 2B), to the Tomaree Peninsula for Summer 2008/09
- Option 2 – New Tomaree 33/11kV zone substation and completion of 2nd 132kV feeder (904 Stage 2B), to the Tomaree Peninsula for Summer 2010/11 in combination with a demand management project to reduce demand in Summer 2009/10

Section 5 presents the results of economic analysis of the options considered, sensitivity analysis and the ranking of the options and identification of the least cost option.

Section 6 concludes that the preferred option is Option 2 – New Tomaree 33/11kV zone substation and completion of 2nd 132kV feeder (904 Stage 2B).

EnergyAustralia's recommended action is the development of a new Tomaree 33/11kV zone substation and its associated feeder works, and the completion of a second 132kV feeder (904 Stage 2B) to the Nelson Bay area. The estimated total capital cost of this option is \$33.7M consisting of \$24.7M for construction of Tomaree 33/11kV zone, which is planned to be commissioned in late 2010, and \$9.0M for construction of feeder 904, which is planned to be completed in 2010/11. The demand management project is considered an operational expense, and involves expenditure of \$1.4M spread over 2009/10 and 2010/11.

1. BACKGROUND

1.1. Introduction

This Final Report has been prepared to advise on the upgrade work that is proposed to be carried out in the Tomaree Peninsula area. The information provided in this Final Report includes:

- A discussion of emerging supply system limitations identified by EnergyAustralia that have lead to the necessity for augmentation of the zone substation;
- A discussion of the service standard that has been adopted for planning purposes;
- Descriptions of options for development of the electricity supply in the area; and
- Details of the outcomes of the cost-effectiveness analysis of the options considered.

This paper advises the works that EnergyAustralia intends to carry out in order to address capacity constraints at Nelson Bay zone substation (ZS) and the associated 11kV network it supplies; and on the construction of a second 132kV feeder to the Tomaree Peninsula to address issues on the existing 33kV network. Note that these are two related but distinct projects and that the proposed feeder development is common to both strategies.

1.2. Supply Arrangements

The Tomaree peninsula is part of the Port Stephens network area and is a geographically isolated area that incorporates suburbs of Nelson Bay, Shoal Bay, Fingal Bay, Corlette, Salamander Bay, Anna Bay and Boat Harbour. The area is a popular tourist destination and growth in the area is predominantly due to medium density tourist related expansion, especially in the vicinity of Nelson Bay, though there is also some residential urban development.

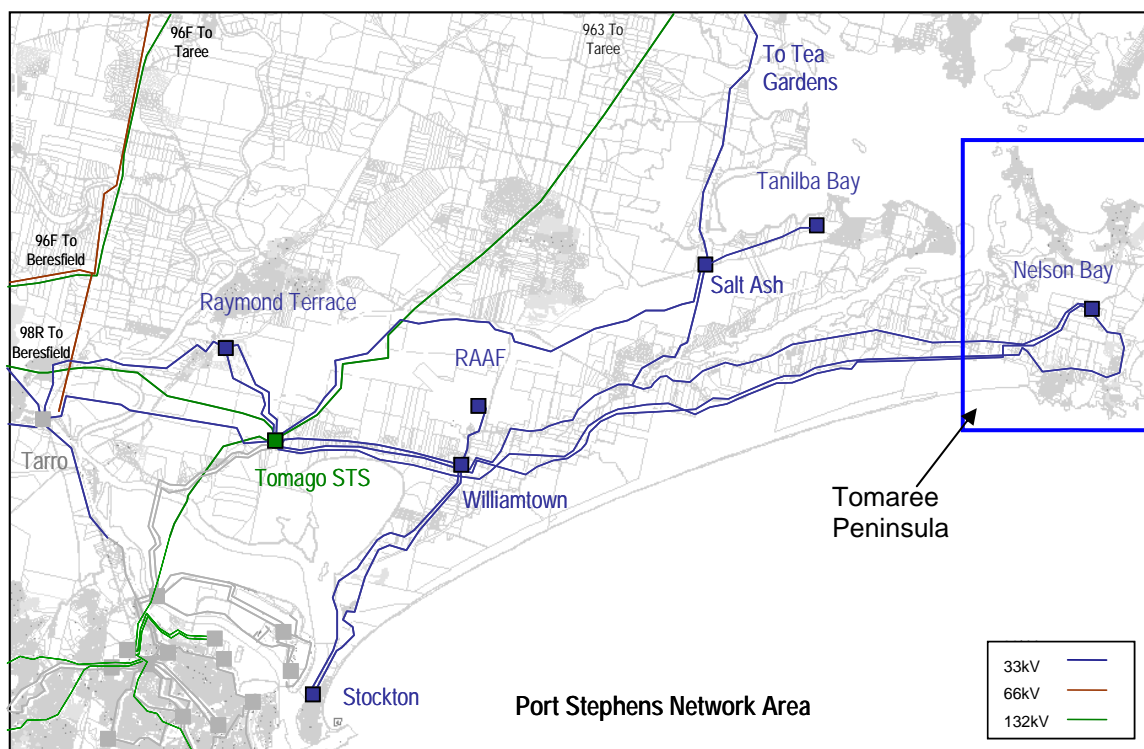


Figure 1: A geographic map depicting the Port Stephens Network area.

Supply to the Tomaree Peninsula is provided by Nelson Bay zone substation, which is supplied via three 33kV feeders from Tomago STS. This network is approaching the capacity that can

reasonably be supplied at 33kV and conversion to a higher supply voltage is necessary. Supply at 132kV has been identified as the most appropriate supply voltage to provide for future requirements of the area.

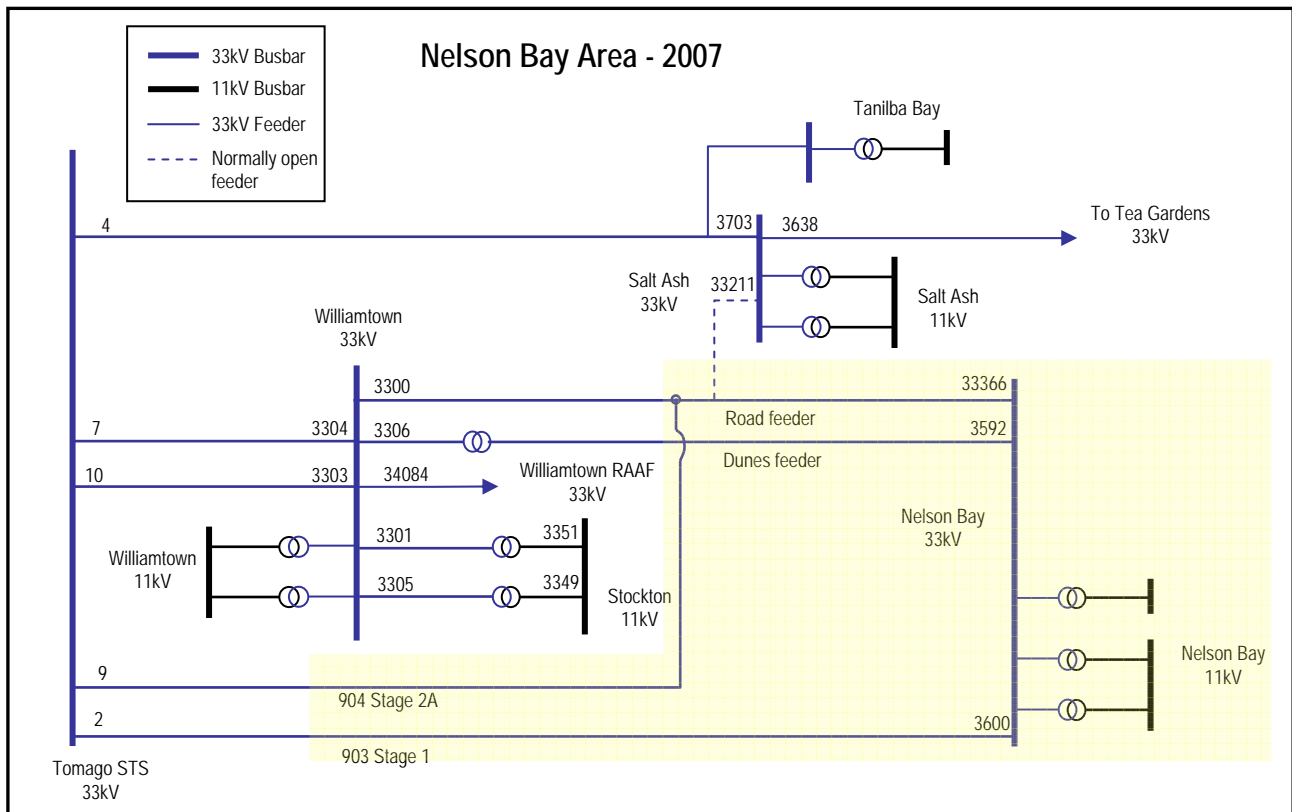


Figure 2: Schematic depicting the normal supply arrangement for the Nelson Bay Area with completion of feeder 904 Stage 2A, which is expected by the end of this year.

1.2.1. 33kV subtransmission network

The existing 33kV network includes two 33kV feeders that supply the Williamtown busbar, which in turn supplies the RAAF base and zone substations at Williamtown, Stockton and Nelson Bay. A third new 33kV feeder connects directly to Nelson Bay from Tomago STS. This new feeder (903) whilst operating at 33kV was constructed at 132kV and was the first stage of the development strategy for the area.

A third direct connection to Williamtown zone substation from Tomago STS, constructed at 132kV, but energised at 33kV, is scheduled for completion in 2011. This feeder is constructed with the intention that it will form part of a second direct 132kV supply to Nelson Bay when supply is converted to 132kV.

1.2.2. Nelson Bay zone substation

Nelson Bay Zone substation consists of a “permanent” two transformer zone substation and a “temporary” single transformer with a separate 11kV busbar. For the loss of the temporary transformer 11kV feeder interconnections between the 11kV circuit breakers allow for the manual transfer of 11kV feeders between the 11kV busbars. The temporary 11kV switch room and third transformer were installed in August 2001 as an interim measure to meet rapidly rising demand.

1.2.3. 11kV distribution network

The Nelson Bay 11kV distribution network presently includes seven 11kV feeders. These feeders are typically long in length, with limited interconnection between feeders. As Nelson Bay is geographically isolated, there is negligible 11kV interconnection with neighbouring zones.

A project to install two new 11kV feeders is under development and is scheduled for completion in early 2009. This project will provide short term load relief to the existing feeders and allow for longer term supply options to be implemented. After the installation of two new 11kV feeders at Nelson Bay Zone no further 11kV circuit breakers are available at the zone substation for future augmentation of the 11kV distribution network.

2. IDENTIFICATION OF NEED FOR AUGMENTATION

2.1. Applied Service Standard

The service standards that are applicable to a consideration of supply constraints affecting the Tomaree Peninsula are summarised below:

2.1.1. Applicable to all Network Elements

The minimum requirement for any network element is that, with all elements in service, the thermal capacity is required to meet at least 115% of forecast demand. The requirements described in the following sections are additional to this requirement.

2.1.2. Zone substations and 33kV subtransmission network

For a failure of a single critical element (i.e. N-1 conditions) within zone substations supplying greater than 10MVA of load and for 33kV overhead network, the forecast demand is not to exceed the thermal capacity for more than 1% of the time i.e. a total aggregate time of 88 hours per annum; up to a maximum of 20% above the thermal capacity. Recovery of load should be within one minute.

The voltage regulation range of the 33kV system is determined by the requirement for zone transformers: to maintain regulation under normal system conditions; and be less than 4% below their set voltage level (allowing for line drop compensation) during first contingency outages. Voltage regulation on the 33kV network also needs to be maintained at adequate levels to ensure satisfactory 11kV distribution network regulation is achieved as described in section 2.1.3.

2.1.3. 11kV distribution network

For urban feeders¹, the expected demand is to be no more than 80% of feeder thermal capacity (under system normal operating conditions), with switchable interconnection to adjacent feeders to enable restoration following an unplanned failure of a single network element (i.e. N-1 conditions).

For 11kV networks, voltage drops of up to 5% are regarded as satisfactory. Higher voltage drops are permissible provided that the network connection provided to low voltage customers is within the limits specified in Australian Standard AS2926.

2.2. Description of Network Issues

The network issues are summarised in the following sections according to their associated asset category, namely: 33kV subtransmission network; zone substations and 11kV distribution network.

Where forecasts are provided, they are based on actual loads up to summer 2005/06 and winter 2006.

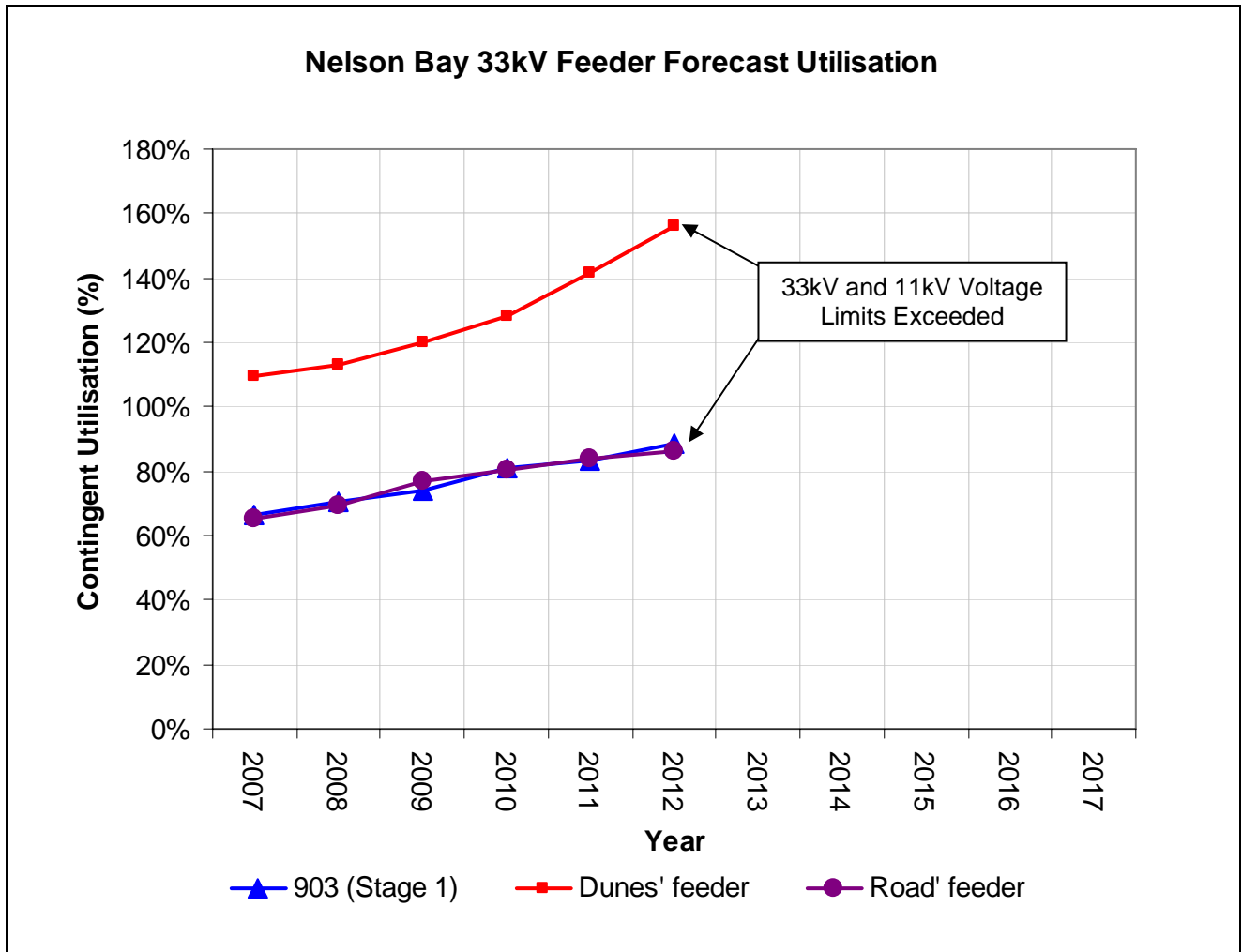
2.2.1. 33kV subtransmission network

Under the applicable design planning criteria, the load that could be reliably supplied to Nelson Bay through the 33kV distribution network is 44MVA. This network is forecast to exceed this limit in summer 2009/10.

¹ Urban, for EnergyAustralia, means an area where the majority of land is zoned for residential and/or commercial and/or industrial use within a town or city type of area which is contiguous with other similar town or city areas with an aggregated population of at least 5,000 people.

In addition, the 33kV feeders between Tomago STS and Nelson Bay zone substation are of significant length and consequently there is substantial voltage drop along the lines at times of peak load. These voltage issues are anticipated to worsen as load on the equipment increases. It is forecast that by summer 2011/12 voltage regulation limits will be exceeded during 33kV feeder outages at times of peak load.

The forecast feeder utilisations are provided in the following graph.

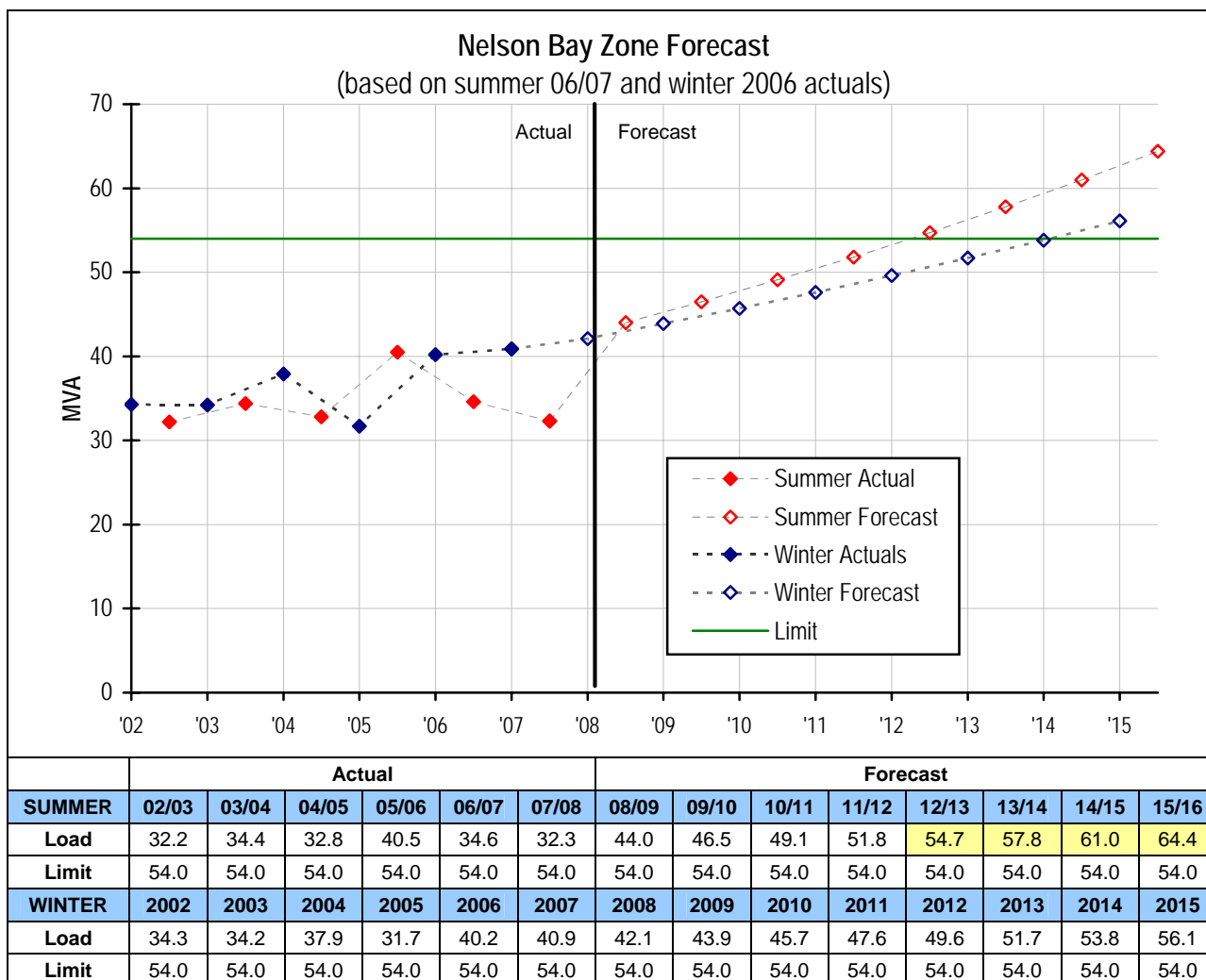


This network was constructed in the 1950s and 1960s and is exposed to the coastal environment, so has been subject to the harsh affects of salty moisture-laden air over a long period of time. Consequently it will likely have increased maintenance requirements in the medium term. Parts of the overhead network will also be subject to encroaching coastal sand dunes in the medium-long term.

2.2.2. Nelson Bay zone substation

Peak loading at Nelson Bay occurs in summer with forecast maximum loading detailed in the table/graph below.

The firm capacity of Nelson Bay Zone is restricted to 45MVA by the rating of the secondary 11kV switchgear. The applicable design planning limit for Nelson Bay zone is 120% of the firm capacity, or 54MVA. Nelson Bay Zone is forecast to exceed this limit in summer 2012/13.



Note: Summer forecast is based on 2006/07 summer actual load (but summer 2007/08 recorded peak load is also shown) and winter forecast is based on winter 2007 actual load.

To comply with revised design planning criteria, a recovery time of less than one minute is required following failure of a single critical element in zone substations of this type. To achieve this, an auto changeover scheme would need to be installed between permanent and temporary 11kV bars; however, with the installation of the two new 11kV feeders previously discussed, there will be no spare 11kV bays to facilitate this.

There are condition issues at Nelson Bay zone substation that need to be addressed in the medium term, however they are not considered drivers for the investment currently under consideration. Future projects to address these issues are included in the economic analysis as they impact the relative net present cost of the options.

2.2.3. 11kV distribution network

Under revised design planning criteria, this type of 11kV network is designed so that the expected demand is no more than 80% of the feeder thermal capacity with switchable interconnection to adjacent feeders to enable restoration for an unplanned network element failure. In addition, the voltage on this network should remain above 95% of the nominal system voltage. The Nelson Bay 11kV network does not currently meet these criteria. Even where feeder utilisations are below 80%, there is insufficient interconnection of this network to enable load to be restored following an unplanned outage.

Forecast feeder utilisations and voltages for this network are provided in the following table. These figures are for the system in its normal configuration (i.e. all elements in service with normal

switching) for peak summer conditions. Highlighted figures indicate that load is forecast to exceed 80% of the thermal capacity of the feeder, or that voltage has fallen below 0.95 per unit (pu)².

Feeder	Forecast Utilisation(%) and Voltages(pu)									
	2007/08		2008/09		2009/10		2010/11		2011/12	
33409	109%	0.99	85%	1.00	90%	1.00	95%	1.00	100%	0.99
33407	107%	0.95	91%	0.96	97%	0.95	103%	0.95	109%	0.94
11460	81%	1.00	81%	1.00	85%	1.00	90%	0.99	96%	0.99
11459	79%	0.97	77%	0.97	81%	0.97	86%	0.96	91%	0.95
11457	84%	0.97	89%	0.97	95%	0.96	101%	0.96	107%	0.95
11454	81%	0.95	48%	0.97	51%	0.97	54%	0.96	57%	0.96
11453	78%	0.94	53%	0.97	56%	0.97	60%	0.96	64%	0.96
33405 (New)	N/A	N/A	54%	0.96	57%	0.95	60%	0.95	64%	0.94
33411 (New)	N/A	N/A	57%	0.98	60%	0.97	64%	0.97	67%	0.96

2.3. Other Issues/Influences/Risks

2.3.1. Environmental Impact Statement (EIS)

Ministerial approval was obtained for construction of the 132kV feeders (903 and 904) to the Tomaree Peninsula and construction is to be in accordance with the environmental impact assessment (EIS), which was exhibited between April and May 2003. A portion of the route negotiated for feeder 904 may require revision due to the need to reduce the risk of sand dune encroachment within the anticipated life of the feeder.

2.3.2. Construction Window

Routes for the new feeder to Nelson Bay are limited and will therefore involve using existing 33kV easements. During stages of the construction, two of the three 33kV feeders that supply Nelson Bay zone will need to be de-energised for safety clearances in order to string conductors. These two feeders can only be de-energised when load is within the rating of a single feeder. Current information shows minimal load growth during seasonal shoulder periods and it is expected that the required outages will be possible for the next 5 years. If loading on the Nelson Bay substation increases at a faster rate than expected, outages of two feeders will become more difficult to obtain. The potential consequences are that work may need to be completed at night when load is lower or generator support may be required.

2.3.3. Community Expectations

- During public consultation for earlier stages of the works at Nelson Bay (2003), the indicative delivery date for feeder 904 was 2006 and for completion of the Tomaree zone substation and associated feeder extensions was 2009. The strategy scope of works and need dates have varied since this public consultation, and base completion date for these works as detailed in the preferred strategy is now 2010/11.

² 'per unit' (pu) is expression a quantity in terms of a nominal or base value. In the case of 11kV distribution voltages, the nominal value is 11kV, and 0.95pu indicates that the voltage is reduced to 95% of this nominal value.

- Concrete poles were pre-ordered in September 2006, on the basis of the existing licence conditions at that time, and are stored on site at pegged pole locations.
- A commitment has been made to landholders containing easements for feeder 903/904 that the access tracks will be grassed once feeder construction is completed.

3. TYPE OF AUGMENTATION

Nelson Bay zone substation and the associated 33kV and 11kV network are classified as distribution system assets by the National Electricity Rules (the Rules).

The Rules (clauses 5.6.2(e) and (f)) require that, where analysis indicates that any relevant technical limits of a distribution system will be exceeded, that the Distribution Network Service Provider must notify any affected Registered Participants of these limitations and of the expected time for corrective action and consult with affected Participants and interested parties on the possible options to address the projected limitations of the relevant distribution system. A Network Service Provider does not need to consult on a network option that would be a small network asset, or for options that do not augment the system.

Each of the options considered under Section 3 are considered new large distribution network assets as they involve a network augmentation with expenditure in excess of \$10 million. They are therefore subject to consultation in accordance with clause 5.6.2(f) of the Rules. Accordingly, EnergyAustralia has published a Consultation Paper on the 12th November 2007. Two submissions were received in response to the Consultation Paper and these are discussed in section 4 below.

The new capacity provided by the proposed augmentation has been necessitated by the need to meet the service standards described in Section 2 and has therefore been treated as a reliability driven augmentation for the purposes of the Regulatory Test. Consequently, EnergyAustralia has used a least cost test to examine the options identified to address projected system limitations.

4. RESPONSES TO THE CONSULTATION PAPER

Two submission to the Consultation Paper were received. Both these submissions proposed potential demand management options relating to deferral of the required completion date for feeder 904 Stage 2B. The first submission was received on the 11th January 2008 and identified two possible options for the installation of diesel generators to provide system support. The second was received on the 24th January 2008 and proposed the installation of solar photovoltaic (PV) panels with battery storage.

These options were investigated as part of EnergyAustralia's Demand Management investigation. It is expected that the feeder 904 Stage 2B can be cost effectively deferred by installing diesel generators in Nelson Bay network. The Demand Management strategy and associated deferral of the feeder 904 Stage 2B have been incorporated into the overall strategy. The PV panels were not considered to be able to provide a cost-effective deferral of the proposed project.

5. OPTIONS CONSIDERED

This Final Report has primarily been provided for consideration of options for two projects:

- Construction of a new (Tomaree) zone on the Stockton St site; and
- Construction of a second 132kV line (feeder 904 Stage 2B) to the Tomaree Peninsula;

However, the choice of configuration for the new Tomaree zone substation will establish the scope of future works and so consideration needs to be given to the broader strategic implications of this decision.

Two technically feasible strategies are under consideration for providing future supply to the Tomaree Peninsula:

- Construction of a new Tomaree 132/11kV zone and reconstruction of the existing Nelson Bay zone to 132/11kV; or
- Construction of a new Tomaree 33/11kV zone and 132/33kV Tomaree STS and refurbishment for the existing 33/11kV Nelson Bay zone.

Both these strategies involve rebuilding the existing 33kV subtransmission network at 132kV and construction of a new “Tomaree” zone substation on a site situated on Stockton Street, Nelson Bay, which was strategically purchased for this purpose³. Details of these strategies and the corresponding project options are provided in the following sections.

The options for construction of the second 132kV feeder (904 Stage 2B) are limited by the requirement for future supply to be at 132kV; and by environmental and community factors, which require that the new feeder be formed by reconstructing the existing network to avoid clearing of sensitive habitat.

A geographic map depicting the feeder route is provided in Appendix B, and also shows the location of the existing zone on Frost Road and the Stockton street site for the proposed Tomaree zone. The 132kV construction of feeder 904 Stage 2B is common between both strategies up to the “Mine Road”.

5.1. Option 1: 132kV/11kV Tomaree zone and Completion of 132kV Feeder 904 Stage 2B in 2009 (Strategy 1)

This option involves:

- Construction of a Tomaree 132/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in 2010/11; and
- Construction of a 132kV feeder 904 Stage 2B to the “Mine Road” and extension from the “Mine Road” to the existing Nelson Bay site on Frost Road. This feeder will initially be energised at 33kV.

The capital cost of this option is \$37.1M for construction of Tomaree 132/11kV zone, including 11kV augmentation and extension of feeders 903 and 904 from the existing Nelson Bay zone site at Frost road to the Stockton street site; and \$11.1M for construction of feeder 904 Stage 2B to Frost road.

The ultimate configuration under this scenario will be two 132/11kV zones supplied via two direct 132kV overhead lines from Tomago STS. The scope of works for this strategy is provided below in Table 1.

In order to energise the new 132kV/11kV Tomaree zone substation, supply to the area needs to be converted to 132kV. Once this is completed, it will not be possible to maintain the existing Nelson Bay zone as there will no longer be a secure 33kV connection to the substation. All load will therefore be transferred to the new Tomaree zone substation. The existing Nelson Bay zone will then be decommissioned and a new 132/11kV zone constructed in its place.

The timing of feeder 904 is determined by the need to supply the new Tomaree zone at 132kV.

³ Public consultation and negotiation with the Port Stephen’s council was undertaken in 2005 for the selection of this site.

Proposed Project	Approximate Cost (\$M)	Indicative Completion
Construct second 132kV feeder (904 Stage 2B) to Frost Road	11.1	2010/11
Tomaree 132/11kV zone substation	26.9	2010/11
11kV augmentation for Tomaree zone	10.2	2010/11
Decommission Nelson Bay 33/11kV zone	1.0	2011/12
Tomago STS 33kV CB replacement	13.9	2011/12
Nelson Bay (new) 132/11kV zone	24.3	2012/13
TOTAL	87.5	

The total net present cost (NPC) of this strategy is \$71.4M, which includes operational and maintenance costs.

5.2. Option 2: 33/11kV Tomaree zone and Deferred Completion of 132kV Feeder 904 Stage 2B with Demand Management

This option involves:

- Construction of a Tomaree 33/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in 2010/11;
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010/11, enabled by this demand management project. Minor works were initiated in 2008 for practical construction reasons; however the works will be spread over three years. This will enable flexibility to prioritise other works and will defer expenditure, producing a net cost saving. Feeder 904 will be constructed at 132kV to the “Mine Road”, and initially energised at 33kV.

The capital cost of this option is \$24.7M for construction of Tomaree 33/11kV zone substation and \$9.0M for construction of feeder 904 Stage 2B. The proposed demand management project is considered an operational expense, and involves expenditure of \$1.4M spread over two years in order to defer the feeder 904 project until 2010/11.

The ultimate configuration under this scenario will be two 33/11kV zones supplied from a 132/33kV STS located near Anna Bay. The STS will be supplied by two direct 132kV overhead lines from Tomago STS to the new STS. The scope of works for this strategy are provided below in Table 2

Under this strategy the existing Nelson Bay 33/11kV zone will be retained. Tomaree 33/11kV zone will be supplied by the existing 33kV network, which will be extended to the new site. Load will be transferred from the existing Nelson Bay zone to the new Tomaree zone to resolve the 11kV and zone capacity constraints, and will allow the removal of the temporary substation at the existing Nelson Bay zone.

With completion of the second 132kV feeder (904 Stage 2B), the system has capacity to supply the network until summer 2014/15, at which point the system is forecast to reach its voltage regulation limit for contingencies during system peak. To resolve this, a 132/33kV STS will be constructed, which will provide 33kV supply to Tomaree and Nelson Bay zone substations. The 132kV feeders (903 and 904) will be converted to 132kV operation to supply the new STS.

It is anticipated that the STS site will be located in the vicinity of the “Mine Road”. Costs to extend feeder 904 from the “Mine Road” to the STS site are included in the connection costs for the STS.

Unlike Strategy 1, the timing of feeder 904 is determined by the thermal capacity of the existing ‘Dunes feeder’. It is considered that demand management would be able to cost effectively defer the need date for this project.

A one year deferral of the completion of feeder 904 Stage 2B is possible by installing 3MVA of portable generation. A second year deferral is enabled by installing 7MVA of portable generation. This DM project is presently under development.

Table 2: Scope of works and approximate timing and costs for Option 2		
Proposed Project	Approximate Cost (\$M)	Indicative Completion
Construct second 132kV feeder (904 Stage 2B) to Mine Road	9.0	2010/11
Demand Management to defer feeder 904 Stage 2B	1.4*	2009-2010
Tomaree 33/11kV zone	24.7	2010/11
Decommission Nelson Bay zone temporary substation	0.1	2010/11
Tomago STS 33kV CB replacement	13.5	2009/10
4MVAr capacitors at Nelson Bay zone	0.7	2012/13
Rebuild 33kV feeder number 1 to Tomaree	2.4	2014/15
Nelson Bay 132/33kV STS	32.7	2014/15
Replace 33kV Switchgear at Nelson Bay zone	6.6	2017/18
TOTAL	89.7	
<i>*: DM is considered an operational cost.</i>		

The total net present cost (NPC) of this strategy is \$68.9M, which includes operational and maintenance costs.

5.3. Consideration of Demand Side Management and Local Generation

The identified system limitations have arisen as a consequence of load growth on the Tomaree Peninsula, and accordingly are subject to consideration of demand management. Investigation into demand management opportunities was carried out in 2008 and its findings are summarised below.

5.3.1. 33kV subtransmission network constraint

Given that the connection infrastructure for a grid-connected diesel generator site still remains at Nelson Bay, this represents one demand management option that is clearly available without further investigation. Demand Management estimate that the cost for this option would be \$403,000 for a one summer deployment of 3MVA and \$958,000 for the second summer with 7MVA portable generation. The project to install these diesel generators is presently under development. A 3MVA relocatable 11kV generator station is planned to be installed for summer 2009/10 and a 7MVA station for summer 2010/11. This project will form part of Option 2 (the preferred option).

5.3.2. Nelson Bay zone and 11kV distribution limitations

The potential for demand management to address the identified system limitations at Nelson Bay zone and on the associated 11kV distribution network was investigated in April 2008. The required demand reduction in order to defer the proposed Tomaree zone substation and its related works by addressing the 11kV network capacity issues is large. Therefore, it is not considered reasonable to expect that it would be cost effective to postpone the construction of the proposed Tomaree zone substation by implementing demand management strategies. However, demand management is considered cost-effective in deferring the feeder 904 Stage 2B as discussed above.

5.4. Preferred Option

The preferred option is Option 2, based on least net present cost in accordance with the regulatory test. This option involves:

- Construction of a Tomaree 33/11kV zone on site owned on Stockton St, which is consistent with a strategy to construct an STS on the Tomaree peninsula (Strategy 2);
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010/11, enabled by this demand management project.

The capital cost of this option is \$24.7M for construction of Tomaree 33/11kV zone and \$9.0M for construction of feeder 904. The demand management project is considered an operational expense, and involves expenditure of \$1.4M spread over 2009/10 and 2010/11.

This option is consistent with a strategy to construct a future 132/33kV STS on the Tomaree Peninsula.

6. APPLICATION OF THE REGULATORY TEST

A preliminary economic analysis has been carried out in accordance with the regulatory test promulgated by the ACCC under clause 5.6.5A of the National Electricity Rules. As indicated in section 4, the “reliability limb” of the test was applied. It involves the comparison of options on an economic basis by carrying out NPC analysis for each of the three options. The option which satisfies the regulatory test is the one that minimises the present value of the costs of meeting relevant service standards discussed in section 2.

EnergyAustralia has included a range of parameters in comparison of options such as change in load growth and variations in material costs. In summary, the two options presented are technically and economically comparable, given due consideration to all capital and operating costs that are able to be defined and quantified.

6.1. Base Case Analysis

The options considered are ranked by cost considering 8.5% p.a. discount rate as the base case in the following table. The NPC is in 2007/2008 real dollars (\$M) and also includes operation and maintenance costs. The options are considered in the context of the broader area strategy. Detailed analysis is provided in Appendix A.

Description	Cost (\$M)	NPC* (\$M)
Option 1: 132/11kV Tomaree and Nelson Bay zones (Strategy 1)	87.5	71.4
Option 2: Construct 33/11kV Tomaree zone and a 132/33kV Nelson Bay STS with Demand Management (Strategy 2)	89.7	68.9

* NPC includes operation and maintenance costs.

6.2. Sensitivity Analysis

Sensitivity Analysis was carried out to consider the impact of different discount factors, growth rates, and escalation rates. The results of the sensitivity analysis is summarised in Table 4 below.

Sensitivity Scenario		Option 1 NPC (\$M)	Option 2 NPC (\$M)
Variation of Discount Rate	7.0% p.a.	74.7	72.7
	8.5% p.a. (Base Case)	71.4	68.9
	10% p.a.	68.3	65.4
Substation Costs	25% increase	82.6	78.5
	25% decrease	60.2	59.3
Sub-transmission Feeder Costs	25% increase	75.6	74.4
	25% decrease	67.2	63.4
11kV Feeder Costs	25% increase	73.6	69.5
	25% decrease	69.2	68.3
Load Growth (ROG)	+1% to base rate	71.4	73.1
	-1% to base rate	71.4	63.9

This analysis concluded that Option 2 is the least cost option under the majority of sensitivity scenarios.

7. CONCLUSION

Of the strategies considered, the strategy to construct a future 132/33kV STS on the Tomaree Peninsula (Option 2) has the least net present cost under the base case and majority of sensitivity scenarios. Therefore, Option 2 is the preferred strategy.

EnergyAustralia intends to implement Option 2. The first stage of this option involves

- Construction of a Tomaree 33/11kV zone on site owned by EnergyAustralia on Stockton street to be completed in late 2010;
- Implementation of a demand management project to delay the thermal constraint on the 33kV network until summer 2010/11; and
- Delayed completion of feeder 904 Stage 2B until 2010, enabled by this demand management project.

The estimated total capital cost of this option is \$33.7M consisting of \$24.7M for construction of Tomaree 33/11kV zone and \$9.0M for construction of feeder 904. The demand management project is considered an operational expense, and involves expenditure of \$1.4M spread over 2009/10 and 2010/11.

This service availability dates indicated above may change if the project is affected by circumstances beyond EnergyAustralia's control, such as changes in the timing of customer load increases or other issues such as: delays in the approval process, equipment supply difficulties, unforeseen technical constraints, acts of God and industrial action.

8. CONTACT DETAILS FOR ENQUIRIES

This report recommends the construction of a new large distribution network asset. Registered Participants may dispute the recommendations of the report under Clause 5.6.2(i) of the Rules. Registered Participants who intend to dispute the recommendations of this report must do so within 40 business days of the report being published and made available on EnergyAustralia's website.

Any enquires regarding this report should be directed to the contact listed below:

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9. APPENDICES

9.1. Appendix A – Economic analysis of base case

WACC = 8.5% p.a.

All figures are in 2007/08 real dollar (\$k). NPC includes operation and maintenance cost (O&M).

Option 1 – Construct 132/11kV Tomaree and Nelson Bay zones (Strategy 1)

	NPC	TOTAL	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Construct second 132kV feeder (904) to Frost Road	8,822	11,140	0	0	1,773	9,077	290	0	0	0	0	0	0
O&M	313		0	0	0	0	0	36	110	110	110	110	110
Tomaree 132/11kV zone substation	22,063	26,936	0	1,511	12,534	11,768	1,123	0	0	0	0	0	0
substation works		20,603		1,511	12,534	6,183	375	0	0	0	0	0	0
132kV feeder works		5,712		0	0	5,275	437	0	0	0	0	0	0
11kV feeder works		621		0	0	310	311	0	0	0	0	0	0
O&M	1,059		0	0	0	0	0	276	334	334	334	334	334
11kV augmentation for Tomaree zone	8,013	10,235	0	0	0	10,235	0	0	0	0	0	0	0
O&M	429		0	0	0	0	35	123	123	123	123	123	123
Decommission Nelson Bay 33/11kV zone	852	1,033	0	65	539	403	26	0	0	0	0	0	0
Tomago STS 33kV CB replacement	10,081	13,875	0	0	0	1,131	12,744	0	0	0	0	0	0
O&M	538		0	0	0	0	0	99	180	180	180	180	180
Nelson Bay (new) 132/11kV zone	18,442	24,326	0	0	1,582	12,827	8,149	1,768	0	0	0	0	0
substation works		20,273	0	0	1,478	12,140	5,639	1,016	0	0	0	0	0
132kV feeder works		3,949	0	0	0	687	2,509	753	0	0	0	0	0
Land		104	0	0	104	0	0	0	0	0	0	0	0
O&M	774		0	0	0	0	0	0	264	305	305	305	305
TOTAL	71,386	87,546											

Option 2 - Construct 33/11kV Tomaree zone and a 132/33kV Nelson Bay STS with Demand Management (Strategy 2)

	NPC	TOTAL	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18
Construct second 132kV feeder (904) to Mine Road	7,944	8,951	1,589	2,906	2,822	1,635	0	0	0	0	0	0	0
O&M	312		0	0	0	0	29	89	89	89	89	89	89
Demand Management (Operational cost)	1,092		0	0	403	958	0	0	0	0	0	0	0
Tomaree 33/11kV zone	19,855	24,717	0	250	8,582	14,217	1,668	0	0	0	0	0	0
Substation works		12,682	0	100	4,699	7,568	315	0	0	0	0	0	0
33kV feeder works		8,619	0	150	3,583	4,840	46	0	0	0	0	0	0
11kV feeder works		3,116	0	0	0	1,809	1,307	0	0	0	0	0	0
Land			0	0	300	0	0	0	0	0	0	0	0
O&M	887		0	0	0	0	0	195	289	289	289	289	289
Decommission Nelson Bay zone temporary substation	54	65	0	0	35	30	0	0	0	0	0	0	0
Tomago STS 33kV CB replacement	11,521	13,468	0	1,113	12,355	0	0	0	0	0	0	0	0
O&M	777		0	0	0	96	175	175	175	175	175	175	175
4MVar capacitors at Nelson Bay zone	527	740	0	0	0	0	622	118	0	0			
O&M	25		0	0	0	0	0	0	9	10	10	10	10
Rebuild 33kV feeder number 1 to Tomaree	1,468	2,410	0	0	0	0	0	0	2,226	184	0	0	0
O&M	26		0	0	0	0	0	0	0	0	8	24	24
Replace 33kV Switchgear at Nelson Bay zone	2,941	6,650	0	0	0	0	0	0	0	0	0	0	6,650
O&M	0		0	0	0	0	0	0	0	0	0	0	0
Nelson Bay 132/33kV STS	21,038	32,681	0	0	0	2,144	1,327	11,050	16,541	1,619	0	0	0
Substation works		22,294	0	0	0	0	1,327	10,977	9,359	631	0	0	0
Sub-trans feeder works		8,243	0	0	0	0	0	73	7,182	988	0	0	0
Land		2,144	0	0	0	2,144	0	0	0	0	0	0	0
O&M	439		0	0	0	0	0	0	0	0	185	371	371
TOTAL	68,906	89,683											

9.2. Appendix B – Geographic map of proposed feeder 904 route

