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Managing risk on Line 963

RIT-T Project Assessment Conclusions Report

Issue date: 6 December 2024

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Executive summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for mitigating environmental, safety and financial (reactive maintenance) risks caused by the widespread condition issues on various line components of the 132 kV transmission line running between Tomago and Taree ('Line 963'). Publication of this Project Assessment Conclusions Report (PACR) represents the final step in the RIT-T process and follows the Project Specification Consultation Report (PSCR) published in February 2024.

Line 963 is a 132 kV transmission line between Tomago and Taree that was commissioned in 1992. Transgrid owns the line north of the Karuah River (Structure 185 onwards) to Taree, while Ausgrid owns the line to the south (including the river crossing) to Tomago.

The Transgrid section of the line has a route length of approximately 109 km and consists of 334 structures; 288 of those structures each contain multiple wood poles. This RIT-T will address condition issues affecting the structures, including non-pole related issues such as insulators, fittings and signage.

Line 963 was impacted by the Hillville Fire in November 2019. The fire impacted a total of 42 Transgrid structures between Structures 435 and 475 (35 of them wood pole structures) over a route length of 13.7 km. The line was restored to a serviceable condition following the fires to meet network needs in the mid-north coast of NSW.

Subsequent inspections of the sections impacted by the fire have identified eight structures as burnt and charred (Structures 445, 446, 449, 451, 452, 457, 460, 462). In addition, the conductor (particularly in the vicinity of Structure 446) has also had significant heat stress during the bushfire event, which can cause aluminium to anneal and lose mechanical strength. Further, the heat caused the conductor to lose some of its grease, which is expected to result in subsequent corrosion issues if not addressed.

In addition to the wood poles that are burnt and charred, detailed analysis of asset condition information has identified that various other non-bushfire-related condition issues impact 102 of the 334 structures across multiple line components, including earthwire.

Identified need: managing risks on Line 963

If action is not taken, the condition of Line 963 will expose us and our customers to increasing levels of risk going forward, as deterioration increases the likelihood of failure.

Specifically, under the 'do nothing' base case, incidents such as conductor drop and tower collapse could occur. Such incidents could have considerable environmental risks through potential bushfires and could have considerable safety consequences for nearby residents and members of the public, as well as our field crew who may be working on or near the assets. These incidents also have financial risks associated with reactive maintenance that may be required under emergency conditions.

The proposed investment will enable us to manage environmental, safety and financial risks on Line 963.

Options considered under this RIT-T have been assessed relative to a base case. Under the base case, no proactive capital investment is made and the condition of the lines will continue to deteriorate.

We manage and mitigate environmental and safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with our obligations under the *New South Wales*

Electricity Supply (Safety and Network Management) Regulation 2014 and our Electricity Network Safety Management System (ENSMS).[1]

The proposed investment will enable us to continue to manage and operate this part of the network to a safety and risk mitigation level of ALARP, consistent with our obligations. Consequently, we consider this to be a reliability corrective action under the RIT-T. A reliability corrective action differs from a 'market benefits'-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation on the network business.

Two credible options have been considered

We consider that there are two feasible options from a technical, commercial, and project delivery perspective that can be implemented in sufficient time to meet the identified need. Specifically:

- Option 1 involves replacement of all wood pole structures that have identified deterioration with steel or concrete poles, including the bushfire impacted wood poles. Option 1 would address all the identified condition issues on the line with the exception of the bushfire impacted conductor and earthwire.
- Option 2 is the same as Option 1, except that it also replaces the bushfire impacted conductor and 28 km of earthwire.

The capital expenditure (capex) of these options is summarised in Table E-1 below. The cost of both options has increased since the PSCR (by $1.7 million and $3.2 million, respectively) on account of the scope of the structural works expected to be required increasing based on further analysis.

Table E-1 Summary of the capex for the credible options

Option	Description of works	Capital expenditure
Option 1	Replace 24 wood pole structures, plus additional defects on the line	$9.5 million
Option 2	Replace 24 wood pole structures, the conductor between Structure 442 to 463 and 28km of earthwire plus additional defects on the line	$12.2 million

Neither option will affect annual routine operating costs since they do not affect the frequency of inspections.

No submissions were received in response to the PSCR and there have been no material developments

We published a PSCR on 14 February 2024 and invited written submissions on the material presented within the document. No submissions were received in response to the PSCR.

In addition, no additional credible options were identified during the consultation period following publication of the PSCR. No other material changes have occurred since the PSCR that have made an impact on the preferred option.

[1] Our ENSMS follows the International Organization for Standardization's ISO31000 risk management framework which requires following a hierarchy of hazard mitigation approach.

No submissions were received in relation to non-network options

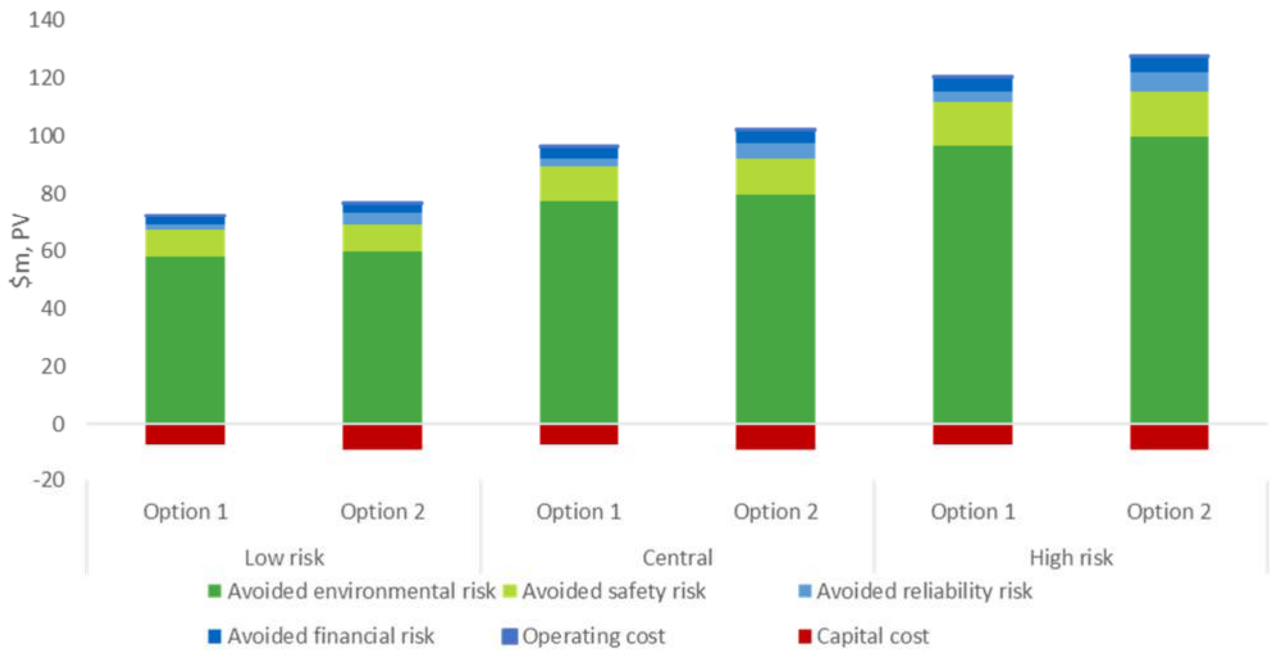
In the PSCR we noted that we do not consider non-network options to be commercially or technically feasible to assist with meeting the identified need for this RIT-T, as non-network options will not mitigate the environmental, safety and financial risks posed as a result of asset deterioration.

No submissions were received in response to the PSCR in relation to non-network options.

Option 2 is the preferred option for this RIT-T

Option 2 is found to have the greatest net economic benefits of the two options assessed, in each scenario as well as on a weighted basis. On a weighted basis, Option 2 is found to deliver approximately $92.4 million in net benefits.

Figure 1-1 Net economic benefits ($m, PV)



The finding that Option 2 is the top-ranked option is also found to be robust to a range of sensitivty and boundary tests.

This PACR therefore finds that Option 2 is the preferred option at this final stage of the RIT-T. Option 2 was also found to be the preferred option in the PSCR.

Option 2 involves the remediation of all identified condition issues on the line, including the replacement of the conductor between Structure 442 to 463 with an equivalent conductor (and replacement of all conductor components and hardware). The scope of work includes the replacement of 24 wood poles, 6 km of conductor and 28 km of earthwire.

The works are estimated to take place between 2024/25 and 2025/26.

Next steps

This PACR represents the final step of the consultation process in relation to the application of the RIT-T process undertaken by Transgrid.

Parties wishing to raise a dispute notice with the AER may do so prior to 17 January 2025 (30 days after publication of this PACR). Any dispute notices raised during this period will be addressed by the AER within 40 to 100 days, after which the formal RIT-T process will conclude.

Further details on the RIT-T can be obtained from Transgrid's Regulation team via regulatory.consultation@transgrid.com.au.. In the subject field, please reference 'Line 963 PACR'.

Contents

1. Introduction

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for mitigating environmental, safety and financial (reactive maintenance) risks caused by the widespread condition issues on various line components of the 132 kV transmission line running between Tomago and Taree ('Line 963'). Publication of this Project Assessment Conclusion Report (PACR) represents the final step in the RIT-T process and follows the Project Specification Consultation Report (PSCR) published in February 2024.

We manage and mitigate environmental and safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with our obligations under the *New South Wales Electricity Supply (Safety and Network Management) Regulation 2014* and our Electricity Network Safety Management System (ENSMS).

This RIT-T therefore examines options for addressing the asset condition issues so that network safety continues to meet a risk mitigation level of ALARP, consistent with our obligations. Consequently, we consider this to be a reliability corrective action under the RIT-T.

1.1. Purpose of this report

The purpose of this PACR[2] is to:

- set out the reasons why we propose that action be undertaken (the 'identified need');
- present the options that we consider address the identified need;
- present the economic assessment of all credible options, as well as the assumptions feeding into the analysis; and
- provide details of the ultimately proposed preferred option to meet the identified need.

Overall, this report provides transparency into the planning considerations for investment options to ensure continuing reliable supply to our customers. A key purpose of the RIT-T process, is to provide interested stakeholders the opportunity to review the analysis and assumptions, provide input to the process, and have certainty and confidence that the preferred option has been robustly identified as optimal.

1.2. No submissions were received in response to the PSCR and there have been no material developments

We published a PSCR on 14 February 2024 and invited written submissions on the material presented within the document. No submissions were received in response to the PSCR.

In addition, no additional credible options were identified during the consultation period following publication of the PSCR. No other material changes have occurred since the PSCR that have made an impact on the preferred option.

1.3. Next steps

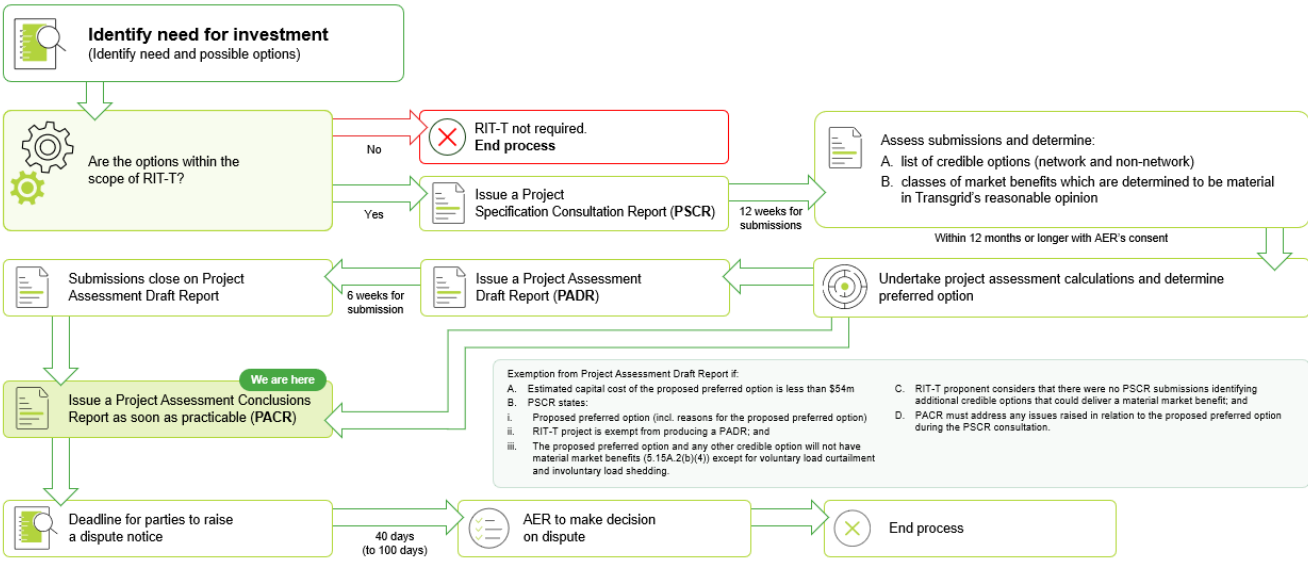
This PACR represents the final step of the consultation process in relation to the application of the RIT-T process undertaken by Transgrid.

[2] See Appendix A for the National Electricity Rules requirements.

Parties wishing to raise a dispute notice with the AER may do so prior to 17 January 2025 (30 days after publication of this PACR). Any dispute notices raised during this period will be addressed by the AER within 40 to 100 days, after which the formal RIT-T process will conclude.

Further details on the RIT-T can be obtained from Transgrid's Regulation team via regulatory.consultation@transgrid.com.au. In the subject field, please reference 'Line 963 PACR'.

Figure 1-1 This PACR is the final stage of the RIT-T process



2. The identified need

This section outlines the identified need for this RIT-T, as well as the assumptions and data underpinning it. It first sets out background information related to Line 963.

2.1. Background to the identified need

Line 963 is a 132 kV transmission line between Tomago and Taree that was commissioned in 1992. Transgrid owns the line north of the Karuah River (Structure 185 onwards) to Taree, while Ausgrid owns the line to the south (including the river crossing) to Tomago.

The Transgrid section of the line has a route length of approximately 109 km and consists of 334 structures; 288 of those structures each contain multiple wood poles. This RIT-T addresses condition issues affecting the structures, including non-pole related issues affecting insulators, fittings and signage.

Line 963 was impacted by the Hillville Fire in November 2019. The fire impacted a total of 42 Transgrid structures between Structures 435 and 475 (35 of them wood poles structures) over a route length of 13.7 km. One pole (Structure 446) was significantly damaged by the fire and had to be replaced at the time.

Figure 2-1 illustrates some of the damage caused by the bushfires.

Figure 2-1 Damage caused to Line 963 in the November 2019 bushfires

The line was restored to a serviceable condition following the fires to meet network needs in the mid-north coast of NSW. Other lines also impacted by fire had to be taken out of service at the time.

Subsequent inspections of the sections impacted by the fire have identified eight structures as burnt and charred (Structures 445, 446, 449, 451, 452, 457, 460, 462). The fire damage affects the outer annulus of the pole at the region in the vicinity of the ground line and above. This is the main load bearing area of the structure and damage to this section of the pole can impact its structural integrity and may also provide a vector for advanced deterioration through termite and rot attack.

In addition, the conductor (particularly in the vicinity of Structure 446) has also had considerable heat stress during the bushfire event, which can cause aluminium to anneal and lose mechanical strength. Further, the heat caused the conductor to lose some of its grease, which is expected to result in subsequent corrosion issues. Structure 446 is located only 14 km from the coast and therefore has a greater exposure to conditions conducive to atmospheric corrosion.

All structures with fire damage are on the one tension section ranging from Structure 442 to 463.

In addition to the wood poles that are burnt and charred, detailed analysis of asset condition information has identified that various other non-bushfire-related condition issues impact 102 of the 334 structures across multiple line components, including earthwire. The most significant element of concern is the condition of the insulators, particularly the pins on the disc insulators. The line is situated in a coastal zone which corresponds to a higher susceptibility to atmospheric corrosion, and the insulator pins have lower levels of galvanising thickness compared to some other line components. If left unaddressed, this could lead to an insulator failure and potentially a fallen conductor.

Other issues on the line include:

- deterioration of conductor and earthwire fittings due to corrosion – failure of these components can lead to a conductor drop;
- deterioration of the earthwire due to corrosion – failure can lead to a conductor drop;
- deterioration of structure earthing due to corrosion – failure of these components results in potential earth current, voltage gradient issues and reduced line reliability;
- deterioration of guys and anchors – failure of these components can potentially compromise structural integrity; and
- deterioration on asset components relating to public safety such as climbing deterrents, warning signage and aerial marker balls.

If the condition issues on the line are not addressed in sufficient time, then the asset will operate with increasing risk of failure as it continues to deteriorate. The level of reactive corrective maintenance needed to keep the line operating within required standards may also increase, particularly when asset failures ultimately occur.

2.2. Description of identified need

If action is not taken, the condition of Line 963 will expose us and our customers to increasing levels of risk going forward, as deterioration increases the likelihood of failure.

Under the ‘do nothing’ base case, incidents such as conductor drop and tower collapse could occur. Such incidents could have considerable environmental risks through potential bushfires and could have considerable safety consequences for nearby residents and members of the public, as well as our field crew who may be working on or near the assets. These incidents also have financial risks associated with reactive maintenance that may be required under emergency conditions.

The proposed investment will enable us to manage environmental, safety and financial risks on Line 963.

Options considered under this RIT-T have been assessed relative to a base case. Under the base case, no proactive capital investment is made and the condition of the lines will continue to deteriorate.

We manage and mitigate environmental and safety risk to ensure they are below risk tolerance levels or 'As Low As Reasonably Practicable' ('ALARP'), in accordance with our obligations under the *New South Wales Electricity Supply (Safety and Network Management) Regulation 2014* and our Electricity Network Safety Management System (ENSMS).[3]

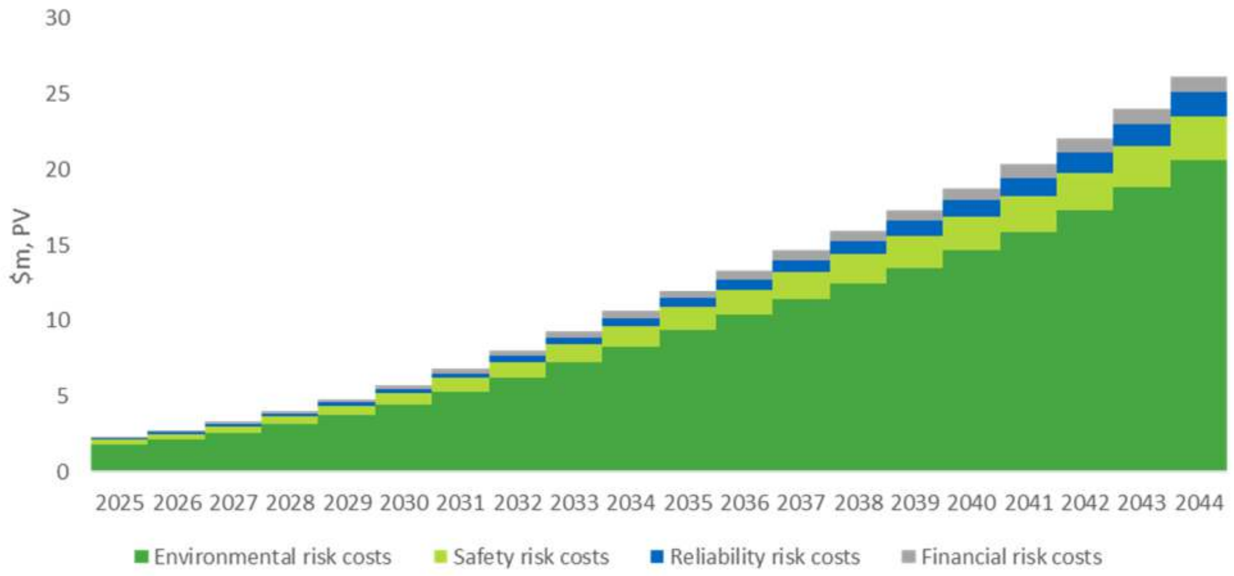
The proposed investment will enable us to continue to manage and operate this part of the network to a safety and risk mitigation level of ALARP, consistent with our obligations. Consequently, we consider this to be a reliability corrective action under the RIT-T. A reliability corrective action differs from a 'market benefits'-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation on the network business.

2.3. Assumptions underpinning the identified need

We adopt a risk cost framework to quantify and evaluate the risks and consequences of increased failure rates. Appendix B provides an overview of our risk assessment methodology.

Figure 2-2 summarises the increasing risk costs over the assessment period under the base case.

Figure 2-2 Estimated risk costs



This section describes the assumptions underpinning our assessment of the risk costs, i.e., the value of the risk avoided by undertaking each of the credible options. The aggregate risk cost under the base case is currently estimated in 2024/25 dollars at around $2.3 million. This is expected to increase going forward if action is not taken and the line is left to deteriorate further, reaching approximately $12.0 million/year by 2035 and $26.2 million/year by the end of the 20-year assessment period.

3 Our ENSMS follows the International Organization for Standardization's ISO31000 risk management framework which requires following a hierarchy of hazard mitigation approach.

2.3.1. Asset health and the probability of failure

Our asset health modelling aligns with Chapter 5.2 of the AER's Asset replacement planning guideline.[4] Condition information for each asset is assessed to generate an asset health index and assets in relatively poor condition, as identified through the asset health index, are candidates for a replacement or refurbishment intervention.

The asset health issues identified on Line 963 are summarised in Table 2.1.

Table 2.1 Asset health issues along Line 963 and their consequences

Issue	Consequences if not remediated
Loss of strength in conductors	Bushfire resulting in potential loss of property and/or life Safety incident resulting in potential injury or death Line outage with potential network reliability impacts
Corrosion of conductor fittings, earthwire, earthwire fittings, and insulator pins.	
Deteriorated guy and anchor.	
Deterioration of ground line wood condition, which can compromise structural integrity.	
Bushfire damage to the base of the wood pole structure which can compromise structural integrity.	
Deterioration of climbing deterrents, dangers signs, and structure ID signs.	Safety incident resulting in potential injury or death Line outage with potential network reliability impacts
Poor connection in structure earthing.	Safety incident resulting in potential injury or death. Reduced line reliability.

Asset health is used to estimate the remaining serviceable life of an asset and forecast the associated probability of failure (PoF) of the asset now and into the future. The future health of an asset (health forecasting) is a function of its current health and any factors causing accelerated (or decelerated) degradation or 'age shifting' of one or more of its components. Such moderating factors can represent the cumulative effects arising from continual or discrete exposure to unusual events, external stresses, overloads and faults.

Asset condition information is the primary source of information on the current health of the transmission line and its components. Condition information obtained through routine inspections of the transmission line (such as condition rating of each component), and asset information (such as natural age, location and ideal life expectancy), form the basis for deriving current health.

The PoF is the likelihood that an asset will fail during a given period resulting in a particular adverse event. The probability of each failure mode is calculated using reliability engineering techniques that take into account conditional age (chronological age moderated by asset health), failure and defect history, and industry benchmarking studies. We screen out failures that are not related to end-of-life when quantifying risk for replacement projects because such risks are not addressed by these works.

[4] AER, *Industry practice application note – Asset replacement planning*, July 2024

2.3.2. Environmental risk

This risk refers to the consequence to the community of an asset failure that results in a bushfire starting. We undertook detailed assessment with the University of Melbourne[5] in 2021 to improve our quantification of bushfire risks across our network, including the moderation of risk costs, using an electricity industry-developed approach.

The bushfire risk model:

- models the potential spread from a fire started at each asset in the network using recognised fire modelling software;
- calculates the consequence based on the number of houses, agricultural and forestry land use (and other infrastructure in the predicted burn area);
- moderates the consequence using a statistical distribution of fire conditions across the year to come up with a most likely consequence to be used in the investment decision;
- moderates this likely consequence by the likelihood of network assets igniting a fire in the event a catastrophic asset failure occurs (i.e., not all asset failures will ignite a fire); and
- further moderates this likely consequence taking into account the expected emergency services response to a fire based on the proximity to population (i.e., locations close to population centres have the highest moderation of likely consequence as the emergency services response is expected to be relatively expeditious).

Consistent with our ALARP obligations, we apply a disproportionality factor of 'six' to the bushfire risk.[6]

Environmental risk makes up approximately 78 per cent of the total estimated risk cost in present value terms.

2.3.3. Safety risk

This risk refers to the safety consequence to our workforce, contractors and/or members of the public of an asset failure whose failure modes can create harm. The estimated value accounts for the cost associated with a fatality or injury including compensation, loss of productivity, litigation fees, fines and any other related costs.

Our safety model underwent a comprehensive update during 2021 and was developed in conjunction with asset management specialist consultancy AMCL.[7] The main changes to the model relate to consequence and likelihood quantifications with our safety risk now considering a range of consequences, from minor injury to fatality, and the likelihood of each based on historical events, human movement data and land use.

Consistent with our ALARP obligations, we apply a disproportionality factor of 'six' to the public safety component and 'three' to the worker safety component of safety risk.

Safety risk makes up approximately 12 per cent of the total estimated risk cost in present value terms.

2.3.4. Reliability risk

This risk refers to the consequence arising from a reduction in reliability of electricity supply for customers that result in involuntary load shedding and is valued using the AER's estimated Value of Customer

[5] Refer to Network Asset Criticality Framework
[6] Refer to section 6.2.5 of the Network Risk Assessment Methodology
[7] Refer to Network Asset Criticality Framework

Reliability (VCR). The likelihood of impacts has been calculated by Transgrid based on our best analytical estimates, with the methodologies subject to independent review.

Reliability risk makes up approximately 5 per cent of the total estimated risk cost in present value terms.

2.3.5. Financial risk

This risk refers to the direct financial consequence arising from the failure of an asset including the cost of replacement or repair of the asset (reactive maintenance), which may need to be under emergency conditions.

Financial risk makes up approximately 4 per cent of the total estimated risk cost in present value terms.

3. Credible options

This section describes the options we have investigated to address the need, including the scope of each option and the associated costs.

We consider that there are two feasible options from a technical, commercial, and project delivery perspective that can be implemented in sufficient time to meet the identified need. Four other options were considered but not progressed for various reasons that are outlined in Table 3.3.

All costs and benefits presented in this PACR are in real 2024/25 dollars, unless otherwise stated.

The estimated capital costs of both credible options have increased since the PSCR on account of more refined estimates being developed by Transgrid's cost estimation team.

3.1. Base case

The costs and benefits of each option in this PACR are compared against those of a base case. Under this base case, no proactive capital investment is made to remediate the deterioration of Line 963. Assets are left in service until they fail and require replacement.

While the base case is not a situation we plan to encounter, and this RIT-T has been initiated specifically to avoid it, the RIT-T assessment is required to use this base case as a common point of reference when estimating the net benefits of each credible option.

The regular maintenance regime will not be able to mitigate the risk of asset failure that will expose us and end-customers to approximately $12.0 million in environmental, safety, reliability and financial risk costs by 2035, rising to $26.2 million per year by the end of the assessment period.[8] The large risk costs are mainly due to the significant consequences of safety and bushfires risks resulting from conductor drop. Under the base case, all of these risks will continue to increase.

3.2. Option 1 – Replace 24 wood pole structures

Option 1 involves replacement of all wood pole structures that have identified deterioration with steel or concrete poles, including the 16 bushfire impacted wood poles. Option 1 will address all the identified condition issues on the line with the exception of the bushfire impacted conductor.

The number of structure replacements (outside of the bushfire impacted wooden poles) has increased since the PSCR due to further investigations. This has resulted in the estimated cost of this option increasing by $1.7 million since the PSCR (as outlined below).

The works are estimated to take approximately two years to complete. Project completion is assumed in 2025/26, with commissioning in 2026/27.

All works would be completed in accordance with the relevant standards with minimal modification to the wider transmission assets. Necessary outages of affected line(s) in service would be planned appropriately in order to complete the works with minimal impact on the network.

8 This determination of yearly risk costs is based on our network asset risk assessment methodology and incorporates variables such as likelihood of failure/exposure, various types of consequence costs and corresponding likelihood of occurrence.

The estimated capital cost of this option is approximately $9.5 million, which is comprised of:

- $2.2 million in labour costs;
- $1.8 million materials costs; and
- $5.9 million in expenses.

Table 3-1 shows the expected expenditure profile of this option.

Table 3-1 Annual breakdown of Option 1's expected capital cost, $m

Item	Capital expenditure
2024/25	3.6
2025/26	5.9
Total capital cost	**9.5**

Option 1 will not affect annual routine operating costs (i.e., the cost is the same as under the base case) since it does not affect the frequency of inspections.

This option has the lower estimated risk reduction of the two options due to it being a 'minimal scope' option designed to address only the components that have experienced the greatest deterioration, to prevent failure in the short-term.

3.3. Option 2 – Replace 24 wood pole structures, the conductor between Structure 442 to 463 and 28km of earthwire

Option 2 involves the same scope as Option 1 plus 8 additional structures and the replacement of the conductor between Structure 442 to 463 with equivalent conductor (including all conductor components and hardware). This option will address all the identified condition issues on the line including the bushfire impacted conductor.

As stated above for Option 1, the number of structure replacements (outside of the bushfire impacted wooden poles) has increased for Option 2 since the PSCR due to further investigations. This, as well as a refined estimate for the conductor replacement works included in this option, has resulted in the estimated cost of this option increasing by $3.2 million since the PSCR (as outlined below).

The additional cost of replacing the conductor for Option 2, is relatively low, given workers will already be onsite for structure and insulator replacements.[9]

In addition to the replacement of 16 wood pole structures covered under Option 1, the scope of work for Option 2 also includes 8 additional structures and 6 km of conductor and 28 km of earthwire.

The works are estimated to take approximately two years to complete. Project completion is assumed in 2025/26, with commissioning in 2026/27.

All works would be completed in accordance with the relevant standards with minimal modification to the wider transmission assets. Necessary outages of affected line(s) in service would be planned appropriately in order to complete the works with minimal impact on the network.

[9] The cost of replacing the conductor at a future date has not been included in Option 1 given that doing so will only add to the cost of Option 1 (and Option 1 is already found to be inferior to Option 2 in the NPV assessment).

The estimated capital expenditure associated with this option is $12.2 million, which is comprised of:

- $2.8 million in labour costs;
- $2.3 million materials costs; and
- $7.1 million in expenses.

Table 3-2 shows the expected expenditure profile of this option.

Table 3-2 Annual breakdown of Option 2's expected capital cost, $m

Item	Capital expenditure
2024/25	4.6
2025/26	7.6
Total capital cost	**12.2**

As with Option 1, Option 2 will not affect annual routine operating costs (i.e., the cost is the same as under the base case) since it does not affect the frequency of inspections.

This option has a greater estimated risk reduction than Option 1 due to it replacing other components (e.g., the conductor together with the associated fittings and insulators).

3.4. Options considered but not progressed

We considered several additional options to meet the identified need in this RIT-T. Table 3.3 summarises the reasons the following options were not progressed further.

Table 3.3: Options considered but not progressed

Description	Reason(s) for not progressing
Uprating the existing lines	We do not expect the conductors included in this RIT-T need to be uprated as we do not expect the line loadings to exceed their existing line ratings in the near future. Line 963, along with lines 96P, 9C8 and 96F, are the main transmission lines connecting generation in the Hunter and Central Coast regions to the load in North-east coast region. The line utilisation data in our 2024 Transmission Annual Planning Report shows Line 963 has a maximum utilisation rate of 79% under credible contingency.[10] Additionally, Line 963 includes a 35km section from Karuah to Tomago which is owned by Ausgrid. To achieve a rating upgrade to the line, the entire line would need to be replaced. For the purposes of this RIT-T we are only proposing to replace a section of the line based on condition. We consider that uprating would cost significantly more than Option 1 and not add a commensurate increase in estimated market benefit. Uprating is therefore not considered commercially feasible.
Increased inspections	The condition issues have already been identified and cannot be rectified through increased inspections. This option is therefore not technically feasible.
Elimination of all associated risk	This can only be achieved through retirement and decommissioning of the associated assets. This option is therefore not technically feasible.
New transmission line	New transmission lines to replace the four lines identified is not considered commercially feasible given the significant cost.

[10] Transgrid, *Transmission Annual Planning Report 2024*, p.170.

Description	Reason(s) for not progressing
Non-network solutions	We do not consider non-network options to be commercially and technically feasible to assist with meeting the identified need, as non-network options will not mitigate the environmental, safety and financial risks posed as a result of asset deterioration. This is outlined in section 4 of the PSCR in more detail. Further, no non-network options were proposed in response to the PSCR.

4. Materiality of market benefits

This section outlines the categories of market benefits prescribed in the National Electricity Rules (NER) and whether they are considered material for this RIT-T.[11]

In short, no categories of market benefit are considered material for this RIT-T. However, the options are expected to avoid costs (risk costs) as compared to the base case, which are captured as expected benefits associated with the credible options. While these avoided risk costs have been included as benefits for the options, they are not considered 'market benefits' under the NER.

4.1. Wholesale market benefits are not material

The AER has recognised that if the credible options considered will not have an impact on the wholesale electricity market, then a number of classes of market benefits will not be material in the RIT-T assessment, and so do not need to be estimated.[12]

The credible options considered in this RIT-T will not address network constraints between competing generating centres and are therefore not expected to result in any change in dispatch outcomes and wholesale market prices. We therefore consider that the following classes of market benefits are not material for this RIT-T assessment:

- changes in fuel consumption arising through different patterns of generation dispatch;
- changes in Australia's greenhouse gas emissions;
- changes in voluntary load curtailment (since there is no impact on pool price);
- changes in costs for parties other than the RIT-T proponent (where this market benefit is driven through wholesale market changes);
- changes in ancillary services costs;
- changes in network losses; and
- competition benefits.

4.2. No other classes of market benefits are material

In addition to the classes of market benefits listed above, NER clause 5.15A.2(b)(4) requires that we consider the following classes of market benefits arising from each credible option. We consider that none of the classes of market benefits listed are material for this RIT-T assessment for the reasons in Table 4.1.

[11] The NER requires that all classes of market benefits identified in relation to the RIT-T are included in the RIT-T assessment, unless the TNSP can demonstrate that a specific class (or classes) is unlikely to be material in relation to the RIT-T assessment for a specific option – NER clause 5.15A.2(b)(6). See Appendix A for requirements applicable to this document.

[12] Australian Energy Regulator, *Regulatory investment test for transmission Application guidelines*, November 2024, Melbourne: Australian Energy Regulator.

Table 4.1 Reasons non-wholesale electricity market benefits are considered immaterial

Market benefits	Reason
Difference in the timing of unrelated expenditure (outside of any benefits of this nature driven by wholesale market changes)	The options considered are unlikely to affect decisions to undertake unrelated expenditure in the network. Consequently, material market benefits will neither be gained nor lost due to changes in the timing of other network expenditure from the option considered.
Option value	We note the AER's view is that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available is likely to change in the future, and the credible options considered by the TNSP are sufficiently flexible to respond to that change.[13] We also note the AER's view that appropriate identification of credible options and reasonable scenarios captures any option value, thereby meeting the NER requirement to consider option value as a class of market benefit under the RIT-T. We note that no credible option is sufficiently flexible to respond to change or uncertainty for this RIT-T. Specifically, each option is focused on proactively replacing deteriorating assets ahead of when they fail.

[13] Australian Energy Regulator, *Regulatory investment test for transmission, Application guidelines*, November 2024, Melbourne: Australian Energy Regulator.

5. Overview of the assessment approach

This section outlines the approach that we have applied in assessing the net benefits associated with each of the credible options against the base case.

5.1. Description of the base case

The costs and benefits of each option are compared against the base case. Under this base case, no proactive investment is undertaken, we incur regular and reactive maintenance costs, and the line will continue to operate with an increasing level of risk.

We note that this course of action is not expected in practice. However, this approach has been adopted since it is consistent with AER guidance on the base case for RIT-T applications.[14]

5.2. Assessment period and discount rate

A 20-year assessment period from 2024/25 to 2043/44 has been adopted for this RIT-T analysis. This period takes into account the size, complexity and expected asset life of the options.

Where the capital components of the credible options have asset lives extending beyond the end of the assessment period, the NPV modelling includes a terminal value to capture the remaining functional asset life. This ensures that the capital cost of long-lived options over the assessment period is appropriately captured, and that all options have their costs and benefits assessed over a consistent period, irrespective of option type, technology or serviceable asset life. The terminal values are calculated as the undepreciated value of capital costs at the end of the analysis period.

A real, pre-tax discount rate of 7.0 per cent has been adopted as the central assumption for the NPV analysis presented in this PACR, consistent with AEMO's latest Input Assumptions and Scenarios Report (IASR).[15] The RIT-T requires that sensitivity testing be conducted on the discount rate and that the regulated weighted average cost of capital (WACC) be used as the lower bound. We have therefore tested the sensitivity of the results to a lower bound discount rate of 3.63 per cent.[16] We have also adopted an upper bound discount rate of 10.5 per cent (i.e., the upper bound in the latest IASR).[15]

5.3. Approach to estimating option costs

We have estimated the capital costs of the options based on the scope of works necessary together with costing experience from previous projects of a similar nature. As outlined in section 3, the cost estimates for the options assessed in this PACR have been updated since the PSCR due to further investigations and have increased by 22 per cent and 36 per cent for Option 1 and Option 2, respectively. The percentage increase in Option 2's estimated capital cost is greater than the cost accuracy range presented in the PSCR (i.e., +/- 25 per cent) on account of the further investigations revealing a greater number of structure

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[14] We note that the AER RIT-T Guidelines state that the base case is where the RIT–T proponent does not implement a credible option to meet the identified need, but rather continues its 'BAU activities'. The AER define 'BAU activities' as ongoing, economically prudent activities that occur in the absence of a credible option being implemented. Australian Energy Regulator, *Regulatory investment test for transmission Application guidelines*, November 2024, Melbourne: Australian Energy Regulator.

[15] AEMO, *2023 Inputs, Assumptions and Scenarios Report*, Final report, July 2023, p 123.

[16] This is equal to WACC (pre-tax, real) in the latest final decision for a transmission business in the NEM (TasNetworks) as of the date of this analysis.

replacements (outside of the bushfire impacted wooden poles) being required and the interaction with the estimated reconductoring works. We consider this was unforeseen at the time of the PSCR.

All costs estimated by Transgrid's project development team use the estimating tool 'MTWO'. The MTWO cost estimating database reflects actual outturn costs built up over more than 10 years from:

- Period order agreement rates and market pricing for plant and materials.
- Labour quantities from recently completed project.
- Construction tender and contract rates from recent projects.

The MTWO estimating database is reviewed annually to reflect the latest outturn costs and confirm that estimates are within their stated accuracy range and represent the most likely expected cost of delivery (P50 costs)[17]. As part of the annual review, Transgrid benchmarks the outcomes against independent estimates provided by various engineering consultancies.[18]

Transgrid does not generally apply the Association for the Advancement of Cost Engineering (AACE) international cost estimate classification system to classify cost estimates. Doing so for this RIT-T would involve significant additional costs, which would not provide a corresponding increase in benefits compared with the use of MWTO estimates and so this has not been undertaken.

We estimate that actual costs will be within +/- 25 per cent of the central capital cost estimate. While we have not explicitly applied the AACE cost estimate classification system, we note that an accuracy of +/- 25 per cent for cost estimates is consistent with industry best practice and aligns with the accuracy range of a 'Class 4' estimate, as defined in the AACE classification system.

No specific contingency allowance has been included in the cost estimates.

All cost estimates are prepared in real, 2024/25 dollars based on the information and pricing history available at the time that they were estimated. The cost estimates do not include or forecast any real cost escalation for materials.

5.4. The options have been assessed against three reasonable scenarios

The RIT-T is focused on identifying the top ranked credible option in terms of expected net benefits. However, uncertainty exists in terms of estimating future inputs and variables (termed future 'states of the world').

To deal with this uncertainty, the NER requires that costs and market benefits for each credible option are estimated under reasonable scenarios and then weighted based on the likelihood of each scenario to determine a weighted ('expected') net benefit. It is this 'expected' net benefit that is used to rank credible options and identify the preferred option.

The credible options have been assessed under three scenarios as part of this PACR assessment, which differ in terms of the key drivers of the estimated net market benefits (i.e., the estimated risk costs avoided).

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17 That is, that there is an equal likelihood of over- or under-spending the estimate total.

18 For further detail on our cost estimating approach refer to section 7 of our Augmentation Expenditure Overview Paper submitted with our 2023-28 Revenue Proposal.

Given that wholesale market benefits are not relevant for this RIT-T, the three scenarios assume the most likely scenario from the 2024 ISP (i.e., the 'Step Change' scenario). The scenarios differ by the assumed level of risk costs, given that these are key parameters that may affect the ranking of the credible options. Risk cost assumptions do not form part of AEMO's ISP assumptions, and have been based on Transgrid's analysis, as discussed in section 2.

How the NPV results are affected by changes to other variables (including the discount rate and capital costs) has been investigated in the sensitivity analysis. We consider this is consistent with the latest AER guidance for RIT-Ts of this type (i.e., where wholesale market benefits are not expected to be material).[19,20]

Table 5-1 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario
Scenario weighting	*1/3*	*1/3*	*1/3*
Environmental, safety and financial risk benefit	Base estimate	Base estimate – 25%	Base estimate +25%
Discount rate	7.00%	7.00%	7.00%
Network capital costs	Base estimate	Base estimate	Base estimate
Operating and maintenance costs	Base estimate	Base estimate	Base estimate

We have weighted the three scenarios equally given there is nothing to suggest an alternate weighting would be more appropriate.

5.5. Sensitivity analysis

In addition to the scenario analysis, we have also considered the robustness of the outcome of the cost benefit analysis through undertaking various sensitivity testing.

The range of factors tested as part of the sensitivity analysis in this PACR are:

- lower and higher assumed capital costs;
- lower and higher estimated environmental, safety and financial risk benefits; and
- alternate commercial discount rate assumptions.

The above list of sensitivities focuses on the key variables that could impact the identified preferred option. The results of the sensitivity tests are set out in section 6.4.

In addition, we have also sought to identify the 'boundary value' for key variables beyond which the outcome of the analysis would change, including the amount by which capital costs would need to increase for the preferred option to no longer be preferred.

19 AER, *Regulatory investment test for transmission Application guidelines*, November 2024, pp. 44-46.
20 See: AER, *Decision: North West Slopes and Bathurst, Orange and Parkes Determination on dispute - Application of the regulatory investment test for transmission*, November 2022, pp. 18-20 & 31-32, as well as with the AER's RIT-T Guidelines.

6. Assessment of credible options

This section outlines the assessment we have undertaken of the credible network options. The assessment compares the costs and benefits of each credible option to the base case. The benefits of each credible option are represented by reduction in costs or risks compared to the base case.

6.1. Estimated gross benefits

Table 6-1 below summarises the present value of the gross benefit estimates for each credible option relative to the base case under the three scenarios. The benefits included in this assessment consist only of avoided risk, i.e., a reduction in reliability, safety, environmental and financial risks.

In all scenarios, Option 2 has a greater estimated risk reduction due to it replacing other components (e.g., the conductor together with the associated fittings and insulators).

Table 6-1 Estimated gross benefits from credible options relative to the base case ($m, PV)

Option/scenario	Central	Low risk cost scenario	High risk cost scenario	Weighted
Scenario weighting	*1/3*	*1/3*	*1/3*	
Option 1	*96.2*	*72.2*	*120.3*	*96.2*
Option 2	*101.9*	*76.4*	*127.4*	*101.9*

6.2. Estimated costs

Table 6-2 below summarises the costs of the options, relative to the base case, in present value terms. The costs consist of the direct capital costs for each option, relative to the base case, and is the same in all scenarios.

Table 6-2 Costs of credible options relative to the base case ($m, PV)

Option	Cost
Option 1	7.4
Option 2	9.5

6.3. Estimated net economic benefits

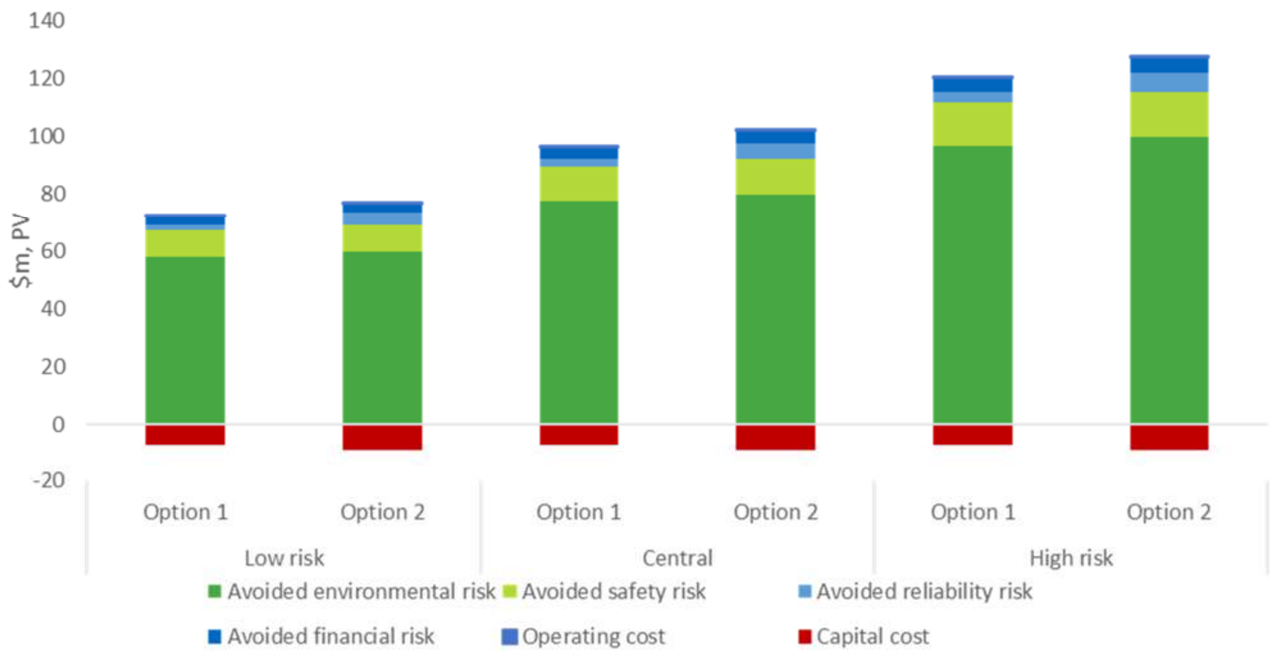
The net economic benefits are the differences between the estimated gross benefits less the estimated costs. Table 6-3 below summarises the present value of the net economic benefits for each credible option across the three scenarios and the weighted net economic benefits.

Table 6-3 Net economic benefits for credible options relative to the base case ($m, PV)

Option/scenario	Central	Low risk cost scenario	High risk cost scenario	Weighted
Scenario weighting	*1/3*	*1/3*	*1/3*	
Option 1	*88.8*	*64.7*	*112.9*	*88.8*
Option 2	*92.4*	*66.9*	*117.9*	*92.4*

Both credible options are found to have positive benefits for all scenarios investigated. On a weighted basis, Option 2 is found to deliver the greatest net economic benefits at approximately $92.4 million.

Figure 6-1 Net economic benefits ($m, PV)



6.4. Sensitivity testing

We have undertaken sensitivity testing to understand the robustness of the RIT-T assessment to underlying assumptions about key variables. In particular, we have undertaken two sets of sensitivity tests:

- Step 1 – testing the sensitivity of the optimal timing of the project ('trigger year') to different assumptions in relation to key variables; and
- Step 2 – once a trigger year has been determined, testing the sensitivity of the total NPV benefit associated with the investment proceeding in that year, in the event that actual circumstances turn out to be different.

The application of the two steps to test the sensitivity of the key findings is outlined below.

6.4.1. Step 1 – Sensitivity testing of the optimal timing

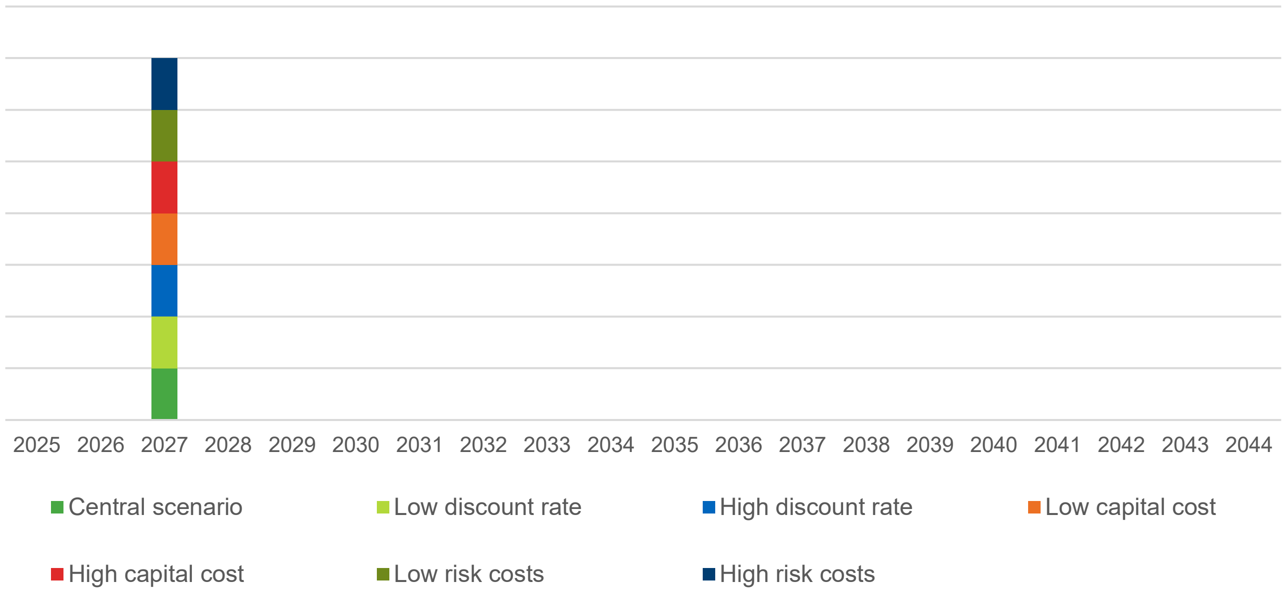
This section outlines the sensitivity of the identification of the commissioning year to changes in the underlying assumptions. Each timing sensitivity has been undertaken on the central scenario.

The optimal timing of Option 2 is found to be invariant to the assumptions of:

- a 25 per cent decrease or increase in the assumed network capital costs;
- lower and higher assumed environmental, safety and financial risks; and
- lower discount rate of 3.63 per cent as well as a higher rate of 10.50 per cent.

Figure 6-2 below outlines the impact on the optimal commissioning year of a range of alternative assumptions. It illustrates that for Option 2, the optimal commissioning year is found to be in 2026/27 for all of the sensitivities investigated. We have not presented the timing assessment here for Option 1 but note that its yields the same results as for Option 2.

Figure 6-2 Optimal timing for Option 2



6.4.2. Step 2 – Sensitivity of the overall net benefit

We have conducted sensitivity analysis on the present value of the net economic benefit, based on construction commencing in 2024/25 and project completion in 2025/26. Specifically, we have investigated the same sensitivities under this step as in the first step:

- a 25 per cent increase/decrease in the assumed network capital costs;
- lower (or higher) assumed environmental, safety and financial risks; and
- lower discount rate of 3.63 per cent as well as a higher rate of 10.50 per cent.

All these sensitivities investigate the consequences of 'getting it wrong' having committed to a certain investment decision.

The figures below illustrate the estimated net economic benefits for each option if separate key assumptions in the central scenario are varied individually.

Both options deliver positive benefits under all cases and Option 2 is always ranked ahead of Option 1.

Figure 6-3 Capital cost sensitivity

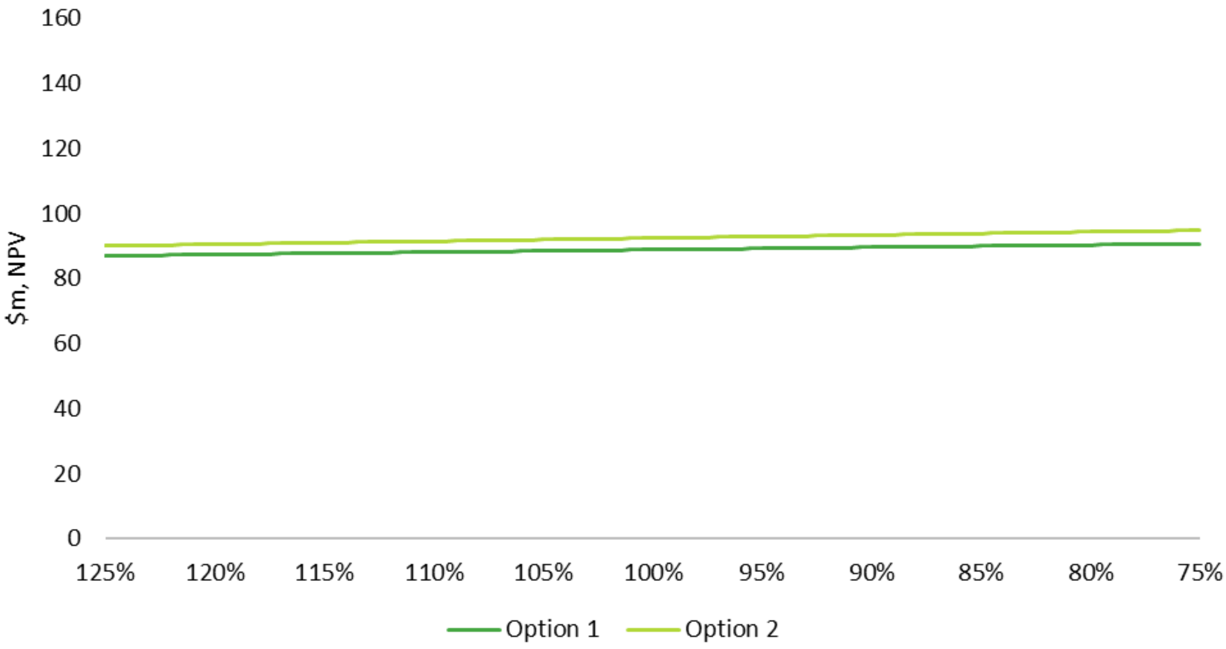


Figure 6-4 Risk costs sensitivity

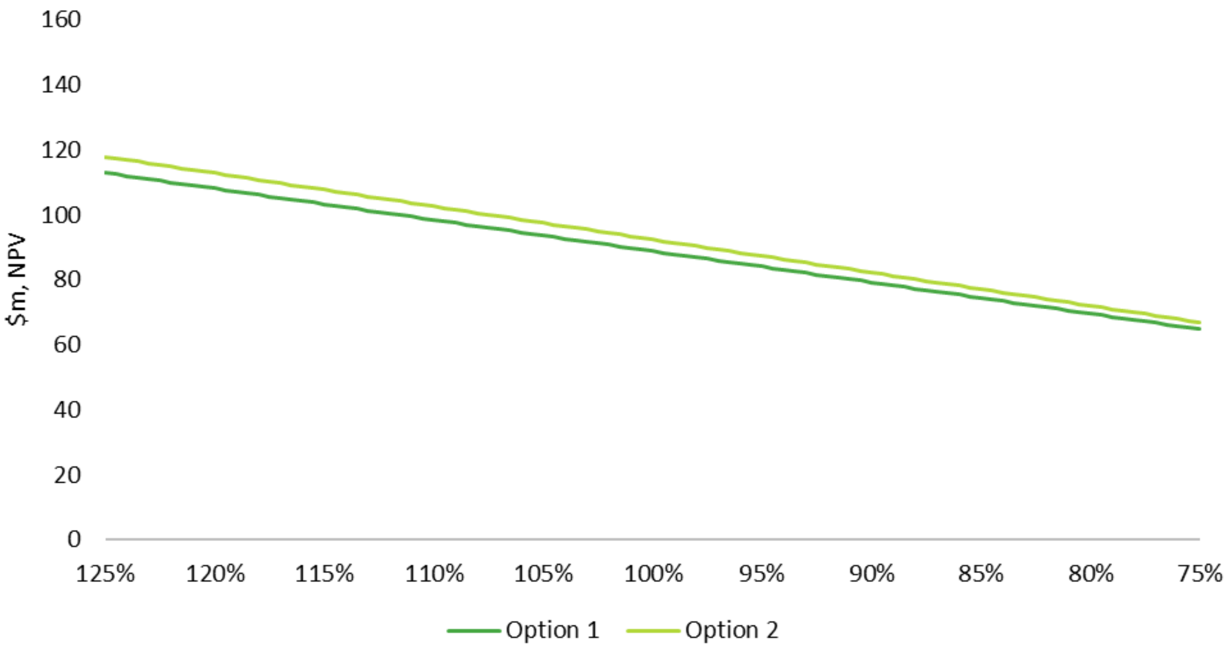
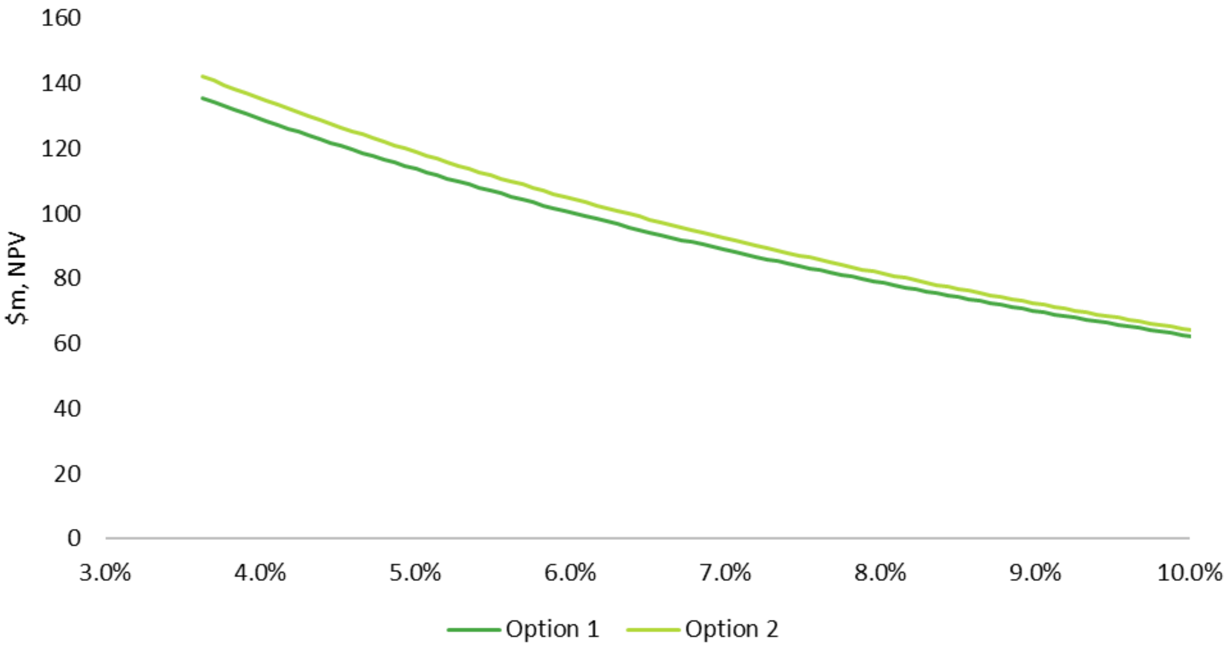


Figure 6-5 Commercial discount rate sensitivity



In terms of boundary testing, we find that the following would need to occur for the second ranked option, Option 1, to have net market benefits equal to that of Option 2:

- assumed network capital costs (for all options) would need to increase by 170 per cent;
- the estimated risk costs (in aggregate) would need to decrease by 63 per cent; and
- a real commercial discount rate of more than 16.2 per cent.

These boundaries where Option 2 would no longer be top ranked are considered extreme and are unlikely to eventuate. We therefore consider the finding that Option 2 is preferred over Option 1 to be robust to the key underlying assumptions.

7. Final conclusion

This PACR has found that Option 2 is the preferred option at this final stage of the RIT-T. Option 2 was also found to be the preferred option in the PSCR.

Option 2 involves the remediation of all identified condition issues on the line, including the replacement of the conductor between Structure 442 to 463 with an equivalent conductor (and replacement of all conductor components and hardware). The scope of work includes the replacement of 24 wood poles, 6 km of conductor and 28 km of earthwire.

The estimated capital expenditure associated with Option 2 is $12.2 million (in 2024/25 dollars). The works are estimated to take place between 2024/25 and 2025/26.

Option 2 is the preferred option in accordance with NER clause 5.15A.2(b)(12) because it is the credible option that maximises the net present value of the net economic benefit to all those who produce, consume and transport electricity in the market, as well as that arising from changes in Australia's greenhouse gas emissions. The analysis undertaken and the identification of Option 2 as the preferred option satisfies the RIT-T.

Transgrid considers this conclusion to be robust to changes in capital cost inputs, estimated risk costs and underlying discount rates, noting that there would need to be unrealistic changes to these key assumptions for there to be no expected net benefits (as shown via the boundary testing at the end of section 6). Transgrid will however continue to monitor these key assumptions and will notify the AER if such changes do occur (or appear likely), which would constitute a material change in circumstance.

Appendix A Compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PACR with the requirements of the National Electricity Rules version 220.

Rules clause	Summary of requirements	Relevant section(s) in the PACR
5.16.4(v)	The project assessment conclusions report must set out:	–
	1. the matters detailed in the project assessment draft report as required under paragraph (k); and	See below.
	2. a summary of, and the RIT-T proponent's response to, submissions received, if any, from interested parties sought under paragraph (q).	NA
5.16.4(k)	The project assessment draft report must include:	–
	1. a description of each credible option assessed;	3
	2. a summary of, and commentary on, the submissions to the project specification consultation report;	NA
	3. a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefit for each credible option;	3 & 6
	4. a detailed description of the methodologies used in quantifying each class of material market benefit and cost;	4 & 5
	5. reasons why the RIT-T proponent has determined that a class or classes of market benefit are not material;	4
	6. the identification of any class of market benefit estimated to arise outside the region of the Transmission Network Service Provider affected by the RIT-T project, and quantification of the value of such market benefits (in aggregate across all regions);	NA
	7. the results of a net present value analysis of each credible option and accompanying explanatory statements regarding the results;	6
	8. the identification of the proposed preferred option;	7
	9. for the proposed preferred option identified under subparagraph (8), the RIT-T proponent must provide: a. details of the technical characteristics; b. the estimated construction timetable and commissioning date; c. if the proposed preferred option is likely to have a material inter-network impact and if the Transmission Network Service Provider affected by the RIT-T project has received an augmentation technical report, that report; an d. a statement and the accompanying detailed analysis that the preferred option satisfies the regulatory investment test for transmission.	3 & 7

In addition, the table below outlines a separate compliance checklist demonstrating compliance with the binding guidance in the latest AER RIT-T guidelines.

Guidelines section	Summary of the requirements	Section in the PSCR
3.5A.1	Where the estimated capital costs of the preferred option exceeds $103 million (as varied in accordance with a cost threshold determination), a RIT-T proponent must, in a RIT-T application: i. outline the process it has applied, or intends to apply, to ensure that the estimated costs are accurate to the extent practicable having regard to the purpose of that stage of the RIT-T ii. for all credible options (including the preferred option), either • apply the cost estimate classification system published by the AACE, or • if it does not apply the AACE cost estimate classification system, identify the alternative cost estimation system or cost estimation arrangements it intends to apply, and provide reasons to explain why applying that alternative system or arrangements is more appropriate or suitable than applying the AACE cost estimate classification system in producing an accurate cost estimate	NA
3.5A.2	For each credible option, a RIT-T proponent must specify, to the extent practicable and in a manner which is fit for purpose for that stage of the RIT-T: i. all key inputs and assumptions adopted in deriving the cost estimate ii. a breakdown of the main components of the cost estimate iii. the methodologies and processes applied in deriving the cost estimate (e.g. market testing, unit costs from recent projects, and engineering-based cost estimates) iv. the reasons in support of the key inputs and assumptions adopted and methodologies and processes applied v. the level of any contingency allowance that have been included in the cost estimate, and the reasons for that level of contingency allowance	6.2
3.5.3	The RIT-T proponent is required to provide the basis for any social licence costs in their RIT-T reports, and may choose to refer to best practice from a reputable, independent and verifiable source.	NA[21]
3.8.2	Where the estimated capital cost of the preferred option exceeds $103 million (as varied in accordance with an applicable cost threshold determination), a RIT-T proponent must undertake sensitivity analysis on all credible options, by varying one or more inputs and/or assumptions.	NA
3.9.4	If a contingency allowance is included in a cost estimate for a credible option, the RIT-T proponent must explain: • the reasons and basis for the contingency allowance, including the particular costs that the contingency allowance may relate to, and • how the level or quantum of the contingency allowance was determined.	NA
4.1	RIT-T proponents are required to describe in each RIT-T report 21 above • how they have engaged with local landowners, local council, local community members, local environmental groups or traditional owners and sought to address any relevant concerns identified through this engagement • how they plan to engage with these stakeholder groups, or • why this project does not require community engagement	NA21

[21] These are new requirements stipulated in revised RIT-T Application Guidelines released by the AER, which came into effect on 21 November 2024. For compliance purposes, the AER only have regard to the guidance that was in effect when Transgrid initiated the RIT-T in question. In this context, initiated means from the publication of a project specification consultation report (PSCR). As the PSCR was published prior to 21 November 2024, these new requirements are not applicable to this RIT-T.

Appendix B Risk assessment methodology

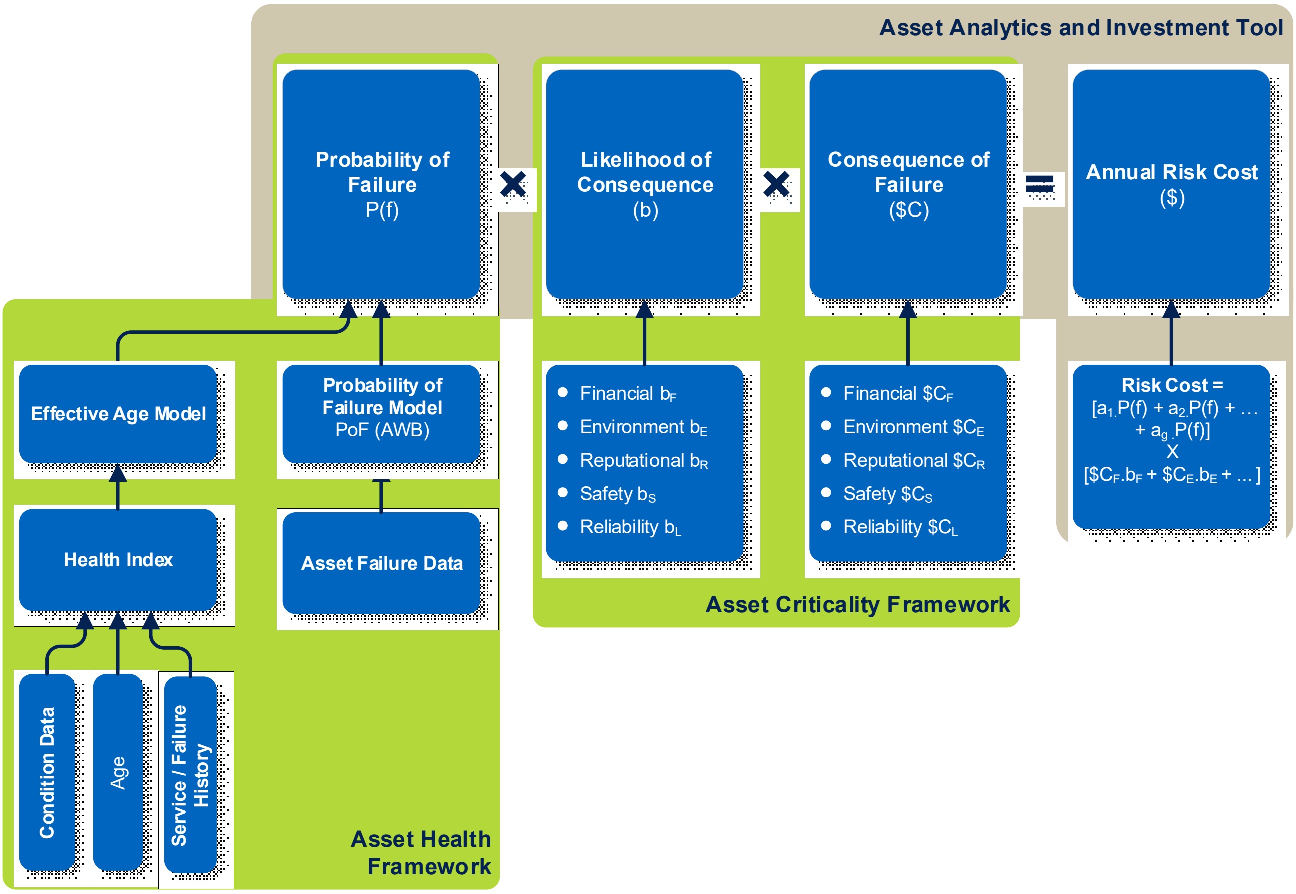
This appendix summarises our network risk assessment methodology that underpins the identified need for this RIT-T. Our risk assessment methodology is aligned with the AER's Asset Replacement Planning guideline[22] and its principles.

A fundamental part of the risk assessment methodology is calculating the annual 'risk costs' or the monetised impacts of the environmental, safety and financial risks.

The monetary value of risk (per year) for an individual asset failure resulting in an undesired outcome, is the likelihood (probability) of failure (in that year with respect to its age), as determined through modelling the failure behaviour of an asset (Asset Health), multiplied by the consequence (cost of the impact) of the undesired outcome occurring, as determined through the consequence analysis (Asset Criticality).

Figure B-1 below summarises the framework for calculating the 'risk costs', which has been applied on our asset portfolio considered to need replacement or refurbishment.

Figure B-1 Risk cost calculation



Economic justification of repex to address an identified need is supported by risk monetised benefit streams, to allow the costs of the project or program to be assessed against the value of the avoided risks

[22] Industry practice application note - Asset replacement planning, AER July 2024

and costs. The major quantified risks we apply for repex justifications include asset failures that materialise as:

- bushfire risk;
- safety risk;
- environmental risk;
- reliability risk; and
- financial risk.

The risk categories relevant to this RIT-T are explained in Section 2.3.

Further details are available in our Network Risk Assessment Methodology.

Appendix C Asset health and probability of failure

The first step in calculating the PoF of an asset is determining the asset health and associated effective age,[23] which considers that:

- an asset consists of different components, each with a particular function, criticality, underlying reliability, life expectancy and remaining life - the overall health of an asset is a compound function of all of these attributes;
- key asset condition measures and failure data provides vital information on the current health of an asset, where the 'current effective age' is derived from asset information and condition data;
- the future health of an asset (health forecasting) is a function of its current health and any factors causing accelerated (or decelerated) degradation or 'age shifting' of one or more of its components – such moderating factors can represent the cumulative effects arising from continual or discrete exposure to unusual internal, external stresses, overloads and faults; and
- 'future effective age' is derived by moderating 'current effective age' based on factors such as, external environment/influence, expected stress events and operating/loading condition.

The PoF is the likelihood that an asset will fail during a given period resulting in a particular adverse event, e.g., equipment failure, pole failure, broken overhead conductor.

The outputs of the PoF calculation are one or more probability of failure time series which provide a mapping between the effective age, discussed above, and the yearly probability of failure value for a given asset class. This analysis is performed by generating statistical failure curves, normally using Weibull analysis, to determine a PoF time series set for each asset that gives a probability of failure for each further year of asset life. This establishes how likely it is that the asset will fail over time.

The Weibull parameters which represent the probability of failure curve for key transmission line components are summarised in Table C-1 below.

Further details are available in our Network Asset Health Methodology.

[23] Apparent age of an asset based on its condition.

Table C-1 Weibull parameters for asset components

Asset component	Weibull parameters	
	η	β
Structure - Wood Pole NR	89	12
Insulators - Non Ceramic Insulators	26.55	3.232
Insulators - Porcelain Disc - Low corrosion	261.7	4.581
Insulators - Porcelain Disc - High corrosion	173.7	4.763
Conductor Fittings - C1/C2	127.4	4.376
Conductor Fittings - C3/C4	64.24	10.13
Earthwire Fittings - C1/C2	116.5	5.198
Earthwire Fittings - C3/C4	66.61	10.98

Note: C1 (Very Low), C2 (Low), C3 (Medium) and C4 (High) relate to atmospheric corrosion zones based on Australian Standard AS 4312-2008.