

ISP Preparatory Activities – Reinforcing Sydney, Newcastle and Wollongong Supply (Southern Ring)

June 2023

This document has been updated in March 2024 as part of Transgrid's draft 2024 ISP submission to include an addendum with additional supporting and updated information.

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Executive Summary

This document provides updates for ISP Preparatory Activities, incorporating a revised cost estimate for the Sydney Southern Ring option. Below is a summary highlighting the key revisions.

In accordance with the 2022 Integrated System Plan (ISP), Transgrid has undertaken preparatory activities for Reinforcing Sydney, Newcastle and Wollongong Supply (RSNWS) (Southern Ring). The high-level network augmentation description is as follows:

- A new 500 kV double circuit from the existing Bannaby substation to a new substation in the locality of South Creek within western Sydney area
- Cut in existing lines 5A1/5A2, 32 and 38 into the new substation in the locality of South Creek (as above)
- Augmentation of Bannaby substation to accommodate the new 500 kV double circuit
- Augmentation of Sydney West substation to accommodate for additional 330 kV incoming feeder
- Replace a section of existing line 39 to double circuit to connect the new substation in the locality of South Creek to existing Sydney West substation

In the previous preparations for the ISP Preparatory Activities¹, the cost estimate for the southern ring ranged from \$1.45bn (for Option 1) to \$2.78bn (for Option 2). Transgrid have discounted Option 2 – a Kemps Creek substation expansion solution – due to cost, complexity, and potential impact on the local community. The discounted Kemps Creek substation option involves undergrounding an approximately 10 km section of the existing 330 kV circuit (Line 37) and utilizing the vacated corridor for constructing the new 500 kV circuit. The Option 1 solution – a new South Creek substation, is the preferred solution for further development.

This South Creek Substation option has been verified to be the least impactful and more cost-effective in terms of capital expenditure. Consequently, in this ISP Preparatory Activities, the upper range of the cost estimate has been eliminated, and we have provided a revised P50 cost estimate of \$1.55bn for the South Creek substation option as outlined in the section 2 of this document. The indicative development corridor for the preferred option is illustrated in section 5, emphasizing the significance of securing easements around the Western Sydney Airport early for the successful execution of this project.

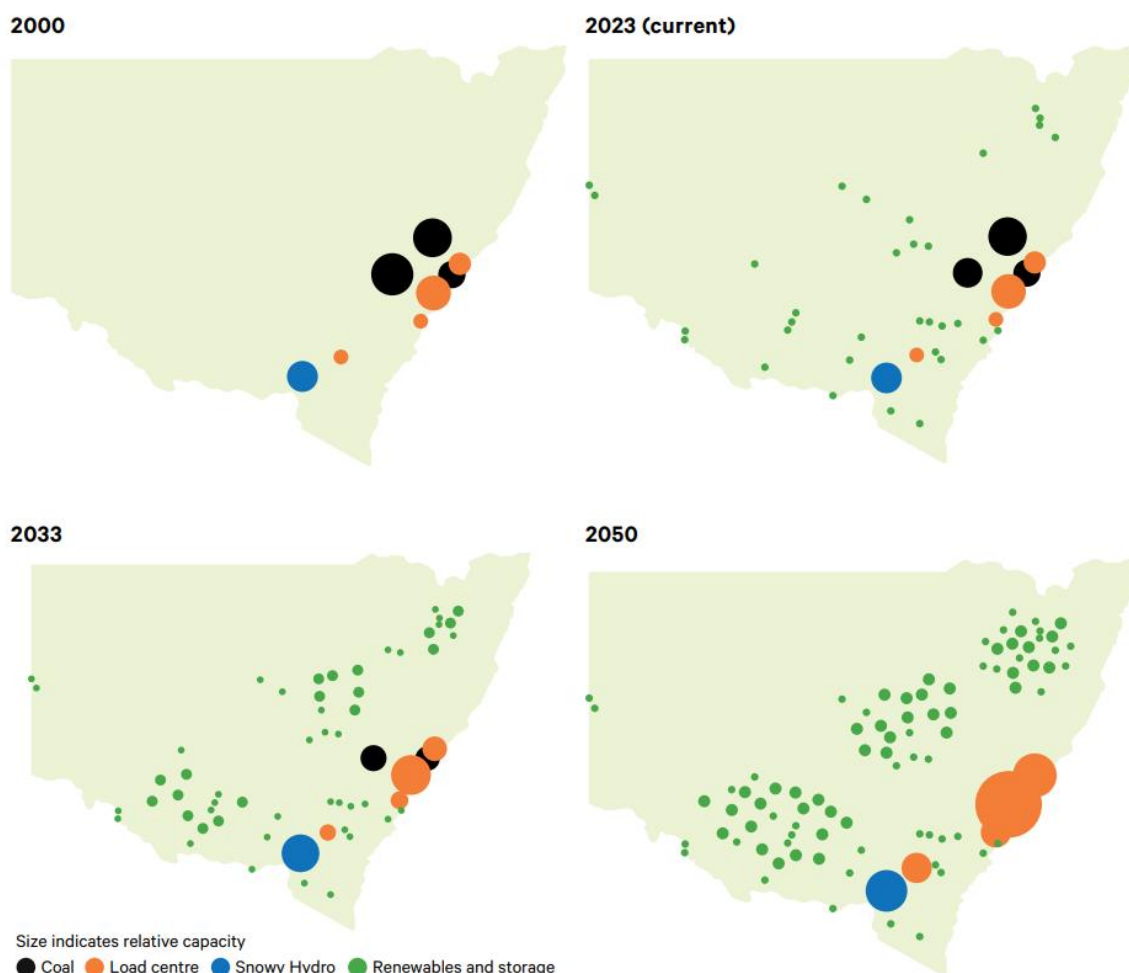
¹ ISP Preparatory Activities – Reinforcing Sydney, Newcastle and Wollongong Supply (Southern Ring), May 2023, AEMO.

1. Need for a Southern Ring – 500 kV Sydney Ring

The NSW electricity network is currently facing significant challenges, as it facilitates decarbonisation with the growth of large-scale renewables seeking connection to the grid and the accelerated retirement of traditional coal generation. In particular, two major power stations Eraring and Vales Point located within the critical Sydney Newcastle and Wollongong load centre area (SNW), with a combined capacity of around 4 GW, will retire by 2025 and 2029 respectively. The SNW area includes significant urban, commercial and industrial loads that comprise about three quarters of the demand for electricity in NSW and contributes towards a significant portion of the national GDP. There are currently no plans for new baseload generation in SNW to meet the local demand and it is therefore expected that demand will be met by generation from outside the area. Therefore, there is a need to increase the transmission capacity from other generators and Renewable Energy Zones (REZ) in regional NSW to the major load centres.

The geographic dispersion of renewable generators (see Figure 1) and the required growth of renewables to reliably and securely transition the NSW transmission network to net zero emission by 2050, necessitates new transmission infrastructure to efficiently transfer many GW of power across hundreds of kilometres.

Figure 1: The NSW power system in 2000, 2023 (current) and projected in 2033 and 2050 (conceptual image)



To reach these new renewable generators, we need new transmission connections from REZs to the 500 kV Energy Superhighway transmission backbone supplying SNW via a 500 kV ring, providing efficient security of supply from both the north and the south – with corridor diversity of supply to SNW. This Sydney Ring necessitates two projects to ‘close the loop’ – the first is the Hunter Transmission Project 1.0 (HTP 1.0) already underway that will connect Bayswater to Eraring at 500 kV, and the second is the Southern Ring to connect Bannaby to Sydney at 500 kV. The northern network option, HTP 1.0, is being progressed under the

Electricity Infrastructure Investment Act 2020 (NSW). The southern network option (Southern Ring) may proceed through the AEMO ISP and RIT-T framework.

Figure 2: The NSW 500 kV Energy Superhighway

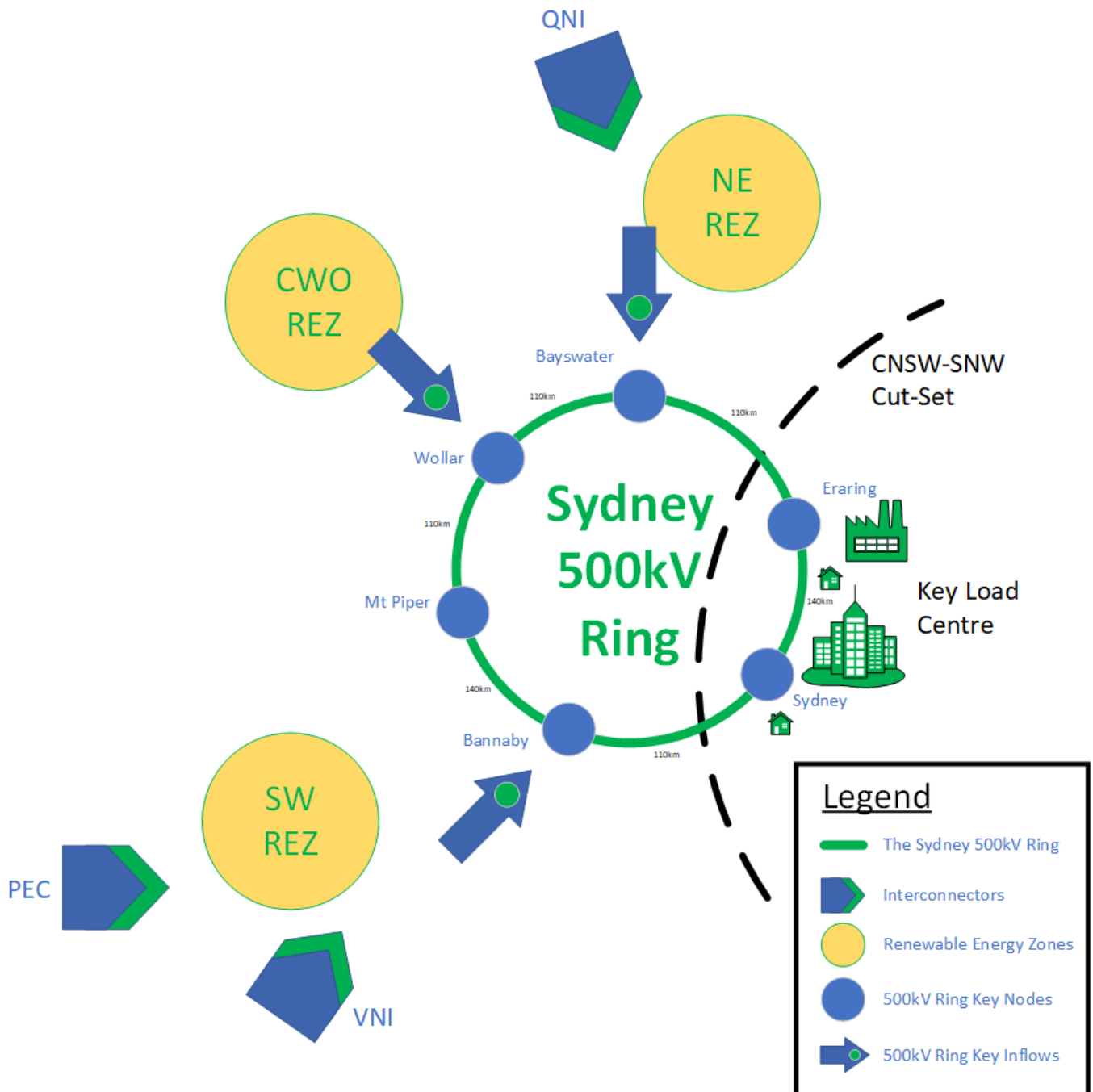


Figure 3 indicates the key Central NSW to Sydney-Newcastle-Wollongong (CNSW-SNW) cut-set across which 4 GW of combined coal retirements of Eraring and Vales Point (circa 2025-26 and 2029) are triggering a need to increase transmission capacity to secure supply to both Sydney and Newcastle under peak demand conditions. SNW demand is itself increasing significantly with a new airport and other load growth exceeding 1 GW.

The current cut-set limit with respect to N-1 contingencies is 6,125 MW and the HTP 1.0 is expected to increase it significantly to approximately 11,000 MW. However, AEMO in ensuring an N-1 secure operating state following the loss of a single 500 kV circuit on the HTP 1.0 line, would be looking to the next most significant credible contingency, which would be the loss of the second circuit of the HTP 1.0 500 kV line, thus reducing the cut-set limit significantly (due to a loss of both 500 kV circuits through the cut-set).

Under peak demand conditions, all existing generations within SNW are likely already being dispatched. Therefore, following the first contingency, no generation would be available within SNW for AEMO to redispatch. This introduces a greater reliance on transfer through the cut-set to prevent the need for AEMO to require pre-emptive load shedding in Sydney and Newcastle to return the system to a secure operating state.

Figure 3: Key CNSW-SNW cut-set across The Sydney 500kV Ring representing critical SNW load centre



The Sydney 500 kV Ring, completed through both the HTP 1.0 and the Sydney Southern Ring project, would mitigate this risk of load shedding by bringing geographically diverse 500 kV supply points into SNW. If coal generation retires earlier than expected, NSW may need to bring forward the planned in-service dates of these two projects to reduce the risk of SNW load shedding.

This Southern Ring Preparatory Activities document supports the next steps in 'closing the loop' of the 500 kV Sydney Ring.

2. Cost Estimate

Cost estimate was undertaken as a part of the preparatory activities. The inputs to the estimate include areas such as desktop environmental and property assessments, preliminary engineering designs and indicative

localities for transmission line and substation. At this stage of the estimating process, it is considered that the estimate has an accuracy of -30% to +40%.

The P50 cost estimate for Reinforcing Sydney, Newcastle and Wollongong Supply (southern Ring) is \$1.55bn (un-escalated \$2022/23). The detailed cost breakdown is shown in the table below.

Table 1. Cost breakdown of Sydney Southern Ring

Description	Costs (\$M)
Transmission Line Cost	481
Substation Cost	283
Easement cost, Lines Land cost, Substation	218
Bio-diversity cost (TL)	274
Site Establishment Costs (Camp Costs)	120
Overall Project Raw Cost	1,376
Total project cost – P50	1,546

3. Preliminary Engineering Design

Concept engineering designs were undertaken as a part of the preparatory activities. The high-level development methodology included:

- Desktop transmission line corridor and substation locality identification utilising constraint mapping analysis
- Desktop geotechnical assessment of the identified areas
- Development of concept engineering designs such as electrical connection diagrams and substation layouts. Desktop assessment of transmission line tower and foundation requirements were also undertaken
- Safety in Design (SiD) Workshops were undertaken to identify and address safety risks of the concept designs

4. Scope of Option

The estimated \$1.55bn cost (\$2022/23) includes the high-level scope below:

- Substation Works:
 - Construct a new South Creek 500/330 kV substation with 2 x 1500 MVA transformers and the associated 500 kV and 330 kV switchbays
 - Augment the existing Bannaby and Sydney West substations
- Line Works:
 - Construct a 500 kV double circuit overhead line from Bannaby to South Creek with approximate length of 114 km alongside a section of line 39 (from Bannaby to Greendale area)
 - Cut the new South Creek substation into line 5A1/5A2, 32, 39 and 38
 - Rebuild the section of existing line 39 from South Creek to Sydney West to double circuit

The indicative development of South Creek substation and existing Bannaby substation are outlined in the diagrams below:

Orange colour represents 330 kV buses and lines and blue colour represents 500 kV buses and lines. The augmentation in Bannaby substation is highlighted by red colour.

Figure 4: Indicative development of South Creek Substation

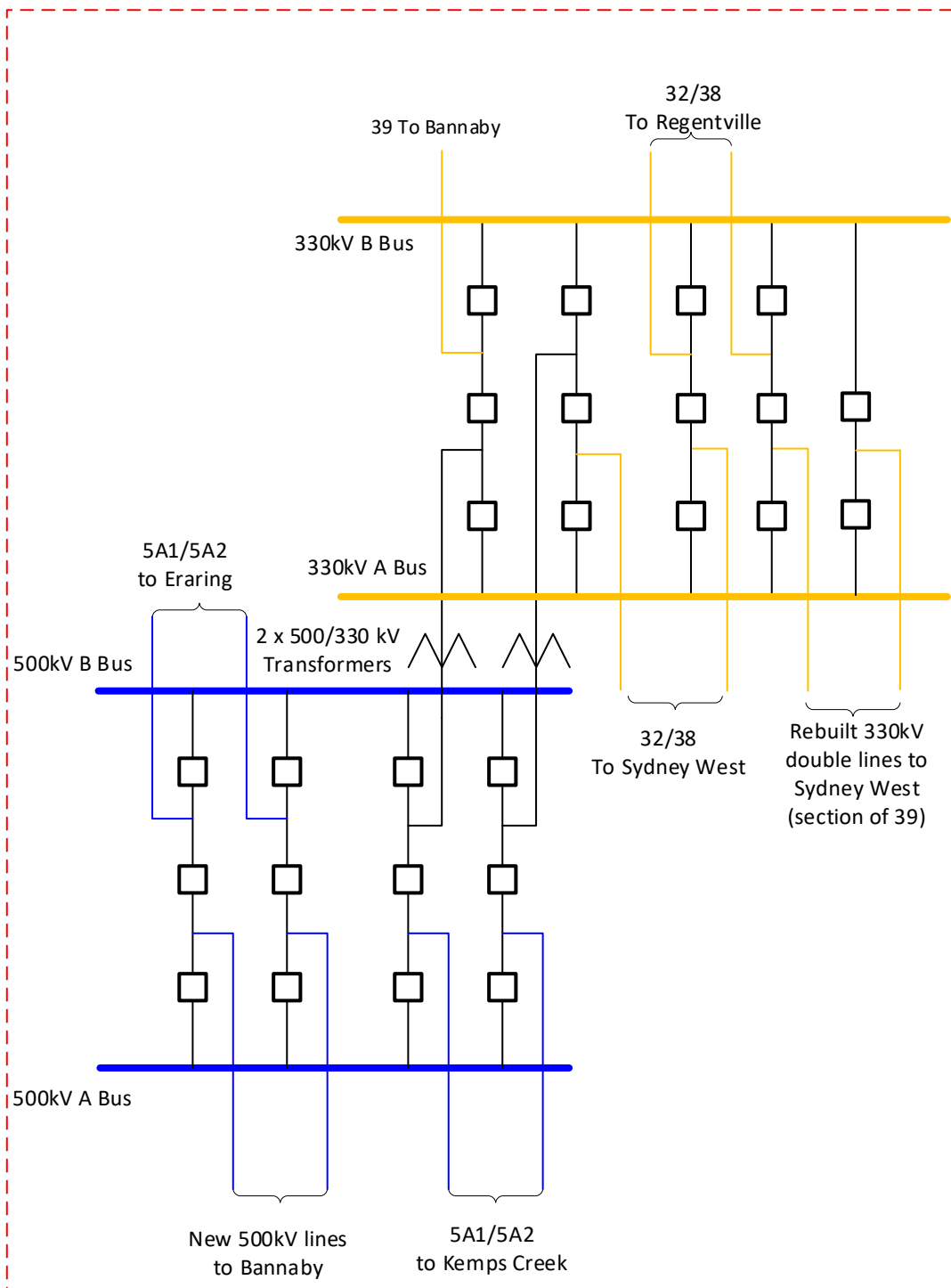
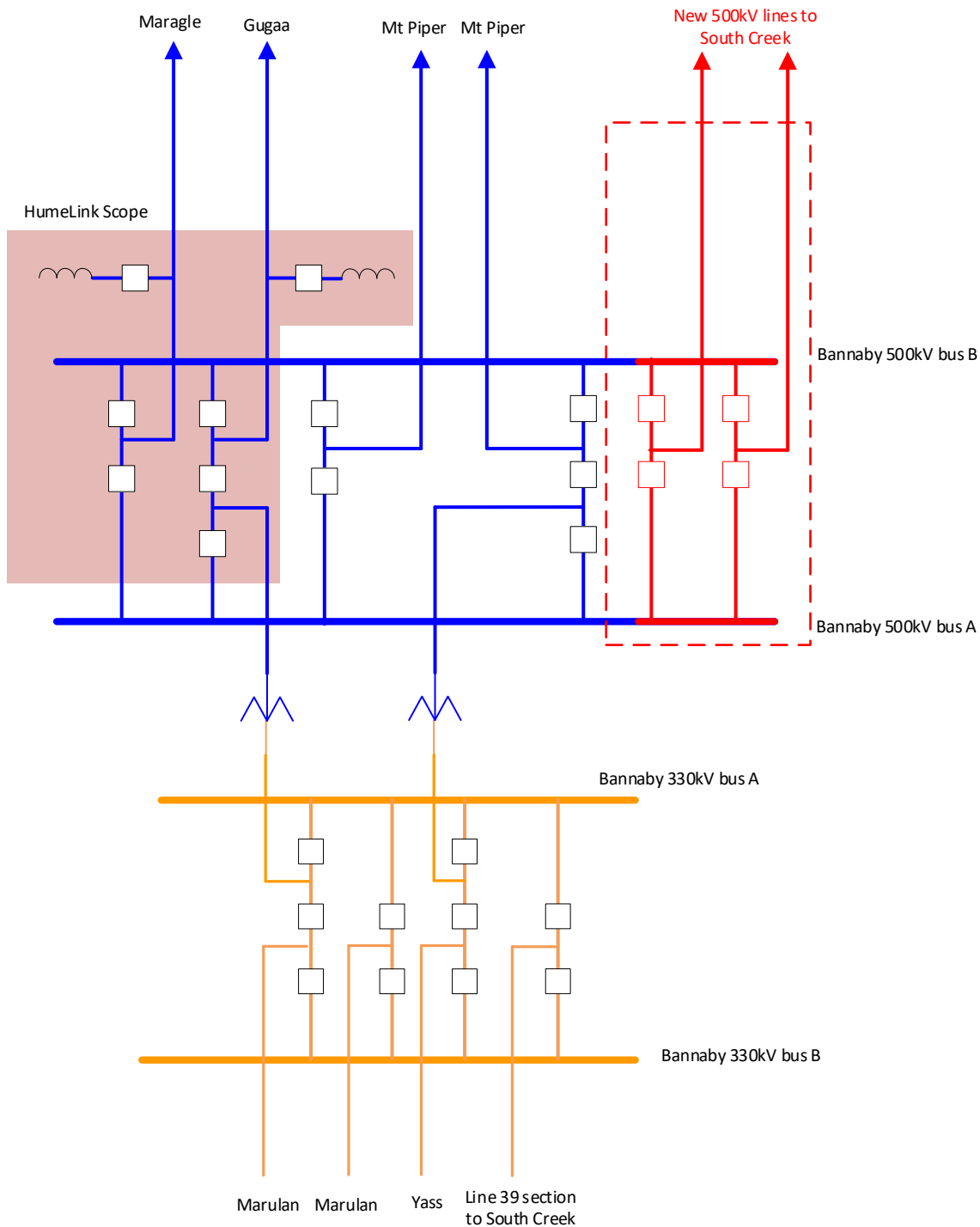


Figure 5: Indicative development of Bannaby Substation



The indicative transmission line data is displayed in Table 2.

Table 2. Indicative transmission line data (percent on 100 MVA base at 500kV or 330kV)

Circuit	Length (km)	R (%)	X (%)	B (%)	R0 (%)	X0 (%)	B0 (%)
Bannaby to South Creek 500kV Double Circuit	114	0.0872	1.151	131.2	1.105	3.856	77.99
South Creek to Sydney West 330kV Double Circuit	7.1	0.021	0.202	2.91	0.1841	0.6843	1.822

The thermal ratings for the 500 kV lines are based on the quad ACSR/GZ Orange 438 mm² conductors with 95 °C design temperature. The thermal ratings are shown in Table 3.

Table 3. Thermal ratings for Bannaby to South Creek 500kV double circuit transmission line

Season	Time	Normal (MVA)
Summer	Day	3,291
	Night	3,330
Autumn and Spring	Day	3,291
	Night	3,442
Winter	Day	3,637
	Night	3,713

5. Desktop Easement Assessment

Desktop transmission line corridor identification and assessment were undertaken as part of the preparatory activities.

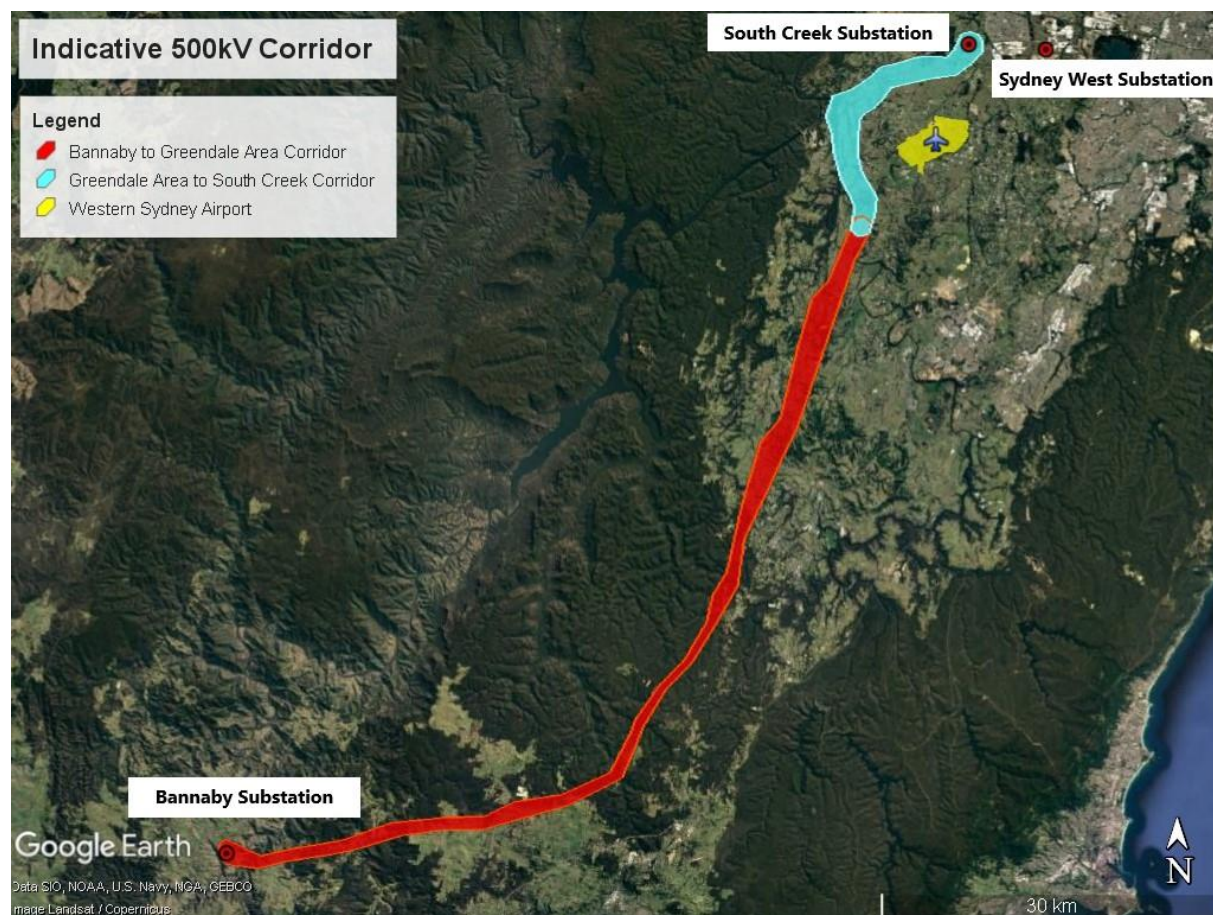
The high-level methodology of corridor identification and assessment includes:

- Options identification:
 - Establish tiered constraints for identification of transmission line corridors
 - Tiered assessments include items such as environment, property and stakeholder criteria
 - Determining options for potential transmission line corridors as per the defined tiered constraints
- Options assessment and evaluation:
 - Assess, evaluate and select corridors for use as part of the preparatory activities

Following the aforementioned methodology, an alternative option into existing Kemps Creek 500 kV substation was evaluated. It was determined limited viable line routes are available without elevated costs and greater community impacts to achieve an overhead solution for both the 500 kV double circuit from Bannaby 500 kV substation and associated requirement for 330 kV reinforcement to Sydney West Bulk Supply Point. Due to these considerations, the overhead line option into South Creek substation is the preferred option. The indicative 500 kV double circuit corridor for the preferred option is presented in Figure 6 below.

The indicative 500 kV corridor leverages off the already established corridor for 330 kV line 39 from Bannaby Substation to near Greendale area (approximate route length of 90 km). However, from Greendale area to South Creek Substation (approximate route length of 24 km), the corridor is strategically diverted to navigate around the Western Sydney Airport with considerations of residential properties, homesteads, flight path, height restrictions and aerotropolis development. Securing easements for the designated teal corridor (from near Greendale to South Creek) will be crucial in the development of Sydney Southern Ring.

Figure 6 The indicative 500kV double circuit corridor for Sydney Southern Ring's preferred option



6. Preliminary Assessment of Environmental and Planning Approvals

The primary environmental approval required for the project may include an Environmental Impact Statement (EIS) to be prepared and approved. This may also include:

- Engaging with the community and government agencies; this may include NSW government bodies such as Department of Planning & Environment (DPE)
- Refining the concept designs of the project to avoid or minimise impacts and to incorporate community feedback
- Assessing the impacts of the project in accordance with any relevant Government legislation, policies and guidelines
- Integrating the findings of any engagement and the assessment of the impacts of the project

It is noted that the planning and approval requirements applicable to the project may change overtime due to:

- General changes in planning and environmental legislation or policy
- Specific changes in planning and environmental legislation or policy that may be targeted at facilitating planning and/or delivery of the project

7. Stakeholder Engagement

Direct community engagement including local government and council engagement have not been undertaken as part of the preparatory works. However, a multitude of stakeholder requirements have been

included in the tiered constraints and used as part of the desktop transmission line corridor identification process based on the available information. Examples of the tiered constraints used include known townships, residential areas, airports, defence owned land, areas of international and national environmental significance, aboriginal and heritage areas, commonwealth land, important agricultural areas, mine sites and zones and existing infrastructure.

This section describes Transgrid's community engagement policy and route selection principles for Sydney Southern Ring.

7.1. Transgrid's Community Engagement Policy

Transgrid's commitment:

We recognise the vital role that landowners and the community have in the planning and delivery of our projects and network operations.

- We work with the communities in which we operate in a meaningful, accountable, responsive and equitable way through effective and inclusive practices.
- We are dedicated to continuously improving our engagement, in our decision making and delivering community benefits.
- We seek to minimise the social impacts of our projects and operations. We will do this by engaging with all our communities to understand what matters most, to build trust and beneficial relationships.
- We strive to build positive and lasting relationships with our local communities and create long-term benefits to our customers, community and the environment as part of our commitment to building a sustainable future.

7.2. Route Selection Principles

Transgrid is responsible for developing the preferred route for Sydney Southern Ring.

Community and stakeholder engagement will be critical throughout the route selection process. There are four key principles which should guide Transgrid's selection process for linear or site-based transmission infrastructure options. These are:

- **Prudent and efficient network** – Transgrid is required by energy regulators to deliver prudent and efficient transmission network projects. This is a key requirement for project funding
- **Triple bottom line decision considerations** – Balanced with the need to deliver a prudent and efficient network, is the need to achieve a favourable social outcome when developing new electrical transmission infrastructure. Transgrid is committed to a route selection process that considers all aspects of a project such as community and/or social impacts, environmental considerations and technical feasibility. This includes ensuring that relevant information (technical, environment, social and cost) is integrated and coordinated to achieve the most appropriate outcome
- **Opportunity for community input to improve decision-making** – Community consultation is a key part of the route/site selection process. Consultation should aim to be open, iterative, and well-documented to enable stakeholders, the community, and landowners to have input into relevant stages of the process and improve decision-making
- **Best practice approach** – Transgrid continually undertakes new electrical infrastructure projects to ensure NSW's energy supply into the future. Transgrid is committed to applying a consistent and best practice approach, and recognises that a fair, efficient route selection process is in the best interests of consumers and communities

8. Risk

Risk assessments were undertaken as part of the preparatory activities. The risk assessment process identified several risks and an extract of these risks is as follows:

- The scope of RSNWS (Southern Ring) can be impacted by current and future major projects, regulatory approval processes, and community feedback. These issues are to be closely monitored to ensure successful project delivery
- Uncertainty surrounding sizing and location of future generation developments, both known and unknown. Corridors may be constrained due to generation development growth leading to increase project cost
- Community feedback and sentiment may impact on the project including but not limited to the locality of the transmission lines, substations, project duration and cost estimate
- All works were based on available desktop information only. Future site investigation and verification works may impact on the outcomes identified as part of the feasibility works. These include but not limited to cost estimates, transmission route locations and substation locality
- Increased build out of the areas surrounding the Western Sydney Airport (WSA) development will further constrain opportunities to secure suitable easements for an overhead solution. The recommendation is to commence development of appropriate corridor and route selection with the intention of securing easements at the earliest opportunity, particularly out of South Creek substation site to the west and south circumnavigating the WSA development area

Addendum to ISP Preparatory Activities for Sydney Ring (South)

March 2024

1. Introduction

Since the submission of Transgrid's ISP Preparatory Activities for Sydney Ring (South) in June 2023 and in response to the publication of the draft 2024 ISP in December 2023, Transgrid has been engaging in ongoing Joint Planning with AEMO to support preparation of the 2024 ISP.

The draft 2024 ISP concluded that *"AEMO recommends that a combination of solutions be considered to address the identified need with detailed market modelling studies – including a northern network option, a southern network option, and other network upgrades as part of the work associated with this Actionable Project."*

Through the Joint Planning process, it was agreed that it may be beneficial to the 2024 ISP to refine the alternative options proposed in the ISP to address the need for transmission augmentation on the Southern segment of the Sydney Ring. This Addendum to Transgrid's ISP Preparatory Activities for Sydney Ring (South) proposes a new alternative option using a 330kV switching station and power flow control technology to relieve congestion on the 330kV network between Bannaby and Sydney and provides an update to the scope assumptions required to accurately assess Option 2b from the 2023 Transmission Expansion Options Report (**TEOR**), being the option to rebuild Line 39 as a double circuit.

2. New option: 330kV switching station with power flow controllers

2.1. Summary

Transgrid has assessed alternative options to provide incremental transfer capacity between the Central NSW (**CNSW**) and Sydney, Newcastle, Wollongong (**SNW**) ISP subregions and determined that a new 330kV switching station with power flow controllers in the Greendale area (refer to Figure 6 in the main body of Transgrid's ISP Preparatory Activities dated June 2023) would enable improved power flow sharing and unlock incremental transfer capacity.

In addition to providing additional transfer capacity, this option is aligned with Transgrid's strategy to secure and supply growing demand in Greater Western Sydney. Development of a switching station in the Greendale area would enable the staged delivery of future transmission capacity into Sydney and could provide a future bulk supply point for Endeavour Energy to supply loads in south-west Sydney and around the Western Sydney Aerotropolis.

2.2. Scope

The high-level scope of works for this option includes:

- Establishment of a new greenfield 330kV switching station in the Greendale area using a three-diameter breaker and a half layout, including all access and ancillary works.
- Rearrangement of existing 330kV lines 39, 76 and 77 to connect into the new switching station.

- Installation of power flow control technology on the segment of existing Line 39 between the new switching station and Sydney West substation. The selection of a preferred power flow control technology supplier is subject to future market engagement.

2.3. Cost estimate

A cost estimate has been prepared as part of the preparatory activities for the new alternative option. The estimate is based on desktop engineering, environmental and property assessments.

The indicative cost for this option is expected to be \$225M (un-escalated, \$2023/24). A high-level breakdown of this cost is provided in Table 1. Given the degree of scope uncertainty at this stage, the estimate is considered a Class 5b (+/- 50%) cost estimate on a P90 basis.

Table 1 - Cost estimate for new alternative option (un-escalated, \$2023/24)

Description	Costs (\$M)
330kV Switching station, property and biodiversity offset	130
Major plant and equipment	55
Transmission line works	40
Total	225

Note 1: Preliminary desktop assessments of potential sites concluded that the cost of biodiversity offsets for this option would be negligible.

2.4. Lead time

It is expected that this option would require 4 to 5 years to implement following commencement of a RIT-T. Assuming a RIT-T commences in July 2024 and key milestones are completed according to the high-level indicative schedule in Table 2, the earliest in-service date for this option is September 2028.

Table 2 - Indicative schedule for key project milestones

Item	Due date
RIT-T commencement	July 2024
RIT-T completion	August 2025
EIS commencement	September 2025
Tender for construction contractor & detailed development	October 2025
EIS completion	September 2026
Contract award & final investment decision	October 2026
Construction commencement	February 2027
Construction completion	March 2028
Assets in service	September 2028

2.5. Capacity increase

The key benefit of a new switching station with power flow control is improved power flow sharing between the northern and southern segments of the CNSW to SNW cutset, which reduces congestion and allows

more capacity to be transferred to Sydney from the south during periods of high generation in Southern NSW and moderate generation in Central NSW. Following completion of Snowy 2.0 and Central West Orana (CWO) REZ, these conditions are most likely to occur in the evening when solar generation is at a minimum level.

The capacity increase under this option is most accurately modelled by amending the generation contribution coefficients in the northern and southern constraints on the CNSW to SNW flow path in the ISP model to capture the dependency on generation dispatch conditions. This would be represented by lower relative contribution coefficients for generators in Southern and Central NSW to the CNSW to SNW (South) constraint, and greater relative contribution coefficients for generators in Southern and Central NSW to the CNSW to SNW (North) constraint.

The benefit of accessing additional dispatchable generation from the south and transferring the power to Sydney is in the order of up to 300MW, depending on system conditions. An alternative to representing this benefit using modified generation contribution coefficients could possibly be in the format of a transfer capacity increase, which could be presented as an increase to the CNSW-SNW cutset flow of up to 300MW.

To ensure the benefits of this option can be accessed under a diverse range of operating conditions, the switching station needs to be configured to allow rearrangement of the connections between lines 39, 76 and 77 to maximise the utilisation of these lines.

It should be noted that the capacity increase for this option has been assessed with the Hunter Transmission Project (HTP) in service, as the earliest in-service date is after the implementation date indicated in the draft 2024 ISP (December 2027). It is anticipated that this option would only be delivered in addition to HTP.

2.6. Preliminary assessment of environmental and planning approvals

The primary environmental approval required for this project may require that an Environmental Impact Statement (EIS) be prepared and approved. Development of an EIS may involve:

- Engaging with the community and government agencies, including the NSW Government Department of Planning & Environment (DPE).
- Refining concept designs for the project to avoid or minimise impacts and to incorporate community feedback.
- Assessing the impacts of the project in accordance with all relevant legislation, policies, and guidelines.
- Integrating the findings of any engagement and the assessment of the impacts of the project.

It is noted that the requirements for environmental and planning approvals may change overtime due to:

- General changes in planning and environmental legislation or policy.
- Specific changes in planning and environmental legislation or policy that may be targeted at facilitating planning for and/or delivery of the project.

2.7. Stakeholder engagement

Community engagement has not been undertaken as part of the preparatory works for this option and is expected to commence during the early stages of the RIT-T process. Transgrid will be responsible for

selecting a preferred site for the new switching station, and community and stakeholder engagement will be critical throughout the site selection process.

Refer to Section 7 of Transgrid's *ISP Preparatory Activities – Reinforcing Sydney, Newcastle and Wollongong Supply (Southern Ring)* for Transgrid's community engagement policy and site selection principles which shall apply to further development of this option.

2.8. Strategic alignment with future network developments

2.8.1. The 500kV Sydney Ring (South) project is anticipated to be required in the future

While the Greendale switching station alternative option could unlock modest capacity improvements, Transgrid analysis indicates that the 500kV transmission line option for Sydney Ring (South) between Bannaby and Sydney will be required in the long term to:

- Support the future reliability and operability of the NSW power system,
- Access the full benefit of dispatchable generation in NSW south of Sydney, including Snowy 2.0, South-West REZ and new southern interconnectors (EnergyConnect and VNI West), and
- Manage the risk of reliability impacts to the critical Sydney load centre during an extended outage of line 39, which may last months if major repairs on the underground section around Western Sydney Airport are required.

It is important that alternative options are compatible with the ultimate network to provide ongoing benefits to consumers.

A RIT-T would ultimately determine the preferred option that maximises the net economic benefit. As part of a RIT-T assessment, further scoping, including transmission line route refinement in consultation with customers, community stakeholders and landowners, will be undertaken.

As discussed in detail in [Transgrid's submission to AEMO in response to Draft 2024 ISP](#), developing the 500kV Sydney Ring (South) project requires access to a critical development corridor through the Western Sydney growth area, where land use pressures have been progressively increasing, as evidenced by rising land values and a substantial increase in rezoning across the four impacted Local Government Areas. This trend is expected to materially increase the cost of securing easements as land progressively moves to higher value uses. It may also significantly increase social licence impacts due to ongoing subdivisions increasing the number of landowners impacted. The impacts of these trends would be further investigated during detailed scoping activities for credible options if a RIT-T progressed for this project. There is a risk that delayed approval to secure easements for the future 500kV Sydney Ring (South) project may eliminate all viable easement corridors between the Greendale area and South Creek.

2.8.2. Opportunity for staged delivery of the future 500kV Sydney Ring (South) project

Establishing a switching station in the Greendale area enables the staged delivery of the 500kV Sydney Ring (South) project. This could enable staging as follows:

- Stage 1: Establish a 330kV switching station in the Greendale area.
- Stage 2: Establish a new transmission line between the Greendale switching station and Transgrid's Sydney West substation in two sections:
 - Section A: Greendale to South Creek: Double circuit 500kV design and construction, initially energised at 330kV.

- Section B: South Creek to Sydney West: Double circuit 330kV design and construction.
- Stage 3: Complete connection to Bannaby and energise to 500kV:
 - Establish the new South Creek 500/330kV substation.
 - Convert the Greendale 330kV switching station to a 500/330kV substation.
 - Establish a new double circuit 500kV transmission line from Bannaby to Greendale.
 - Convert the Greendale to South Creek double circuit transmission line (Stage 2 Section A) to 500kV by cutting over connections to respective 500kV switchyards.
 - Energise the Sydney Ring (South) at 500kV from Bannaby through to South Creek (including at Greendale).

Assessment of these and other potential staging options to deliver the 500kV Sydney Ring (South) may be considered in a future RIT-T, alongside other credible options.

2.8.3. Opportunity to develop a new bulk supply point for South-West Sydney

Establishing a switching station in the Greendale area provides an opportunity for a future bulk supply point to be established in South-West Sydney to accommodate development planned for the region (subject to Joint Planning with Endeavour Energy and a future RIT-T process). This reduces the risk that the switching station becomes redundant should the future 500kV Sydney Ring (South) project proceed. It is anticipated that the 330kV power flow controllers could be re-deployed if they are no longer required at that location in the network.

3. Update to TEOR Option 2b: Rebuild Line 39 as a double circuit

3.1. Summary

AEMO has requested that Transgrid prepare a detailed review of the scope and assumptions for the alternative option to rebuild Line 39 as a double circuit (Option 2b in the 2023 TEOR), which was not assessed in detail in Transgrid's Preparatory Activities dated June 2023.

This section provides a summary of the challenges identified during Transgrid's review of the scope assumed in the 2023 TEOR and outlines a high-level scope summary that can be used by AEMO to update the option cost estimate using the Transmission Cost Database.

3.2. Challenges with TEOR assumed scope of works for Option 2b

Option 2b in the TEOR generally assumed that Line 39 would be converted from the current single circuit design to a double circuit 330kV design along the centreline of the existing easement. While Transgrid looks to maximise opportunities to rebuild existing assets to minimise impacts to communities and the environment, there are several constraints and challenges that need to be considered when assessing this option, including:

- **Outage constraints:** Line 39 is a critical connection between Southern NSW and Sydney, making outages challenging to schedule without causing significant market disruption or increased reliability risks to loads in Sydney. Typically, outages would only be available during shoulder periods in Spring and Autumn and require strict recall arrangements to be in place. This extends the construction timing substantially and would increase costs.

- **Limitations on new developments within an existing easement:** Redevelopment of assets within existing easements would require renegotiation of the easement with landowners and may result in property compensation costs equivalent to the establishment of a 60m wide new easement alongside the existing.
- **Height constraints around Western Sydney Airport:** Due to structural height constraints around the new airport to accommodate safe flight paths (formally known as the Obstacle Limitation Surface or OLS), any changes in tower structure heights that are already mapped may not be allowed. This is a challenge given that the proposed double circuit 330kV towers can be 15 to 30m higher than the existing design. This could be overcome by extending the underground section of Line 39 further north and south along the existing Line 39 alignment.
- **Existing cable section:** The existing underground cable section of Line 39 around the perimeter of the Western Sydney Airport would need to be duplicated (3.8km).

3.3. Proposed amendments to scoping assumptions for Option 2b

In response to the constraints and challenges associated with Option 2b, the following amendments are proposed to the scoping assumptions to reflect the updated option as being establishment of a new double circuit line adjacent to Line 39 rather than a Line 39 rebuild. Transgrid is continuing to engage with AEMO through joint planning to finalise an appropriate cost estimate uplift for this option based on the revised scope and assumptions.

- **Transmission line scope:**
 - *Section A:* Bannaby to near Greendale Road (**92.8 km**):
 - > New double circuit 330kV transmission line built generally abutting the western side of Line 39 centred within a new 60m easement.
 - *Section B:* Near Greendale Road to near Luddenham Road (**9.3 km**)
 - > Establish a new southern underground to overhead (UGOH) transition station alongside Line 39 off Greendale Road.
 - > Establish new northern underground to overhead (UGOH) transition station alongside Line 39 off Luddenham Road.
 - > Lay new 330kV cables suitable to maintain the transfer capability of the double circuit 330kV overhead sections generally along the already established Line 39 easement (inclusive of the existing cable easement) or alternatively alongside the proposed Outer Sydney Orbital alignment.
 - *Section C:* Near Luddenham Road to Sydney West substation (**12.8km**):
 - > New double circuit 330kV transmission line built along western/northern side of Line 39 within a new 60m easement.
- **Substation scope:**
 - Sydney West substation
 - > Establish two new 330kV switch bays.
 - Bannaby substation
 - > Establish two new 330kV switch bays.

- **Property and biodiversity:**

- Establish a new 60m easement to accommodate new overhead double circuit transmission lines in Section A (92.8km) and Section C (12.8km).
- Establish a new easement suitable for accommodating the proposed underground cable Section B (9.3km).
- Procure biodiversity offsets required to establish the new easement sections.

- **General assumptions:**

- Existing Line 39 to remain in service for the duration of the construction of the new adjacent double circuit 330kV transmission line.
- The lead time for this option with the amended scope would be similar to the 500kV option due to similar constraints around easement acquisition and construction scope for the transmission line sections.