

# APPLICATION NOTICE

**PROPOSED NEW LARGE TRANSMISSION NETWORK ASSET**

**PROPOSED NEW LARGE DISTRIBUTION NETWORK ASSET**

## **DEVELOPMENT OF ELECTRICITY SUPPLY TO THE MACARTHUR AREA AND SOUTHWEST SECTOR**

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## **Executive Summary**

This application notice has been prepared to provide a basis for TransGrid and Integral Energy to consult with NEM registered participants, NEMMCO and interested parties to identify options for the development of electricity supply to the Macarthur area and into the proposed South West Sector development that will be included in an application of the AER's regulatory test.

Section 1 provides the context of this application notice within the regulatory approval process. It is proposed to allow interested parties to make submissions and provide other feedback in the period to 01/02/2007. A final report, which will include a decision on the preferred option, is envisaged during April 2007.

Section 2 describes in detail the regulatory requirements relating to proposals for new large transmission network assets and new large distribution network assets, the existing supply arrangements and nature of the growing load in the Macarthur (Campbelltown/Camden) area, and the network constraints giving rise to a need to augment supply to the area. The agreed network performance requirements (planning criterion) against which the need and effectiveness of augmentation options are assessed are also described.

In Section 3 three feasible augmentation options are described, together with a fourth option which is not considered feasible. Each feasible option involves establishment of a 330 kV substation in the area and provision of sections of 330 kV and lower voltage lines to connect it to TransGrid's 330 kV network and to Integral Energy's 132 kV and/or 66 kV networks in the area.

Option 1, which involves the augmentation of the existing 330/66kV substation at Ingleburn, is not considered feasible.

Option 2 involves establishment of a 330/66 kV substation at Macarthur. This option is not considered in the preliminary application of the regulatory test on the basis of cost.

Option 3 involves establishment of a 330/132 kV substation at Catherine Field together with a 132/66 kV substation at Campbelltown at an estimated capital cost of \$92 million.

Option 4 involves establishment of a 330/132/66 kV substation at Macarthur at an estimated capital cost of \$70 million.

In Section 4 the results of a preliminary application of the regulatory test, considering Options 3 and 4, are presented.

The main conclusion is that Option 4 has the lowest present worth of costs in all cases.

Subject to completion of the consultation process, TransGrid and Integral Energy conclude that Option 4 would satisfy the regulatory test. On that basis they would recommend the construction of that option. This would entail the establishment of a new 330/132/66 kV substation at Macarthur close to the route of the existing Kemps Creek – Avon 330 kV line, together with associated 132kV high capacity lines to Nepean Substation and 66kV connections in the Campbelltown area. Those works are expected to cost \$70 million ( $\pm 25\%$ ) and to be substantially completed by summer 2009/10.



## 1. Introduction

### 1.1. Purpose and Scope

TransGrid owns the majority of the transmission network within NSW and is responsible, inter alia, for planning and developing its network to meet the requirements of customers within the State and to facilitate operation of the National Electricity Market (NEM). As part of its planning responsibilities and the requirements of the National Electricity Rules (the Rules) TransGrid consults with NEM registered participants, NEMMCO and interested parties on emerging limitations within its transmission network and options being considered to relieve them.

Integral Energy owns the subtransmission and distribution networks within the Macarthur area and is responsible for planning and developing those networks.

TransGrid and Integral Energy have responsibilities under the Rules to carry out joint planning to facilitate the optimal development of connections between the transmission and distribution networks within Integral Energy's network area.

This application notice has been prepared in accordance with Clauses 5.6.6 (b) and 5.6.2(f) of the Rules. It relates to a proposal for a new large transmission network asset and a new large distribution network asset that will address the requirements of providing an appropriate supply for the Macarthur area and initial strategic supplies for the proposed development of the South West Sector.

It includes:

- A summary of the load forecast for the area;
- A description of the network reliability criterion that has been adopted for planning purposes;
- A description of the network limitations identified by TransGrid and Integral Energy that have led to a necessity for augmentation of the transmission and distribution networks supplying the Macarthur area;
- A description of all reasonable network and non-network options that have been identified to meet these limitations;
- An analysis of the ranking of these options in accordance with the Australian Energy Regulator's (AER's) regulatory test;
- A preliminary assessment of the outcome of the regulatory test and proposed course of action; and
- An invitation to NEM registered participants and interested parties to make submissions on this application notice.

### 1.2. Summary of Consultation Process

TransGrid published a description of the limitations of the transmission network supplying the South West of Greater Sydney area (Macarthur area) in its Annual Planning Report (APR) for 2004.

The 2005 and 2006 APRs also described these limitations in the context of a summary new large transmission network asset proposal involving the establishment of a new 330 kV supply point to Integral Energy near Mount Annan (Macarthur Substation).

This application notice covers consultation and application of the regulatory test to reasonable network and non-network options to meet these network limitations and is the first step in the formal consultation process.

A summary of this application notice has been published on NEMMCO's website. In accordance with Clauses 5.6.2 and 5.6.6 of the National Electricity Rules it is intended to proceed with further consultation on this new large transmission network asset and new large distribution network asset proposal as follows.

Submissions Period	Until 01/02/2007
Consideration of Submissions	02/02/2007 - 15/03/2007
Meetings with Interested Parties (if Required)	16/03/2007 - 17/04/2007
Publication of Final Report	20/04/2007 <sup>1</sup>
Period for Notification of Disputes	23/04/2007 - 04/06/2007

<sup>1</sup> This and subsequent dates assume that meetings with interested parties are required. If this is not the case these dates may be advanced by up to 21 business days.

## 2. Identification of a Necessity for Augmentation

### 2.1. Regulatory Requirements

#### 2.1.1. Requirements of the National Electricity Rules

This application notice covers a proposal for a new large transmission network asset and a new large distribution network asset.

The requirements of the National Electricity Rules for new large transmission network asset proposals are set out in Clause 5.6.6. This requires applicants (in this case TransGrid), inter-alia, to:

- Set out the reasons for proposing the new large transmission network asset, including the actual or potential constraint or inability to meet network performance requirements;
- Describe all reasonable network and non-network options to address the constraint;
- Rank the options in accordance with the principles of the AER's regulatory test including detailed analysis of why the applicant considers the new large transmission network asset satisfies the regulatory test;
- Where relevant, provide analysis of why the applicant considers the new large transmission network asset is a reliability augmentation.
- Provide an augmentation technical report or consents to proceed from affected TNSPs if the new large transmission network asset is likely to have a material inter-network impact.

The requirements of the National Electricity Rules for new large distribution network asset proposals are set out in Clause 5.6.2.

This requires DNSPs (in this case Integral Energy), inter-alia, to:

- Identify a necessity for augmentation of its network, or implementation of a non-network alternative;
- Consult with NEM registered participants, NEMMCO and interested parties on possible options to meet the necessity for augmentation;
- Carry out an economic cost effectiveness analysis of possible options to identify options that satisfy the regulatory test;
- Publish the results of the consultation and regulatory test analysis in a report that recommends the action to be taken.

These requirements are underpinned by Clauses 5.6.2 (a), (b) and (c) of the Rules, which require network service providers to:

- Analyse their networks and conduct joint TNSP/DNSP annual planning reviews to identify necessities for augmentation or extension of those networks; and
- Undertake joint planning in order to determine plans that can be considered by registered participants, NEMMCO and interested parties.

#### 2.1.2. Requirements of the Regulatory Test

The regulatory test may be applied in either one of two ways. The regulatory test states that an option satisfies the test if:

- (a) in the event the option is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 of the Rules or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction - the option minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios;
- (b) in all other cases - the option maximises the expected net present value of the market benefit (or in other words the present value of the market benefit less the present value of costs) compared with a number of alternative options and timings, in a majority of reasonable scenarios.

The Rules define a reliability augmentation as:

## **Application Notice – Development of Supply to the Macarthur Area and Southwest Sector**

A transmission network augmentation that is necessitated solely by inability to meet the minimum network performance requirements set out in schedule 5.1 or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction.

Thus, for reliability augmentations, clause (a) of the test should be used. That is, for reliability augmentations, the option that satisfies the regulatory test is the one that minimises the cost of meeting the minimum network performance requirements set out in schedule 5.1 of the Rules or via a jurisdictional requirement.

DNSPs are required to carry out an economic cost effectiveness analysis of options, to identify options that satisfy the regulatory test, to meet an identified necessity for augmentation. These requirements imply that DNSPs should also use clause (a) of the regulatory test.

### **2.2. Jurisdictional Requirements – Reliability Criterion**

As stated in its Annual Planning Report, TransGrid is expected by the NSW jurisdiction to plan and develop its transmission network on an “N-1” basis. That is, unless specifically agreed otherwise by TransGrid and the affected distribution network owner or major directly connected end-use customer, there will be no inadvertent loss of load (other than load which is interruptible or dispatchable) following an outage of a single circuit (a line or a cable) or transformer, during periods of forecast high load.

These requirements are underpinned by the recent introduction of mandatory licence conditions for DNSPs which, inter-alia, set out reliability standards for subtransmission and distribution networks. The licence conditions for Integral Energy specify N-1, one minute reliability levels for sub-transmission lines and zone substations supplying loads greater than or equal to 5 MVA in urban and non-urban areas.

Accordingly TransGrid and Integral Energy have jointly agreed that the network performance requirements for reliability to be applied to the Macarthur area and the South West Sector development are as follows:

1. With all network elements in service, the loading on each element is not to exceed the continuous rating of that element.
2. Following outage of one network element, the loading on each remaining element is not to exceed the short time emergency rating of that element whilst operator actions, such as opening of other network elements and transferring of loads via lower voltage networks, are taking place.
3. With one network element out of service and following operator actions:
  - The loading on each remaining element is not to exceed the sustained emergency rating of that element;
  - The voltage levels at end-user premises are to be within acceptable levels following switching of reactive plant and operation of transformer tap-changers.

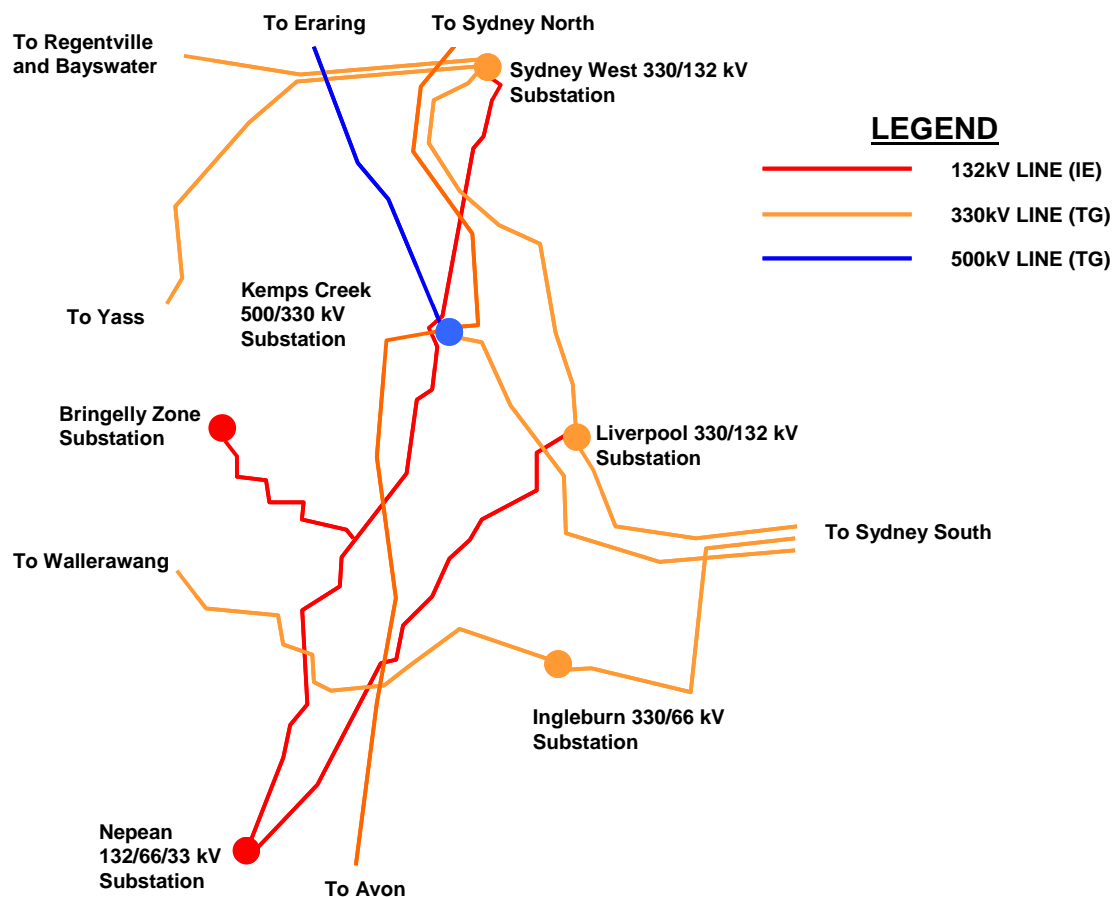
In terms of network reliability standards as described in the Rules, this constitutes a nominal “N-1” reliability criterion (as described in S5.1.2.2 (b) (4)).

### **2.3. Existing Supply Arrangements for the Macarthur Area**

The Macarthur area includes the local government areas of Campbelltown and Camden. It has a population of around 200,000. The area electrical load is characterised primarily by residential loads with some commercial, light industrial and rural loads.

TransGrid’s 500 kV & 330 kV transmission system and Integral Energy’s 132 kV transmission system in the area are shown in Figure 1. Integral Energy takes supply at 132 kV from Sydney West and Liverpool 330/132 kV substations and at 66 kV from Ingleburn 330/66 kV substation.

Figure 1 Transmission Systems in the Macarthur Area



The supply capacity from Ingleburn is limited to 250 MVA, the firm transformer capacity. The demand on Ingleburn was 175MVA in summer 2005/06 and is forecast to rise to 212MVA in 2015/16.

Integral Energy owns two 132 kV lines from Sydney West and West Liverpool to Nepean 132/66/33 kV substation. The capacity of these two lines is limited by sections of underground cable near Nepean substation.

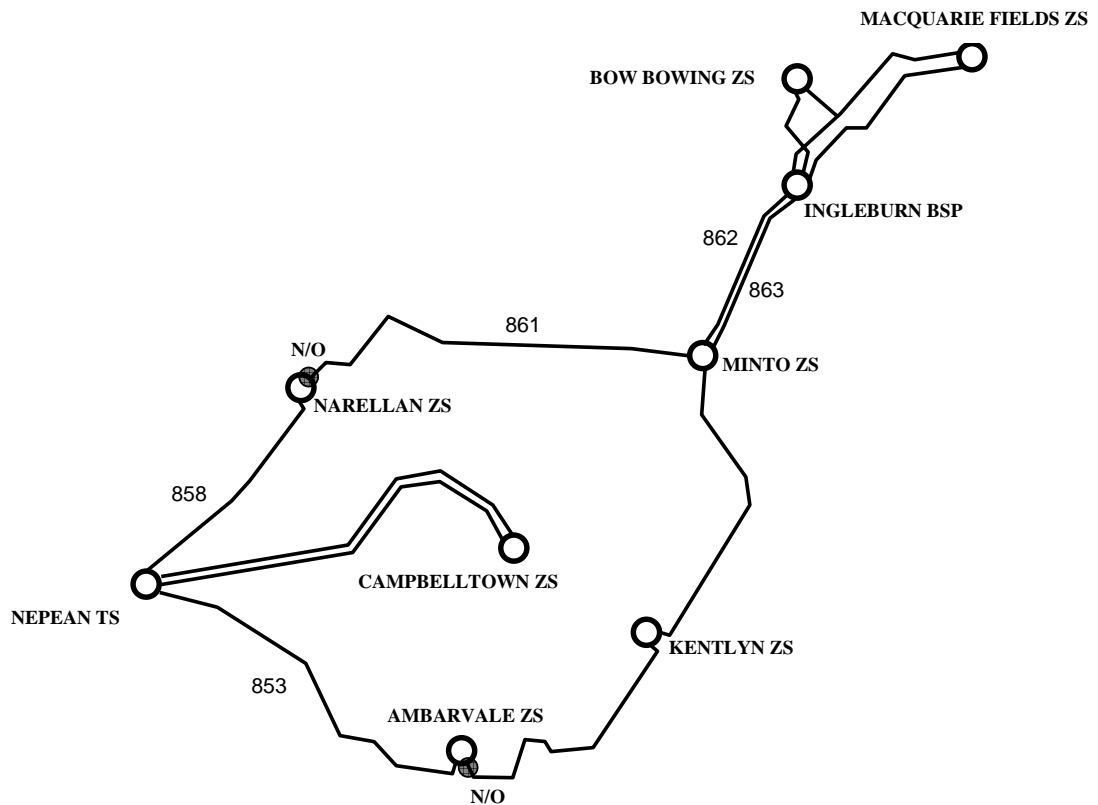
There is generation embedded within Integral Energy's 66 kV network supplied from Nepean. That generation utilises methane drained from coal mines. Its output can be limited to 65 MW due to air quality requirements. This generally occurs on hot days when the system load is high.

Consequently, the maximum load from a transformer capacity perspective which can be reliably supplied from Nepean is 245MVA, (2 x 60MVA at 33kV and 2 x 120MVA at 66kV transformers), taking into account 65 MW of embedded generation. However, this is further constrained by the capacity of the incoming 132kV lines (Feeders 93X and 93Y), which are rated at approximately 172MVA (summer) each, making a resultant firm capacity of 237MVA. The demand on Nepean was 172MVA in summer 2005/06 and is forecast to rise to 266MVA by 2015/16

Some measure of support to Nepean can be provided from Ingleburn substation by allowing for the transfer of Narellan Zone Substation and Ambarvale Zone Substation to the Ingleburn system. This is only feasible at non peak times, as supply from Ingleburn is limited due to constraints with the 66kV feeders from Ingleburn to Minto Zone Substation.

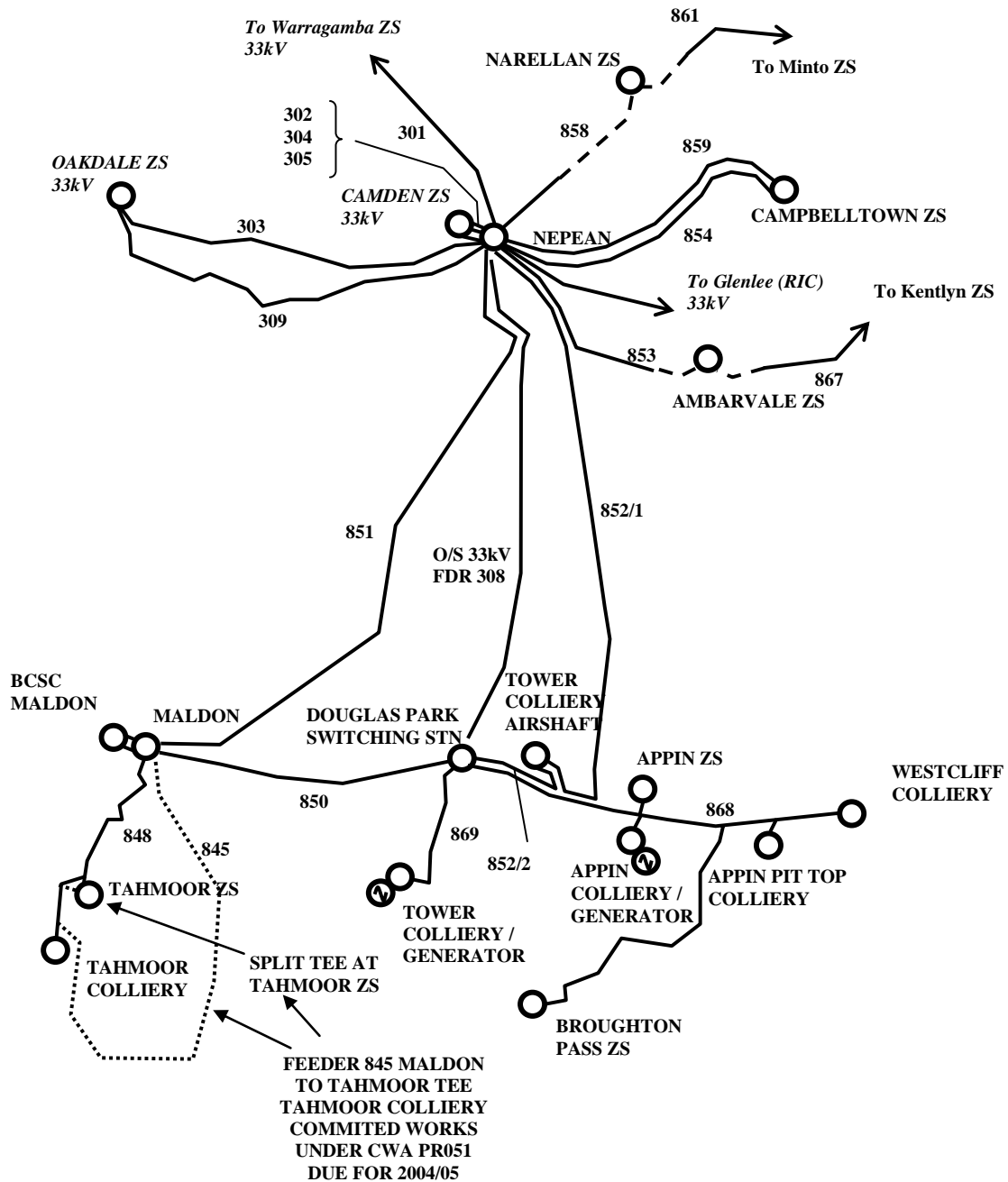
Integral Energy's subtransmission systems serving the area, which are supplied from Ingleburn and Nepean substations, are shown in Figure 2 and Figure 3.

Figure 2 Ingleburn 66 kV Subtransmission System



The capacity of Integral Energy's 66 kV network south of Ingleburn substation is currently limited to 64MVA firm by the rating of feeders 862 and 863, which are each rated at 64MVA (summer). A single contingency on one of these lines requires that Kentlyn Zone Substation be transferred to the Nepean system. The southern load supplied from Ingleburn is forecast to reach 67MVA in 2006/07, which is a constraint on this system.

Figure 3 Nepean 66 kV and 33 kV Subtransmission Systems



The combined capacity of Ingleburn and Nepean is therefore comprised of the capacity of Ingleburn together with the capacity at Nepean. This amounts to a total of 487MVA. As explained above, there is little transfer capacity across these systems due to constraints on the subtransmission networks.

## 2.4. Local Load Forecast

Load forecasts for the Macarthur area have been developed and the results are summarised in the following Table 1 and Figure 5 in Section 2.6.

Table 1 shows the load for each of the discrete areas of the network in the Macarthur area using forecast data for the 2014/15 summer. It can be seen that the projected total load is in the order of 660 MVA, with an additional 11 MVA being supplied into the South West sector.

**Table 1 Potential Load in the Macarthur Area**

	Existing/Proposed Zone Substation	Potential Load (MVA)
<b>Northern (Ingleburn) Area</b>	Bow Bowling	59.7
	Macquarie Fields	41.9
	Minto	78.5
	Edmondson Park (Release Area)	37.1
	<b>Subtotal</b>	<b>217.2</b>
<b>Central (Campbelltown) Area</b>	Kentlyn	39.1
	Ambarvale	33.8
	Campbelltown	53.2
	Narellan	67.2
	Menangle Park / Mt Gilead (Release Area)	39.5
<b>Subtotal</b>	<b>233</b>	
<b>Nepean (Northern) Area</b>	Camden	74.1
	Nepean RIC	6.1
	Oakdale	11.3
	Elderslie / Spring Farm (Release Area)	21.5
<b>Subtotal</b>	<b>113</b>	
<b>Southern (Appin/Tahmoor) Area</b>	Appin	10.0
	Appin Pit Top	5.2
	Appin Colliery	9.1
	BCSC Maldon	11.8
	Brooks Point	2.9
	Broughton Pass	3.4
	Maldon	34.2
	Tahmoor	14.2
	Tahmoor Colliery	11.2
	Douglas Park Site	15.0
	Westcliff Colliery	22.0
	Wilton (Release Area)	10.0
	<b>Subtotal (Incl Embedded Generation)</b>	<b>89</b>
<b>Total Study Area 66kV Potential Load</b>		<b>661</b>
<b>Load of South West Sector to be supplied from Nepean</b>		<b>11</b>
<b>Total Estimated Load 2015</b>		<b>672</b>

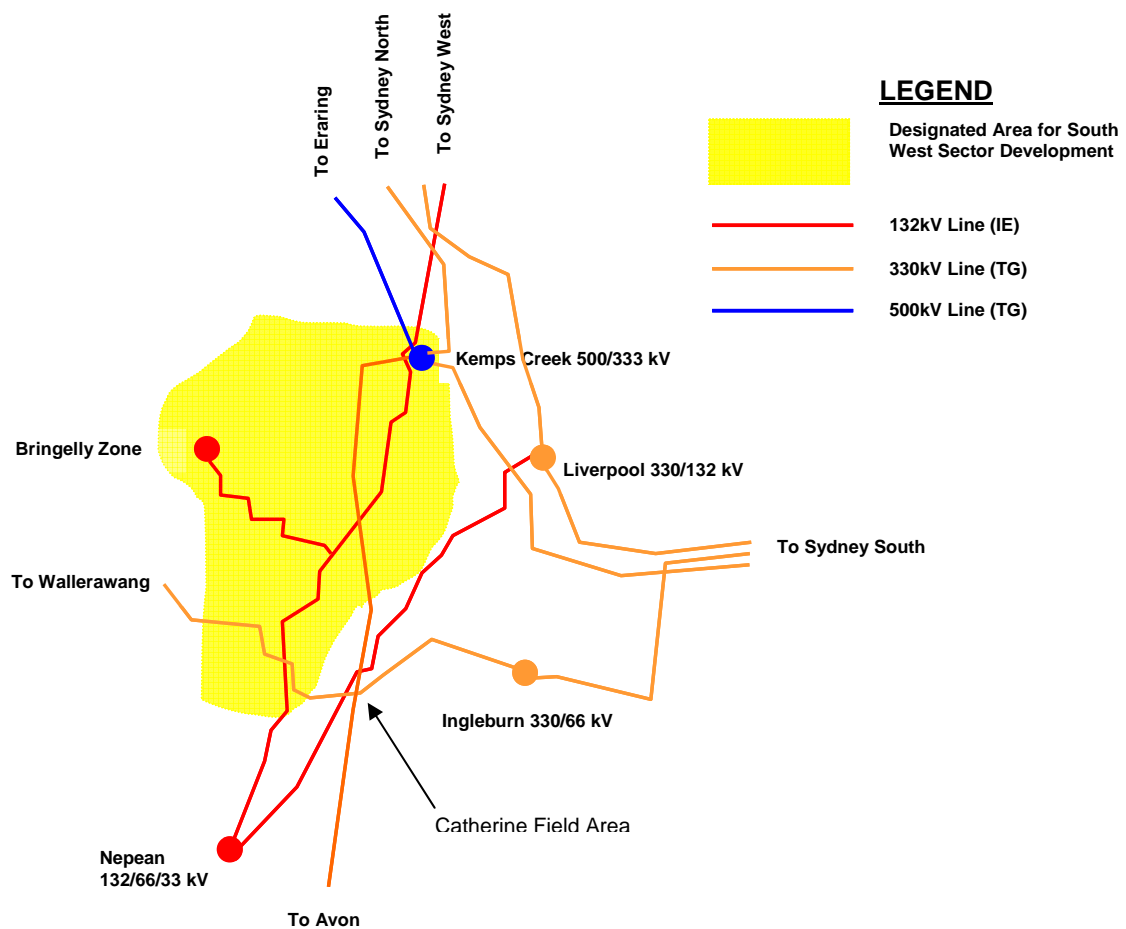
As previously stated, the capacity of the existing supply sources of Ingleburn and Nepean is 250MVA and 237MVA respectively, leaving a capacity shortfall of approximately 113MVA in meeting the forecast demand of the total area. As also previously stated, there is limited transfer capacity from the Ingleburn subtransmission system to assist the Nepean system and this further highlights the capacity shortfall.

## 2.5. Development of the South West Sector

The Department of Planning has announced the development of the South West Sector, shown in Figure 4, to an accelerated program. This development is forecast to create up to 110,000 new residential lots, as well as new urban and employment centres, and will result in substantial demand overall. In the long term the area demand is expected exceed 500 MVA.

Any development to meet the requirements of the Macarthur area must also be capable of accommodating at least part of the South West Sector development. Preliminary planning for the South West Sector has determined that support of the order of 260MVA ultimately will be required into the southern part of the South West Sector, specifically the Oran Park, Maryland, Catherine Field and East Leppington precincts. This could be sourced from Nepean substation and transmitted into the new development areas utilising the existing 132kV feeders 93X and 93Y and by converting the existing 33kV feeder 301 (Nepean – Warragamba) to 132kV operation. Alternatively, it could be provided from a new 330/132 kV substation in the Catherine Field area.

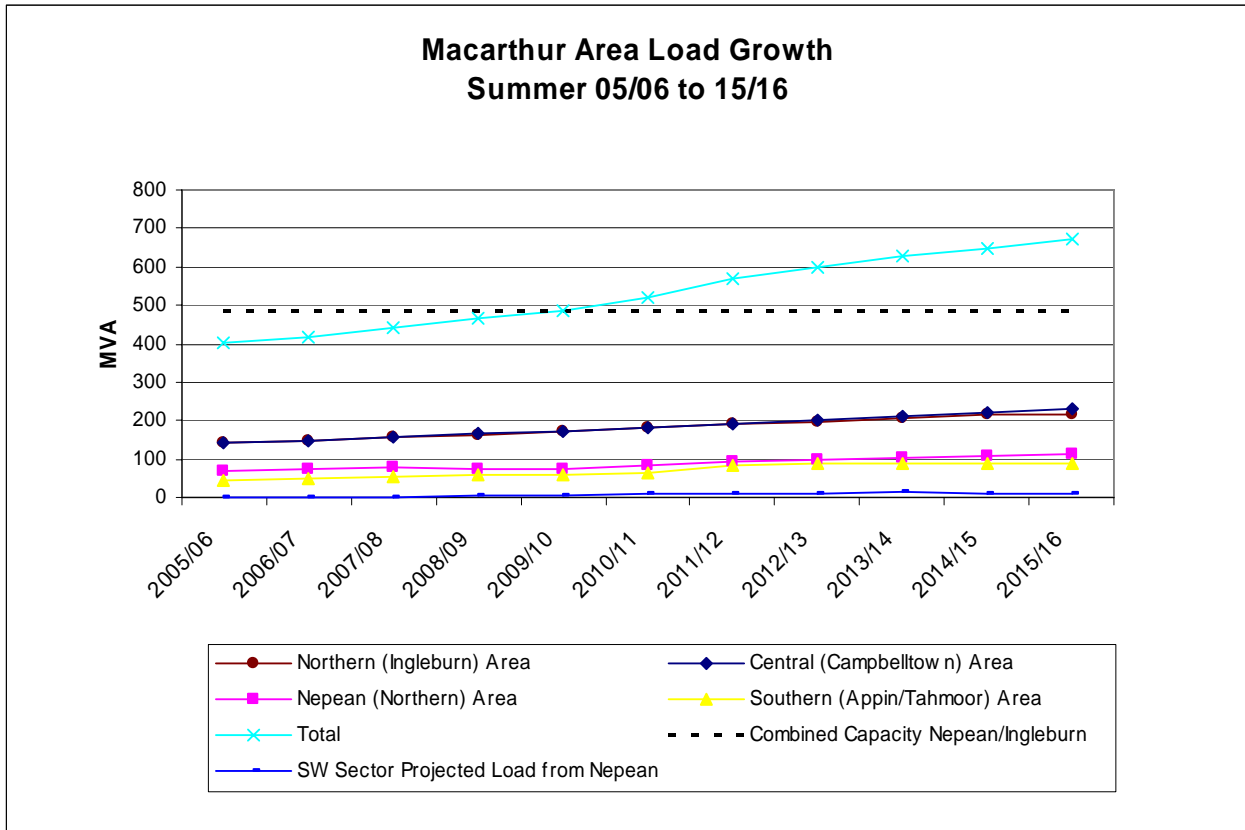
Figure 4 South West Sector



## 2.6. Network Constraints

If all elements of the network supplying the Macarthur area are in service, it is expected to be capable of adequately supplying the area at all times over the next ten years. However, within this period the loading on the network is expected to exceed its firm capacity. Figure 5 shows the forecast demand. The firm network capacity (indicated by the dotted line) is expected to be reached by summer 2009/10.

Figure 5 Macarthur Area Forecast Demand to 2015/16



## 2.7. Joint Planning

Integral Energy and TransGrid have jointly planned the 330 kV and 132 kV networks supplying the Macarthur area for many years.

TransGrid and Integral Energy 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 constraints outlined in Section 2.6 give rise to a need for network augmentations and have carried out joint planning to determine options for these augmentations.

As a result of joint planning for this proposal it has been agreed that, in meeting the above requirements, TransGrid will construct any required 330 kV line and 330/132/66 kV substation works, and that Integral Energy will construct any required 132 kV and 66 kV connections to its existing network and 132 kV and 66 kV substation works.

## 2.8. Reliability Augmentation

It follows from Sections 2.1 – 2.6 that the proposals covered by this application notice constitute a reliability augmentation and that the regulatory test should be applied in accordance with Clause 1(a) of the test.

## **2.9. Material Inter-network Impact**

The Rules require TransGrid to assess whether a proposed new large transmission network asset is reasonably likely to have a material inter-network impact.

TransGrid has determined that none of the options described in Section 3 will impose power transfer constraints or adversely impact on the quality of supply to adjoining transmission networks.

## **2.10. Consideration of DSM and Local Generation**

In 2003 TransGrid issued a request for proposals for demand management in the Liverpool/Camden area. That request elicited no responses.

As part of Integral Energy's normal planning processes demand management options are investigated as alternatives and compared with network expansion options. The most technically feasible and cost effective option(s) are selected for implementation. This is also a regulatory requirement as stipulated in the Demand Management for Electricity Distributors Code of Practice.

The main driver for a network reinforcement is twofold, the first being to supply load growth in the existing Macarthur area, including such developments as Elderslie, Springs Farm, Glen Alpine and Blair Athol and secondly to supply new developments in the South West Sector and Campbelltown region. The 'Demand Management Code of Practice for Electricity Distributors' states that a 'reasonableness test' be performed to determine if a public process is required to investigate demand management alternatives. The 'reasonableness test' used by Integral Energy states that 'Greenfield' re-development does not warrant the adoption of a public process for investigating non-network options via an RFP.

Integral Energy is currently running a demand management program in the Campbelltown CBD and surrounding industrial area to reduce peak demand by 3,900kVA to defer the augmentation of Campbelltown Zone Substation. A new demand management program is also being developed for the Minto industrial area to defer the construction of a new zone substation by reducing peak demand by 3 MVA.

The impact of these demand management activities has been incorporated into the forecast.

As previously mentioned, one of the main drivers for network reinforcement is the release of new development areas in the South West Sector. The area is expected to see some 1,000 lots released per annum from 2009 increasing the peak demand by approximately 5 MVA annually. Consequently to defer the need for network reinforcement the peak demand would need to be reduced by 5 MVA plus the general annual load growth. As the bulk of the total load growth is in the residential sector this is not considered to be feasible.

In summary, demand management initiatives have been implemented in commercial and industrial areas to defer local distribution network augmentation. However, demand management will not defer the need for network augmentation due to the high level of load growth that would need to be reduced in the Macarthur residential sector and the fact that the bulk of the load growth is due to new residential development in the South West Sector.

### 3. Options

TransGrid and Integral Energy have developed four network options to meet the constraints described in Section 2. These options are described in the following sections.

#### 3.1. Option 1: Augment Ingleburn 330/66 kV Substation and 66 kV Works

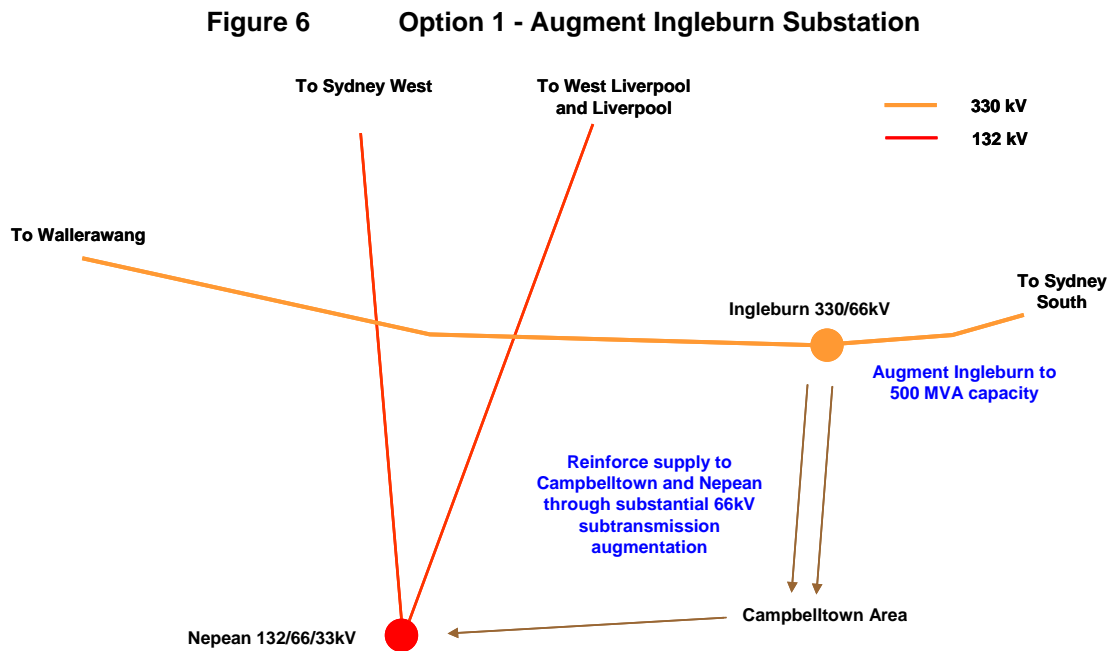
This option is shown in Figure 6 below. It would involve the following works:

- Installation of two additional 250 MVA 330/66 kV transformers at Ingleburn 330/66 kV substation; and
- A significant increase in the capacity of Integral Energy’s 66 kV network between Ingleburn and the Campbelltown area.

To provide the increased capacity it would be necessary to construct a number of new 66 kV lines through existing built up areas. Routes for those lines would be very difficult to obtain.

This option would provide increased capacity to the Campbelltown area but would not provide sufficient capacity to allow some of the South West Sector load to be supplied from the existing 93X and 93Y 132 kV lines. Consequently, to supply the South West Sector, an additional 330/132 kV substation in the Catherine Field area would be required.

Due to the difficulty in obtaining additional 66 kV line routes and the cost of augmenting Ingleburn and constructing an additional 330/132 kV substation at Catherine Field, this option has not been considered further.



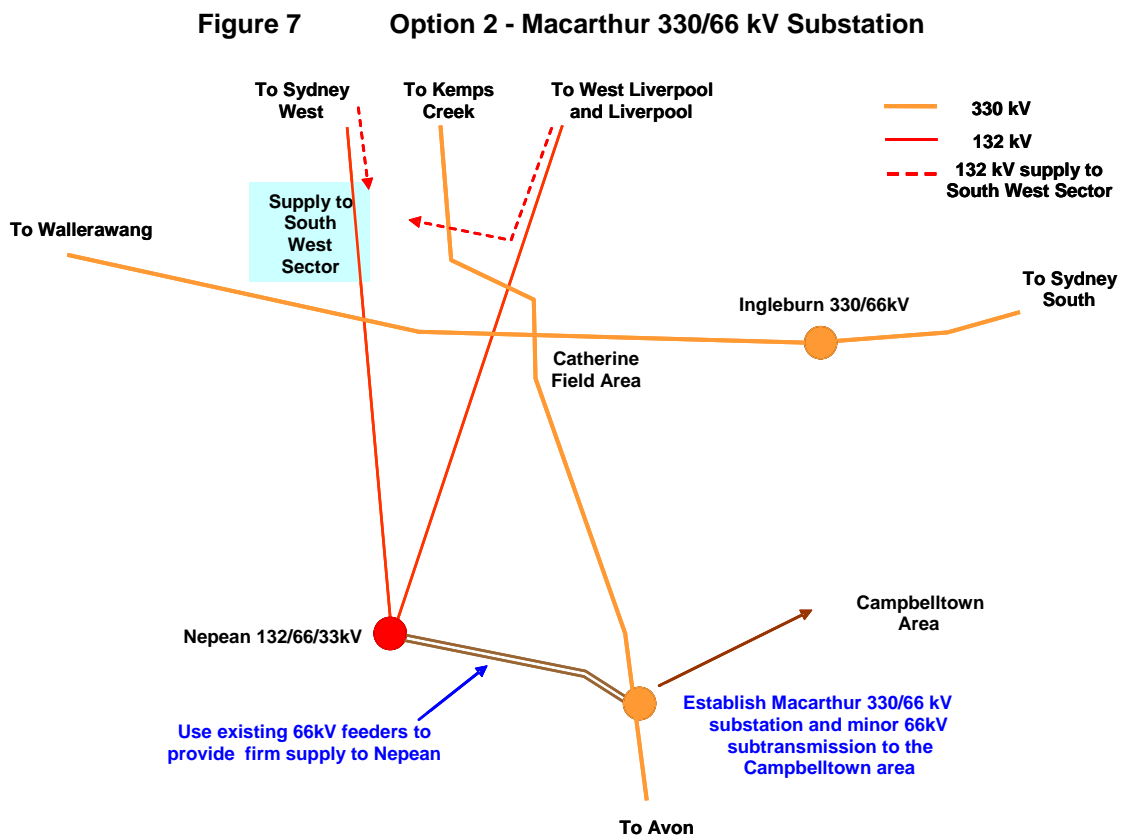
### 3.2. Option 2: Macarthur 330/66 kV Substation & 66 kV Connections

This option is shown in Figure 7 below. It would involve the following works:

- Establishment of a new Macarthur 330/132/66 kV substation close to the route of the existing Kemps Creek – Avon 330 kV line;
- Construction of some new sections of 66 kV line to connect it to Integral Energy’s existing 66 kV network in the area.

This option would allow for some capacity to be released from Nepean, and this would be in the order of 160MVA in 2014/15, comprising the summated loads of the existing Campbelltown, Kentlyn and Ambarvale substations and the future Mt Gilead release area.

As this option would not provide sufficient capacity for the South West Sector, an additional 330/132 kV substation in the Catherine Field area would be required. Due to the cost of establishing both Macarthur 330/66 kV substation and Catherine Field 330/132 kV substation, this option has also not been considered further.



### 3.3. Option 3: Catherine Field 330/132 kV Substation, Campbelltown 132/66 kV Substation and 132 and 66 kV Connections

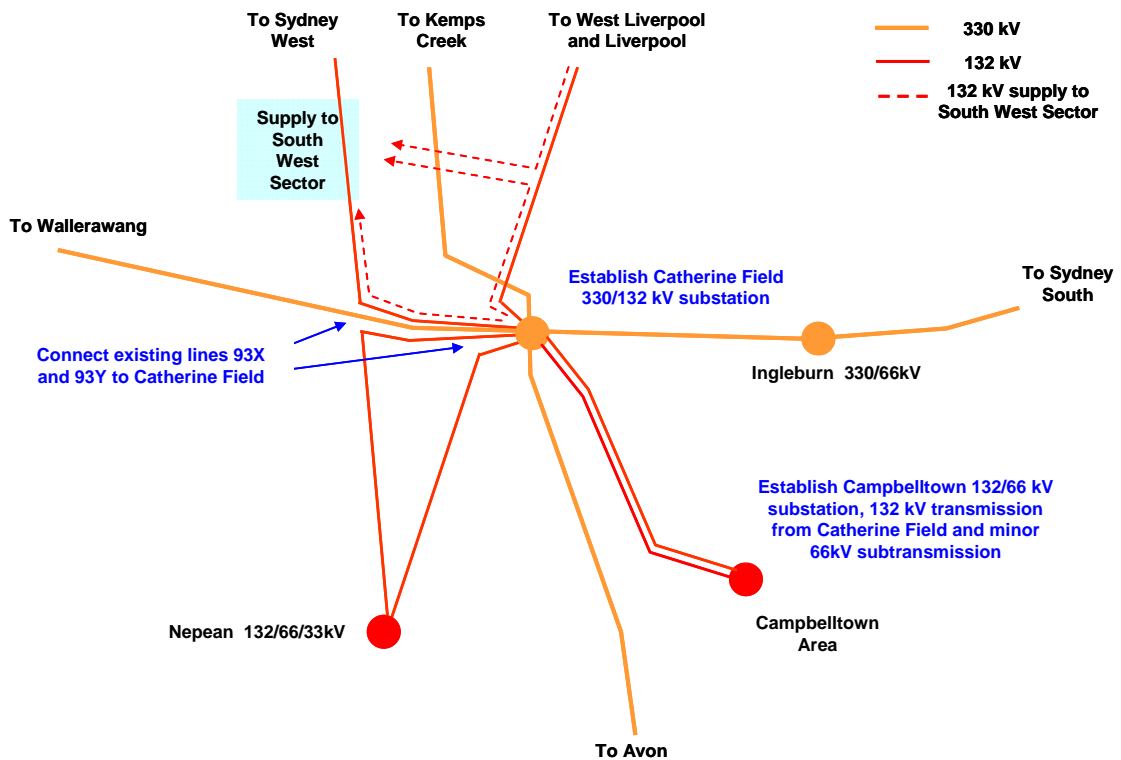
This option is shown in Figure 8 below. It would involve the following works:

- The establishment of a new 330/132 kV substation at Catherine Field near the intersection of TransGrid’s Kemps Creek – Avon and Wallerawang – Ingleburn/Sydney South 330 kV lines and Integral Energy’s 93Y line;
- To supply the Campbelltown area the establishment of a new 132/66 kV substation in that area plus construction of a new double circuit 132 kV line to connect Catherine Field and Campbelltown substations plus minor 66 kV connections near Campbelltown; and
- To supply the south west sector, construction of 132 kV connections between the existing Sydney West – Nepean line 93X and Liverpool – Nepean 132 kV line 93Y and Catherine Field substation.

Obtaining a route for the Catherine Field - Campbelltown 132 kV line would be difficult.

This option would meet the needs of the Macarthur area and also provide substantial capability to supply the south west sector. It is estimated to cost \$92 million (±25%).

**Figure 8 Option 3 - Catherine Field and Campbelltown Substations**



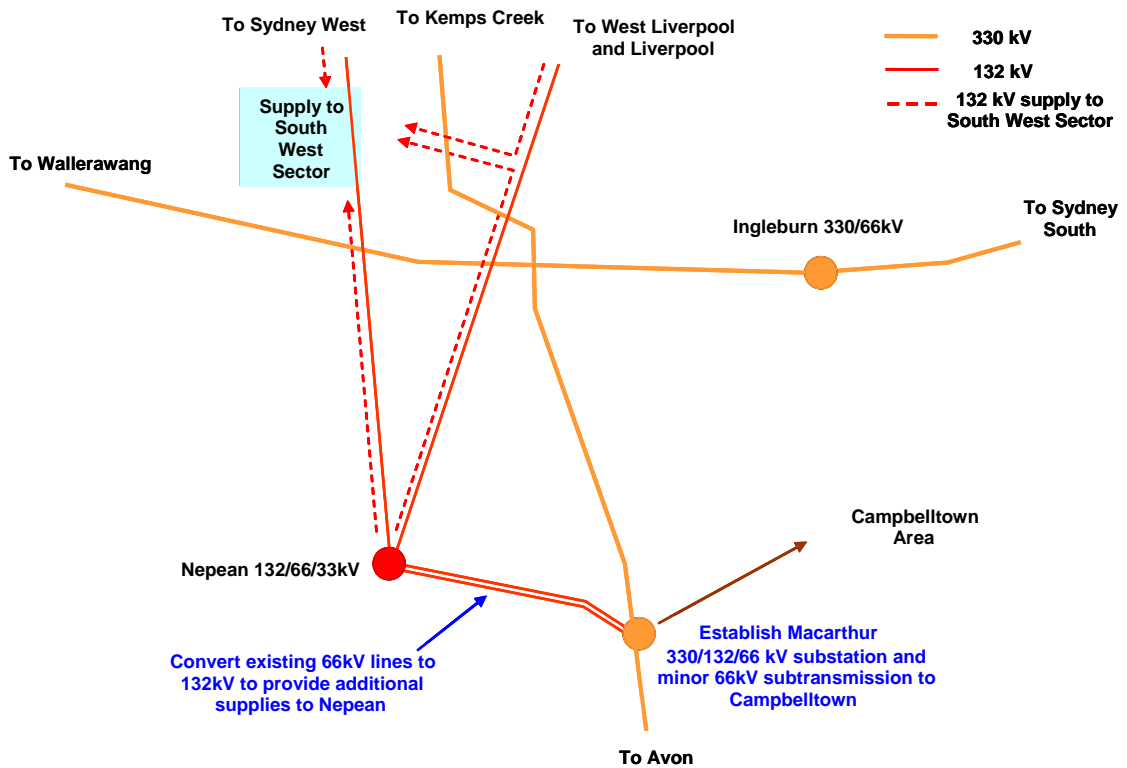
### 3.4. Option 4 Macarthur 330/132/66 kV Substation, 132 and 66 kV Connections

This option is shown in Figure 9 below. It involves the following works:

- Establishment of a new Macarthur 330/132/66 kV substation close to the route of the existing Kemps Creek – Avon 330 kV line;
- Replacement of two existing 66 kV circuits by two high capacity 132 kV circuits to supply Nepean 132/66/33 kV Substation from Macarthur substation; and
- 66 kV connections from Macarthur substation to Campbelltown and an additional 66kV feeder to Ambarvale.

This option would meet the needs of the Macarthur area and also provide substantial capability to supply the south west sector. It is expected to cost \$70 million (±25%) and be substantially completed by summer 2009/10.

**Figure 9 Option 4 - Macarthur 330/132/66 kV Substation, 132 kV and 66 kV Connections**



## 4. Preliminary Application of the Regulatory Test

A preliminary application of the Regulatory Test, considering network Options 3 and 4, has been carried out. A summary of the results is provided in the following sections.

### 4.1. Form of the Regulatory Test

As discussed in Section 2 the options covered by this application notice are a reliability augmentation and the regulatory test is to be applied in accordance with clause 1(a) of the test:

- (a) in the event the option is necessitated solely by the inability to meet the minimum network performance requirements set out in schedule 5.1 of the Rules or in relevant legislation, regulations or any statutory instrument of a participating jurisdiction - the option minimises the present value of costs, compared with a number of alternative options in a majority of reasonable scenarios;

TransGrid and Integral Energy's interpretation of the regulatory test for reliability augmentations is as follows.

The following costs should be included:

- Capital costs of options;
- O&M costs of options;
- Costs associated with relevant government taxes;
- Negative costs associated with relevant government subsidies; and
- Costs of other transmission developments that may be required to address future constraints.

The following avoided costs should not be included:

- Reductions in electrical losses;
- Reductions in unserved energy;
- Deferrals of generation investment in the NEM; and
- Avoided fuel costs elsewhere in the NEM.

Market development scenarios are only relevant to the extent that they affect the timing of the onset of network constraints and/or the ability of options to meet those constraints.

### 4.2. Preliminary Regulatory Test Application – Summary

#### 4.2.1. Costs

For the preliminary regulatory test application only the capital and operating & maintenance costs of Options 3 and 4 have been explicitly included.

There are no known existing or anticipated government tax or subsidy schemes that would apply materially differently to the operation of these Options.

There are no known emerging network constraints in the area (other than those described in Section 2.6) for which the solution would be materially differently affected by any one of these options.

#### 4.2.2. Scenarios

There are no known committed, advanced or publicly announced generation developments that are likely to affect the timing of the onset of the network constraints described in Section 2.6 or the ability of any of the options to meet those constraints. Thus a single market development scenario has been considered, which corresponds to a medium economic growth outcome, and which does not explicitly model generation developments.

### 4.2.3. Results

The present value of costs of each option has been calculated for a base case of financial and technical assumptions and the options ranked accordingly. Sensitivity tests of these calculations due to reasonable variations to the major assumptions have been carried out.

The base case assumptions and the range over which sensitivity tests were conducted are shown in Table 2. The results of the analysis are shown in Table 3 and Table 4.

Details of the base case economic model are shown in Appendix A.

**Table 2 Base Case Values and Range of Values Used in Sensitivity Checks**

Parameter	Base Case Value	Sensitivity Checks at
Real Discount Rate	9%	6% and 12%
Annual O&M Cost	2% of Capital Cost	1% and 3% of Capital Cost
Asset Lifetimes		
Substations	30 years	20 and 40 years
Transmission Lines	45 years	30 and 60 years
Capital Costs	Nominal Value	±25% variation

**Table 3 Comparison of Options – Base Case**

Option	Description	PV of Costs (\$M)	Rank
Option 1	Augment Ingleburn 330/66 kV Substation	This option was discarded.	
Option 2	Macarthur 330/66 kV Substation	This option was discarded.	
Option 3	Catherine Field 330/132 kV Substation	62.0	2
Option 4	Macarthur 330/132/66 kV Substation	46.5	1

**Table 4 Comparison of Options - Results of Sensitivity Studies**

Sensitivity Case	Option 3 Catherine Field 330/132 kV Substation PV of Costs (\$M)	Option 4 Macarthur 330/132/66 kV Substation PV of Costs (\$M)
Base Case	62.0	46.5
12% Discount Rate	58.9	44.0
6% Discount Rate	63.6	48.0
25% Increase in Capital Costs	77.5	58.2
25% Decrease in Capital Costs	46.5	34.9
Decrease in Asset Lives	66.3	49.8
Increase in Asset Lives	59.8	44.9
Decreased O&M Cost	57.3	43.0
Increased O&M Cost	66.0	50.0

In each case Option 4 has lower present value of costs and is the highest ranked option.

The robustness of these results can be tested by carrying out “stress tests” on the assumptions. For example, if the capital costs of all components of Option 4 are increased by up to about 33%, with no increase in the capital costs of Option 3, Option 4 is still the highest ranked option. Similarly, Option 4 is still the highest ranked option if the capital costs of Macarthur Substation are increased by up to about 48% with no other increases in capital costs.

## 5. Preliminary Conclusions and Recommendation

At this stage and subject to comments received during the consultation process, TransGrid and Integral Energy conclude that Option 4 would satisfy the regulatory test. On that basis they would recommend the construction of that option. This would entail the establishment of a new 330/132/66 kV substation at Macarthur close to the route of the existing Kemps Creek – Avon 330 kV line, together with associated 132kV high capacity lines to Nepean Substation and 66kV connections in the Campbelltown area. Those works are expected to cost \$70 million ( $\pm 25\%$ ) and to be substantially completed by summer 2009/10.

## 6. Contact Details for Submissions and Enquiries

In accordance with the National Electricity Rules, TransGrid and Integral Energy invite written submissions from interested parties on this application notice.

Submissions are due by 01/02/2007.

Submissions or other enquiries should be directed by email to:

TransGrid : [regulatory.consultation@transgrid.com.au](mailto:regulatory.consultation@transgrid.com.au)

OR

Integral Energy : Ty Christopher

Manager System Development ([ty.christopher@integral.com.au](mailto:ty.christopher@integral.com.au))

Application Notice – Development of Supply to the Macarthur Area and Southwest Sector

Appendix A - Least Capital and Operating Cost Analysis of Base Case

Macarthur Area: Preliminary Application of the Regulatory Test Option 3: Catherine Field Area 330/132 kV Substation																
	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Residual
<u>Capital Expenditure</u>																
Integral Energy Lines																
Minto - Campbelltown	0.1	1.4														-1.0
Ingleburn - Minto	0.1		2.6													-1.9
Catherine Fld - Campbelltown	0.1	4.0	3.0	3.0												-7.2
Campbelltown - Ambarvale	0.1		1.8	1.8												-2.7
Ambarvale - Menangle Park	0.1		2.0	2.0												-2.9
TransGrid Line				1.6												-1.2
Integral Energy Substations																
Campbelltown	2.0		8.0	5.0	5.5											-12.0
Minto busbar works			2.0													-1.1
Zone substation switchbays			1.0	1.3												-1.4
Nepean Reactors					0.4											-0.3
TransGrid SS - Catherine Field				42.7												-25.6
<u>O &amp; M Expenditure</u>																
Line		0.0	0.1	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Substation		0.0	0.0	0.3	1.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Total Expenditure	2.4	5.5	20.6	58.0	7.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	-57.3
<b>PV of Expenditure (\$Million)</b>	<b>62.0</b>															

<b>Total Capex Costs (\$Million)</b>	<b>91.6</b>
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**Application Notice – Development of Supply to the Macarthur Area and Southwest Sector**

<b>Macarthur Area: Preliminary Application of the Regulatory Test</b>																
<b>Option 4: Macarthur 330/132/66 kV Substation</b>																
	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Residual
<b>Capital Expenditure</b>																
<b>Integral Energy Lines</b>																
Minto - Campbelltown	0.1	1.4														-1.0
Macarthur - Nepean	0.1		4.1	4.0												-5.9
Macarthur - Campbelltown	0.1		2.7													-2.0
Macarthur - A'vale/D'g'lass Pk	0.1		0.5													-0.4
Macarthur - Ambarvale	0.1		0.7	0.7												-1.1
TransGrid Line				1.0												-0.7
<b>Integral Energy Substations</b>																
Minto busbar works			2.0													-1.1
Zone substation switchbays			1.0	1.3												-1.4
Nepean 132 kV Switchbays				0.7	0.8											-0.9
TransGrid Substation - Macarthur				48.8												-29.3
<b>O &amp; M Expenditure</b>																
Line		0.0	0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Substation				0.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Total Expenditure	0.4	1.4	11.0	56.8	2.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	-43.8
<b>PV of Expenditure (\$Million)</b>	<b>46.5</b>															

<b>Total Capex Costs (\$Million)</b>	<b>70.1</b>
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