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Assessment of the Aberbaldie-Niangala travelling stock reserve route

New England REZ network infrastructure project

August 2024

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Executive summary

This report assesses a community suggested change to the New England Renewable Energy Zone (REZ) network infrastructure project (the Project), using the Aberbaldie-Niangala travelling stock reserve (TSR) for hosting part of the transmission corridor.

Project background

The Energy Corporation of NSW (EnergyCo) is in the early stages of planning for the New England REZ network infrastructure project. The Project will provide network infrastructure including transmission lines, energy hubs and enabling infrastructure to connect the New England REZ to the National Electricity Market (NEM) at Bayswater Power Station west of Singleton NSW.

EnergyCo released a preliminary study corridor for the Project in June 2023. Following community engagement and consultation with landowners and other key stakeholders, a revised study corridor was released in March 2024, with subsequent ongoing community engagement and consultation with landowners and other key stakeholders carried out since that time.

The revised study corridor included a number of benefits compared to the preliminary study corridor, including about 80 fewer landholders in the study corridor, a total reduction in transmission line easements of about 39km, the use of more NSW Government land around Dungowan and Glenbawn areas, the avoidance of smaller landholdings, and better outcomes for the environment.

EnergyCo released a preferred study corridor with the Project's scoping report in July 2024 which generally follows the 1km-wide revised study corridor, with some narrowed sections where co-location with existing infrastructure is proposed.

Alternative route proposed by the community

In March 2024, some landholders and stakeholders around Dungowan, Woolomin, Duncans Creek and surrounds raised concerns about the proposed location of the study corridor through this area. The concerns included:

- impacts to agriculture and existing land uses
- construction and operational impacts from transmission lines, including visual amenity
- route selection and alternative options considered by EnergyCo in developing the Project, such as undergrounding and upgrades to existing transmission lines
- use of private land over public land for project infrastructure

- firefighting constraints around transmission lines and impacts to water bombing aircraft using Chaffey Dam
- biodiversity and environmental impacts
- other matters relating to landowner engagement and acquisition, including compensation for easement acquisition and mental health support.

Based on these concerns, community members and a local community group known as Valley Alliance provided feedback to EnergyCo suggesting an amended alignment be considered, using the Aberbaldie-Niangala TSR, located around 20km east of the study corridor in the Walcha Local Government Area (LGA) (referred to as the TSR route).

The TSR route suggested by Valley Alliance would avoid the Dungowan, Woolomin and Duncans Creek localities, and use the TSR for a distance of around 40km. The proposal did not initially identify how the TSR transmission alignment would connect back to the Project to the north and south of the TSR route. Subsequent discussions with Valley Alliance identified a suggested option for the connection of the TSR route to the project.

A detailed and objective assessment has been completed

EnergyCo has assessed the constraints and opportunities associated with the suggested TSR route, including a comparative assessment of the preferred study corridor (or 'Base Case') against the TSR route. It is necessary for any transmission line located in the TSR to connect to the rest of the transmission line, and this needs to be considered as part of the overall assessment of the TSR route. EnergyCo's assessment considered four alternative options to connect back to the Project, to ensure that the TSR route was assessed holistically and its feasibility fully considered.

For the purposes of a comparative assessment, the following route options connecting the TSR route to the preferred study corridor were identified and considered:

- TSR route Option 1A – via Duncans Creek
- TSR route Option 1B – via Garoo-Hanging Rock
- TSR route Option 1C – via mid-western route
- TSR route Option 1D – via Glenrock (i.e. the option suggested by Valley Alliance).

TSR route Options 1C and 1D use elements of the mid-western route that was previously considered by EnergyCo as part of the options evaluation assessment, which is discussed in the scoping report. This option runs from Glenbawn Dam – Moonan Flat – Ellerston – Glenrock and up to the top of the plateau near the start of the TSR. The mid-western route was previously not recommended by EnergyCo when assessed against the western corridor due to:

- impacts to predominantly undisturbed 'greenfield' land and associated visual sensitivity
- increased impacts on native vegetation and reduced bushfire resilience
- higher estimated costs and longer construction period
- reduced opportunities for co-location of infrastructure

- greater constructability and access challenges due to the remoteness of the route and roughness of the terrain.

Given the previous constraints associated with the mid-western route, the TSR assessment focused on the TSR route itself as well as a comparative assessment of the preferred study corridor and the TSR options 1A and 1B.

Results of the assessment

Using the foundational principles outlined in the NSW Government's Draft Transmission Guideline and EnergyCo's planning pillars and planning principles, the comparative assessment included a desktop assessment of each option against a range of criteria relating to people and communities, environmental and land use, and efficiency and deliverability.

The comparative assessment is summarised in the following table:

Table E- 1 Comparative assessment of preferred study corridor against TSR route options.

Key
Option would result in a better outcome, relative to other options
Option would result in a worse outcome, relative to other options

Foundational principle	Planning pillar	Base Case	TSR route option 1A	TSR route option 1B
People and communities	People	Reduced impact to rural dwellings and total number of landholdings compared to Options 1A and 1B.	Greater impact to rural dwellings and total number of private landholdings compared to the Base Case.	Greatest impact to rural dwellings and total number of private landholdings compared to the Base Case and Option 1A.
		Least number of private landholders compared to Options 1A and 1B.	Greater number of private landholders compared to the Base Case.	Greatest number of private landholders compared to the Base Case and Option 1A.
		Least number of government landholders compared in Options 1A and 1B.	Greater number of government landholders compared to the Base Case.	Greatest number of private landholders compared to the Base Case and Option 1A.
Environment and land use	Environment	Does not intersect a national park or protected area. No impact to high conservation value TSR. Least number of recorded threatened flora and fauna compared to Options 1A and 1B. Intersects the least area of Biophysical Strategic Agricultural Land (BSAL) compared to Options 1A and 1B.	Does not intersect a national park or protected area, however impacts high conservation value TSR. Greater number of recorded threatened flora and fauna species compared to the Base Case. Intersects a greater area of BSAL compared to the Base Case.	Intersects around 600m of the edge of Tomalla Nature Reserve, however could be realigned to avoid. Impacts high conservation value TSR. In proximity to critically endangered flora species, however could be realigned for avoidance. Greatest number of recorded threatened flora and fauna

Foundational principle	Planning pillar	Base Case	TSR route option 1A	TSR route option 1B
				species compared to the Base Case and Option 1A.
		A higher proportion of the Base Case extent is located in the highest composite bush fire risk (Level 4 and 5) compared to Options 1A and 1B.	Lowest composite bush fire risk compared to the Base Case and Option 1B.	Lower composite bush fire risk compared to the Base Case.
Efficiency and deliverability	Economic	Overall lowest construction cost**	Increase in construction cost by approximately 20% over the Base Case**	Increase in construction cost by approximately 25% over the Base Case and is the highest estimated cost**
	Strategy	Highest amount of co-location with existing transmission lines (23.9km)*** Lowest construction time	Reduced amount of co-location with existing transmission lines (13.2km)*** Increased construction time compared to the Base Case.	No co-location with existing transmission lines (0km)*** Greatest construction time compared to the Base Case and Option 1A
	Technical	Shortest overall line length at 204km and a significantly lower amount of line angle deviations overall.	Increased line length over Base Case with at least 20% increase at +42km. Significant increase in line deviations.	Increased line length over Base Case with at least 20% at +50km. Significant increase in line deviations.
		Largest % of the route in slope >30%.	Improved average slope and reduction in % of route in >30% slope.	Improved average slope and reduction in % of route in >30% slope.
		Requires the most new access roads.	Fewer access roads compared to the Base Case as the TSR can be used.	Requires the least amount of access roads compared to other options.

Foundational principle	Planning pillar	Base Case	TSR route option 1A	TSR route option 1B
		Least required amount of vegetation clearance.	Increased vegetation clearing, increased accommodation camps and the most stringing sites compared to Base Case and Option 1B.	Greatest vegetation clearing, increased accommodation camps and a greater number of stringing sites compared to the Base Case.

** For the purpose of the assessment, assessment start and end points were developed including a comparative segment of the preferred study corridor. The route options and assessment end points are shown in Figure 5.*

*** The cost assessment is high level and considered a pro-rata rate based on cost per line length. This provides a basis of comparison between options.*

**** Between assessment points as shown in Figure 5.*

The comparative assessment found that the TSR route options would provide a better outcome compared to the Base Case on some criteria, including lower average slopes, access to existing roads for construction, and bushfire resilience in the TSR section.

However, the TSR options would provide an inferior outcome on other criteria, including proximity to dwellings, number of landholdings affected, interactions with land with high environmental and BSAL values, and construction costs.

In particular, the analysis indicates that the TSR route options would affect a considerably greater number of dwellings than the preferred study corridor, with many of these dwellings located along the TSR section itself.

A summary of the affected dwellings is provided in the following table:

Table E- 2: Dwelling analysis – route option comparison

Criteria	Base Case	Option 1A	Option 1B
Dwellings within 250m of edge of corridor*	3	18	16
Dwellings within 500m of edge of corridor*	12	37	37
Dwellings within 1km of edge of corridor*	32	67	74
Dwellings within 2km of edge of corridor*	125	144	128

** Total dwellings within the stated distance either side of the 250m assessment corridor, including any dwellings within the assessment corridor.*

Given this assessment, any option that used the TSR would interact with a considerable number of dwellings in close proximity to the network infrastructure. On this basis, EnergyCo considers that any TSR route option (including options 1A, 1B, 1C and 1D) would present significant constraints.

Conclusion

EnergyCo has assessed the options against all of the planning pillars (refer Section 2.2).

As noted above, a key benefit of the change from the preliminary study corridor to the revised study corridor was the reduction in number of impacted landholders by around 80 landholders. Adopting any of the TSR route options would materially increase the impact on private landholders, with around 18-25 additional landholders effected by options 1A and 1B respectively compared to the Base Case 1km-wide assessment corridor, notwithstanding the TSR route option increasing the use of NSW Government land.

In summary, with consideration to people and communities, environmental and land use, and efficiency and deliverability criteria, the assessment concluded that the Base Case (i.e. preferred study corridor) would, on balance, result in a better outcome compared to the TSR route options.

1 Introduction

1.1 Background

EnergyCo is in the early stages of planning for the New England Renewable Energy Zone (REZ) network infrastructure project (the Project). The Project will provide network infrastructure including transmission lines and energy hubs to connect the New England REZ to the National Electricity Market (NEM) at Bayswater Power Station west of Singleton NSW.

The Project has been subject to a route options development process including options design, feasibility and evaluation processes. This process is detailed in the Project's scoping report, available on the NSW Major Projects Portal at New England REZ Transmission Project | Planning Portal - Department of Planning and Environment (nsw.gov.au).

A preliminary study corridor was released in June 2023. Following field investigations and community engagement and consultation with landowners and other key stakeholders, a revised study corridor was released in March 2024, with subsequent ongoing community engagement and consultation with landowners and other key stakeholders occurring since that time. A preferred study corridor was released with the scoping report in July 2024 which generally follows the 1km-wide revised study corridor, with some narrowed sections where co-location with existing transmission infrastructure is proposed.

Project information can be viewed on EnergyCo's website at energyco.nsw.gov.au/ne.

1.2 Community suggested route option

In March 2024, some landholders and stakeholders around Dungowan, Woolomin, Duncans Creek and surrounds raised concerns about the proposed location of the study corridor through this area. The concerns raised were:

- impacts to agriculture and existing land uses
- construction and operational impacts from transmission lines, including visual amenity
- route selection and alternative options considered by EnergyCo in developing the Project, such as undergrounding and upgrades to existing transmission lines
- use of private land over public land for project infrastructure
- firefighting constraints around transmission lines and impacts to water bombing aircraft using Chaffey Dam
- biodiversity and environmental impacts
- other matters relating to landowner engagement and acquisition, including compensation for easement acquisition and mental health support.

In response to these concerns, community members and the local community group known as Valley Alliance provided feedback to EnergyCo suggesting an amended corridor utilising the existing Aberbaldie-Niangala TSR, located around 20km east of the preferred study corridor in the Walcha LGA (referred to as the 'TSR route').

The TSR route was put forward by community members and Valley Alliance and on the basis that it may provide improved outcomes compared to the preferred study corridor, such as increased use of public land, and reduced impacts on private land.

The TSR route initially suggested by Valley Alliance identified the use of the TSR, although it did not identify how the route would connect back to the Project. Subsequent discussions with Valley Alliance identified a suggested option for the connection of the TSR route back to the Project via the Central South Hub and a connection in the south. The community-suggested TSR route and connection option is provided in Figure 1. Refer to section 1.3 for further information on the routes considered in this assessment.

The Aberbaldie-Niangala TSR is not a continuous parcel of land. It includes a network of Crown land parcels dissected by private property and road reserves. The implications of this are described in section 5.3. The TSR co-locates with existing public road reserves in sections, including Forest Way, Niangala Road and Aberbaldie Road, and hosts existing distribution lines.

While the TSR route runs generally in a north-south direction, the width of the TSR varies from 50m-500m across the extent of the TSR route.

The TSR route is broken up into the following reserves: R56057, R56848, R532, R1002241, R1297, R339, R579, R55803 and R67483.

1.3 Purpose of this report

Following engagement with community members and Valley Alliance, EnergyCo committed to undertaking an assessment of the TSR route.

The purpose of this report is to detail the approach to and outcomes of the assessment.

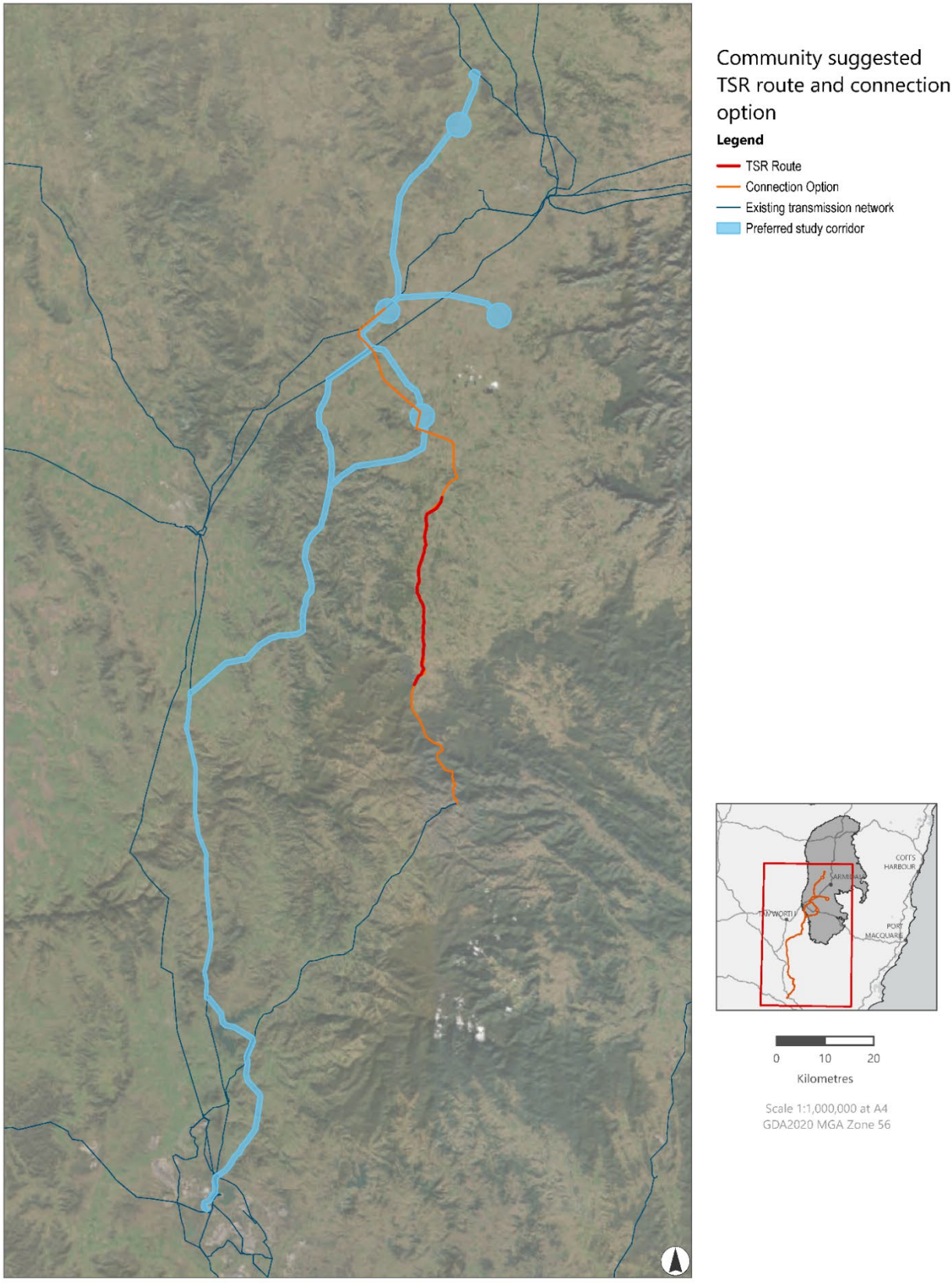

Figure 1: Community suggested TSR route and connection option.

2 Guiding principles

The assessment of the TSR route has been guided by and considers the foundational principles relating to transmission line route selection identified in the NSW Department of Planning, Housing and Infrastructure's (DPHI) Draft Transmission Guideline (2023), as well as the planning pillars developed by EnergyCo as part of the route options development process (referenced in section 1.1).

2.1 Foundational principles

According to the Draft Transmission Guideline, given the large-scale nature of major transmission infrastructure projects and the inherent challenges in route selection due to competing factors, route selection needs to consider:

- co-location with existing structures and the use of previously disturbed land where possible to enhance efficiency and minimise environmental and social impacts
- avoiding impacts as far as possible, including prioritisation of impact avoidance for high conservation areas
- striking an appropriate balance between competing commercial, technical, environmental and social impacts.

The assessment was guided by the following foundational principles for the design and development of major transmission projects as defined in the Draft Transmission Guideline:

Principle 1: Efficiency and deliverability

Projects should be efficient from an economic and technical perspective and be deliverable in time to meet the investment need.

Given the cost of transmission lines is passed on to consumers through electricity bills, the cost and affordability of new infrastructure should be a significant factor in the evaluation of route options.

However, while the most cost-effective option for linear infrastructure projects is to take a straight-line approach from point to point, this option is not generally feasible due to a range of environmental, social, land use and engineering constraints.

Principle 2: Environment and land use

Environmental impacts should be avoided, minimised or mitigated, and best practice environmental management incorporated into project design. Impacts on important biodiversity and cultural values should be a key consideration.

Projects should be sited on public land as far as practicable, with the exception of some categories such as National Parks and reserves (including environmental, heritage, recreation and other reserve categories). When weighing up the appropriateness of prioritising public land over private land, proponents should give careful and sensitive consideration to the inherent characteristics and public purposes between the different categories of public land and their underlying social, economic, environmental and cultural values.

Principle 3: People and communities

Projects should avoid and minimise social impacts, including those associated with visual impacts, and direct interactions with town centres, residential areas, and other sensitive land uses should be minimised.

2.2 Planning pillars

The assessment was guided by the following planning pillars and corresponding planning principles developed by EnergyCo to guide the route selection process for the Project:

Table 1: Key planning pillars and related planning principles for route options selection.

Planning pillar	Definition	Planning principles
People 	Positive benefits and negative impacts on people's wellbeing, amenity and quality of life	• Minimise impacts on the visual amenity of residences and landscapes • Minimise impacts on residential areas and rural residences • Maximise opportunities to deliver community benefits
Environment 	Impacts to natural and cultural environments	• Minimise impacts on biodiversity values • Minimise impacts on cultural heritage values • Maximise the use of available industrial and mining land.
Economic 	The cost of the option and its impacts on key industries	• Deliver energy infrastructure that is in the long-term financial interests of NSW energy consumers • Minimise impacts on high value agricultural land, including Critical Industry Cluster (CIC) land and Biophysical Strategic Agricultural Land (BSAL) • Maximise the use of suitable public land.
Strategic 	The consistency of the option with the Electricity Infrastructure Road Map	• Deliver energy infrastructure that meets the objectives and timing requirements of the Roadmap • Maximise co-location with existing transmission infrastructure

Planning pillar	Definition	Planning principles
		• Maximise co-location with existing and proposed energy projects.
Technical 	The technical efficiency and reliability of the option in meeting electricity demand	• Maintain energy security and reliability, ensuring resilience of the power system • Optimise electricity infrastructure and power system development over the long term.

3 Assessment methodology

3.1 Route options

The assessment considered the TSR route options (as defined in section 4) and compared the options to the preferred study corridor for relative evaluation.

For the purposes of the assessment, a 250m assessment corridor was identified and applied to the preferred study corridor (based on the centreline, and herein referred to as the 'Base Case'), as well as the TSR route options, as defined in section 4.

A desktop comparative assessment was carried out of the preferred study corridor and the TSR route including connection options to the preferred study corridor to the north and south of the TSR route.

The alternative routes consider both the 500kV double circuit transmission line from Bayswater to the Central Energy Hub; and the 500kV double circuit transmission line from Bayswater to the Central South Energy Hub.

For the purposes of completing the comparative assessment, the following route options connecting the TSR route to the preferred study corridor were identified and considered:

- TSR route option 1A – via Duncans Creek
- TSR route option 1B – via Garoo-Hanging Rock
- TSR route option 1C – via mid-western route, and
- TSR route option 1D – via Glenrock (i.e. the option suggested by Valley Alliance).

The routes identified for assessment were based on desktop study and site inspection (outlined in Section 3.3).

The routes identified for assessment are discussed in Section 4.

3.2 Comparative assessment criteria and rating

Based on the foundational principles of the Draft Transmission Guideline and EnergyCo's planning pillars and planning principles, the TSR route assessment included a desktop comparative assessment using the following criteria:

Table 2: Comparative assessment criteria.

Foundational principle	Planning pillar	Comparative assessment criteria
People and communities	People	Localities Dwellings Property and landholders
Environment and land use	Environment	Biodiversity

Foundational principle	Planning pillar	Comparative assessment criteria
		Land use, including suitable public land Aboriginal and non–Aboriginal heritage Bushfire resilience
Efficiency and deliverability	Technical	Design Constructability Accessibility
	Economic	Construction cost and time
	Strategic	Co-location with existing transmission lines Co-location with existing and proposed energy projects Time

The datasets and limitations which apply to the assessment are detailed in section 9.

The assessment compared the TSR route options against the Base Case for relative evaluation using the following comparative rating system for each criteria:

Table 3: Comparative rating

Rating key			
Better performing option than the Base Case	Same, or similar to the Base Case	Noticeably worse than the Base Case	Material Issue. Much worse than the Base Case, may require realignment.

Based on the outcomes of the comparative assessment, the overall key differentiators for each option were considered against the foundational principles and planning pillars using the following rating system:

Option would result in a better outcome, relative to other options
Option would result in a worse outcome, relative to other options

3.3 Site inspection and engagement

In July 2024, EnergyCo carried out a site inspection of the TSR route from the public road network within and adjacent to the TSR to inform the desktop assessment. The purpose of the site inspection was to observe existing TSR site conditions and key criteria considered in the assessment, including dwellings, roads and road condition, private property access, terrain, vegetation, and existing distribution line infrastructure.

EnergyCo has also met with representatives from Valley Alliance during the assessment (including meetings on 17 April, 11 June, 26 June, 3 July and 8 August) to discuss route options and assessment criteria and data.

4 Route options

4.1 Identification of route options

As noted in Section 1.2, the TSR route initially suggested by Valley Alliance identified the use of the TSR for a distance of around 40km, however it did not identify where within the TSR the alignment would be located, or how it should connect back to the Project. Subsequent discussions with Valley Alliance identified a suggested option for the connection of the TSR route back to the preferred study corridor (identified as option 1D in this assessment).

To facilitate assessment of the TSR route, a high-level corridor analysis was required to:

- Identify a route for the dual 500kV double circuit transmission lines within the TSR. This is discussed further in section 4.2.
- Identify a route from the TSR to the preferred study corridor, including to the Central South Hub to the north, and back to the study corridor at a point to the south. This is discussed further in section 4.3.

Any such alternative route/s also considered both:

- Stage 1 - the 500kV double circuit transmission line from Bayswater to Central Energy Hub
- Stage 2 - the 500kV double circuit transmission line from Bayswater to Central South Energy Hub.

4.2 Identifying a route along the TSR

4.2.1 Key route constraints

To identify an alignment through the TSR, initial high-level observations and previous constraint mapping used in the options evaluation phase of the Project (refer section 1.1) were considered.

Initial observations of the TSR identified a number of constraints:

- **Varying TSR land parcel width and size**: The TSR is not consistent in width, varying from 50m to 500m along its length, shape and direction and therefore only able to partially accommodate the easements within the TSR.
- **Multiple angle deviations of TSR**: The TSR corridor has multiple directional deviations that are not ideal for transmission infrastructure. This would increase the number of tension towers and shorten spans for the transmission line to follow the TSR, resulting in the need for more towers.
- **Existing road infrastructure:** Niangala Road, a public road, is within the TSR and is not aligned consistently to one side of the TSR, therefore creating potential multiple road crossings. The existing alignment of Niangala Road also limits the placement of towers and therefore the ability to maximise use of the TSR for transmission infrastructure. While changes to the alignment of

Niangala Road could be considered locally, a wholesale alignment change was not considered a reasonable assumption, so this remains a constraint to consider.

- **Existing distribution electricity lines:** The TSR hosts existing high voltage distribution lines. Section 4.2.3 discusses this in more detail.
- **Observed dwellings:** Dwellings were observed in the neighbouring properties to the TSR, mainly accessed from the road reserve. Dwellings are discussed further in section 5.2.

Noting the abovementioned constraints, the approach to route selection along the TSR aims to achieve the following objectives where practical:

- **Maximising TSR co-location:** Locating the transmission route within the boundary of the TSR as much as possible.
- **Minimising road crossings:** Avoiding multiple road crossings to reduce complexity in construction and potential impacts to road users.
- **Reducing building point impacts:** Avoiding routes that would directly impact or affect building points and dwellings along the alignment.
- **Limit number of tension towers:** Reducing the number of line deviations where practical to reduce the number of tension towers required.
- **Route optimisation:** Route selection that minimises additional line length.

4.2.2 Route deviations from the TSR

EnergyCo developed a proposed alignment for the TSR route which considers the objectives and constraints outlined in section 4.2. Given the constraints, there are sections where the route deviates from the TSR to optimise the efficiency of the route. These are outlined in Figure 2.

Noting the above constraints and deviations, a route along the TSR was identified for the purposes of the assessment. This is provided in Figure 2. This includes the TSR route alignment with a 250m corridor. Landholdings intersected by the TSR route corridor are also identified in Figure 3.

ID1: TSR not followed due to minimal area between the road and prospective tower locations. Capturing a portion of the TSR land by following the road would also require the addition of numerous heavy tension towers and potential impacts to the building points on the eastern side of the road.

ID2: TSR on the eastern side not pursued due to extra road crossing required and potential impacts to another building point south of Topdale Road.

ID3: TSR not followed directly to minimise the number of road crossings, additional tension towers to follow the TSR and minimise encroachment on the building point to the west of Niangala Road.

ID4: TSR not directly followed as multiple road crossings would be required to capture additional TSR area on the eastern side of Niangala Road in this area.

ID5: TSR co-location not maximised at this location due to the building points located north and south of Geraldine Road.

ID6: TSR co-location not maximised in this location due to building points located on the western side of Niangala Road.

ID7: TSR not followed due to the building points to the west of Niangala Road and entire easement not being able to be accommodated within the TSR.

ID8: TSR not followed at this location as two road crossings would be required to capture the TSR on the western side and the eastern side of Niangala Road. Having the route on the eastern side of Niangala Road also minimises impacts to the building points on the western side of Niangala Road.

ID9: TSR not followed directly to minimise number of tension towers and potential tower spotting limitations by adding a control point adjacent to Macdonald River.

ID10: TSR not followed as additional line length would be required to get back to Central South Hub.

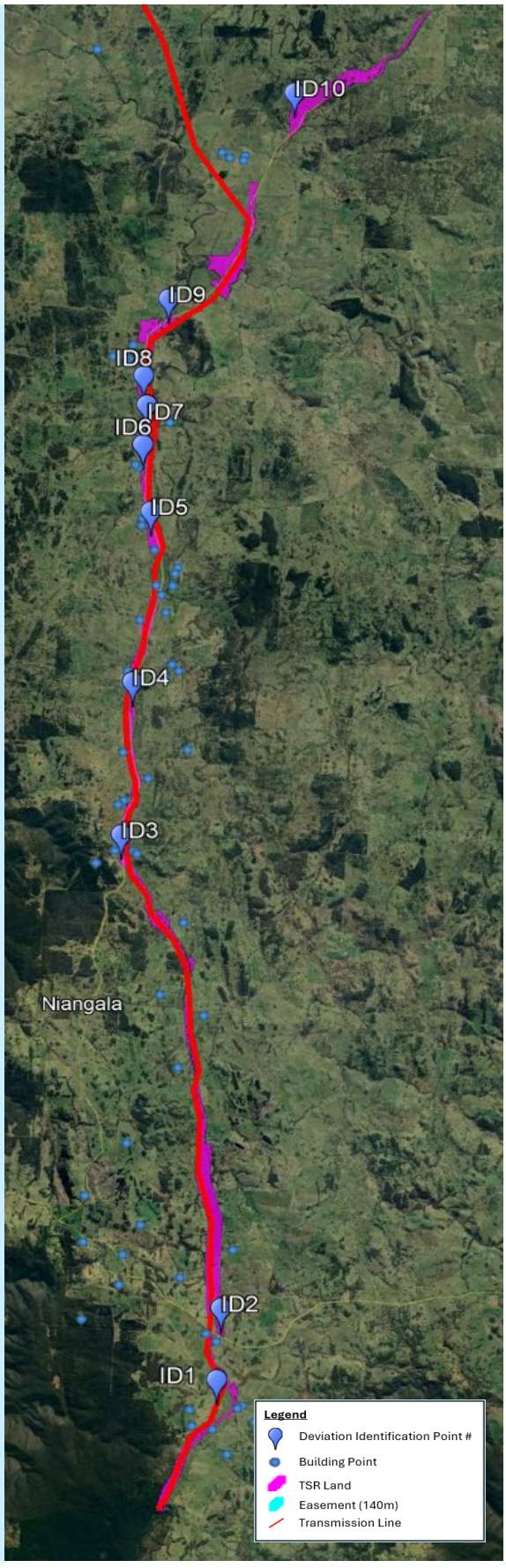

Figure 2: Route deviations of the TSR.

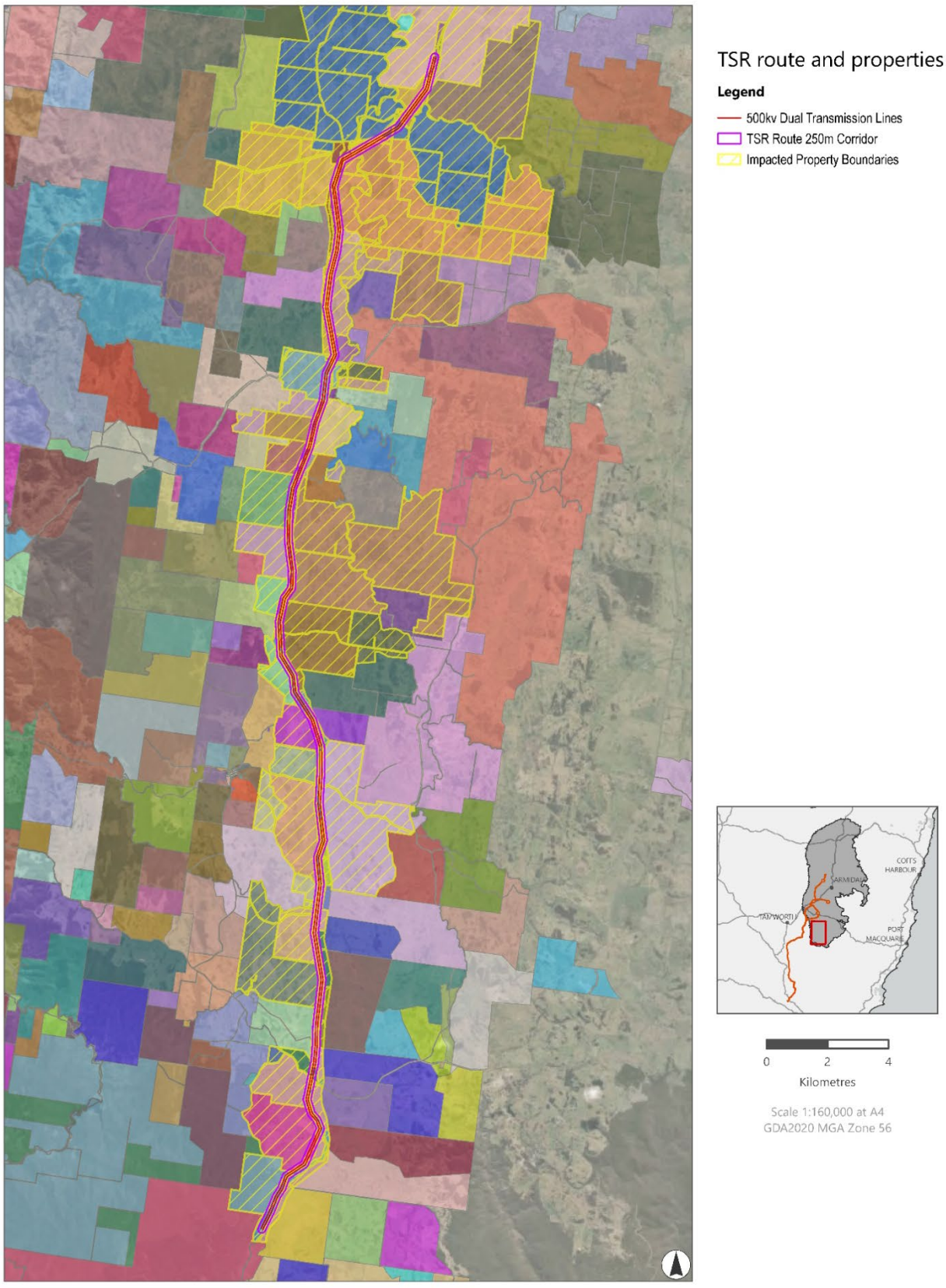

Figure 3: TSR route and properties.

4.2.3 Existing distribution lines

The existing distribution lines located along sections of the TSR generally run in a parallel direction with the proposed high voltage transmission lines. The existing distribution lines running parallel to the TSR provide electricity to the adjacent private rural landholdings.

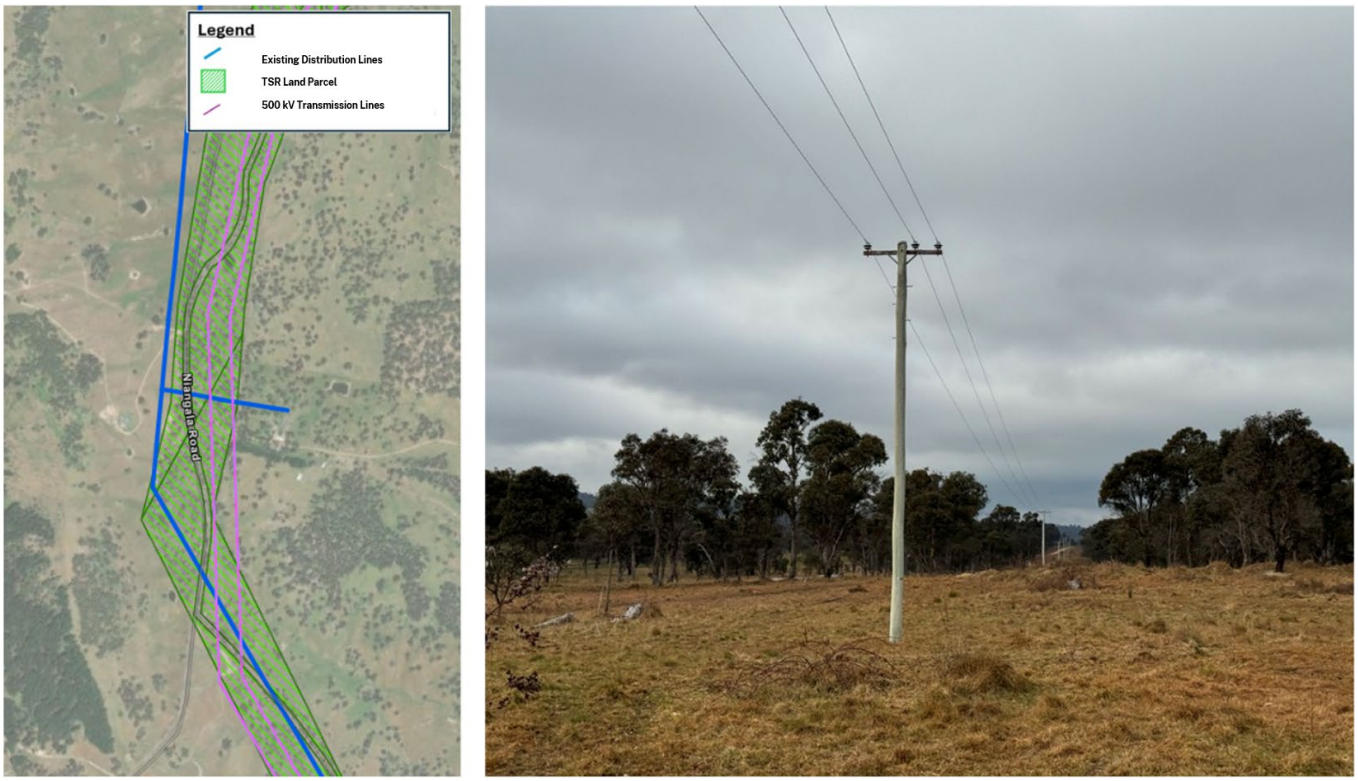

Figure 4: Existing distribution lines in the TSR.

While co-location with existing transmission infrastructure is a key planning pillar, co-location with the distribution line presents the following constraints that would need to be considered in any high voltage transmission line alignment through the TSR:

- **Electromagnetic interference:** High voltage transmission lines generate electromagnetic fields that could interfere with the operation of distribution lines, causing signal distortion and potential equipment malfunction.
- **Induced voltages:** The electromagnetic fields from high voltage lines could induce voltages in the distribution lines, which could lead to overvoltage conditions and damage to the equipment connected to these lines.
- **Additional crossings:** The transmission line route would likely require multiple crossings of the distribution line. This would increase construction complexities such as constructing a physical barrier over the distribution line, known as hurdling, or converting a part of the overhead distribution line to underground. The extent of these constraints would be exacerbated where the crossings do not dissect the line in a perpendicular manner.
- **Maintenance challenges:** Maintenance of distribution lines becomes more complex and hazardous when they are located under high voltage lines, requiring additional safety measures and coordination.

The impacts of this may be significant and should the TSR route be progressed to the next phase of design development, these matters would need to be addressed. To mitigate these impacts the options would be to:

- relocate the distribution line to a new location, requiring a new easement
- underground the distribution line
- move the transmission lines away creating a physical separation. This may result in the transmission line no longer being in the TSR as intended.

4.3 Identifying a route from the TSR to the preferred study corridor

4.3.1 Northern connection

The TSR route initially put forward by the community did not include a connection option between the TSR north to Central South Hub.

A portion of the TSR intersected with the previous preliminary study corridor, released in June 2023, along the then proposed connection from South Hub to Central South Hub. As part of this assessment, an alignment similar to the preliminary study corridor was considered to link up with the Central South Hub.

During further engagement, Valley Alliance suggested a northern connection route which followed the TSR closer to Walcha and along Aberbaldie Road before deviating back on itself to Central South Hub. Although this option remains on the TSR for longer, it increases line length by around 15km. The community suggested connection option is discussed further in Section 4.3.3.

4.3.2 Southern connection

The southern end of the initially suggested TSR route does not intersect with the Project's existing preferred study corridor. Therefore, for the purposes of this assessment, a route connecting the southern end of the TSR to the remainder of the Project needed to be identified. EnergyCo carried out an initial analysis of route options connecting the TSR route to the preferred study corridor for the purposes of undertaking a comparative assessment.

The identification of the connecting route used constraint mapping from previous route selection processes. Some of the initial constraints identified associated with the connection included:

- Townships: there are some townships between the TSR section and the preferred study corridor that need to be avoided.
- Terrain: the TSR is located on the New England tablelands plateau and has an elevation greater than 1000m above sea level, therefore providing steeply sloping terrain for the connection route.
- Access: Given the rugged terrain for the connection route, there is also limited accessibility and constructability challenges that need to be considered in selecting the connecting route.

- **National Parks and State Conservation areas:** including Nowendoc National Park, Curracabundi National Park, Barrington Tops National Park, Ben Halls Gap Nature Reserve, Back River Nature Reserve, Tomalla Nature Reserve, Tuggolo Creek Nature Reserve.

Identifying a southern connection route from the preferred study corridor to the TSR that may be technically feasible to build resulted in the following options being identified for the purposes of the comparative assessment:

- Option 1A – via Duncans Creek
- Option 1B – via Garoo-Hanging Rock

These options are presented in Figure 5. To maintain a relative comparison between the Base Case and the TSR route options, the assessment points for which the comparison is made are also shown in Figure 5.

4.3.3 Additional connection options

The mid-western bulk corridor route, as assessed in the earlier options evaluation phase of the Project, aligns with the southern part of the TSR section.

Furthermore, the suggested connection route from Valley Alliance also uses parts of the previously studied mid-western corridor route.

These two alternatives were considered as:

- Option 1C – mid-western route to TSR section
- Option 1D – mid-western route to Glenrock to TSR section (Valley Alliance suggested).

These options are presented on Figure 5.

Both of these alternative routes use elements of the mid-western route which was previously considered by EnergyCo as part of the options evaluation assessment. This is discussed further in the Project's scoping report.

The mid-western route was ultimately not pursued, with key reasons against each of the planning pillars including:

- **People and communities**: While the mid-western route avoids built up areas and impacts fewer dwellings, the route mostly impacts undisturbed 'greenfield' land, with visual sensitivity likely to be higher compared to the Western route
- **Environment**: Increased impacts the native vegetation (including intact remnant vegetation), more watercourse crossings and reduced bushfire resilience. Option 1D intersects with the Curracabundi National Park area
- **Economics**: Higher estimated costs and longer construction period
- **Strategy**: Reduced opportunities for co-location of infrastructure
- **Technical:** Reduced constructability outcomes and access challenges due to the remoteness of the route and roughness of the terrain.

Considering the previous options evaluation assessment, and the findings of the TSR assessment (see sections 6 and 7 below), options 1C and 1D were not considered further as part of this comparative assessment.

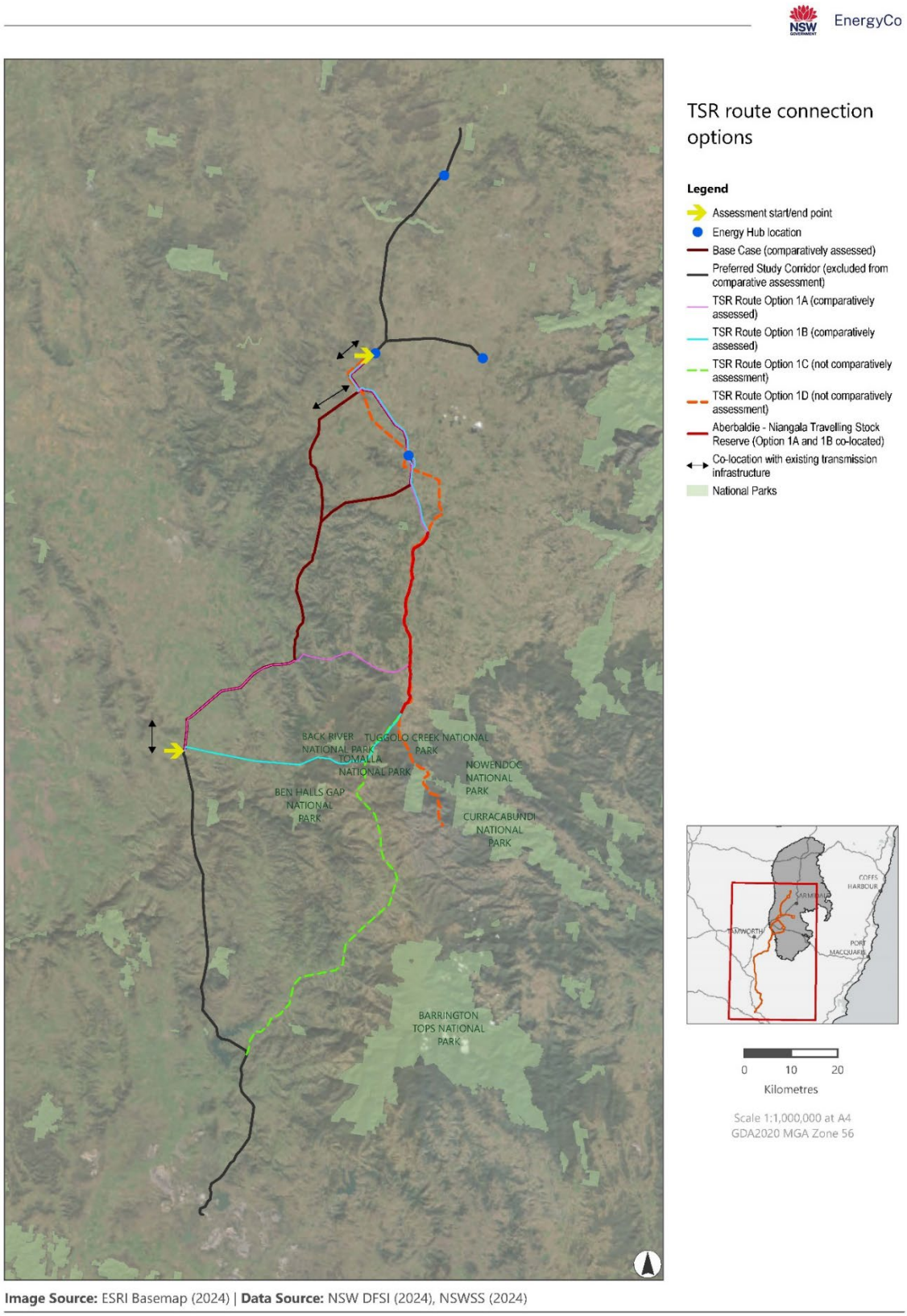

Figure 5: TSR route connection options.

5 Assessment of people and communities

This section of the report provides a comparative assessment of community, people and property criteria between the Base Case and the proposed TSR route Options 1A and 1B, using publicly available data, as defined in section 9.

5.1 Townships and localities

One of the key planning principles considered in relation to people is minimising impacts on the visual amenity for residential areas and rural residents. While the preferred study corridor has been designed to avoid interacting with townships and rural settlements as far as practicable, the current alignment passes near some localities including Woolomin (approximately 2km).

A key consideration in planning any transmission alignment is to minimise the number of affected properties and maximise distances to dwelling locations as far as practicable. Table 4 compares approximate distances to various townships and localities of the Base Case and options 1A and 1B, noting the data captures properties in a wider geographical area in and around rural townships.

Table 4: Route distance to townships / localities.

Township/locality	Population*	Approximate distance		
		Base Case	Option 1A	Option 1B
Woolomin	260	2km	3km	24km
Ogunbil	152	11km	2.5km	13km
Nundle	482	11km	11km	6.5km
Hanging Rock	98	17km	17km	4km
Niangala	149	21km	2.5km	2.5km
Walcha Road	72	3km	3km	3km
Mulla Creek	87	2.5km	25km	25km
Dungowan	366	6km	13km	29km
Limbri	113	7.5km	28km	28km
Duncans Creek	70	7km	7km	13.5km

** Suburbs and Localities (SAL) data, 2021 Census, Australian Bureau of Statistics.*

*** Approximate distance to rural village / locality.*

Whilst options 1A and 1B would increase the distance of the transmission infrastructure to Woolomin, Mulla Creek, Limbri and Duncans Creek, decreased distances occur in other localities including Nundle, Hanging Rock and Niangala. The dwelling assessment in section 5.2 further considers impacts relating to proximity to people and communities.

5.2 Dwellings

Table 5 provides a summary of the analysis carried out to compare the number of dwellings in proximity to the Base Case and the TSR route options 1A and 1B. These are presented in Figure 6.

Table 5: Dwelling analysis – route option comparison.

Criteria	Base Case	Option 1A	Option 1B
Dwellings within 250 m of edge of corridor*	3	18	16
Dwellings within 500 m of edge of corridor*	12	37	37
Dwellings within 1km of edge of corridor*	32	67	74
Dwellings within 2km of edge of corridor*	125	144	128

**Total dwellings within the stated distance either side of the 250m assessment corridor, including any dwellings within the assessment corridor.*

The dwelling analysis indicates that there is a considerably greater number of dwellings located in close proximity to the TSR route options 1A and 1B compared to the Base Case.

The number of dwellings within the TSR section itself (i.e. excluding any connection corridors), is detailed in Table 6 and presented in Figure 7.

Table 6: Dwelling analysis – TSR only.

Criteria	TSR section (around 40km in length)
Dwellings within 250 m of edge of corridor*	13
Dwellings within 500 m of edge of corridor*	23
Dwellings within 1km of edge of corridor*	37
Dwellings within 2km of edge of corridor*	47

** Total dwellings within the stated distance either side of the 250m assessment corridor, including any dwellings within the assessment corridor.*

The dwelling analysis of the TSR section indicates that there are a number of dwellings located in close proximity to the TSR. With consideration to the dwelling analysis for options 1A and 1B, most the dwellings identified as within 500m of the edge of the corridor for those options (around 62%) are located along the TSR portion of these alignments.

This evaluation indicates that overall, the Base Case has the least number of dwellings within 250m, 500m, and 1km from the edge of the assessment corridor compared to options 1A and 1B. The Base Case also has less dwellings within 2km of the edge of the assessment corridor compared to both options.

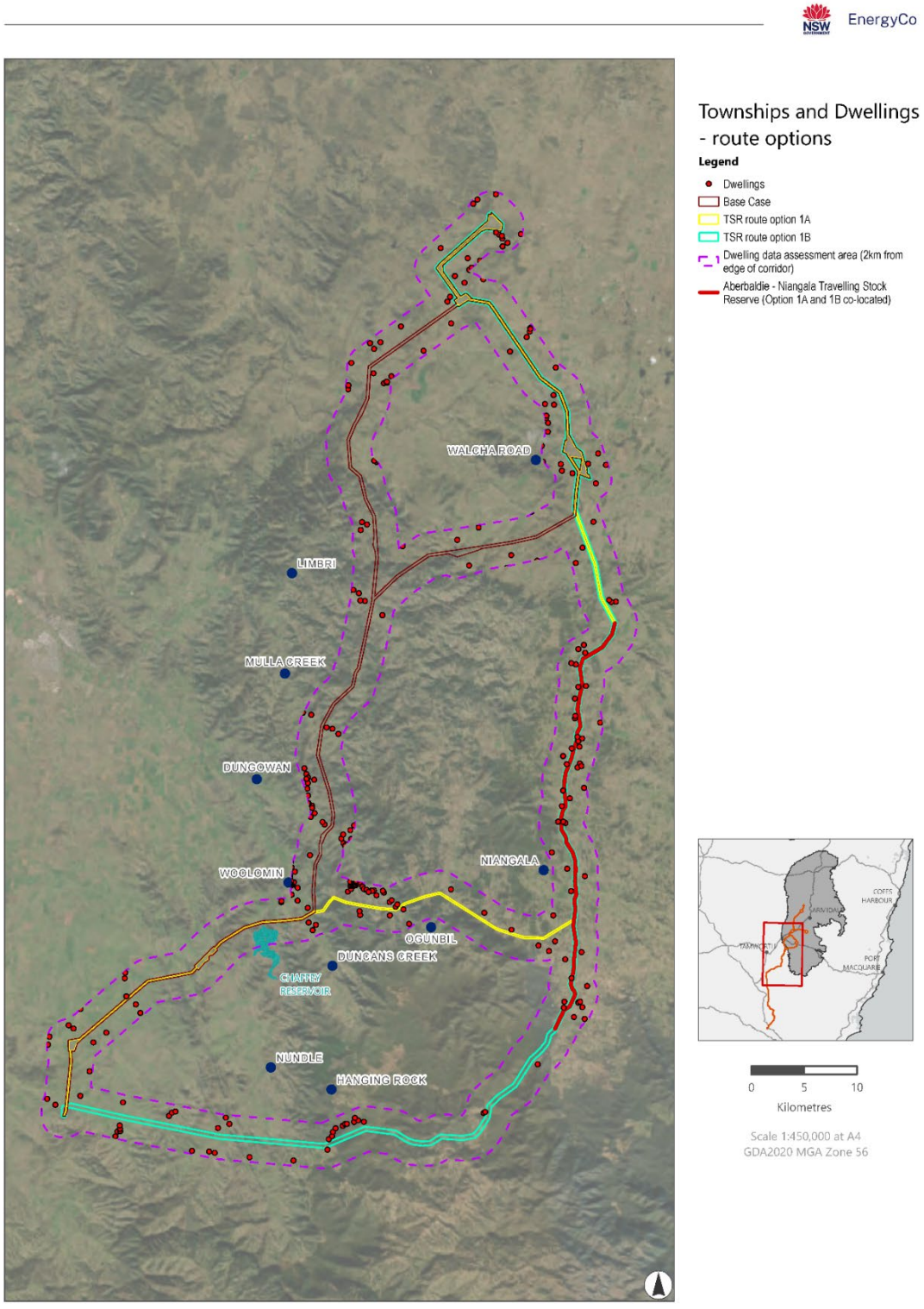

Figure 6: Townships and dwellings – route options.

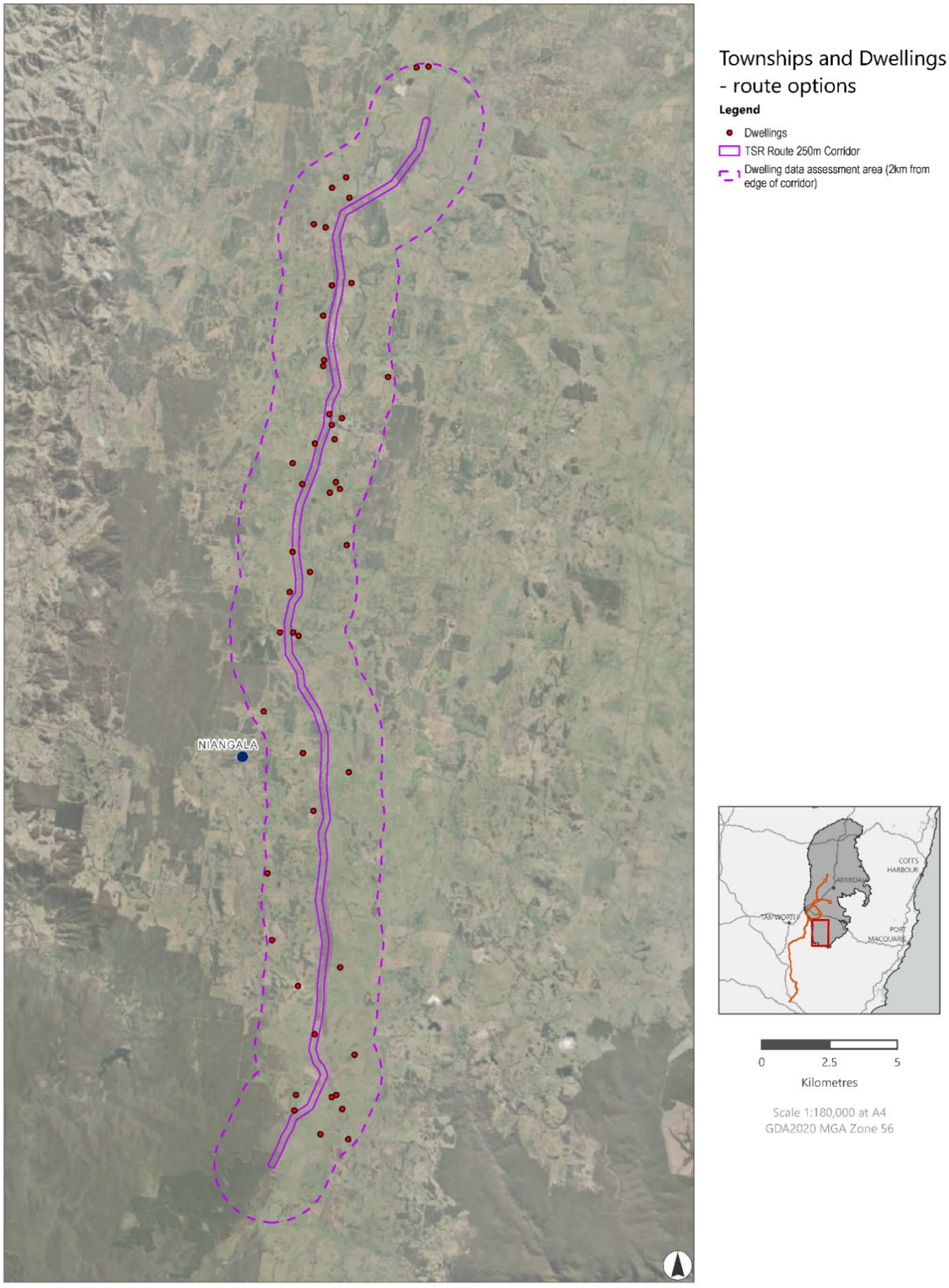

Image Source: ESRI Basemap (2024) | **Data Source:** NSW DFSI (2024), NSWSS (2024)

Figure 7: Townships and dwellings – TSR.

5.3 Property and landholder assessment

The TSR is not a continuous parcel of land. It includes a network of Crown land parcels dissected by private property and road reserves. The TSR route co-locates with existing public road reserves in sections and hosts existing distribution lines. The TSR itself ranges in width from 50m up to 500m, with multiple angled deviations across its length. The final transmission line easement needs to be at least 140m wide to accommodate two 500kV lines, and consideration given to an efficient number of direction changes of the line. Therefore, it is not possible for the TSR route to stay completely within the TSR, and as such the route would interact with a number of private landholdings.

The property and landowner assessment considered the total number of properties and landholders that are intersected along the alignment for each option. The assessment considers the properties and landowners within a 1km corridor (as per the preferred study corridor) but also in a 250m corridor (assessment corridor) (refer to section 9 for data sources).

The findings of the assessment are summarised in Table 7, and landholdings are shown in Figure 3

Table 7: Property and Landowners Intersected – route options.

Criteria	Base Case	Option 1A	Option 1B
1km corridor			
Total properties	133	176	182
Private landholders	93	111	118
Government landholders	4	7	6
250m corridor			
Total properties	107	131	131
Private landholders	78	83	85
Government landholders	2	5	6

The analysis indicates that the Base Case impacts a lower number of total properties and private landholders than options 1A and 1B.

A property assessment has also been carried out for the TSR section itself (i.e. excluding connections).

Table 8 identifies the number of properties and landholders intersected by the 250m assessment corridor along the 40km TSR section. Table 9 identifies the affected property area associated with private and government landholdings relating to the TSR section.

Table 8: Property and landowners intersected - TSR section only.

Criteria	TSR section
Total properties	48
Private landholders	24
Government landholders	2

Table 9: Affected property area - TSR section only.

Criteria	Affected property area (ha)	Percentage of total (%)
Private	422	40
Government	635	60
Total	**1,057**	**100**

While one of the key drivers for the suggested TSR route option was the use of Government land, analysis of the TSR section indicates that this option would still interact with a considerable amount of private land, given the varying width and spatial characteristics of the TSR. Within the 250m assessment corridor for the TSR section, around 40% of the land (area) is privately owned and 60% is government owned.

6 Assessment of environment and land use

This section of the report provides a comparative assessment of key environmental and land use constraints undertaken between the Base Case and the proposed TSR route options 1A and 1B using publicly available data, refer to Section 9.

6.1 Biodiversity

While the preferred study corridor has been designed to avoid interacting with the National Parks estate and old growth protected areas, a key consideration in planning any transmission alignment is to minimise impacts to biodiversity values. This section undertakes a comparative assessment using publicly available biodiversity data.

Table 10: Biodiversity assessment.

Criteria	Base Case	Option 1A	Option 1B
Biodiversity – preliminary constraints	1000ha of very high constraint area 214ha of high constraint area	1032ha of very high constraint area 90ha of high constraint area	902ha of very high constraint area 112ha of high constraint area
Biodiversity – threatened species records within the 250m corridor	No threatened flora records 43 threatened fauna records	2 threatened flora records 72 threatened fauna records	2 threatened flora records 72 threatened fauna records
Biodiversity – threatened species records within a 1km corridor*	No threatened flora records 234 threatened fauna records	9 threatened flora records 443 threatened fauna records Records are clustered around waterways and creek lines and State Forests and Nature Reserves Option 1A's proximity to these natural features may contribute to the higher number of records.	30 threatened flora records and 1 critically endangered 444 threatened fauna records Identified cluster of Euphrasia arguta (critically endangered flora species, refer further discussion in Section 6.1.1 below): Option 1B's proximity to suitable habitats may

Criteria	Base Case	Option 1A	Option 1B
			contribute to the higher number of records This rating could potentially be reduced with realignment of the corridor in this area to avoid direct and indirect impacts to this critically endangered species
Biodiversity private conservation agreements	No private conservation agreements within 2km of study corridor	No private conservation agreements within 2km of study corridor	No private conservation agreements within 2km of study corridor
Key fish habitat	Key fish habitat present within corridor	Key fish habitat present in Option 1A study corridor	Key fish habitat present in Option 1B study corridor

** Based on a 1km corridor along the alignment.*

TSR route options 1A and 1B have a greater number of recorded threatened flora and fauna species than the Base Case and as such, the options 1A and 1B are inferior options with regard to currently known biodiversity values.

It is noted that the availability of biodiversity data varies, and is partly based on the following factors:

- There may be increased sightings within 1km for option 1A and 1B likely due to the corridors following a publicly available road alignment, unlike the Base Case. This may result in more public recordings of threatened species.
- Option 1B is partially located within a vegetated State Forest, likely leading to more survey work and species identification previously completed in this area.
- The limited land access and public land along the Base Case is likely indicative of there being less available public data relating to threatened flora and fauna.

6.1.1 Critically endangered species: *Euphrasia arguta*

A critically endangered flora species Euphrasia arguta (E. arguta) has been recorded near the option 1B corridor. This includes records approximately 100-200m east and 600m west of the corridor. The recorded locations are shown in Figure 8.

The material issue rating has therefore been applied in Table 10 above, based on the following considerations:

- E. arguta is listed as critically endangered under both the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and NSW Biodiversity Conservation Act 2016.
- the species has a limited geographic range (noting it was previously presumed to be extinct)
- E. arguta has been recorded in close proximity (within around 120m) of the Option 1B study corridor

- it is likely that the Option 1B study corridor intercepts suitable habitat for this species
- considering its conservation status and limited distribution, an alignment change in this area is likely to be required to avoid any direct and indirect impacts to the species.

This rating could potentially be reduced with realignment of the corridor in this area to avoid direct and indirect impacts to this critically endangered species.

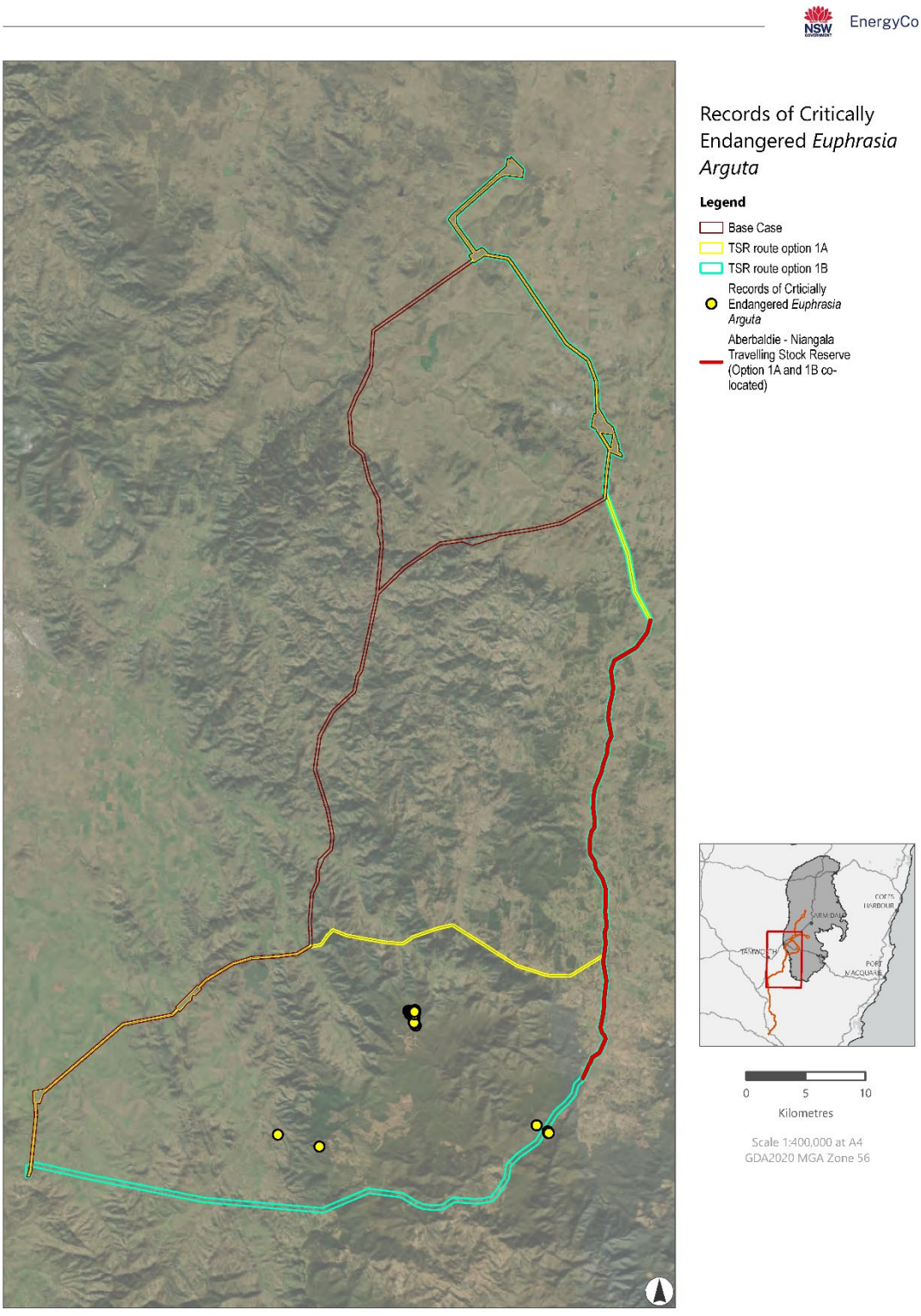

Figure 8: Records of critically endangered Euphrasia arguta.

6.2 Land use assessment

The minimisation of impacts to high value agricultural land, including BSAL, as well as the use of suitable public land, are key planning principles for the Project. This section carries out a comparative assessment of land use within and in proximity to each assessed option.

Table 11: Land use assessment.

Criteria	Base Case	Option 1A	Option 1B
National parks / protected areas / conservation areas	This route does not intersect a national park or protected area The Aberbaldie Nature Reserve is located around 5.8km south of the Base Case.	This route does not intersect a national park or protected area. The Aberbaldie Nature Reserve is located around 3.2km west of this option.	This route intersects around 600m of the edge of Tomalla Nature Reserve. The route could potentially be amended to avoid this area.
State forests intersect	0km of intersection. The Nundle State Forest is located around 7.2km southwest of the Base Case.	0km of intersection. The Terrible Billy State Forest is located around 600m south, and the Nundle State Forest is located around 5.5km south.	10km (approximately 249ha) of Nundle State Forest (public land) (approximately 7% of Option 1B route) (refer further discussion in Section 6.2.1 and Section 6.2.3 below).
Biophysical Strategic Agricultural Land (BSAL)	Approximately 35ha of BSAL.	Approximately 29ha of BSAL.	Approximately 52ha of BSAL.
Critical Industry Cluster (CIC) land	No CIC (equine / viticulture).	No CIC (equine / viticulture).	No CIC (equine / viticulture).
Crown land / Travelling stock reserves	Traverses a TSR of high conservation value where this TSR occurs along the New England Highway. The approximate impacted area is 250m x 250m.	30km of TSR which has been classed as having a high conservation value. Note: the section of route in this area has specifically targeted the use of the TSR (refer further	41km of TSR which has been classed as having a high conservation value. Note: the section of route in this area has specifically targeted the use of the TSR (refer further

Criteria	Base Case	Option 1A	Option 1B
		discussion in Section 6.2.2 and Section 6.2.3 below).	discussion in Section 6.2.2 and Section 6.2.3 below).
Land use - general	Predominantly cleared land Varying density of vegetation cover Scattered trees to large dense stands of vegetation Grazing modified pastures Cropping Grazing native vegetation Some pockets of land mapped as 'minimal use'.	Predominantly cleared land Varying density of vegetation cover Scattered trees to large dense stands of vegetation Grazing modified pastures and cropping Production from dryland agriculture and plantations Less land of natural environments used for production compared to Base Case Larger pocket of 'other minimal use' lands north of Ogunbil Intersects some plantation forest.	North of Nundle State Forest: Predominantly cleared land. Varying density of vegetation cover Scattered trees Grazing modified pastures and cropping South of Nundle State Forest: Heavy vegetation cover within and around the forest Includes part of Tomalla Nature Reserve Areas mapped as 'minimal use', native vegetation grazing, and grazing modified pastures.

** The NSW Land Use Classification is in accordance with the Australian Land Use and Management (ALUM) Classification system. There are six categories of land uses which are sub-categorized into specific land uses. The six categories are Conservation and Natural Environments, Production from Relatively Natural Environments, Production from Dryland Agriculture and Plantations, Production from Irrigated Agriculture and Plantations, Intensive Uses and Water.*

6.2.1 Nundle State Forest – forest management zones

Forestry Corporation of NSW (FCNSW) maintains and implements a Forest Management Zone (FMZ) system which is a land classification system that sets out the way State forests are managed. The FMZ system differentiates between those areas of State forests that are specifically set aside for conservation and those areas that are available for other activities including wood harvesting. The zones are:

- Zone 1 – Special protection: Management and protection zone of native forests containing very high natural and cultural conservation values (e.g. old growth forests, rainforests, etc.)
- Zone 2 – Special management: Management and protection zone of native forests containing significant natural and cultural conservation values where it is not possible or practical to include in Zone 1. (e.g., fauna corridors, areas of unique or uncommon biological values etc.)
- Zone 3A – Harvesting exclusions: Areas where harvesting is excluded but other management and production activities preclude Zone 1 or 2 (e.g. permitted activities include grazing and residency) or where there are current or imminent petroleum and mineral exploration or mining activities.
- Zone 3B – Special prescription: Areas where management and production activities such as timber / forest product and material extraction are permitted but are minimised in their design or implementation to maintain or enhance the values that the area is zoned to protect.
- Zone 4 – General management: Management area of native forests for timber production utilising the full range of silvicultural options as appropriate and designed for a range of uses but timber production has a high priority in this zone.
- Zone 5 – Hardwood plantations: Management areas of hardwood plantations for sustainable timber production on a continuing and cyclical basis.
- Zone 6 – Softwood plantations: Management areas of softwood plantations for timber production on a continuing and cyclical basis.

Nundle State Forest is approximately 13,160.5ha in size. Around 2,800ha of this (around 21% of the total area of the State Forest) is designated as Zone 2, meaning this area has specific management and protection of natural and cultural conservation values.

Option 1B intersects around 10km in length, or 249ha, of the Nundle State Forest, including the following FMZs:

- 55.9 ha of Zone 2 (special management)
- 0.7 ha of Zone 3A (harvesting exclusions)
- 99.8 ha of Zone 4 (general management)
- 3.5 ha of Zone 5 (hardwood plantations)
- 89.1 ha of Zone 6 (softwood plantations).

Around 22% of the total area of the option 1B alignment that occurs within Nundle State Forest is designated Zone 2 special management, a management and protection zone of native forests containing significant natural and cultural conservation values and in which harvesting is excluded.

The Forest Management Zones, including the special management Zone of Nundle State Forest are detailed in Figure 9.

6.2.2 TSR conservation value

The Niangala-Aberbaldie TSR is identified in NSW Government mapping as having High Conservation Value (HCV) as shown in Figure 9. The TSR Conservation Value mapping provides a statewide dataset of conservation values based on condition of native vegetation on TSRs to assist public land managers with asset management and was developed by the NSW Government under the NSW Environmental Trust. The dataset maps 70% of all TSRs managed by Local Land Services as having high conservation value, confirming the importance of the TSR network to the protection of environmental values in NSW, particularly in those regions that are highly cleared and fragmented, including the Northern Tablelands.

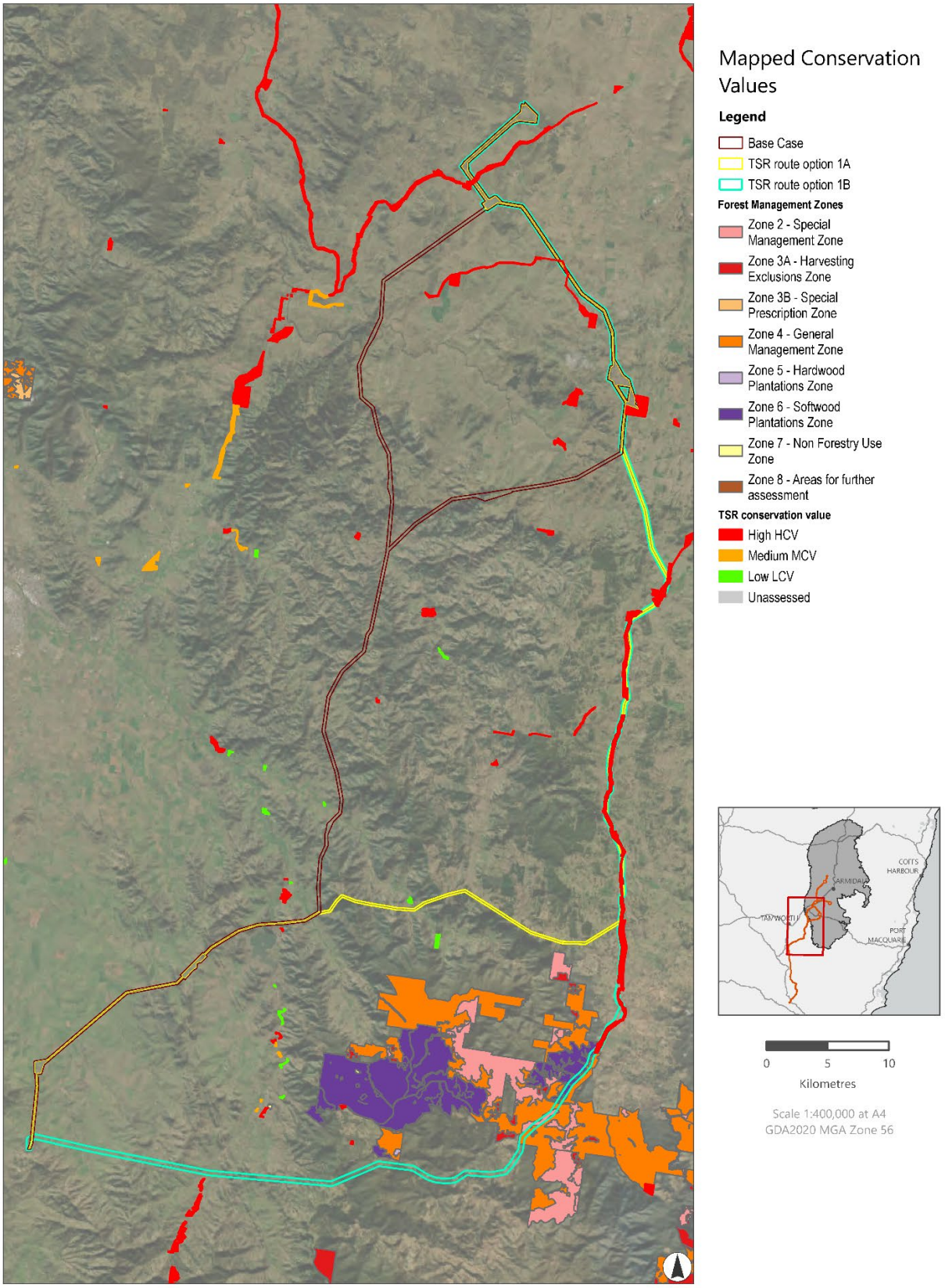

Image Source: ESRI Basemap (2024) | **Data Source:** NSW DFSI (2024), NSWSS (2024)

Figure 9: Mapped conservation values.

6.2.3 Summary of findings

The use of suitable public land and the minimisation of impacts to biodiversity values are both key planning principles for the Project.

Option 1B intersects around 10km of the Nundle State Forest (public land) and on this basis would be considered a superior rating compared to the Base Case. Both options 1A and 1B also specifically target the use of the TSR, being around 40km in length. As noted in Section 5.3, around 60% of the assessment corridor within the TSR route occurs on government owned land.

However, as noted in Section 6.1.1, Section 6.2.1 and Section 6.2.2:

- 22% of the area intersected by option 1B within the Nundle State Forest is managed for its conservation values
- there are records of Euphrasia arguta (critically endangered in NSW and Commonwealth legislation) located in proximity to the option 1B route through Nundle State Forest
- the Niangala-Aberbaldie TSR is identified in NSW Government mapping as having High Conservation Value (HCV).

While opportunities for avoidance or minimisation of the Nundle State Forest conservation values could be considered in adjustments to the Option 1B alignment, both options 1A and 1B specifically target the use of the TSR which is identified as having high conservation value.

Considering the use of suitable public land and minimisation of impacts to biodiversity values as key planning principles, and given both the positive and negative land use aspects as noted above, both options on balance are rated as not materially different compared to the Base Case in regard to land use.

6.3 Aboriginal and historical heritage

A key consideration in planning any transmission alignment is to minimise impacts to cultural heritage values. This section provides a comparative assessment using publicly available data.

Table 12: Aboriginal and heritage assessment.

Environmental criteria	Base Case	Option 1A	Option 1B
Native Title claims	No Native Title Determinations in the area. Part of the Gomeroi People Native Title Application (NC2011/006).	No Native Title Determinations in the area. Part of the Gomeroi People Native Title Application (NC2011/006). Part of the route east of Ogunbil and north to the Central South Hub are outside the Gomeroi Native Title Application Area.	No Native Title Determinations in the area. Part of the Gomeroi People Native Title Application (NC2011/006). Around 80km of the route is outside the Gomeroi Native Title Application Area.

Aboriginal places / areas	None identified.	Inglebah Aboriginal Place: Located approximately 500m east of the route.	Inglebah Aboriginal Place: Located approximately 500m east of the route.
AHIMS sites	Three AHIMS records within the corridor: 20-6-0088 (Artefact) 20-6-0089 (Artefact) 20-6-0083 (Artefact).	Three AHIMS records within the corridor: 20-6-0088 (Artefact) 20-6-0089 (Artefact) 20-6-0083 (Artefact).	Three AHIMS records within the corridor: 20-6-0088 (Artefact) 20-6-0089 (Artefact) 20-6-0083 (Artefact).
Historical heritage sites	No State or Local listed heritage items within or immediately adjacent to the corridor. Closest heritage listed item: Residence at Woolomin. Listed under the Tamworth Local Environmental Plan 2010. Located approximately 1.7km west of the alignment.	Intersects the heritage-listed 'Ogunbil Brick Shearing Shed and Silo': Noted for local significance. Heritage curtilage covers the property where the shed is located. Located approximately 900m east of the heritage listed 'Five Head Stamping Battery'.	No State or Local listed heritage items within or immediately adjacent. Located approximately 900m east of the heritage listed 'Five Head Stamping Battery'.

6.3.1 Inglebah Aboriginal Place

Inglebah Aboriginal Place located near Walcha, is a heritage site of significant cultural and historical importance to the Himberrong clan of the Anaiwan (Nganyaywana) Aboriginal tribe. Declared an Aboriginal reserve in 1893 and occupied until the 1950s, Inglebah was traditionally used for fishing, ceremonial activities, and as a secure camping spot due to its sheltered location and permanent water supply. The name 'Inglebah' means 'whirlpools of crayfish', reflecting the area's natural features. Today, it remains a site for community gatherings and cultural preservation.

Due to its cultural and historical significance, Inglebah was identified as a key constraint for the purpose of route options identification and this area was therefore avoided. The proposed TSR route is located approximately 500m east of Inglebah. As such, options 1A and 1B are considered inferior options for Aboriginal cultural heritage values.

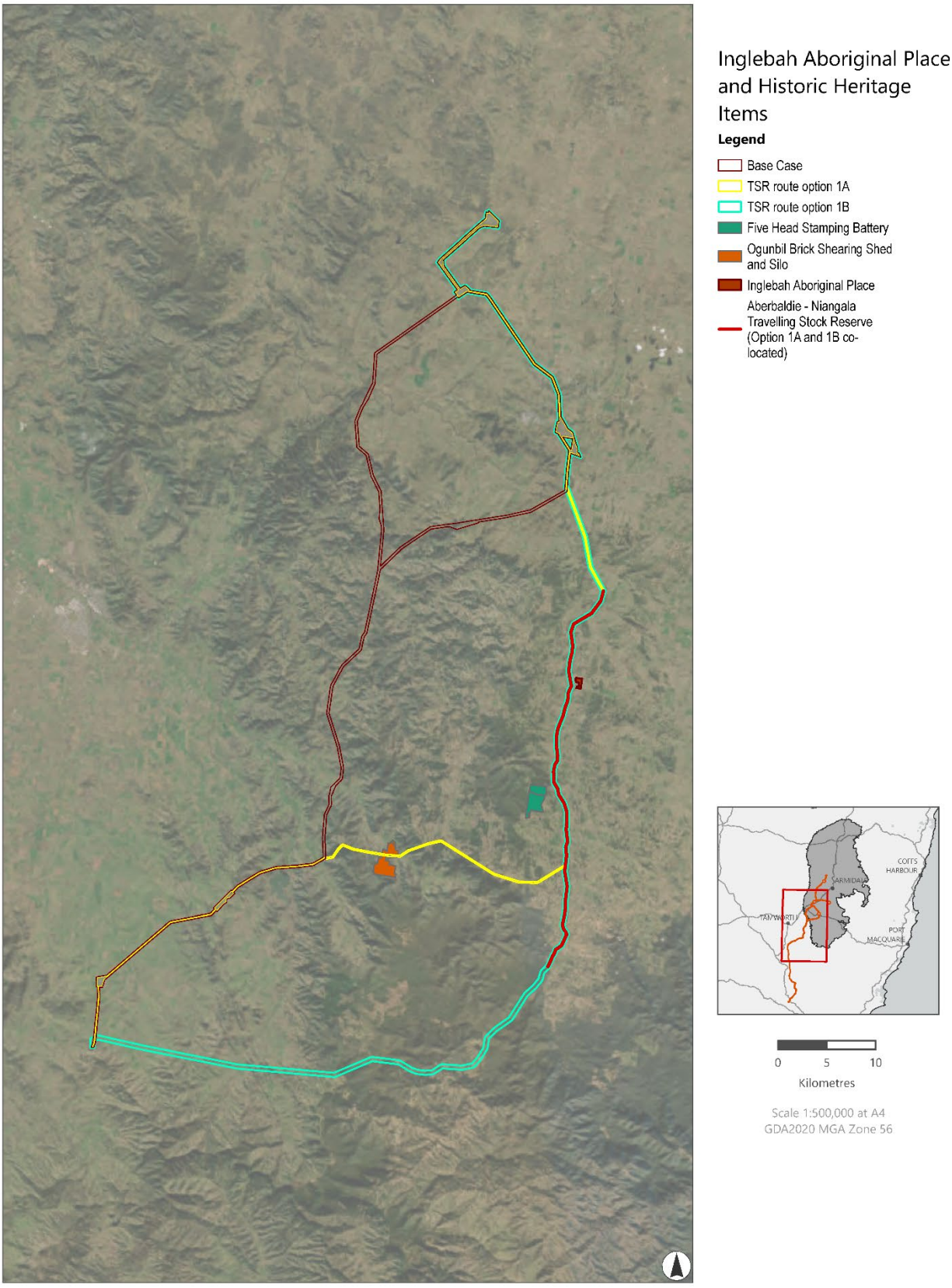

Image Source: ESRI Basemap (2024) | **Data Source:** NSW DFSI (2024), NSWSS (2024)

Figure 10: Inglabah Aboriginal Place and historic heritage items.

6.4 Bushfire resilience

A composite bushfire risk factor rating, based on slope, vegetation, north-westerly exposure and access, was used to characterise bushfire risk to the transmission infrastructure generally along each option. This composite rating does not include landscape bushfire risk, which refers to fires burning in rugged country to the north-west of each option and burning at high intensity towards the route.

Table 13: Bushfire resilience assessment.

Criteria	Base Case	Option 1A	Option 1B
Bushfire risk factor	Level 2 – 4.94km (5.3%) Level 3 – 33.05km (35.3%) Level 4 – 40.66km (43.4%) Level 5 – 15.04km (16.1%)	Level 2 – 14.36km (13.1%) Level 3 – 54.91km (50.1%) Level 4 – 32.34km (29.5%) Level 5 – 7.90km (7.2%)	Level 2 – 11.59km (10.2%) Level 3 – 48.70km (42.9%) Level 4 – 41.35km (36.5%) Level 5 – 11.76km (10.4%)
Elevated risk percentage (Level 4 and 5)	59.5%	36.7%	46.8%

Of the three options, the Base Case has a higher proportion of its extent located in the highest composite bushfire risk (Level 4 and 5) – 60% compared to 47% for Option 1B and 37% for option 1A.

However, both options 1A and 1B carry considerable sections of elevated bushfire risk associated with connecting the preferred study corridor to the TSR, exposures to north-west facing steep slopes, inaccessibility and the landscape risk exposure to large fires burning towards the route under adverse conditions (particularly at the southern end of option 1B). These higher risk sections are outlined below.

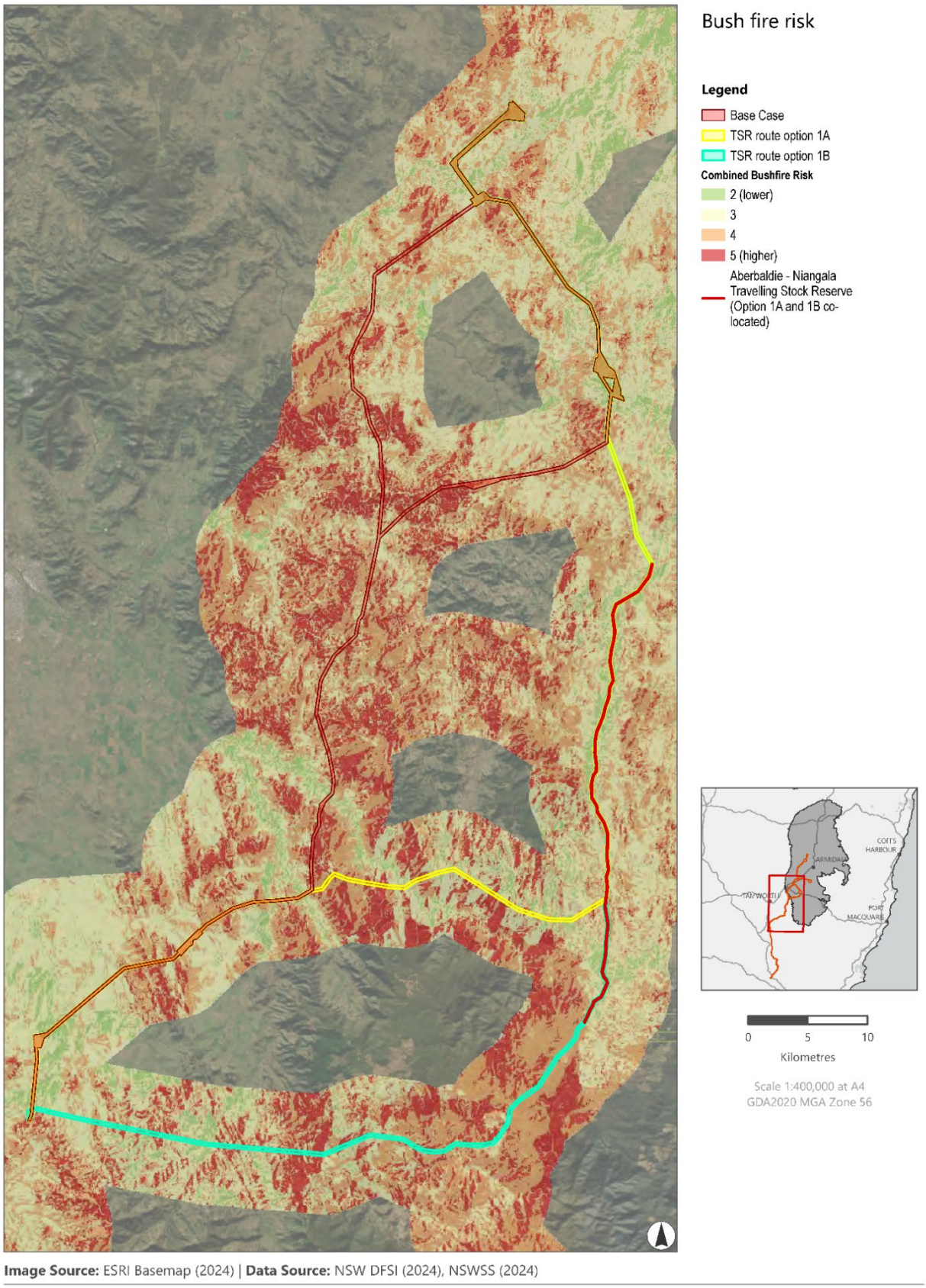

Figure 11: Bushfire risk map.

Base Case

- From the Woolomin Station intersection with the preferred study corridor heading north, the route enters rugged and steep topography for approximately 8km to Dungowan Creek and then again for an additional 45km to the Oxley Highway.
- The section of the line co-located with the Transgrid transmission line also has an elevated bushfire risk, but this as result of the land around not being cleared rather than an impact of topography.
- The remainder of the corridor is medium risk with smaller sections at lower risk.

Option 1A

Summary of key bushfire risk sections of the route:

- From the Woolomin Station intersection with the preferred study corridor eastward, the route enters rugged and steep topography with uphill fire runs towards the transmission line for around 20km, with a slight break at Dungowan Creek.
- Continuing eastward towards the TSR intersection, the exposure to steep slopes and forested vegetation reduces, as does the risk factor, although there is a section of undulating landscape with higher risk.
- The section along the TSR has a higher risk profile compared to the immediate surrounds due to the exposure to forest vegetation (grading into woodland then forest vegetation in the north), however it is likely that much of this vegetation would need to be cleared to enable construction of the transmission lines.
- There is a slight reduction in risk within the Macdonald River Valley to Brick Wall Creek before the route re-enters undulating country with pockets of forest and woodland vegetation which can support high intensity bushfires.

Option 1B

Summary of key bushfire risk sections of the route:

- Benama Creek to Peel River: Fire control would be more difficult due to potential undulating uphill fire runs.
- Peel River to Yellow Rock Hill: There are a series of north-west facing ridge lines which may be prone to high intensity fire runs in a more heavily vegetated area.
- Nundle Creek Road to Great Divide/Morisons Gap: Includes westerly facing uphill fire runs in forested vegetation and reduced access. This creates significant potential for high intensity fires burning towards the line.
- From Morrisons Gap/Great Divide extending east: The bushfire risk significantly increases with potential for high intensity fires building up to the northwest (over many days) and burning towards the alignment. The elevated risk exposure continues to the east of Terrible Billy State Forest.

7 Assessment of efficiency and deliverability

This section of the report provides a comparative analysis of technical and constructability elements between the Base Case and the proposed TSR route options 1A and 1B.

7.1 Technical

This comparative assessment compares the line between the assessment points as outlined in Section 4.

Table 14: Technical options assessment.

Criteria	Base Case		Option 1A		Option 1B	
	Assessment point to Central Hub (Stage 1)	Assessment point to Central South Hub (Stage 2)	Assessment point to Central Hub (Stage 1)	Assessment point to Central South Hub (Stage 2)	Assessment point to Central Hub (Stage 1)	Assessment point to Central South Hub (Stage 2)
Transmission line length	110km	94km	137km	109km	141km	113km
Total length of 500kV line	204km		246km		254km	
Change in line length	0km	0km	+27km	+15km	+31km	+19km
Co-location with existing transmission lines	17.3km	6.6km	6.6km	6.6km	0km	0km
Average slope	7.8%, -6.5%	8.0%, -7.6%	5.6%, -4.6%	6.5%, -5.4%	5.1%, -4.2%	5.7%, -5.0%
% Route in slope > 30%	20.6% (22.7km)	25% (23.5km)	9.5% (13.0km)	11.8% (12.9km)	7.4% (10.4km)	9.0% (10.3km)
Number of Line angle deviations (5-40°)	39	33	55	50	65	60

Number of Line angle deviations (>40°)	7	5	10	7	10	7

The assessment indicates that options 1A and 1B result in at least a 20% increase in transmission line length. The Base Case option also provides greater co-location with existing transmission lines.

While Options 1A and 1B provide less direct routes to the energy hubs compared to the Base Case, they do offer improved average slope across the alignment with reductions of 10-13km of the transmission line in very steep slopes (>30%). However, being a less direct route would introduce significant increases in line angle deviations in the transmission line (at least 30%). These deviations have direct implications to constructability as considered in Section 7.2.

7.2 Constructability and accessibility

This comparative assessment compares the line between the assessment points as outlined in Section 4.

Table 15: Constructability options assessment.

Criteria	Base Case	Option 1A	Option 1B
Length of line that vegetation clearance is required (km)	32km	54km	69km
Accommodation camps required	2	3	3
Terrain degree of difficulty	Similar to Option 1A	Similar to Base Case	Marginally more difficult
Emergency services: (ambulance)	More direct access to Tamworth than Options 1A and 1B	Requires Walcha ambulance service	Requires Walcha ambulance service and quite remote from Tamworth
New access tracks*	246km	153km	121km
Private roads required*	54km	59km	55km
Stringing sites	31	41	37
Construction difficulty (kms of route)	High: 75km Moderate: 47km Low: 82km	High: 27km Moderate: 57km Low: 162km	High: 48km Moderate: 41km Low: 165km

**Estimate only (no tower spotting carried out). Private roads are sourced via the road segment database that are classified as roads with no name. The length of road to be upgraded is desktop based and requires ground truthing to verify the condition of the private roads. Named roads are not included in this estimate.*

An additional camp would be required for options 1A and 1B to facilitate the construction of the additional line length due to crew travel time considerations. The line route locations are also more remote requiring emergency services support from Walcha.

There would be additional stringing sites required for options 1A and 1B compared to the Base Case, due to the additional number of towers due to longer line lengths (22km and 37km respectively) as well as more tension towers required for these routes.

The length of new access tracks required in the Base Case is greater than options 1A and 1B due to the location of the infrastructure in relation to public roads. However, options 1A and 1B would require more localised upgrades of the public roads than the Base Case to manage the construction traffic.

The Base Case and option 1A routes north and east of Woolomin both pass through difficult topography. The length of Option 1A in difficult terrain is lower than the Base Case, but the difficulty in delivery overall for option 1A is greater due to more stringing sites and tension towers, as well as more vegetation clearing.

Option 1B has lower amounts of difficult terrain than the Base Case, however access to option 1B is primarily on unsealed roads or fire trails, especially in the Nundle State Forest. These tracks limit the types of vehicles which can utilise them for access, presenting a greater degree of construction difficulty associated with accessibility than option 1A.

Overall, the Base Case is considered superior to options 1A and 1B in terms of constructability and accessibility, given the lower overall line lengths and vegetation clearing, less accommodation camps needed, fewer stringing sites and tension towers, and better access to emergency services.

7.3 Terrain mapping

Construction on steep gradients adds extra complexity to the construction of the transmission infrastructure. Figure 12 and Figure 13 show the terrain where the slope gradient is 30% or more. This can be seen on the approach to the New England Tablelands plateau.

As indicated in Section 7.1, options 1A and 1B both include a longer transmission line length than the Base Case. While the TSR itself is not on difficult terrain, additional difficult terrain is required to be traversed to connect to the TSR route.

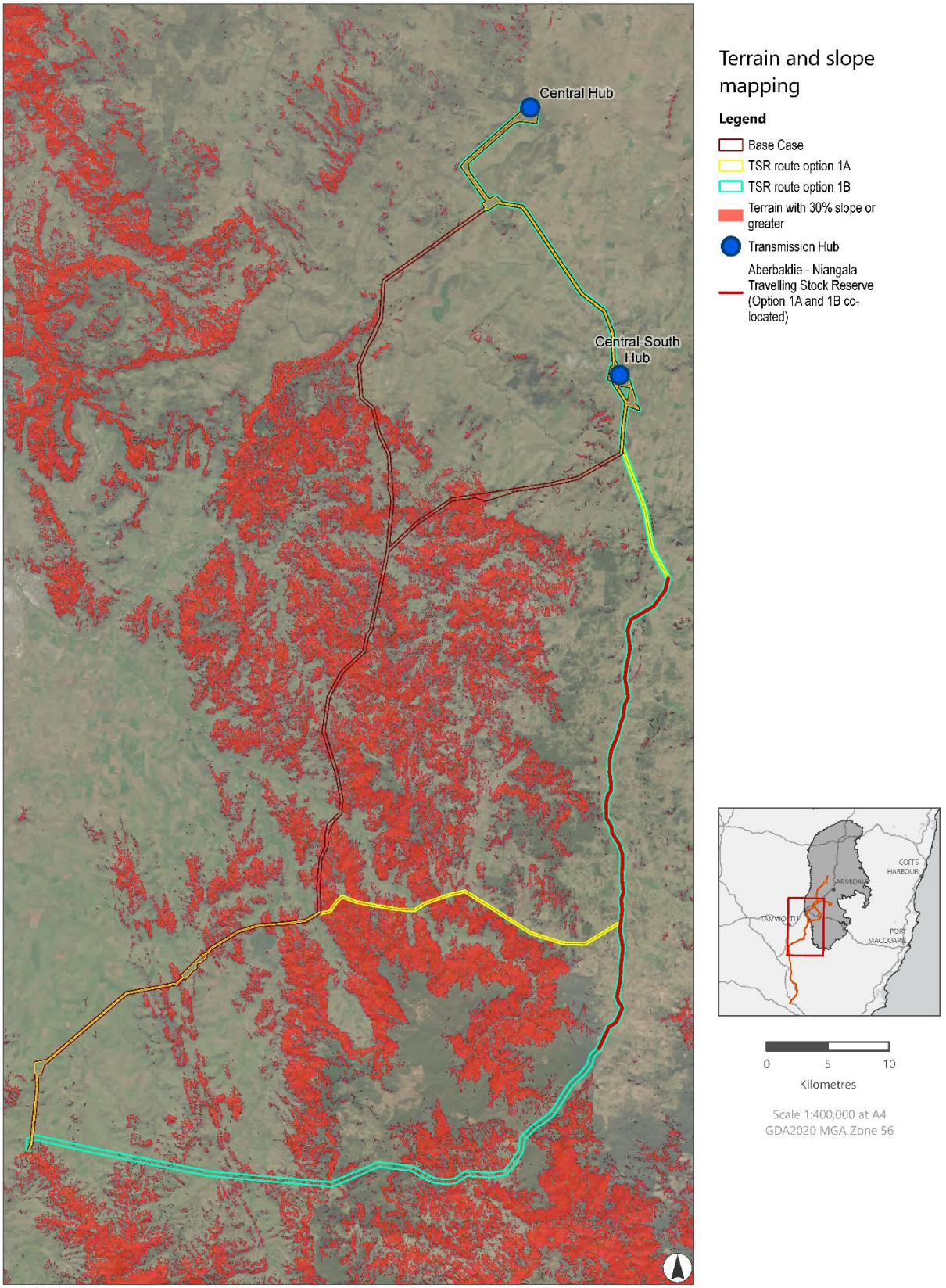

Image Source: ESRI Basemap (2024) | **Data Source:** NSW DFSI (2024), NSWSS (2024)

Figure 12: Terrain and slope mapping.

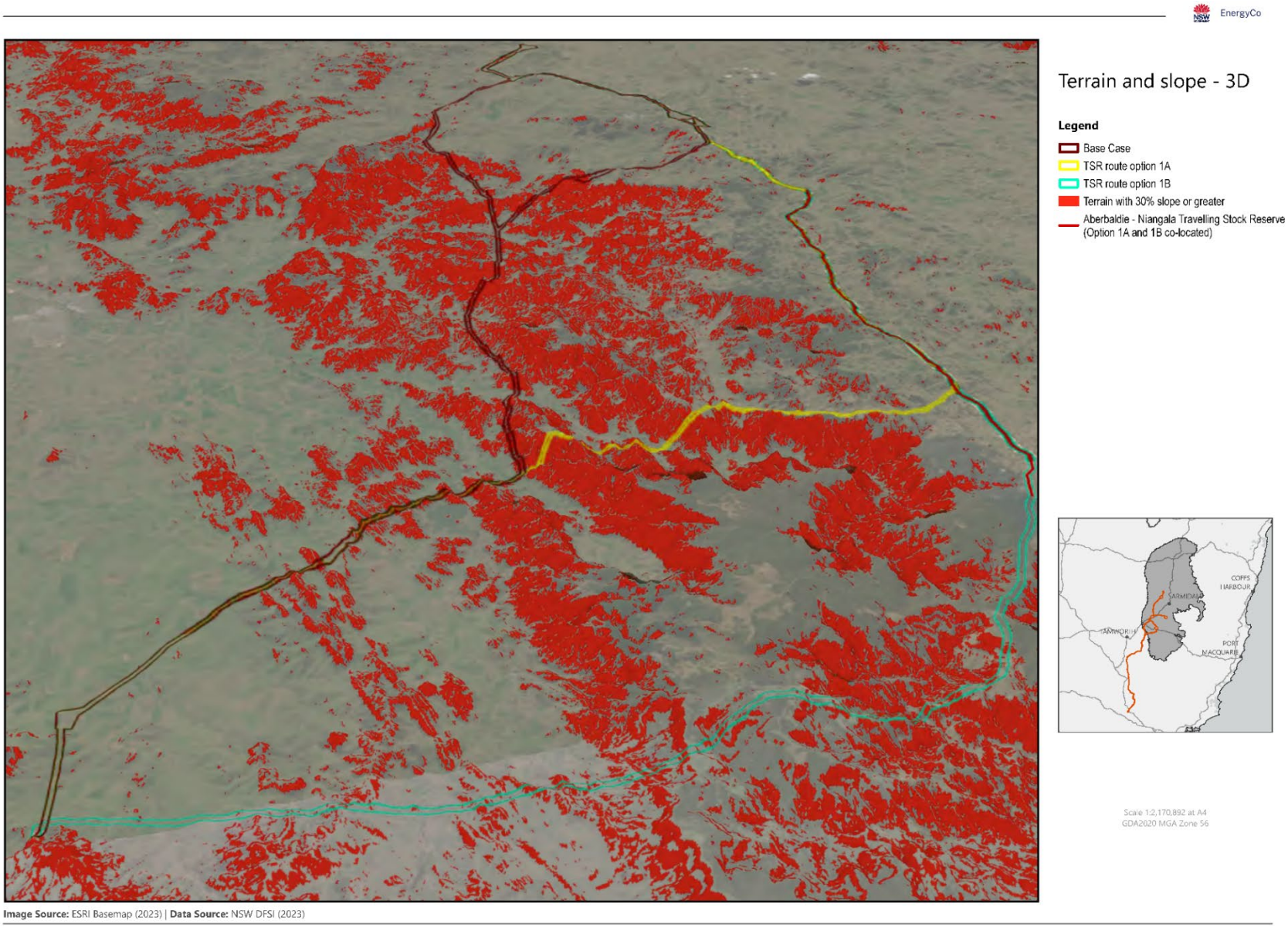

Figure 13: Terrain and slope - 3D.

7.4 Construction time

The time assessment considers the estimated construction times for options 1A and 1B relative to the Base Case. Using the pro rata construction rate of 2 weeks/km for the basis of comparison, the following estimate of time impacts was developed.

Table 16: Timeframe options assessment.

Criteria	Base Case	Option 1A	Option 1B
Construction time	No change	Stage 1 - 30 weeks extra Stage 2 - 54 weeks extra	Stage 1 - 38 weeks extra Stage 2 - 62 weeks extra

Based on the considerable additional transmission line length, both options 1A and 1B are expected to require longer to construct than the Base Case. Each of these delays is significant, but the delays to Stage 1 would mean that the transmission of power from the REZ to the NEM would be delayed. Such a delay could require the continuation of energy production from sources currently scheduled for closure.

7.5 Construction cost

The cost assessment considers the estimated construction costs for options 1A and 1B relative to the Base Case. The cost assessment is high level and considered a pro-rata rate based on cost per line length. This provides a basis of comparison between options. However, noting the costs exclude overhead, risk, contingency and escalation, absolute figures have not been prepared. Note the cost comparison is for the section between the assessment endpoints (refer Figure 5).

Table 17: Cost options assessment.

Criteria	Base Case	Option 1A	Option 1B
Change in construction cost* (excluding roads)	No change	Increase by approximately 20% over base case	Increase by approximately 25% over base case
Change in biodiversity and property acquisition cost estimate**	No change	Increase by approximately 20% over base case	Increase by approximately 25% over base case
Total cost estimate	No change	Increase by approximately 20% over base case	Increase by approximately 25% over base case

Based on the considerable additional transmission line length, both options 1A and 1B are expected to result in higher costs to construct than the Base Case.

7.6 Generator consideration

Co-location and interactions with existing and proposed energy projects is a key consideration when designing transmission infrastructure.

The Base Case, option 1A and option 1B are all located in the vicinity of a range of proposed or potential renewable energy projects in the region. In the northern part of these routes the nearby projects include Thunderbolt wind farm, Ruby Hills wind farm and the Woolbrook project. The Base Case is also located in proximity to the Bendemeer wind farm. Options 1A and 1B are located in proximity to the Dungowan pumped hydro project, and option 1B is also located in proximity to the Hills of Gold wind farm project.

The status of these renewable energy projects is variable, with the Woolbrook, Ruby Hills, Bendemeer and Dungowan projects in concept stage (pre-scoping), the Hills of Gold project in the assessment stage (recommended for approval), and the Thunderbolt project is approved.

These energy projects are not expected to significantly constrain any of the transmission route options, and all route options would provide some potential for co-location of infrastructure. These interactions would need to be considered during detailed design of the respective projects. None of the transmission route options are considered to be significantly inferior or superior relative to other options in relation to generator connections.

8 Summary and conclusion

8.1 Key findings of the comparative assessment

The comparative assessment between the Base Case and TSR route options 1A and 1B is summarised in the following table:

Table 18: Summary of comparative assessment of preferred study corridor against TSR route options.

Key
Option would result in a better outcome, relative to other options
Option would result in a worse outcome, relative to other options

Foundational principle	Planning pillar	Base Case	TSR route option 1A	TSR route option 1B
People and communities	People	Reduced impact to rural dwellings and total number of landholdings compared to Options 1A and 1B.	Greater impact to rural dwellings and total number of private landholdings compared to the Base Case.	Greatest impact to rural dwellings and total number of private landholdings compared to the Base Case and Option 1A.
		Least number of private landholders compared to Options 1A and 1B.	Greater number of private landholders compared to the Base Case.	Greatest number of private landholders compared to the Base Case and Option 1A.
		Least number of government landholders compared in Options 1A and 1B.	Greater number of government landholders compared to the Base Case.	Greater number of government landholders compared to the Base Case.

Foundational principle	Planning pillar	Base Case	TSR route option 1A	TSR route option 1B
Environment and land use	Environment	Does not intersect a national park or protected area. No impact to high conservation value TSR. Least number of recorded threatened flora and fauna compared to Options 1A and 1B. Intersects the least area of Biophysical Strategic Agricultural Land (BSAL) compared to Options 1A and 1B.	Does not intersect a national park or protected area, however impacts high conservation value TSR. Greater number of recorded threatened flora and fauna species compared to the Base Case. Intersects a greater area of BSAL compared to the Base Case.	Intersects around 600m of the edge of Tomalla Nature Reserve, however could be realigned to avoid. Impacts high conservation value TSR. In proximity to critically endangered flora species, however could be realigned for avoidance. Greatest number of recorded threatened flora and fauna species compared to the Base Case and Option 1A.
		A higher proportion of the Base Case extent is located in the highest composite bush fire risk (Level 4 and 5) compared to Options 1A and 1B.	Lowest composite bush fire risk compared to the Base Case and Option 1B.	Lower composite bush fire risk compared to the Base Case.
Efficiency and deliverability	Economic	Overall lowest construction cost.	Increase in construction cost by approximately 20% over the Base Case.	Increase in construction cost by approximately 25% over the Base Case and is the highest estimated cost.

Foundational principle	Planning pillar	Base Case	TSR route option 1A	TSR route option 1B
	Strategy	Highest amount of co-location with existing transmission lines (23.9km) Lowest construction time	Reduced amount of co-location with existing transmission lines (13.2km) Increased construction time compared to the Base Case.	No co-location with existing transmission lines (0km) Greatest construction time compared to the Base Case and Option 1A
	Technical	Shortest overall line length at 204km and a significantly lower amount of line angle deviations overall.	Increased line length over Base Case with at least 20% increase at +42km. Significant increase in line deviations.	Increased line length over Base Case with at least 20% at +50km. Significant increase in line deviations.
		Largest % of the route in slope >30%.	Improved average slope and reduction in % of route in >30% slope.	Improved average slope and reduction in % of route in >30% slope.
		Requires the most new access roads.	Requires substantially less access roads compare to the Base Case as the TSR can be utilised.	Requires the least amount of access roads compared to other options.
		This option results in the least required amount of vegetation clearance.	Increased vegetation clearing, increased accommodation camps and the most stringing sites compared to Base Case and Option 1B.	Greatest vegetation clearing, increased accommodation camps and a greater number of stringing sites compared to the Base Case.

8.2 Conclusion

EnergyCo has assessed the options against all its planning pillars.

The comparative assessment found that the TSR route options 1A and 1B would provide a better outcome compared to the Base Case on some criteria, including lower average slopes, access to existing roads for construction, increased use of public land and bushfire resilience in the TSR section.

However, the TSR options would provide an inferior outcome on other criteria, including proximity to dwellings, number of private landholdings affected, interactions with land with high environmental and BSAL values, and construction time and costs.

In particular, the analysis indicates that the TSR route options would affect a considerably greater number of dwellings than the preferred study corridor, with many of these dwellings located along, and in close proximity to, the TSR itself.

The TSR route options would also affect a larger number private landholdings, partly due to the varying width and nature of the TSR.

A key benefit of the change from the preliminary study corridor to the revised study corridor was the reduction in number of impacted landholders by around 80 landholders. Adopting any of the TSR route options would materially increase the impact on private landholders, with around 18-25 additional landholders affected by Options 1A and 1B respectively compared to the Base Case 1km-wide assessment corridor, notwithstanding the TSR route option increasing the use of government land. The assessment found that any option that used the TSR would interact with a considerable number of dwellings in close proximity to the network infrastructure. On this basis, EnergyCo considers that any TSR route option (including options 1A, 1B, 1C and 1D) would present significant constraints.

EnergyCo has assessed the TSR route against the foundational principles in the NSW Government's Draft Transmission Guidelines and EnergyCo's planning pillars.

In summary, with consideration to people and communities, environmental and land use, and efficiency and deliverability criteria, the assessment identified that the Base Case (i.e. preferred study corridor) would, on balance, result in a better outcome compared to the TSR route options.

9 Data sources and limitations

The following datasets were applied in this assessment:

Dwellings: A combination of publicly available datasets were reviewed against the most recent available aerial imagery to provide a dwelling dataset (not verified by field investigations, apart from site inspection from the public domain), for houses within 250m, 500m, 1km and 2km from the edge of the 250m assessment corridor of the TSR route Options 1A and 1B and the preferred study corridor.

Building points: A subset of data was extracted from The NSW General Cultural Area Dataset - Built up area which is a publicly available dataset showing general cultural feature types and found online at NSW General Cultural Area Dataset.

Biophysical strategic agricultural land / Critical industry clusters (equine / viticulture): Sourced from NSW SEED at NSW Sharing and Enabling Environmental Data (SEED),

Conservation Value of Travelling Stock Routes: Sourced from NSW SEED at Conservation value of NSW Travelling Stock Reserves (TSRs) | Dataset | SEED.

National Parks and Protected Areas (including Nature Reserves, Regional Parks, State Conservation Areas, Aboriginal Areas, Historic Sites and Karst Conservation Reserves): Sourced from NSW SEED at NSW National Parks and Wildlife Service (NPWS) Estate | Dataset | SEED.

Land use – general: Sourced from NSW SEED at NSW Landuse 2017 | Dataset | SEED.

State Forests: The boundary dataset comes from the NSW SEED data portal located at State Forest | Dataset | SEED (nsw.gov.au)). The NSW State forest zones dataset was sourced at Forest Management Zones | Dataset | SEED (nsw.gov.au).

Biodiversity - preliminary biodiversity constraints (within the 250m corridor): Biodiversity datasets were sourced from multiple publicly available datasets categorised into five constraint levels for constraints identification purposes only:

- Very Low: Areas that align with Category 1 Lands (i.e. historically cleared land).
- Low: Areas that are mapped as unclassified that are not Category 1 Lands (i.e. has no identified Plant Community Type (PCT)).
- Medium: Any PCT that does not have any associations to a Threatened Ecological Community (TEC) under the NSW Biodiversity Conservation Act 2016 (BC Act) or EPBC Acts.
- High: Any PCT that does have an association to a TEC under the BC or EPBC Acts.
- Very High: PCTs that have an associated Critically Endangered Ecological Community (CEEC) under the BC Act.

The following caveats apply to this dataset:

- It is entirely based on the State Vegetation Type Mapping (SVTM).

- The Category 1 mapping used to define the very low constraint layer is based on a layer developed by the Project and not the Transitional Native Vegetation Regulatory Map.
- The dataset has been developed and used for the purposes of a very high level constraint analysis and further detailed assessment is required to confirm actual biodiversity constraints and values.

Biodiversity – threatened species records: Data sourced online at BioNet Species Sightings data | NSW Environment and Heritage .

Private biodiversity conservation areas: Dataset sourced by EnergyCo from the NSW Biodiversity Conservation Trust (BCT).

Key fish habitat: Data gathered from the Fisheries and Spatial Data portal at Fisheries Spatial Data Portal (nsw.gov.au) .

Aboriginal heritage: Data gathered from searches on the Aboriginal Heritage Information Management System (AHIMS) carried out on 28 March 2024 and 27 May 2024 at AHIMS.

Native Title claims (Aboriginal heritage): National Native Title Tribunal data sourced online at Data downloads (nntt.gov.au).

Historical heritage: Commonwealth, State and Local heritage item datasets gathered online at Dataset | SEED (nsw.gov.au).

Roads data: Private roads are sourced via the road segment database that are classified as roads with no name. The length of road to be upgraded is desktop based and requires ground truthing to verify the condition of the private roads. Named roads are not included in this estimate.

Terrain Mapping: The terrain modelling used Steep Land Dataset from the SEED Portal at Steep Land | Dataset | SEED (nsw.gov.au).

NSW Planning Portal Spatial Viewer: Property details and planning controls derived from the property report on the NSW Planning Portal Spatial Viewer.

NSW Land Registry Services: Property ID, property area and land use restrictions gathered from Land Registry Services Online.

CoreLogic RP Data: Used to obtain further property and landownership details online at CoreLogic.

Dye & Durham: Used to obtain further property and landownership online at Dye & Durham.

Limitations

The data used for this assessment is based on publicly available information and provides a high-level understanding of the study area only. The data used has not been verified by field investigations apart from site inspection from publicly accessible areas and should only be used for an indicative comparison between the route options.