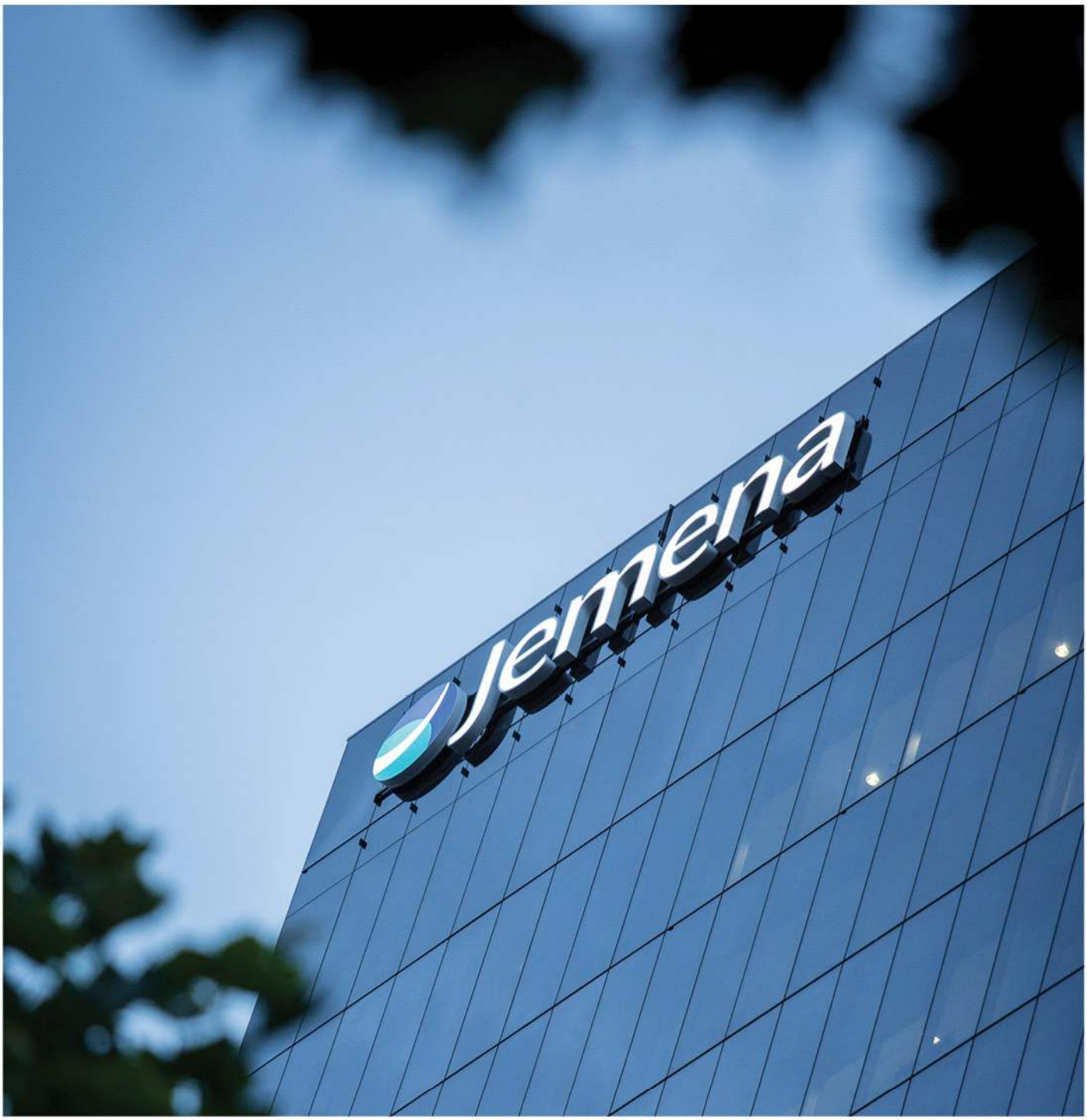

Jemena Gas Networks (NSW) Ltd

SPM Integrity Management - Phase 2

Jemena
bringing energy to life

1 August 2023

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1. Summary

The business case is for the continuation of the Sydney Primary Main Integrity Management Program, which was developed and reviewed during the previous access arrangement review process (for the period 2020-2025).

The Sydney Primary Main (SPM) from Lane Cove to Willoughby is a vital JGN asset that travels through highly populated areas carrying natural gas to domestic and commercial customers in Sydney's northern suburbs. This pipeline was commissioned in 1976 and is nearing the end of its design life. The SPM has various historical constructability issues such as heat shrink sleeves and inability to be internally inspected. It is also subject to increasing encroachments by surrounding developments. The Willoughby PRS also has risks inherent in its current position due to the developments that have encroached around the site.

In the options analysis document GAS-1400-RP-RM-003, JGN proposed to address the integrity risk on the Lane Cove to Willoughby section of the SPM by de-rating the pipeline down to secondary pressure. This was determined to be a more practicable and prudent method of managing this particular section of the pipeline than reconfiguration or replacement. The Australian Energy Regulator (AER) accepted this proposal to de-rate the pipeline in its access arrangement determination.

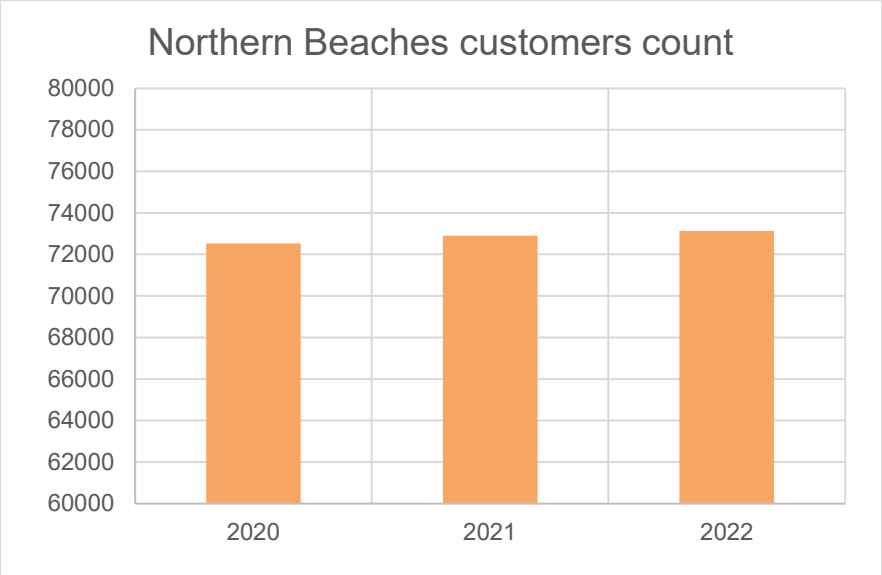
A consequence of de-rating the SPM is that it creates a shortfall in the capacity of the network around the Northern Beaches, which would impact approximately 3,300 customers and prevent further network connections in the area. Growth is still expected in the Northern Beaches area, recent data shows new connections are still strong and customer base increasing, see figure 1-1 below, these customers expect a reliable gas supply, therefore the three-stage SPM Integrity Management Program was initiated.

As shown in Table 1-1 below, the SPM Integrity Management Program incorporates several stages of work designed to address integrity of supply to the region and ultimately allow JGN to de-rate the SPM and retire the Willoughby PRS. Stage 1 has been delivered. This business case relates to Stage 2, which seeks to reinforce the Northern Beaches secondary network.

Table 1-1 SPM Integrity Management Program breakdown

Stage	Scope	Value	Progress
Stage 1 (Early Works)	80m HDD across Waterloo Rd to avoid interface with TfNSW works.	$1.26M	Completed
Stage 1	1.8km of DN250 Secondary Main in Talavera Rd, 70% nightworks to construct.	$13.75M	Complete May 2023
Stage 2 (This Project)	Further reinforcement of Northern Beaches secondary network - interconnect: 7km of DN250	$21.4M	Gate 1 June 2023
Stage 3	Interconnect Primary and Secondary mains at Lane Cove MLV – 15m of 250mm Steel. Also decommissioning of Willoughby PRS	~$1.5M	Planned for CY26

Figure 1-1: Northern Beaches Customer numbers



1.1 Business need

The key driver is to manage integrity and the risk of operating aging assets (SPM and Willoughby PRS) through an area of Sydney with increasing population density and potential for encroachment. With the commencement of early works and stage 1 of the program to manage the integrity risk, the commencement of stage 2 will be required to satisfy the overall objectives moving forward.

The decision to de-rate the Northern Primary Main and decommission Willoughby PRS requires an increase in capacity to the Northern Beaches region to prevent loss of supply and maintain safety and compliance within the network in Sydney's North. There are multiple constraints within the network due to pipe diameter that will not allow for gas to be reliably supplied to customers as a result of this de-rating integrity management strategy.

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 so, 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 consider 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.

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.[1]

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

Four options were considered to address the capacity issues in the Northern Beachers:

1. Do not continue to the SPM Integrity Management Program.
2. Develop a local source of biogas that can be injected into the Northern Beaches secondary network during time of peak demand.
3. Install a new secondary main in the Northern Beaches.
4. Develop a gas peaking facility (storage and compression) that can supply the region.

Option 3 is the recommended approach. Installing a new secondary main in the region:

- eliminates the risk of supply loss to customers in the scenario that the SPM from Lane Cove to Willoughby is downrated;
- addresses the identified risks for the most efficient capital cost;
- uses a conventional strategy with minimal opex liability; and
- is a traditional and well understood scope of works, performed by Zinfra Network Services, who are experienced in such projects.

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 to maintain quality of supply in the Northern Beaches. Conducting the necessary reinforcement works in the region is a prerequisite for derating the SPM and Willoughby PRS, which has been identified as the most prudent method of managing these aged assets.
- **Efficient** – Installing a new secondary main in the region is the most practicable and efficient option. It is a lower cost option than developing a peaking supply, and the work can be conducted in a relatively straightforward manner by our operations partner, Zinfra. Unit rates for this type of work are well understood and have been/will be established via competitive tendering processes.

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

- **Consistent with accepted and good industry practice** – The installation of another secondary main will ensure the distribution network in the Northern Beaches will remain above its minimum allowable operating pressure during times of peak demand. The proposed solution is well established good industry practice and is proven to be a practicable solution to declining operating pressures.
- **Achieve the lowest sustainable cost of delivering pipeline services** – Network reinforcement in the Northern Beaches will allow the SPM to be de-rated, without compromising quality of supply. De-rating the aged SPM and decommissioning the Willoughby PRS is a lower cost alternative to reconfiguring the pipeline and PRS, and will enable lower and more sustainable maintenance costs to be achieved over the longer term.

NGR 79(2)

The proposed capex is justifiable under NGR 79(2)(c)(i) and 79(2)(c)(ii), as it is necessary to maintain the safety and integrity of services. The project addresses the integrity and safety risks of operating the higher populated and high density area of Lane Cove to Willoughby section of the SPM. De-rating the pipeline down to secondary pressure was determined to be a more practicable and prudent method of managing this particular section of the pipeline than reconfiguration or replacement.

NGR 74

The cost estimate has been developed using rates provided by our current service provider, Zinfra, who establish unit rates and subcontractor costs via a competitive tender process. Material/equipment costs are based on current market rates, and demand forecasts are based on 2023 data. We therefore consider that this estimate has been developed on a reasonable basis and reflects the best information available at this time.

NGO

The SPM is vital to the gas distribution network in Sydney and will continue to provide gas distribution services to customers throughout the next regulatory period and for the foreseeable future. The SPM is likely to have a significant role throughout Australia's energy transition, therefore maintaining its efficient operation is in the long term interests of consumers. De-rating the Lane Cove to Willoughby section of the SPM is the lowest cost option to address current integrity issues. The associated reinforcement works in the Northern Beaches are in the long term interests of consumers in the region, who continue to want and value a gas connection.

1.5 Financial information

The total cost estimate for this option including overheads is $21.4M

2. Background

2.1 Project background

The North Ryde, Lane Cove and Willoughby region is supplied gas from the SPM. The SPM is a vital JGN asset that supplies gas to over 500,000 domestic and industrial customers across the Sydney region. The North Ryde Primary Receiving Station (PRS), Lane Cove PRS and Willoughby PRS, which distribute gas from the SPM are bound by the following geographical restrictions:

- Parramatta River and Port Jackson to the south;
- Windsor Road to the west;
- Tasman Sea to the east; and
- Hawksbury River to the north.

There are still two high priority growth areas outlined by the government for Ingleside and surrounding Frenchs Forest where a new state-of-the-art hospital has been constructed and will be expanded. Varying growth scenarios have been assessed with consideration of the high priority growth areas and findings from previous capacity development programs.

Figure 2-1: Sydney North Region Boundary

2.1.1 History of the project

The need to reinforce capacity in the northern suburbs of Sydney has a long history. The project has gone through many iterations and potential options in the past, beginning before 2012 with a full growth strategy of laying over 30km of primary and 10km of secondary mains with an associated PRS at a cost of $150,000,000 see PRJ-02519-01. JGN Sydney Northern Primary CDP.

In recent years, while the number of connections in the area continues to increase, growth has slowed. This slowdown has allowed JGN to defer some aspects of the long-term growth strategy for the area, substituting major works with a series of relatively minor projects to maintain the overall network in Northern Sydney.

The decision to de-rate the SPM and decommission the Willoughby PRS means further works are necessary to maintain supply in Sydney's northern suburbs. When the SPM is de-rated to lower pressures and the Willoughby PRS retired, our modelling indicates it will result in substandard operating pressures in the Northern Beaches, particularly during times of peak demand. This will affect around 3,300 customers and will inhibit the ability for the network support ongoing growth in the area.

JGN therefore developed the three-stage SPM Integrity Management Program, which comprises the necessary works to enable the SPM to be de-rated and the Willoughby PRS retired without compromising customer supply. Stage 1 of the SPM Integrity Management Program has already been delivered (see Table 1-1). This business case relates to Stage 2, which requires a supply solution for the Northern Beaches.

Several solutions have been considered to address the supply shortfall, including the potential for a renewable gas opportunity at the Kimbriki Resource recovery centre (discussed in Option 2 of this business case). However, the timing of projects and customer need means a more conventional network solution is required to mitigate customers supply impact.

2.2 Risk analysis

The SPM and Willoughby PRS run through an area of Sydney with increasing population density and potential for encroachment. The SPM and Willoughby PRS are aged assets, which have begun experiencing integrity issues and have become difficult and costly to maintain. The SPM Integrity Management Program is designed to mitigate the high risk associated with these assets. A risk assessment was carried out to address the options for treating the greater integrity risk, this is attached at Appendix A. Stage 1 of the program has already been delivered; the commencement of Stage 2 is necessary for the risk to be reduced to as low as reasonably practicable.

2.3 Consistency with asset class strategy and plans

Our strategy for trunk and primary mains is to prudently extend the life of network assets through proactive condition and assessment programs. Provided the assets meet operational and performance measures, we do not enforce an artificial replacement age.

Historically, we have managed trunk and primary mains through spot checks (integrity digs) inspecting the condition of the pipework. We then use the data collected to infer the pipe condition and operational safety elsewhere in similar locations. This practice is acceptable where pipelines are within their design life and the cost of undertaking a spot check is reasonable.

However, for ageing, critical assets such as the SPM, we have changed our strategy for managing the SPM to account for two things:

1. the condition of the SPM is deteriorating; and
2. the cost of integrity digs is increasing, which means spot checks are becoming less efficient.

Our strategy is therefore to de-rate the main where achievable. Where de-rating is not feasible, we will look to reconfigure the pipeline to enable pigging. De-rating reduces the risk from loss of containment, which is especially

important given the SPM traverses through densely populated parts of Sydney. Reconfiguring the main to enable pigging means we can detect corrosion and any potential damage early, allowing for prompt repairs to the pipeline before the loss of containment occurs. To meet customer needs for safety and reliability requirements, JGN monitors and assesses each network asset in compliance with relevant legislative requirements in accordance with AS/NZS 2885 Pipelines and its constituent parts.

The decision to de-rate the SPM and decommission Willoughby PRS is consistent with the JGN Pipelines Asset Class Strategy to de-risk aging infrastructure with incomplete historical records.

3. Options

3.1 Option costs & benefits

The following options were identified:

1. Option 1: Do not continue to the SPM Integrity Management Program – Stage 2 of the program would not be delivered. This is the base case and in effect, the adoption of this option would be seen as 'retaining the risk by informed decision[2]'. This option does not allow for the SPM to be de-rated.
2. Option 2: Develop source of Biogas at Kimbriki Resource Recovery Centre - this approach includes provision for storage at 25,000kPa, in two containerised cylinder packages (332GJ), the route being via HDD easement to Mona Vale Road. Biogas from the Kimbriki Resource Recovery Centre is upgraded to sales gas specification and stored at high pressure for injection into the network at times of high demand via an alternate route.
3. Option 3: Install new secondary main in the Northern Beaches area to reinforce supply. This approach involves installing new secondary main on Forest Way. This option interconnects the secondary networks in Frenchs Forest and Terrey Hills, providing the required capacity to allow the SPM to be de-rated.
4. Option 4: NG peaking facility. Storage at 25,000kPa, in two containerised cylinder packages (332GJ), the route being- via HDD easement to Mona Vale Road. Natural Gas is extracted from the network during periods of low demand, compressed and stored at high pressure for injection into the network at times of high demand via a two-way pipeline.

All Options are explained in detail below and expanded upon with variations in GAS-1999-RP-IN-014 - OPTIONS ANALYSIS – SPM INTEGRITY MANAGEMENT STAGE 2.

3.2 Option 1: Do not continue the SPM Integrity Management Program

Under this option, the ongoing SPM Integrity Management Program will cease. Stage 2 of the program will not be delivered. JGN would effectively be accepting the risk of loss of supply to more than 3,000 customers if the SPM is de-rated. If the SPM is not de-rated, JGN would be accepting the high safety and integrity risk posed by continuing to operate the aged SPM and Willoughby PRS at higher pressures.

This option requires zero upfront capex but would result in JGN incurring significant opex during peak periods when thousands of customers would likely lose supply.

This option is not recommended, as it would not address the risk associated with de-rating the SPM and would result in significant disruption to customers.

3.3 Option 2: Develop source of Biogas at Kimbriki Resource Recovery Centre

This option takes the following approach:

1. Engineer, design, procurement, and construction of a biogas (land fill gas) upgrader at Kimbriki Resource Recovery Centre, inclusive of facility balance of plan, amenities and utilities.
2. Construct custody transfer meter station downstream of the upgrader.
3. Install two containerised cylinder packages (332GJ) and compressor for gas storage at Kimbriki site, high pressure storage (25000kPa).
4. Construct secondary injection station and secondary pipeline to existing main on Mona Vale Rd via HDD through the existing sewer easement.

(i)

Refer to Figures 3-1 and 3-2 and 3-3 for the proposed works.

Figure 3-1: Kimbriki Resource Recovery Centres Option indicative proposed scope

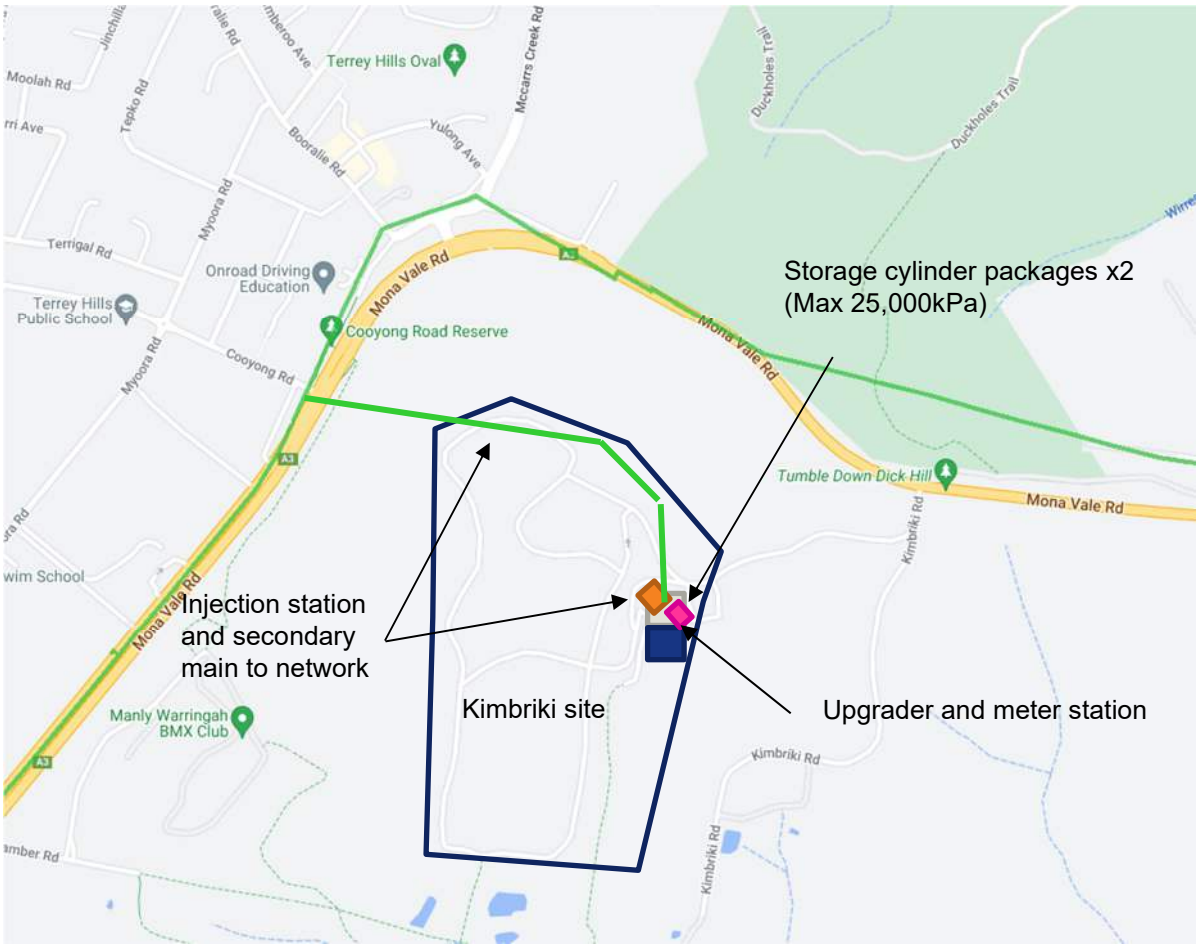


Figure 3-2: Aerial view of proposed solution

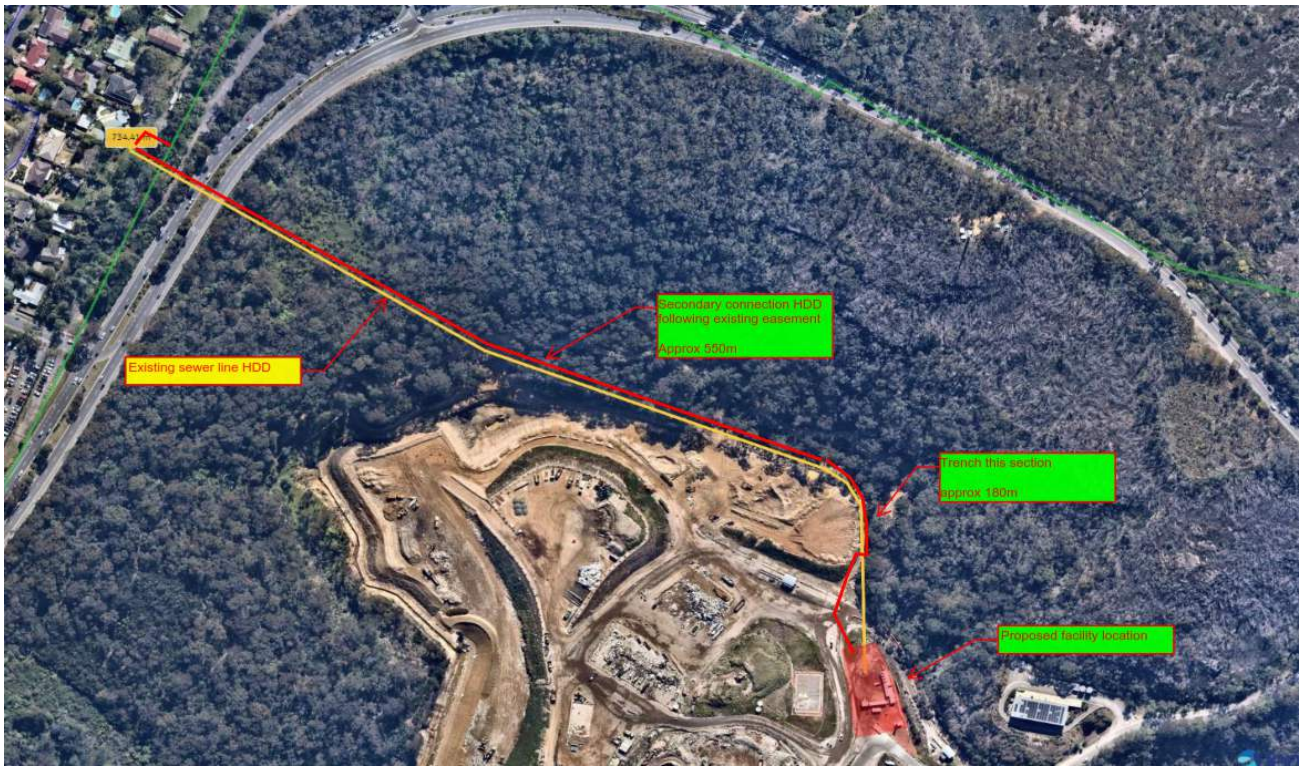


Figure 3-3: Site footprint proposed

Option 2 is not recommended. Further analysis revealed that the quality and quantity of available biogas at the Kimbriki site means it would be uneconomical to upgrade and inject to the network, at this time. For this option to be economically viable, it would require significant funding assistance from ARENA or another external/government entity. JGN does not consider this funding assistance would be available within the timeframes required to undertake this work and de-rate the SPM.

3.4 Option 3: Install new secondary main in Northern Beaches to reinforce supply

This option takes the following approach:

1. Lay ~6.1km of DN250 secondary main along Forest Way, interconnecting the existing DN200 main in Rabbett St, Frenchs Forest and the DN250 main in Mona Vale Rd.

2. Tie-in and commission new main.

Refer to Figure 3-4 below.

Figure 3-4 – Secondary route along Forest Way

This is the recommended option. We have identified the most viable route for the mains, and consider that the mains extension can be constructed during the forthcoming regulatory period, enabling the SPM de-rating and the Willoughby PRS decommissioning to be completed as soon as reasonably practicable.

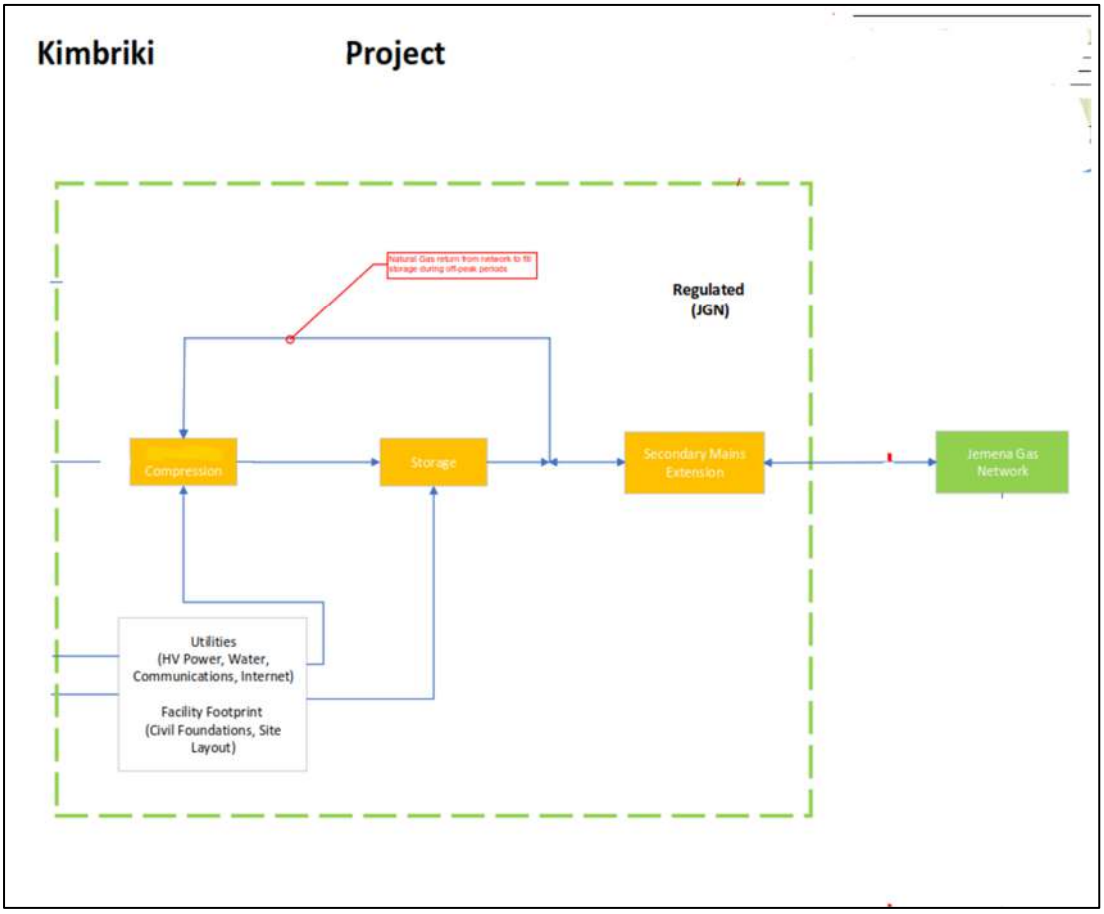
3.5 Option 4: Develop a Gas Peaking Facility (Compression and Storage)

This option takes the following approach:

1. Engineer, design, procurement and construction of a natural gas peaking facility at Kimbriki Resource Recovery Centre, inclusive of facility balance of plant, amenities and utilities.
2. Install 2 containerised cylinder packages (332GJ) and compressor for gas storage at Kimbriki site, high pressure storage (25000kPa).
3. Construct secondary injection station and secondary pipeline to existing main on Mona Vale Rd via HDD through the existing sewer easement.

Refer to Figure 3-5 below.

Figure 3-5: NG Peaking proposal



This option is not recommended, although it provides for the capacity shortfall caused by the de-rating the SPM, the line route is difficult to construct, which will lead to a high project cost.

3.6 Options Analysis

Criteria	Option 1	Option 2	Option 3	Option 4
Option description	Do not continue the SPM Integrity Management Program	Develop source of Biogas at Kimbriki Resource Recovery Centre	Install new Secondary Main in Northern Beaches area to Reinforce supply	Develop a gas peaking Facility (Storage and Compression)
Benefits	• This option is the lowest capital cost (CAPEX) option.	• This option aligns with Jemena ESG (Environmental, Social, Governance) commitments to introduce renewable sources of gas to the network . • Network capital outlay is in-line with the traditional network reinforcement options. • This option follows a similar model to the Malabar biomethane project which allows Jemena to leverage systems and processes that are already in use.	• The option addresses the objectives of the project, eliminating the risk of supply loss to customers in the scenario that the SPM from Lane Cove to Willoughby is downrated. • The route along Forest Way provides more space for construction and therefore better production rates lowering the cost of the project. • Although Forest Way is an RMS road requiring extra approvals, the space constraints and proximity of residents on Powderworks Road would provide more challenging construction constraints, again reflected in the price. • The need for permits for work along Forest Way also allows stakeholder risk to be managed more effectively.	• Network capital outlay is in-line with the traditional network reinforcement options. • The storage facility is proposed to be built with the Kimbriki Waste Management facility, reducing interface with community and RMS • The compression and storage facility is a modular, self-contained of asset, making it scalable, relocatable and saleable.

Limitation	When the Sydney Primary Main between Lane Cove and Willoughby is derated as planned, the do-nothing option would cause ~3,300 customers to lose supply during winter peak periods on an ongoing basis. • The ongoing loss of supply would create unwanted reputational damage, regulatory scrutiny and un-necessary operational costs to relight customers. • Jemena would be operating below the minimum design threshold in both the secondary and medium pressures systems, creating an unwanted Level of Service (LoS) to our customers. • All gas connections (growth) in the area need to be halted, this would result in lost revenue and regulatory scrutiny.	• Ongoing OPEX costs including maintenance of the upgrader package • Extra cost associated with compression design and regulatory hoops for high pressure • HDD through existing sewer easement with require design and stakeholder engagement for right to use space. • Financial viability of build, own and operate model for the upgrader is not feasible without government incentives or co-funding. • Difficulty in finding build, own, operate partner due to financial unviability of the upgrader process at this site. • Extra cost associated with compression design and regulatory hoops for high pressure gas storage	• Forest Way and Mona Vale Road are RMS roads, requiring ROLs to work on which will limit time and space availability. • This route is slightly longer than some alternatives considered	• Compressions and storage facility is a complex piece of equipment that requires significant design work to work efficiently. • Locating the facility on site of the Kimbriki Waste Management facility would require negotiation and compensation as without a biogas component there is no benefit to Kimbriki in such an arrangement. • Jemena would build, own and operate the compression and storage facility which would require ongoing OPEX spending. • Lack of experience and expertise in operating this type of plant
Treated Risk Ranking	High	Low	Low	Low
High level Cost($M)	Nil	$38.6M	$21.4M	$22.4M
Recommendation	Not Recommended	Not Recommended	Option 3	Option 4

4. Recommendation

The recommended option is to reinforce the secondary network by constructing a new DN250 main along Forest Way, interconnecting the existing DN200 main in Rabbett St, Frenchs Forest and the DN250 main in Mona Vale Rd.

4.1 Economic analysis

A Costs and Benefits Analysis has been undertaken, based on the PEM pricing. The results show that Option 3 is the lowest cost in NPV terms. See file 'JGN - RIN - 4.3 - 10043035 - SPM Integrity Management - Phase 2 - CBAM - 20240628 - Public'.

4.2 Preferred option

The recommended option was selected as it addresses the identified risks in the most efficient, cost-effective way. The new secondary main project will supply the required capacity to the network after the Lane Cove to Willoughby section of the Sydney Primary Main is de-rated, it is a traditional solution that minimises ongoing operating costs by being consistent with majority of JGN's asset base.

5. Appendices

5.1 Appendix A – Risk Assessment

A risk assessment was conducted to determine the level of risk severity of the untreated risk. The table below shows the summary of results and then the treated risk summary for each option. The risk assessment was undertaken in accordance with the Jemena Risk Manual JAA MA 0050 (based on ISO 31000). This risk assessment addresses the underlying driver of the project which is the derating of the Sydney Primary Main from Lane Cove to Willoughby. The options discussed below are discussed in detail in Options Analysis GAS-1400-RP-RM-003

	UNTREATED IMPACT/CONSEQUENCES							UNTREATED RISK SUMMARY		
Contributing Factors/ Scenario	Strategic	Financial	Safety	Operational	Regulatory & Compliance	Reputation	Comments	Consequence (Highest Impact)	Likelihood	Risk Level
Pipeline integrity issue i.e. metal loss corrosion failure due to CP shielding or third party damage resulting in Loss of containment with ignition causing jet fire	N/A	N/A	Catastrophic (Jemena) Catastrophic (AS2885)	Major (Jemena) Severe (AS2885)	Major	Major	○ SAFETY: CATASTROPHIC –Potential fatality associated with Loss of Containment anywhere on line ○ REGULATORY: MAJOR – Government/regulator review results in fines and/or litigation ○ REPUTATIONAL: SEVERE - Reputation impacted in pipeline industry, government and community stakeholders. ○ OPERATIONAL: MAJOR – Loss of Supply to 60,000 to 70,000 customers	Catastrophic (Jemena) Catastrophic (AS2885)	Unlikely (Jemena) Unlikely (AS2885)	High (Jemena) High (AS2885)
Inability to maintain supply to all customers during emergency or planned repairs as a result of pipeline failure causing loss of supply to customers downstream of Stringybark MLV	N/A	Serious (Jemena)	N/A	Major (Jemena) Major (AS2885)	Major	Severe	○ FINANCIAL – For a seven to 21 days loss of supply during repair works of SPM (SB-W). Financial consequence includes lost transmission and distribution profits, claims for lost profits by customers, breach of supply contracts, etc ○ OPERATIONAL – For a twenty one day loss of supply, 68,000 plus small customers and 3 large customers affected. ○ REGULATORY & COMPLIANCE – Violation of Gas Supply Act requirement to ensure the continuity supply of natural gas to customers requiring formal explanation by senior management and regulatory review	Major (Jemena) Major (AS2885)	Unlikely (Jemena) Remote (AS2885)	Significant (Jemena) Intermediate (AS2885)

		○ REPUTATION – Persistent public scrutiny for loss supply for large scale loss of supply to large customers including airport and major customers.			
PREFERRED OPTION – Risk assessment summary			**TREATED RISK SUMMARY**		
Preferred Option/Treated risk	Benefit	Key Mitigations	Consequence	Likelihood	Risk Level
Option 2 – Reconfigure for ILI and install physical protection	- SPM (SB-W) section can be operated as Primary, therefore no network augmentation will be required. - Undertaking slabbing, ILI and compliance upgrade projects will reduce the risk of pipeline failure from “High” to “Low” in terms of AS2885, and “Moderate” as per Jemena Risk Matrix.. - JGN would be compliant to Gas Supply Act 1996 No.38 and AS2885. - Provides the ability to plan for future integrity works and inform about the expected life of the asset.	○ Confirmation of pipeline’s ability to continue operating at MAOP in its entirety. ○ This option will provide a mechanical barrier to third party external interference. ○ Satisfy the requirements of AS2885.3 Section 6 “Pipeline Structural Integrity”. ○ Will effectively reduce the consequences of all worst case scenarios and thus reducing the overall risk to general public, adjacent properties and to Jemena’s reputation from High to Low (in terms of AS2885)	Major (Jemena)	Rare (Jemena)	Moderate (Jemena)
			Major (AS2885)	Hypothetical (AS2885)	Low (AS2885)
		○ Confirmation of pipeline’s ability to continue operating at MAOP in its entirety. ○ This option will provide a mechanical barrier to third party external interference.	Major (Jemena)	Rare (Jemena)	Significant (Jemena)
		○ No guarantee against anomalies causing restriction or loss of supply which do not fit trend.	Major (AS2885)	Hypothetical (AS2885)	Intermediate (AS2885)
Option 3 – De-rate pipeline pressure by augmenting the network	- Single project will be required to mitigate public safety and security of supply, avoiding any future re-work or additional projects to maintain this section at primary pressure. - JGN would be compliant to Gas Supply Act 1996 No.38, AS2885.and AS4645. - Augmenting the network will allow JGN to remove the downstream bottle neck in the secondary network thus maintaining security of supply in the event of asset failure and also provide provision for future capacity growth in the region. - Undertaking the network enhancement project is considered to be the lowest sustainable cost option as compared to other options. - Implementation of this project will reduce the potential life cycle operational cost of this asset, requiring less stringent integrity management.	○ Pressure reduction will eliminate any catastrophic failure along this section by reducing the consequence of leak failure with ignition due to lower pressure in the pipeline. ○ MOP reduction will satisfy the energy release rate limit for high consequence areas ○ Concrete slabs or similar prevent any damage from external excavator or vertical auger leading to gas leak.	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena)
			Severe (AS2885)	Remote (AS2885)	Low (AS2885)
		○ Augmenting the network will provide the shortfall to be met from other sources. ○ Less impact on customers due to removing the bottleneck in the network.	Serious (Jemena)	Rare (Jemena)	Low (Jemena)
			Minor (AS2885)	Remote (AS2885)	Negligible (AS2885)

Option 4 – Replace the entire 7.5km section of the main	- SPM (SB-W) section can be operated at a Primary pressure - Undertaking pipe replacement will reduce the risk of pipeline failure from “High” to “Low” in terms of both AS2885, and Jemena - JGN would be compliant to Gas Supply Act 1996 No.38 and AS2885. - Minor OPEX savings resulting from a newer pipeline	○ Eliminates the threat of third party damage and corrosion failure to low. ○ Achieves regulatory compliance ○ Best long term risk reduction option ○ Significant capital outlay ○ High delivery & low efficiency	Major (Jemena)	Rare (Jemena)	Moderate (Jemena)
			Major (AS2885)	Hypothetical (AS2885)	Low (AS2885)
		○ Eliminates the threat of third party damage and corrosion failure to low.	Major (Jemena)	Rare (Jemena)	Moderate (Jemena)
			Major (AS2885)	Hypothetical (AS2885)	Negligible (AS2885)