FINAL REPORT

DEVELOPMENT OF
132/11KV LAKE MUNMORAH ZONE SUBSTATION

1st May 2009

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EXECUTIVE SUMMARY

This final report has been prepared, in accordance with Clause 5.6.2 (h) of the National Electricity Rules, to report on upgrade work that is proposed for development of the electricity supply network in the Lake Munmorah load area. The proposed work is classified as a new large transmission network asset.

An application notice on the projected network limitations and options for corrective action was published on 19th December 2008. It included a preliminary application of the regulatory test to those options. No submissions were received on this application notice.

There are various capacity and aged asset issues in the Lake Munmorah load area. To ensure a safe and reliable electricity supply for existing customers and new developments in the area an overall area supply strategy is required to:

1. Replace or retire aging equipment in zone substations over the next decade; and
2. Provide additional supply system capacity to meet projected load growth.

This final report covers the following issues:

Section 1 provides a background of the Lake Munmorah load area and describes the proposed augmentation in relation to the National Electricity Rules (the Rules).

Section 2 describes the limitations affecting the supply network in the area and the need for augmentation of supply to the area. The objectively measurable service standard (planning criterion), against which the need and effectiveness of augmentation options are to be assessed, is also presented.

Section 3 indicates that no submissions were received on the application notice.

Section 4 describes the options that were considered. These were a demand management investigation (which was discontinued) and two area supply strategies as follows:

1. Option 1 – Rebuild Lake Munmorah zone substation to 132/11kV operation on the existing site; and
2. Option 2 – Upgrade 33/11kV Lake Munmorah zone substation on the existing site.

Section 5 presents the results of an economic analysis of the two area supply strategies in accordance with the regulatory test. This includes sensitivity analysis and identification of the least cost area supply strategy.

Section 6 concludes that the preferred option is Option 1 – Rebuild Lake Munmorah zone substation to 132/11kV operation on the existing site.

The recommended actions are that EnergyAustralia and TransGrid will construct Option 1, that is:

1. Establish new Lake Munmorah 132/11kV zone substation including its associated feeders (by EnergyAustralia);
2. Decommission the existing Lake Munmorah 33/11kV zone substation (by EnergyAustralia); and
3. Establish 132kV busbars at Munmorah BSP and Vales Point BSP (by TransGrid).

The estimated capital cost of these works is $50.7M and they are planned to be completed by mid 2012.

Section 7 provides information relevant to notice of disputes.

1. BACKGROUND

1.1. Introduction

This final report has been prepared to report on upgrade work that is proposed to be carried out in the Lake Munmorah load area. The information provided includes:

1. A discussion of emerging supply system limitations identified by EnergyAustralia and TransGrid that have led to the necessity for augmentation of supply to the area;
2. A discussion of the service standard that has been adopted for planning purposes;
3. Descriptions of feasible options that have been identified for development of the electricity supply to the area within the context of overall area supply strategies;
4. Details of the outcomes of an application of the Australian Energy Regulator's (AER) regulatory test to these options; and
5. Recommended actions arising from these considerations.

1.2. Applicable National Electricity Rules Requirements

The existing 33/11kV Lake Munmorah zone substation and its associated 11kV distribution network are classified as distribution system assets by the Rules. The recommended actions involve redeveloping the existing zone substation to 132/11kV operation. This will require it to be connected at 132kV between TransGrid's Vales Point and Munmorah 132 kV Bulk Supply Points (BSPs) which will also need to be augmented. The new zone substation and new 132 kV feeders would be classified as transmission assets under the Rules.

The estimated cost of the network augmentation component of the recommended actions exceeds $20 million and consequently they are a new large transmission network asset.

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, the Distribution Network Service Provider must notify any affected Registered Participants of these limitations and the expected time for corrective action and consult with affected Registered Participants and interested parties on possible options to address the projected limitations.

In this case, as the recommended actions are for the construction of a new large transmission network asset, consultation was carried out under Clause 5.6.6 of the Rules with EnergyAustralia and TransGrid as joint TNSP Applicants. Accordingly an application notice was issued on 19th December 2008 to consult on options that had been developed to meet the projected limitations. No submissions were received on this application notice.

The development of options is necessitated principally by the future inability to meet the minimum network performance requirements as set out in Schedule 5.1 of the Rules. Consequently limb (a) of the regulatory test has been applied to determine the option that satisfies the test. Under limb (a) the option that satisfies the regulatory test is the one that minimises the present worth of costs compared with a number of alternative options in the majority of reasonable scenarios.

1.3. Joint Planning

EnergyAustralia and TransGrid have jointly planned the 330kV and 132kV networks supplying the Upper Central Coast area for many years.

TransGrid and EnergyAustralia have carried out joint annual planning reviews as required by Clause 5.6.2(b) of the Rules. As required by Clause 5.6.2(c) they have identified that the network limitations outlined in section 2.5 give rise to a need for network augmentations and have carried out joint planning to determine options for these augmentations.

1.4. Material Inter-network Impact

The rules require an assessment of whether a proposed new large transmission network asset is reasonably likely to have a material inter-network impact.

EnergyAustralia and TransGrid have determined that none of the options described in section 4 will impose power transfer constraints or adversely impact on the quality of supply to adjoining transmission networks.

1.5. Existing Supply Arrangements

The Lake Munmorah load area is situated in the Upper Central Coast area. Figure 1a below is a geoschematic diagram of the Upper Central Coast area and Figure 1b on the next page is a single line diagram detailing the existing connections to Lake Munmorah zone substation.

Figure 1a: Upper Central Coast Geoschematic Diagram

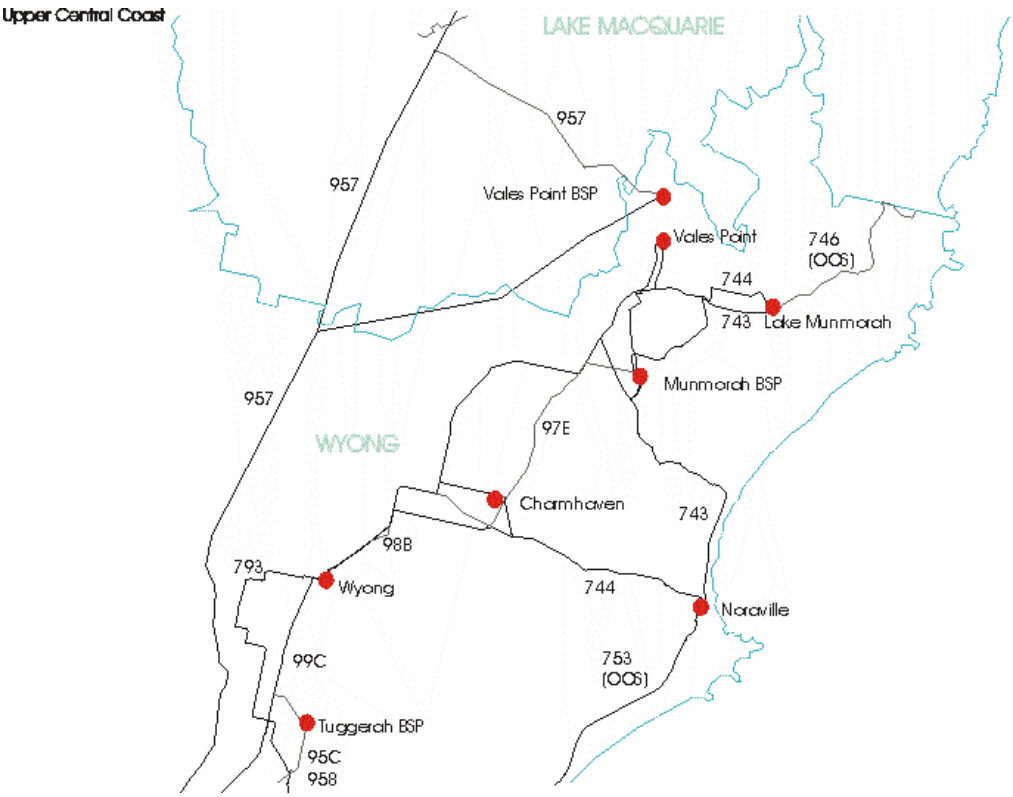
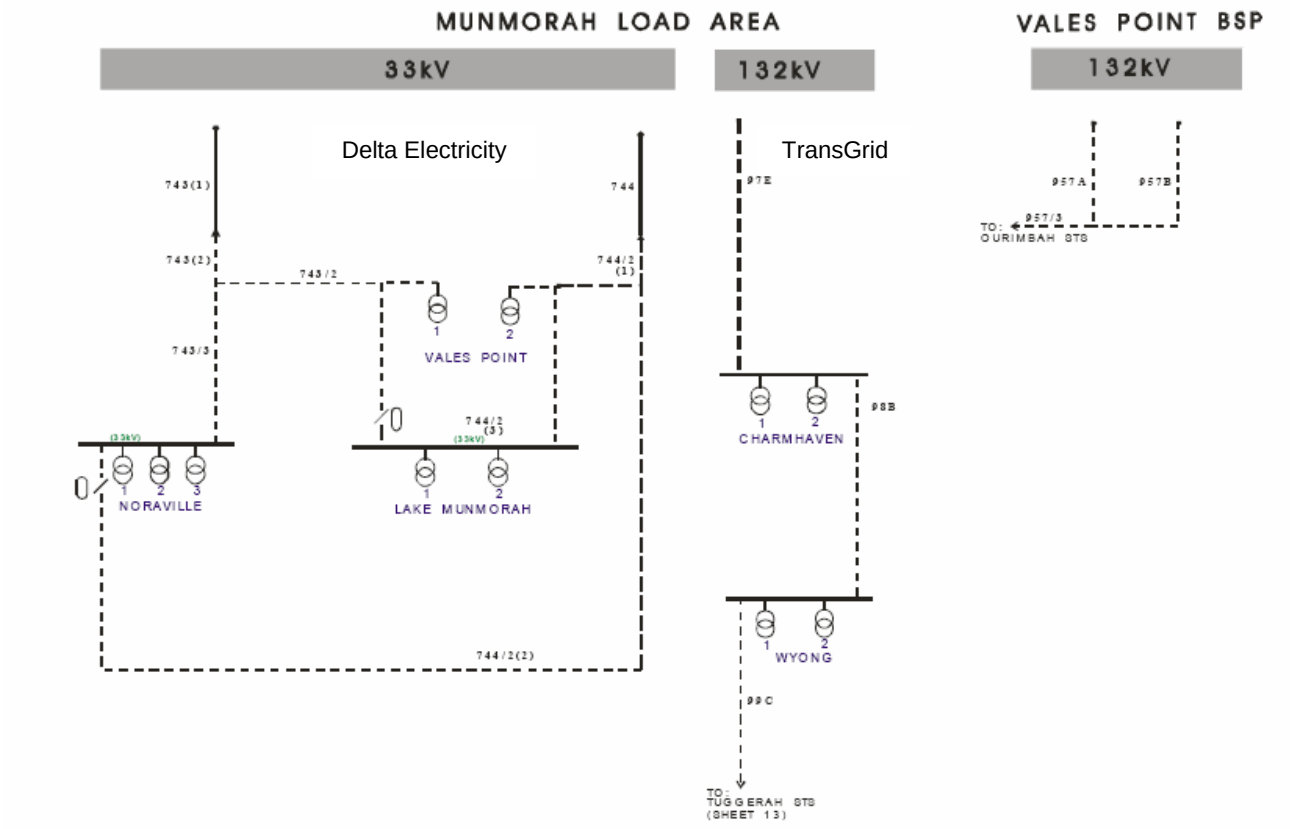


Figure 1b: Upper Central Coast Single Line Diagram



1.5.1. Lake Munmorah Zone Substation

Lake Munmorah is a 33/11kV zone substation that was commissioned in 1979. It is supplied from a 33 kV BSP at Delta Electricity's Munmorah Power Station via two 33kV feeders 743/2 and 744/2. It supplies parts of the following suburbs: Budgewoi, Chain Valley Bay, Doyalson, Elizabeth Bay, Frazer Park, Gwandalan, Lake Munmorah, Mannering Park and Summerland Park.

The substation was designed to accommodate two 12.5MVA transformers. A third transformer was installed as a temporary measure in December 2007 to increase the firm capacity of the substation from 14.7MVA to 26.5MVA in summer and from 17.2MVA to 26.9MVA in winter.

1.5.2. Noraville Zone Substation

Noraville 33/11kV zone substation is equipped with three 12.5MVA transformers and is supplied via two 33kV feeders 743/3 and 744/3 from Delta Electricity's Munmorah Power Station. The firm capacity of Noraville zone substation is 22.6MVA in summer and 24.3MVA in winter.

1.5.3. Vales Point Zone Substation

Vales Point 33/11kV zone substation is equipped with two 15MVA transformers and is supplied via two 33kV feeders 744/2 and 743/2 from Delta Electricity's Munmorah Power Station. The firm capacity of Vales Point zone substation is 14.1MVA in summer and winter.

1.5.4. Supply from Munmorah Power Station

As indicated in Figure 1b EnergyAustralia takes supply at 33 kV from Delta Electricity's Munmorah Power Station via feeders 743 and 744 and at 132 kV from a TransGrid BSP at Munmorah via feeder 97E.

The available capacity from the 33 kV BSP is 69.0MVA in both summer and winter. However the outgoing firm capacity from this BSP is limited in summer to 63.8MVA due to the rating of outgoing underground 33kV feeders.

There is currently no 33kV busbar at the 33 kV BSP. Supply is provided direct from Delta Electricity 330/33kV transformers. The peak load was 39.7MVA in summer 2006/07 and 53.5MVA in winter 2007.

At the 132 kV BSP there is no 132kV busbar. Connection of any additional 132kV feeders to this BSP would require the establishment of a 132kV busbar.

1.5.5. Vales Point Bulk Supply Point

There are two 330/132kV transformers at Vales Point BSP. There is no 132kV busbar at the BSP. EnergyAustralia's single outgoing feeder connects to both 330kV transformers. Connection of any additional 132kV feeders to Vales Point BSP would require the establishment of a 132kV busbar.

1.5.6. Main Cable Supplies – 33kV Feeder System

Lake Munmorah zone substation is supplied by 33kV feeders 743 and 744 from the 33 kV BSP at Munmorah. These feeders also supply Noraville and Vales Point zone substations.

1.6. Supply Strategy Requirements

In order to provide a safe and reliable supply of electricity a long term supply strategy must address the following:

1. Replace and/or retire aging infrastructure; and
2. Provide additional supply system capacity to enable existing infrastructure to be reconstructed and meet projected load growth.

An integrated replacement and augmentation strategy is required to provide:

1. Sufficient capacity to enable infrastructure to be replaced or retired; and
2. Low cost capacity to meet long term load growth.

The construction of a 132/11kV zone substation would result in an increase in capacity which is therefore regarded as an augmentation under the Rules.

2. ISSUES

2.1. Applied Service Standard

Distribution Network Service Providers (DNSPs), such as EnergyAustralia, are required to follow the service standards specified in the "*Design, Reliability and Performance Licence Condition for Distribution Network Service Providers*", issued by the Minister for Energy and dated 1 December 2007. The service standards specified in this document that are applicable to a consideration of supply constraints affecting the Lake Munmorah area are summarised below:

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.

Overhead Sub-transmission Line and Zone Substations

For a failure of a single critical element (i.e. N-1 conditions) within zone substations supplying greater than 10MVA of load and for overhead subtransmission 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.

Under normal conditions (ie N conditions) the thermal capacity is required to meet at least 115% of forecast demand.

Underground Sub-transmission Cables

For an underground subtransmission cable the forecast demand must not exceed the thermal capacity of any underground section at any time under N-1 conditions.

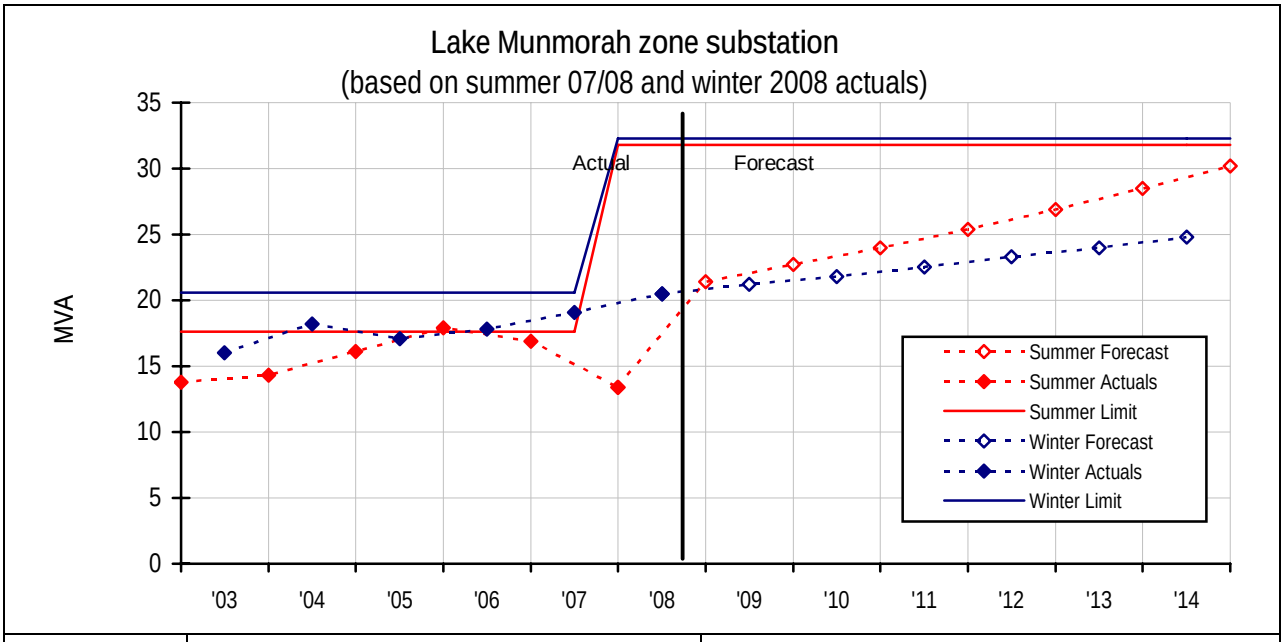
2.2. Description of Network Issues

2.2.1. Lake Munmorah Zone Substation

The peak load forecast and the relevant planning limit, as specified by EnergyAustralia's licence condition, for Lake Munmorah 33/11kV ZS are shown in Figure 2 below.

The firm capacity of the zone substation increased in summer 2007/08 following the installation of the temporary third 33/11kV 12.5MVA transformer. The peak load is expected to exceed the substation firm capacity in summer 2012/13 but, as can be seen in Figure 2, is not expected to exceed EnergyAustralia's service standards in this forecast period.

Figure 2: Lake Munmorah Zone Substation Load Forecast



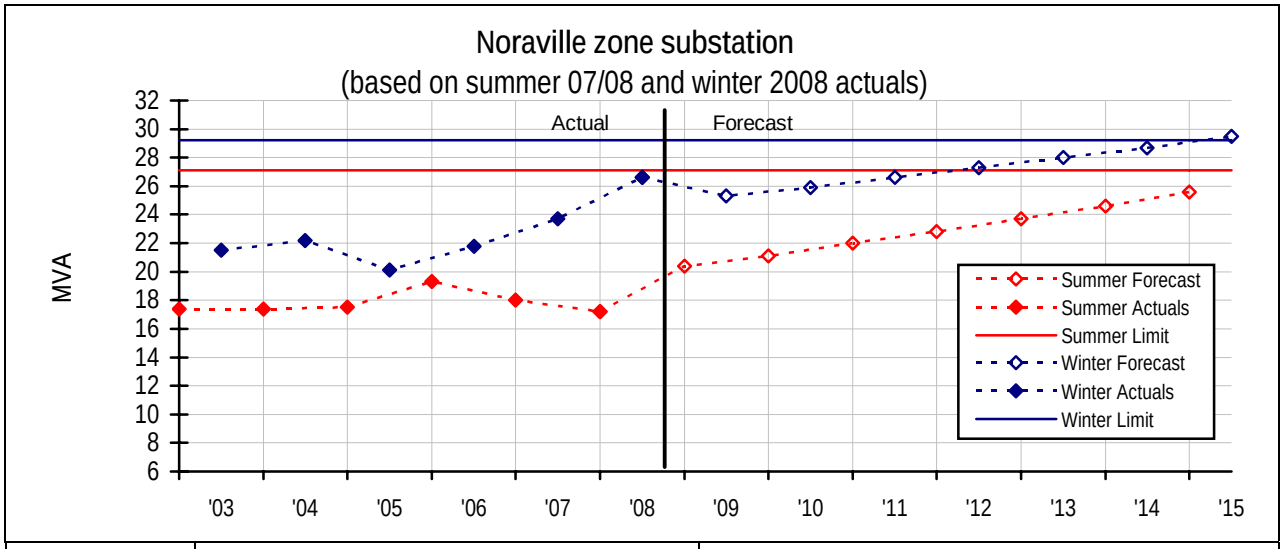
	Actual (MVA)						Forecast (MVA)						
SUMMER	**02/03**	**03/04**	**04/05**	**05/06**	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**
Load	13.8	14.3	16.1	17.9	16.9	13.4	21.4	22.7	24.0	25.4	26.9	28.5	30.2
Firm Capacity	14.7	14.7	14.7	14.7	14.7	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Limit (120% of Firm Capacity)	17.6	17.6	17.6	17.6	17.6	31.8	31.8	31.8	31.8	31.8	31.8	31.8	31.8
WINTER	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Load	16.0	18.2	17.1	17.8	19.1	20.5	20.5	21.2	21.8	22.5	23.3	24.0	24.8
Firm Capacity	17.2	17.2	17.2	17.2	17.2	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9
Limit (120% of Firm Capacity)	20.6	20.6	20.6	20.6	20.6	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3

2.2.2. Noraville Zone Substation

The peak load forecast and the relevant planning limit, as determined by EnergyAustralia's licence condition, for Noraville 33/11kV zone substation are shown in Figure 3 below.

The Noraville peak load is forecast to exceed the licence capacity limit in winter 2015.

Figure 3: Noraville Zone Substation Load Forecast



	Actual (MVA)						Forecast (MVA)						
SUMMER	**02/03**	**03/04**	**04/05**	**05/06**	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**
Load	17.4	17.4	17.5	19.3	18.0	17.2	20.4	21.1	22.0	22.8	23.7	24.6	25.6
Firm Capacity	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6
Limit (120% of Firm Capacity)	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1
WINTER	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Load	21.5	22.2	20.1	21.8	23.7	26.6	25.3	25.9	26.6	27.3	28.0	28.7	29.5
Firm Capacity	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3
Limit (120% of Firm Capacity)	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2

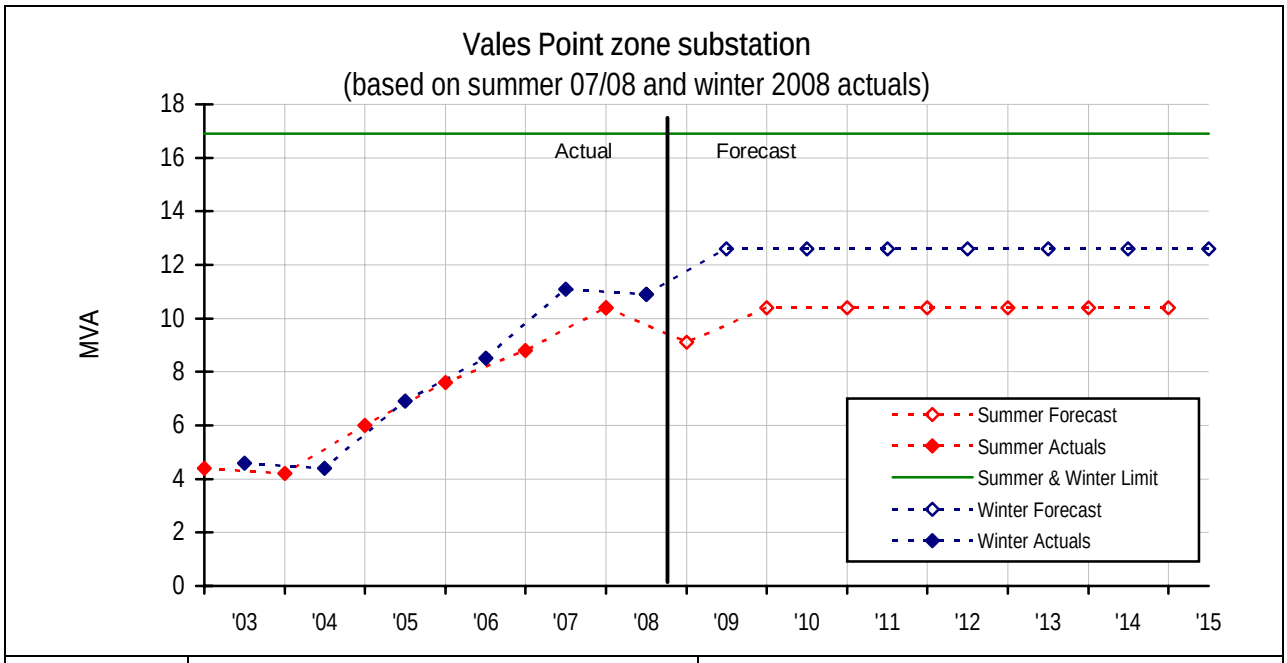
Note: The yellow highlighted field indicates the load is above EnergyAustralia's licence condition.

2.2.3. Vales Point Zone Substation

The peak load forecast and the relevant planning limit, as determined by EnergyAustralia's licence condition, for Vales Point 33/11kV zone substation are shown in Figure 4 below.

The Vales Point peak load is not forecast to exceed the licence capacity limit within the present forecast period.

Figure 4: Vales Point Zone Substation Load Forecast



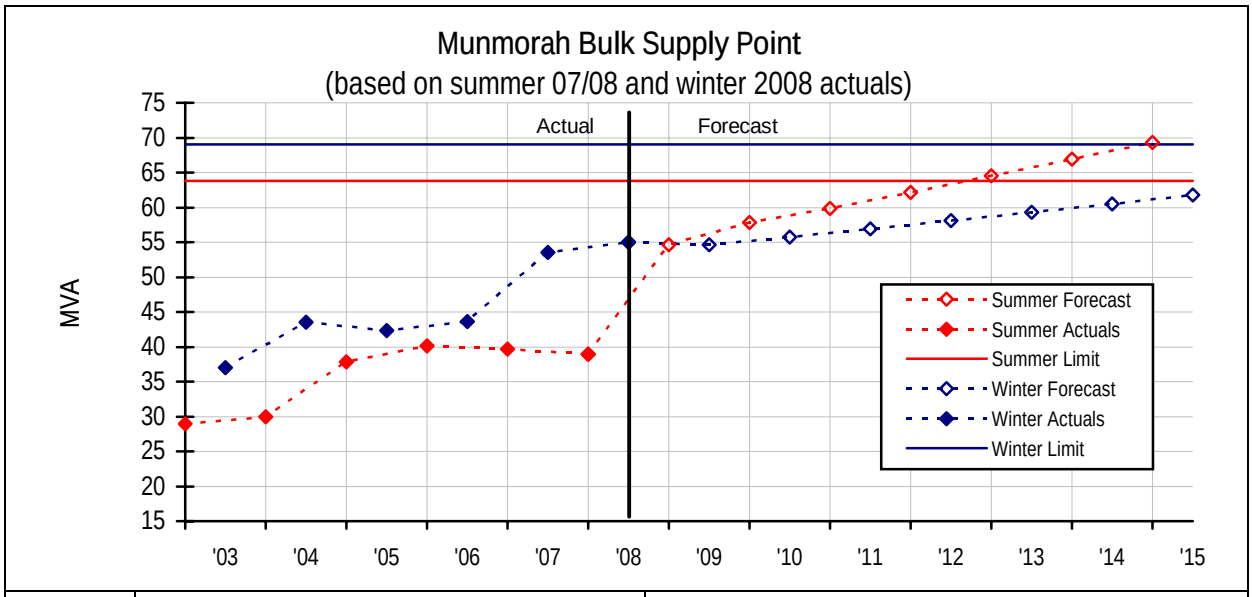
	Actual (MVA)						Forecast (MVA)						
SUMMER	**02/03**	**03/04**	**04/05**	**05/06**	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**
Load	4.4	4.2	6.0	7.6	8.8	10.4	9.1	10.4	10.4	10.4	10.4	10.4	10.4
Firm Capacity	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
Limit (120% of Firm Capacity)	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9
WINTER	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Load	4.6	4.4	6.9	8.5	11.1	10.9	12.6	12.6	12.6	12.6	12.6	12.6	12.6
Firm Capacity	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
Limit (120% of Firm Capacity)	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9

2.2.4. Munmorah 33 kV Bulk Supply Point

The peak load forecast and the relevant planning limit, as determined by EnergyAustralia's licence condition, for the Munmorah 33 kV BSP is shown in Figure 5 below.

The Munmorah 33 kV load is forecast to exceed its limit in summer 2012/2013.

Figure 5: Munmorah 33 kV BSP Load Forecast



	Actual (MVA)						Forecast (MVA)						
SUMMER	**02/03**	**03/04**	**04/05**	**05/06**	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**
Load	28.9	30	37.8	40.1	39.7	38.9	54.6	57.8	59.9	62.2	64.5	66.9	69.3
Firm Capacity	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0
Limit *	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8
WINTER	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Load	37	43.5	42.3	43.6	53.5	55.0	54.6	55.7	56.9	58.1	59.3	60.5	61.8
Firm Capacity	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0
Limit	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0

Note: The yellow highlighted field indicates the load is above EnergyAustralia's service standards.
* The limit is less than the firm capacity due to the rating of the outgoing 33kV underground feeders. Furthermore, during a transformer outage and generator start-up at Munmorah Power Station, load is required to be reduced to approximately 40MVA.

2.2.5. 33kV Feeders

There is no 33kV busbar at Munmorah 33 kV BSP and the two 33kV feeders are tail-ended to Delta Electricity 330/33kV transformers. The 33kV zone substations are supplied radially with a standby feeder to provide alternate supply during feeder or 330/33kV transformer outages.

Under N-1 conditions a section of feeder 744 is already above 120% utilisation level in summer and hence does not comply with the licence condition. Feeder 743 is forecast to exceed 120% utilisation level under N-1 conditions in summer 2012/2013.

2.3. Asset Condition Issues

2.3.1. Lake Munmorah Zone Substation

Based on EnergyAustralia's condition assessment the 11kV and 33kV switchgear at Lake Munmorah zone substation is in relatively poor condition and requires replacement by 2012. The type and the recommended replacement timeframe for the switchgear are summarised in Table 1 below.

Table 1: Recommended replacement timeframe for Lake Munmorah ZS switchgear

Equipment	Manufacturer	Manufacturer Type	Units	Recommended Timeframe
HV CB	ABB	R-MAG	1	< 5 years
HVCB	AEI	LGIC/44	2	< 5 years
HVCB	EE	OLX	2	< 5 years
HVCB	REY	LMT	2	< 5 years
HVCB	SWALES	D	2	< 5 years
HVCB	WEST	345GC	3	< 5 years
CB HOUSING	EE	OLX	2	< 5 years
CB HOUSING	REY	LZMT	1	< 5 years
CB HOUSING	REY	LMT/X2/MO	1	< 5 years
CB HOUSING	SWALES	D4X4	2	< 5 years

3. SUBMISSIONS

An application notice was issued on 19th December 2008 to consult on options that had been developed to meet the projected limitations in the Lake Munmorah area. No submissions were received on this application notice.

4. OPTIONS CONSIDERED

Development needs for the Lake Munmorah load area are driven by the need to rectify equipment age and condition issues at Lake Munmorah zone substation and provide sufficient capacity to relieve the 33kV network from Munmorah Power Station and meet forecast load growth in the area.

To meet these objectives EnergyAustralia has investigated a number of options. Possible options are impacted by:

1. The availability of land for substation sites in existing established areas;
2. The need for the new zone substations to be located near existing zone substations to minimise 11kV connection costs; and
3. The need to be in close proximity to load centres.

The following sections describe a demand management investigation and two network augmentation options to address the issues described in section 2. The network augmentation options are presented within the context of two overall area supply strategies.

4.1. Demand Management Investigation

Demand management was investigated as an alternative to the proposed network investment.

The previous load forecast indicated that the Munmorah BSP load was forecast to exceed its limit in summer 2009/10. A demand management screening test was completed in October 2008 based on this forecast and found that a substantial cost saving could arise from deferring the proposed investment. Consequently a more detailed demand management investigation was initiated.

However the latest load forecast has indicated that the Munmorah BSP load will not exceed its limit until summer 2012/13. This latest information makes the demand management investigation unnecessary. The 11kV and 33kV switchgear at Lake Munmorah zone substation requires replacement by 2012 which would necessitate the proposed supply side solution by this date. Therefore demand reductions after 2012 would not result in a deferral of network investment. Consequently the demand management investigation was terminated.

4.2. Option 1: Rebuild Lake Munmorah Zone Substation to 132/11kV Operation on the Existing Site

This option involves rebuilding the existing 33/11kV Lake Munmorah zone substation to a 132/11kV zone substation on the existing site by 2012. The new zone substation would be equipped with two 37.5MVA 132/11kV transformers and would be supplied by two new 132kV feeders, one from Munmorah 132 kV BSP and the second from Vales Point BSP. These two 132kV feeders would utilise relevant sections of existing 33kV overhead feeders 743/2 and 744/2 by reconstructing them at 132kV design.

This option would also require TransGrid to establish new 132kV busbars at Munmorah 132 kV BSP and Vales Point BSP for connection of the new 132kV feeders.

A preliminary consultation with school communities neighbouring the existing Lake Munmorah zone substation site has provided the opportunity to continue to use the existing site with the inclusion of a number of design and siting concessions. This has potentially afforded savings relative to other alternatives that would require relocation, purchase of new land and extension of existing overhead feeders.

Initially a 5MVA load transfer from Noraville ZS to the new Lake Munmorah ZS was planned to be carried out in conjunction with the zone substation works. However due to the latest forecast indicating smaller load increases Noraville ZS is not forecast to exceed its limit until winter 2015. Therefore the load transfer will be carried out prior to 2015.

The expected projects associated with Option 1 are provided in Table 2 below. The establishment of Lake Munmorah 132/11kV ZS and its associated 132kV feeders and 11kV feeder works and decommissioning of the existing Lake Munmorah ZS by EnergyAustralia and the establishment of 132kV busbars at Munmorah BSP and Vales Point BSP by TransGrid form Stage 1 of the overall area strategy detailed in the table.

Future projects that are part of this strategy include another load transfer from Noraville zone substation to the new Lake Munmorah 132/11kV zone substation in 2020/21 (originally 2017/18) to address the forecasted capacity limitation at the Noraville ZS and installation of a new 132/11kV zone substation at Doyalson in 2022/23 to address forecast capacity limitations in the area at that time.

The capital cost for Stage 1 (Option 1) is expected to be $50.7M. The estimated total capital cost of the overall area supply strategy is $97.7M.

Table 2: Area Supply Strategy Associated with Option 1 with Approximate Timing and Costs

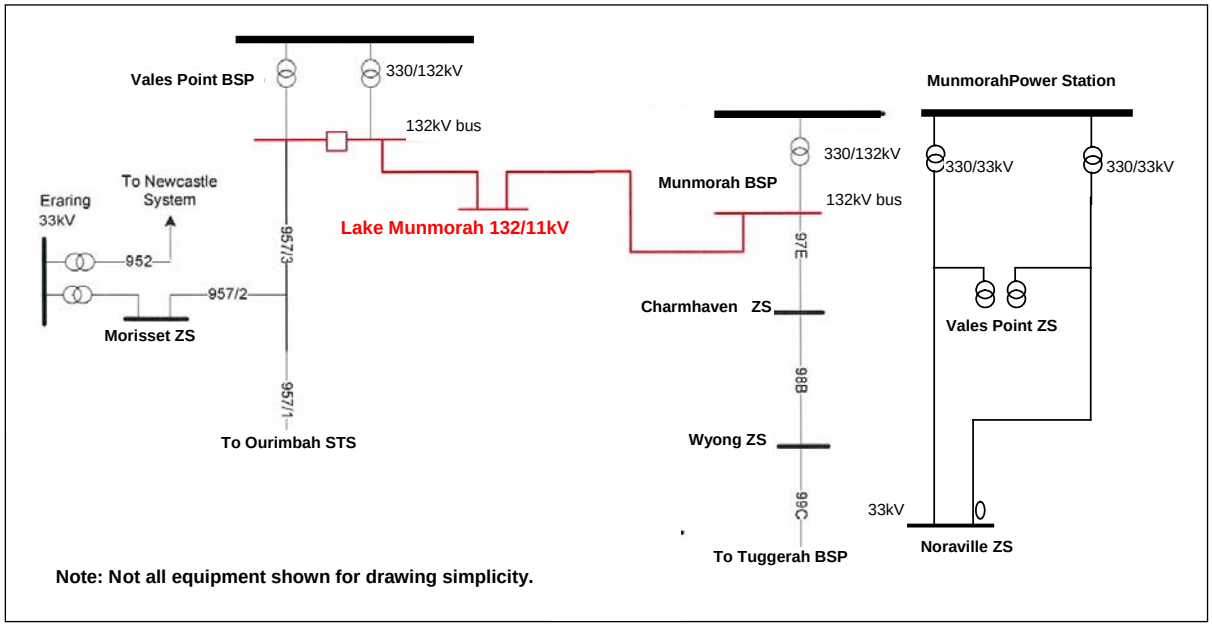
Proposed Project	Estimated Cost ($M)	Estimated Completion
Stage 1 (Option 1)- Rebuild Lake Munmorah zone substation to 132/11kV operation		
Establish 132kV busbar at Munmorah 132 kV BSP by TransGrid	9.1	2011/12
Establish 132kV busbar at Vales Point BSP by TransGrid	5.8	2011/12
Conversion of Lake Munmorah from 33/11kV to 132/11kV +132 kV feeders	34.4*	2011/12
Decommissioning of existing Lake Munmorah zone substation	1.3	2012/13
Total Stage 1 (Option 1) Costs	**50.7**	
Future Works		
5MVA Load transfer from Noraville to Lake Munmorah zone substation	7.2	2014/15
Additional switchgear groups at Lake Munmorah 132/11kV zone substation	0.8	2016/17
5MVA Load transfer from Noraville to Lake Munmorah zone substation	7.2	2020/21
New 132/11kV Doyalson zone substation + 132kV feeders	31.8	2023/24
Total Future Works Costs	**47.0**	
Total Area Strategy Costs	**97.7**	

Note: *: A detailed cost estimation was carried out for the development of Lake Munmorah 132/11kV zone substation and associated feeder works. This resulted in a cost lower than the previously estimated cost for this project presented in the Application Notice.

The conversion to 132kV supply would provide sufficient capacity to supply the Lake Munmorah load area and relieve the 33kV network from Munmorah Power Station. This option would also address the equipment age and condition issues at the existing 33/11kV Lake Munmorah zone substation.

The overview of network configuration after the completion of Stage 1 of this area supply strategy (Option 1) is shown in Figure 6 below.

Figure 6: Network Overview after the Completion of Option 1.



4.3. Option 2: Upgrade Existing 33/11kV Lake Munmorah Zone Substation on the Existing Site

This option involves upgrading the existing 33/11kV Lake Munmorah zone substation to a new 33/11kV zone substation to address its aged asset issues. The new substation would be initially equipped with two 33MVA transformers. This upgrade would be completed in 2012/13.

A 132/33kV sub-transmission substation would be constructed at Doyalson in order to address the capacity issues at Munmorah 33 kV BSP and the 33kV feeder network. This also requires TransGrid to establish new 132kV busbars at Munmorah 132 kV BSP and Vales Point BSP for connection of new 132kV feeders to the new Doyalson sub-transmission substation.

The expected projects associated with Option 2 are provided in Table 3 below. The works described above form Stage 1 of the overall area strategy detailed in the table.

A 132/11kV zone substation would also be constructed at the Doyalson STS site by 2014 to address the capacity issues at Noraville zone substation. In Option 1 the Noraville zone substation capacity issues are addressed via 11kV load transfers, one in 2014 and another in 2021, to the 132/11kV Lake Munmorah zone substation. However, due to the lower capacity of the 33/11kV Lake Munmorah zone substation in Option 2, it is considered more appropriate to commission the Doyalson 132/11kV zone substation in 2014 to address the capacity issues at Noraville zone substation.

Future projects that are part of this strategy include reconductoring of the 33kV feeder 744/2 in 2017/18 to address the capacity limitation on this feeder, and installation of a 132kV feeder from the new Doyalson STS in 2018/19 to supply a future substation at Swansea.

The capital cost for Stage 1 (Option 2) is expected to be $76.7M. The estimated total capital cost of the overall area supply strategy is $114.4M.

Table 3: Area Strategy Associated with Option 2 with Approximate Timing and Costs		
Proposed Project	**Estimated Cost ($M)**	**Estimated Completion**
Stage 1 (Option 2)– Upgrade existing Lake Munmorah zone substation		
Upgrade of existing 33/11kV Lake Munmorah zone substation	14.1	2012/13
Decommissioning of existing Lake Munmorah zone substation	1.3	2013/14
Development of new 132/33kV Doyalson STS + Land	46.3	2011/12
Establish 132kV busbar at Munmorah 132 kV BSP by TransGrid	9.1	2011/12
Establish 132kV busbar at Vales Point BSP by TransGrid	5.8	2011/12
Total Stage 1 (Option 2) Costs	**76.7**	
Future Works		
New 132/11kV Doyalson zone substation	23.3	2014/15
Reconductoring of 33kV feeder 744/2 to tee to Lake Munmorah and Noraville zone substation	3.7	2017/08
132kV feeder from Doyalson STS to Lake Munmorah for Swansea supply	12.4	2018/19
Warnervale 132kV feeder saving due to reduced feeder requirements (compared to Option 1)	-1.6	2016/17
Total Future Works Costs	**37.7**	
Total Area Strategy Costs	**114.4**	

5. ECONOMIC ANALYSIS OF OPTIONS

Economic analysis has been carried out in accordance with the regulatory test promulgated by the ACCC under clause 5.6.5A of the Rules. As indicated in section 1.2 the "reliability limb" of the test was applied. It involves the comparison of options by carrying out a Present Worth of Costs (PWC) analysis. In this case the option that satisfies the regulatory test is considered to be the one that minimises the PWC of the relevant overall area supply strategy.

A range of parameters has been included in the 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.

5.1. Base Case Analysis

The options considered are ranked by the PWC of the relevant area supply strategy considering an 8.5% p.a. discount rate for the base case as shown in the following Table 4. The total costs of each strategy are also shown in the table.

Table 4: Comparison of Costs under the Base Case

Description	PWC ($M)	Cost ($M)
Option 1: Rebuild Lake Munmorah zone substation to 132/11kV operation on the existing site	63.3	97.7
Option 2: Upgrade existing 33/11kV Lake Munmorah zone substation on the existing site	91.4	114.4

As indicated in the table (yellow shaded cell) Option 1 forms part of the "least cost" area supply strategy. Refer to Appendix A.1 for a detailed analysis.

5.2. Sensitivity Analysis

Sensitivity analysis was carried out to consider the impact of different discount rates and price variations. The values of key parameters for the base case and sensitivity cases are shown in the following Table 5.

Table 5: Sensitivity analysis

Sensitivity Scenario		Option 1 PWC ($M)	Option 2 PWC ($M)
Variation of Discount Rate	7.0% p.a.	68.4	96.6
	8.5% p.a. (Base Case)	63.3	91.4
	10% p.a.	58.9	86.7
Zone Substation Costs	25% increase	75.9	99.5
	25% decrease	50.7	83.4
STS + BSP Costs	25% increase	66.5	106.7
	25% decrease	60.0	76.1

As indicated in the table above (yellow shaded cells) Option 1 has the least PWC under all sensitivity scenarios.

6. CONCLUSIONS AND RECOMMENDED ACTIONS

Option 1 forms part of the least cost area supply strategy under all scenarios considered and hence is the preferred option.

The recommended actions are for EnergyAustralia and TransGrid to construct Option 1, that is:

1. Establish new Lake Munmorah 132/11kV zone substation including its associated feeders (by EnergyAustralia);
2. Decommission the existing Lake Munmorah 33/11kV zone substation (by EnergyAustralia); and
3. Establish 132kV busbars at Munmorah BSP and Vales Point BSP (by TransGrid).

The estimated capital cost of these works is $50.7M and they are planned to be commissioned by mid 2012.

The commissioning date may change if the works are affected by circumstances beyond EnergyAustralia and/or TransGrid'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 or industrial action.

7. NOTICE OF DISPUTES

Persons wishing to dispute the contents, findings, assumptions or recommendations of this final report are referred to clause 5.6.6(j) of the Rules.

Disputing parties must lodge a notice of the dispute in writing to the AER and provide a copy of the dispute notice to EnergyAustralia and TransGrid within 30 business days of the publication of the summary of this final report on NEMMCO’s website.

EnergyAustralia copies of dispute notices regarding this final report should be forwarded to:

John Hele
A/Manager – Network Investment
GPO Box 4009
Sydney 2001
Email: jhele@energy.com.au
Phone: 02 9269 2862
Website: www.energy.com.au

TransGrid copies of dispute notices should be forwarded to:

Garrie Chubb
Tel: 02 9284 3553
fax: 02 9284 3456
email: garrie.chubb@transgrid.com.au

A. APPENDICES

A.1. Economic Analysis of the Base Case

WACC = 8.5% p.a.

All figures are in 2008/09 real dollar ($M). PWC includes operation and maintenance cost (O&M).

Option 1: Rebuild Lake Munmorah zone to 132/11kV operation on the existing site																		
Proposed projects – network	**PWC ($M)**	**Total ($M)**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**	**22/23**	**23/24**
Stage 1 - Rebuild Lake Munmorah zone to 132/11kV operation																		
Establish 132kV busbar at Munmorah BSP by TransGrid	7.2	9.1	0.0	0.0	0.7	8.4												
Establish 132kV busbar at Vales Point BSP by TransGrid	4.6	5.8	0.0	0.0	0.4	5.4												
Conversion of Lake Munmorah from 33/11kV to 132/11kV +132 kV feeders	28.8	34.4	0.3	5.5	15.5	13.0	0.2											
Decommissioning of existing Lake Munmorah zone substation	0.1	0.2	0.0	0.0	0.0	0.1	1.3											
Capital Cost (Stage 1)		**50.7**																
Future Works																		
5MVA Load transfer from Noraville to Lake Munmorah zone	4.4	7.2	0.0	0.0	0.0	0.0	0.0	0.5	6.6									
Additional switchgear groups at Lake Munmorah 132/11kV zone substation	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8							
5MVA Load transfer from Noraville to Lake Munmorah zone	2.7	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	6.6			
New 132/11kV Doyalson zone substation + 132kV feeders	10.2	31.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	6.8	17.1	7.6
Total operation and maintenance (O&M)	4.1		0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8
TOTAL COST	**63.3**	**97.7**	0.3	5.5	16.6	26.8	2.1	1.2	7.3	0.7	1.5	0.7	0.7	1.3	7.7	7.6	17.9	8.5

Option 2: Upgrade existing 33/11kV Lake Munmorah zone on the existing site																		
Proposed projects – network	**PWC ($M)**	**Total ($M)**	**08/09**	**09/10**	**10/11**	**11/12**	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**	**22/23**	**23/24**
Stage 1 – Upgrade existing Lake Munmorah zone + Doyalson STS																		
Upgrade of existing 33/11kV Lake Munmorah zone substation	10.6	14.1	0.0	0.0	0.2	6.1	7.8											
Decommissioning of existing Lake Munmorah zone substation	0.1	0.2	0.0	0.0	0.0	0.0	1.3											
Development of new Doyalson STS + Land	39.0	46.3	0.4	9.0	21.3	15.7												
Establish 132kV busbar at Munmorah BSP by TransGrid	7.2	9.1	0.0	0.0	0.7	8.4												
Establish 132kV busbar at Vales Point BSP by TransGrid	4.6	5.8	0.0	0.0	0.4	5.4												
Capital Cost (Stage 1)		**76.7**																
Future Works																		
New 132/11kV Doyalson zone substation	15.7	23.3	0.0	0.0	0.0	0.3	6.1	13.5	3.4									
Reconductoring of 33kV feeder 744/2 to tee to Lake Munmorah and Noraville zone	1.8	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.4						
132kV feeder from Doyalson STS to Lake Munmorah for Swansea supply	5.6	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	8.2					
Warnervale 132kV feeder saving (compared to Option 1)	-0.8	-1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.5							
Total operation and maintenance (O&M)	6.8		0.0	0.0	0.0	0.0	0.8	1.0	1.0	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4
TOTAL COST	**91.4**	**114.4**	0.41	9.0	22.9	41.7	23.4	4.4	1.3	1.2	0.0	8.9	9.5	1.4	1.4	1.4	1.4	1.4