OPTION FEASIBILITY STUDY (OFS)

Renewables in Central Western NSW

OFS- 000000001903E revision 0.0

Option description: 330 kV D/C line west of Wellington to renewable zone

Ellipse project description:
TRIM file: [TRIM No]

Project reason: Reliability - To meet connection point reliability requirements
Project category: Prescribed - Connection

Approvals

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Date submitted for approval	27 October 2017	

Table of contents

1. Request

This Option Feasibility Study (OFS) is provided in response to Need/Opportunity Statement and Option Screening Assessment (NOSA) 1903 Rev 0, Option E – 330kV Double Circuit Line West of Wellington to Renewable Zone. The NOSA requests Project Development to undertake a desktop assessment of the works associated with the installation of a new double circuit 330kV line of approximately 170km from Wellington substation to a future renewable zone location, in proximity to the Coonabarabran township, as well as a third 330kV single circuit line from Mt. Piper to Wallerawang substations.

This report provides a desktop assessment of the works described above, taking into account the cost, timing of activities, environmental issues, risk analysis and practicality of being able to complete the works.

2. Considerations

The following scope of work is associated with a new double circuit 330 kV transmission line from Wellington to Coonabarabran and a new single circuit 330 kV transmission line from Mt. Piper to Wallerawang substations.

1. The construction of approximately 170km of a new 330 kV double circuit transmission line from Wellington ,along a new northern greenfield route, to Coonabarabran. The new line is to be constructed with twin Olive conductors, be designed for an operating temperature of 120 degrees Celsius and be equipped with twin OPGW.
    - Wellington 330 kV substation requires the establishment of two new switchbays within the existing substation boundary, located either side of existing Line 79 Wollar and Line 72 Mt Piper switchbays.
    - Coonabarabran requires the establishment of a new 330kV switching station with two new switchbays to connecting to the 330kV busbar.
2. The construction of a new 330 kV single circuit line between Mt Piper and Wallerawang in parallel to the existing route of the double circuit Mt Piper to Wallerawang lines 70 and 71. The new single circuit 330 kV line is to be constructed with twin Olive conductors, be designed for an operating temperature of 120 degrees Celsius and be equipped with OPGW.
    - Wallerawang 330kV switchyard requires the termination of the third Mt Piper to Wallerawang line using the existing spare switchbay and primary equipment on the 330kV Generator Bus that was previously used for No. 8 Generator Transformer (breaker and a half configuration to connect to 330kV Main Bus with Line 70 Mt Piper).
    - Mt Piper 330kV Switchyard requires the termination of the line using the spare bay located between the switchbay for Line 72 Wellington and Line 70 Wallerawang.

2.1 Wellington to Coonabarabran Double Circuit 330 kV Transmission Line

2.1.1 Transmission Line Route

The development of a new 330kV double circuit line between Wellington substation and a future renewable zone location, in proximity to the Coonabarabran township, is shown in Figure 1 below. The 170km of new line route was developed via a desktop identification of potential constraints, such as major highways, waterways, large clusters of vegetation and residential receptors. Further work will be required at the Project development in order to refine the route.

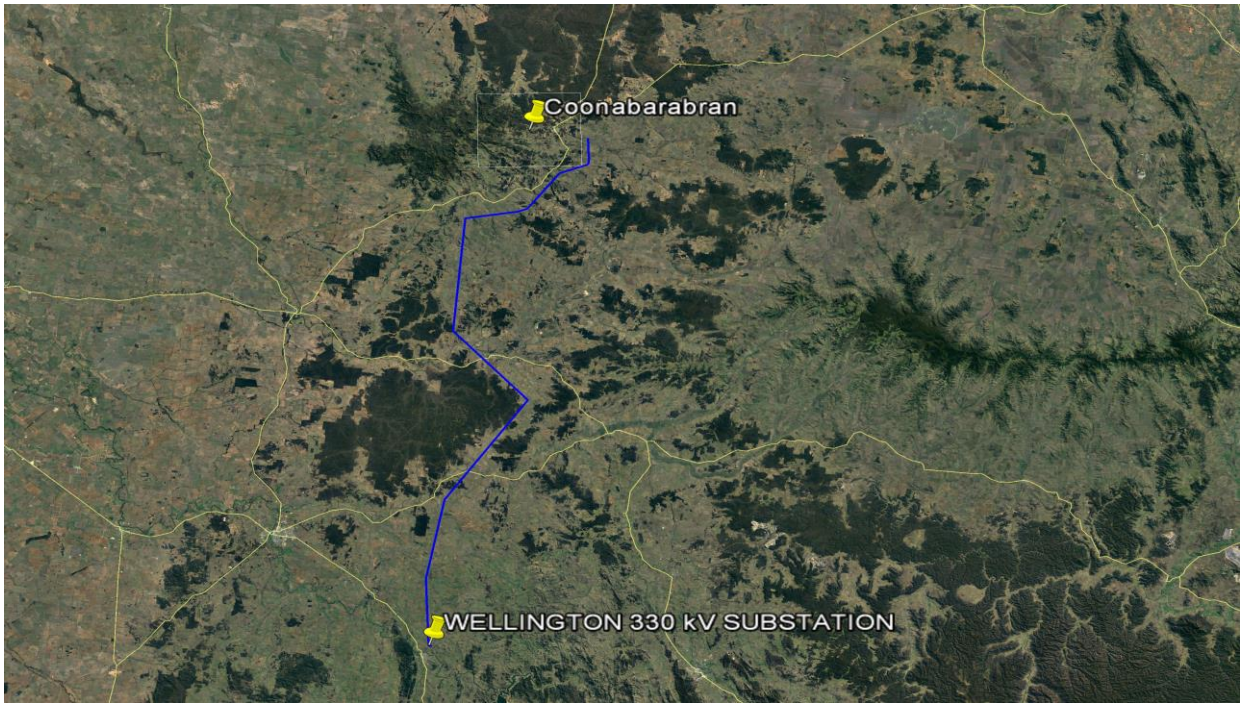

Figure 1 – Proposed Wellington to Coonabarabran 330 kV TL Route

2.1.2 Community and Environmental Issues

2.1.2.1 Land Use

The proposed route utilises both public land and private property. A desktop assessment of the line route indicates the land use being primarily livestock grazing and grain production with some potential forestry uses in an around the Goonoo state forest. The route avoids the urban centres of both Wellington and Coonabarabran, but does pass nearby many rural residences.

2.1.2.2 National Parks

The current route avoids going directly through the Goonoo State Forest, but rather traverses through the cleared sections of vegetation along the south eastern edge of the Goonoo State Forest.

2.1.2.3 Extent of Possible Clearing

Standard clearing ratios have been accounted for in the cost estimate (10, 20, 40, 20, and 10 percent from light to heavy clearing).

Further development of the line route will be required in order to avoid the Goonoo State Forest and minimize the levels of clearing that are required.

2.1.3 Transmission Line Design and Works

The proposed transmission line is as a 330kV double circuit transmission line with twin olive conductors designed for an operating temperature of 120 degrees Celsius. The transmission line will be equipped with OPGW.

2.1.4 Line Connection Works at Wellington 330kV Substation

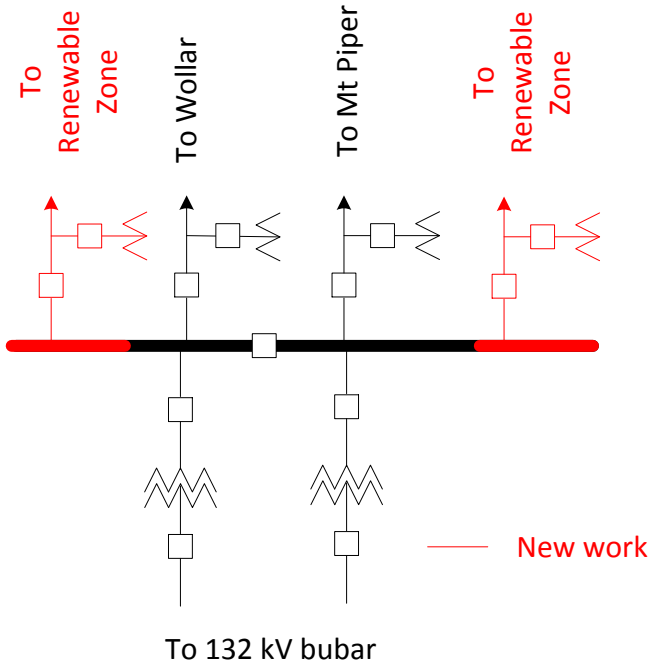

Figure 2 – Proposed Wellington 330 kV Substation Single Line Diagram

2.1.4.1 Civil Works

It is assumed that civil works typical for switching station augmentations and new transmission lines will be required. No unusual civil works have been identified at this stage.

Two new switchbays are required, including a bench extension, site drainage, access, footings and supports for all associated bus extensions and primary equipment (i.e. including two new reactors).

2.1.4.2 Building Works

It has been assumed that no new building works will be required at Wellington for the new line connection. Based on a desktop assessment, the control room contains sufficient space to install new secondary systems equipment.

2.1.4.3 Major Plant and Equipment

Two new reactors, on each of the new 330kV line bays, are required. The reactors are assumed to be POW switched, the rating of each reactor is assumed to be 50MVAr.

2.1.4.4 Minor Plant and Equipment

Standard equipment will be required for two new switchbays and reactors including primary switchgear and associated secondary systems. The switchbay equipment will be designed for a short-circuit rating of 50kA and a load rating of 1500MVA.

2.1.4.5 Electrical Works

Two new switchbays are required including a new reactor for each switchbay. Bus extensions are required for the connection of the new switchbays.

2.1.4.6 Secondary Systems

The secondary systems work required will be typical for the type of work being conducted (i.e. new control and protection panels will be required). Twin OPGW and Power Line Communications (PLC) are required to interface with the site communications system. The other secondary systems infrastructure will not be affected by the proposed substation augmentations.

It is assumed that the existing auxiliary systems have sufficient capacity to provide the required auxiliary supplies to all new equipment. Further assessment is required during the Project Development stage to determine whether upgrades to the AC or DC supplies are required.

2.1.5 Line Connection Works at Coonabarabran 330kV Switching Station

2.1.5.1 Civil Works

The proposed 330kV switching station is a greenfield site that will require earth works to establish a new substation bench. Further footings will be required to facilitate the installation of a new 330kV bus and two switchbays with associated primary equipment and minor field equipment. Civil works will also be required for establishing site facilities including a Secondary Systems Building (SSB) that will contain all required site amenities. Figure 3 below illustrates the proposed circuit breaker arrangement required to facilitate the initial connection works at Coonabarabran.

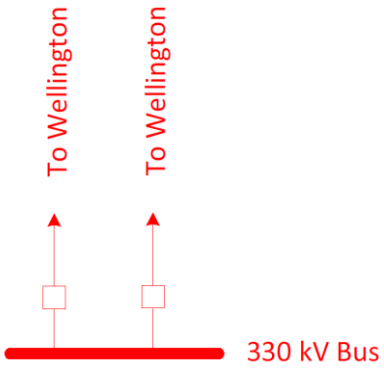

Figure 3 – Proposed Coonabarabran 330 kV Switching Station Single Line Diagram

2.1.5.2 Building Works

A new SSB will be required to provide a control room and site amenities. The SSB should provide space for future customer connections.

2.1.5.3 Major Plant and Equipment

No major plant, such as transformers / reactors are required as part of the initial development of the site.

2.1.5.4 Minor Plant and Equipment

All equipment required to establish a new switching station including a 330kV bus, two switchbays for 330kV line terminations, secondary systems and an SSB. The switchbay equipment will be designed for a short-circuit rating of 50kA and a load rating of 1500MVA.

2.1.5.5 Electrical Works

Electrical works are required to establish a new 330kV bus and two switchbays for 330kV line terminations.

2.1.5.6 Secondary Systems

Standard secondary systems are required for the new switching station, including protection and control for two new line connections. Communications systems are required for the site to interface with twin OPGW and PLC over

the new double circuit 330kV transmission line terminating in the switching station. Note that twin OPGW and PLC are assumed to meet the communications diversity requirement for this site. Auxiliary supply requirements are assumed to be met by a standard 315kVA auxiliary transformer with backup supply from a diesel generator. All secondary systems are required to be installed with provision for future expansion to facilitate customer connections and switchyard extensions/modifications.

2.2 Mt. Piper to Wallerawang Single Circuit Transmission Line

2.2.1 Transmission Line Route

The development of the new 330kV single circuit line between Mt Piper and Wallerawang is expected to parallel the existing Mt Piper to Wallerawang 70 and 71 line shared route as shown in Figure 4 below.

Figure 4 – Proposed Third Wallerawang to Mt Piper 330kV TL Route

2.2.2 Community and Environmental Issues

2.2.2.1 Land Use

The proposed route utilises both public and private land. The majority of the route traverses through the Ben Bullen State Forest. The proposed line entries into Wallerawang may traverse land owned by Delta Electricity as part of the decommissioned Wallerawang Power Station.

2.2.2.2 National Parks

The proposed route runs parallel to the existing 70/71 TL, being approx. 4km through the Ben Bullen State Forest of the overall 8km route length.

2.2.2.3 Extent of Possible Clearing

The new transmission line route requires a new 60m easement through approx. 4km of the Ben Bullen State Forest. The new easement location is proposed to be adjacent to the existing easement for Lines 70 and 71. Allowance has been made for upgrading existing access roads to be used for construction and future maintenance of the new easement. The extent of clearing through the state forest has been accounted for in the estimate.

2.2.3 Transmission Line Design and Works

The proposed transmission line is a 330kV single circuit transmission line with twin olive conductors designed for an operating temperature of 120 degrees Celsius. The transmission line will be equipped with OPGW.

2.2.4 Line Connection Works at Wallerawang 330kV Switching Station

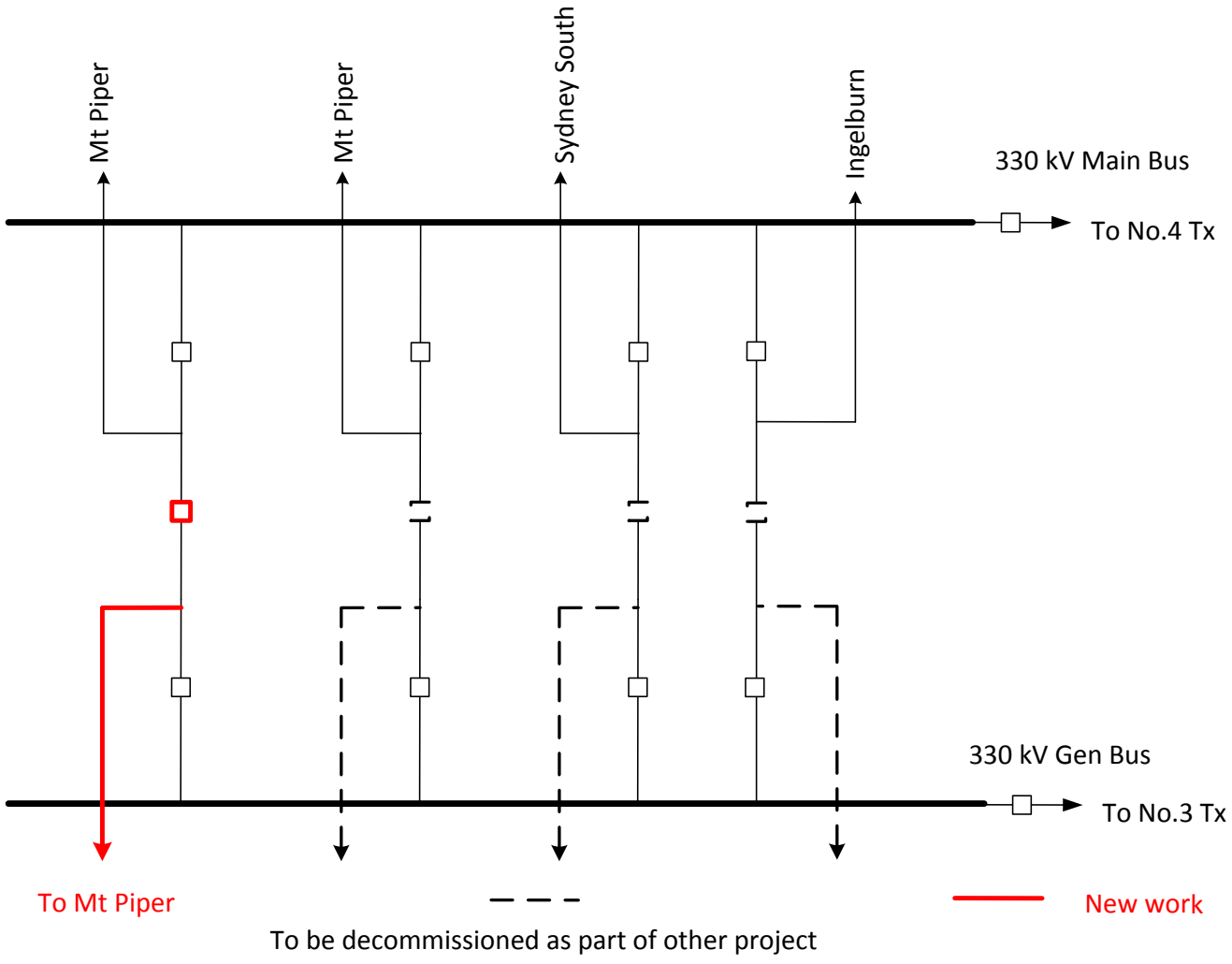

Figure 5 – Proposed Wallerawang 330kV Switchyard Single Line Diagram

The new line connection is to have a breaker-and-a-half arrangement at Wallerawang, with the switchgear to have a short-circuit rating of 50kA and a load rating of around 1500MVA.

At Wallerawang the switchbays on the Generator Bus are all spare, following the recent decommissioning of the Wallerawang power station. Need 1244 has DG1 approval, with the scope of works including decommissioning the centre bay circuit breaker and associated equipment from each switchbay at Wallerawang and installing a rigid bus. This OFS proposes utilising one of the spare switchbays for the new line to Mt Piper, as shown in Figure 6 below. A new centre circuit breaker and associated primary equipment is proposed, to facilitate a breaker and a half arrangement for the new line and the existing line 70 to Mt Piper. The Generator Bus circuit breaker will be renewed as part of need 1244, and so this estimate assumes that only the centre bay requires new equipment.

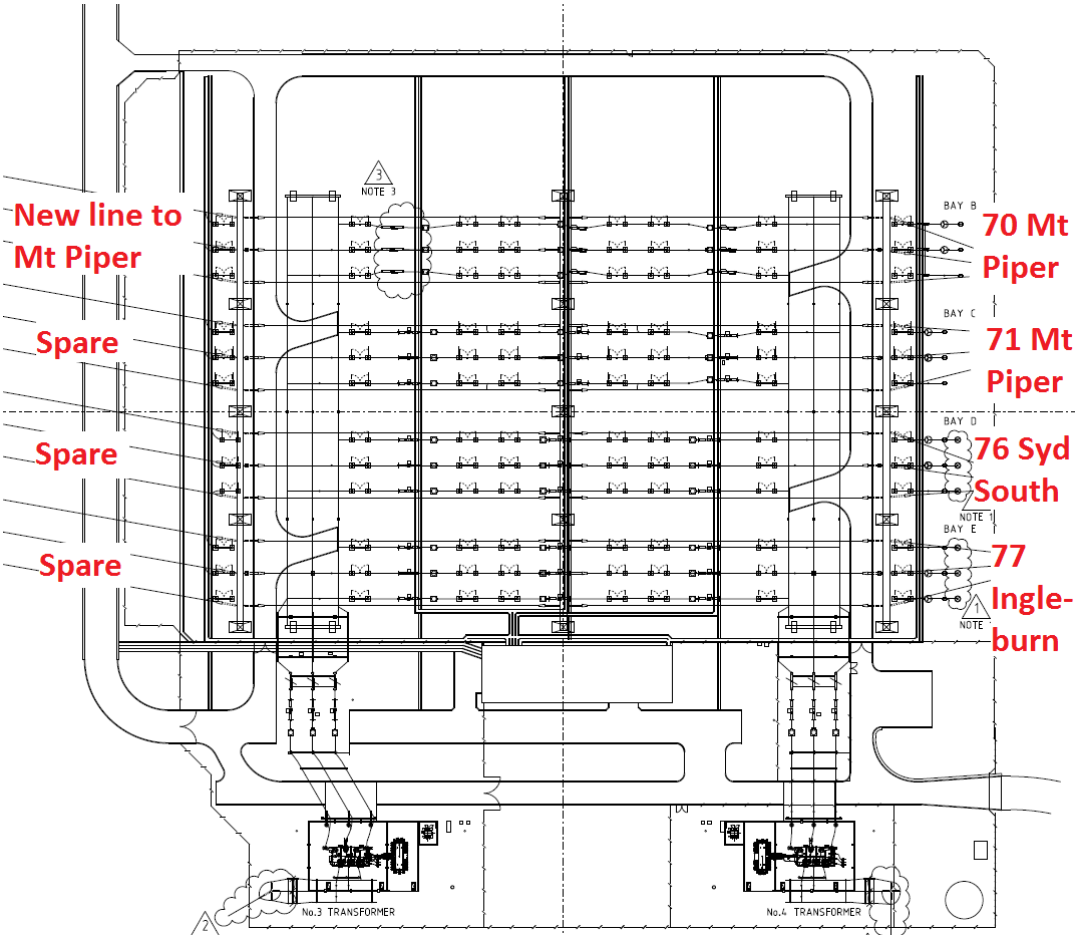

Figure 6 – Connection to Wallerawang 330kV Switchyard

This OFS assumes that the Generator Bus circuit breaker and associated equipment are suitable for reuse. Further assessment of the existing equipment is required during the Project Development stage to confirm suitability of the existing equipment.

2.2.4.1 Civil Works

Standard footings have been assumed for the switchbay. The suitability of the existing equipment footings is should be further assessed during the Project Development stage. Reuse of existing footings may result in a reduction in project cost.

2.2.4.2 Building Works

No new building works will be required at Wallerawang for the new line connection.

2.2.4.3 Major Plant and Equipment

Nil.

2.2.4.4 Minor Plant and Equipment

The switchbay equipment will be designed for a short-circuit rating of 50kA and a load rating of around 1500MVA. New switchbay primary equipment will be required for the centre bay to enable the existing switchbay to be used. All plant can be procured under existing period orders and no unusual plant is required.

2.2.4.5 Electrical Works

New primary equipment is required for the centre bay to establish a breaker and a half arrangement in the switchbay housing the new line termination.

2.2.4.6 Secondary Systems

For this project it has been assumed that the secondary systems work required will be typical for the type of work being conducted (i.e. new secondary systems for the coupler bay will be required). It has also been assumed that other secondary systems infrastructure, such as communications and metering, will not be affected by the proposed switching station augmentations. New secondary systems are required for the centre bay equipment; need 1244 includes scope to decommission existing secondary systems and to leave blank secondary systems panels in place.

2.2.4.6.1 Protection

Standard protection is required for the new line. The existing busbar protection scheme at Wallerawang is sufficient to include the addition of the new line.

2.2.4.6.2 Communications

Communications systems are required to interface with OPGW on the new line to Mt. Piper. It has been assumed that site communications infrastructure will not be affected by the proposed switching station augmentations.

2.2.4.6.3 Control Systems

There is currently a project underway (need 1244) that will upgrade and replace the secondary systems (in-situ) for the entire Wallerawang Substation site. The current project includes decommissioning the existing centre circuit breakers and associated secondary systems. As such, new secondary systems are required for the centre bay to interface with the site secondary systems.

It is assumed that the site will not require additional upgrades or modification of the overall secondary system infrastructure.

2.2.4.6.4 Auxiliary Supplies

It is assumed that there is sufficient capacity on auxiliary supplies for the new secondary systems associated with the new transmission line connection.

2.2.5 Line Connection Works at Mt. Piper 330kV Substation

The new line connection is to have a breaker-and-a-half arrangement at Mt Piper, with the switchgear to have a short-circuit rating of 50kA and a load rating of around 1500MVA.

At Mt Piper the spare bay previously used for the connection of 35 Line to Marulan is to be reused for the connection of the new line, as shown in Figure 7 below.

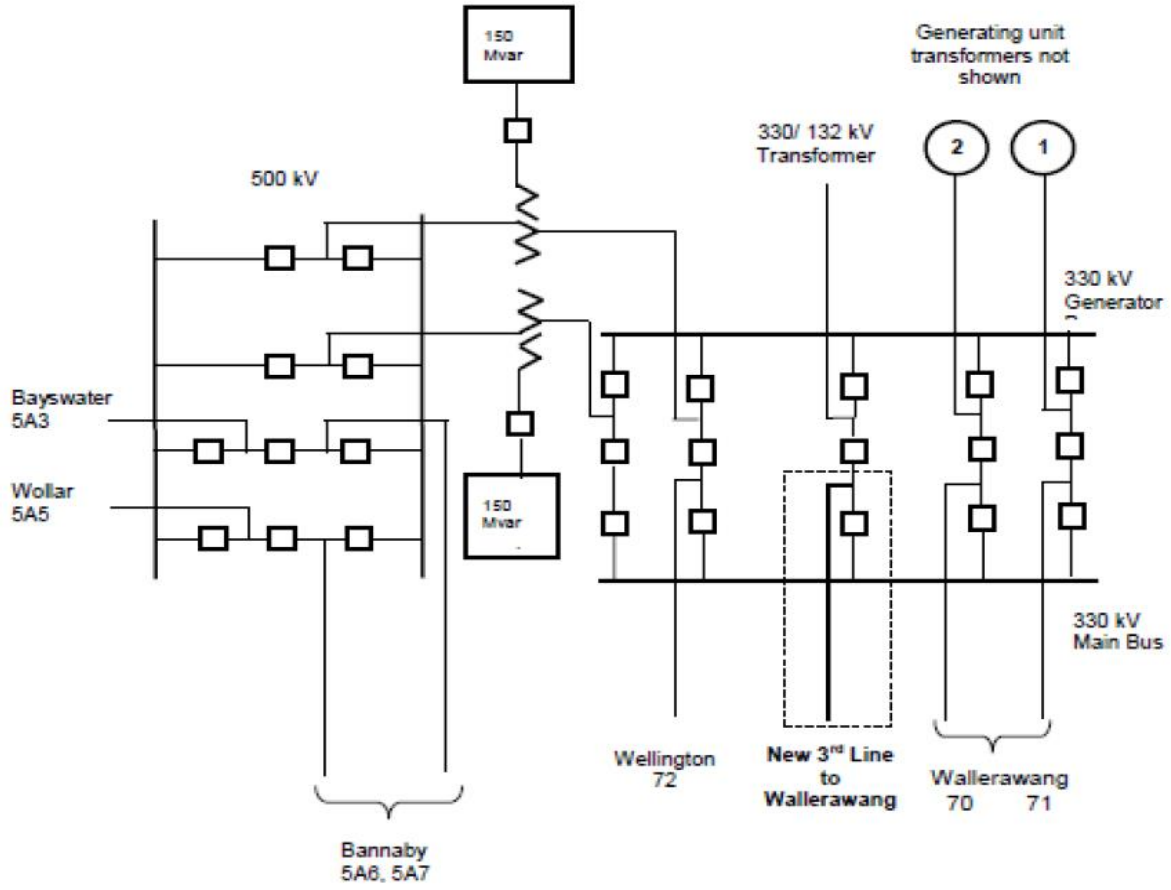

Figure 7 - Development of the Mt Piper 330kV Switchyard

This existing 35 line and line bay has been disconnected, with the overhead conductors and droppers into the yard removed, along with the line VT's. PAD-1436 includes scope to decommission line 35 switchbay by removing the CB, CTs, wave traps, earth switch and disconnectors. As a consequence, this OFS scope includes replacing the main bus CB bay with new equipment.

The bay coupler CB bay is assumed to be suitable in its current condition, other than installing a new disconnector and earth switch that are scheduled to be decommissioned. A detailed condition assessment of this bay is required to be completed to determine the suitability of the HV equipment.

2.2.5.1 Civil Works

At this stage of the project concept it is assumed that civil works typical for switching station augmentations and new transmission lines will be required. Equipment footings in the decommissioned line 35 switchbay are assumed to be suitable for reuse. No unusual civil works have been identified at this stage.

2.2.5.2 Building Works

No new building works will be required at Mt Piper for the new line connection.

2.2.5.3 Major Plant and Equipment

Nil.

2.2.5.4 Minor Plant and Equipment

The switchbay equipment will be designed for a short-circuit rating of 50kA and a load rating of around 1500MVA. All plant can be procured under existing period orders and no unusual plant is required.

2.2.5.5 Electrical Works

The electrical works required will be typical for the type of works undertaken. Potential site specific complications, such as transmission line congestion close to the existing switching station, have not been considered and should be investigated further in the Project Development stage.

2.2.5.6 Secondary Systems

For this project it has been assumed that the secondary systems work required will be typical for the type of work being conducted (i.e. new control and protection panels will be required). Note that the scope of IWR-1436 includes the decommissioned Line 35 secondary system panels to be replaced by blank panels. It has also been assumed that other secondary systems infrastructure, such as communications and metering, will not be affected by the proposed switching station augmentations.

2.2.5.6.1 Protection

The existing Line Protection relays on the spare bay at Mt Piper are due for an age based replacement and have been included for replacement, whilst the existing busbar protection scheme at Mt Piper is sufficient to accommodate the new line.

2.2.5.6.2 Communications

It has been assumed that communications infrastructure will not be affected by the proposed switching station augmentations.

2.2.5.6.3 Control Systems

The Mt Piper control system has been converted to the SAS standard and therefore will only require the addition of the new feeder to the database.

2.2.5.6.4 Auxiliary Supplies

It is assumed that there is sufficient capacity on auxiliary supplies for the new secondary systems associated with the proposed switching station augmentations.

3. Outage Requirements

3.1 Wellington to Coonabarabran Double Circuit Transmission Line

The preliminary assessment of outage requirements is as follows.

Equipment	Outage Duration	Recall	Availability	Comment
Wellington 330kV Busbar	1 day each	Nil	All year (avoid clashes with other local outages)	Required to for the new double circuit 330kV line terminations to the extended 330kV busbar sections.

3.2 Mt. Piper to Wallerawang Single Circuit Transmission Line

The preliminary assessment of outage requirements is as follows.

Equipment	Outage Duration	Recall	Availability	Comment
Wallerawang No. 8 Gen Tx Gen Bus CB Bay (Line 70 Mt Piper)	1 day each	4 hours	All year (avoid clashes with other local outages)	Required to install new switchbay equipment.
Wallerawang B Bay Coupler CB Bay	1 day each	4 hours	All year (avoid clashes with other local outages)	Required to install new switchbay equipment.
Mt Piper 35 Marulan Main Bus CB Bay	1 day each	4 hours	All year (avoid clashes with other local outages)	Required to install new switchbay equipment.
Mt Piper C Bay Coupler CB Bay (No. 3 Tx 330/132kV)	1 day each	4 hours	All year (avoid clashes with other local outages)	Required to install new switchbay equipment.

Replacement of plant within the main bus CB bay and bay coupler CB bay would require extended outages of these bays and also two 1 day outages of No.3 TX to disconnect and reconnect to the bay coupler isolator. The extended bay outages need to be determined in further detail when the condition assessment of plant is completed and the requirement for equipment replacement determined.

Outages of 70 and 71 lines maybe required for safety clearance for construction of the new line, depending on the placement of structures. These outages need to be determined when the new line route is examined in further detail as outages of 70 and 71 lines are a clash (refer to OM250) and should not be taken at the same time.

4. Environmental and Development Approvals

The construction of the new double circuit and new single circuit 330kV transmission lines has the potential to have a significant impact on both the environment and community.

This project will most likely require an Environmental Impact Study (EIS) in accordance with Director General Requirements and may require ministerial approval.

A more detailed assessment of environmental risk at an early stage of this project should be undertaken as timeframes for approval and potential biodiversity offsetting may be significant. The EIS will need to further consider the alternatives outlined in this study and associated environmental constraints.

Public consultation is a statutory requirement of this process.

5. Property Considerations

5.1 Wellington to Coonabarabran Double Circuit Transmission Line

Acquisition will generally be by private treaty but compulsory acquisition will be used where necessary or appropriate, for example, when acquiring public land. It is not anticipated that options will be taken over land prior to purchase.

The proposed route traverses through the cleared sections of vegetation along the south eastern edge of the Goonoo State Forest and consequently there are potential timing risks in acquiring the needed easements.

The cost for purchasing the required easements has been included based on estimates provided by Manager/Property.

5.2 Mt. Piper to Wallerawang Single Circuit Transmission Line

This option will require the acquisition of approximately 8km of new 60m wide easement for the entirety of the new transmission line route.

Acquisition will generally be by private treaty but compulsory acquisition will be used where necessary or appropriate, for example, when acquiring public land. It is not anticipated that options will be taken over land prior to purchase.

The proposed route runs through Ben Bullen State Forest and Wallerawang Power Station and consequently there are potential timing risks in acquiring the needed easements.

The cost for purchasing the required easements has been included based on estimates provided by Manager/Property.

6. Cost Estimate

6.1 Capital Expenditure

Based on the program provided in Section 7, the estimated project capital cost for completing works for the required scope is detailed below:

Item	Unescalated ($m)	Escalated ($m)
Wellington to Coonabarabran D/C TL		
– Coonabarabran Switching Station	13.6	14.7
– Wellington – Coonabarabran TL	230	252
– Wellington Sub Augmentation	15.2	16.5
– **Sub-Total**	**259**	**284**
Mt Piper to Wallerawang S/C TL		
– Mt Piper Augmentation	2.1	2.3
– Mt-Piper – Wallerawang TL	14.4	15.3
– Wallerawang Augmentation	1.3	1.4
– **Sub-Total**	**18**	**19**
Total Project P50 Cost	**277**	**303**

The expected expenditure profile for this project based on standard spending curve distribution is as follows:

	Total Project Base Cost	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0
Estimated Cost– non-escalated ($m 2017-18)	277	2.5	4.3	4.7	26.5	160	79

Notes:

1. The detailed breakdown provided in the above table is approximate only and is based on the total scope and nature of works included in the option. Individual numbers cannot be used for estimation of other projects or to separately cost components of this estimate.
2. The cost has been estimated from a scope of work determined by a limited review of the project, as detailed in section 2.
3. The values used in the estimate were generally obtained using TransGrid's Estimating Database.
4. The estimate has been prepared on the basis of standard bays and allowances for the works, with adjustments as detailed in this study for the specific option scope.
5. The estimate has a nominal uncertainty of ±25%. There is some risk that final costing may be outside these bounds due to the low level of investigation able to be completed in the time for preparation of this OFS.
6. The following factors have been applied to the estimates:
   - "Transmission Line – 500kV New" for D/C 330kV line between Wellington to Renewable zone due to the large capital values associated with the works.
   - "Transmission Line – 330kV Augmentation" for S/C 330kV line between Mt Piper and Wallerawang and associated substation works at both ends.
   - "Substation – 330kV New" for new switching station and Wellington substation works.
7. No allowance has been included in the estimate for exchange rate variations.
8. No adjustment for forward escalation has been included in the totals above. Based on forecast commodity escalation, the nominal estimated cost in each year (i.e. the amount in 2018-19 is in forecast $2018-19) is as follows:

	Total Project Budget Cost	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Nominal escalated cost ($m)	303	2.5	4.5	5	28	175	88

7. Project and Implementation Method

7.1 Wellington to Coonabarabran Double Circuit Transmission Line

The project is expected to be completed in an estimated 61 months from the approval of the Project Development Initiation (PDI), allowing 33 months for completion of Project Development and issue of the PAD and 28 months for project completion following issue of the PAD.

The key dates for this program are detailed below:

Milestone	Duration (Months)	End of Month
Issue of Project Development Initiation (PDI)	0	0
Transmission line route identification	6	6
Concept design complete – Substations	4	10
Concept design complete – Transmission line	12	18
Environmental approval	24	32
Detailed design complete – Substations	6	16
Detailed design complete – Transmission line	9	27
Issue PAD (DG2)	1	33
Site Works -		
Prepare specification and call tenders	3	36
Award of contract	3	39
Possession of site – Substations	3	42
Possession of site – Transmission line	3	42
Practical completion – Substations	9	51
Practical completion – Transmission line	18	60
In-service date	1	61

7.2 Mt. Piper to Wallerawang Single Circuit Transmission Line

The project is expected to be completed in an estimated 32 months from the initiation of a detailed Option Feasibility Study (OFS), allowing 16 months for completion of Project Development and issue of the PAD and 16 months for project completion following issue of the PAD.

The key dates for this program are detailed below:

Milestone	Duration (Months)	End of Month
Issue of Project Development Initiation (PDI)	0	0
Transmission line route identification	3	3
Concept design complete – Substations	4	4
Concept design complete – Transmission line	6	9
Environmental approval	12	15
Detailed design complete – Substations	6	10
Detailed design complete – Transmission line	6	15
Issue PAD (DG2)	1	16
Site Works -		
Prepare specification and call tenders	3	19
Award of contract	3	22
Possession of site – Substations	3	25
Possession of site – Transmission line	3	25
Practical completion – Substations	6	31
Practical completion – Transmission line	6	31
In-service date	1	32

7.3 Project Implementation Assumptions

The above programs have been based on the standard program templates for a Line – New (EIS) project and Substation – Augmentation project, with the following adjustments:

a) The construction phase of the transmission line schedule for Mt Piper to Wallerawang has been reduced from the standard template to reflect the 8km length of transmission line to be constructed.

b) All switchyard augmentation works are expected to be completed in parallel with the associated transmission line works program, with work occurring simultaneously at both connecting substations/switching yards.

The timeframes assume the completion of the following steps prior to issue of the PAD:

- Environmental Approval complete;
- Property acquisition has commenced and negotiations are expected to be complete within twelve months. Approval has been given for compulsory acquisition of those properties where negotiated settlements are not deemed possible.
- Transmission Line design has been completed;

- Substation design completed;
- Regulatory Approval processes complete.

For this option the following key risks to the program have been identified:

a) Environmental Approval of the project is subject to the level of community feedback and decisions by the Department of Planning and the Minister. Standard time frames allow for a “typical” process, however, if there is significant opposition to the project delays of up to 12 months could occur. It is likely that this risk could occur and the DG1 funding approval should be issued with sufficient float to allow for this while still meeting the project needs date.

b) Property acquisition is likely to require some level of compulsory acquisition. The timing of this acquisition is subject to both completion of the environmental approval process and approval to progress to the stage of compulsory acquisition. Further delays could be experienced in this process which may delay Possession of Site for parts of the route. This risk is considered unlikely to occur due to the significant float allowed in the program.

c) The nominated construction period is based on a preliminary line route and assessment of terrain and conditions. No geotech or detailed environmental studies have been completed. As a result, the estimated construction period could vary for a number of reasons including, but not limited to:

   1. The final line route may require additional line length,
   2. Non-standard construction methods, piled foundations or alternative access methods may be required;
   3. Significant environmental works may need to be completed depending on the results of EIS processes;
   4. Final approvals may impose restrictions on the way in which the line is constructed.

   It is possible that this risk could occur and the DG1 funding approval should be issued with sufficient float to allow for this while still meeting the project needs date;

d) The project development period is dependent on completion of the Regulatory Approval process. Delays in this approval will impact on project completion.

e) The program makes allowance for normal inclement weather. If periods of abnormal rainfall occur the program will be delayed.

Transmission line works programs are inherently uncertain until such time as detailed studies and community consultation processes are completed. Accordingly it is likely that delays may occur to this project that result in a program that varies from that detailed above.

The program is based on the specific scope included in this report. If this option is combined with other options on the same site, the total project construction time frame will extend by a period that will be dependent on the availability of outages and staging of the total package of works. This should be allowed for when determining the date for issue of the DG1 approval.

The project program and costing is based on the following implementation method:

- Project development including design, environmental assessment, and estimating to be managed by Project Development. Specification, HV plant procurement and contracting managed by Works Delivery and competitive bids being called for the switching station, substation and transmission line works.
- Site construction works completed by contractors.
- Construction supervision, site management, testing and commissioning by Works Delivery.

8. Project Delivery Risks

The key risks outlined in the table below have been identified and will need to be managed as part of this project. In the event that these risks occur there could be impacts to both project cost and time for completion. These risks should be assessed at all stages of project development and delivery.

Risk	Treatment
Safety Risks	
There are the normal risks associated with working on a construction project or in a live high voltage station.	Ensure that all works are carried out in accordance with TransGrid's Safety Rules and standard policies and procedures. All site works are to be managed using a site specific safety management plan.
There are normal risks associated with the design of substations.	Ensure that all design works are carried out in accordance with TransGrid's standard designs, policies and procedures. Ensure that all design work is carried out in accordance with TransGrid's safety in design processes.
There are risks associated with access to site locations for new transmission line work.	Access to be assessed in Project Development stage to identify issues and resolve save access. Access plans to be developed in detail and included in relevant safety management plans.
Environment Risks	
There are the normal risks associated with the delivery of large capital projects that may impact on the environment.	Conduct an Environmental Assessment of Project in accordance with TransGrid's standard policies and procedures.
Property Risks	
There are the normal risks associated with significant easement acquisition and property acquisition.	Conduct an Environmental Assessment of Project in accordance with TransGrid's standard policies and procedures.
Community Risks	
There are the normal risks associated with the delivery of large capital projects that may impact on local communities.	Implement a Communication Strategy in accordance with TransGrid's standard policies and procedures.
Project Delivery and Program Risks	
There are the normal risks associated with the delivery of capital projects.	Implement TransGrid's standard policies and procedures during all phases of the work.
Program may be delayed if Regulatory Approval has not been completed in time	Ensure that Regulatory Approval is completed in a timely manner.
Program may be delayed if the equipment orders are not placed with sufficient lead time	Ensure that equipment is ordered as early as possible to suit the project program.
Program may be delayed if outages cannot be obtained	Prepare an implementation plan and providing the earliest possible notification of the required outages.
Project may be delayed if appropriate resources are not available	Ensuring that the project is given the appropriate priority.

Risk	Treatment
There is a risk that Delta Electricity will not allow a new line alignment through Wallerawang Power Station and that a new line route around the site would be required.	The proposed line route needs to be examined in detail at the Project Scoping Study stage of the project and alternate routes developed (if required). This could potentially result in an increase to both the cost and time estimates detailed in this OFS.
There is a risk that environmental approval for a new transmission line easement for the proposed line route through Ben Bullen State Forest will be difficult and require compensatory habitat offsets.	A detailed assessment of environmental risk at an early stage of this project should be undertaken (as timeframes for approval and potential biodiversity offsetting may be significant). This risk should also be further investigated as part of the Project Development stage of the project, and may result in an increase to both the cost and time estimates detailed in this OFS.

9. Change History

Revision	Approver	Amendments
0	J Howland	Initial Issue