

Cable tunnel refurbishment program (PRJ006)

Regulatory Business Case (RBC) 2024-29

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1. Summary

This business case has been prepared to support the 2024-29 Regulatory Proposal. The business case demonstrates that Power and Water has undertaken appropriate analysis of the need for the expenditure and identified credible options that will resolve the need and ensure that Power and Water continues to meet the National Electricity Objectives and maintain the quality, reliability, and security of supply of standard control services and maintain the safety of the distribution system.

The proposed investment identified in this business case will undergo further assessment and scrutiny through Power and Water's normal governance processes prior to implementation and delivery.

This business case addresses the condition risks of cable tunnels in the Darwin CBD area.

1.1 Business need

The Darwin CBD is supplied by cables which are installed in underground tunnels constructed of reinforced concrete. These tunnels are typically more than 30 years old and a recent survey identified significant deterioration that is causing safety issues for field crews and if not addressed will cause continued deterioration of the tunnel, shortening its serviceable life.

The key issues identified include water ingress, failed sump pumps, corrosion of the steel reinforcement, corroded cable racks, decommissioned cables that are not removed taking up valuable space, and non-standard cable installations causing obstruction in the main tunnels.

These issues result in risks to Power and Water, including:

- **Health and safety** as a result of injury due to debris hidden by the water, obstruction of egress routes and danger from snakes and other animals/insects that are attracted to the water and shelter.
- **Direct financial costs** due to insufficient space for new cables, damage to cables due to the corroded cable racks and a shortened serviceable life of the tunnel due to corrosion which would result in a significant cost to replace.

The cable tunnel condition needs to be addressed to ensure the ongoing serviceability, safety and useful life of the cable tunnels. This is highly important given its function and the reliance of the CBD on these tunnels for secure and reliable electricity supply.

1.2 Options analysis

Table 1 describes the two credible options have been identified to resolve the cable tunnel condition issues. These options address the identified need, are technically feasible and can be implemented within the required timeframe.

Table 1 Summary of credible options

Option No.	Option name	Description	Recommended
1	Do nothing	This option proposes not to undertake any specific work to refurbish the deteriorated	No

		areas and components of the cable tunnels.	
2	Refurbishment program	This option proposes to implement a remediation /refurbishment program during the next regulatory period.	Yes

As part of a holistic assessment, non-network solutions, capex/opex trade-offs and retirement or derating options were also considered, but found that none of these options addressed the underlying network issues.

A cost benefit analysis was completed for each of the options where the risk reduction, compared to Option 1, was used as the benefit achieved by the option.

1.3 Recommendation

The options analysis identifies Option 2 – Refurbishment program at an estimated cost of \$0.9 million (real 2021/22) to be most prudent and cost effective to meet the identified needs.

Option 2 is deliverable, contributes to Power and Waters strategic direction and is align to our customers expectations.

Table 2 shows a summary of the expenditure requirements for the 2024-29 regulatory period.

Table 2 Annual capital and operational expenditure (\$'000, real 2021/22)

Item	FY25	FY26	FY27	FY28	FY29	Total
Capex	130	380	130	130	130	900
Opex	-	-	-	-	-	-
Total	130	380	130	130	130	900

2. Identified need

This section provides the background and context to this business case, identifies the issues that are posing increasing risks of overhead services wires to Power and Water and its customers, describes the current mitigation program and its delivery status, highlights the consequence of asset failure, and provides a risk assessment of the inherent risk if no investment is undertaken.

2.1 Asset profile

The Darwin CBD is supplied by cables which are installed in underground tunnels, as shown in Figure 1. These tunnels are typically more than 30 years old and build of reinforced concrete.

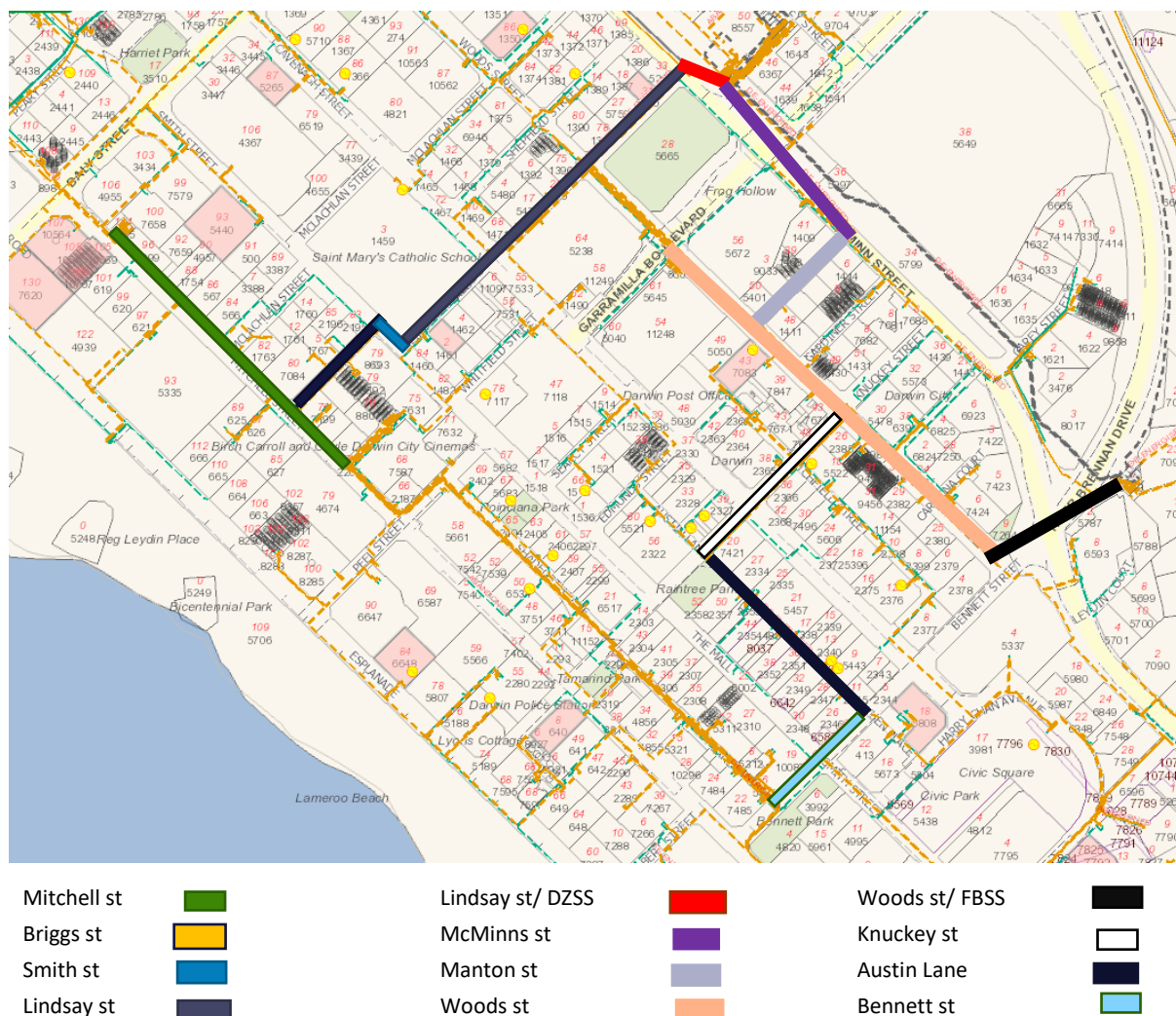


Figure 1 Cable tunnel routes in the Darwin CBD

2.2 Asset condition issues and risks

A recent survey of the tunnels (Work Order 2939720) identified significant issues that are causing safety issues for field crews and if not addressed will cause continued deterioration of the tunnel, shortening its serviceable life. The asset condition and issues are captured in Appendix B.

The key issues identified are listed below:

- Water ingress during the wet season means the tunnels are consistently subject to flooding. The flooding also brings debris such as mud, foliage, and other rubbish into the tunnels.
- Sump pumps are relied upon to remove the water, however, these can become blocked or over used, resulting in failure.
- Stagnant water in the tunnels can be a health and safety issue to field crew as they are unable to see where they are walking, there can be snakes and rats attracted to the water and it can also become a breeding ground for insects.
- The tunnels have damage in different areas that has been caused by corrosion of the steel (concrete cancer), where tree roots have broken through the walls, and by deliberate modifications to the tunnels to install new cables.
- The cable racks are also becoming corroded in some sections.
- There are cables that are decommissioned, but not fully removed, that are taking up valuable space in the racks.
- Cables are installed in non-standard layouts, resulting in obstruction to the main tunnels.

2.3 Risk assessment

Power and Water has developed the Risk Quantification Procedure to enable consistent quantification of risk from their assets into dollar terms. Power and Water does not have sufficient data to quantify the risk posed by the poor condition of the cable tunnels so a qualitative assessment of the risks has been undertaken instead.

The key risks posed by the poor condition of the cable tunnels result in a Medium risk rating with a target risk rating of Low. The factors that contribute to this risk ranking are:

Health and safety:

- The risk of injury due to debris that is hidden under water when field crews are working underground.
- Danger from snakes and other animals that may be attracted to the water and shelter.
- Obstruction of egress routes due to poor installation practices.

Direct financial costs

- The decommissioned cables that have not been properly removed mean that there is no space for new cables to be installed.
- Damage to cables due to failure of cable trays (damage to the sheath or increased tension causing damage to the conductor or insulation).
- Shortened serviceable life, or higher remediation costs, of the tunnel due to corrosion not being adequately addressed.

The qualitative risk assessment of the inherent risk and targeted risk is shown in Figure 2 using the matrix approach set out in the Enterprise Risk Management Standard.

	Insignifiant	Minor	Moderate	Major	Severe
Almost certain	Medium	High	Very High	Extreme	Extreme
Likely	Low	Medium	High	Very High	Extreme
Possible	Low	Low	Medium	High	Very High
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	Medium

Figure 2 Qualitative risk assessment

2.4 Summary

The issues raised above need to be addressed to ensure the ongoing serviceability, safety and useful life of the cable tunnels. This is highly important given their function and the reliance of the CBD on these tunnels for secure and reliable electricity supply.

3. Options analysis

This section describes the various options that were analysed to address the increasing risk to identify the recommended option. The options are analysed based on ability to address the identified needs, prudence and efficiency, commercial and technical feasibility, deliverability, benefits and an optimal balance between long term asset risk and short-term asset performance.

3.1 Comparison of credible options

Credible options are identified as options that address the identified need, are technically feasible and can be implemented within the required timeframe. The following options have been identified:

- Option 1 – Do nothing: This option proposes not to undertake any specific work to refurbish the deteriorated areas and components of the cable tunnels.
- Option 2 – Refurbishment program: This option proposes to implement a remediation / refurbishment program during the next regulatory period.

A comparison of the two identified credible options and the issues they address in the identified need is depicted in Table 3 below.

These options are described and assessed in detail in the sections below.

Table 3 Summary of options analysis outcomes

Assessment metrics	Option 1	Option 2
NPC (\$'000, real 2021/22)	0	790
BCR	N/A	N/A
Capex (\$'000, real 2021/22)	0	900
Meets customer expectations	○	●
Aligns with Asset Objectives	○	●
Technical Viability	○	●
Deliverability	●	●
Preferred	✗	✓

● Fully addressed the issue ◐ Adequately addressed the issue ◑ Partially addressed the issue ○ Did not address the issue

Notes: NPC is the net present cost of the program. While there are benefits to this program, they have not been quantified.

3.1.1 Option 1 – Do nothing

Option 1 proposes to not undertake any specific work to refurbish the deteriorated areas and components of the cable tunnels.

While the identified issues are long-term deterioration modes, the longer that any remedial action is deferred, the more expensive the cost of remediation. Importantly, until the issues are addressed there will continue to be an elevated risk to field crew.

This option does not align with Power and Water's strategic pillar of safety nor with its objective for long term asset management. Hence, this option is not recommended.

3.1.2 Option 2 – Refurbishment program

Option 2 proposes to implement a remediation/refurbishment program during the next regulatory control period. This will enable the issues to be progressively addressed, starting with safety issues and continuing on for the issues that will affect the structure over time.

The estimated cost of this option is \$0.9 million (real 2021/22) over the regulatory period. The scope of this options includes:

- Sealing the joints between prefab panels to prevent water ingress and tree roots entering the tunnel and causing damage to the panels.
- Replacement of sump pumps and refurbishing drainage systems.
- Refurbishment of cable racks.

The above scope has been established based on a recent inspection of the tunnels and the assessment by field crews of what needs to be addressed.

This option aligns with Power and Waters strategic pillar for safety and also enable the long term management of the assets.

This option is recommended.

3.2 Non-credible options

Our analysis also identified a number of options found to be non-credible. These options are described below and were not taken through to detail analysis for the reasons provided.

3.2.1 Retire or de-rate assets to extend life – does not address the need

Total retirement of the assets is not a credible option as the cables supplying the Darwin CBD are housed in the cable tunnels.

3.2.2 Non-Network alternatives – does not address the need

Due to the type and function of these assets, there are no non-network alternatives or solutions that can be implemented in place of direct asset replacement / refurbishment.

3.2.3 Capex/Opex Substitution – does not address the need

Since the driver of this investment is significant deterioration, and which maintenance has not been able to address, it is not feasible to substitute capital expenditure with operational expenditure to resolve the risk. Only capital expenditure to refurbish the cable tunnels will resolve the underlying issues.

4. Recommendation

The recommended option is Option 2 – Refurbishment program at an estimated cost of \$0.9 million (real 2021/22) as the most prudent and cost effective to meet the identified needs.

The proposed program is consistent with the National Electricity Rules Capital Expenditure Objectives as the expenditure is required to maintain the quality, reliability, and security of supply of standard control services and maintain the safety of the distribution system.

4.1 Strategic alignment

The “Power and Water Corporation Strategic Direction” is to meet the changing needs of the business, our customers and is aligned with the market and future economic conditions of the Northern Territory projected out to 2030.

This proposal aligns with Asset Management System Policies, Strategies and Plans that contributes to the D2021/260606 “PWC Strategic Direction” as indicated in the table below.

Table 4 Alignment with corporate strategic focus areas

Strategic direction focus area		Strategic direction priority
1	Customer and the community at the centre	Improve Public Health and Safety
2	Always Safe	Cost Prudence

4.2 Dependent projects

There are no known projects or other network issues that are dependent on the resolution of this network issue.

4.3 Deliverability

This is a low value program to progressively refurbish parts of the Darwin CBD cable tunnels system. No delivery risks have been identified.

4.4 Customer considerations

As required by the AER’s Better Resets Handbook, in developing this program Power and Water has taken into consideration feedback from its customers.

Feedback received through customer consultation undertaken at the time of writing this PBC, has demonstrated strong support amongst the community for appropriate expenditure to enable long term maintenance of the network to ensure continued reliability, maintainability and safety of supply.

4.5 Expenditure profile

Table 5 shows a summary of the expenditure requirements for the 2024-29 regulatory period.

Table 5 Annual capital and operational expenditure (\$'000, real FY22)

Item	FY25	FY26	FY27	FY28	FY29	Total
Capex	130	380	130	130	130	900
Opex	-	-	-	-	-	-
Total	130	380	130	130	130	900

4.6 High-level scope

Table 6 shows the indicative high-level scope that has been identified based on field crew survey of the tunnels.

Table 6 High-level scope

Item	Scope	Volumes
1	Sealing prefab panels joints	250 joints
2	Replacement of sump pumps and refurbishing drainage systems	10 pumps
3	Refurbishment of cable racks	Identified sections

Appendix A. Cost estimation

The cost estimate for this program has been based on field crew estimates. This has included previous similar scopes of work, similar asset types and the extent of the damage identified during the site inspections. Evidence of the issues are captured in Appendix B.

Appendix B. Detailed survey of cable tunnel condition

Table 7 Condition report

Cable tunnel location	Condition report	Photos taken
Mitchell St	<p>Mitchell St has two decommissioned LV cables, one XLPE and one PILC cable that could be removed, roughly 50 to 100m long each. The general state of Mitchell St is okay but could do with a clean up at all pit entry sites.</p> <p>Minor crack repairs required.</p> <p>There is rusted unistrut from MSS to Daly street down Mitchell St.</p> <p>This sump pump appears to be operating fine.</p>	Yes
Briggs St	<p>Briggs St is also in relatively good condition. However there's a few conduit penetrations that require sealing around. There is significant silt build up around half way down this tunnel section.</p> <p>Sealing is required along the floor in sections.</p>	Yes
Smith St	Smith St is only a small section of tunnel and is in okay condition.	Yes
Lindsay St	I have found a leaking pipe that requires repairs. Significant root damage, and cracking to tunnel walls causing silt build up.	Yes
Lindsay St/ DZSS	This section of tunnel is the worst, mainly due to it being the lowest point. More cracks/ root ingress. Significant silt build up. Sump pumps do work but are continuously blocked. This section requires thorough cleaning and absolutely stinks. I dread working in the part of the tunnels. Climbing through the low section is very unpleasant. Please note there is another large pump here but I couldn't get to it without filling up my gum boots. There's also a few decommissioned cables that require removing.	Yes
McMinns St	Cracks, roots and silt build up. Unsealed penetrations.	Yes
Knuckey St	Not too bad. Very congested in sections. Penetrations require sealing.	Yes
Austin Lane	In good condition. Has a couple of penetrations that require sealing.	No
Bennett St	Spare decommissioned HV cable. Tunnel in okay condition.	Yes
Woods st/ FBSS	In okay condition. A few cracks here and there. Mild silt build up. Minor root damage.	Yes



Figure 3 Mitchell Street



Figure 4 Mitchell Street



Figure 5 Briggs Street



Figure 6 Briggs Street



Figure 7 Smith Street



Figure 8 Lindsay Street



Figure 9 Lindsay Street



Figure 10 Lindsay Street / DZSS



Figure 11 McMinns St



Figure 12 Knuckey St



Figure 13 Bennet St



Figure 14 Woods St / FBSS

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