Jemena Gas Networks (NSW) Ltd

Kurri Kurri Rehabilitation Stage 2

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1. Summary

This gas mains rehabilitation business case identifies options to address the ongoing decline of network integrity and performance in the 100kPa Kurri Kurri network. With Stage 1 now complete, the preferred option is to continue with Stage 2 and replace the remaining unprotected steel mains with new PE at a cost of $9.82M.

The Kurri Kurri network was originally owned by Hunter Gas. Jemena (AGL at the time) purchased the network in 1982. It currently operates at a maximum allowable operational pressure (MAOP) of 100kPa and supplies gas to approximately 2,900 customers in the suburbs of Kurri Kurri, Abermain, Weston, Neath, Pelaw Main and Stanford Merthyr. Typical of the older ferrous gas mains in the industry, unprotected steel mains in the network do not have effective protection measures such as coatings or cathodic protection (CP). As a result, the unprotected ferrous mains have gradually corroded over the past 70+ years.

There are 82km of mains consisting of steel, PE and nylon mains. The 11km steel feeder main from the SRS in Kurri Kurri to Neath was rehabilitated in 2020-21 as part of Stage 1, with the installation of 160mm PE and 110mm PE.

All Australian gas distribution businesses are systematically removing, or have fully removed, these types of older ferrous mains due to the safety, integrity and supply risks posed to the customers, general public and employees from leaks. Reduction in greenhouse gas emissions is a further driver for removing aged ferrous mains. There is a strong focus from customers and governments on emissions reduction, who expect energy providers to play their part in achieving greenhouse gas targets. The introduction of the Safeguard Mechanism[1], which requires industrial facilities (including gas networks) to reduce greenhouse gas emission by 4.9% per year, means it is essential the poorest condition mains are removed as soon as practicable.

Unaccounted for gas (UAG) is an indicator of network integrity and leaks, with JGN's overall network allowance being 2.9% of throughput. Based on the mains material type, previous leakage tests and publicly reported leaks, data indicates that the UAG from fugitive emissions is likely to be significantly higher in comparison to the overall JGN network. These high leak rates, coupled with emissions reduction targets means the mains rehabilitation program should not be deferred further.

The ongoing mains rehabilitation program will replace the unprotected metallic mains, which has been programmed to efficiently utilise the workforce and resources across the next 5 year period, with completion due in 2029.

1.1 Business need

The principal drivers for undertaking the Kurri Kurri 100kPa network rehabilitation project are:

- Reduce number and magnitude of gas leaks to improve personnel and public safety.
- Ensure customers receive a reliable gas supply (reduce emergency incidents and repairs).
- Compliance with standards and statutory requirements.
- Reduce greenhouse gas emissions in alignment with Jemena's Emission Reduction Strategy.
- Reduce operational and UAG cost.

[1] See link.

1.2 Customer feedback

Customers have told us they value a safe and reliable gas supply, and expect JGN to ensure the gas network remains safe and that gas is available when customers need it. In recent engagements, customers have indicated a preference for targeted investment in safety and reliability, encouraging JGN to proactively manage integrity issues with the aim of reducing ongoing maintenance costs. A strong theme that emerged from our customer engagement program is that while customers expect JGN to keep costs as low as practicable and encourage non-critical investments to be deferred where prudent to do, safety must not be compromised.

Customers have suggested JGN should carefully consider the pace of investment, and take a considered approach to how the network may be used in the future. Customers want us to considered affordability over the short and long term when making decisions. Customers expect us to act now and plan for a net zero emissions future, rather than delaying investment. This includes looking at how new technology could be applied to improve asset management.

Reduction in greenhouse gas emissions is also valued by customers. Residential customers have expressed a preference for lower-emissions technology and support exploration of renewable gas technologies. Some larger customers have their own emissions reduction targets and expect their energy providers to play their part in facilitating a greenhouse gas decrease.

Customers continue to connect to the gas network. While growth in demand for natural gas services has slowed in recent years, new connections will continue during the next regulatory period, with growth expected in some pockets of the network. The distribution network is expected to continue to play a major role in NSW's energy future. Customers have told us that that they value choice and diversity in their energy supply. Though there is a current trend towards electrification of industries, 85% of Sydney customers agree that NSW needs a mix of energy sources – including solar, wind and gas – and that we should not 'put all energy eggs in one basket'. 78% of customers support having the choice of renewable gas options as part of the energy transition.[2]

Thousands of customers remain dependent on the gas network, with many not be willing or able to switch away from gas as an energy supply. As such, while investment in network growth may be more conservative than compared to historical levels, it is important JGN continues to invest to sustain the network and ensure compliant pressures and uninterrupted supply.

1.3 Recommendation

In order to address the risks identified, four options have been considered

Option	Description	Capital cost ($ 2023)	Risk
1	Reactive maintenance only	$0	Significant
2	Reactive maintenance with minor capital works on ferrous mains	$1.96M	Moderate
3	Replace unprotected steel mains with plastic mains.	$9.82M	Low
4	Seasonal reduction in network operating pressure to 70kPa	$2.3M	Moderate

Option 3, which is to rehabilitate the unprotected steel mains is recommended to be the most prudent option. Proactively replacing unprotected steel mains in the Kurri Kurri network will improve the safety, reliability of supply

[2] Redbridge, Sydney energy attitudes and sentiments, December 2023.

and affordability to customers. This project will eliminate the risks of gas leaks, mains repairs and operational costs associated with unprotected steel mains corrosion.

1.4 Consistency with the National Gas Rules and National Gas Objective

When developing this business case, we have given regard to the requirements of the National Gas Rules (NGR) and the National Gas Objective (NGO).

NGR 79(1)

We submit that the proposed solution is prudent, efficient, consistent with good industry practice, and will achieve the lowest sustainable cost of providing services.

- **Prudent** – The expenditure is necessary in order to ensure the safety of the Kurri Kurri network and the reliability of service to the customers whose gas supply is dependent on the network's ongoing operation. The work will reduce the current high rated risk to low.
- **Efficient** – Removing all the unprotected steel mains in the area as one continuous project is the most cost effective option. Work will be carried out by approved contractors based on competitively tendered rates to reflect the most favourable market rates possible.
- **Consistent with accepted and good industry practice** – The removal of ferrous mains from distribution networks is consistent with accepted and good industry practice, with distribution companies across Australia on a pathway to removing, or already removed, all unprotected ferrous mains. The installation of PE that is capable of higher pressures, should it be required, is considered industry standard.
- **Achieve the lowest sustainable cost of delivering pipeline services** – targeting the replacement of end of life unprotected steel mains achieves the lowest sustainable cost of providing services whilst being conscious of the changing landscape of gas and customer sentiment. It is prudent to invest now to remove unprotected steel mains to help keep costs sustainable over the long term as leaving in situ results in escalating maintenance, emissions and UAG costs, as well as unacceptable safety concerns.

NGR 79(2)

The proposed capex is justifiable under NGR 79(2)(c)(i) as it is necessary to maintain the safety of personnel and the public living and working around the ageing steel network. The rehabilitation works can also be justified under NGR 79(2)(c)(v) as removing these leaking steel mains will contribute to meeting emissions reduction targets.

NGR 74

Demand forecasts are based on 2023 data, and the cost estimate has been developed using a top-down approach, utilising information from similar projects that went through a competitive tender process. We therefore consider that this estimate has been developed on a reasonable basis and reflects the best information available at this time.

NGO

Removing the aged, unprotected steel mains from the network also contributes to achieving the NGO, specifically with regard to emissions reduction. Leakage rates in the Kurri Kurri network are estimated to be significantly higher than the overall network. Replacing these leaking mains with fit-for-purpose plastic pipes will significantly reduce the volume of UAG and therefore the volume of methane potentially released into the atmosphere. This is likely to contribute towards achieving NSW emissions reduction targets and reducing Australia's greenhouse gas emissions.

1.4.1.1 SAFE GUARD MECHANISM

The Safeguard Mechanism is the Australian Government's policy for reducing emissions at Australia's largest industrial facilities which includes mining, oil and gas industries, manufacturing, transport and waste facilities. The

Safeguard Mechanism applies to facilities emitting more than 100,000 tonnes of carbon dioxide equivalent (CO2-e) per year. There are legislated limits (also known as the “Baseline”) on emissions which gradually decline (approximately by 4.9% yearly) over time to achieve emissions reduction targets. If emissions exceed the baseline target for the given year, the company would incur penalties and on the contrary if the emission remain under baseline, then they receive a credit. The greenhouse gas emission reduction target for NSW is 50% below 2005 levels by 2030 and approaching net zero by 2050. In 2022, JGN emission accounted to 336,260 tCO2e from which 98% was due to fugitive emissions from the medium pressure and low pressure networks. This ranks JGN within the top 100 emitters in Australia.

1.5 Financial information

The cost estimates for this project were benchmarked against similarly scoped projects that have undergone a competitive tender process as per Jemena’s Project Management Methodology Summary of Costs.

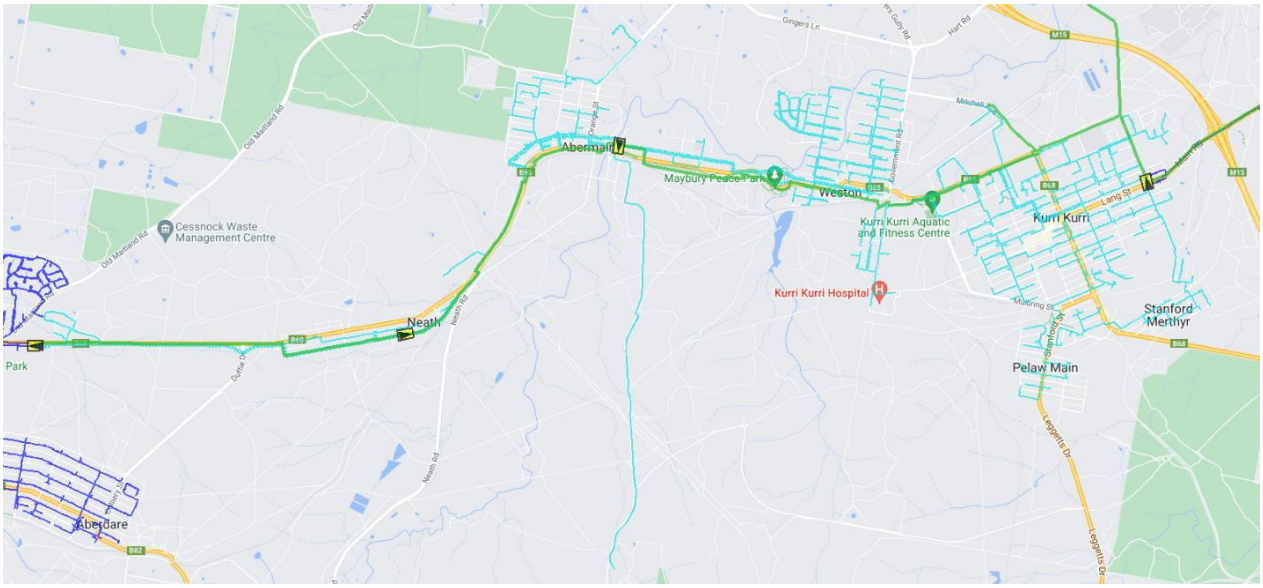
Table 1–1: Kurri Kurri rehab capital cost estimate

Item	Estimate ($ 2023)
Materials	Included in contractor costs
Contractor costs	5,100,085
Labour	301,167
Total direct costs	**5,401,252**
Overheads	**2,859,571**
Risk allocation	1,558,035
Total project cost	**9,818,858**

2. Background

The Kurri Kurri network was originally constructed in the 1940s/50s and operated by Hunter Gas. The network currently operates at the maximum allowable 100kPa, and supplies approximately 2,900 customers in the suburbs of Kurri Kurri, Pelaw Main, Stanford Merthyr, Weston, Abermain, and Neath.

Figure 2-1: Map of Kurri Kurri 100kPa Network



There are approximately 82km of mains consisting of steel, PE and nylon mains. The unprotected steel mains were constructed in the 1940/50s. They make up 43% by length of the mains distribution network, spanning approximately 24km. The plastic mains were constructed from the 1980s to present, spanning approximately 59km of the network.

Particularly over the past ten years the integrity of the steel mains in the network has deteriorated to a point where the performance of the network consistently fails a number of Jemena Gas Networks' (JGN) performance indicators, and UAG from fugitive emissions is likely to be significantly higher in comparison to the overall JGN network.

A rehabilitation plan for the network was developed and approved in the previous access arrangement determination. Stage 1 of the plan, which was to replace the steel feeder main, was completed in 2020-21. Stage 2 of the plan is to replace the remainder of the steel.

2.1 Risk analysis

The current network performance gives rise to serious safety and operational risks, as well as a financial risk in paying penalties due to emissions exceeding baseline targets in relation to the Safeguard Mechanism. Unless action to mitigate risks is taken, there is increasing likelihood of gas release leading to serious harm, significant disruption to customer supply, or causing JGN to exceed its Safeguard Mechanism legislated limit. The risk level for this project is therefore assessed as significant. Under JGN's risk framework, any risks deemed significant (or higher) must be addressed to reduce the risk to low or as low as reasonably practicable (ALARP).

A risk assessment was conducted to determine the extent of the untreated risk. The risk assessment was undertaken in accordance with the Group Risk Management Manual JAA MA 0050 Revision 10.

UNTREATED RISK SUMMARY

Contributing Factors/Scenario	Strategic	Financial	Safety	Operational	Regulatory & Compliance	Reputation	Consequence (Highest Impact)	Likelihood	Risk Level
Corrosion of steel mains resulting in loss of containment.	Significant	Significant	Significant	Moderate	Significant	Moderate	Severe	Possible	Significant

RISK TYPE	RISK SUMMARY		UNTREATED RISK SUMMARY	RISK LEVEL
Strategic	Severe	Possible	• To not complete works would not be in alignment with JGN's Networks Asset Class Strategy. • Jemena emission reduction strategy would be impacted as this network has a high leakage.	Significant
Financial	Serious	Likely	• Jemena incurs higher operating costs to purchase gas to replace the gas lost through leakage. • If the ageing and corroding steel remains in situ, opex cost will continue escalating as unplanned and emergency repairs will increase • Jemena will also be liable to pay penalties for failing to reduce emissions below baseline targets as per the Safeguard Mechanism.	Significant
Safety	Severe	Possible	• Leakage from corrosion of the pipe and fittings could cause fire and gas incidents that lead to injury to the public and Jemena employees • Environmental damage due to the higher leakage rates from emitted UAG.	Significant
Operational	Serious	Possible	• Supply to customers would likely be affected in the event of emergency repairs. • Continuity of supply and level of customers cannot be assured when operating a network which requires continual maintenance and repair.	Moderate
Regulatory & Compliance	Severe	Possible	• High rates of leakage have the potential to cause adverse publicity. In larger incidents, reports may be requested by the technical regulator. • Jemena will also be liable to pay penalties for failing to reduce emissions below baseline targets as per the Safeguard Mechanism.	Significant
Reputation	Serious	Possible	• Responding to a high level of emergency incidents and repairs has required the use of the fire brigade and the police to ensure public safety. This is a drain on this resource to attend gas emergencies, and also affects their availability to the community • Constant customer complaints and being unsatisfied with the service may lead to higher disconnections and adverse media, which would negatively impact the reputation of Jemena.	Moderate

2.2 Consistency with asset class strategy and plans

As described in JGN's Networks Asset Class Strategy, our assets are necessary for the safe distribution of gas, while ensuring the correct pressures and volumes are available to all our customers at all times. In addition to achieve net zero greenhouse gas emissions and comply with JGN's legislative requirements.

Investment in the networks asset class is largely driven by the installation of new mains to service new areas, as well as the timely replacement of existing mains and services. The replacement of mains, services and pressure reducing facilities is optimised to achieve a balance of targeted risk reduction, whilst still maximising economies of scale where possible.

Once network assets are in service, as prudent asset managers our role is to ensure these assets continue to function safely, and remain fit for purpose, replacing or refurbishing them in a timely manner. Our aim is to manage our network assets for the lowest practicably sustainable cost.

Our key considerations are:

- **Safety** – It is vital our network assets remain safe and compliant. We replace network assets when they pose an unacceptable safety risk. This may be due to deterioration in asset performance, or a change in the local environment that increases the risk associated with asset failure and/or unacceptable gas leaks. It is also important that our networks are constructed in compliance with AS/NZS 4645: Gas Distribution Management and its relevant Parts, and that our network activities and asset management align with ISO 55001. This enables us to demonstrate to ourselves, our customers, external stakeholders and business partners that we maintain industry good practice, whilst managing our risk to as low as reasonably practicable.
- **Reliable service** - It is vital our network assets continue to provide the required levels of service. Our networks and flow stopping activities are designed such that third party damage incidents as well as planned and reactive maintenance is such that it does not interrupt the supply to residential, commercial or industrial customers where possible. Hydraulic modelling and network design ensure that pressures and capacity are carefully balanced to remain above the minimum allowable pressure, whilst also being mindful that higher pressures result in increased fugitive emissions.
- **Enable net zero** – We have a responsibility under the Safeguard Mechanism and the Government's Net Zero 2050 targets to reduce our greenhouse gas emissions, and to use our network assets to help customers reduce theirs. The largest source of greenhouse gas emissions from our network is fugitive gas. Therefore, where there is an opportunity to modify our network assets to reduce or better measure our greenhouse gas emissions we will consider investment. Similarly, where renewable or lower- emissions gasses are introduced into the gas distribution system, we must also invest in the appropriate network assets to ensure they remain safe and that gas volumes can be measured accurately.

Jemena's Emissions Reduction Plan is to reduce CO_2 emissions to Net Zero by 2050. The Federal Government is also mandating via the Safeguard Mechanism to reduce 4.9% of CO_2 emissions every year from mid-2024 to 2030. In Jemena Gas Networks (JGN) the biggest contributor to CO_2 emissions is in the form of methane from fugitive emissions on gas assets, namely mains, services and meters.

The key pillars of the Emissions Reduction Plan for JGN are:

- Pressure reduction (both permanent and Seasonal)
- Targeted network repair and replacement, and
- System use gas reduction

The replacement of the mains in the Kurri Kurri network aligns to the strategies presented in the JGN Network Asset Class Strategy 2023 such as safety, reliability and reducing fugitive emissions.

3. Options

3.1 Option costs & benefits

The following options were considered to address the risks associated with the Kurri Kurri 100kPa network:

- Option 1: Reactive maintenance only.
- Option 2: Reactive maintenance with minor capital works on ferrous mains.
- Option 3: Replace unprotected steel mains with plastic mains.
- Option 4: Seasonal reduction in network operating pressure to 70kPa.

3.1.1 Option 1: Reactive maintenance only

This option considers reactively responding to network maintenance as it continues to deteriorate over time, with no planned or proactive maintenance to be conducted. The risk profile will continue to escalate with more corrective maintenance occurring in an attempt to maintain an acceptable level of safety and reliability, thus rendering this option infeasible.

There would be increasing costs associated with responding to larger and more frequent leaks, as well as increasing operational costs for UAG. This would come at an operating cost starting $900k p.a. ($2023).

3.1.1.1 Benefits

There would be no immediate capital investment in the network, therefore this is a less capital-intensive option and would have a lower impact on network tariffs in the short term. However, reactive operational maintenance costs would escalate significantly over time given that no proactive maintenance will be completed.

3.1.1.2 Limitations

- If no proactive work are undertaken, our regression analysis demonstrates publicly reported leaks, and therefore all leaks, will increase further in the following years. The likelihood of an incident that may cause injury would therefore increase too. This option fails to improve safety to customers.
- Continuity of supply cannot be assured when operating a network that requires continual maintenance and repair. Hence the option fails to improve reliability of supply.
- This option also fails to improve efficiency and affordability to customers as operational costs will continue to increase due to recurring operating and maintenance activities, increased UAG, lost revenue from current customers and reputational damage to Jemena.
- This option does not provide JGN with a means to reduce emissions from gas leaks, nor enable a comparison of the emissions using the Picarro technology of pre and post repair. Hence this option does not support the transition to ‘Net Zero by 2050’ and Jemena emission reduction strategy.
- This option will also involve ongoing penalties for failing to reduce emissions below legislated limits in accordance with the safeguard mechanism.

3.1.2 Option 2: Reactive maintenance with minor capital works on ferrous mains

Under this option, we would deliver a program of minor capital works, with any other works undertaken on a reactive basis. This option considers reactively responding to network maintenance as it continues to deteriorate over time, along with minor capital rehabilitation activities. The priority of mains to be rehabilitated is based on the risk level of individual sections of mains, relative to each other.

The capital cost for this option is approximately $72K per year ($ 2023) in with an opex of $900k p.a. ($2023) which will be ongoing until 2050. The operating cost is not assumed to increase each year as the yearly capex piecemeal rehabilitation projects will address a portion of leaking and corroded network.

3.1.2.1 Benefits

- This option would allow JGN to address the most urgent risks first, with the remainder of issues managed on a reactive basis.
- According to the priority and level of deterioration of the mains within the network, individual sections will be replaced to reduce the ongoing leaks and associated repairs this would ensure customers receive a reliable gas supply.

3.1.2.2 Limitations

- The capital cost estimate includes provision for occasional interconnections as needed to ensure supply pressure is maintained. Additionally, as the network deteriorates at an increasing rate, opex would likely never reduce hence the option fails to improve efficiency of the network and affordability to customer.
- The success of this option requires JGN's minor works program to keep pace with the deterioration of the ferrous mains network. There is a risk under this option that the volume of ongoing reactive works would increase as further integrity issues are discovered.
- This option limits our ability to reduce emissions from gas leaks and enable a comparison of the emissions using the Picarro technology of pre and post repair. Hence this option does not support the transition to 'Net Zero by 2050' and Jemena emission reduction strategy.
- This option will still involve ongoing penalties for failing to reduce emissions below legislated limits in accordance with the safeguard mechanism.
- This option is not consistent with the long-established industry good practice of proactively removing aged and high leakage unprotected steel mains from gas distribution networks.

3.1.3 Option 3: Replace unprotected steel mains with plastic mains

This option continues with the original plan to remove all steel from the network by delivering Stage 2 of the project. Network modelling indicates that mains reinforcement may be required to meet the capacity demands of the network after the rehabilitation is implemented, however we are planning to defer this reinforcement until the project is completed, whereby we will reassess any capacity constraints and take actions accordingly. As this network is not growing as previously considered, planning for growth is not incorporated into this project, and will be assessed on a case by case basis.

Customers have expressed the high importance of emissions reduction. Our plan to target a network with high UAG from emissions aligns with customer expectations. Deferral of the project does not address the safety concerns nor the objectives of the emissions reduction strategy.

Based on the costing for this rehabilitation, the capital cost for this option is $9.82M ($ 2023) with an operating cost of $6k p.a. till 2050 for residual costs on the plastic mains.

3.1.3.1 Benefits

- The mains rehabilitation project will improve safety to customers by reducing the number and frequency of a publicly reported leak, as well as undetected leaks. Consequently, it will reduce the risk and potential harm to our customers, the public and Jemena personnel.
- Less reactive maintenance would practically eliminate network supply interruptions due to leaks, ensuring customers receive a reliable gas supply.

- Rehabilitating these gas mains will significantly reduce emissions, as well as its associated cost such as penalties from non-compliance with safe-guard mechanism. It would also enable us to reach Jemena's Emission Reduction target of Net zero by 2050.
- A proactive mains replacement is the most efficient manner to remove the risks with significantly lower costs than a mains repair or a piecemeal reactive mains replacement. This is because the fixed costs associated with replacing mains are spread over a greater volume and using the insertion technique is a cost-effective replacement methodology. Also, the project is designed such that planning for growth will be assessed on a case by case basis in the future.
- Operating costs will be reduced significantly after rehabilitation project, making the network more affordable to customers over the longer term.

3.1.3.2 Limitations

- The older plastic mains will still have levels of leakage. However, the repair of plastic mains is less complex than for ferrous mains and the magnitude of leakage is typically lower.
- This is a higher capital cost than Option 1 or 2.

3.1.4 Option 4: Leave unprotected steel in situ and seasonally reduce network operating pressure to 70kPa

Option 4 is lowering the network pressure to 70kPa between the months of November and March as there is less demand on the network during the warmer months, reinforcement of the network is not required. The network pressure must be returned to 100kPa April to October to meet demand.

In its current configuration the network can be lowered to 70kPa for the summer period. However, any further reduction will result in meter regulators operating below their manufactured design pressure. To lower the network pressure lower than 70kPa would require:

- Replacing service regulators on domestic meter sets.
- Upgrading commercial meter sets. In some cases replacement of the customers service and customer piping/equipment.

It can be assumed lowering the network pressure between November and March will reduce the volume emitted by gas leaks, as well as the number of reported leaks. Note that this method does not reduce the number of leaks, just the volume of gas escaping the leak. The network will continue to deteriorate, which will increase the magnitude of leaks, opex and emissions over time.

The estimated capital cost to allow for future demand is $400K. Additionally, as the mains have not been rehabilitated, it is assumed that minor capital works similar to Option 2 would still be required and included in the estimate.

3.1.4.1 Benefits

- The reduction in pressure will in turn reduce the leakage rate. This decrease in UAG from leakage translates to a saving in opex.

3.1.4.2 Limitations

- The reduction in pressure will result in minimal opportunity for growth without reinforcement.
- Network pressure reduction may require customer sites to be assessed and upgraded (meter sets and downstream pipework) to enable sufficient pressure and flow delivery. This has not been included in the cost estimate.

3.2 Options analysis

Table 3–1: Options analysis – Kurri Kurri rehabilitation Stage 2

Criteria	Option 1	Option 2	Option 3	Option 4
Option description	Maintain Status Quo	Undertake minor capital works on steel mains	Replace unprotected steel mains with plastic mains	Seasonal reduction of operating pressure to 70kPa
Benefits	• No Capex costs • No capacity constraints from pressure reduction	• Minor Capex costs spread over 25 years • Opex costs remain stable	• Provides a safer network • Eliminates the risk to personnel working on steel mains. • Reduction in Opex due to rehabilitation of steel mains • Totex ($15.5M) over 25 years is lowest for compared to all options • Provides best outcomes (financial and safety) for customers	• Low Capex costs • Reduces leakage rates due to lower pressures
Limitations	• Increasing Opex costs (repairs and UAG) • Does not address the safety risk to personnel working on steel mains • Does not address the safety risk to the public from corroding steel mains	• UAG costs still high • Progressively only addresses the issue with corroding mains	• Requires high upfront capital expenditure	• Capacity constraints from pressure reduction • Limited growth opportunity
Treated Risk Ranking	Significant	Moderate	Low	Moderate
Total Capex	$0M	$1.96M	$9.82M	$0.4M
Total Opex (25years)	$27.6M	$36M	$6M	$23M
Relative NPV to 'Status Quo' ($2023)	$0k	-$4.4M	$65.7M	$14.8M
Options Analysis	Does not address the issue	Partially addresses the issue	Fully addresses the issue	Partially addresses the issue
Recommendation	Not recommended	Not recommended	Recommended	Not recommended

4. Recommendation

Option 3 - Replace unprotected steel mains with plastic mains and maintain pressure at 100kPa - is recommended as the most prudent option for this project.

The proposed solution addresses safety of the public, customers and our employees, but also delivers a cost effective solution in the medium term. In addition to primary drivers, this option will significantly reduce our fugitive emissions, whilst enabling JGN the time to utilise new technologies in development of future replacement strategies for other network materials.

This option addresses the project drivers and aligns with Jemena's business plan, customer expectations, the NGO, the NGR and well as accepted industry practice.

4.1 Economic analysis

Please refer to Investment Framework file name 'JGN - RIN - 4.3 - 10068650 - Kurri Kurri Rehabilitation Stage 2 - CBAM - 20240628 - Public'.

Please refer to Pricing Estimate Model (PEM) file name 'JGN - RIN - 4.3 - 10068650 - Kurri Kurri Rehabilitation Stage 2 - PEMO - 20240628 - Public'.

4.2 Risk outcomes for the preferred option showing how risks is mitigated / reduced.

The treated risk in implementing Option 3 to rehabilitate the steel mains is reduced from 'Significant' to 'Low'.

Table 4–1: Summary of preferred option

PREFERRED OPTION – Risk assessment summary				Treated risk summary		
Preferred Option/Treated risk	Cost	Benefit	Key mitigations	Consequence	Likelihood	Risk level
Option 3 Replace unprotected steel mains	$9.82M	• Eliminates all the corrosion issues associated with ferrous mains • Reduction in emissions and UAG • Reduction in opex due to removal of corroded ferrous mains	• Eliminates the risk of complex repairs on leaking steel mains for Jemena personnel • Provides a safer network for the residence and visitors • Complies with the Gas Supply Act 1996; No 38 (3), due for the ferrous mains being rehabilitated and condition of plastic mains being addressed on an as required basis	Minor	Unlikely	Low