Jemena Gas Networks (NSW) Ltd

Networks Asset Class Strategy

Jemena
bringing energy to life

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Abbreviations

AA	Access Arrangement
ABS	Asset Business Strategy
ACS	Asset Class Strategy
AMS	Asset Management System
APaIR	Asset Performance and Integrity Review
COWP	Capital and Operating Work Plan
DRS	District Regulator Sets
FBE	Fusion Bonded Epoxy
HDCU	High Density Community Use
HDPE	High Density Polyethylene
HRVs	High Risk Valves
I&C	Industrial and Commercial
JCARS	Jemena Compliance and Risk System
JGN	Jemena Gas Networks
LPDRS	Low Pressure District Regulator Sets
MAOP	Maximum Allowable Operating Pressure
MPDRS	Medium Pressure District Regulator Sets
OPSO	Over Pressure Shut Off
RASCI	Risk Information. Table 3-3 Outlines the
SDRS	Secondary District Regulator Sets
SRS	Secondary Regulator Sets
UAG	Unaccounted for Gas

Asset class snapshot

Asset sub-classes

- Secondary mains and services
- Low and medium pressure mains and services
- Network pressure control
- Consumer pressure Control

Expenditure drivers

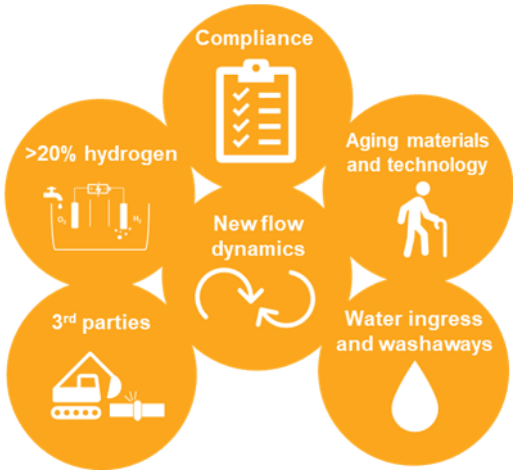
Asset management considerations

- Whole of lifecycle costs
- Contemporary technologies and innovations
- UAG and emissions reduction
- Renewable gas ready

Performance

- Notifiable incidents
- Public reported escapes
- Maintenance plan compliance
- Customer hours off supply
- Poor supply incidents
- 30-minute emergency response
- TBC – capex/opex efficiency
- Reduce fugitive emissions
- Ready for biomethane and 10-20% H_2
- Ready for>20% H_2
- Reduced UAG
- TBC — Capex per new connection / dwelling

Emerging risks and opportunities



Key initiatives

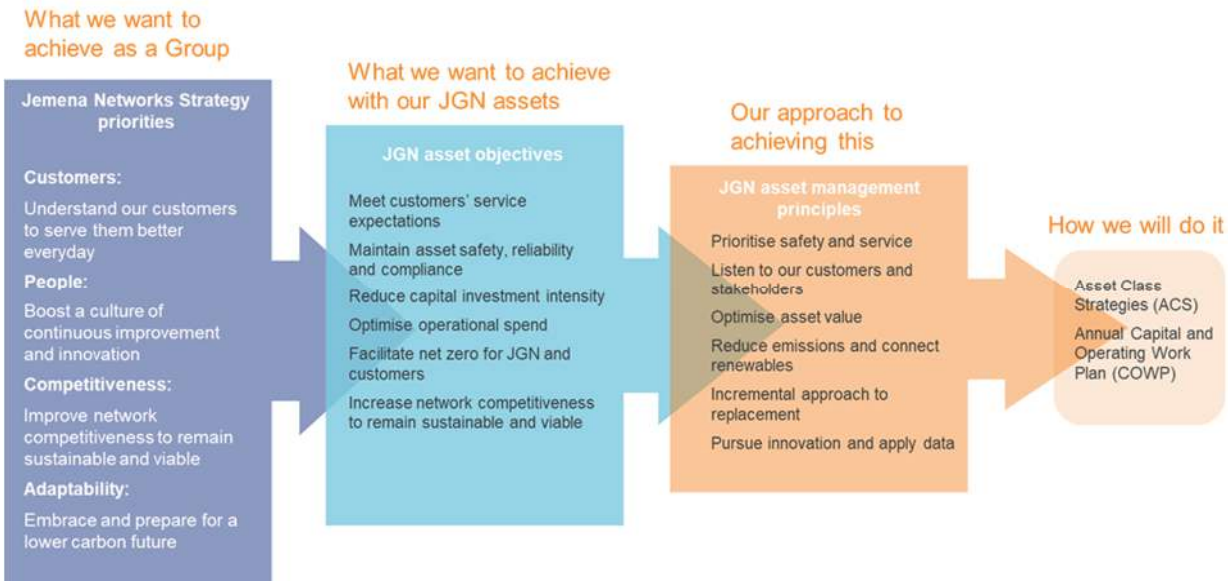
- Utilising Picarro leak detection technology for methane volume quantification, fugitive emissions reporting and optimising mains replacement planning
- Constructing networks and supply facilities to service new areas
- Planned and reactive maintenance of assets, as well as end of life replacement programs
- Network readiness research for >20% hydrogen concentration of renewable gas

PART A: Strategy and asset management principles

1. Purpose of this document

The purpose of this Networks Asset Class Strategy (**ACS**) is to explain the approach and principal methods by which the networks asset class contributes to delivering the Jemena Gas Networks (**JGN**) asset objectives. The JGN asset objectives are defined in the JGN Asset Business Strategy (**ABS**) and driven by the overarching Jemena Networks Strategy. The ACS is reviewed and updated annually and considers up to a 20-year outlook for the asset class.

Figure 1–1: Summary of JGN asset objectives and asset management principles



As shown in Figure 1–1, the Jemena Networks Strategy sets out what we want to achieve with our network assets (both gas and electricity) as a Group. This informs our JGN asset objectives, which outline what we want to achieve with our gas network assets. We then have a set of asset management principles, which inform the approach we will take to achieving our JGN asset objectives.

The role of the ACS is to bring these together and explain at a high level of **how** we will manage each asset class. From here we can develop the various business cases and works programs that form our annual work plan, budgets, and ongoing expenditure forecasts.

The Networks ACS includes information about each asset sub-class, including:

- Drivers for expenditure – the key asset management drivers that inform why and when we invest in our network assets
- Asset management considerations – the important factors we consider when determining when and how to invest in our network assets
- Asset performance – information about performance, condition, and service levels
- Emerging risks and priorities – identified threats, opportunities, strengths and weakness that we need to be aware of and factor into our network asset management plans
- Key initiatives – taking all of the above into consideration, the ACS provides a high level summary of key initiatives / asset management practices we will undertake to ensure our network assets meet the JGN asset objectives

The ACS also includes appendices containing contextual information on the asset class profile. This is the detailed information about the type, specifications, life expectancy and age profile of the network asset sub-class in service across the JGN distribution network.

1.1 Structure of this ACS

Main body

The main body of ACS is structured into three broad parts, designed to allow the document to be reviewed and updated easily:

- **Part A: Strategy and asset management principles** – this section makes the link between the ACS and the overarching Jemena Network Strategy, summarising the asset class objectives, expenditure drivers and governance process for managing network assets.
- The information in Part A should be relatively static, only changing when there is a material change to the overarching Jemena strategies. While Part A should be revisited as part of the annual ACS review, it is unlikely to require significant updates, and should be reserved for a major review every five years.
- **Part B: Asset performance** – this section summarises the current performance and risk associated with the asset class. It also includes as summary of asset quantities as at the end of the last full calendar year. Part B is essentially a summary of the critical information from the annual Asset Performance and Integrity Review (**APaIR**), as well as the relevant asset risk register for each asset class.
- The information in Part B should be high level only, with the finer detail on asset performance and risk available in the related APaIR and risk register. Part B should be reviewed and updated annually, to reflect the critical information from these two documents.
- **Part C: Emerging risks and priorities** – this section summarises any risk or opportunities that we need to be aware of when managing the asset class. This may include, for example; technical obsolescence; pending supply or specification changes; government policy; or technical developments/innovation.
- Part C should include a high-level summary of the current key initiatives, a high-level view of the strategies we are undertaking or asset management approach being applied to the asset class. For detail on specific projects or costings, this information is contained in the individual business cases and Capital and Operating Work Plan (**COWP**).
- The information in Part C should be reviewed and updated annually, to make sure it still reflects the emerging risks, priorities and current projects.

Appendices

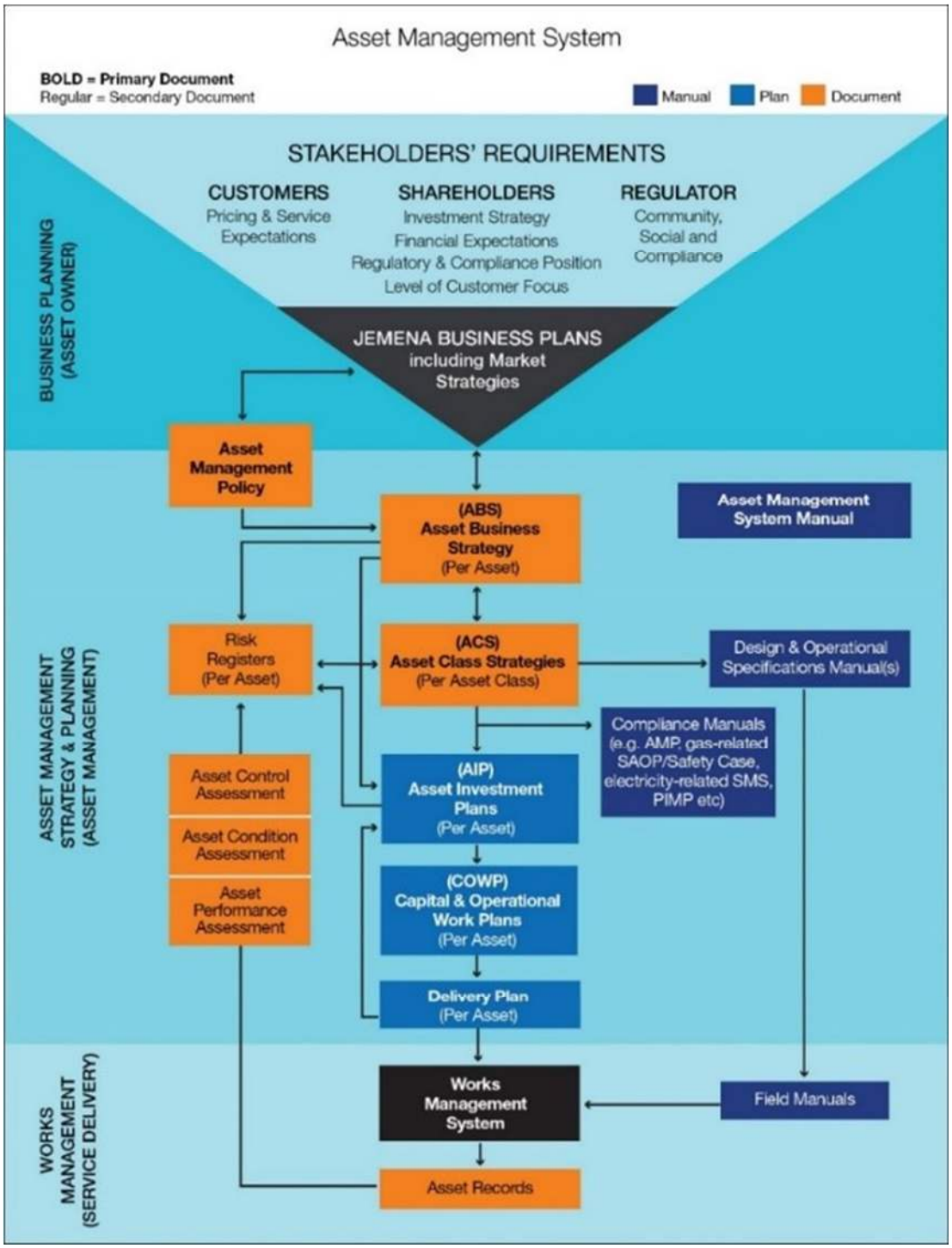
The ACS also includes appendices that contain additional exhaustive information on the asset class type, failure modes, lifecycle management, regulatory and legislative framework, and information requirements. The information in these appendices is relatively static in nature and should not require an annual update. It should be reserved for a major review every five years.

Much of the information contained in the appendices is drawn from other parts of our Asset Management System (**AMS**) (see Figure 1-2). Network asset information is collated in the ACS to provide a central source of useful and contextual information for the Asset Class Owner. The ACS provides line of sight across our AMS and demonstrates consistency with the holistic asset management good practice contemplated by the ISO 55001 asset management standard.

1.2 Asset management system

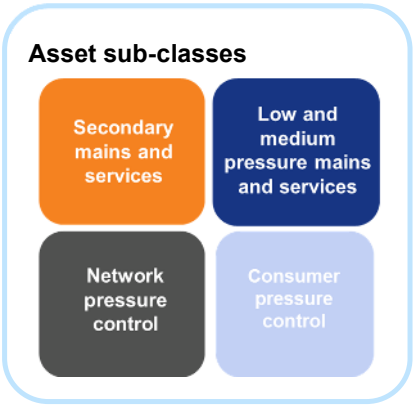
The relationship between the ABS and other documents within JGN's asset management system is illustrated in Figure 1-2.

Figure 1-2: JGN Asset Management System document hierarchy



A detailed description of JGN's asset management system and its constituent parts is available in the Jemena Asset Management System Manual and the Asset Management System Guidelines.

2. Description of assets covered



This document describes the asset class strategy for the JGN distribution network assets that operate at 1050kPa and below. The ACS covers the following asset sub-classes and ancillary equipment:

- Secondary network (including mains and services, valves);
- Medium and low pressure network (including pressure mains and services, valves)
- Network pressure control (secondary regulator sets (**SRS**) and district regulator sets (**DRS**)); and
- Customer pressure control (boundary regulators, excluding customer meter sets).

Figure 2-1 shows how the networks asset class features within the broader gas distribution network.

Figure 2-1: Schematic of JGN asset classes

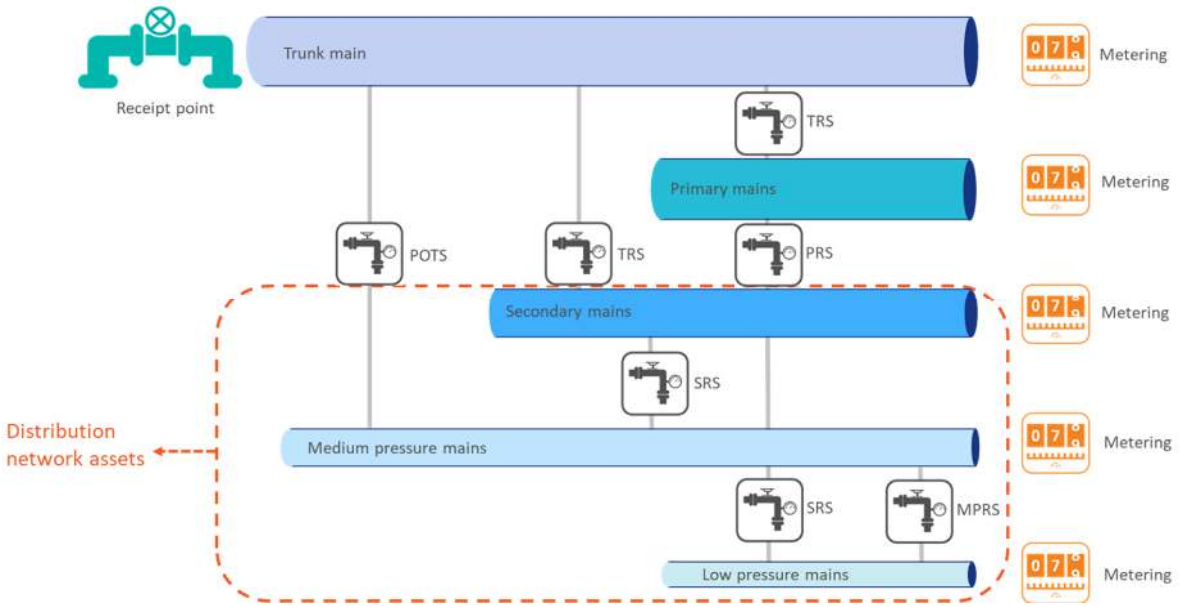


Table 2-1 provides a high level view of the assets covered by this ACS. Further details on the individual asset sub-classes, quantities and condition is provided in Part B of this ACS.

Table 2-1: Summary of key asset statistics

Sub-asset class	Description	Element
Secondary pressure 525 kPa to 1050 kPa	Gas distribution mains and services for the purposes of transporting gas throughout the serviced areas and up to the meter at industrial, commercial and residential properties. This sub-asset class also includes the cathodic protection system to extent asset lives as a corrosion preventive measure for the infrastructure Valves are part of this sub class and are used for cost effective network maintenance to isolate sections of mains, as well as used reactively to ensure safe, timely and efficient isolation of gas leaks during a reactive incident.	Mains Services
Medium and low pressure		Mains

Sub-asset class	Description	Element
7 kPa to 400 kPa	Gas distribution mains and services for the purposes of transporting gas throughout the serviced areas and up to the meter at industrial, commercial and residential properties.	Services
Network pressure control 7 kPa to 1050kPa	This sub asset class relates to pressure regulating equipment that reduces higher pressure gas within the distribution system to lower pressure, allowing for the most efficient transport of large volumes of gas.	DRS
Customer pressure control 2 kPa to 525 kPa	This sub asset class relates to pressure regulating equipment that reduces gas pressure from the distribution system to customer installations on private property.	Boundary regulators

The quantity of each types of asset in our network is continually changing. The number of each different type of asset as at the end of the last calendar year is summarised in Part B of this ACS.

A detailed asset description, along with failure modes and our lifecycle management methodologies, is provided in **Error! Reference source not found.** and **Error! Reference source not found.**.

3. Strategy and asset management principles

3.1 Alignment of asset objectives

The networks asset class objectives are designed to support the overarching JGN asset objectives. The JGN asset objectives are detailed in the JGN Asset Business Strategy (**ABS**).

The networks asset class objectives, along with the measures and targeted used to assess performance against these objectives, are presented in Table 3-1.

Table 3-1: Networks asset class objectives

JGN asset objective	Networks asset class objective	Asset class measure	Target (per annum)
Meet customers service expectations	Maintain current service levels to customers	Customer hours off supply – external caused	32720
		Customer hours off supply – internal causes	8180
		Poor supply incidents reported by the public per 1000 customers	1.4
		Percentage of emergency response jobs attended to within 30 minutes	85%
Maintain asset safety, reliability and compliance.	Maintain current level of network risk, only improving risk where efficient to do so	Significant Network incidents notifiable to technical regulator	[1]96
		Public reported escapes per 1000 customers	14
		Maintenance plan compliance	95%
Reduce capital investment intensity	Reduce the cost of investing in and maintaining distribution network assets, without compromising network risk	Demonstrated alignment on capital spend, reviewed quarterly	Within 10% of budget target (+/-)
Optimise operational spend		Opex budget control	Opex costs at or below Access Arrangement (**AA**) allowance level.
Increase network competitiveness to remain sustainable and viable			
Facilitate net zero for JGN and our customers	Renewable gas readiness	Network assets ready for Biomethane 100% & H_2 10/20%	100%
	Reduce fugitive emissions	Network pressure reduction program	5% average emissions reduction across program areas
		Targeted mains rehabilitation program	5% reduction from baseline survey v post repair survey
		Unaccounted for gas	<2.86%

3.2 Asset management principles

As detailed in the ABS and JGN-10 strategies, the operating environment and stakeholder expectations are crucial inputs into how we operate and invest in the network. External factors, including regulations, technical

[1] Target changed from 144 to 96 in January 2023

standards, technological advances, and customer requirements are regularly evolving, which means we must regularly review and monitor the strategic drivers for investment.

The ABS identifies the following principles that influence how we manage our assets. A summary of how these principles relate to the network asset class is provided in the table below.

Table 3–2: How the ABS asset management principles apply to the network asset class

ABS asset management principles	Summary	Network ACS
Prioritise safety and service	Our priority is to make certain our assets are safe, provide the service or function our customers and staff need.	Design standards align with Australian Standards such as AS/NZS 4645, to ensure JGN has safe and reliable mains and services in alignment with good industry practice.
Listen to our customers and stakeholders	We will listen to customer feedback and seek to offer them the network services they want, working within the regulatory and legislative framework set by our stakeholders	In addition to safe and reliable mains and services, customers want us to consider the most cost effective replacement or repair strategy and that materials are future gas ready.
Maximise asset value	Where possible we will seek to change the investment triggers for replacement/rehabilitation of assets such as meters, facilities, pipelines and network pressure mains, with a view to extending asset life where safe and prudent to do so;	We maximise asset life through ongoing assessments of materials and asset performance, and replace ageing materials with modern, industry good practice, plastic mains and services. We pursue innovative non-network solutions to reduce capital intensity, deferring spend where it is safe and prudent to do so.
Net zero	We will pursue opportunities to use our assets, or connect new assets, to help reduce our own or our customers' emissions, where economically efficient to do so;	The introduction of Picarro technology has enabled us to identify opportunities to reduce network leakage. Network modelling enables us to optimise network pressure to reduce leakage while still meeting customer demand. The network has been incrementally improving in readiness for renewable gasses for many years, as we have been installing plastic mains, which are ready for biomethane and blended hydrogen.
Incremental approach	We will adopt an incremental approach to modernising and adapting the network, introducing new asset types as older assets fall due for replacement, avoiding large-scale, high-cost replacement programs where practicable	Where prudent and cost effective we will incrementally replace components with >20% hydrogen blend capable materials. Consideration will be made, for example, when upgrading or replacing the soft parts (e.g. elastomers) of pressure reduction equipment to be hydrogen ready.
Use data to inform decisions	We will seek to inform our asset management practices with better data, for example using more sophisticated leak detection data to target mains and services replacement	The EAM Tool enables faster, smarter, "big bang' return on investment decisions which assist with managing safety, reliability and cost optimisation on our assets. Picarro technology will enable us to have more data regarding locations, scale of network leakage and maintenance requirements
Pursue innovation	We will follow technological advancements and investigate how we can apply innovative solutions to ensure the gas network remains valued by customers	Continued demonstration of the network's ability to transport less carbon intensive gas with projects such as Malabar Biomethane production plant connection and the Western Sydney Green Gas Trial. Pursue technology innovations such as the FTIR machine and bedding in Picarro leak detection equipment as part of business as usual.

3.3 Expenditure drivers and asset management considerations

Network 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 keeping the network safe and reliable, understanding and minimising our fugitive emissions is critical to help achieve net zero greenhouse gas emissions and comply with JGN's legislative requirements.

Investment in the networks asset class is largely driven by 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.

Figure 3–1 summarises the key drivers for expenditure in networks asset replacement and/or refurbishment.

Figure 3–1: Drivers of expenditure in networks asset replacement/refurbishment

These expenditure drivers are described further below:

- **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, 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.

Cost and affordability are always a factor. When incurring expenditure against these drivers, our aim is always to address the issue at the lowest practicably sustainable cost. Note this may not always mean the cheapest option. In making our investment decisions we consider the longer-term use of the assets in question, along with a suite of additional considerations. For the networks asset class, these key considerations are:

- **Whole of life costs** – will constructed infrastructure (new or replacement) be capable of delivering safe and reliable volumes and pressures in the medium and long term?
- **Contemporary technologies and innovations** – is a like-for-like replacement the best option? What new material and technology developments are likely to emerge during the asset's useful like?
- **Emissions reduction** – is there a lower-emissions alternative and is the incremental cost of this alternative a prudent and efficient option?
- **Renewable gas ready** – will the assets be ready for renewable gas of the future?
- **Unaccounted for gas** – networks will always leak, vent, or record variances between the amount of gas being distributed and the amount of gas being consumed. Is there a way of quantifying UAG more accurately?

Taking these considerations, our expenditure drivers, and our asset objectives into account, we select the most prudent and efficient strategy for managing each class and sub-class of asset.

3.4 Asset strategies

Our strategy for mains, services and pressure reducing facilities 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.

We are continuously improving and investing in tools that allow us to use better data and technology to optimise our asset management practices, capital intensity and operating costs. For example, a key technology that will enable better asset management decisions is the continued roll out of the Picarro leak detection units. These units provide information on leakage locations as well as the quantification of leakage. This data will help us optimise our mains and services repair and asset replacement strategies, reducing fugitive emissions, allow for more targeted pressure reduction strategies, whilst accurately scaling and targeting mains replacement projects.

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 4645: Gas Distribution Network Management*

We maintain the performance of our assets through proactive and reactive maintenance and to the extent it makes economic sense to repair, rather than replace assets. As network assets age, the amount of expenditure required to maintain acceptable safety and reliability performance increases. At the point where the cost of corrective maintenance outweighs the benefits, or the asset fails, we replace our assets and consider economies of scale by assessing the viability of replacing other similar condition assets in proximity.

Where network assets are no longer fit for purpose, an assessment is undertaken to cost effectively install renewable gas ready assets or components. For network assets this is pertinent to those pressure regulation facilities that may be subject to greater than a 20% hydrogen gas blend. However, greater than 10% hydrogen blend is not expected to materialise within the next 5 years, and the current facilities can accommodate up to 20% hydrogen without further assessments, as well as 100% biomethane.

All our plastic mains are ready for renewable gas, however with the increasing volume of renewable gas and the potential to have greater than 20% hydrogen in the network after 2030, we are taking prudent steps to review the equipment specifications when pressure regulating assets fail, or are replaced through end of life programs. If the incremental cost of replacing components with hydrogen ready equipment is reasonable, then it is installed in preference to a like for like unit.

We will continue to monitor and assess any blended hydrogen impact on pressure reduction equipment, particularly regarding the performance of elastomers, however standard inspections and performance testing at short term forecast hydrogen levels is currently considered adequate.

3.5 ACS planning horizons

The ACS considers 3 forecasting horizons when planning, with the two-year COWP being the most accurate. The Asset Investment Plan takes a 7 year view, and a 20 year outlook to ensure planning for the long term benefit of customers.

Over time, planning profiles have been informed by the objectives outlined in the ABS as well as customer expectations, JGN's regulatory and operating environments, asset condition and risk. The forecast beyond two years is more subject to change as these factors evolve, and even more so beyond year seven[2]. Therefore the forecast is indicative only and represents the projects required for this asset class to continue to support the JGN objectives.

3.6 Governance

This ACS is reviewed annually to ensure ongoing alignment with the Jemena Business Plan, JGN Market Strategy and the asset objectives outlined in the ABS, and to and to account for any additional asset performance and risk information. Table 3-3 outlines the **RASCI** for this ACS.

Table 3-3: RASCI governance table for ACS

Element	Descriptor	Group/Person
Responsibility	Who is responsible for carrying out the entrusted task?	Gas Assets & Operation
Accountable (Approval)	Who is responsible for the whole task and who is responsible for what has been done?	GM Gas Assets & Operation
Support	Who provides support during the implementation of the activity / process / service?	Jemena Network Services Gas Assets & Operation
Consultation	Who can provide valuable advice or consultation for the task?	Customer & Markets Asset Investment Jemena Network Services Asset Risk & Management Systems
Inform	Who should be informed about the task progress or the decisions in the task?	EGM Jemena Networks

[2] Seven years is the planning horizon of the AIP.

PART B: Asset performance

4. Asset quantities

The volume of network assets in our gas distribution network is continually changing as the network expands, it is reinforced, and existing assets are replaced. Table 4–1 provides an overview of network asset quantities as at the end of the most recent calendar year prior to developing this version of the ACS.

For the latest information on asset quantities, refer to ECMS. For further information on current asset performance, refer to the Networks APaIR (http://ecms/otcs/cs.exe/link/322264641).

Table 4–1: Networks asset quantities on 31 November 2023

Sub-asset class	Element	Quantity (2023)
Secondary pressure	Mains	1,459 km
	Services	2,205[3]
	Secondary line valves	2,037
	Exposed mains	166
Medium and low pressure	Mains	24,441km
	Services	1,061,000[4]
	Exposed main	181
	Sector valves	861
	High risk areas	965
	High risk valves	2,105
	Bushfire valves	166
Network pressure control	Secondary DRS	570
	Medium and low pressure DRS	77
Customer pressure control	Boundary regulators	4,550[5]

Table 4-2 provides a breakdown of the materials within the medium and low pressure network.

Table 4-2: Breakdown of materials in the medium and low pressure network

Asset	Length (km)	% Split
Nylon	19,858	82.7
Polyethylene	3,752	15.6
Cast Iron	255	1.1
Steel	140	0.6

[3] Based on 'SER_SECOND' volumes in SAP with "User Status" as "INSV"

[4] Figure rounded up

[5] Based on 'BOUDAR_REG' volume of BR's in SAP with "User Status" as "INSV".

5. Asset performance

Performance across the network asset class is fair. We are currently meeting the majority of networks asset performance indicators, and have corrective actions or mitigating circumstances in place to address underperformance.

Detailed information on performance in each asset class, including detailed condition assessment is provided in the network APaIR. For the purpose of this ACS, Table 5–1 provides a summary of current performance against indicators.

Table 5–1: Networks asset class performance against objectives and indicators

Networks asset class objective	Asset class measure	Target	RY23 performance	Status
Maintain current levels of network risk, only improving risk where efficient to do so	Network incidents notifiable to technical regulator	12 per month (144 per year)	66	
	Public reported escapes per 1000 customers	14	10.32	
	Maintenance Plan compliance	90%	98%	
Maintain current service levels to customers	Customer hours off supply - external	32720	9633[6]	
	Customer hours off supply - internal	8180	5006	
	Poor supply incidents reported by the public per 1000 customers	0.90	0.77	
	Percentage of emergency response jobs attended to within 30 mins	85%	83.5%	
Continuous improvement in asset management information to balance capital and operating expenditure	All relevant investments have an approved business case	100%	100%	
Reduce fugitive emissions	TJ's UAG	<2.95%	2.75%	
Renewable gas ready	Renewable gas KPI's established e.g. % >20% hydrogen ready mains	Q4 2023	NA	
Renewable gas ready	% biomethane gas ready mains	100%	100%	
Downward pressure on the cost of new services	Capex per new connection / dwelling	$TBC /connection	$TBC /connection	

[6] Note: this figure does not include the critical Central West incident where supply was lost to several towns for a prolonged period as a result of the APA washaway. CHOS hours could not be calculated accurately but were conservatively estimated at 20 million with approximately 20,000 customers affected.

5.1 Continuous improvement recommendations

As part of the annual APaIR review, a number of recommendations for improvement are developed and captured as part of the process. Below is a summary of these recommendations.

Table 5–2: Status of continuous improvements recommendations

No.	Asset	Recommendation	Status
2022-1	Medium pressure mains	Review of areas of the network operating at 300kPa with high levels of Publicly Reported Leaks to determine if possible for pressure reduction to reduce emissions	In progress – locations identified and some areas have already been lowered
2023-1	All Asset Types	Capability of Synergi hydraulic modelling software to be able to model hydrogen and biomethane	Open – to review in near future
2023-2	Secondary mains	Review of the new CP data loggers and telemetry units to identify whether the objectives of the business case (CP data loggers) are being realised.	In progress - Review of new CP data loggers indicates issue with performance
2022-2	Secondary valves	Operational checks for 150mm valves should revert back to every six months as they are at the highest risk of seizing.	Closed - Specific valves are being reverted back to six months where required
2022-3	Secondary and Critical mains	Review locations where secondary and critical mains cross rivers	In progress – There are 64 secondary and 4 critical mains locations identified that cross water bodies. These locations will need to be reviewed to understand if these cross underneath the water, or within bridges or exposed. Two locations on Manly Ck current underway for depth of cover
2021-1	Secondary mains	Review of locations in CBD areas where mains are shallow	In progress – locations identified, mapped and review of data for protection measures underway
2021-2	Isolated Mains	Review of locations where isolated mains are within sensitive areas (water crossings, tidal locations, nature reserves)	In progress – locations identified with next step is review of these locations against topographic data and syphon locations in the surrounding area of Mortlake to proactively identify and map potential leak sources
2022-4	All asset types	Use of Picarro vehicle mounted technology to conduct leakage surveying, instead of previous method of walking along the route of mains	Closed – use of 2 new vehicles has commenced in May and ongoing
2023-3	Network Pressure Control	Due to obsolescence of the Cocon 26 from 2023 a review of equipment and parts required	In progress – working group established to undertake change management
2022-5	Network Pressure Control	Develop dashboard for categorising defects/issues found and linking to equipment numbers. This will assist in identifying those assets with similar issue	In progress – has commenced using the EAM Tool to identify equipment
2021-3	Boundary regulators	Determining the volume of boundary regulators within the network, as only ~4,550 are in SAP	In progress – an investigation is underway, including the Boundary Regulator Replacement program

5.2 Unaccounted for gas (UAG)

The integrity of the network has a direct impact on fugitive emissions thus on Unaccounted for Gas (UAG). UAG as a key indicator of the health of the network and a large component of the overall operational costs of JGN. UAG is reported on a monthly basis to ensure irregularities are picked up and investigated immediately.

UAG monitoring is managed by a multidisciplinary team and is part of the Measurement asset class. (Please refer to the *JGN -Measurement Asset Class Strategy 2023* document for further information).

6. Current asset condition, risks and controls

The purpose of this section of the ACS is to provide a high-level overview of asset condition, and to highlight the highest priority risks associated with each sub-class. This section is indicative only and is designed to provide an annual snapshot of the key asset condition and risk issues that need to be managed.

More detailed information on asset condition is available in the Networks APaIR. The full suite of asset risks, along with a more contemporary view of the risk status is recorded in the Networks asset risk register (http://ecms/otcs/cs.exe/link/316682864).

6.1 Secondary mains and services

6.1.1 Condition assessment

The secondary mains are generally in good condition, therefore no major secondary main replacement programs are currently identified for mains integrity purposes in the short to medium-term.

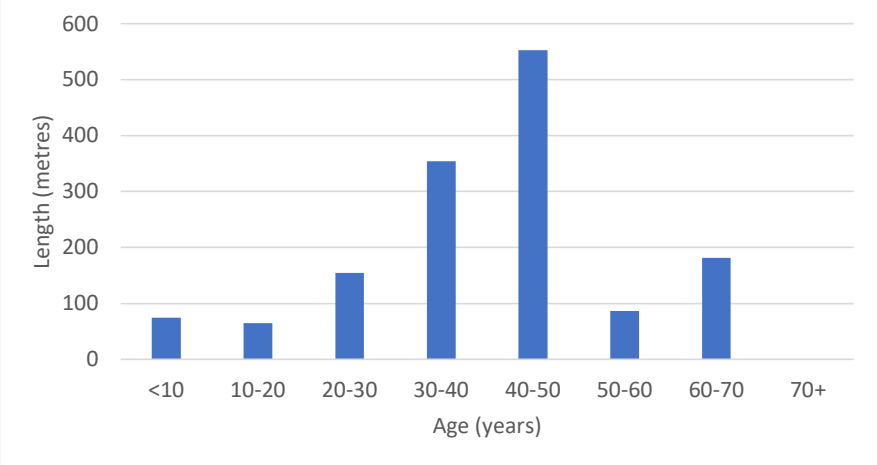
Shallow secondary mains in high density areas have been rated as carrying a significant risk level. The 'Shallow Mains Project' has commenced where the mains in CBD areas have been assessed through ground penetrating radar and confirmed by pot-holing, and where necessary, mains have been protected and all locations considered shallow have been mapped. Additional valves will be installed to assist in isolation to minimise the impact to downstream customers.

We will continue to monitor asset performance and conduct reactive replacement when necessary.

6.1.1.1 Age profile

Figure 4-1 shows the secondary network mains and services age profile.

Figure 6–1: Secondary mains age profile



Source: GIS-2023

The age profile of secondary valves cannot be determined, however, the age profile of the valves would be similar to the mains profile.

6.1.2 Risks and controls

Risks related to secondary mains and services assets are captured in the risk register in ECMS (http://ecms/otcs/cs.exe/link/319384885). The following table summarises the current risks and controls that

were identified as inadequate/not at target levels in the most recent Formal Safety Assessment (FSA). These risks should be prioritised for mitigation.

Of the 57 risks identified, 5 are currently rated a greater risk than target. A further 4 risks are rated Low or Negligible, but the control effectiveness is considered to be lower than target. The following tables also includes a brief description of how we aim to improve the risk rating.

Table 6–1: Secondary mains and services risks and actions and prioritised for action

Risk Assessment ID	Asset Type	Threat Category	Risk Rating	Specific Threats	Action for Risk Reduction from FSA
P.6,S.19	Shallow Mains	People/ Supply	Intermediate	Shallow mains being hit by third party resulting in gas leak. Potential for explosion in presence of ignition source and also possibility of loss of supply.	Ongoing – project underway Complete the survey and actions based on the findings of these surveys from the ongoing Shallow Mains Project (BAB-RAK-000062) which is initiated to improve the controls.
P.9	Secondary Services	People	Intermediate	Corrosion on Secondary services entering the buildings up to the inlet of Secondary meter resulting in a gas leak. Low volume of gas escape due to corrosion on inlet secondary service pipe and with possible build-up of gas and ignition source present leading fire or explosion	Closed – FOMS and work scopes updated to include service inspection as part of meter set ops checks
P.14	Spiral Secondary Mains	People	Intermediate	Lack of temporary repair equipment to carry out maintenance on Spiral Secondary mains in case of emergency when hit by third party. Risk to the maintenance crew due to gas escape and in presence of potential source of ignition could result in explosion if not suitable repair equipment used.	Ongoing - Conduct an engineering assessment on repair methodologies for spiral secondary mains.
S.6	Single Feed Mains	Supply	Intermediate	Damage to "single feed" secondary main leading to rupture of main causing loss of supply to downstream distribution network.	Current Risk level is considered acceptable. Risk is managed through network modelling, Emergency Response procedures and repair procedures, including the use of bypasses to maintain supply.
E.9	Exposed Mains	Environment	Intermediate	Corrosion on Isolated Exposed main on Mascot Bridge-Ricketty Street posing an environmental risk.	a. Include 91A inspection findings in APAIR for 2021 and use results to confirm the completion time frame for the mitigation works stated in part b. b. Complete the project (SAP Inquiry Number-10057557) raised which is currently scheduled for CY22 to mitigate the risk and address the corrosion. Update the risk register on completion of project

Risk Assessment ID	Asset Type	Threat Category	Risk Rating	Specific Threats	Action for Risk Reduction from FSA
					Closed – Main was inspected with replacement of some clamps to be done as BAU

6.2 Low and medium pressure mains and services

6.2.1 Condition assessment

Overall the condition of the plastic mains is considered as stable. Where items have failed prematurely, these are classified as 'field failures' and the mechanism of failure is identified. This work is sourced in the Plastics Lab at Old Guildford.

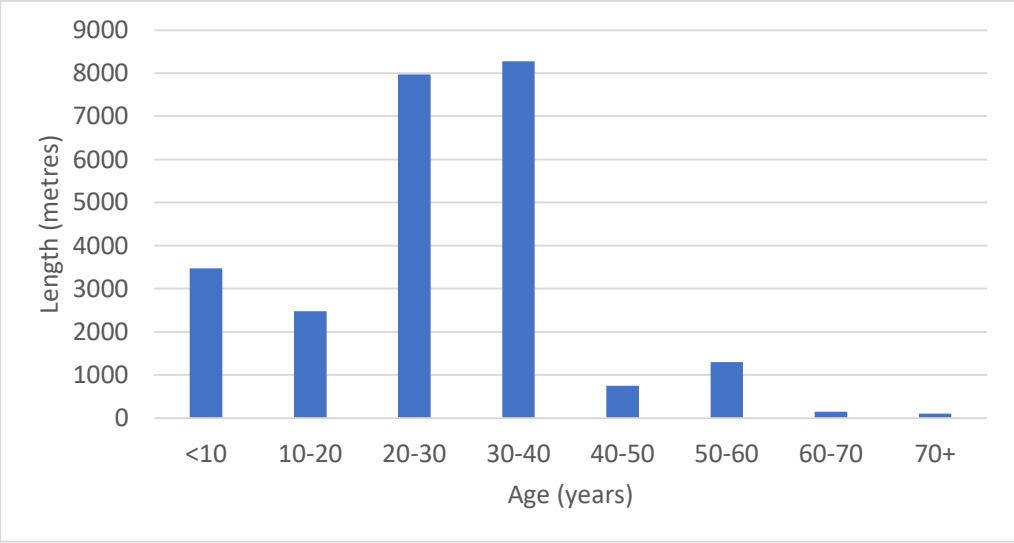
Leakage Surveying of the network is a means to assess the condition of the network. This was previously done by foot as part of a 5 yearly cycle, with the Sydney CBD and special events done yearly. During mid 2023, two Picarro units were installed into two vehicles and all 5 yearly compliance leakage surveying is now being done with vehicle mounted technology.

6.2.1.1 Age profile

The vast majority of the low and medium pressure network is well within its design life. The majority of plastic mains are less than 40 years old. This reflects the large scale rehabilitation program carried out in the 1990s to replace the ageing and leaking network. During the renewal program most of the cast iron and steel pipe in the low and medium pressure networks was inserted with nylon.

Approximately 475km of old cast iron and steel pipe remains in service, which are more than 50 years old. These legacy sections of the network continue to be monitored via leakage surveys and leakage data analysis and managed under rehabilitation programs. There is a rolling 30-year renewal program, with individual projects ranked based on risk or public amenity. The Matraville 2kPa project (completed in 2022) was the final project undertaken to remove the last remaining 2kPa network within JGN.

Figure 6–2: Age profile of the JGN low and medium pressure mains and services



Source: GIS-2023

The age profile of valves cannot be determined, however, the age profile of the valves would be similar to the mains profile.

6.2.2 Risks and controls

Risks related to low & medium mains and services assets are captured in the risk register in ECMS (http://ecms/otcs/cs.exe/link/316693832). The following table summarises the current risks and controls that were identified as inadequate/not at target levels in the most recent FSA. These risks should be prioritised for mitigation.

Of the 94 risks identified, 10 are currently rated a greater risk than target. A further 5 risks are rated Low or Negligible, but the control effectiveness is considered to be lower than target. The following tables also includes a brief description of how we aim to improve the risk rating.

Table 6–2: Low and medium pressure mains and services risks and actions identified and prioritised for action

Risk Assessment ID	Asset type	Threat Category	Risk Rating	Specific Threats	Actions for Risk Reduction from FSA
LMP1/LMP2	Steel Mains	People	Intermediate	Poor condition of steel mains and absence of isolation valves (E.g. Mt. Druitt - 200kPa, Kurri Kurri operating at 100kPa) during emergency/unplanned maintenance makes it difficult for maintenance crew to isolate the network and increased time to work in live condition and hence prolonged exposure to gas. Consequence: Risk to the safety of maintenance crew being exposed to risks such as fires, burns, asphyxiation, property damage.	a. Review leakage survey process: - Forms, - Contracts - FOMS b. Review of current equipment endorsed by Technical Committee to be used for repair of steel main greater than 2" in size. Engage with Service Delivery. Action Plan updated (08 Jan, 2020) 1. Review ACS for additional controls to reduce the risk for large diameter mains in absence of isolation valves during emergency. Status – ongoing – large diameter mains in Mt Druitt and Kurri Kurri have been rehabilitated. The Pennant Hills main utilises stoppling equipment to enable isolation
LMP6	Mains	People	Intermediate	Damage to buried pipes due to operation of Mechanical plant/construction activities (such as excavation, post hole digging, trenching, excavators, Hydrovac m/c). Consequence: Hit on mains causing gas leakages leading to injury to people	Status – Completed annually as part of APAIR Conduct benchmarking for third party hits to assess performance/ statistics against the peers (e.g. Hits/km of the network)

Risk Assessment ID	Asset type	Threat Category	Risk Rating	Specific Threats	Actions for Risk Reduction from FSA
LMP9/LMP10	Mains / Services	People	Intermediate	Third party damage and leaks for existing LP & MP mains/services running within or underneath a building. Gas escape due to 3rd party damages potentially causing fire or explosion. Consequence: Risk to maintenance crews and occupants of the building.	a. Review the need for systematic/planned condition assessment of internal mains and services. b. To review adequacy and effectiveness of emergency isolation for mains & services under/within buildings. Status – ongoing – addressed when found
LMP11/LMP12	Shallow Mains	People	Intermediate	Third Party damage due to construction/road work (e.g., road profiler, concrete saw, boring machine) specially on shallow mains. Consequence: Gas escape causing fire/explosion causing loss of supply and asset damage.	a. Include OB in 2019 Asset Class Strategies. b. Develop strategy to identify and record the shallow mains. (Priority based on diameter, criticality and location). c. Link shallow main register to GIS Maps for instance where a location of shallow main is known. Status – Actions completed

Risk Assessment ID	Asset type	Threat Category	Risk Rating	Specific Threats	Actions for Risk Reduction from FSA
LMP13	Mains / Services	People	Intermediate	Third Party Damage to disconnected(isolated) services to properties still existing on the ground and connected to Gas network without evidence of gas supply to house/granny flats/ additional building in properties (i.e. supply connected to 'homed meter set' or 'removed meters'). Unintended Gas supply. Consequence: Third party hit on main/service extension leading to gas escape, injury	Abolishment and MNOP -Meter not on premise Project is in progress a. Risk assessment for this project will be held on 1st May, 2019 should address the risk b. Following Risk assessment determine whether this action be can be closed out. Status – to be updated as part of FSA scheduled for 2024
LMP23	Isolation valves	People	Intermediate	Absence of isolation valves in critical mains (e.g. Kurri Kurri, 200mm PE Wellington main, Kiama 160mm PE) make it difficult to isolate the mains during emergency and since work is carried out in live condition. Consequence: Prolonged exposure to maintenance crew while carrying out repairs during gas escape and potential for fire and explosion which could lead to injury.	a. Consider controls are in place (Need to consider COMMS) and review the effectiveness of those controls b. Look at definition of criticality that is updated in AMS(no differentiation in regional and metro) c. Link findings to annual budget allowance for Minor Capital Works for installation of new isolation valves if required. Status – ongoing where identified as part of Capacity planning BAU

Risk Assessment ID	Asset type	Threat Category	Risk Rating	Specific Threats	Actions for Risk Reduction from FSA
LMP27	Mains / Services	People	Intermediate	Third Party Damage to mains and services causing gas leakage in HIGH DENSITY COMMUNITY AREA. Consequence: Loss of containment causing GAS build up HDCA where – built up to 50% of LEL or greater- leading to fire and explosion.	a. Identify High Density Community Areas and overlay with our mains b. Establishment of operational policy on management of HDCA and necessary maintenance measures c. Revisit the threat once HDCA's are identified. d. Corelate with current HRA's and identify the gaps. Include in Asset Class Strategy. Status - completed
LMP42	Mains	People	Intermediate	Insufficient separation distances of gas pipes and electrical cables in shared trenches , where Faulty cables electrocuting gas pipes. Consequence: Electrocution leading to Injuries	a. Review control effectiveness based on Quality audits to ensure sufficient distances are maintained and update the guidelines to meet AS4645 requirements. Status – to be updated as part of FSA scheduled for 2024
LMP49	Path Valves	People	Intermediate	Absence of Path valves in the network and inability to isolate the network during emergency. Consequence: Gas escape leading to inability to isolate/control the LP and MP network causing risk to public.	a. Check if the path valve is accessible and operational b. Note if a path valve is not installed in a location requiring one and notify the regional coordinator, including any additional issue. Status – ongoing and addressed when found
LMP50	Path Valves	People	Intermediate	Path valves not in operating condition due to infrastructure changes by third party. Consequence: Delay in carrying out repairs in case of emergency. Risk to public	a. Check if the path valve is accessible and operational b. Note if a path valve is not installed in a location requiring one and notify the regional coordinator, including any additional issue. **Status – ongoing and addressed when found**

6.3 Network pressure control

6.3.1 Condition assessment

Overall, the DRS asset class is in good condition. There has, however, been an increase in corrective maintenance service orders due to water ingress from the significant rainfall over the last few years. A capital program initiated in 2023 to address this issue is underway with 6 locations targeted each year over the next six years. We will continue to monitor the condition of these assets and modify maintenance programs accordingly.

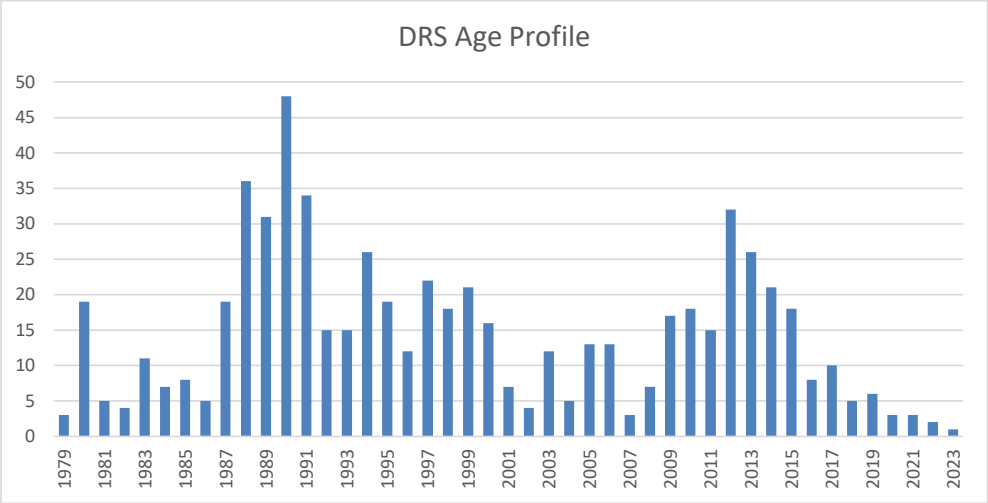
There is an ongoing DRS replacement program and two individual projects to relocate a DRS. DRS are replaced/relocated where:

- the condition of the DRS has degraded over its lifetime (e.g. corrosion, gas leaks, water ingress);
- the regulators inside the DRS are older models that are no longer produced and spare parts are no longer available, e.g. Donkin and Cocon 26;
- the surrounding area has been developed over time (e.g. changes to roads, reduced width of road reserve, no parking), making it increasingly difficult to access and maintain the DRS;
- the surrounding area may have been reclassed as a high consequence area, making the current location of the DRS not ideal; and
- there is a safety risk to our field staff when performing maintenance.

6.3.1.1 Age profile

Figure 6–3shows the known age profile for district regulator sets (all pressures) in the network.

Figure 6–3: DRS age profile



It is not possible to accurately determine the ages of DRS installed prior to 1995, as there are no records stored in GASS or SAP archives dated earlier than this. Some research has been performed using other data sources to estimate the ages. Cocon regulators have only been installed in the network since 2009 and are therefore all well within their design life.

Based on age estimates, almost 20% of DRS will reach the end of their nominal design life with in the next 10 years. However, a large number of the older DRS were upgraded several years ago to remove capacity constraints and integrity issues, which will extend current operating life. Close monitoring of DRS will continue to confirm any age related issues.

6.3.2 Risks and controls

Risks related to network pressure control assets are captured in the risk register in ECMS (http://ecms/otcs/cs.exe/link/316694830). The following table summarises the current risks and controls that were identified as inadequate/not at target levels in the most recent FSA. These risks should be prioritised for mitigation.

Of the 72 risks identified, 2 are currently rated a greater risk than target. There are currently no risks where the overall control effectiveness is below target. The following tables also includes a brief description of how we aim to improve the risk rating.

Table 6-3: Network pressure control asset risks and actions identified and prioritised for action

Risk Assessment ID	Asset Type	Threat Category	Risk Rating	Specific Threats	Action for Risk Reduction from FSA
DRS.41	DRS	Supply	Intermediate	DRS fails closed (eg. 7kPa Cocon 26s are equipped with an OPSO) leading to loss of supply to the downstream network if not back fed.	* For a single feed network, it is not recommended to install a DRS with a slam shut/OPSO. * Demonstrate ALARP
DRS.52	DRS	Supply	Intermediate	Vehicle hits the above ground bypass for Cocon leading to loss of supply	* Review all existing Cocon DRSs with the above ground bypass pipework and reassess the risk for each site. *Relocate the Bypass underground and/or use protection barriers.

6.4 Consumer pressure control

6.4.1 Condition assessment

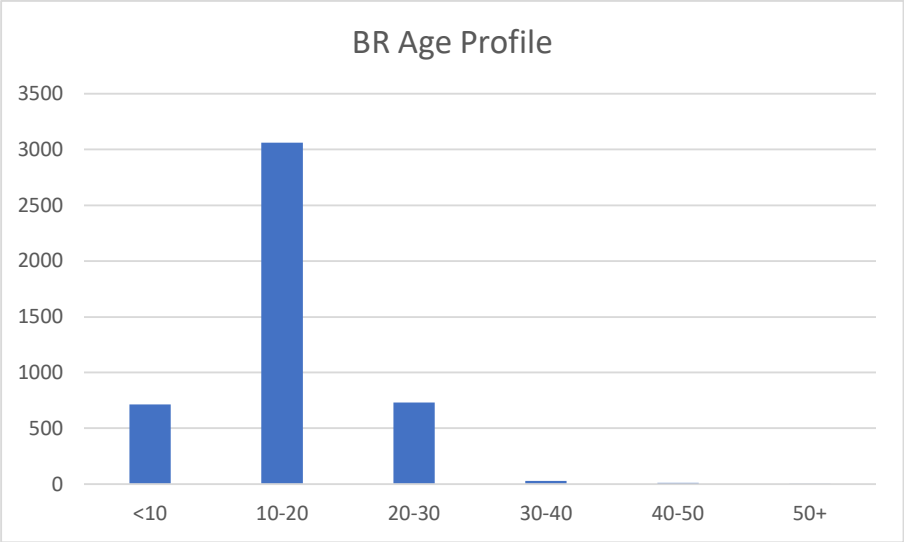
Overall, the consumer pressure control asset class is in good condition. All boundary regulators installed after 2000 have an over pressure shut off (**OPSO**) valve, which will operate if the regulator fails. Some older boundary regulators in the network only have a relief valve, which poses a safety risk. The risk associated with these older regulators is being monitored via annual service checks and an ongoing replacement program.

Secondary boundary regulators with outlet pressure >15kPa are overhauled every six years. All boundary regulators are replaced on breakdown. Boundary regulators with outlet pressure <15kPa are replaced on breakdown.

During 2017, a trial was completed where ten boundary regulators were replaced due to issues with not having OPSO, corrosion and no bypass on majority. The trial was proven successful, and the program has been incorporated into the COWP to replace boundary regulators without sufficient OPSO or other issues

6.4.1.1 Age profile

It is not possible to accurately determine the number of boundary regulators installed prior to 2001, as records stored in GASS or SAP archives dated earlier than this are not accurate. There are 4,550 boundary regulators recorded in SAP, however, there could be several thousand more boundary regulators in the Jemena network that have not been identified. A review of locations that may have boundary regulators, e.g. where multiple customers at the same address, is in progress.



6.4.2 Risks and controls

Risks related to consumer pressure control assets are captured in the risk register in ECMS (http://ecms/otcs/cs.exe/link/310326085). The following table summarises the current risks and controls that were identified as inadequate/not at target levels in the most recent FSA. These risks should be prioritised for mitigation.

Of the 48 risks identified, 7 are currently rated a greater risk than target. A further 7 risks are rated Low or Negligible, but the control effectiveness is considered to be lower than target. The following table also includes a brief description of how we aim to improve the risk rating/control effectiveness

Table 6–4: Consumer pressure control asset risks and actions identified and prioritised for action

Risk Assessment ID	Asset Type	Threat Category	Risk Rating	Specific Threats	Actions for Risk Reduction From FSA
BR15	Consumer services & Boundary Regulators	People	Intermediate	Non-compliance with separation distances a. Either when installation - of service and mains/Secondary Boundary regulator/ associated ancillary within building - from potential ignition sources(e.g. naked flames, pilot lights, electrical switchgear), specific to Legacy Sites b. Or -inability to prevent excessive temperature fluctuation that may cause damage to the service(unlagged hot water or steam pipes) Damage to gas services causing gas escape with potential for fire and explosion resulting in injuries to people	ALARP review to investigate feasibility of 5-yearly Inspection/Checklist program for internally located BR's. The following items could be considered during installation inspection: • Alteration to the buildings • Physical protection from third party damage • Ventilation adequacy • Materials/components defects • Signage • Incorrect installation • Proximity to ignition sources • Can isolation valves be operated
BR18	Consumer services & Boundary Regulators	People	Intermediate	Non-compliance with separation distances a. Either when installation - of service and mains/BR15kPa Boundary regulator/ associated ancillary within building - from potential ignition sources(e.g. naked flames, pilot lights, electrical switchgear), specific to Legacy Sites b. Or inability to prevent excessive temperature fluctuation that may cause damage to the service(unlagged hot water or steam pipes)	ALARP review to investigate feasibility of 5-yearly Inspection/Checklist program for internally located BR's. The following items could be considered during installation inspection: • Alteration to the buildings • Physical protection from third party damage • Ventilation adequacy • Materials/components defects • Signage • Incorrect installation

				Gas leak potential for fire and explosion leading to Injury to people	• Proximity to ignition sources • Can isolation valves be operated
BR21	Consumer services & Boundary Regulators	People	Intermediate	BR<15kPa GAS escape in faulty/ineffective joints and connections (eg : external parties use of non-approved jointing methods in service connections, Poor workmanship -when using joining method - during installation affecting mechanical strength of services main/ valves and regulators connections resulting joint failures). In enclosed space gas may build up and with an ignition source cause an explosion.	ALARP review to investigate feasibility of 5-yearly Inspection/Checklist program for internally located BR's. The following items could be considered during installation inspection: • Alteration to the buildings • Physical protection from third party damage • Ventilation adequacy • Materials/components defects • Signage • Incorrect installation • Proximity to ignition sources • Can isolation valves be operated
BR22	Consumer services & Boundary Regulators	Supply	Intermediate	GAS escape in faulty/ineffective joints and connections (eg : external parties use of non-approved jointing methods in service connections, Poor workmanship -when using joining method - during installation affecting mechanical strength of services main/ valves and regulators connections resulting joint failures). In enclosed space gas may build up and with an ignition source cause an explosion. Gas leakages from joints and end-caps of the consumer service	

				(BR/Meter kit/service pipes/valves) installation leading to low pressure or supply interruption	
BR35	Consumer services & Boundary Regulators	Supply	Intermediate	Unauthorised access to consumer services/BR/Valves etc Note: Interferences with gas assets(Building maintenance crew) in high-rise building Gas escape leading to loss of supply	ALARP to review Jemena's asset protection policy to determine whether additional protection (e.g. cable ties, locked enclosures) are required
BR40	Consumer services & Boundary Regulators	Supply	Intermediate	BR<15kPa Uncertainty of exact location of Path Valve or Path Valve not in working condition in Network. Delays to carry out repair or inability to isolate the building in case of gas release resulting loss of supply	Review maintenance strategy for Path Valves
BR46	Consumer services & Boundary Regulators	People	Intermediate	Failure of Gas detectors installed in enclosed areas Gas escape leading to fire and explosion causing property damage and injuries to people	Liaise with Building owners to callibrate the gas detectors are in working condition

PART C: Emerging issues and priorties

7. Emerging risks and priorities

This section highlights the key emerging and priorities for the networks asset class. This is not an exhaustive list, and any new risks or priorities that emerge during the year should be captured in the asset class risk register, and then documented in the following year's ACS and captured in the ECMS.

The are currently five broad types of emerging risks for this asset class.

1. **3rd party developments, projects and easements** – the expanding metropolitan area, general metropolitan improvement projects and an increasing population density, as well as JGN assets in proximity to large areas of congregation, is continuously changing the land categorisation and increasing occurrences of encroachment onto JGN assets.
2. **River crossings, Water washaways and ingress –** large volumes of water during the last few winters is causing issues for gas mains when the surrounding supporting soil can be washed away, leaving the mains exposed and unsupported, but also we are finding more water collecting in underground pressure reduction sites that are not draining away in a timely manner due to a high water table.
3. **Ageing technology and materials –** our program of asset maintenance and life extension is effective, with assets useful lives being extended wherever possible, however we are cognisant that a number of our assets are now reaching end of useful life, and we must ensure that they continue to deliver reliability and service for our customers. We are also seeing some material issues with our older plastic mains and joints (pre 1996) that are in need of bringing up to current standards.
4. **Hydrogen volumes greater than 20%** - although our network is well placed for biomethane and lower blends of hydrogen, it is important that we continuously study and incrementally modify our standards and network to accommodate the foreseeable gas blends of the future for our higher pressure containment materials as well as our softer elastomers.
5. **Boundary regulator compliance –** We are discovering that further works is required with our boundary metering to ensure compliance in the areas of overpressure protection, access for maintenance and general proximity to ignition sources.

Further details of the more specific emerging risks per sub asset class can be found below.

7.1 Secondary mains and services

- The latest revision to the standard *AS/NZS 4645: Gas Distribution Networks* has additional requirements for management in HDCU areas. This includes maximum diameters, MAOP and set back distances of mains from buildings. While any changes will not be retrospective, it will be necessary to determine the impact of HDCU areas and how future new mains and services will be affected.
- Sydney Light Rail Light Rail Projects Parramatta, North West Sydney Metro – stray current from electric traction has affected cathodic protection on sections of the secondary main along the North West Sydney Metro line. This is currently being investigated and monitoring of all light rail lines is ongoing.
- Deteriorating abandoned exposed mains – there is a risk of pipes collapsing on third party assets, public or sensitive areas. In response to this potential risk, we have initiated an isolated mains removal project.
- Mains in private property with no easement – there is a risk of third party damage. We will continue to monitor this risk and will address where appropriate.
- Hydrogen embrittlement – there is a risk that the introduction of hydrogen into the gas stream may impact the material, reducing asset life. This is an area that will need to be investigated. Ongoing research in FFCRC.
- Washaways – there is a risk emerging whereby more severe flooding events is causing ground to be washed away from the mains, leaving the pipe unsupported and more likely to suffer failure.

- River Crossings - Post APA incident in Bathurst early 2023, an internal audit was conducted with the objective to verify the effectiveness of processes in place to identify, monitor and manage any mains buried under the riverbed that may adversely impact on the safety of the asset for Gas Networks. It included both AS2885 and AS4645 (secondary & critical mains) gas assets. The audit is focused on both compliance to existing processes and procedures and best practices.
- Mines Subsidence

- Planned longwall mining at Bargo on sections of pipe rated at secondary but operates at medium pressure.
- Ground subsidence on the secondary mains at Wallsend is being monitored

7.2 Low and medium pressure mains and services

- The latest revision to the standard *AS/NZS 4645: Gas Distribution Networks* has additional requirements for management in HDCU areas. This includes maximum diameters, MAOP and set back distances of mains from buildings. While any changes will not be retrospective, it will be necessary to determine the impact of HDCU areas and how future new mains and services will be affected.
- Nylon to PE – the reduction in the use of nylon may reduce the availability to supply pipe and fittings to conduct works on existing nylon system.
- Older generation PE (PE63) – increasing incidences of leaks and repairs to the older generation PE material. There is a research project occurring in this field.
- Older grades of nylon – as per older generation PE, the older grades of nylon starting to exhibit issues, predominantly the use of compression fittings for low pressure networks, or exhibiting brittle failure.
- Nylon joints – issues regarding higher than expected saddle failures in new estate areas.
- Potential encroachment onto existing assets from light rail projects; Parramatta Light Rail, Sydney metro, major road upgrades.
- Large diameter cast iron mains operating at 7kPa – integrity/capacity issues due to increasing medium/high rise developments.
- Large diameter steel mains – mains greater than 100mm in diameter have higher complexity for repair. The use of bolt on fittings has been utilised for non-permanent repairs
- Dust in mains – some suburbs in Sydney South have had issues with dust coming from steel mains
- Path Valves – isolation of premises during an emergency, particularly for services in high risk areas and CBD areas
- Hydrogen – research and additional inspections will be required for material compatibility and potential performance issues with elastomers

These risks will be investigated further and mitigation strategies developed pending further information regarding their likelihood and potential impact.

7.3 Network pressure control

- Cocon 26 cease of production – the vendor has given notice that the production of Cocon 26 regulators will cease immediately, with the support of soft components to continue for 10 years. There are 144 installed within JGN. An announcement on Cocon 13's has been flagged for the end of 2023.
- Water ingress is increasingly becoming a challenge with network pressure control equipment becoming submerged when it is below ground. Investigations into proactive waterproofing for new and existing designs will be investigated, along with dewatering techniques to facilitate functional maintenance and inspections.

- The need for additional/upgrading existing DRS to meet any increase in demand – future capacity requirements are assessed by the Capacity team and will put forward a recommendation to increase supply. Where older district regulator sets exist, it may be possible to upgrade the internal regulators instead of installing a new DRS. This depends on the model that was installed and the required increase in capacity.
- Assets exhibiting integrity issues – approximately one-third of DRS in the network are over 20 years old. Data from SAP has shown that older DRS begin to leak through flanges and screwed connections as the material has degraded over time. Corroded parts will also need to be replaced. A DRS replacement program has been proposed to assess the condition and replace older DRS where required.
- Some DRS have older model regulators, namely Donkin regulators, which are no longer manufactured and parts no longer available. When these DRS are due for overhaul, there are no spare parts available to maintain them. Alternate compatible regulators and components are sourced. In some instances, the entire DRS will need to be replaced.
- Hydrogen – research will be required for material compatibility and potential performance issues with elastomers. A research project is currently underway at Deakin University through FFCRC.

7.4 Consumer pressure control

- Legacy boundary regulators with no overpressure protection – at some point in the future, a regulator will fail. All boundary regulators installed after 2000 have over-pressure protection, protecting the customer in the event of a regulator failure. Majority of boundary regulators installed prior to 2000 do not have over-pressure protection, so there is the potential of gas entering a building at a higher pressure, causing an explosion if an ignition source is present. A project is in place to identify and replace boundary regulators with no over-pressure protection.
- No access to boundary regulators – some boundary regulators are inside buildings or enclosures which require access via the building manager or security. At times the gas service technicians are refused access because the building manager doesn't know who Jemena is, or the building manager hasn't communicated with security to grant access. Over the last couple of years, the number of access issues has decreased through updated contact details of building managers and scheduling access in advance.
- Internal boundary regulators next to ignition source – internal boundary regulators are located and installed in accordance with Australian Standards, however, the customer may install an electrical appliance near the boundary regulator in the future. This ignition source could cause an explosion in the event of a gas escape. A 5-yearly inspection program is in place to identify and rectify any introduced hazards.
- Hydrogen – research will be required for material compatibility and potential performance issues with elastomers. A research project is currently underway at Deakin University through FFCRC.

8. Projects

8.1 Ongoing projects

The full list of projects can be found in the Asset Investment Plan (AIP) and the Capital and Operating Work Plan (COWP). Below is a summary of the types of projects that are being undertaken by JGN to meet the requirements of the Networks ACS.

Table 8–1: Summary of ongoing networks asset class key projects and initiatives

Asset sub-class	Project	Description
Secondary mains and services	Installation of new mains & services	New mains and service installations to service new greenfield and brownfields areas, as well as to add additional capacity to the network to meet demand
	Replacement of existing mains & services	Replacement of mains that have reached the end of their useful operating life
	Mains relocations	Relocation of mains to facilitate 3rd party works
	Reactive maintenance	Repairing leaking mains and services
	Valve maintenance	Planned and reactive valve maintenance to ensure safe operation when required
	Cathodic Protection systems	Construction, replacement and maintenance of cathodic systems used to mitigate metallic pipe corrosion
Low and medium pressure mains and services	Installation of new mains	New mains installations to service new greenfield and brownfields areas, as well as to add additional capacity to the network to meet demand
	Replacement of existing mains	Replacement of mains that have reached the end of their useful operating life
Network pressure control	Installation of new DRS	New or upgraded equipment to meet customer demand and/or service new areas
	Replacement of DRS	Replacement or upgrade of components that have reached their end of life
	Planned and reactive maintenance	Functional checking of operations and performance and reactive works or adjustments to meet demand.
Consumer pressure control	Installation of new boundary regulator	New or upgraded equipment to meet customer demand and/or service new areas
	Replacement of boundary regulator	Replacement or upgrade of components that have reached their end of life
	Planned and reactive maintenance	Functional checking of operations and performance and reactive works or adjustments to meet demand.
		Fisher 299H Regulators – This issue is being managed through operational checks and if the issue occurs the regulator is replaced, with only a small number (<10) found to have this issue.
Hydrogen readiness	All asset sub-classes	Continued study into the requirements of a distribution network at greater than 20% hydrogen throughput
FFCRC Research	All asset sub-classes	Future Fuels Cooperative Research Centre, the industry focussed Research, Development & Demonstration (RD&D) partnership enabling the decarbonisation of Australia's energy networks

8.2 New projects to address emerging risks or strategic drivers

This section provides a high-level overview of new initiatives designed to help address emerging risks and meet our asset objectives. Projects/initiatives in this section will commence within the next few years.

Further information on these new/proposed initiatives is available in the COWP and in the individual business cases.

Table 8–2: Summary of new networks asset class key projects and initiatives

New project / initiative	Description (what and why)
Network reinforcement - Renewable Gas suppliers	Construction of networks assets to enable renewable gas to flow into and around the network, delivering customer supply at the correct volume and pressure
Picarro vehicles deployment– leak detection, emissions and strategic mains replacement planning	Picarro vehicles will be utilised to identify leaks on the network, to understand the current leak profile and performance of our mains and services assets. This will assist with the quantification of fugitive emissions to assist with the Safeguard Mechanism assessment as well as unnacounted for gas understanding. Information will feed into asset replacement and repair strategies.
Hazardous areas for regulating equipment	Hazardous area upgrades and studies to enable hydrogen distribution at increasing levels, if hydrogen blends increase above 20%.
HDCU review	The latest revision to the standard *AS/NZS 4645: Gas Distribution Networks* has additional requirements for management in HDCU areas. This includes maximum diameters, MAOP and set back distances of mains from buildings. While any changes will not be retrospective, it will be necessary to determine the impact of HDCU areas and how future new mains and services will be affected.

Appendix A
Regulatory and legislative environment

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A1. Summary of key legislative requirements

Error! Reference source not found. summarises the key legislative requirements and technical standards relating to assets in the distribution network (excluding metering). These requirements are factored into our asset management strategies and help inform the investments and operating activities we undertake to manage asset performance.

Table A1–1: Summary of key legislative requirements and technical standards relating to distribution network assets (excluding metering)

Legislative requirement / technical standard	Summary of requirements
Gas Supply Act 1996 No 38 (NSW)	Sets out the overarching objectives to promote the efficient use of gas and deliver a safe and reliable supply of gas. Specifies requirements to facilitate the continuity of supply of natural gas to customers.
Gas Supply (Safety and Network Management) Regulation 2013	Sets out the regulations governing the safe supply of gas and establishes an obligation for network operators to lodge, implement and review safety and operating plans. JGN's key output under this Regulation is the JGN Safety and Operating Plan (SAOP), which sets out the strategies for ensuring the continued safe management and operation of the network, and how the business will comply with relevant legislative requirements and Australian Standards.
AS/NZS 4564:2011 Specification for general purpose natural gas	This Standard sets out requirements for the safe composition, transportation and supply of general purpose natural gas for use in natural gas appliances and equipment, and for use as fuel in natural gas vehicles.
AS/NZS 4645:1:2018 Gas Distribution Networks Part 1: Network Management	Specifies requirements for safe, reliable and sustainable management of gas distribution networks operating less than or equal to 1050 kPa that reticulates gas to customers. Requirements apply to the lifecycle of assets and covers operations, maintenance, repair, decommissioning, gas quality and risk assessment.
AS/NZS 4645.2:2018 Gas distribution networks Part 2: Steel pipe systems	Specifies materials, design, construction, installation, testing and maintenance requirements for steel piping systems and shall be used in conjunction with AS/NZS 4645.1, for the distribution of fuel gas suitable for domestic, commercial or industrial uses.
AS/NZS 4645.3:2018 Gas distribution networks Part 3: Plastic pipe systems	Specifies materials, design, construction, installation, testing and maintenance requirements for plastic piping systems and shall be used in conjunction with AS/NZS 4645.1, for the distribution of fuel gas suitable for domestic, commercial or industrial uses.
AS/NZS 5601.1:2013 Gas Installation – General Installations	Contains the requirements and methods of compliance for the design, installation and commissioning of gas installations that are associated with the use of intended use of fuel gases such as natural gas, LP gas or biogas.
Jemena Network Operator Rules	These rules are issues by Jemena and form part of Jemena's Safety and Operating Plan (SAOP) for its Networks in NSW. The SAOP and these rules are prepared in accordance with the Gas Supply Regulation.
Safety Case (SAOP) of Jemena Gas Assets (NSW)	This Safety Case describes the operation and maintenance of gas assets in a safe and reliable manner. The arguments and evidence for safety is assured by an appropriate Asset Management System operating under a controlled environment in accordance with the applicable gas legislation and regulatory instruments across various Australian jurisdictions.
National Gas Rules	National Gas Rules governs access to natural gas pipeline services and elements of broader natural gas markets. It includes economic value tests (specifically Rules 79 and 91) that set requirements for efficient capital and operating expenditure.

Appendix B
Lifecycle management

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B1. Secondary mains and services

JGN manages the life cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as outlined in the AMS Manual

B1.1 Creation

Assets in the secondary network are largely created to meet increased demand requirements, due to either increases in peak demand or new customer connections. This is discussed in the Capacity Design Specification Manual (GDN-1999-SP-DN-001).

The secondary network is designed to be a “build and bury” asset, with a monitor and maintain strategy. A good baseline is established via the use of high quality materials and standard construction methodologies.

Assets are designed to meet the requirements of the suite of AS/NZS 4645 standards, which are detailed in the Secondary Systems Design Basis Manual (GDN-1999-DG-DN-001). The Construction Field Manual and the Approved Materials List are used to ensure the secondary network is constructed to JGN’s design requirements and AS/NZS4645. This supports the strategy that the distribution network is designed and constructed in a consistent, robust manner.

All secondary mains, valves and services are mapped and equipment updated in SAP. This includes services that have been disconnected.

The only secondary main that is built from high density polyethylene (PE) pipe was installed along Wakehurst Parkway and has been successfully operating at 1050 kPa. Whilst there are no immediate plans to use this material for secondary mains, future asset creation should consider the use of this material where it is considered feasible, such as for renewable gas projects.

The most significant driver of secondary mains asset creation forecast in the next 20 years is the need to install new secondary mains to extend the network into the urban growth areas on the outskirts of the Sydney metropolitan area, including the Western Sydney Airport and associated industrial and commercial customer developments, and renewable gas projects. Further information is provided in JGN’s COWP.

B1.2 Asset operation and maintenance

The way assets are operated and maintained is an important factor in how they perform and how long they remain serviceable. JGN’s approach is to ensure assets perform within their design guidelines to enable the lowest sustainable life cycle cost. This includes operating assets within acceptable parameters, which may change over the life of an asset as they degrade.

Details of standard asset operation and maintenance activities on the secondary network are provided in the GAS-960-SP-ME-021 Field Operations And Maintenance Specification: Distribution Networks ≤1050kPa.

Secondary services including those entering buildings were highlighted for action in the latest 2021 Formal Safety Assessment and are inspected as part of the operational check for the meter set to mitigate against corrosion. In the greater Sydney region Zinfra repairs secondary inlet services if defects are found.

We have also recently commenced two non-operation and maintenance programs to address specific risks associated with the secondary asset class. Firstly, due to increased construction activity in the vicinity of secondary mains, we have employed external standby resources to aid with third party construction projects near our mains. These resources are trained by Jemena’s training contractor and are authorised representatives of Jemena during third party construction activities.

Secondly, we have commenced a removal program for isolated exposed mains, which will continue. The program is designed to remove the isolated exposed mains that are deemed high risk to the environment or to public safety. Capital projects have been initiated for higher risk locations such as Lane Cove. Less risky sites, or those where removal costs are minor will be managed by JGN Service Delivery field resources as part of a minor opex program.

Thirdly, the Shallow Mains project is currently in progress to locate mains within CBD areas where the main is deemed shallow. All locations identified as shallow have been marked as such on the GIS and locations where rectification works, such as installation of protection plates is ongoing.

B1.3 Asset replacement/disposal

B1.3.1 Asset replacement

Secondary network assets generally comply with current Australian standards for materials and operation. As such, the secondary network asset replacement strategy is limited to:

- relocations due to 3rd party activities which will impact the mains in their current location (refer to maintenance and asset creation) and;
- replacement due to 3rd party damage.

B1.3.2 Disposal strategies

When a buried steel asset has been isolated or abandoned, JGN is responsible for determining if the asset is to remain protected as per Jemena's Corrosion Mitigation Strategy (GAS-999-PA-IN-002). This is especially important if the asset may be utilised for future use.

If the asset is to be abandoned (no longer required), then all above ground cathodic protection equipment shall be removed and the environment restored to its former condition. Unless otherwise required by the decommissioning plan, any buried corrosion mitigation equipment including ground-beds, sacrificial anodes and cables are to remain undisturbed.

Where isolated exposed mains that are deemed to be of high risk to the environment or to public safety, these will be removed.

B2. Medium and low pressure mains and services

JGN manages the life cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as outlined in the AMS Manual.

B2.1 Creation

Assets in the medium and low pressure networks are largely created via demand for capacity and connections. This is discussed in the Capacity Design Specification Manual (GDN-1999-SP-DN-001).

Risk is also a key driver of asset creation. High risk locations including shopping areas, hospitals and bushfire prone areas are managed through installation of additional valves to allow safe and efficient isolation of these network sections when required.

The medium and low pressure network is designed to be a "build and bury" asset, with most of the network operating on a run to failure strategy. This is supported by the use of high quality materials and standard construction methodologies. Some components of the network have planned maintenance

Assets are designed to meet the requirements of AS/NZS 4645 and this is detailed in the Low & Medium Pressure Design Basis Manual (GDN-1999-DG-DN-002). The Construction field manual and the Approved Materials List are used to ensure the medium pressure network is constructed to Jemena's design requirements and AS/NZS 4645. This supports the strategy that the distribution network is designed and constructed in a consistent, robust manner.

Development of new networks and upgrade of existing networks will be continually driven by growth. Maintaining adequate capacity is a major issue for the network with continuously increasing demands, particularly where older suburbs are redeveloped into high density housing. This issue is managed with comprehensive modelling to optimise network utilisation. The specification for asset creation is defined in the Capacity Design Specification Manual.

The preferred material for all Asset Creation works including market expansion and rehabilitation projects is PE. In situations where PE cannot be used, the alternative material is Nylon.

B2.2 Asset operation and maintenance

The way assets are operated and maintained is an important factor in how they perform and how long they remain serviceable. JGN's approach is to ensure assets perform within their design guidelines to enable the lowest sustainable life cycle cost. This includes operating assets within acceptable operating parameters, which may change over the life of an asset as they degrade.

Full details of standard asset operation and maintenance activities on the medium and low pressure network are provided in the following document:

- GAS-1999-SP-ME-001 AS4645 Field Operations And Maintenance Specification: Distribution Networks ≤1050kpa

B2.3 Inspection and testing

The medium and low pressure network is subject to a number of inspection and testing activities. Types of inspections include:

- exposed mains inspections (frequency and scale of inspection is dependent on site specific risk level);
- leakage survey (whole network is subject to leakage survey over a five year rolling period);
- high risk sector leakage survey (specific areas are subject to annual leakage survey);
- high risk valve operational check (annually);
- high risk area proving (annually);
- sector valve operational check (annually);
- bushfire valve operational check (annually)
- leakage tests (ad hoc basis, identified for specific areas); and
- field failure and integrity testing.

B2.4 Preventative maintenance

Medium and low pressure network components are typically robust and designed to run to failure. The long design life of the network means there are only a small number of preventative maintenance activities primarily related to proving of high risk and bushfire valves.

B2.4.1 Reactive and corrective maintenance

Reactive and corrective maintenance is undertaken when faults occur or after inspection/testing has identified a fault. Corrective maintenance prioritisation and time-frames are:

- class 1 leaks repaired immediately;
- class 2 leaks repaired within 7 days;
- leaks identified in high risk areas are repaired immediately if >10% LEL or within 7 days if below this level; and
- class 3 leaks are noted for reference purposes.

B2.5 Asset replacement/disposal

B2.5.1 Asset replacement

Medium and low pressure mains and services are constructed from a variety of materials, depending on when they were installed. Though assets will have complied with Australian standards of the time, older materials such as ferrous mains and early plastics (PE63 and plasticised nylon) are no longer standard materials, with PE now being standard for mains expansion and rehabilitation. As a result, material type and age are key replacement drivers for the medium and low pressure network, with older ferrous mains and services being a priority.

Other key drivers for replacement are:

- third party works requiring asset relocation;
- leakage rates within sections of the network;
- mains in private property;
- historical construction practices; and
- exposed mains condition and location.

Asset replacement strategies for specific areas within the network are based on the performance of the network or known issues requiring mitigation.

The age profile of the network shows that the vast majority of the low and medium pressure network is well within its design life. There is still 5% of the network deemed at the end of its useful life and are a large proportion of this is planned for replacement.

Networks are rehabilitated to; reduce safety risks, avoid cost increase from rising repair costs, improve supply reliability and improve the capacity of the network. There is a rolling 30-year renewal program, with individual projects ranked based on a combination of risk, cost and public amenity.

The considerations for prioritising replacement are as follows:

- Capacity constraints – usually for areas operating at 7kPa.
- Operational cost due to costly repairs and network leaks.
- Large diameter steel mains ≥150mm operating at medium pressure – stopping gas to repair the main is a complex task and requires specialised resources; hot-tapping crews, welders and inspectors.
- Cast iron or steel mains operating at 7kPa and 30kPa – these mains have the highest leaks/km and cost/km and inserted when pipe failure occurs.
- Older generation PE (PE63) with significantly higher than average integrity issues in comparison to other areas with same material
- Small diameter steel mains ≤100mm operating at medium pressure. Prioritised based on:
- high density community usage areas;
- areas with high levels of leaks / repairs.
- regional areas; and
- other areas – small sections are replaced as minor capital works.
- Older generation PE (PE63) plastic mains – areas with high levels of integrity issues.
- Nylon mains with known integrity issues – black nylon, mechanical fittings, internal socket joints, older glues.

We are currently looking into alternative methods to test and rehabilitate mains, which may influence the strategy of dealing with older materials. These are discussed below.

- Large diameter cast iron mains – these mains operate at low pressure and form the feeder mains for the networks they are within. As such the replacement of these assets may be conducted in three ways:
- Insert the section with a smaller diameter pipe – this usually has the impact of reducing the capacity of the network and reinforcement to augment capacity is usually required.
- Insert the section with a smaller diameter pipe, but upgrade this to 210kPa – this upgraded section provides higher capacity and involves installation of a DRS to supply into the 7kPa (some reconfiguration of mains may also be required)
- EPCRC Plastics research project – this project is run through Deakin University in Geelong
- At the Warnambool Campus, four sandpits were constructed as part of a 5 year project for each for the different materials used within the gas networks in Australia (NY, PVC, PE63, PE80, PE100) and how stress concentration, such as squeeze-offs, are impacted by hydrogen.
- Testing is planned to be undertaken with how hydrogen may affect the elastomers in use within the gas networks in Australia. Preliminary research has indicated that hydrogen may have a material effect on these elastomers, so further research is necessary.

We will factor the outcome of these research studies into future asset management strategies.

B2.5.2 Disposal strategies

When a buried asset has been isolated or abandoned, JGN is responsible for determining if the asset is to be considered for future use as a conduit. The process for isolated mains is in the Low/Medium Pressure Design Basis Manual.

B3. Network pressure control

JGN manages the life cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as outlined in section 7 of the AMS Manual.

B3.1 Creation

DRS are created to support market expansion and capacity development projects. They are also created to replace existing DRS that have reached their end of life. The need for additional regulators within the networks is identified through the Capacity Planning team and is based on the results from network modelling, winter gauging and demand forecasts. DRS regulators will be designed based on input from the Capacity Planning team. Design requirements for DRS are given in the *GAS-1999-DG-DN-003 Network Pressure Control Design Basis Manual*.

With the introduction of Cocons in 2009, there are only three standard DRS models JGN installs:

- Honeywell's Cocon 26 for secondary inlet pressure;
- Honeywell's Cocon 13 for secondary inlet pressure; and
- the 800 sm3/hr, 1,400 sm3/hr, 3,000 sm3/hr and 7,000 sm3/hr district regulator sets, designed by Jemena and fabricated by a third party.

As each DRS will provide a set flow rate, they are not intended to run at maximum capacity. The Cocon models cover secondary to medium pressure and secondary to low pressure. These DRS comply with the requirements of:

- AS/NZS 4645.1 (predominantly a performance standard),

- JGN's DRS specification; and
- the Network Pressure Control Design Basis Manual.

In 2023 Honeywell announced they will no longer be producing the Cocon 26. For all new installations that would previously have used the Cocon 26, the Y20 Box must now be installed.

B3.2 Asset operation and maintenance

Full details of standard asset operation and maintenance activities on the medium and low pressure network are provided in the following documents:

- GAS-960-SP-ME-021 AS4645 Field Operations And Maintenance Specification: Distribution Networks ≤1050kpa Rev 1

B3.2.1 Asset spares

DRS are an assembly of individual components (filter, regulators and valves). As such, each component can be removed for maintenance or replacement. Spare parts are often sourced from decommissioned or overhauled regulators. The Cocon components (filter and regulators) are assembled in one unit and spare parts include removable cartridges.

There have been issues in the past with spares as suppliers will phase out older models, such as the Cocon 26. Alternate spares need to be sourced and the DRS modified to accommodate the new parts. An action plan is in place.

In 2023 Honeywell have announced they will not be producing the Cocon 26. Spare parts will only be supplied for the next 10 years (2033).

B3.2.2 Inspection and testing

The regulators are inspected regularly through the Operational Check. At present, the cocoons are inspected every 6 months while all other DRS are inspected annually.

The Cocons were originally placed on a 6-monthly operational check as they were a new piece of equipment and there was some initial concern over their reliability. Recent data has shown that the Cocons are performing well and JGN is now in a position where it can extend the operational check out to 12 months.

Ad hoc field inspections also take place as part of asset management activities. These activities are generally triggered as a result of concerns raised by field staff or due to increased corrective maintenance activities.

B3.2.3 Preventive maintenance

Cocons are scheduled for overhauls every eight years. All other district regulator sets are scheduled every six years.

The first Cocon overhauls were conducted during 2017. Recommendations that arose from these overhauls include:

- swapping out cartridges due for overhaul with spare cartridges in stock. The spare cartridge is placed in a test rig prior to swap-out to ensure it is operating correctly. Rotating stock enables Ops to conduct overhauls during a time when weather prohibits field work;
- testing O-rings for shelf life to see if they are affected long term by oxidation or moisture; and
- design and construction of maintenance rig/equipment to perform overhauls more efficiently.

There is a potential for the network pressure control equipment to be run to failure for areas that have dual feed. This can be investigated based on risk/benefit.

B3.2.4 Reactive and corrective maintenance

Reactive and corrective maintenance is undertaken when faults occur or after inspection/testing has identified a fault (or both). Previously, the majority of report-in codes were either “complete” or “incomplete”. There was little or no information as to what was repaired or the issues that occurred, preventing the work being done. The report-in codes have now been updated to better reflect the outcome of the work order. This will help identify the most common types of repairs.

B3.3 Asset replacement/disposal

B3.3.1 Asset replacement

The drivers for replacement or relocation of DRS include:

- HSE issues (ergonomic, traffic, trips, etc.);
- water ingress creating corrosion;
- capacity constraints; and
- third party development activities,

DRS replacement/relocation projects are prioritised based on asset performance, location and risk.

B3.3.2 Disposal strategies

District regulator sets that are retired from service are inspected for serviceable components. The components are reconditioned and re-stocked for future use as spare parts to support the legacy population of DRS.

B4. Consumer pressure control

JGN manages the life cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as outlined in section 7 of the AMS Manual.

B4.1 Creation

Medium and high pressure is not suitable for supply within residential areas of medium density and high rise residential developments due to safety, fire rating, Building Code of Australia requirements and AS5601. As such, the gas is required to be reduced in pressure through a regulator set so that it can be reticulated through the building safely, and at a pressure suitable for the appliances for which the gas supply is required (typically 5 kPa).

B4.2 Asset operation and maintenance

The boundary regulator operation and maintenance strategy includes 5-yearly inspections of internal boundary regulators and 20-year replacement of regulator and OPSO on boundary regulators <15kPa. This is reflected in the number of asset management activities listed for the operation and maintenance program of works.

B4.2.1 Asset spares

Asset spare parts are kept in store at the Jemena depots. Any overhaul is planned three months in advance i.e. works planning sends a site specific list to Jemena Procurement, items are purchased and technicians pick up from store before they commence work.

B4.2.2 Inspection and testing

Boundary regulators have a similar maintenance regime to customer meter sets. Medium pressure boundary regulators with a pressure of >15kPa and secondary boundary regulators are subject to a six monthly inspection and operational check regime. However, the uncertainty as to the locations of sets may result in some boundary regulators in this category not being inspected.

B4.2.3 Preventive maintenance

Boundary regulators with outlet pressure of >15kPa and all secondary boundary regulators are subject to a six yearly planned maintenance regime (overhaul). The basis of this is the regulators used are similar to those of SRS/DRS.

Internal boundary regulators with outlet pressure of <15kPa are subject to a 5-yearly inspection. This is to ensure adequate ventilation still exists, there are no leaks or corrosion, and no ignition sources have been recently introduced within the immediate vicinity.

External boundary regulators with outlet pressure of <15kPa are not subject to any planned maintenance regime. As there are over 4,500 known boundary regulators in the Jemena network, there would be a significant cost to have overhauls every six years and are operated to failure.

A regulator is expected to operate for at least 20 years. When a customer reports a failure of the boundary regulator, the aim is to replace the regulator the same day. This translates to a loss of supply for 1 day over a 20 year period, making them 99.99% reliable. The OPSO prevents the risk of over-pressurisation within the building if the regulator should fail in the open position. OPSOs are also expected to function for at least 20 years, therefore boundary regulators with outlet pressure of <15kPa shall have the regulator and OPSO replaced every 20 years.

B4.2.4 Reactive and corrective maintenance

Reactive and corrective maintenance is undertaken when faults occur or after inspection/testing has identified a fault (or both). Boundary regulators do not have any asset specific corrective maintenance work codes. Any corrective maintenance is carried out using the work codes for meter sets. Boundary regulators are also subject to emergency response activities if required.

Defective boundary regulators are replaced under the 613 work code. This work code is linked to the ‘Defective Regulator Replacement’ program which incorporates Domestic, I&C and boundary regulators.

B4.3 Asset replacement/disposal

B4.3.1 Asset replacement

Secondary boundary regulators with outlet pressure >15kPa and are overhauled every six years. All boundary regulators are replaced on breakdown.

Boundary regulators with outlet pressure <15kPa are replaced on breakdown. Since the beginning of 2017, any boundary regulators with no over pressure protection that have been retired from service are sent for a condition assessment.

During 2017, ten boundary regulators were replaced due to issues with surface corrosion, not having an OPSO, and no bypass on majority. In 2018, an ongoing yearly program to replace boundary regulators without sufficient over-pressure protection was approved.

B4.3.2 Disposal strategies

Boundary regulators that are retired from service are inspected for serviceable components. The components are reconditioned and re-stocked for future use as spare parts.

Appendix C
Asset overview

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C1. Secondary mains and services

The JGN secondary network consists of approximately 1,500 km of mains operating at a Maximum Allowable Operating Pressure (**MAOP**) of 1050kPa, with a minimum operating pressure of 525kPa. The network also includes services, line valves and cathodic protection systems. The secondary mains provide gas to the district regulator sets in the distribution networks and also directly supply a number of larger industrial and commercial (**I&C**) customers. Section 4summarises the secondary network assets.

The secondary mains network is primarily constructed from steel pipe with a small section of SDR9 PE100 installed in the Wakehurst Parkway in Sydney's Northern Beaches. The majority of the network is externally coated with high density polyethylene (**HDPE**) to protect it from corrosion and internally lined to reduce frictional losses. Since 2012, mains have been externally coated with either a tri-laminate coating or fusion bonded epoxy (**FBE**) coating. Additional corrosion protection is also achieved by the cathodic protection system.

Secondary services supply customers directly from the secondary mains network. These services are constructed to the same standards as the secondary mains, with a minimum diameter of 50mm. Main secondary line valves are devices used to manually isolate secondary mains gas flow. The valves are operated during emergencies or when isolation is required.

C1.1.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the gas distribution network, which alongside the AS/NZS 4645 Formal Safety Assessment process provides the robust framework for managing risk.

The Gas Distribution Network "Top 10" Risk Register is maintained and is reassessed and updated each year through consultation with the Asset Management Networks team. Specific network risks are captured and tracked via the network sub-asset class risk registers and the network opportunities register.

The primary types of risk that impact the secondary network mains and services are:

- asset failure (e.g. corrosion);
- third party hits;
- failure or reduction in control effectiveness (e.g. inadequate signage);
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

C1.2 Criticality

Critical assets on the secondary network are:

- single-way feeds to larger numbers of customers or significant customers;
- main line valves that enable isolation of areas where failure may lead to higher consequences;
- exposed mains (subject to their location and levels of protection);
- cathodic protection systems; and
- assets in high density community usage areas.

C1.3 Failure modes

Distribution network assets can fail due to a number of circumstances or external events. JGN monitors the failure modes of network assets and factors these into risk assessments and ongoing mitigation activities. The

following table summarises the typical failure modes for secondary mains, services and line valves, and the controls in place to mitigate failure.

Table C1–1: Secondary network failure mode assessment

Asset	Failure type	Failure mode	Controls	Comments
Secondary mains and services	Integrity	Corrosion leading to loss of supply or loss of containment	• Inspection • Coating • Condition-based replacement • Cathodic protection	• Exposed mains and buried assets are inspected and checked • Coating inspected and repaired • Damaged coating or exposed mains replaced when necessary • CP checks and tests are performed
	Integrity	Design defect leading to loss of supply	• Project management methodology • Quality control	• Design review and approvals • Quality control checks during construction
	Operational	Third party hits leading to loss of containment or supply	• Depth of cover • Pipeline markers • Before You Dig Australia • Liaison • Encroachment Management process • Patrols	• Physical separation • Visual indication of buried gas main • BYDA process Jemena notification • Jemena standby process, construction activities near gas mains are supervised • Regular patrols of mains are performed
Pressure control (DRS)	Operational	Over pressurisation leading to loss of containment	• Pressure relief devices • SCADA monitoring/alarms	• Design approvals and regular maintenance • Emergency management process
	Operational	Under/Over temperature leading to loss of supply or loss of containment	• Pressure relief devices • SCADA monitoring/alarms of temperature transmitters • Design basis •	• Design approvals and regular maintenance • Emergency management process • Design parameters are determined by the DBM
Line valves	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Detailed work procedures • Control assessment reporting and condition monitoring to set frequencies • Review and approval of operating parameters	• FOMS and Work Orders regularly reviewed and updated • Inspection and reporting of issues • Approvals and change management process
Secondary system in general	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits	• SAOP reviews and regular updates

C1.4 Life expectancy

The industry accepted design life for secondary network components is 50 years. A critical assumption when defining the design life is the effectiveness of controls which ensure the asset's integrity. Effective integrity management can extend the operating life well beyond the design life.

Factors affecting the life expectancy of the network include:

- exposed mains subject to environmental conditions;
- third party encroachment activities;
- historical poor construction activities;
- operations and maintenance activities; and
- network growth.

Network components deemed to be at the end of their design life are assessed for fitness of purpose.

C2. Low and medium pressure mains and services

C2.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the gas distribution network, which alongside the AS/NZS 4645 FSA process provides the robust framework for managing risk.

The primary types of risk that impact the medium and low pressure network mains and services are:

- asset failure (e.g. corrosion);
- operational risks (e.g. human error);
- third party hits;
- failure or reduction in control effectiveness (e.g. inadequate signage);
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

C2.2 Criticality

Critical assets on the medium and low pressure network are:

- high risk valves;
- bushfire valves;
- critical mains;
- exposed mains;
- assets in high density community usage areas; and
- isolated mains in sensitive areas.

C2.2.1 High risk valves

High risk valves (**HRVs**) are used to isolate areas that require a high level of safety management. These high risk areas are locations where there is a higher density of public usage over what is considered normal usage. HRVs have a high criticality, determined by:

- location, generally within shopping centre precincts and other areas with high pedestrian activity (sporting complexes, etc.); and

- high potential consequence of failure.

C2.2.2 Bushfire valves

Bushfire valves are used in areas that are prone to bushfires. These valves allow rapid isolation of network sections deemed to be within the path of a bushfire. Bushfire valves have been installed in the Blue Mountains and Hunter regions.

C2.2.3 Critical and exposed mains

Critical medium pressure mains have high importance from a capacity/supply point of view. These mains are usually large diameter and represent a single supply source to a large number of customers or a strategic customer, where any failure would leave these customers without gas.

The asset criticality is deemed to have similar requirements as per secondary mains and is managed through pipeline patrol activities, leakage surveys and standbys. The criteria for determining critical mains is listed in the Design Basis Manual.

Exposed mains may be considered critical if they are essential to supply large volumes of customers or if they are located near to areas of public access.

C2.2.4 High density community usage areas

High density community use (**HDCU**) applies where large numbers of people reside or congregate in the normal use of the area. This includes areas where buildings of four or more storeys are prevalent, major shopping centres, schools, hospitals, major sporting and cultural facilities and public infrastructure (e.g. roads and railways) adjacent to the high density community area.

The latest revision to the standard *AS/NZS 4645: Gas Distribution Networks* has additional requirements for management in HDCU areas. This includes maximum diameters, MAOP and set back distances of mains from buildings. While any changes will not be retrospective, it will be necessary to determine the impact of HDCU areas and how future new mains and services will be affected.

C2.2.5 Isolated mains in sensitive areas

These mains do not convey gas, but are considered critical in the sense they are of high importance from an environmental perspective as they may contain remnants of hazardous substances. Any hazardous substance release in these environmentally sensitive areas is considered unacceptable.

C2.3 Failure modes

Distribution network assets can fail due to a number of circumstances or external events. JGN monitors the failure modes of network assets and factors these into risk assessments and ongoing mitigation activities. The following table summarises the typical failure modes for medium and low pressure mains and services, and the controls in place to mitigate failure.

Table C2–1: Medium and low pressure network failure mode assessment

Asset	Failure type	Failure mode	Controls
Medium and low pressure mains and services	Integrity	Corrosion leading to loss of supply or loss of containment	• Inspection • Leakage survey • Condition-based replacement • Cathodic protection
	Integrity	Failure of cast iron joints leading to loss of containment or supply	• Inspection • Leakage survey • Condition-based replacement

	Integrity	Cracking or fracturing (plastic pipes) leading to loss of supply or loss of containment	• Inspection • Leakage survey • Condition-based replacement
	Integrity	Cracking resulting from squeeze-off failure	• Inspection • Leakage survey • Condition-based replacement
	Integrity	Design defect leading to loss of supply	• Project management methodology • Quality control
	Operational	Third party hits leading to loss of containment or supply	• Depth of cover • Pipeline markers • Before You Dig Australia • Landowner Liaison • Encroachment management process • patrols
	Operational	Over pressurisation leading to loss of containment	• Pressure relief devices • SCADA monitoring/alarms
	Operational	Under/Over temperature leading to loss of supply or loss of containment	• Pressure relief devices • Design basis • SCADA monitoring/alarms of temperature transmitters
	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Detailed work procedures • Control assessment reporting and condition monitoring to set frequencies • Review and approval of operating
	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits

C2.4 Life expectancy

The industry accepted design life for medium and low pressure network components is 50 years. A critical assumption when defining the design life is the effectiveness of controls which ensure the asset's integrity. Effective integrity management can extend the operating life well beyond the design life.

Factors affecting the life expectancy of the medium network include:

- exposed mains subject to environmental conditions;
- third party encroachment activities;
- historical materials selection (e.g. Cast iron, unprotected steel, black nylon, PE63);
- historical poor construction activities;
- operations and maintenance activities; and
- network growth.

Network components deemed to be at their end of design life are assessed for fitness of purpose.

C3. Network pressure control

District Regulator Sets (DRS) is the generic term used to describe regulators that supply the medium pressure networks. There are three types of DRS in operation to provide regulation at different stages on the network:

- secondary district regulator sets (**SDRS**) are installed at an off-take from the secondary network to supply medium and low pressure networks. SDRS reduce the inlet pressure of 1,050kPa to 400, 300, 210, 100, 30 or 7kPa;
- medium pressure district regulator sets (**MPDRS**) are installed at an off-take from the medium pressure network to supply low pressure networks. MPDRS reduce the pressure from between 30 and 400kPa inlet pressure to 7kPa; and

Most DRS are located on public land and usually comprise an underground steel box with lid and internal regulator components consisting of an active run with inlet and outlet valves, two regulators (active and monitor), associated pilots, one filter and various pressure gauge points (inlet, outlet, inter-stage). Most regulator sets also have a manual bypass run with inlet and outlet valves and a single regulator. There are over ten different regulator box types, and at least 50 different regulator types have been identified in various sizes and combinations.

There are variations to the basic design where three regulators are employed in the active run due to the overpressure protection policy where the district regulator reduces the secondary pressure to outlet pressures of less than 15 kPa. There are also regulator sets that do not possess a bypass, but provide fittings for a portable bypass, or utilise a throttle valve instead of a regulator.

C3.1 Risk associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the gas distribution network, which alongside the AS/NZS 4645 FSA process provides the robust framework for managing risk.

The primary types of risk that impact DRS are:

- asset failure (e.g. corrosion);
- operational risks (e.g. human error);
- third party hits;
- failure or reduction in control effectiveness (e.g. inadequate signage);
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

C3.2 Criticality

Critical areas within network pressure control assets are:

- the filter within the DRS;
- single feed networks; and
- multiple feed, high capacity networks.

C3.2.1 DRS filter

The filter is installed to prevent large particles from entering the regulators, which may cause blockages or damage to the regulators. If the filter is not checked and cleaned on a regular basis, the filter could become blocked, resulting in a loss of supply, or the filter mesh may rupture and allow large particles to pass through, preventing the regulator to close which will result in overpressure downstream. There are instances/locations where supply is critical during winter that these filters are highlighted as critical to check.

C3.2.2 Single feed networks

Single feed networks are medium or low pressure networks where the supply is dependent on a single DRS. A failure of the DRS could result in the loss of supply to over one thousand customers. At present, there are approximately 73 single feed networks.

C3.2.3 Multiple feed, high capacity networks

In cases where there is significant demand on a network, multiple DRS are installed to provide the additional flow and maintain pressure in the network. During peak consumption times if one DRS should fail, the other DRS in the network may not be able to provide the additional flow required, resulting in a loss of supply to some customers.

C3.3 Failure modes

Distribution network assets can fail due to a number of circumstances or external events. JGN monitors the failure modes of network assets and factors these into risk assessments and ongoing mitigation activities. The following table summarises the typical failure modes for district regulator sets, and the controls in place to mitigate failure.

Table C3–1: Network pressure control assets failure mode assessment

Asset	Failure type	Failure mode	Controls
District regulator sets	Integrity	Corrosion leading to loss of supply or loss of containment	• Corrective maintenance • Annual operational checks • Use of approved materials • Condition-based replacement
	Integrity	A filter mesh rupture causing debris to be lodged inside the regulator, forcing it open and leading to over pressurisation downstream	• Corrective maintenance • Annual operational checks • Use of approved materials • Condition-based replacement
	Integrity	Design defect leading to loss of supply	• Project management methodology • Quality control
	Operational	Third party hits leading to loss of containment or supply	• Liaison • Asset markers
	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Detailed work procedures • Control assessment reporting and condition monitoring to set frequencies • Review and approval of operating
	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits

C3.4 Life expectancy

The design life of an individual DRS is nominally stated as 35 years. However, the actual life of the asset depends on a number of factors including condition, performance and changes in legislation.

Factors affecting this life expectancy include:

- corrosion;
- metal fatigue;

- ergonomic factors (accessibility for maintenance);
- water ingress; and
- obsolescence and availability of spare parts.

Network components deemed to be at their end of design life are assessed for fitness of purpose.

C4. Consumer pressure control

This section includes information about the type and specifications of the consumer pressure regulating sets in service across the JGN distribution network. The focus of this section is boundary regulators. Meter installations are covered by the Measurement Asset Class Strategy.

Boundary regulators are used to reduce the secondary or medium pressure at the property boundary to low pressure. The low-pressure end-user service then supplies medium or high-density housing, such as units, townhouses or villa complexes, shopping centres and some I&C customers. There are over 4,500 known boundary regulators, however it is believed that there are thousands more in the network.

Boundary regulators are installed to:

- reduce gas pressure to a safe minimal level before delivery into the customer's premises. Lowering the pressure reduces the consequences from the threat of a gas escape;
- protect the customers' (building) piping services from the threat of over pressurisation that can result in a gas leak within a building;
- protect the customer's appliances from the threat of over pressurisation that causes poor combustion and "lift off" of the flame; and
- avoid the need for over pressurisation management on internal meter sets, eliminating the need for vent lines.

C4.1 Risk associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of the gas distribution network, which alongside the AS4645 FSA process provides the robust framework for managing risk.

The primary types of risk that impact boundary regulators are:

- asset failure;
- operational risks;
- third party hits;
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

C4.2 Criticality

Critical customer pressure control assets are:

- secondary boundary regulators;
- critical customers;
- internal boundary regulators;

- boundary regulators with no over pressure shut off (OPSO) valve; and
- the filter within the BR (secondary boundary regulators and >15kPa outlet).

C4.2.1 Secondary boundary regulators

A secondary boundary regulator is installed when a customer requires high pressure or flow and connected from the secondary network (1050kPa). A failure of the regulator will result in secondary pressure entering the premises over pressurising the pipework.

C4.2.2 Critical customers

Critical customers such as hospitals and nursing homes where natural gas is relied on for heating and cooking for patients.

C4.2.3 Internal boundary regulators

In the past, some boundary regulator sets have been installed inside the building with poor ventilation and in close proximity to ignition sources. A leak or gas escape from an internal boundary regulator could have serious consequences.

C4.2.4 Boundary regulators with no OPSO

Current boundary regulator sets are installed with an OPSO which protects the customer in the event of a regulator failure. Older boundary regulator sets did not come with an OPSO. As these regulators age, there is an increasing risk that they will fail at some point, over-pressurising the downstream pipework.

C4.2.5 The filter within the BR (secondary boundary regulators and >15kPa outlet)

The filter is installed to prevent large particles from entering the regulators, which may cause blockages or damage to the regulators. If the filter is not checked and cleaned on a regular basis, the filter mesh may rupture and allow large particles to pass through.

C4.3 Failure modes

Distribution network assets can fail due to a number of circumstances or external events. JGN monitors the failure modes of network assets and factors these into risk assessments and ongoing mitigation activities. The following table summarises the typical failure modes for boundary regulators, and the controls in place to mitigate failure.

Table C4–1: Boundary regulator assets failure mode assessment

Asset	Failure type	Failure mode	Controls
Secondary Boundary Regulators and Boundary Regulators >15kPa outlet	Integrity	Corrosion leading to loss of containment.	• Corrective maintenance • Annual operational checks • Use of approved materials
	Integrity	A filter mesh rupture causing debris to be lodged inside the regulator, forcing it open and leading to over pressurisation downstream.	• Corrective maintenance • Annual operational checks • Use of approved materials
	Integrity	Filter or regulator failure in poorly ventilated space or near ignition source in customer's property, leading to fire/explosion	• Corrective maintenance • Annual operational checks • Use of approved materials
	Integrity	Design defect leading to gas escape and igniting.	• Project Management Methodology

			• Quality control
	Operational	Third party hits leading to loss of containment or supply	• Liaison • Asset markers
	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Use of approved materials
	Operational	Under/Over temperature leading to Loss of Supply or Loss of Containment	• Use of approved materials
	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits
All other Boundary Regulators	Integrity	Corrosion leading to loss of containment.	• Corrective maintenance • Use of approved materials
	Integrity	A filter mesh rupture causing debris to be lodged inside the regulator, forcing it open and leading to over pressurisation downstream.	• Corrective maintenance • Use of approved materials
	Integrity	Filter or regulator failure in poorly ventilated space or near ignition source in customer's property, leading to fire/explosion	• Corrective maintenance • Use of approved materials
	Integrity	Design defect leading to gas escape and igniting.	• Project Management Methodology • Quality control
	Operational	Third party hits leading to loss of containment or supply	• Liaison • Asset markers •
	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Use of approved materials
	Operational	Under/Over temperature leading to Loss of Supply or Loss of Containment	• Use of approved materials
	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits

C4.4 Life expectancy

Boundary regulators are not designed with any specific design life. However, technical life of an individual secondary or a medium pressure boundary regulator is 20-25 years. Not all boundary regulators subjected to fixed interval operational check and overhaul. Medium pressure boundary regulators with an outlet pressure below 15 kPa are not maintained and are replaced upon failure.

The actual life of the asset depends on a number of factors including location, condition, and performance. Factors affecting this life expectancy include:

- contamination and corrosion;
- ageing or natural wear and tear;
- interference from third parties;
- maintainability (with bypass, without bypass and without option for bypass);
- proximity to coast (sand and salt contamination); and
- obsolescence and availability of spare parts.

Network components deemed to be at their end of design life are assessed for fitness of purpose.

Appendix D
Information requirements

D1. Information requirements

Jemena's AMS provides a hierarchical approach to understanding the information requirement to achieve Jemena's business objectives at the asset class. In summary, the combination of Jemena's Business Plan, the ABS and various ACSs all provide the context for and determine the information required to deliver JGN asset objectives and the distribution network asset class objectives.

JGN's asset objectives are:

- Maintain customer KPIs
- Maintain asset safety and reliability KPIs and comply with regulations and legislative instruments
- Reduce capital investment intensity
- Reduce operational spend
- Explore innovative opportunities which help determine the role of gas in the low carbon future
- Increase investment scrutiny, to ensure the expenditure is prudent and costs can be recovered within a reasonable timeframe
- Increase long term competitiveness of networks through higher asset utilisation and by connecting profitable new customers

In support of these, distribution networks asset class has three asset class objectives. These are:

- Maintain current level of network risk, only improving risk where efficient to do so.
- Reduce the cost of investing in and maintaining distribution network assets, without compromising network risk.
- Maintain current service levels to customers.

From these business objectives, it is possible to identify at a high-level the business information systems' content required to support these objectives (Table D1–1).

Table D1–2 identifies the current and future information requirements to support the asset class's critical decisions and their value to the asset class.

Table D1–3 provides the information initiatives required to provide the future information requirements. Included within this table is the risk to the asset class from not completing the initiative.

All of the information required by the distribution network asset class is available within Jemena's current business systems.

D1.1 Distribution network assets

Table D1–1: Distribution network assets business objectives and information requirements

Business objective	Jemena information sources	Externally sourced data
Maintain customer KPIs	Jemena Business Plan JGN Market Strategy JGN ABS Monthly JGN KPI report	AER Network Performance Reports Other gas networks' regulatory proposals and public planning/performance reports

	JGN Corporate Scorecard VOC reports / studies	AER Consumer Challenge Panel reports
Maintain asset safety and reliability KPIs and comply with regulations and legislative instruments	Jemena Business Plan JGN Market Strategy JGN ABS Monthly JGN KPI report JGN Corporate Scorecard VOC reports / studies Formal Safety Assessments Jemena Network Operator Rules Safety Case (SAOP) of Jemena Gas Assets (NSW) Jemena Risk Management Policy (and the Group Risk Management Manual) Jemena Compliance and Risk System (JCARS) Asset sub-class risk registers Design Basis Manuals Networks APaIR Operations and Maintenance Specification Operations, Control, Monitoring and Response Specification AMS Manual Capacity Design Specification Manual Field Operations And Maintenance Specification: Distribution Networks ≤1050kpa	Gas Supply Act 1996 No 38 (NSW) Gas Supply (Safety and Network Management) Regulation 2013 AS 4564:2011 Specification for general purpose natural gas AS 4645:1:2018 Gas Distribution Networks Part 1: Network Management AS/NZS 4645.2:2018 Gas distribution networks Part 2: Steel pipe systems AS/NZS 4645.3:2018 Gas distribution networks Part 3: Plastic pipe systems AS/NZS 5601.1:2013 Gas Installation – General Installations AER Network Performance Reports Other gas networks' regulatory proposals and public planning/performance reports
Reduce capital investment intensity	JGN Market Strategy JGN ABS JGN Corporate Scorecard Asset Investment Program VOC reports / studies Jemena Investment Governance Framework	AER benchmarking AER regulatory determinations Other gas networks' regulatory proposals and public planning/performance reports
Reduce operational spend	JGN Market Strategy JGN ABS JGN Corporate Scorecard Asset Investment Program VOC reports / studies	AER benchmarking AER regulatory determinations Other gas networks' regulatory proposals and public planning/performance reports
Facilitate net zero	ECMS GPA hydrogen readiness report Renewable Gas Strategy Emissions reduction strategy	ENA reports Other gas network's regulatory proposals and public planning/performance reports Competitor analysis Future fuel CRC Report
Increase long term competitiveness of networks through higher asset utilisation and by connecting profitable new customers.	JGN Market Strategy JGN ABS Networks APaIR	AER benchmarking AER regulatory determinations

		Other gas networks' regulatory proposals and public planning/performance reports

D1.2 Distribution network assets critical decisions

Table D1–2: Distribution network assets critical decisions business information requirements

Critical business decision	Current information usage	Future information requirement	Value to asset class (High, Medium, Low with justification)
When to replace boundary regulators that do not have OPSO.	Records in SAP Annual assessments	Location of all BRs. Only There are 4,266 boundary regulators recorded in SAP, however, there could be several thousand more that have not been identified.	High – BRs without an OPSO carry a high risk, particularly if located in an unventilated area or near to an ignition source
When to replace/rehabilitate medium and low pressure mains, and the priority order.	Leakage survey Publicly reported leaks Levels of mains repairs Materials Leakage Tests Field failure reports	Heat mapping of these locations using GIS Leakage survey module in GIS/EAM Tool for automated analysis Database / Mobility for recording field failures More accurate recording of confirmed public reported leaks by sub-asset type (service, main, meter)	High – allows visual aid and prioritisation of projects
When it is safe and efficient to extend the life of low and medium pressure mains rather than replace them.	Leakage survey Publicly reported leaks Levels of mains repairs Materials Leakage Tests Risk register	As per #2 above Locations of HDCU areas using GIS Forecasting deterioration rate based on historical data for all areas using analytics	High – this information feeds into the Options Analysis
When pressure reduction is an appropriate risk management strategy, without compromising service performance.	Network pressures Network modelling Growth Customer base mix (Business vs Residential)	Winter gauging Long term plans Development planning	High – to ensure pressures do not drop below design requirements at terminal points
When to invest in network expansion – secondary and medium/low pressure mains.	Telemetry Winter gauging Annual network assessment Customer usage pattern	IOT for monitoring CMM module in SAP to integrate with modelling software	Medium -prudent capital expenditure
When a DRS should be overhauled and when it should be decommissioned.	Scheduled overhaul - planned in SAP. Unscheduled overhaul as a result of a planned inspection breakdown (low supply/loss of supply) -publicly reported & logged in SAP.	Newly designed PM Report using mobility solution. Link this report to GIS/SAP. Use of Notification in SAP. Information requirements are as follows: Equipment specifications, location, operational data	Medium – to identify useful life and fine tune overhaul schedule

		(pressure), defects/failures, root cause, other issues (old/poor design, obsolescence), non-complaint sites (HSE)	
When to modify inspection cycles of assets.	Field report Winter gauging -Jemena representatives in Standard committees. -Field reports -SAP data -Asset Strategy and Service Delivery reports -Service Delivery and warehouse	Use of Internet of Things (IOT) SAP Notification PM Report as referenced in the item above. BOM in SAP	High- It will allow better Planned Maintenance Optimisation.

D1.3 Information initiatives

Table D1–3: Information initiatives to support business information requirements

Information initiative	Use case description	Asset class risk in not completing	Data quality requirement	Status
Boundary regulator field data capture	There are 4,266 boundary regulators recorded in SAP, however, there could be several thousand more boundary regulators in the network that have not been identified. Capturing data on boundary regulator locations and volumes will help reduce the risk associated with asset failure, particularly if we can identify the location of all BRs that do not have an OPSO	High	95% of BR population to be located and captured in SAP	In progress
Public reported leaks workcode	When a member of the public calls Jemena to report a leak, the leak is assigned to a category (meter set, main, service etc) based on the information given by the caller. When the leak is investigated, it is often not on the sub- asset category it was assigned to originally, however this original information cannot be changed in SAP retrospectively. This results in inaccuracies in reporting for leakage by sub-asset type (affects RIN and other regulatory reporting, asset condition monitoring)	Low	Simplification of workcode/report in code to ensure more accurate assignment of public reported leak to the correct sub-asset class.	

Field Failures	Mobility solution for instances of Field Failures – currently paper based and difficult to ascertain how many are actually occurring compared to how many arrive at the Plastics Lab	Low	All Field Failure reports to be completed by field personnel using the mobility solution	
Location of HDCU areas using GIS	Conformance to AS4645 for network operator to know where mains are within HDCU areas where a high risk may be present. Current estimates of 'potential' HDCU areas within NSW indicates 15,000 places of interest. This would need to be refined using proximity of 'place of interest' to distribution mains to narrow down actual number of HDCU areas. Gas Spatial Analysis tool can be used.	High	List and location of HDCU areas in proximity to distribution mains	Completed
Leakage survey module in GIS for automated analysis	Leakage survey reports are a manually intensive process and analyzing the data is cumbersome. Automating this through the module will allow better analysis with the in-built tools available	Low	Prioritisation to assist with mains replacement programs	In progress
Location of isolated mains in sensitive areas	Means to document the locations of isolated mains that are in sensitive areas such as creek crossing and national parks. Gas Spatial Analysis tool can be used for proactive condition assessment of assets	Moderate	List of all locations with proximity to sensitive areas	Completed
Location of exposed mains in bushfire prone areas	Means to document the locations of exposed mains that are within bushfire zones. Potential for gas release during intense fires or backburning operations. List can be updated into Emergency Management Plans. Gas Spatial Analysis tool can be used.	High	List of overlapping areas	List completed but not updated into EMP