Alice Springs corroded poles replacement (NMP22)

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 condition and unassisted failure of Power and Water's steel poles in the Alice Springs area.

1.1 Business need

Power and Water has experienced an increase in unassisted failures of its steel poles. The investigation following an unassisted[1] failure of a steel power pole in Alice Springs in January 2015 raised concerns over the fleet of pole assets in the Alice Springs area. The investigation revealed that the pole failed to due to corrosion of the pole footing. The pole had been in service for approximately 40 years before it failed, which is considerably less than the expected service life for steel poles of 60 years.

In response, Power and Water conducted a broader investigation into the condition of pole footings for poles of similar design in the Alice Springs region. This investigation found that the design, installation practices and soil conditions was leading to accelerated corrosion of the steel below ground. Left unmanaged, this was likely to lead to an increase in unassisted pole failures in the Alice Springs area.

A pole remediation program was initiated in 2019 to replace the pole footing of corroded poles and has so far addressed approximately 570 poles. There are approximately 2,440 poles remaining in high corrosion locations which need to be assessed.

Analysis of the results from the existing program has identified that approximately 47% of poles located in the corrosive soil areas have had advanced levels of corrosion and required replacement of the pole.

The risk posed by these poles predominately impacts network safety and reliability as a pole failure is highly likely to result in high voltage conductors falling to the ground or hanging low. The impacts may include:

- Reduced clearances of HV and LV conductors as a result of pole failure (or leaning) may create hazardous conditions to members of the public that may result in injury or death.
- For failed poles resulting in HV conductors falling to the ground, protection will operate to de-energise the conductor to make the network safe, resulting in an outage to customers and emergency repair. Whilst it is expected that the electricity network is safe, the hazard created by the failed pole remains. For LV conductors, there is a higher probability that the fault currents will not be high enough to cause protection devices to operate, resulting in the LV conductor and possibly the pole being energised. This results in hazardous conditions to members of the public that may lead to injury or death.

[1] Unassisted means that the pole failed without and external forces applied such as a car or storm, indicating that it was a condition based failure.

Since the high salinity soils are located in urban areas, the likelihood of the public being in close proximity to a pole when it fails is elevated.

1.2 Options analysis

To address the identified need, a range of options were identified and assessed. Four credible options were identified as 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 would involve only replacing the poles upon failure.	No
2	Targeted (risk based) replacement	Targeted test and replace program. Inspects all poles within the high-risk areas identified through the analytics. Only addresses the corroded poles based on inspection results. This option aims to manage risk.	Yes
3	Replace all poles in high risk areas	Proactive replacement programme. Replacement (or rebutting) of the entire fleet of poles within the high-risk areas identified through the analytics and inspection programme. Using a street-by-street schedule/approach, this option aims to remove all risk from the network and achieve efficiencies from the systematic approach.	No
4	Inspect then replace	Inspection based replacement. Inspects all poles in Alice Springs and only replaces if found to be corroded.	No

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 was compared to Option 1 (the counterfactual case) and the improvement in network risk was used as the benefit achieved by the option.

1.3 Recommendation

The recommended option is Option 2 Targeted (risk based) replacement at an estimated cost of $9.1 million (real 2021/22), for the scope of work to be completed within the 2024-29 regulatory period (between July 2024 and June 2029), to be most prudent and cost effective to meet the identified need.

The recommended option:

- is aligned to our strategy and asset objectives.
- is deliverable based on experience from the current program, and
- is aligned to customer expectations for maintaining the reliability and safety of the network.

The scope of this option is expected to involve the treatment of 900 poles in the high risk area across the 2024-29 regulatory period.

This approach has been implemented by Power Water since the corrosion issue was first identified. Up to June 2021, $5.9 million (real 2021/22) has been spent to replace or rebut approximately 600 poles. The start up phase also included the design and testing of the pole support device that enables in-situ pole rebutting. The forecast for the next regulatory period includes a higher average unit rate to account for more poles with attachments and complex poles.

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

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

Item	FY25	FY26	FY27	FY28	FY29	Total
Capex	1,814	1,814	1,814	1,814	1,814	9,068
Opex	-	-	-	-	-	-
Total	**1,814**	**1,814**	**1,814**	**1,814**	**1,814**	**9,068**

2. Identified need

This section provides the background and context to this business case, identifies the issues that are posing increasing risks of obsolescence and non-compliant protection relays 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 Background

The unassisted[2] failure of a steel power pole due to corrosion of the pole footing in Alice Springs in January 2015 caused concern regarding the condition of pole assets in the Alice Springs area. The pole had been in service for approximately 40 years before it failed, which is considerably less than the expected service life for steel poles of 60 years and the average life in the NEM of 53 years.

Figure 1 Undoolya Rd Pole Failure 10/01/2015 Due to Footing Corrosion

An investigation into the condition of pole footings for poles of similar design in the Alice Springs region found that the design and soil conditions accelerated corrosion of the steel below ground.

2.2 Asset profile

All distribution poles in the NT are steel due to the prevalence of termites and annual bushfires which affect much of the NT. Steel poles in the Alice Springs region have been installed as:

- direct buried where the steel pole is placed directly in the ground with no concrete protection
- 'top and toe' construction meaning it has a footing with a concrete collar around the pole at the ground level (top) and at the bottom of the hole (toe), or
- concrete encased where pole has been installed with concrete encasing the entire section of the pole that is in the ground.
- Our assessments in Alice Springs have found that poles were often placed into the hole and slightly embedded into the ground prior to the concrete being poured, resulting in a section of the pole being

[2] Unassisted means that the pole failed without and external forces applied such as a car or storm, indicating that it was a condition based failure.

exposed. This has enabled corrosion to progress up the pole and still cause deterioration and loss of strength.

- Modern practice is to ensure the footing is fully covered to prevent moisture ingress. A new installation standard specifying the new requirements was published and implemented in 2016.

Typically, concrete was only used based on the required pole moment (tip load) and to prevent corrosion at the pole-ground interface of the footing. The type and method of concrete installation used in the 1970's did not prevent moisture ingress like modern materials.

At the time of writing this business case there are 6,378 steel poles[3] in the Alice Springs area, as shown in Table 3.

Table 3 Population of all steel polies in Alice Springs by function and zone

Function	Rural	Urban	Unclassified	Total
Service Pole	613	336	18	967
LV Pole	739	529	7	1,275
HV Pole	3,227	692	-	3,919
Transmission Pole	-	-	217	217
Grand Total	**4,579**	**1,557**	**242**	**6,378**

The asset age profile for the poles, now and projected forward to 2029 without any investment, is shown in Figure 2. The bulk of these were installed during the early development of Alice Springs Township, where the population grew rapidly from approximately 7,800 in 1971 to 18,400 in 1981[4]. The population growth was concentrated in the areas of Gillen, The Gap and Eastside.

The asset population has been steadily increasing over time, with a sharp increase in the 1970's comprising over 33% of the population of poles, reflecting the population growth, as shown in Figure 2.

[3] Excluding transmission poles

[4] http://population.city/australia/alice-springs/

Figure 2 Asset age profile (years) – ASP steel distribution poles in high salinity areas

2.3 Historical and current management strategy

Once the failure modes and causes were identified, Power and Water established a replacement program to address poles considered at high risk of failure in response to the presentation of accelerated corrosion in high salinity areas. Based on testing and inspection, Power and Water replaced 163 distribution poles between 2015 and 2019 due to corrosion.

2.3.1 Initial unassisted failure investigation findings

An investigation was established to determine the root cause of the pole failure in 2015. It identified High Salinity Areas (HSA) around Alice Springs and that the increased levels of soil salinity was a significant contributing factor of the accelerated corrosion, indicating an elevated risk posed by this asset fleet.

In addition to high soil salinity, the type of footing construction was a key factor. Poles in Alice Springs have a combination of footing types of direct buried, "top-and-toe" and full concrete encasement. Full concrete encasement was historically only used for highly loaded poles and only became more common after the 1990's.

The combination of the high soil salinity soil and the direct exposure of the unprotected steel (not fully encased or water blocked concrete) was deemed to have accelerated the corrosion and to have led to the pole failure.

2.3.2 Pole condition investigation findings

In 2016, a broad investigation involving excavation for visual inspection of 350 poles to assess the extent of the salinity, corrosion and footing type issues was initiated. Soil data was used to define "at risk" areas and a below ground inspection program commenced. The inspection program found:

- Approximately 120[5] service and distribution poles (35% of poles inspected) were considered at risk of failure due to complete loss of section below ground while the above ground section of the poles was generally in a good condition.
- Two further unassisted pole failures, including one outside of the defined "at risk" area and anecdotal evidence of others occurring in the past.
- A partial failure also occurred during an inspection which highlighted the complexity and risk associated with both inspection and replacement practices.
- Inspections found that poles with full depth concrete footings had no additional protection. While concrete can provide corrosion protection, this was not its purpose and the materials used and installation procedures at the time were not designed to provide the protection.
- Anecdotal evidence emerged of additional historical unassisted pole failures, highlighting an increasing trend of unassisted failures in the Alice Springs area.
- There have been no unassisted pole failures in any other part of Power and Water' network.

This initial investigation meant that a much larger proportion of poles in the region may be at risk and that additional parameters needed to be considered in addition to the suspected area of highest soil salinity. The investigation was expanded to cover more soil parameters and topography to improve our knowledge of the risk areas.

Additional investigation indicated that:

- Updated geospatial data indicated the high saline area is more extensive than the original "at risk" area and poles outside of this area are at similar risk of corrosion.
- Structural inspections confirmed the above ground section of the poles was generally in a good condition.

2.3.3 Introduction of pole re-butting solution

In parallel to the replacement of high risk poles, Power and Water investigated and developed an alternative approach to mitigate the risk of pole failure. The objective of the alternate solution was to rapidly reduce the public safety risk by increasing the volume of treated poles, reducing the impact on customers by reducing the required outage time and reducing the cost.

Power and Water determined that pole re-butting for steel poles was economic, and developed a support structure that allowed re-butting to be applied without the need to remove the pole from services. Rebutting is the process of removing the bottom section of the pole, welding on a new section and re-installing the pole in the ground. This is analogous to pole staking that is done by DNSPs who have wooden poles.

The solution consists of a movable frame that is placed on the ground adjacent to the pole. It is used to support the corroded poles while the base is removed and a new based installed. The poles are then re-installed in the ground with a full concrete casing that is designed to prevent water ingress and future corrosion.

A small volume of poles are constructed with pole tip loads that necessitate additional support using pole stays. While this is normal construction practice, this level of loading exceeds the parameters of the pole support solution. It was not economical to design a support solution to support the low volume of very

[5] April 2016 Board submission, consisting of 40 distribution poles and 81 service poles

highly loaded poles. These poles are also at very high risk of failure due to their loading condition, as well as similar corrosion risks for the pole stays. These poles are deemed not suitable for remediation using a re-butt process and are replaced with new poles.

There are other external or condition factors that also limit the suitability of a pole for rebutting and require full replacement. These include:

- proximity to underground services, particularly water mains
- if the pole is leaning more than 5 degrees
- conductor clearance from the ground, and
- other general deterioration issues that make it more efficient to replace the entire pole than correct each item individually.

In these cases a risk and cost based decision is made regarding rebutting, relocation or replacement of the pole. This has resulted in a small number of full pole replacements being necessary. In the current programme, approximately 3% of poles have been found to not be suitable for rebutting.

Since the introduction of the new method, Power and Water has remediated 407 poles, undertaken additional investigation due to water infrastructure encroachment on 137 poles and completed full replacement of 7 poles that were not suitable for rebutting – a total of 551 poles. With the rebutting process now implemented as business as usual, the average cost per pole replacement has reduced from approximately [redacted] (real FY22) to approximately [redacted] (real FY22)[6].

2.3.4 Historical and estimated expenditure

Figure 3 shows the historical expenditure to treat corroded poles in addition to the estimated expenditure for the remainder of the current regulatory control period. We also show the estimated capex included in the capex allowance for this project for the 2019-24 regulatory period.

The reduced expenditure in RY20 was a result of the research undertaken to design, test and implement the pole clamp that enables rebutting. However, now the new methodology is standard practice the rate of replacement/remediation of one pole per day is being achieved and the forecast is to meet to the capex allowance.

[6] Weighted average unit cost for different pole types

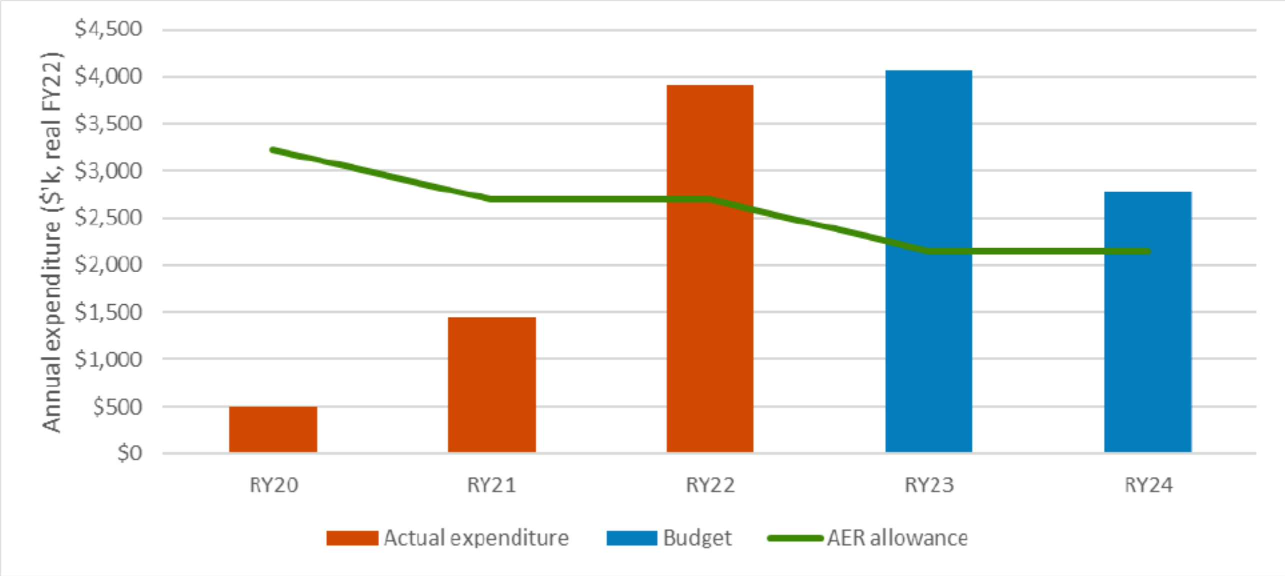

Figure 3 Actual expenditure versus regulatory allowance

2.4 Emerging issues and risks

2.4.1 Population of poles at risk

Using the existing inspection and condition data, significant work has been undertaken to determine the quantum of the poles at risk of failure to be able to forecast the remaining fleet that requires remediation.

An assessment model based in the GIS software has been developed to identify the high-risk poles using a number of GIS layers and the results of the inspection data[7]. The parameters used are:

- Highest salinity area – GIS layer that identifies the areas with highest levels of salinity.
- Alkaline soil areas – GIS layer that identifies the areas with highest levels of alkaline soil
- Ground water salinity – GIS layer that identifies the areas with highest levels of ground water salinity
- Flood mapping – GIS layer that identifies the areas impacted by a 100-year flood

These layers were then given a risk ranking based on their expected impact on corrosion, weighted for importance, overlayed and summed to provide a final view of high-risk areas.

The calculated high risk GIS layer was then overlayed on the assets and used to identify the assets with the highest risk based on corrosive conditions, as shown in Figure 4.

[7] Alice Springs Corroded Pole Re-Butt Project PowerPoint, 3 Sept 2021

Figure 4 Sample of GIS based risk mapping for Alice Springs Poles

Within the identified high risk areas there are 2,442 poles with an average age of 37 years. The age profile, shown in Figure 5, reflects a large volume that was installed during the 1970's and 1980's growth periods and are now between 35 and 55 years old. There are 2,150 poles that were installed prior to the new installation standard being implemented in 2016. Since corrosion occurs over time, the longer a pole is in the ground, the higher the probability of it being corroded and in deteriorated condition.

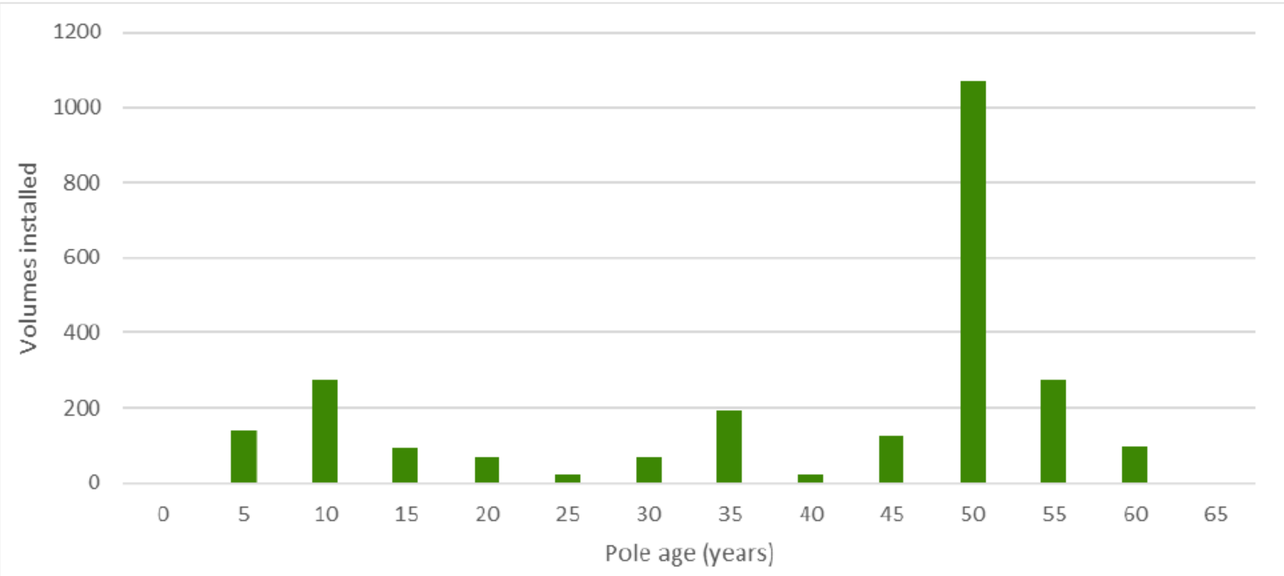

Figure 5 Asset age profile (years) – ASP steel distribution poles in high salinity areas

The characteristics of the pole, including age, maximum voltage and maximum tip loading were then incorporated to further refine and prioritise the poles identified with an elevated likelihood of failure and higher consequence upon failure. This assessment has been used to develop the poles inspection and remediation works forecast and scheduling.

The model forecast has been validated against the findings in the field and found to accurately predict the extent of corrosion about half of the time. Notably, field crews have found significant localised effects in the corrosion of poles. We have incorporated this into our options analysis. However, for the remainder of this regulatory period we will continue with this model while trying to refine it with improved input data as it is our best tool for targeting the program. Further information is provided in Appendix C.3.

2.4.2 Asset condition

Corrosion is the primary failure mode of steel poles and the rate of corrosion depends on environmental conditions and corrosion protection. The methods used for pole inspections and their applicability in this situation are provided in Appendix C.

Corrosion causes a loss of cross-section (thickness) over time and end-of-life is reached when the remaining section no longer meets safety criteria for the load applied at the tip of the pole. The load applied is caused by a combination of the conductor weight and tension, transformer weight, etc.

Figure 6 shows a summary of the inspections results from July 21 through to Feb 22. It demonstrates that 47% of poles were sufficiently deteriorated to require action to be taken. This was comprised of 16% of poles which were severely or very severely deteriorated and required remediation within 6 months and an additional 31% were moderately deteriorated and required remediation within a year. Minor and very minor categories do not require any action.

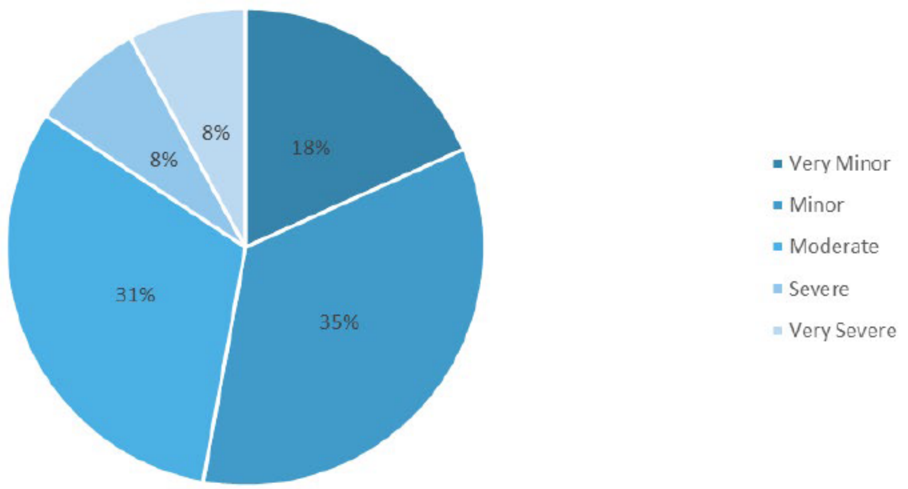

Figure 6 Summary of inspection results

Table 4 shows summary statistics from the current program and demonstrates that poles are reaching their end of life at an early age compared to normal industry expectations. The mean age of the corroded poles is currently shown to be 49 years, this in influenced by the program targeting older poles as a priority. Since the youngest pole to be found in severely corroded condition was 35 years, it indicates that the poles in the high salinity areas present a risk starting from 35 years.

The number of poles in high salinity areas that will exceed 35 years of age (identified as the age of onset of elevated risk) will increase to 1,800 by mid-2029 if no action is taken, resulting in an elevated level of risk to network safety and reliability.

Table 4 Replacement and rebutting statistics

Metric	Value
Mean	49 years
Median	47 years
Youngest	35 years
Oldest	59 years
Expected life	60 years

The combined analysis of failed poles, visual inspections and past replacement requirements indicate that the asset fleet is in deteriorated condition and that without remediation, failures are likely to increase.

2.4.3 Effectiveness of inspection

Inspection of poles to assess condition is difficult as it is the underground section that deteriorates. Power and Water trialled an assessment technique that involved limited excavation (pot-holing) using high pressure water. The poles were then visually inspected using a GoPro camera and assessed against a condition score-card.

We undertook economic analysis to test the benefits of inspection prior to replacement and found that:

- A pole must survive longer than 16 years following inspection for it to me more efficient on a present value basis to inspect prior to replacement. Given the average age of poles is 37 years and the mean replacement age is 49 years and youngest 35 years, it is unlikely that poles will survive an additional 16 years before requiring replacement.
- If a pole is inspected and then replaced, the full cost of inspection will not be incurred, only an incremental amount for labour to do the inspection and analyse the photos. We allowed an incremental additional cost of [redacted], bringing the cost of a pole replacement to [redacted] under this scenario. Our analysis found that if the percentage of poles requiring replacement is less than 41%, it is more efficient to inspect first, then replace. Otherwise, it is more efficient to rebut each pole without prior inspection and therefore save the inspection costs. Our experience has found that 47% of poles require replacement, hence inspection prior to replacement is unlikely to be efficient.

Addition considerations for inspection are that there is risk with respect to disturbing the footing of the pole – ie, it may be a partially destructive test, even though filled with concrete once completed. Each pole may require the suitability of inspection to be assessed on a case by case basis and inspection may only be suitable under certain circumstances.

Accuracy of the inspections is also uncertain as it requires boring a hole next to the pole and using a camera to assess the state of corrosion. There is poor lighting, surface corrosion and dirt that can conceal the true condition, hence, there may be incorrect assessments leading to replacing poles that are in good condition or failing to identify those that are in poor condition.

2.5 Consequence of failure

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

- **Health and Safety.** There are three failure modes that can impact safety:
  > physical injury from the falling pole.
  > electrocution from the conductors if they fall to the ground, or the loss of the support causing the conductors to sag low enough to be touched by people from the ground.
  > injury to field crew when weakened footings cause pole failure while being climbed for maintenance purposes.

  Fortunately, there have not been any safety incidents on the network and no reported incidents of electrocution or shock as a result of pole failure on Power Service's network. However, there have been several near-misses associated with live conductors coming into contact with fences.
- **Service delivery.** Pole failure generally results in an outage to customers. The impact of an individual pole is dependent on its location in the network, in particular the number of customers downstream and if there are any options to restore supply by switching. The historical outages are recorded in the outage data. It shows that since 1998 there have been 16 third party impacts, 51 planned and 2 asset failures that have resulted in an outage.
  The data demonstrates that there is significant volatility from year to year and this has historically been a reliable asset class. Hence, there is limited data to use as a basis for assessing individual risk based on historical outages. Table 5 shows some of the statistics we have considered when assessing the impact of outages on service delivery.
- **Direct financial costs.** Reactive repair of assets has an increased cost compared to proactive and planned replacement. The additional cost is [redacted] (real FY22) per pole[8]. This will increase the cost for a simple pole to [redacted].
- **Property.** Damage to public or private property if the pole or conductors fall onto assets in the proximity.
- **Environmental.** There is a small risk to the environment due to pole top distribution transformers that contain oil. However, the risk is low due to only 8% of poles in high corrosion areas having distribution transformers and the volume of oil is relatively small for most transformers.

Table 5 Poles outage statistics

Cause	Number	Outage duration (minutes)			Energy not supplied (MWh)		
		Min	Average	Max	Min	Average	Max
Equipment Failure	2	190	355	520	1.90	11.51	21.13
Planned Outage	51	6	188	768	-	0.23	2.12
Third Party Impact	16	26	305	1,506	-	0.85	3.23

[8] Analysis of RIN data, shows the unit rate to replace a full pole [redacted]. Based on the volumes and differing cost for poles with different configurations, such as with a distribution transformer or cable attachment, the volume weighted average cost per poles is [redacted] (real FY22). The difference to replace a pole reactively, where rebutting can not be done, is [redacted] (real FY22).

2.6 Risk assessment

We applied the risk quantification procedure to assess the risk cost if there is no investment. This is the counterfactual option, meaning it does not represent current business practice but is an alternative base case for comparison purposes, representing the network risk should the current program be stopped.

We used the inspection results to derive the distribution parameters for calculating the pole survival curve in high salinity areas. The approach is described in Appendix B.1.

Figure 7 shows the outcome of the analysis and demonstrates an increasing level of risk. This is consistent with the cause of deterioration, the aging asset base and consequence categories. The key drivers of the risk cost are energy not served, impact to public safety, and the increased cost of reactive replacement compared to planned replacement.

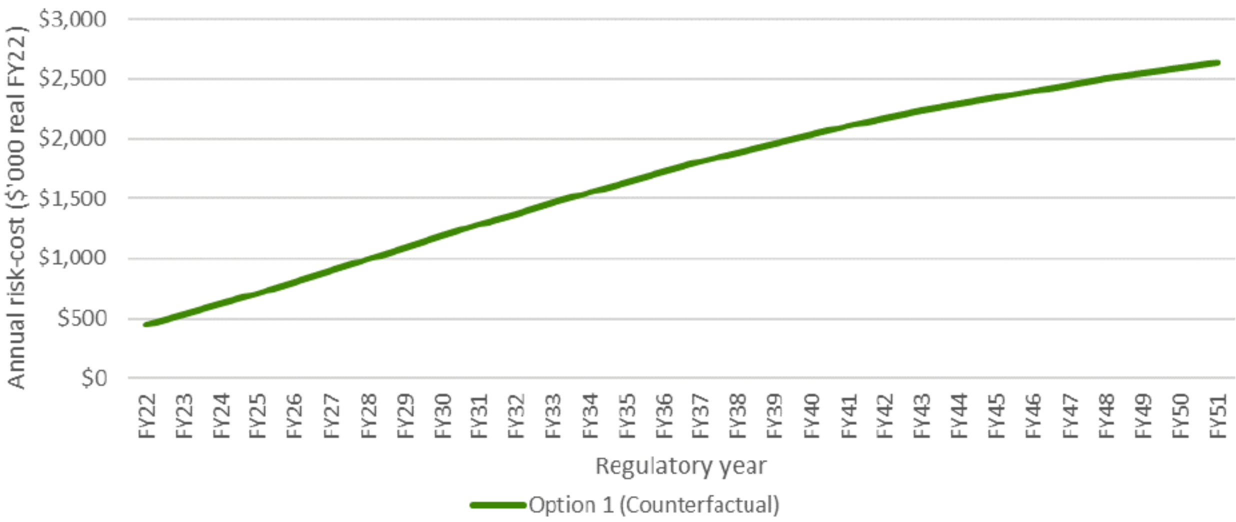

Figure 7 Risk-cost forecast based on reactive replacement (inherent risk)

Comparison to peer businesses further supports that there is an elevated risk in Alice Springs. When the number of unassisted distribution steel pole failures in Alice Springs is converted to a 3-year rolling average of unassisted pole failures per 10,000 poles as measured in other parts of Australia, this presents an increasing trend which is above an industry target of 1 pole failure per year per 10,000 poles[9].

The industry benchmark is informative, as it is typically based on a population of poles across the entire network. However, the observed failures in the Alice Springs area are representative of a type-specific failure mode associated with the footing design and corrosive soil conditions present. Similar conditions or failure characteristics in other parts of Australia have not been identified so a direct comparison to the Power and Water pole types, deterioration mode, failure rates and management practices is not available.

We note that the risk of pole failure is highest when the poles are exposed to increased loading levels (due to wind) at times of high rainfall where the below-ground footing sections are likely to fail as a result of the loss of pole strength, due to corrosion, combined with loss of structural strength of the ground due to soil moisture content.

[9] Department of Consumer and Employment Protection, EnergySafety, WESTERN POWER'S WOOD POLE MANAGEMENT SYSTEMS: REGULATORY COMPLIANCE AUDIT 2005, page 2 (Based upon Electricity Council of NSW guide EC 8 – 1994)

2.7 Summary

Power and Water has undertaken extensive testing and modelling to understand this issue and to be able to manage it prudently and efficiently. The existing program has been set up to target the higher risk poles based on our modelling that incorporates salinity risk area, pole age and pole top loading. Analysis of the results of the program, based on over 350 poles addressed, has found:

- There is a total of 2,442 poles located in the high salinity areas, of which 1,800 are at elevated risk as they will be over 35 years by 2029.
- The average age of poles in the high risk area is 37 years old.
- The onset of elevated risk starts at 35 years old based on the earliest severely corroded pole discovered, even though the program has been biased towards older poles (perceived to be at higher risk due to more time in the ground to corrode).
- Our experience in the field has found that 47% of the poles inspected required rebutting.
- Our analysis has demonstrated that without mitigating actions, the risk to the safety of the public and reliability of supply will continue to increase. This does not align with the asset objectives and is not acceptable to Power and Water.

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

The following options have been identified, Table 6 provides a short summary of key parameters:

- Option 1 – Replace on failure (Counter factual). Only replacing the poles upon failure.
- Option 2 – Targeted (risk based) replacement program. Replacement (or rebutting) of poles within the high-risk areas that were installed prior to the new installation standard.
- Option 3 – Replace all poles in high risk areas. Replacement (or rebutting) of all poles within the high-risk areas regardless of age.
- Option 4 – Inspection based replacement. Inspect all poles in high risk areas and only replace those found to be corroded.

Table 6 Summary of key volumes and timing of the options

	Option 2	Option 3	Option 4
Poles remaining to be addressed at July 2024	1,250	1,540	1,540
Quantity per year replaced	180	180	90
Quantity inspected prior to replacement	0	0	225
Program completion year	2031	2033	2032

Table 7 provides a high-level comparison of the four identified credible options. A detailed discussion of each option is provided in the following sections.

Table 7 Summary of options analysis outcomes

Assessment metrics	Option 1	Option 2	Option 3	Option 4
NPV ($'million, real FY22)	-	8.3	5.8	5.7
BCR	-	1.77	1.44	1.50
Capex ($'million, real FY22)	-	9.07	9.07	4.8
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:

- The NPV is calculated across the full assessment period
- The capex provided is for the 2024-29 regulatory period only. Option 2 and 3 have the same capex as they are rolled out at the same delivery rate. Option 3 continues for a longer period of time.
- Real WACC of 2.75% was applied but tested at up to 4% in the scenarios without changing the order of preference of the options.

3.1.1 Option 1 – Replace on failure (counter factual)

This option proposes to only replace poles upon failure. This is the counterfactual option to assess the level and value of risk that would be incurred if the current practice was changed.

Given the suburbs affected, asset age, assessed condition and deterioration mode of the distribution poles in the Alice Springs area, without action the risk to Power and Water will increase to an unacceptable level. It is expected that the unassisted pole failure rate would continue to increase, with an elevated risk of a safety incident involving a member of the public or a Power and Water worker.

Alice Springs experienced several periods of rapid growth, so there are large numbers of poles of similar age that are in similar locations (areas with elevated salinity) and which are likely to be experiencing similar rates of corrosion below ground. Given this scenario, we expect these poles to reach the end of their serviceable life at similar times, creating a significant increase in the risk to safety, reliability and deliverability of remedial actions.

Once a pole has failed, the pole needs to be fully replaced as rebutting is no longer a viable option. Hence there is an increased cost of [redacted] per pole.

The resultant risk posed by the pole population in Alice Springs has been forecast based on our Risk Quantification Procedure and the outcome is presented in Figure 8. The assessment includes the current program which is in progress and will continue through to the end of 2023-24, providing the reducing risk observed from FY22 to FY24.

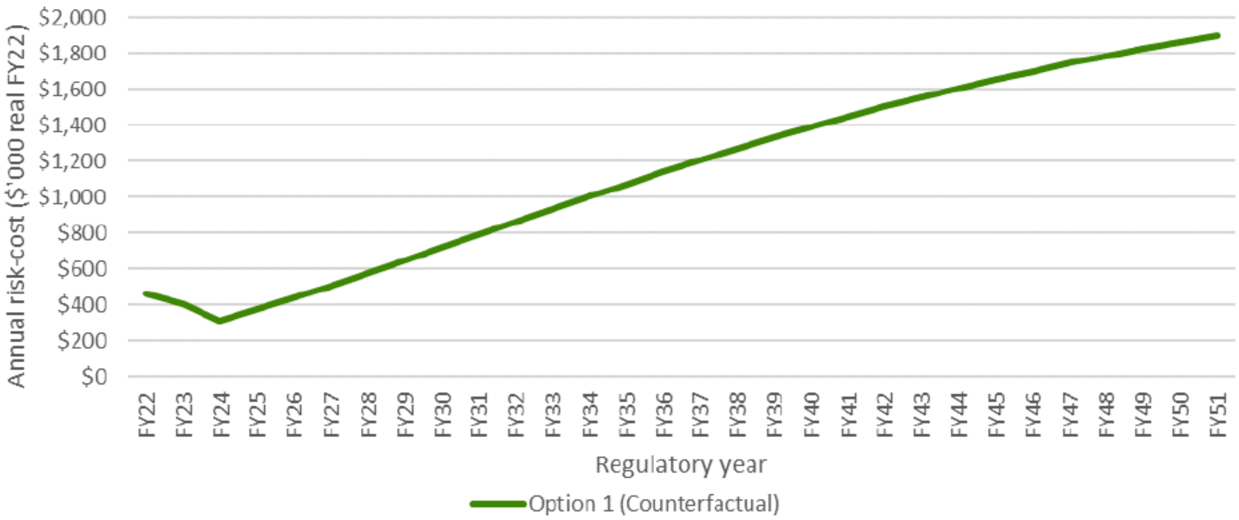

Figure 8 Risk profile of the 'Replace at failure' option

Adopting a reactive replacement approach is not considered to be a prudent or efficient option and is not recommended.

3.1.2 Option 2 – Targeted replacement program (current practice)

This option proposes a targeted replacement program and is the continuation of the existing program. Poles within the high-risk areas identified through GIS based analytics will be addressed according to the remediation guidelines.

At the time of preparing this business case, there are 6,438 distribution poles located in Alice Springs with 2,442 located in high salinity/alkalinity areas with elevated risk characteristics. Of these, there are 2,150 that were installed prior to the new installation standard was implemented in 2016.

Current delivery rates demonstrate we have the capacity to address up to 300 poles per year on average, hence, we expect to address 900 poles during the remainder of the current period (FY22 – FY24) which will leave 1,250 poles in the high corrosion area.

This option proposes to address 900 of the remaining poles during the 2024-29 regulatory period that will be over 35 years old by 2029 (onset of elevated risk). Our experience from the current program demonstrates that approximately 47% of these will have reached their end of life and the most efficient method of inspection and remediation is to excavate and rebut all of these poles.

At the end of the 2024-29 regulatory period, there will be 350 poles remaining that were installed prior to the new installation standard was implemented in 2016. These poles are likely to be at an elevated level of risk. Subject to further assessment, we propose to continue the program to address these poles. This will have the benefit of avoiding any additional mobilisation costs and maintaining the economic delivery achieved through the larger program.

We expect that as the program continues, there will be more complex poles that need to be addressed and therefore the volume of poles able to be treated each year will be reduced accordingly.

To ensure the program is sustainable, and based on advice from our current contractors, we consider that a treatment rate of 180 poles per year is more aligned with a sustainable level of treatment. This means we will replace 900 poles during the 2024-29 regulatory period. The average unit rate will increase [redacted], refer to Appendix A. Table 8 summarises the proposed replacement volumes.

Table 8 Summary of Option 2 replacement volumes

Description	Number
Current volume of poles in high risk area (2021-22)	2,150
Volume replaced from 2021-22 to 2023-24	900
Volume of poles at July 2024	1,250
Volume replaced during the 2024-29 regulatory period	900 at 180 per year
Volume of poles in July 2029 (to be replaced during the 2029-34 regulatory period, pending further analysis)	350

The schedule of the replacements is based on a criticality analysis that augments the risk score determined by the GIS analysis with an assessment of the tip load of each pole. The tip load is the summated load from any attachments and conductor tensions that exert force on the pole top. The higher the tip load, the stronger the footing is required to be to support it. By undertaking tip load analysis, our ability to target the high risk poles is improved through the combined assessment of the likely condition of the footing resulting in degraded strength as well as external forces that require a good footing strength to support the pole.

This option will address the identified network need:

- Prioritise the remediation or replacement of poles with compromised footing strength beyond acceptable limits based on each poles function, net tip load, attached assets, soil risk factors and public accessibility.
- It will manage the risk and maintain existing levels of reliability and network safety enabling us to meet customer expectations for a safe and reliable network.
- It will be efficient as it will only address poles installed using old standards and predominately apply the efficient rebutting method unless there are other factors present.
- Enable us to remain compliant with our obligations, including for safety, reliability and technical standards.
- This option aligns with our corporate and asset management objectives related to network safety, reliability and prudent and efficient management of network risk.

We applied our risk quantification procedure to determine the risk cost that would be incurred by the option and to quantify the avoided risk-cost compared to Option 1. This is presented in Figure 9. The avoided risk-cost is a benefit attributed to this project and is included in the Cost Benefits Analysis.

The analysis shows that the approach is effective in mitigating the risk posed by the assets through addressing the poles in high risk locations which have a higher criticality. The risk is largely mitigated by 2029, however the program will continue through to 2031 to address all poles installed using old standards.

The CBA demonstrated that this option had the highest NPV of $8.3 million and BCR of 1.77 across the 30 year period due to the reduction in risk compared to the base case. This was the best outcome of the three options assessed and across all scenarios tested. This option also addresses the need and is aligned with our corporate and asset management objectives.

This option is recommended.

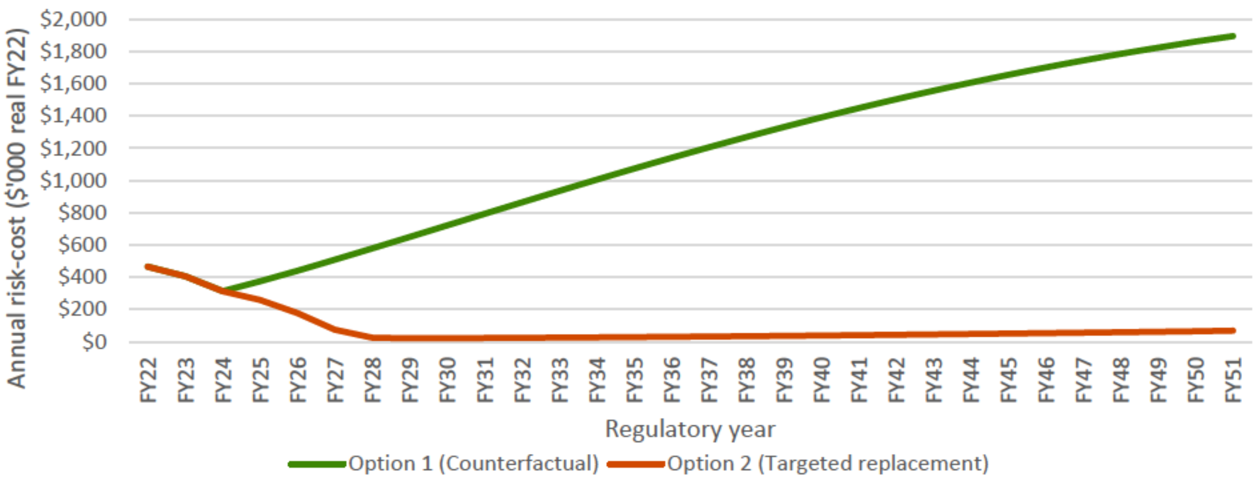

Figure 9 Risk-cost comparison of the counterfactual to Option 2

3.1.3 Option 3 – Replace all poles in high risk areas

This option proposes to undertake a systematic remediation program for all poles in the high risk areas. The program would complete a systematic replacement by going street by street (or similar approach) to enable advanced scheduling and therefore enable cost efficiencies on a per unit basis.

At the time of preparing this business case, there are 6,438 distribution poles located in Alice Springs with 2,440 poles located in high salinity areas with elevated risk characteristics. Our experience from the current program demonstrates that approximately 47% of these will have reached their end of life and the most efficient method of inspection and remediation is to excavate and rebut these poles.

Based on current delivery rates and capacity, we expect to be able to address 300 poles per year on average at a sustainable pace. We expect to address 900 poles during the remainder of the current period, leaving 1,540 poles to be addressed. We will remediate poles at the rate of 180 per year to ensure the program is sustainable for the long term, so will replace 900 poles during the 2024-29 regulatory period, but the project would need to continue through to 2033 to complete the replacement.

Due to replacing all poles and not only the high risk ones, this option will take an additional two years to reduce the risk to the same level as Option 2 and require the replacement of approximately 300 additional poles. This option will address the identified network need:

- Replace poles with compromised footing strength beyond acceptable limits based on each poles function, net tip load, attached assets, soil risk factors and public accessibility. However, this is not as targeted as Option 2.
- It will manage the risk and maintain existing levels of reliability and network safety enabling us to meet customer expectations for a safe and reliable network.
- It will address all poles, regardless of the installation standards applied at the time. While this will result in an increased volumes of poles, the outcome will ensure all poles have footing fully encased by concrete.
- Enable us to remain compliant with our obligations, including for safety, reliability and technical standards.
- This option mostly aligns with our corporate and asset management objectives related to network safety, reliability and prudent management of network risk. It is likely to be less efficient than Option 2.

We applied our risk quantification procedure to determine the risk cost that would be incurred by the option and to quantify the avoided risk-cost compared to Option 1. This is presented in Figure 10. The avoided risk-cost is a benefit attributed to this project and is included in the Cost Benefits Analysis.

The CBA demonstrated that this option had a lower NPV and BCR than Option 2, due to the higher capital cost and slower risk reduction. We also found that while it addressed the need and is aligned with our corporate and asset management objectives, it was less effective at doing so compared to Option 2.

This option is not recommended.

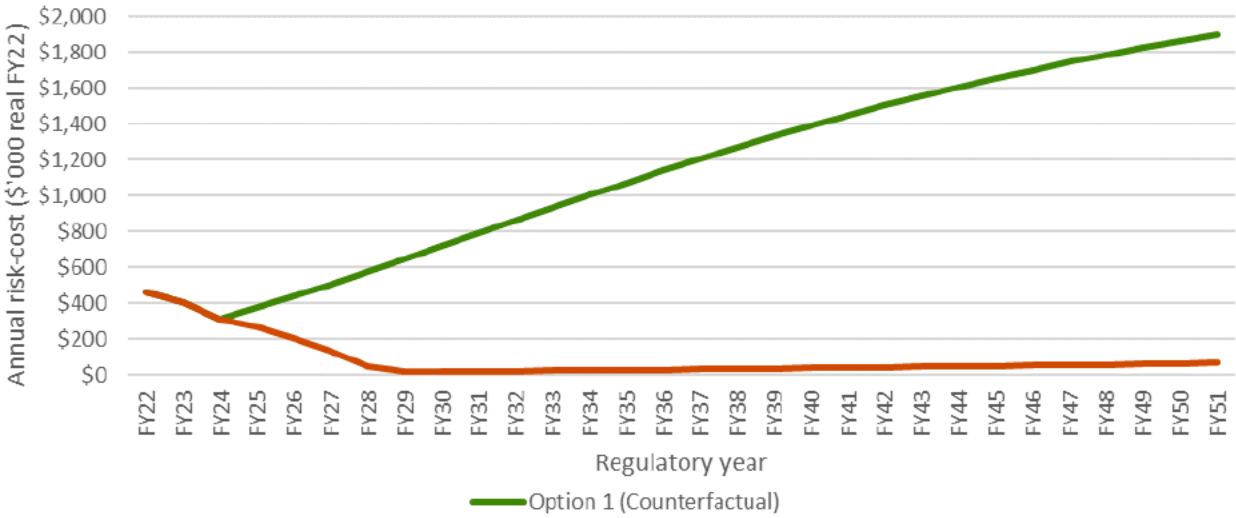

Figure 10 Risk-cost comparison of the counterfactual to Option 3

3.1.4 Option 4 – Inspection based replacement

This option proposes to inspect all poles in the high risk area and only replace those that are found to be corroded. The program would aim to result in an efficient outcome as only corroded poles will be replaced. Based on the inspections results and validation of the model, we have found that only approximately 47% of poles required replacement or rebutting.

Our analysis considered that since inspecting a pole requires approximately one day to set up, inspect and allow backfill concrete to cure, compared to 4 days to complete a rebut. Therefore, an additional 25% of poles can be inspected. Hence 225 poles can be inspected each year, of which 106 would be rebutted (47% of poles inspected). However, as discussed in section 2.5, there are concerns with the effectiveness of inspecting poles and limitations regarding the circumstances in which it is more efficient than replacing without prior inspection.

With 1,540 poles in the high risk area that will not have been addressed by the end of this regulatory period, this program will take 8 years to complete and result in replacement of 725 poles. We have made conservative assumptions that poles will remain in service for an additional 20 years following inspection and then require rebutting or replacement.

The resulting risk from this option is shown in Figure 11, the reduction in risk from FY47 is the result of the poles identified to only have minor corrosion requiring replacement at end of life. The analysis accounts for the risk of incorrect assessment of pole condition and therefore leaving corroded poles on the network. Our modelling has addressed this by increasing the residual risk by 2.5% which is the percentage of poles that were incorrectly classified as very minor or minor by the field crews but reassessed to be moderate or above (triggering replacement) by the asset management team. Based on the current data, this is considered the best data we have available to base an assumption for potential mis-classification.

The CBA demonstrated that this option had a NPV and BCR lower than Option 2. While there is an initial lower capex expenditure, there is a higher cost of inspections and the cost of replacing poles that were not rebutted under this program when they reach end of life in approximately 20 years. In addition, there is a higher risk profile as a result of the likely error in condition assessments during inspection and retaining the more corroded poles on the network for longer. We also found that while this option addressed the need and is aligned with our corporate and asset management objectives, it was less effective at doing so compared to Option 2.

This option is not recommended.

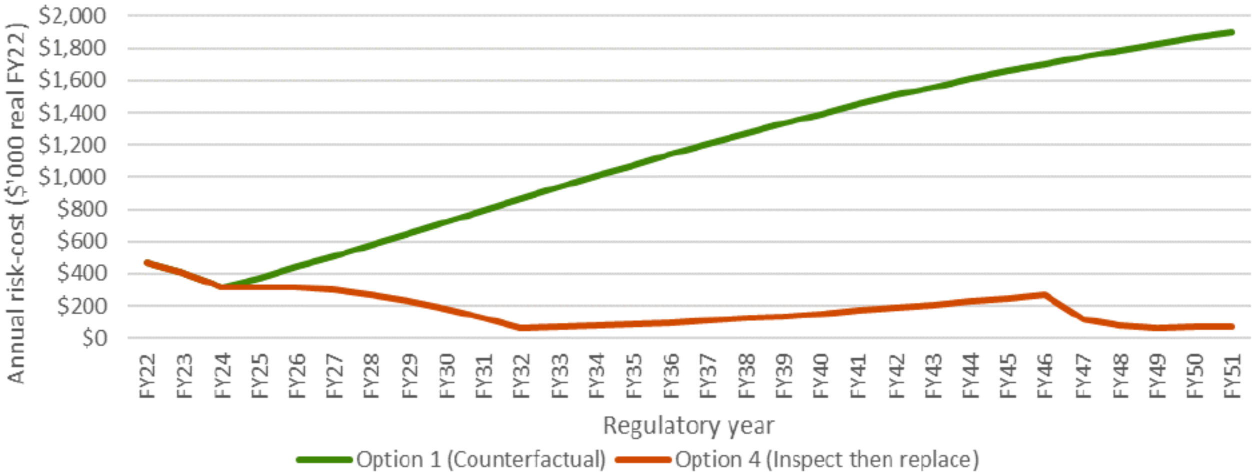

Figure 11 Risk-cost comparison of the counterfactual to Option 4

3.2 Non-credible options

In our analysis, we also identified a number of options that we found to be non-credible. These options are described below.

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 poles are required for safe and reliable distribution of the electricity network. De-rating the pole will not have any impact as the strength requirements are determined by the assets connected to the pole top, and the pole must have sufficient strength to withstand the forces created by those assets. However, when a pole is identified to require full replacement, we will assess if it can be retired by changing the route (network topology) and if that will result in a lower cost to customers.

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 with like for like (modern equivalent/re-butted) assets. When a pole is identified for replacement, Power and Water undertakes an assessment of whether the size or connection points can be changed to reduce cost or to meet future demand most efficiently.

3.2.3 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 and environmental conditions, 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 pole will resolve the underlying issues.

3.2.4 Undergrounding the network – excessive cost and does not meet the timeframe

The current approach to rebutting the poles is being achieved at an average cost of approximately $8.2k per pole. The cost of undergrounding the network, including converting the HV and LV conductors, and converting distribution switches and distribution substations to ground based assets is approximately $1,585k per kilometre, based on costs from our Underground Power Program. The average span (distance between poles) in the urban Alice Springs area is 100m, meaning there are 10 poles per kilometre. Therefore, rebutting a kilometre length will cost approximately $90k[10] compared to $1,585k to underground. This is approximately 20 times cheaper than converting to underground. In addition, the time required to convert to underground is significantly longer, meaning the network risk is not managed as quickly.

---

[10] Based on the volumes and differing cost for poles with different configurations, such as with a distribution transformer or cable attachment, the volume weighted average cost per poles is $8.9k (real FY22).

4. Recommendation

The recommended option is Option 2 Targeted (risk based) replacement at an estimated cost of $9.1 million (real FY22), for the scope of work to be completed in the 2024-29 regulatory period (between July 2024 and June 2029), to be the most prudent and cost effective 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.

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 "Power and Water Corporation Strategic Direction" as indicated in the table below.

Table 9 Power and Water Strategic Direction focus areas

	Strategic direction focus area	Strategic direction priority
1	Always Safe	Improve Public Health and Safety
2	Customer and the community at the centre	Enhance Customer Experience and Engagement
3	Sustainable solutions for the future	Cost Prudency

4.2 Dependent projects

There are no projects or programs dependent upon the completion of this program and this program is not dependent on any other projects or programs.

4.3 Deliverability

This project is the continuation of the existing pole refurbishment program in Alice Springs. It has an established contract with a service provider and the process has been embedded and proven to be efficient through lower individual pole refurbishment costs. Hence, we consider this program to be deliverable.

4.4 Customer considerations

As required by the AER's Better Resets Handbook[11], in developing this program Power and Water has taken feedback from its customers into consideration.

[11] Better Resets Handbook – Towards Customer Centric Network Proposals, Australian Energy Regulator, Dec 2021

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, security and safety of supply[12].

4.5 Expenditure profile

Table 10 show a summary of the expenditure requirements for Regulatory Period 2025-29 and financial evaluation metrics, respectively.

Table 10 Annual capital and operational expenditure ($'000, real FY22)

Item	FY25	FY26	FY27	FY28	FY29	Total
Capex	1,814	1,814	1,814	1,814	1,814	9,068
Opex	-	-	-	-	-	-
Total	**1,814**	**1,814**	**1,814**	**1,814**	**1,814**	**9,068**

4.6 High-level scope of works

The scope of work to be completed in the 2024-29 regulatory period and estimated costs are summarised in Table 11 below and the assumptions are described in Appendix A. The assumptions underpinning this program will continue to be reviewed and refined as more information becomes available. The average unit rate is expected to be $10,075 (real FY22)

Table 11 Scope of work and estimated costs for Option 2 ($'000s, real FY22)

Pole configuration	Volumes	[redacted]	[redacted]
Pole without attachment	735	[redacted]	[redacted]
Pole with Distribution transformer	66	[redacted]	[redacted]
Pole with HV cable	27	[redacted]	[redacted]
Pole with LV cable	37	[redacted]	[redacted]
Pole with HV switch	27	[redacted]	[redacted]
Pole with HV switch and LV cable	2	[redacted]	[redacted]
Pole with LV switch	6	[redacted]	[redacted]
Allowance for H-Poles and complex poles	NA	[redacted]	[redacted]
Total	900	[redacted]	[redacted]

[12] Darwin Peoples Panel forum, 2-3 April 2022

Appendix A. Cost estimation

In developing the cost estimates, the following scope assumptions have been applied:

- the unit rates per pole type have been built up based on the contracted rates of the service provider, set out in Table 12. The unit rate applied includes design, engineering support, project supervision and contract management.
- based on historical data, 3% of poles have been estimated to require full replacement plus the 'H-type' poles and complex poles that are not suited to rebutting. All other poles are treated using the re-butting method. An allowance has been made to cover these assets.
- the volume of poles requiring replacement has been based on the current practice of excavating and rebutting all poles without pot holing first.
- all poles identified for treatment are completed within the program, and no backlog of pole treatment has been included. The program will continue at a steady rate until completed.

Table 12 Unit rates derived from contract

Pole configuration	[redacted]
Pole without attachment	[redacted]
Pole with Distribution transformer	[redacted]
Pole with HV cable	[redacted]
Pole with LV cable	[redacted]
Pole with HV switch	[redacted]
Pole with HV switch and LV cable	[redacted]
Pole with LV switch	[redacted]

In addition to the above, an allowance of an additional [redacted] was made to cover the more complex poles identified in the program. This has been based on recent replacement experience where the cost for replacing one complex pole was [redacted], and which is approximately [redacted] higher than the average. This is expected to be one of the more costly scenarios, so the additional allowance is anticipated to cover approximately three to five complex poles per year.

The cost for an inspection is estimated at [redacted] per pole based on a build-up of man hours and material costs.

Appendix B. Assumptions

B.1 Risk modelling assumptions

The risk modelling was based on the Risk Quantification Procedure. The following additional assumptions were made:

- The poles were allocated to a High or Low corrosion area. All replacement is focused on the High corrosion areas.
- The age profile was allocated to three risk levels that were based on the suburb the pole was located as a proxy for proximity to public should the pole fail
- The probability of a pole reaching end of life resulting in an outage was assumed to be 2% as a conservative value. With a very low sample of actual failures to undertake quantitative analysis, an assumption of 2% was considered to be appropriate as it resulted in a failure of 2 poles in FY23. During a storm in November two poles failed due to a corroded base, hence validating this assumption.
- Survival curve characteristics were based on quantitative analysis of the poles replaced that were identified to have moderate to very severe corrosion. Since this survival curve is used to identify the poles reaching end of life, and not directly failing, the data set was considered to be appropriate for the application.
- The reactive replacement premium was based on the difference in cost between a full pole replacement and pole rebutting. The latter is not possible following a failure.
- Energy not supplied is based on high level analysis of demand in Alice Springs and estimated time for restoration of power.
- The replacement profiles incorporated in each of the options are based on the options (and corresponding justifications) set out in this RBC.
- Based on the contracted rates, an average cost per pole was calculate for application in the financial model. The average value included an allowance for the 'complex poles' which will be more expensive to address due to attachments, location, adjacent services and customers affected.

B.2 Calculating survival curve parameters

Power and Water undertook quantified numerical analysis of the program inspection results to fit a probability function that is informed by actual data. This helps ensure that the inputs to our risk-cost quantification are appropriate for the sub-section of the asset fleet that we are assessing. The parameters that were used to create the survival curves, and therefore the probability of failure, were based on analysis of the poles that have been replaced or rebutted as part of the existing program.

A sample of 312 poles was available and was used to develop a frequency distribution using age at replacement or rebutting. The age of the pole when it was replaced or rebutted was taken as the poles age when it reach the end of its serviceable life. The sample was used to derive suitable probability distribution parameters using five approaches:

- Weibull Method 1: Maximum Likelihood Estimation (MLE)– a numerical approach to calculate the shape and scale parameters using the Newton Raphson method.
- Weibull Method 2: MLE using Excel Solver to complete the numerical iterations
- Weibull Method 3: Median Rank Estimation – a numerical linear regression approach to calculate the slope and intercept of the line of best fit to determine the shape and scale parameters.

- Normal distribution Method 4: calculated the mean value as the scale parameter and the standard deviation calculated using the excel function
- Normal distribution Method 5: calculated the mean value as the expected asset life parameter and the standard deviation calculated using the square root of the mean (AER's approach with the Repex model).

The resulting probability density functions from these five methods are shown overlaying the frequency plot of the age at replacement or rebutting in Figure 12. The three Weibull methods have very similar results and were equally ranked using the Chai-Squared statistical test, whereas the Normal Distribution Method 4 was ranked best using the Kolmogorov–Smirnov statistical test. We have assessed the impact of the different distribution parameters in our risk and cost benefit analyses.

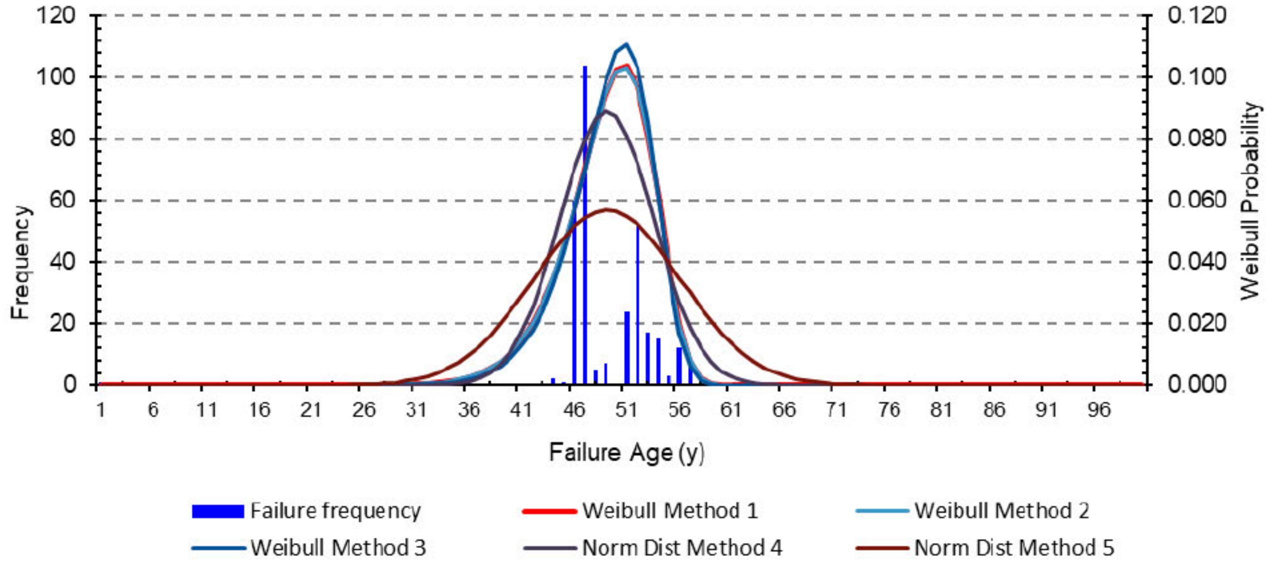

Figure 12 Analysis of existing program to determine distribution parameters

Method	Parameter estimation	Numerical solving method	β	α
1	Maximum Likelihood Estimation	Newton Raphson Method	14.40	50.94
2	Maximum Likelihood Estimation	Excel Solver	14.31	50.93
3	Median Rank Estimation	Least Squares Regression	15.34	50.99
4	Normal Distribution	Excel functions	4.48	49.10
5	Normal Distribution	SQRT assumption for Std Dev	7.01	49.10

Appendix C. Pole inspection and treatment

C.1 Inspection methods

Typically, corrosion issues that have required intervention have occurred at, or just below, the pole-ground interface. This is due to the combination of ground moisture, exposure to air and any external factors such as regular rain or garden watering that create an ideal environment for corrosion to occur.

Relative Loss Section (RLS)

The extent of corrosion has historically been assessed using RLS testing that applies an electrical signal to test the thickness of the remaining steel. This is a non-intrusive test and has been effective in assessing condition to a depth of approximately 200mm, depending on ground conditions.

Corrosion below ground level has been rare and previously were only identified in a limited tidal area in the Darwin region, most of which was replaced with underground infrastructure in the 2000's. However, the events in Alice Springs demonstrated it is a systemic issue in certain areas. The corrosion observed in Alice Springs is occurring much deeper in the footing and RLS is not effective at identifying the issues.

Pot holing (visual inspection)

Power and Water initially trialled a non-destructive assessment technique that involved limited excavation (pot-holing) using high pressure water. The poles are then visually inspected using a GoPro camera and assessed against a condition score-card. This approach confirmed the need to replace poles in the high corrosion areas. The assessment was difficult and time consuming but demonstrated the need to replace approximately 60% of the poles.

Pot holing remains an option for inspection for complex poles (such as those supporting transformer and switches) that will be more expensive to remediate, and when expanding into new areas.

Extraction and inspection

Due to the high percentage of corroded poles, the current practice is to excavate poles in high corrosion areas and then inspect the base. This is a destructive technique that requires the pole to be rebutted, however, it provides the best inspection accuracy.

The key benefit of the current approach is that we are able to gain the best condition data and ensure that all poles are in good condition, by ensuring the footings of all poles are fully encased in concrete and the life of the pole is extended for an additional 60 years. Hence, this is currently the preferred inspection approach.

However, we will use the inspection data obtained to assess the efficiency of the approach, and any other options available, once we have confidence in the condition assessment capability of the field crew. If the percentage of corroded poles found during inspection decreases, we will re-assess the benefits of inspection prior to rebutting.

C.2 Two pole substations

Legacy dual pole overhead transformers (similar to H-pole in other utilities) are installed in 53 locations across Alice Springs. These H-poles are typically constructed using a standard fabricated pole and a shorter round steel pole. Round steel poles have a much thinner steel cross-section and observations have found a greater reaction between galvanisation and soil, resulting in a far greater level of corrosion damage.

Round steel poles are generally used for service poles which are typically lightly loaded and not at high risk of failure, however, the loading on H pole structures is significantly higher due to the mass of the transformer. These installations are planned for complete replacement, which will likely involve relocation of the transformer to an adjacent pole location.

C.3 GIS forecast model validation

The actual outcomes from the replacement program were compared to the modelled results to validate the model and defined risk areas. The results are shown in Table 13 and demonstrate that the model identified poles that required replacement or rebutting with an accuracy of 46%.

Since the assessment is visual, and based on the experience of the field crews, the photos taken on site of the pole footings were reassessed by the asset management team. We found that some of the field crews appeared to be taking a conservative approach in their assessment and the poles appeared to be in a more advanced state of deterioration than recorded, while others were less corroded. We have provided this feedback to the crews, along with updated guidance notes containing better photos and additional information, so we can ensure continual improvement in the accuracy of the assessments.

Power and Water has taken the accuracy rate of the model into account in the analysis of options for how to continue to manage the corroded poles. The program will be run in its current form for the remainder of this period as it is important to gather the asset data and to continue to refine and improve the onsite assessment of asset condition. We will also use the data gathered to improve the forecasting accuracy of the model.

Table 13 Modelled versus Inspection pole condition outcomes

Modelled results	Inspection results					Total
	1	2	3	4	5	
1	0	1	1	0	0	**2**
2	1	0	1	1	0	**3**
3	17	33	24	7	4	**85**
4	32	57	47	8	9	**153**
5	13	25	29	8	13	**88**
Total	**63**	**116**	**102**	**24**	**26**	**331**

Contact

Power and Water Corporation
55 Mitchell Street, Darwin NT 0800
Phone 1800 245 092
powerwater.com.au

PowerWater