# Cullen Bay and Bayview LV Cable Replacement (NMP2)

Regulatory Business Case (RBC) 2024-29

PowerWater

# Contents

# 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 rapidly deteriorating condition, and associated safety risks of the LV cable in the Cullen Bay and Bayview areas.**

## 1.1 Business need

Early deterioration of the LV cables in the Cullen Bay and Bayview areas due to water ingress has been identified. Investigations have found that the outer sheath of the cables are damaged in a manner consistent with poor installation techniques which has caused external damage and allowed water to enter into the cable. The water reacts with the internal materials and causes calcium adipate to form. The calcium adipate causes further damage to the cables by:

- Expanding within the cable and causing further damage to the sheath, allowing more water ingress.
- The expansion puts stress on the cable and degrades the insulation which can lead to failure.
- Expanding cable joints and lugs cause hot spots which will eventually lead to failure.
- The calcium adipate is also conductive when wet which poses an electric shock hazard to field crews who are undertaking works on the affected assets.

An additional issue identified is a deficient neutral earthing system installed in the Cullen Bay area. The earthing system is not built to the current standards and further elevates the level of safety risk to field crews through earth potential rises when disconnecting neutral cables as a part of work on the assets. This is further compounded by the high soil resistivity, which when taken together results in poor earthing and higher risk of electric shock.

Power and Water has a replacement program in place during the current regulatory period. We estimate that there will be 7.5km of LV cable in the suburbs of Cullen Bay and Bayview that requires remediation at the end of the current regulatory period.

## 1.2 Options analysis

The options considered to resolve this need are shown in Table 1.

*Table 1 Summary of credible options*

| Option No. | Option name | Description | Recommended |
|---|---|---|---|
| **1** | Replace on failure | Replace on failure (Counter factual). This option will involve reactive replacement of LV cable upon failure. | No |

| | | | |
|---|---|---|---|
| **2** | Proactive replacement program | Implement a program to replace the remaining **7.5km** of cable during the next regulatory period. | Yes |

As part of a holistic assessment, we considered non-network solutions, capex/opex trade-offs and retirement or derating, 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 recommended option is Option 2, a Proactive replacement program at an estimated cost of $4.5 million (real 2021/22) as the most prudent and cost efficient option to meet the identified need. The recommended option:

- Is aligned to our strategy and asset objectives.
- Continues the existing replacement program (NMP7).
- had the highest NPV, addressed the need and is found to be essential to manage the continued safe and reliable operation of the network.
- is aligned to customer expectations for maintaining the reliability and safety of the network.

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

*Table 2 Annual capital and operational expenditure ($'000, real FY22)*

| Item | FY25 | FY26 | FY27 | FY28 | FY29 | Total |
|---|---|---|---|---|---|---|
| **Capex** | 905 | 905 | 905 | 905 | 905 | 4,530 |
| **Opex** | | | | | | |
| **Total** | **905** | **905** | **905** | **905** | **905** | **4,530** |

# 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 suburbs of Cullen Bay and Bayview were established in the early 1990's. Both suburbs were developed by the same developer who used the same construction techniques and materials for installation of the LV distribution network. Investigations undertaken during 2016 and 2017 identified that the low voltage cables in the Cullen Bay and Bayview areas were in particularly poor condition with consistent sheath and insulation deterioration. The damage is consistent with poor installation techniques that damaged the outer sheath.

The poor cable insulation condition has accelerated moisture ingress and the incidental development of calcium adipate leading to accelerated cable insulation and cable termination degradation. The level of deterioration of such a large proportion of cables is unprecedented based on their age and is considered a type issue unique to the cable installed.

The LV neutral earthing system in Cullen Bay is also compromised. The LV neutral conductor connection between a substation and the network being supplied is one of the fundamental components of the TN-C-S (Australia's MEN) network configuration as described by AS/NZS 3000. As such, an LV neutral conductor is reticulated to all locations of the supplied LV network (Protective Earth and Neutral, PEN). Throughout Australian utilities, this is generally achieved through the installation of a neutral conductor with each LV circuit leaving a substation. This is to ensure redundancy and interconnectivity of the Multiple Earthed Neural (MEN) system. This is not the case in Cullen Bay.

In Cullen Bay Neutral conductors are "shared" creating many single points of failure as explained in Figure 1.

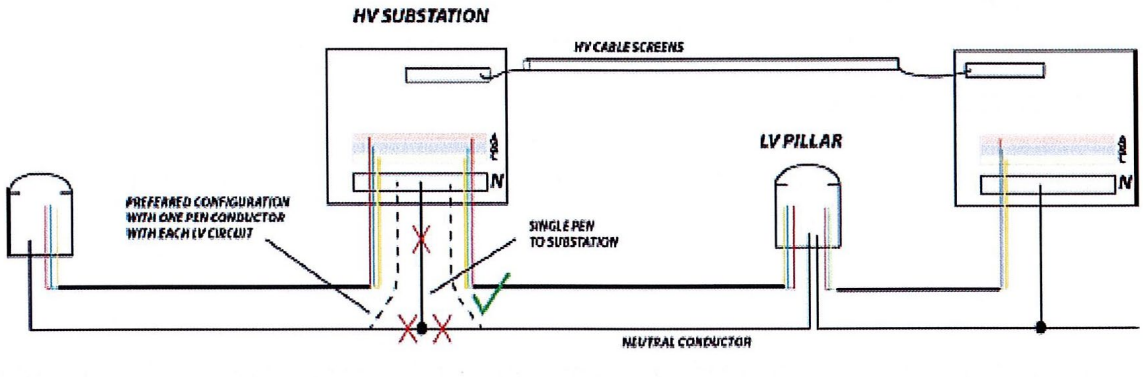


*Figure 1 Cullen Bay Neutral Configuration and Single Points of Failure*

In addition to the current asset replacement program, we undertake frequent testing of neutral integrity, frequent inspections of the area for civil works and additional earthing.

## 2.2 Asset population

Power and Water has a population of 706 kms of LV cable across its network. LV cables are typically not a managed asset, where planned replacement projects are only initiated in response to an identified 'type' issue or fault.

Of the total, there is 15.7km of XLPE/PVC cable located in the Cullen Bay and Bayview distribution areas. The majority of these cables were installed in the 1990's when the suburbs were first created, but a portion of the cables have been installed more recently as the suburbs have expanded and do not suffer the same type and installation issues.

Asset data and 'As Built' drawings have been reviewed to assess the location of the cables, cable lengths and cable types to determine the cables that are likely to be subject to the identified type issue. Only cables that are greater than 20 years old and have a length of greater than 2 metres are included[1]. We have identified approximately 11.4 km of the existing 15.7km of LV cable as having the type issue. This is the focus of this business case.

Table 3 shows the location, type and length of cables in the affected areas as well as the lengths that are expected to be affected, identified in 2017.

*Table 3 Overview of asset population*

| Suburb | Cable type | Average age (years) | Volume (km) | Affected volume (km) | Affected volume (per cent) |
|---|---|---|---|---|---|
| **Cullen Bay** | LV XLPE/PVC | 25.2 | 6.9 | 5.9 | 85% |
| **Bayview** | LV XLPE/PVC | 23.8 | 8.8 | 5.5 | 63% |
| **Total** | | **24.5** | **15.7** | **11.4** | **72%** |

The location of these assets on the network is shown in Figure 2 and Figure 3. The geographical areas are small, however, access to the cables is complicated due to other underground services (that were built in close proximity to each other with the cables direct buried) and assets (such as footpaths) that have been built over the top of the cables since installation.

[1] Short sections of cable are used for bus connections within RMUs that are not affected by this type issue and have been excluded from the analysis.

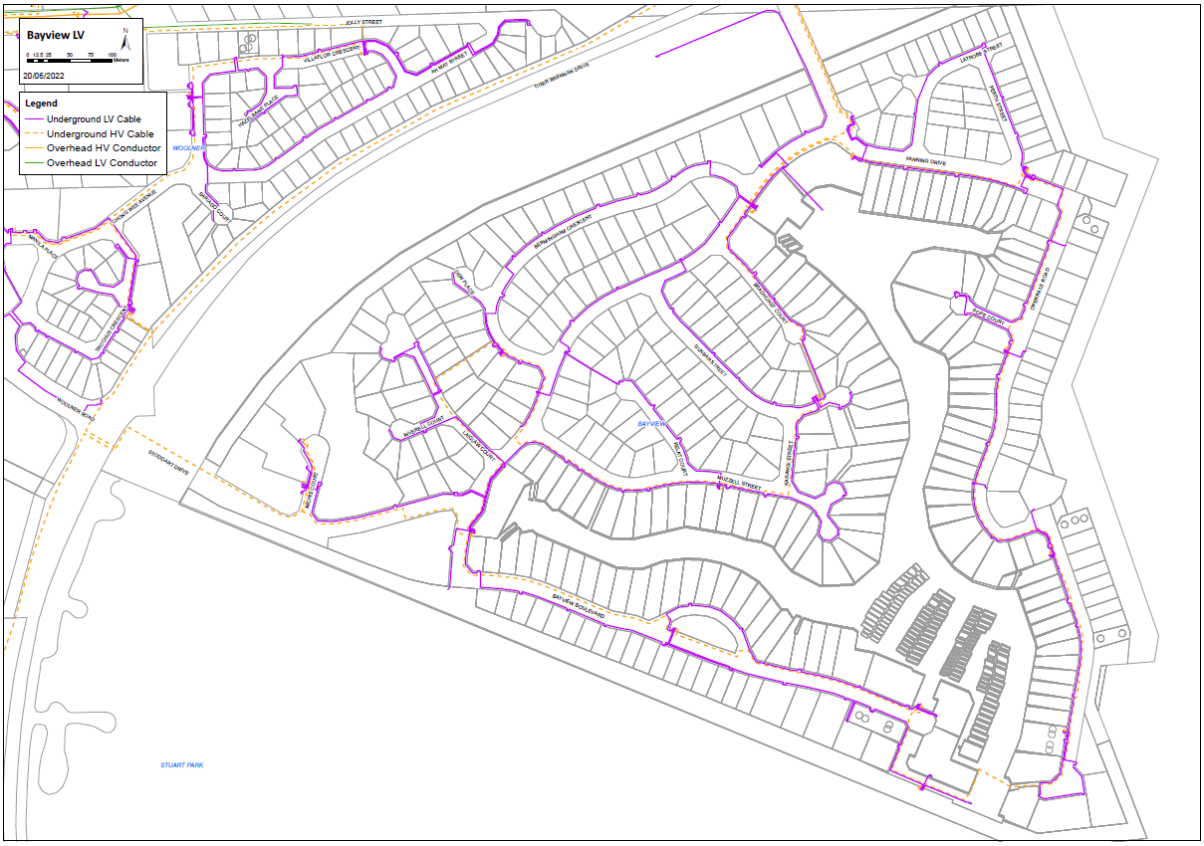


*Figure 2 Bayview area*

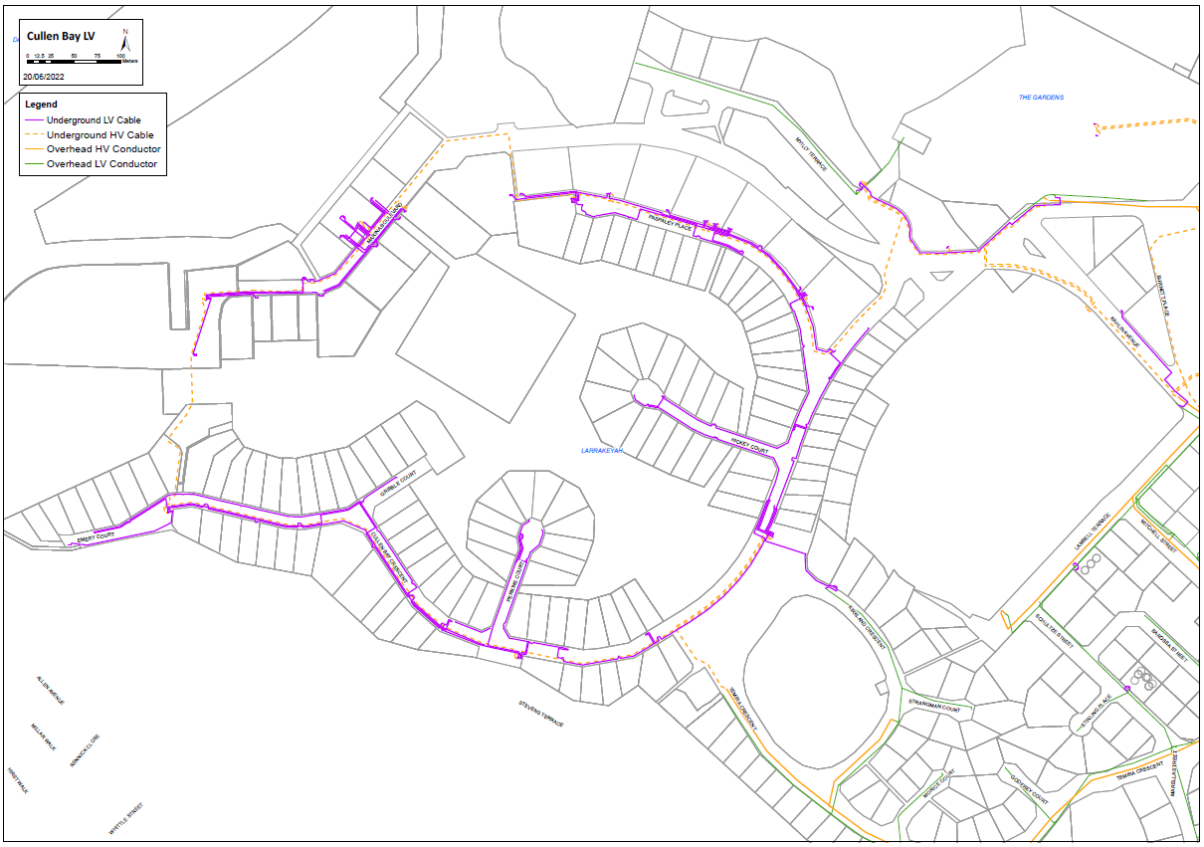


*Figure 3 Cullen Bay area*

## 2.3 Asset condition and construction issues

Table 4 describes each of the cable deterioration modes and the hazard that they present.

*Table 4 Cable deterioration and the hazards they present*

| Risk factor | Description of hazards |
|---|---|
| **Calcium Adipate** | Calcium adipate is produced when water reacts with certain compounds or "fillers" in the cable insulation[2]. Issues caused by calcium adipate include:<br>• The adipate expands inside the cable and places high physical stress on the cable insulation, resulting in localised insulation and sheath cracking and swelling.<br>• The adipate enters cable lugs, expanding the lug and causing high resistance joints, these are undetectable on neutrals. On phases these cause hot spots and eventually result in failure of the joint.<br>• It is conductive when wet placing personnel at risk when working on pillars or fault finding.<br>• A safety alert was issued by Ausgrid in 2015 describing the same issue. The issue affects cables that were produced prior to 1995.<br>Examples are shown in Figure 4 below.<br>  <br>*Figure 4 Examples of Calcium Adipate in Pillars (left) and Substations (right)* |
| **Sheath Degradation** | Cables excavated for failure replacement or other works have consistent damage to the outer sheath. The damage allows water into the cable which then reacts with the cable insulation fillers to produce calcium adipate and also reduces insulation performance. |

[2] 02012/63469 20120208 Energy Aus - Cable white powder issue report Calcium Adipate

| | |
|---|---|
| **Insulation Resistance** | Insulation Resistance (IR) of 50% of cables sampled was very low, with a high proportion below 1 MΩ which is considered a critical limit based on AS/NZS 3000:2008 Wiring Rules. Of six Australian utilities sampled, none have acceptance criteria below 1 MΩ for LV cables[3].<br>While functional failures have not yet increased, it is expected that any failure will be extremely difficult to locate due to the volume of cables that will have very low IR values. As LV cables do not have an earth screen, it is common for faulted LV cables to still have high measured insulation values. |
| **Neutral Arrangement** | Common design practice for LV networks is to have a neutral conductor run with every LV circuit to ensure a robust return path to manage phase balance and provide a direct fault return path in addition to earthing for reliable protection operation.<br>In Cullen Bay (not Bayview) this is not the case and most LV circuits do not have a dedicated neutral. Instead, neutrals have been installed in essentially a separate network which tees off to individual pillars, refer to Figure 1.<br>This practice is highly susceptible to failure of individual neutral conductors which are generally undetectable and relies heavily on the earthing system for fault return path and control of hazardous voltages on downstream neutrals and interconnected equipment during LV faults.<br>Performing work on the network is hazardous. Maintainers are unable to determine if a neutral being disconnected for repair or otherwise will create a break in the neutral network. In this scenario hazardous voltages can be created at the point of disconnection placing the maintainer at risk, and protection systems may be compromised as described above. |
| **Earthing Arrangement** | Common practice in the NT is to run earth cables with LV circuits as very high soil resistivity reduces the effectiveness of earthing at pillars, without installing significant earthing infrastructure at each pillar.<br>This design practice was not applied at Cullen Bay, instead local pillar earthing is applied using two 2m deep earth stakes at each pillar. This is not adequate based on the measured high soil resistivity in the area. |
| **High Soil Resistivity** | Soil resistivity testing in Cullen Bay shows a soil resistivity of 30000 to a depth of 4m, rendering the earthing rods installed ineffective.<br>Protection in the LV network does not have an effective return path in the event of a broken neutral which is not detectable when |

[3] D2017/369295 LV Cable Maintenance Specification Background

| | |
|---|---|
| | performing maintenance activities requiring disconnection of neutrals. |

## 2.4 Current and historical mitigation programs

A program of works was developed to manage the risk posed by these LV cables and the expenditure was approved by the AER in the 2019-24 regulatory determination. The determination allowed for the replacement of 7 km of cable for a total cost of $1.8 million (real 2021/22) over the five year period.

However, in 2020 the implementation of the program was delayed:

- The COVID19 pandemic impacted the business and its ability to obtain appropriate expertise from interstate to continue with testing and project development. This impacted the dry season which is the period where the majority of construction takes place.
- The approach to deliver the program aimed to be efficient through only engaging contractors once a cable was tested and confirmed to be at end of life. However, this resulted in multiple small packages of work being issued, increasing the time required for preparing packages of work and going through the market tendering process, therefore delaying the project.

During 2021 a concerted effort was made to improve the delivery approach that will benefit both efficiency of expenditure as well as speed of delivery.

The change has included packaging the work into larger scopes to obtain economies of scale from the civil contractor(s). The approach to contracting has also changed from a contract per cable to a period contract to secure the services of the contractor(s):

- Power and Water has awarded contracts to three civil contractors who will provide between three and five crews for eight months to focus on the portfolio of cable replacement programs.
- Power and Water will establish a further contract to provide up to seven crews for the civil components of all underground works (including the government funded Underground Power Program, Northern Suburbs HV cable replacement and this program).

This approach will ensure certainty of capacity to deliver and the competitive market process will facilitate an efficient unit rate.

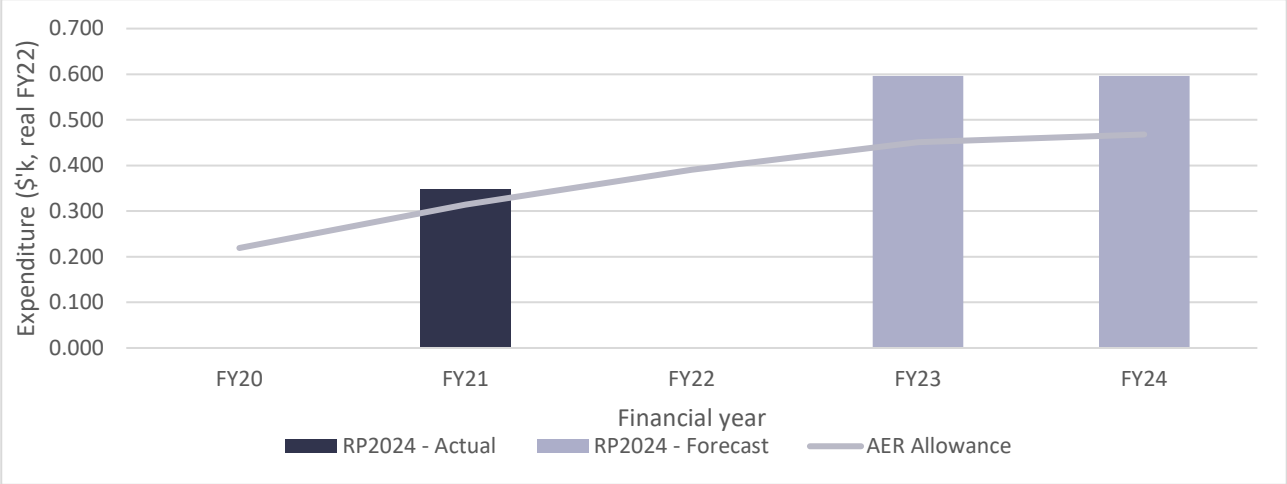


Figure 5 shows the actual historical volumes and costs (adjusted to real 2021/22 dollars) that have been implemented and the projected volumes and expenditure to the end of the current regulatory period. The step increase evident in 2022/23 is the direct result of the new contracting arrangement enabling rapid replacement, and following completion of the procurement processes.

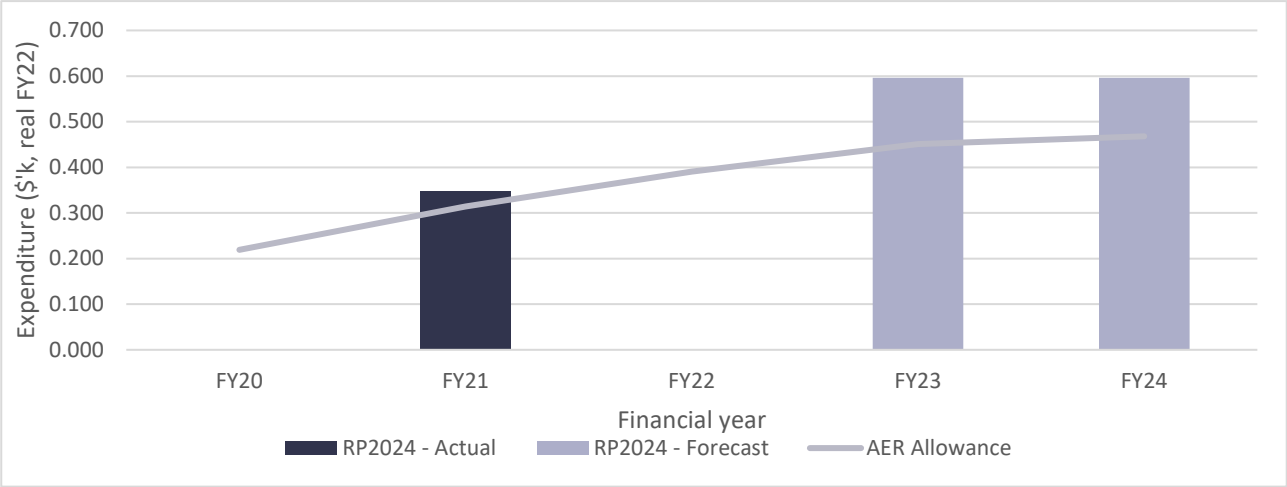


*Figure 5 Expenditure on the Cullen Bay and Bayview LV cables*

By the end of this regulatory period, Power and Water expects to have replaced 4km. The total cost to achieve this will be $2.2 million (real 2021/22) being 121% of the original forecast expenditure. The focus of the current regulatory period is primarily on the Cullen Bay area to rectify the deficient earthing arrangement. Following Cullen Bay, the program will continue with Bayview.

The changed timing of the project due to COVID and the changed contracting approach has resulted in an increased unit rate due to external drivers, predominately the impact of COVID on global supply chains and the expected impact of the Ukraine war on fuel and polymer materials and the resulting inflation in costs.

*Table 5 Actual and estimated LV cable replacement volumes (km)*

| | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | Total |
|---|---|---|---|---|---|---|
| **Original forecast** | 1.8 | 1.6 | 1.4 | 1.2 | 1.0 | 7.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Actual / estimate** | **0** | **0.8** | **0** | **1.6** | **1.6** | **4.0** |

At the end of the current regulatory period, we expect to have a total of 7.4km of the LV cable identified with the type issue remaining.

## 2.5 Consequence of failure

There are three key consequences of cable failure that are aligned to the Risk Quantification Procedure. These are:

**Health and Safety**

The unpredictable operational conditions resulting from neutral sharing applied in the Cullen Bay and Bayview distribution areas poses a safety risk to the public as well as PWC employees involved in undertaking works on and in the vicinity of the assets and fittings.

The accelerated deterioration of cables increases the risk of failure as cables reach end-of-serviceable life well before expected service life. Replacement of the LV cables and coincident refurbishment of the earthing and neutral system addresses the public and worker safety risk.

Fortunately, there have not yet been any reported incidents of electrocution or shock as a result of cable failure.

**Service delivery**

The deterioration in cables and associated replacement works have not impacted reliability to date. It is expected that the rapid deterioration of the cables will lead to an unpredictable increase in reliability impact at some stage. As the condition of the cables is very poor, when unplanned failures do occur it is likely that they will be extremely difficult to locate using traditional methods, leading to extended outages for customers in these areas.

**Compliance**

A fundamental business driver for PWC is compliance with the relevant Health and Safety Legislation, the Network Technical Code and Network Planning Criteria objective of providing safe, secure, reliable, high quality power supply at a minimal cost.

This is consistent with the principles of the Risk Quantification Procedure, and while there are legislated penalties for non-compliance, we have considered compliance in a qualitative manner. The relevant Legislation, Regulation and Codes include:

- Electricity Reform Act 2000
- Network Licence (varied 15 May 2020)
- National Electricity (NT) Rules (NT NER)
- Network Technical Code and Network Planning Criteria (Network Technical Code)
- System Control Technical Code

The Network Licence Clause 10 requires Power and Water to comply with all applicable provisions of the System Control Technical Code and the Network Technical Code.

The Electricity Reform Act 2000 Clause 31 provides a maximum penalty of 2,500 penalty units for contravening the licence conditions. A penalty unit is worth $157 in FY224, providing a maximum penalty of $392,500 per contravention.

[4] https://justice.nt.gov.au/attorney-general-and-justice/units-and-amounts/penalty-units

## 2.6 Risk assessment

The risk posed by this cable fleet due to the identified type issue has been quantified by applying Power Services Risk Quantification Procedure[5]. This procedure was developed based on good industry practice and take into account recent guidelines and determinations made by the AER, AS ISO 31000 Risk Management, and other professional publications.

The assessment has been undertaken based on the counterfactual case, that is, on the basis that Power Services does not undertake any specific measures to address the risk and only addresses faults reactively. Figure 6 below shows the increasing level of risk that would be incurred by Power Services in the absences of any mitigating actions.

The dominant components are the economic impacts of outages, calculated based on the Value of Customer Reliability (VCR). While the consequences of health impacts are significant, the probability of them materialising is very low and we have no historical data to use, so we have relied on the probabilities suggested by Ofgem as documented in our Risk Quantification Procedure.

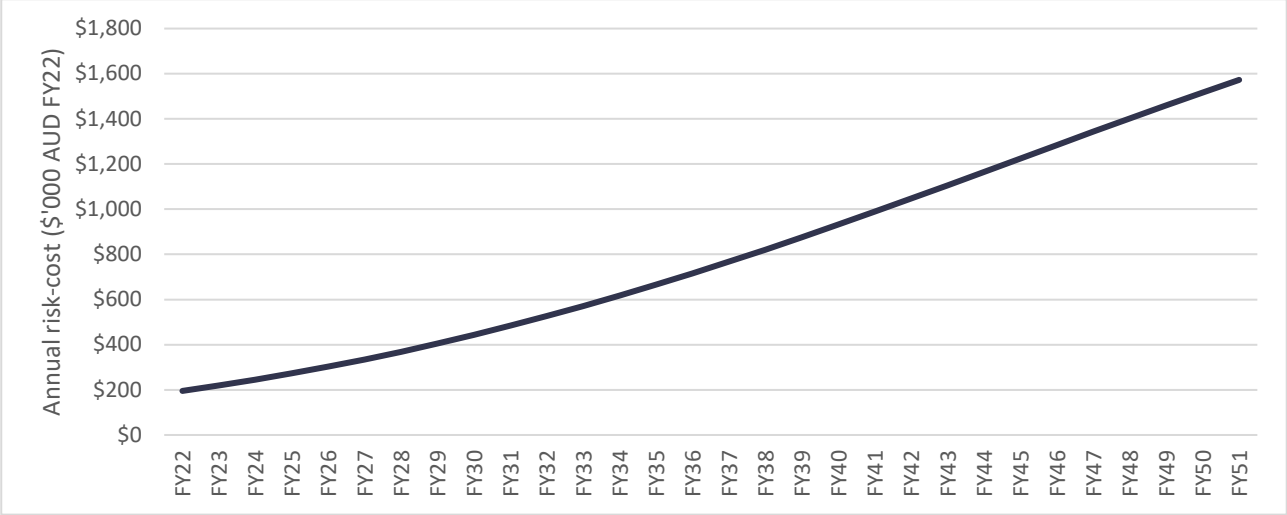


*Figure 6 Current risk with base case scenario*

The risk assessment demonstrates that there is an increasing risk, that across the fleet of assets, is likely to materialise. The reduction in risk that is achieved by different credible mitigation options, along with the cost of the option and any other direct financial cost savings, is used to identify the preferred option in section 3.

## 2.7 Summary

Power and Water has a population of LV cables that are rapidly deteriorating, and as a consequent In the Cullen Bay and Bayview areas, investigations have found that the outer sheath of the LV cables are damaged in a manner consistent with poor installation techniques which has caused external damage and allowed water to enter into the cable. The water reacts with the internal materials and causes calcium adipate to form. The calcium adipate causes further damage to the cables by:

[5] CONTROL0932 - PWC Risk Quantification Procedure RevB4

- Further damaging the cable insulation.
- Expanding cable joints and lugs which causes hot spots and will eventually lead to failure.
- Elevating the risk of electric shock to field crews as calcium adipate is conductive when wet.

In addition to cable degradation, the neutral earthing system in Cullen Bay is inadequate and elevates risk to field crew through potential rises when disconnecting neutral cables to work on the assets. This is compounded by the high soil resistivity that results in poor earthing.

The type issue causing degradation of the cable and terminations as well as the non-compliance method of installation mean that these cables are considered to be at the end of their functional life.

Power and Water has a replacement program in place during the current regulatory period. We estimate that there will be 7.4km of LV cable in the suburbs of Cullen Bay and Bayview that requires remediation at the end of the current regulatory period.

Section 3 discusses the options identified to resolve these issues.

# 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, prudency 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

Power and Water has identified the following two credible options to address the need detailed in the previous section. Credible options are identified by the AER as options that address the identified need, are technically feasible and can be implemented within the required timeframe.

- Option 1 – Replace on failure. This option would involve continuing to repair or replace services upon failure.
- Option 2 – Targeted proactive replacement. This option proposes to continue the existing program to replace the at risk LV of the cables and correction of the earthing and neutral systems to maintain system safety and reliability in a prudent and cost efficient manner.

A comparison of the two identified credible options and the issues they address in the identified need is depicted in the table below. A detailed discussion of each option is provided below.

*Table 6 Summary of options analysis outcomes*

| Assessment metrics | Option 1 | Option 2 |
|---|---|---|
| **NPV ($'000, real FY22)** | - | 3,461 |
| **BCR** | - | 1.83 |
| **Capex ($'000, real FY22)** | - | 4,530 |
| **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

### 3.1.1 Option 1 – Replace on failure (Base case)

Run to failure involves the reactive maintenance and repair of assets. It is characterised by increasing operations and maintenance costs, adverse system performance impacts, and unacceptable public and worker safety risk associated with the continued degradation of the assets.

Failure of the LV cables in these areas creates the conditions to realise the hazards outlined in Section 2. Namely, identification of failure location is very difficult given there are currently limited options for remote access or measurement of cables that have failed. Direct access to the cables is complicated due to other underground services (that were built in close proximity to each other with the cables direct buried) and assets (such as footpaths) that have been built over the top of the cables since installation.

To utilise this approach would result in a significant overspend of labour and capital while also likely resulting in greater outage durations and frequencies, compared to a more proactive and targeted replacement approach.

Figure 7 shows the risk profile outcome from applying our Risk Quantification Procedure. This option was assessed to result in the highest risk cost of the three options, indicating the worst network performance.

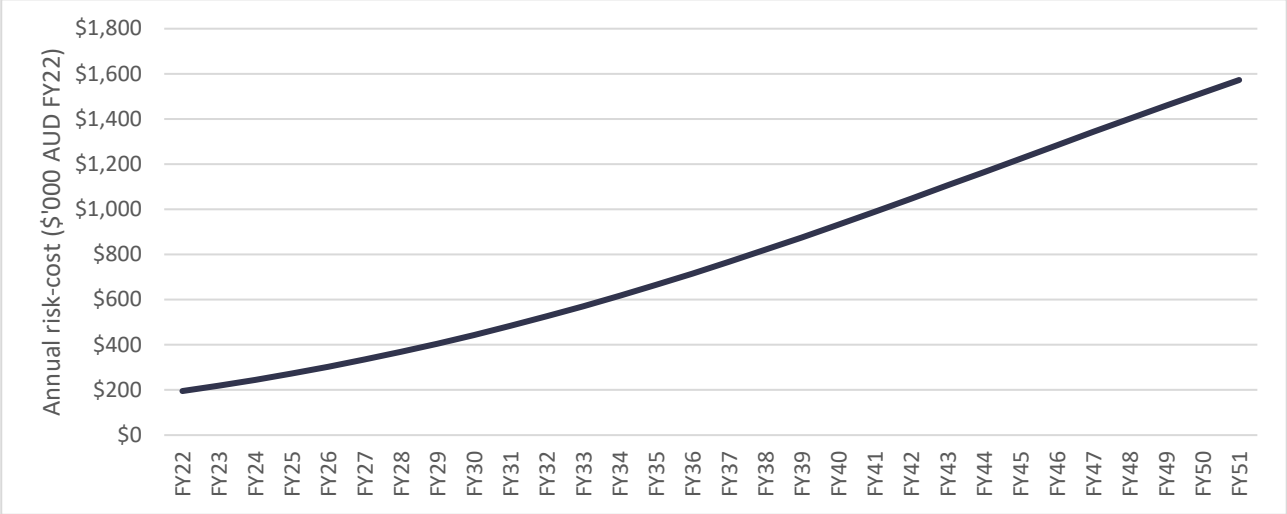


*Figure 7 Risk profile achieved through Option 1*

Based on the outcome of investigations to date and the hazards associated with continued operation of the network, this is not aligned with Power and Water's business objective for operating a safe and reliable network.

Therefore, this option is not recommended.

### 3.1.2 Option 2 – Targeted proactive replacement and refurbishment (current practice)

This option proposed to undertake targeted proactive replacement of the cables and correction of the earthing and neutral systems to maintain system safety and reliability in a prudent and cost efficient manner. It relies on a risk based prioritisation of cables taking into consideration asset health and criticality to inform a replacement program.

This option requires $4.5 million (real 2021/22) to replace an additional 7.4km of remaining LV cable with the preferred timing to be between July 2024 and June 2029 (2024-29 regulatory period). It has a Net Present Value of $3.5 million (real 2021/22) and BCR of 1.83.

The program considers asset criticality, health, and probability of failure to prioritise the cables that poses the higher risk. Criticality has been determined to be homogenous across the network, given

the small size of the networks and the similarity in customer composition. The severity of calcium adipate deposit provides an indication of asset health.

This approach has the following benefits:

- This is a continuation of the current replacement program (NMP2) that replaces cables once they have failed testing.
- It addresses the underlying need which is the large volume of cable that is known to be in poor condition and at end of their serviceable life.
- It will contribute towards achieving the Asset Objectives of maintaining reliability and safety of the network. As the fleet of cables is removed from the network, reliability and safety will be improved.
- Developing a pipeline of cable replacement will promote efficiency by enabling a longer term, market based contract
- Replacement based on testing will ensure cables are at end of life before being replaced, therefore maximising asset serviceable life.
- Reduced cost to customers by undertaking the replacement over a longer timeframe (reduces the present value of the capex).
- The approach is consistent with customer feedback to ensure network reliability and safety.

Figure 7 shows the risk profile outcome from applying our Risk Quantification Procedure. This option was assessed to result in the highest risk cost of the three options, indicating the worst network performance.

The risk-cost outcomes for this approach, based on continuing the current program, have been determined through the Risk Quantification Procedure, shown in Figure 8.

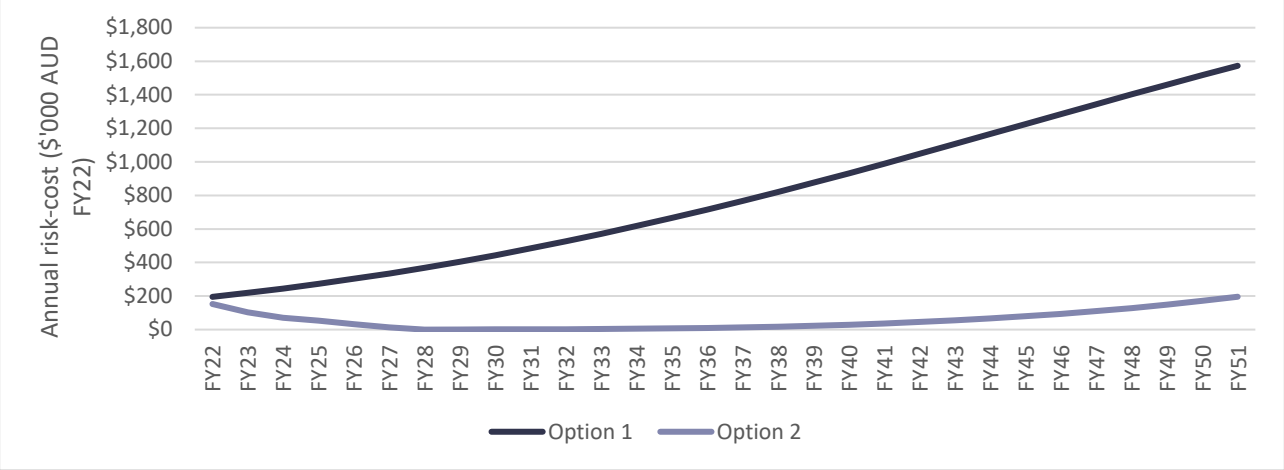


*Figure 8 Risk profile achieved through Option 2*

We undertook sensitivity analysis, by deferring the program of works by 5 and 10 years and compared that with Option 2.

The modelling assumed the works would be carried out across a five year period (at 1.5 km per year). The outcome was that continuing the current program has the highest benefit, as shown in Figure 8.

*Table 7 Results of deferral scenario modelling*

| Start date | Net Present Value ($'000, FY22) | Risk mitigated ($'000, real FY22) | BCR |
|---|---|---|---|
| **FY25** | $3,460 | $7,611 | 1.83 |
| **FY30** | $1,567 | $5,369 | 1.41 |
| **FY35** | $531 | $4,013 | 1.15 |

This option results in the most credible and prudent outcomes for customers, addressing risk outcomes at costs consistent with ALARP principles. 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 Replace all cables in one year – does not provide the optimum risk outcome from a whole of network perspective

This would require replacing 7.5km of cable in one year. To achieve the volume of replacement, the work on the Northern Suburbs cables would need to be reduced. Hence, the risk on the HV network which has been assessed to be higher would not be managed.

This option would therefore be trading off an increase in replacement in an asset with a relatively lower level of risk for a decrease in replacement of an asset with a relatively higher level of risk. This is not a prudent approach.

### 3.2.2 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 are required for safe and reliable distribution of the electricity network. However, each option will assess where an individual cable can be retired or the topology can be changed to ensure prudency and efficiency of the option.

### 3.2.3 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 with like for like (modern equivalent) assets. When a cable is identified for replacement, Power Services undertakes an assessment of whether the size or connection points can be changed to reduce cost or to meet future demand most efficiently.

### 3.2.4 Capex/Opex Substitution – does not address the need

Since the driver of this investment is significant deterioration across a fleet of assets caused by the same design deficiency, it is not feasible to substitute capital expenditure with operational expenditure to resolve the risk. Only capital expenditure to replace part or all of the cable will resolve the underlying issues.

# 4. Recommendation

The recommended option is Option 2 - Proactive replacement and repair of 74 of LV cable at an estimated cost of $4.5 million (real 2021/22) to meet the identified need.

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.

The program will address safety, compliance with the Network Technical Code and the Network Planning Criteria objective of providing safe, secure, reliable, high quality power supply at minimal cost.

The recommended option:

- Is aligned to our strategy and asset objectives.
- Continues the existing replacement program (NMP7).
- had the highest NPV, addressed the need and is found to be essential to manage the continued safe and reliable operation of the network.
- is aligned to customer expectations for maintaining the reliability and safety of the network.

## 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 8 Strategic alignment*

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

## 4.2 Dependent projects

There are no known projects or other network issues that are dependent on the resolution of this network issue and this issue is not dependant on the completion of any other projects.

## 4.3 Deliverability

Delivery will use the new method of engaging external civil contractors on a long term market tested contract, with the electrical works completed by Power Services. This approach to contracting will result in a more efficient delivery as it reduces the procurement effort and provides certainty to contractors, allowing economies of scale. This approach will also ensure there are known quantities of cables requiring replacement and will provide a visible pipeline for contractors.

Power and Water has secured the long term services of a civil contractors and has the internal resources to complete the electrical connection works. Hence, this program of works is considered to be deliverable at the proposed rate given the Northern Suburbs Cable Replacement program that will be running concurrently.

## 4.4 Customer considerations

As required by the AER's Better Resets Handbook[6], in developing this program Power Services has taken into consideration feedback from its customers.

Feedback received through customer consultation undertaken at the time of writing this RBC, has demonstrated strong support amongst the community for appropriate expenditure to enable long term maintenance of the network to ensure continued reliability and safety of supply[7].

## 4.5 Expenditure profile

The proposed approach has been implemented by Power Services since the type issue was first identified in 2017.

This RBC is requesting approval for $4.53M (real FY22) to replace the remaining 7.4km of LV cable in Cullen Bay and Bayview between July 2024 and June 2029 (Regulatory Period 2024-29).

Table 9 show a summary of the expenditure requirements for Regulatory Period 2025-29 and financial evaluation metrics, respectively.

*Table 9 Annual capital and operational expenditure ($'000, real FY22)*

| | FY25 | FY26 | FY27 | FY28 | FY29 | Total |
|---|---|---|---|---|---|---|
| **Capex** | 905 | 905 | 905 | 905 | 905 | 4,530 |
| **Opex** | | | | | | |
| **Total** | **905** | **905** | **905** | **905** | **905** | **4,530** |

## 4.6 High-level scope

The scope for this project is to replace 7.4km of LV cable from FY2025 to FY2029 that have been identified to be in poor condition and ranked based on risk cost to prioritise them.

The identified priority may change during implementation due to other factors such as changes to load, faults experienced, or other related works being undertaken on or around the asset that could result in efficiency savings.

*Table 10 Proposed replacement volume for 2024-29 regulatory period (km)*

| | 2024-25 | 2025-26 | 2026-27 | 2027-28 | 2028-29 | TOTAL |
|---|---|---|---|---|---|---|
| **TOTAL** | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | **7.4** |

[6] Better Resets Handbook – Towards Customer Centric Network Proposals, Australian Energy Regulator, Dec 2021
[7] Darwin Peoples Panel forum, 2 and 3 April 2022

# Appendix A. Cost estimation

The unit rates applied in this model are based on analysis of actual historical replacements as assessed by RIN category. These unit rates have been compared to peer DNSPs based on publicly available data from the Category Analysis RIN for the year 2018 to 2021, inclusive.

Refer to the Cost estimation methodology and approach document[8] for more details.

[8] TRIM reference D2022/474750

# Appendix B. Key assumptions

It is assumed 25% of the affected Cullen Bay LV cable and all of Bayview will be addressed in the 2024-29 regulatory period.

It is assumed unit costs will remain the same for each of the years included in the forecast.

A number of specific assumptions were applied to the risk quantification. As review and identification of assets has shown degradation far in advance of the specified serviceable asset life, a lower than standard life estimate was applied. Using a weighted average approach to the asset profile and the majority of cables that require replacement resulted in a serviceable end of life of 28 years. We observe that this is not largely dissimilar to the end of life (EOL) for service cables used by other distribution providers with adjustments reflecting the observed condition of the assets.

A probability of disruptive failure at EOL has been estimated at 100% given the lack of redundancy in the LV network. It was assumed the entirety of the cable would be replaced on failure, with an average cable length at 0.6 m used.

The public safety multiplication factor of two was applied. The data from Ofgem that sets the probability of a safety consequence is based on a network average, so given the nature of the type issue and challenges with earthing and proximity to households, there is an elevated risk of a safety impact due to these specific assets. We consider this estimate is at the low end of a reasonable range.

Energy Not Served (ENS) values have been applied from an average network ENS value for LV cables, as there is insufficient data to calculate specific values for Bayview and Cullen Bay.

Power and Water Corporation

55 Mitchell Street, Darwin NT 0800

Phone 1800 245 092

powerwater.com.au