AusNet

Gas Network

Network Capacity Strategy

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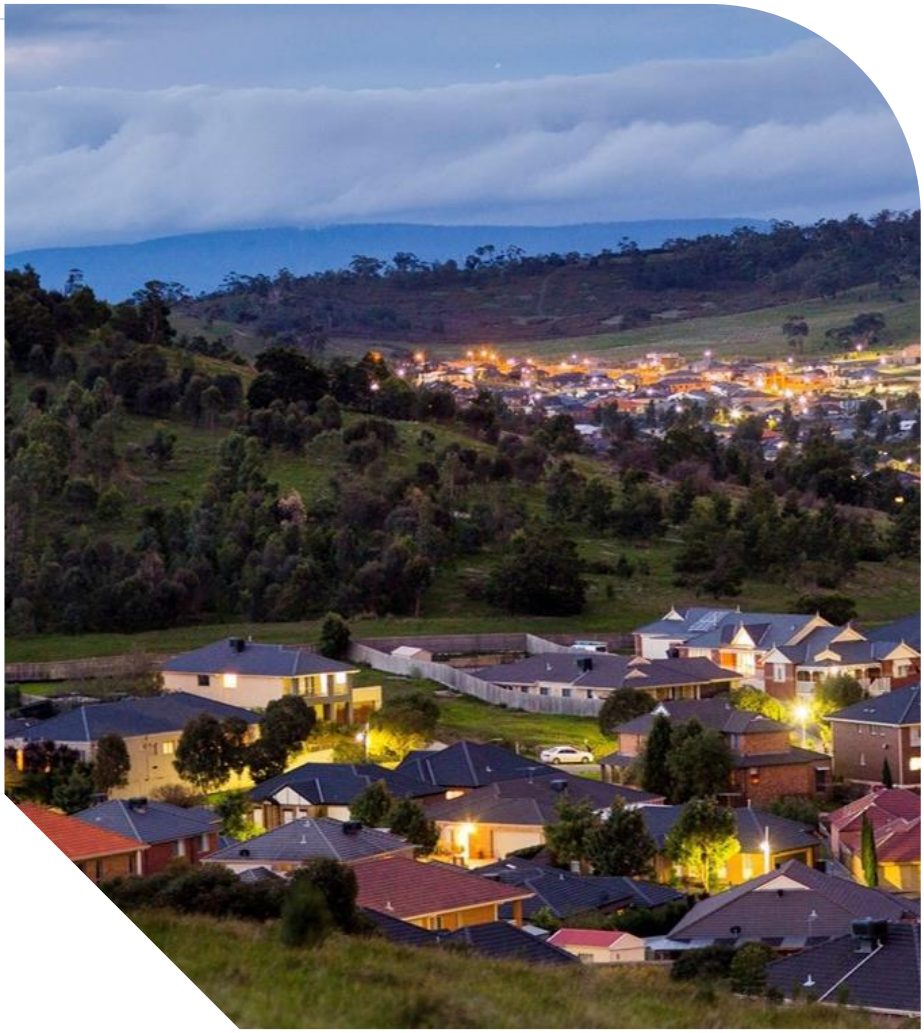

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AusNet

Table of contents

Executive Summary

AusNet Services has an obligation to maintain and manage the supply of natural gas to its customers in accordance with its Gas Safety Case (GSC) (this being compliant with the *Gas Safety Act* and *Gas Safety Regulations*) and the Gas Distribution System Code (GDSC).

AusNet Services' annual augmentation program, which results from forecasts of customer growth, winter performance, and network analysis, is required to create new assets or upgrade the capacity of existing assets to achieve appropriate outcomes for customers and other stakeholders.

This program is driven by seven Gas Network Objectives:

- Maintain network safety in accordance with the Gas Safety Case;
- Maintain top quartile operating efficiency;
- Undertake prudent and sustainable network investment;
- Delivery of valued services to our customers;
- Simplify and remove cost by investing in technology and automation;
- Provide sector leading customer experience by improving systems, processes and communication;
- Secure future for gas with increased utilisation and renewable gas options.

Demand on AusNet Services' gas network is forecast to remain reasonably stable over the next five years, with customer growth expected to compensate for lower consumption per capita. With strong population growth in Melbourne localities such as Hume, Rockbank and Wyndham and regional areas such as Ballarat and Geelong, overall customer growth is forecast to increase by an average of 2.1% to 2028.

Contrastingly, smaller housing, energy efficiency and the increasing competitiveness of electrical appliances is expected to reduce residential consumption per household over the same period. Some isolated networks are however predicted to exceed the average rate of customer growth due to their geographical position in the key urban growth zones in Melbourne's west and key regional hubs.

The program outlined for the next access arrangement period include installing new City Gate and Field Regulator facilities, upgrades to existing facilities, and laying mains reinforcements.

Approximately 25.02km of pipeline reinforcements, 2 new facility installations and 4 capacity upgrades to existing facilities have been identified in the augmentation works package up to June 2028.

The project details and performance analysis pertaining to these works are contained in network planning reports referenced for each project.

Table 1: Planned Augmentation Capex Summary ($2022, $'000)

[C.I.C]	

1. Document Overview

1.1. Purpose

The document articulates AusNet Services' approach to maintaining network capacity. The document is for use by:

- Internal staff and senior management; and
- Regulators: Economic, Technical and Safety.

The Network Capacity Strategy is one of several plant and network strategies developed and maintained for the management of AusNet Services' Gas Distribution Network. It Identifies network areas where existing capacity is insufficient to meet forecast demand and describes proposed network augmentation to meet forecast demand.

1.2. Scope

The Network Capacity Strategy covers AusNet Services' natural gas distribution and transmission assets operating in the western region of metropolitan Melbourne and regional Victoria.

This strategy is only concerned with the available capacity of such assets that physically carry gas sourced from APA's gas transmission pipeline system and their ability to meet consumer demand.

Assets in scope:

- Network regulating stations (City Gates, Field Regulators and District Regulators),[1] and
- Transmission pipelines, supply mains, and reticulation mains.

Assets out of scope:

- SCADA,
- City Gate Heaters,
- Cathodic protection,
- Consumer regulators (Domestic, Black Box or Industrial and Commercial (I&C)), and
- Services.

1.3. Definitions

AEMO	Australian Energy Market Operator: Focuses on delivering a range of gas (and electricity) market, operational, development, and planning functions by managing the Victorian gas transmission network and overseeing gas retail markets.
APA	Australian Pipeline Trust: Principal national gas transmission pipeline owner.
CAPEX	Capital Expenditure
City Gate	The largest type of gas pressure reduction station and where asset ownership shifts from the principal transmission operator (APA) to the distribution business (AusNet Services).

[1] Company initiated capital only.

EDD	Effective Degree Day: A composite measure of weather coldness incorporating the effect of temperature; wind, sunshine and time of the year. EDD figures are provided daily by AEMO.
Field Regulator	A pressure regulating facility fed from AusNet Services' Transmission Pipeline in order to supply a high or medium pressure distribution system.
GDSC	Gas Distribution System Code
GSC	Gas Safety Case
HP	High Pressure
HP2	High Pressure 2
I&C	Industrial and Commercial
SCADA	Supervisory Control and Data Acquisition
Synergi Gas	Gas network modelling software.
TP	Transmission Pressure

1.4. Asset Management Framework

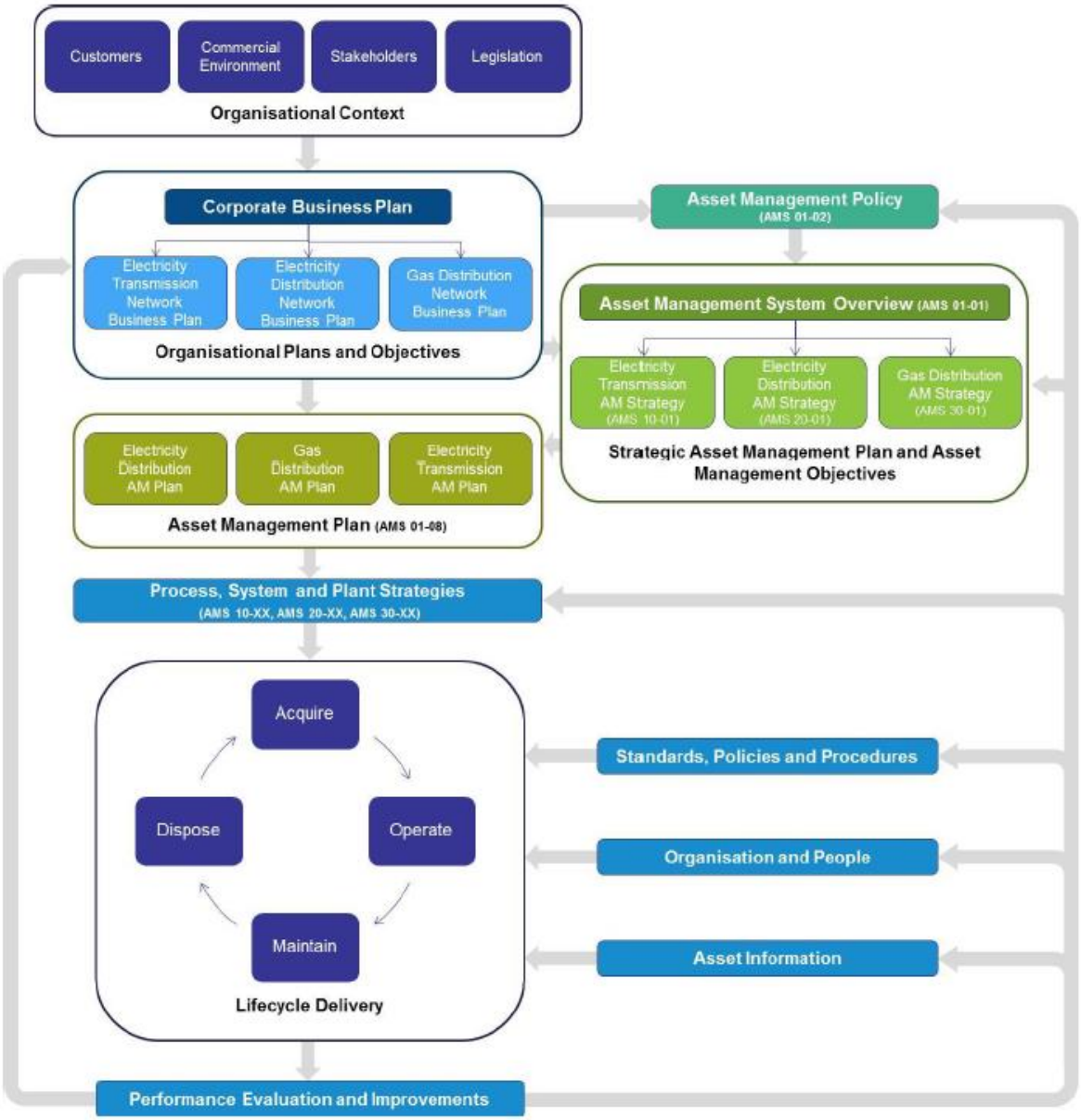

Figure 1 below provides an overview of AusNet Services asset management framework. This framework is centred around the objective to operate the network in top quartile of efficiency benchmarks with an aim to care for customers and strive to make energy more affordable.

The Gas asset management strategy plays a key role in ensuring alignment between asset management objectives, corporate objectives, and stakeholder requirement.

The Network Capacity Strategy is one of the Plant Strategies providing visibility on asset class performance, issues, risks, and investment required to support delivery of safe and reliable service and achieve the long-term objectives of the gas distribution network.

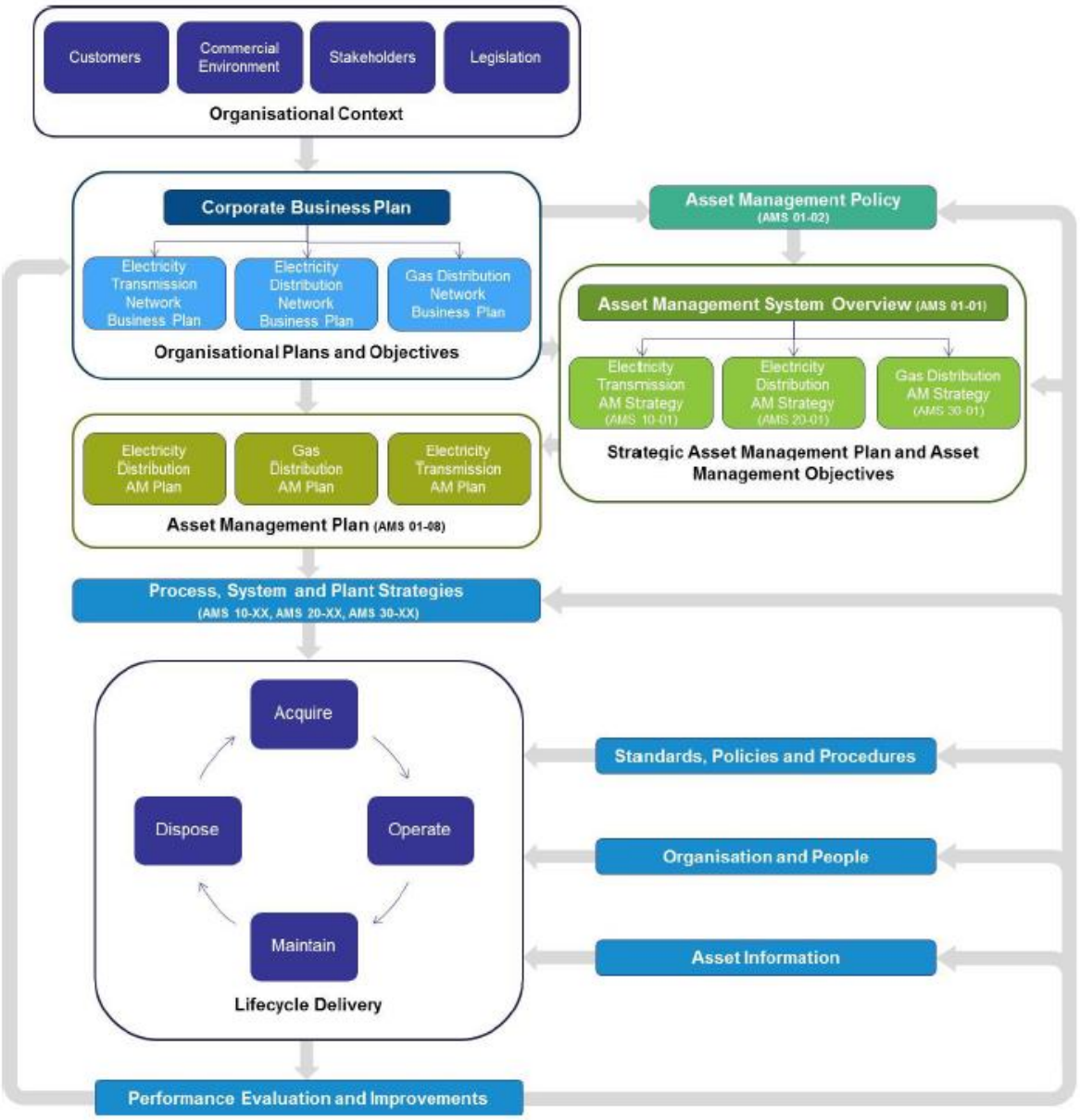

Figure 1: Ausnet Services Asset Management Framework

1.5. References

Other referenced documents within this strategy are:

- AEMO – Victorian Gas Planning Review, Victorian Gas DTS Capacity, Annual Winter Preparedness Strategy.
- APA Group – Connection Agreement
- 30-2507-07 Gas Network Planning – Winter Testing Strategy
- Gas Distribution System Code, Version 12, 2018
- Gas Safety Case Regulations
    - GSC 10-00 – Gas Safety Case – Introduction & Facility Description
    - GSC 10-01 – Safety Management System
    - GSC 10-02 – Gas Safety Case – Formal Safety Assessment

2. Alignment with Drivers

AusNet Services' purpose statement is "Connecting communities with energy and to accelerate a sustainable future". This statement places the customer (as individuals and communities) at the forefront as a business driver and acknowledges the critical relationship with their energy supply and usage. The following diagrams shows that Customers are a key theme linking the Corporate Business Strategy with the Gas Network Vision and Gas Network Objectives, which influence the key plant strategies forming the basis of the regulatory submission.

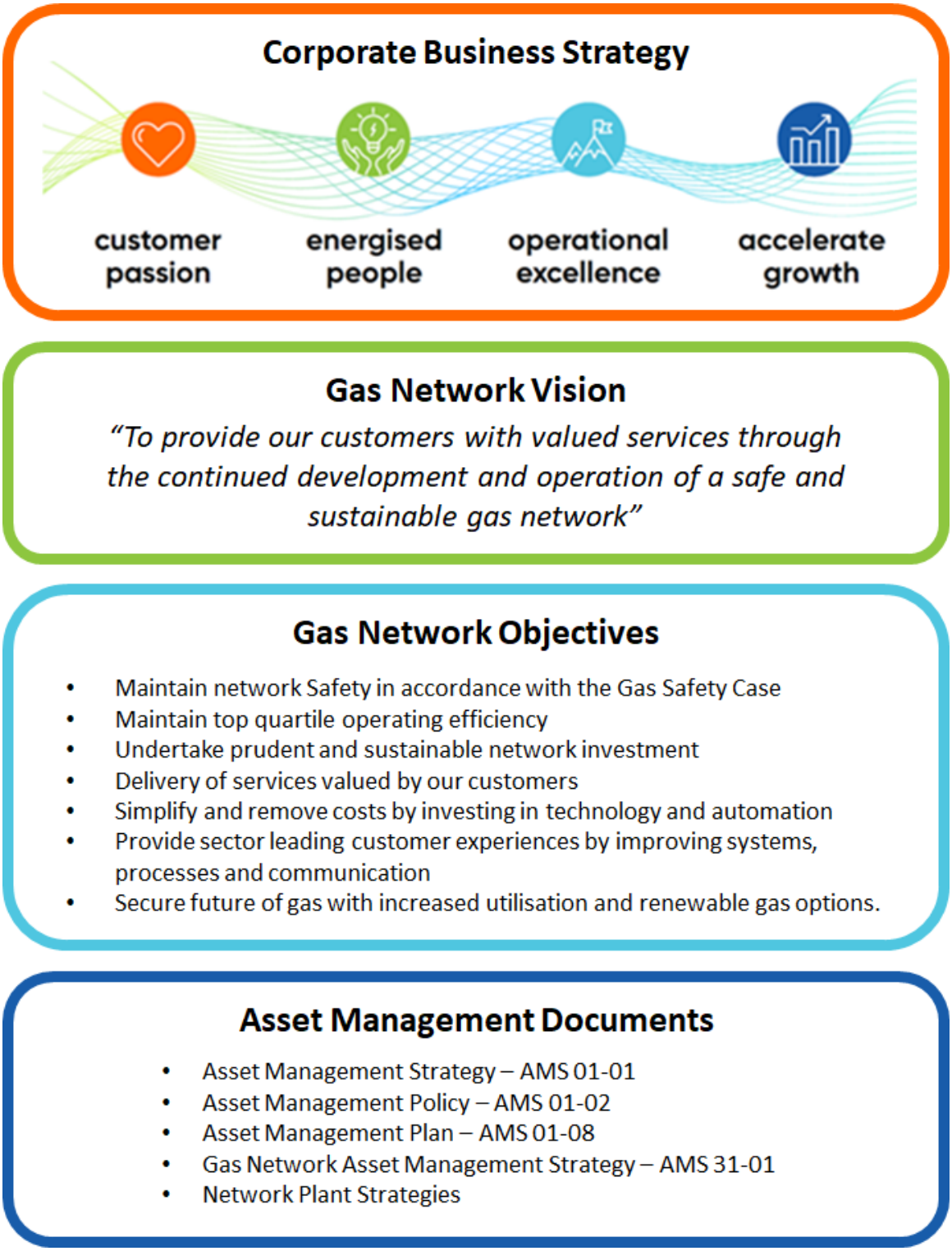

Figure 2: The Business Strategy, Network Vision and Objectives all centre around our customers

The Gas Network Objectives align with the four Corporate Business Objectives as shown below:

Maintain network Safety in accordance with the Gas Safety Case.

Maintaining network safety supports our commitment to "Mission Zero", ensuring our people go home safety at the end of the day. This is one of the strategic priorities of the "energised people" corporate objective.

Maintain top quartile operating efficiency.

AusNet Services aspires to operate all three of its core networks in the top quartile of efficiency benchmarks. This aligns with the "operational excellence" corporate objective.

Undertake prudent and sustainable network investment.

This network objective supports AusNet Services' obligation to undertake prudent and sustainable network investment, as defined in the National Gas Rules and Gas Distribution System Code. This in turn aligns with the "operational excellence" corporate objective.

Delivery of valued services to our customers.

AusNet Services strives to better understand our customers (their needs and behaviours) in order to deliver the services they value. This aligns with the "customer passion" corporate objective.

Simplify and remove costs by investing in technology and automation.

By working more efficiently, AusNet Services improves its "operational excellence" and provides better value for customers.

Provide sector leading customer experiences by improving systems, process and communication.

Similarly, improving how we work increases efficiency, thereby improving "operational excellence".

Secure future of gas with increased utilisation and renewable gas options.

Exploration of renewable gas options and the role gas will play in the energy ecosystem of the future will support the "accelerate growth" corporate objective.

3. Planning Overview

3.1. Introduction

This strategy outlines the network augmentation required during the 2024-28 regulatory period, to ensure supply and control of network pressures is maintained throughout AusNet Services' natural gas distribution system.

The gas network in the north-western and south-western corridor of metropolitan Melbourne has been experiencing significant levels of new customer growth with external factors influencing demand based on the type of development and occupancy numbers.

The western regional districts of Victoria are also experiencing increased levels of commercial and industrial development due to the economic availability of land and the close proximity to Melbourne and major arterials.

New customer connections are forecast to grow at an average rate of 2.7% per annum to 2028.

To ensure continuity of supply and maintain the minimum network pressures in accordance with the Gas Distribution System Code (Version 18, Schedule 1, Part A), identified areas of the gas network will require augmentation designed on the Victorian accepted methodology.

At the completion of each winter period, a review of the network is undertaken to determine the effectiveness of the augmentation with system pressures being compared to the forecast model. The resulting planning strategy is incorporated into AusNet Services' Capital Program as stated in the Asset Management Plan (AMP 30-01).

The augmentations identified for 2024-28 include upgrades and/or new installations for City Gate and Field Regulator facilities, and pipeline reinforcements.

3.2. Planning Methodology

AusNet Services' gas network is divided into approximately ninety (90) discrete sections, which are continually expanding due to organic residential growth and commercial and industrial development. To manage this, continued planning and management is undertaken using a computational fluid dynamics program called *Synergi Gas* that simulates the actual performance of the networks in the field.

The network models are based on a 1-in-2 Peak Winter Day standard which is based on climate conditions factoring in temperature, sun time, wind speed and seasons which are seen to be experienced once every two winters on average. An algorithm which utilises the variables defines a number known as the Effective Degree Day (EDD). This derivative is provided by AEMO and is based on the system coincident peak day with a 50% probability of exceeding this value in any given year. EDD is used extensively in Victoria and is based on research of the impact of weather on Victorian residential gas demand.

Modelling of forecast gas consumption indicates the need for future augmentation to the networks to ensure network capacity and fringe pressures are maintained in accordance with the GSC and GDSC.

Effective Degree Day

EDD = 18 – T	**(Temperature Effect)**
+ [(0.038)(DD)(Avg. Wind)]	**(Wind Chill Factor)**
- [1.8(Sunshine Hours)]	**(Warming effect of Sunshine)**
+ 2Cos[2π(day – 200/365)]	**(Seasonal factor)**

EDD = 0 if the calculated value is negative.

Figure 3: Effective Degree Day Calculation

The EDD value will be higher as the temperature gets colder. Eighteen (18) degrees Celsius represents the threshold temperature for residential heating.

A major input to augmentation planning is the annual Winter Testing Program. It is a detailed pressure monitoring program conducted at selected locations across the network during peak load conditions. Winter testing data is analysed and used to update the *Synergi Gas* models of individual gas networks and identify potential future augmentation of the network.

AusNet Services undertakes detailed winter testing each year on selected areas (networks) of the overall network. Each network undergoes winter testing at least once within an eight-year period. Document *30-2507-7 Gas Network Planning – Winter Testing Strategy* defines the criteria for prioritising and selecting networks for winter testing.

The following criteria are considered:

- Date of previous year of winter testing;
- Planned date of next reinforcement;
- Net load growth factor; and
- Network character factor based on fringe rating, interconnection rating, and load factor.

Gas pressures at the fringe of the network are projected forward by reference to current recorded pressures and forecast load growth. This process is used to identify network augmentation requirements to ensure that network fringe pressures remain above required minimum levels.

A typical representation of the behaviour of network pressures with and without undertaking augmentation is depicted in Figure 4 below.

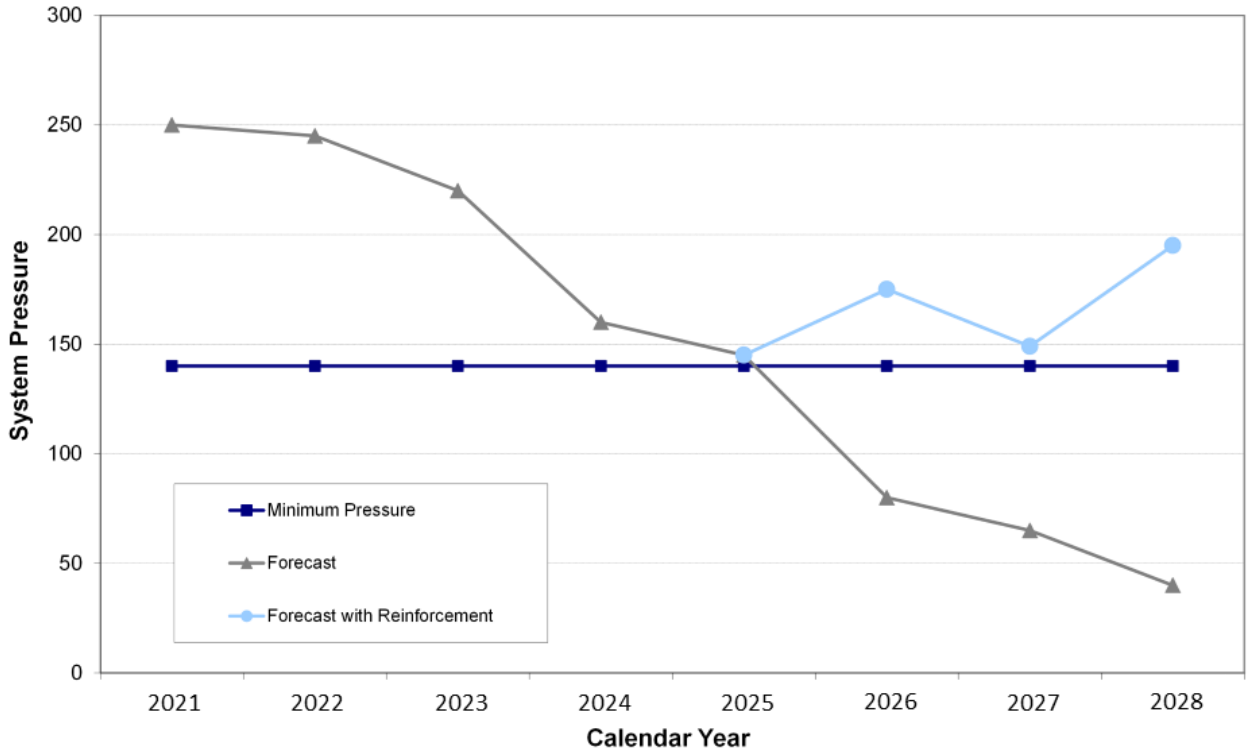

Figure 4: Typical performance of a High Pressure Network (Illustration Only)

Network minimum pressures are expected to fall slightly each winter due to cumulative demand growth. In the example above, indications are that pressure falls below the high pressure benchmark of 140kPa post 2025. All reasonable endeavours are to be made to ensure pressures remain above the minimums stipulated for each pressure tier as required by the GDSC. The identified augmentations (in 2026) enable pressures to be maintained above this benchmark, as indicated by the light blue curve. Without undertaking this reinforcement, the trend of falling minimum pressures continues (grey curve).

AusNet Services' obligations under the GDSC to maintain network pressures above minimum levels are highlighted below in Table 2.

Table 1: Gas Distribution System Code Minimum Obligated Network Pressures

Network Pressure Tier	Minimum Obligated Pressure
High Pressure	140kPa
Medium Pressure	7kPa
Low Pressure	1.4kPa

3.3. Prioritisation

Network augmentation is identified by simulating future growth and demand, which in turn determines the appropriate timing of each individual project. This ensures compliance with conforming capital criteria as defined within Section 79 of the National Gas Rules, Version 29.

Once augmentation requirements are identified, AusNet Services undertakes feasibility and prioritisation studies for each major proposed capital project. This study comprises a relevant combination of the following elements:

- Proposed network design and associated cost of construction;
- Economic evaluation; and
- Short and long-term requirements.

AusNet Services has divided its gas asset base into ninety (90) separate networks, each managed separately, and operating at a range of pressures. Where required, AusNet Services introduces local reinforcement, such as closed loop tie-ins, to cater for specific growth in some areas.

AusNet Services must continue its network augmentation CAPEX programs to maintain asset utilisation at acceptable levels. It must avoid a situation where high gas demand and limited system capacity results in inadequately supply to customers.

3.4. Delivery

Various types of augmentations are undertaken to reinforce the Distribution Network and Transmission Pipeline system including new installations and upgrading of existing regulating facilities. As networks expand due to organic domestic growth, fringe locations become further in distance from the supply point being City Gates, Field Regulators, and even District Regulators.

To ensure adequate network pressures, the Distribution network may require large diameter supply main duplication, inclusion, or extension of a 'backbone' supply main or providing an additional source of supply. Transmission Pipeline delivery pressures may also deteriorate with insufficient gas inlet pressures being delivered to the downstream Regulating Facility. This necessitates the duplication of the upstream Transmission Pipeline.

4. Planned Augmentation Program

AusNet Services' planned network augmentation works are summarised in this section. The program is required to ensure GDSC compliance, whilst also being essential to responsibly and efficiently control network performance.

Note:

1. No augmentation works were identified for the Low Pressure networks.

2. All growth forecasts were provided by Customer Consumption Data Analytics in AusNet Services' Finance department.

The diagrams in the following sections use the colour scheme shown in Table 3 below for indicating network operating pressure tiers.

Table 3: Colour Scheme for Pressure Tiers

Pressure Tier	Pressure Range (kPa)
Transmission	1,000 - 2,700
High Pressure 2	600 - 1,000
High Pressure 1	140 - 450
Medium	15 - 45
Low	1.4 - 2.5

4.1. Macedon Ranges

The existing Macedon Ranges HP2 network cannot maintain adequate pressures required at Gisborne Field Regulator to supply the Gisborne and Riddells Creek townships. Pressures in the HP2 network will be sufficiently increased to allow for adequate supply to downstream townships through required network reinforcement.

Project Overview:

- [C.I.C]

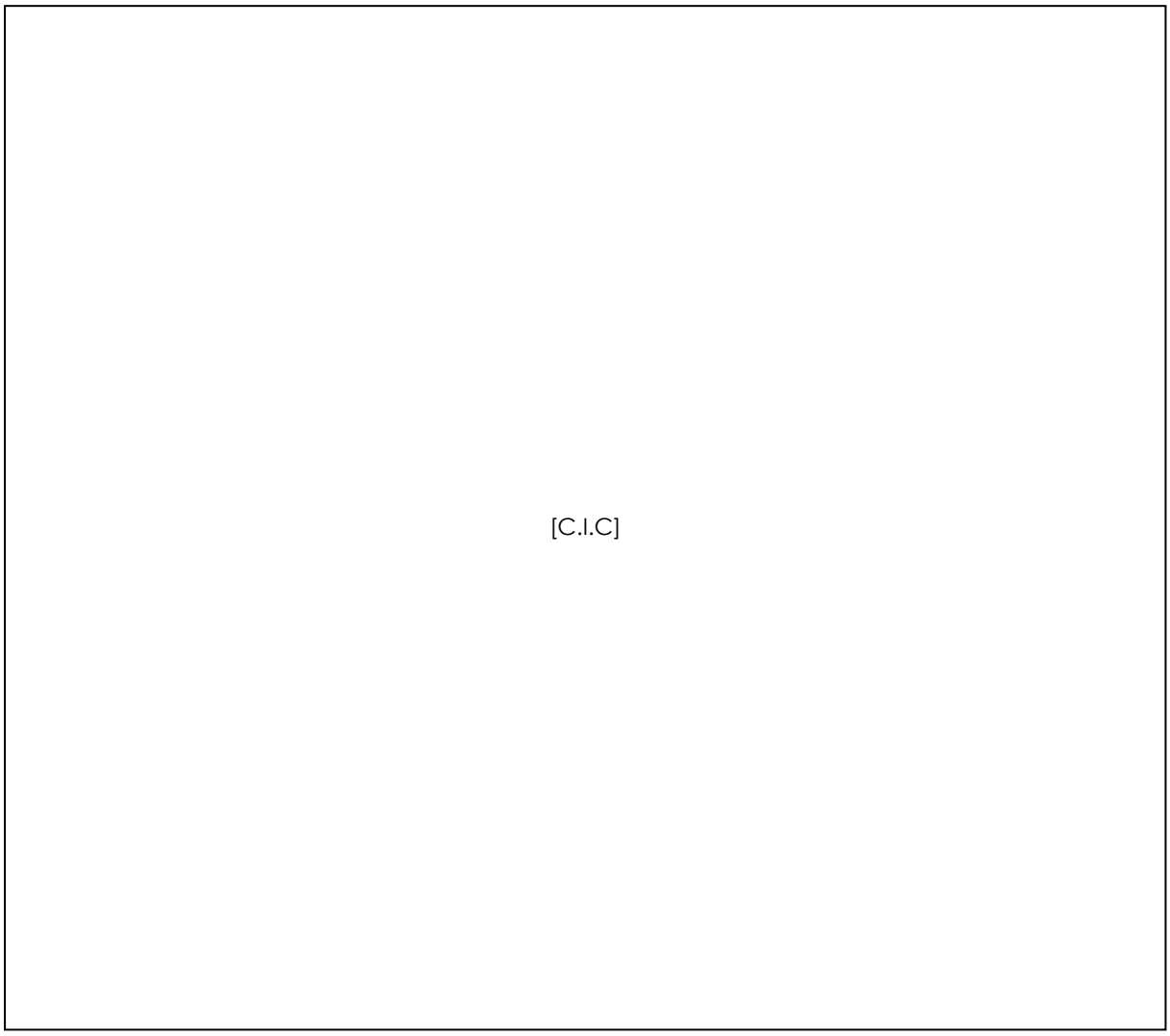

Figure 5: Macedon Ranges network and reinforcement

Project Details:

See AMS 30-17-Macedon_Ranges for project details and performance analysis.

4.2. Point Cook

The existing Point Cook gas network will be unable to support projected customer growth and the continuing expansion of network fringes in the Point Cook Eastern areas. The proposed reinforcement will ensure the Point Cook' network capacity is increased at sufficient level to maintain adequate supply to customers.

Project Overview:

- [C.I.C]

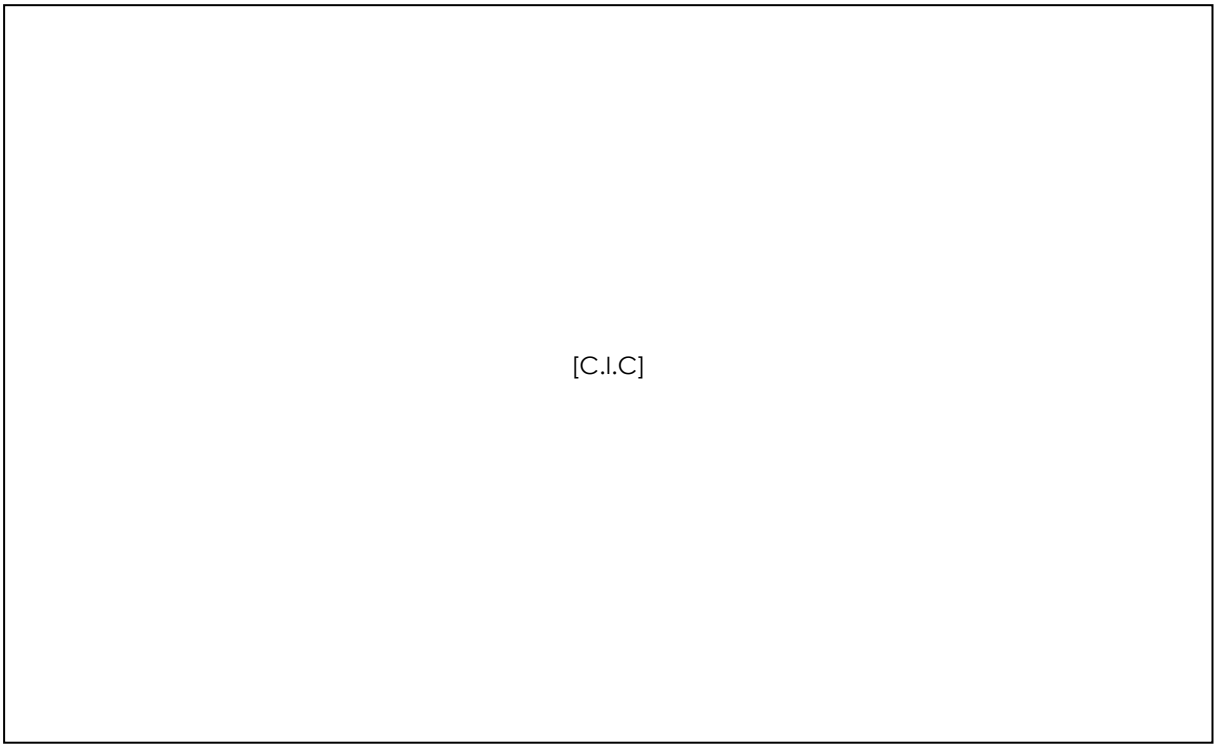

Figure 6: Point Cook network and reinforcement

Project Details:

See AMS 30-17-Point_Cook for additional project details and performance analysis.

4.3. Bacchus Marsh

The existing Bacchus Marsh network will be unable to support projected growth concentrated in the Northern region currently experiencing capacity constraints. Reinforcing the network with a large-diameter supply main will direct gas flow further North towards the growth areas and improve fringe pressures.

Project Overview:

- [C.I.C]

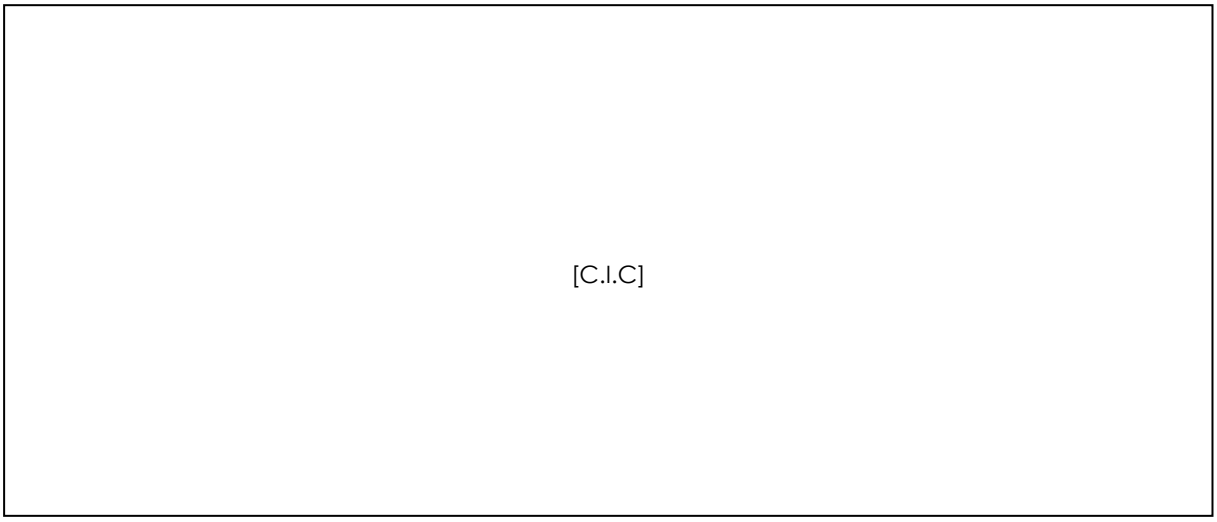

Figure 7: Bacchus Marsh network and reinforcement

Project Details:

See AMS 30-17-Bacchus_Marsh for additional project details and performance analysis.

4.4. Sunbury

The existing Sunbury gas network will be unable to support projected customer growth concentrated in the Sunbury Eastern growth corridor. The proposed reinforcement will alleviate current capacity limitations in the Eastern Region and ensure capacity is available for additional growth.

Project Overview:

- [C.I.C]

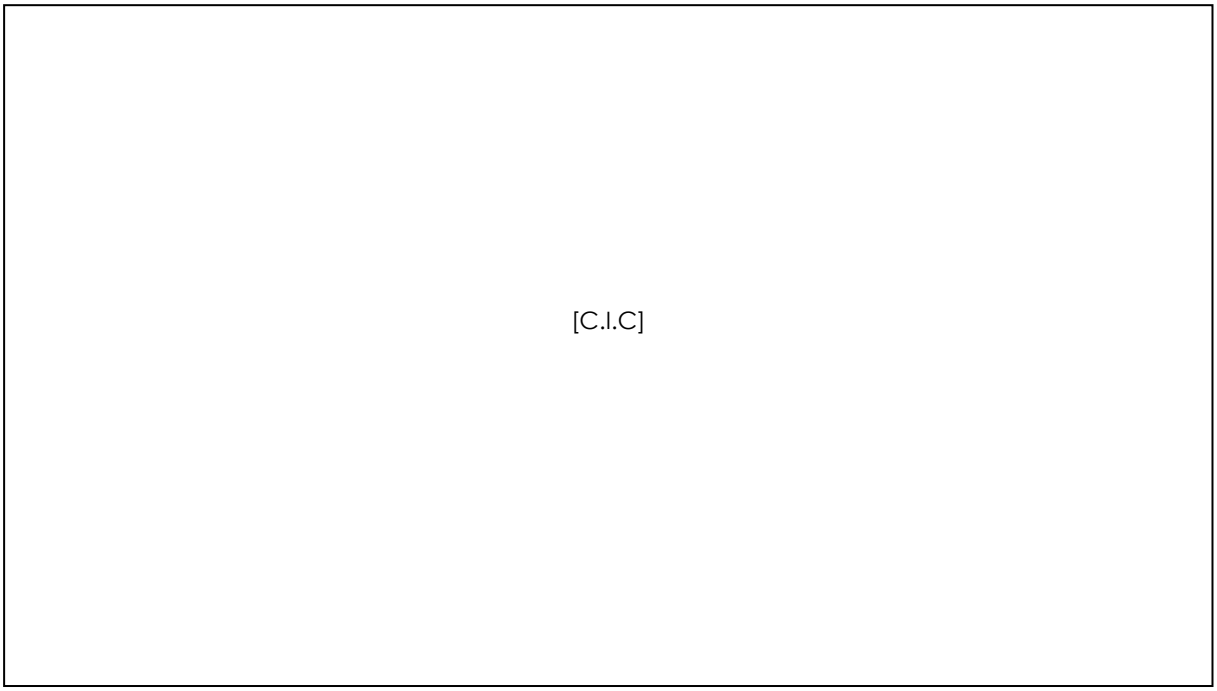

Figure 8: Sunbury network and reinforcement

Project Details:

See AMS 30-17-Sunbury for additional project details and performance analysis.

4.5. Ballan

The existing Ballan gas network will be unable to support further customer growth. The proposed reinforcement will boost supply capacity towards the growth in the Northern region and provide additional capacity required for further growth.

Project Overview:

- [C.I.C]

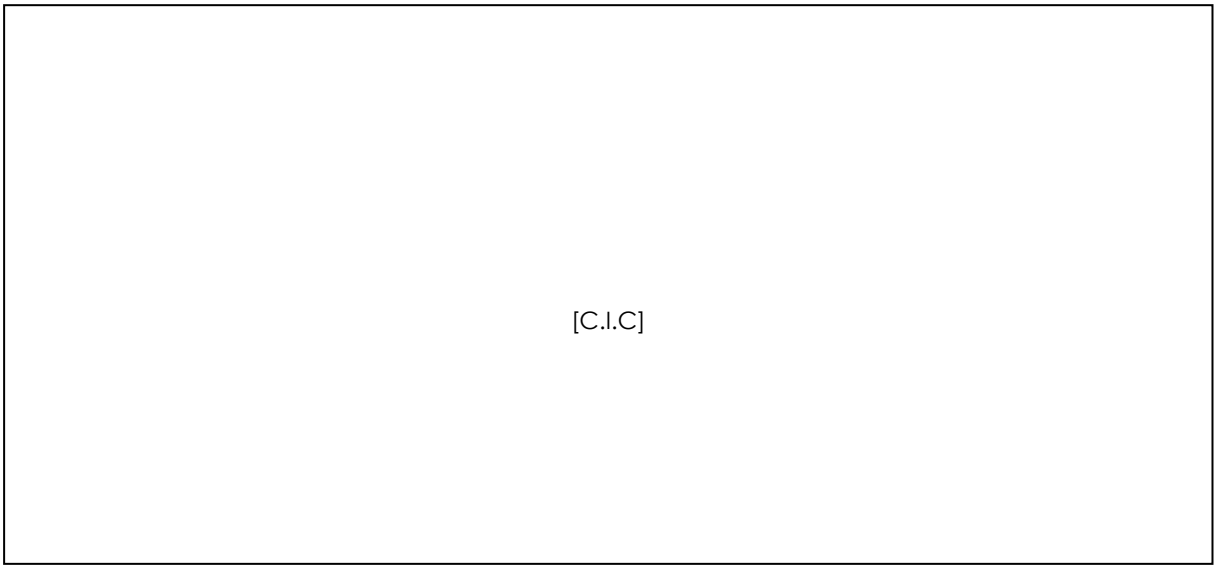

Figure 9: Ballan network and reinforcement

Project Details:

See AMS 30-17-Ballan for additional project details and performance analysis.

4.6. Craigieburn

The Craigieburn network will be unable to support the projected connection rate in the Hume growth area and network expansion due to continued strong growth. Network reinforcement will be required to transfer capacity to the areas of the network undergoing growth.

Project Overview:

- [C.I.C]

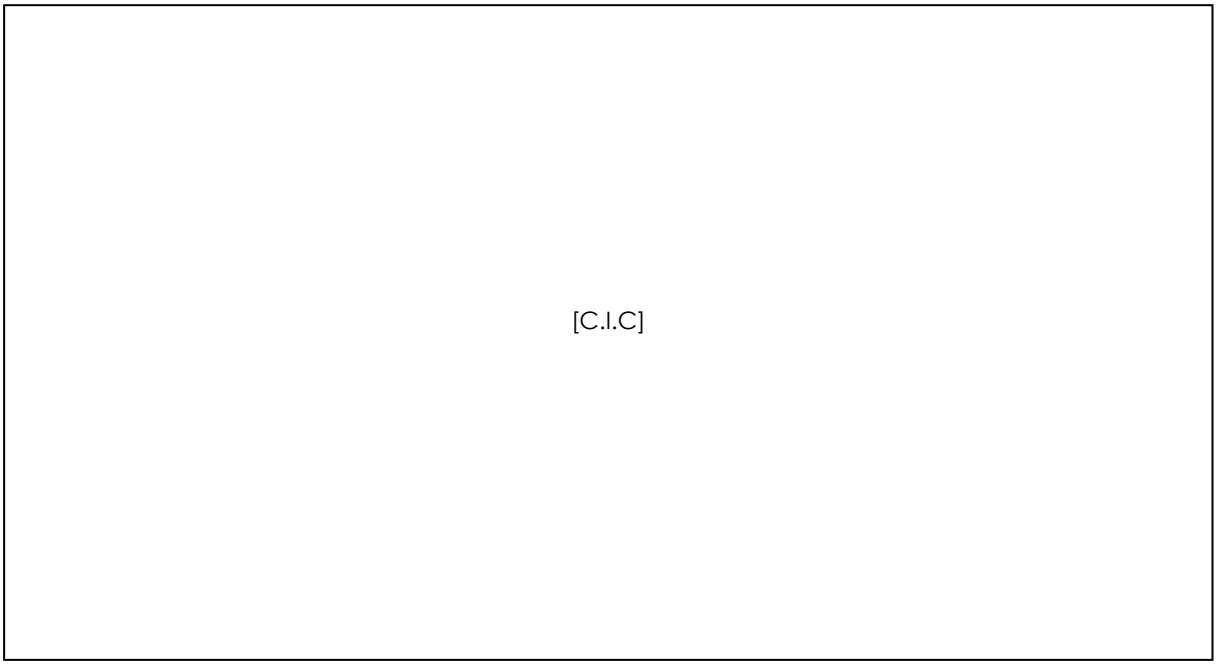

Figure 10: Craigieburn network and reinforcement

Project Details:

See AMS 30-17-Craigieburn for additional project details and performance analysis.

4.7. Tarneit

The existing Tarneit network will be unable to support projected growth in the Western growth corridor. The Tarneit network is continuing to experience capacity decrease due to the strong growth in the Western part of the network expanding away from the current main supply source at Mt Cottrell City Gate. The reinforcement will boost supply from the critical supply source at Mt Cottrell city gate towards to the Western growth fringe and increase capacity in the Tarneit network.

Project Overview:

- [C.I.C]

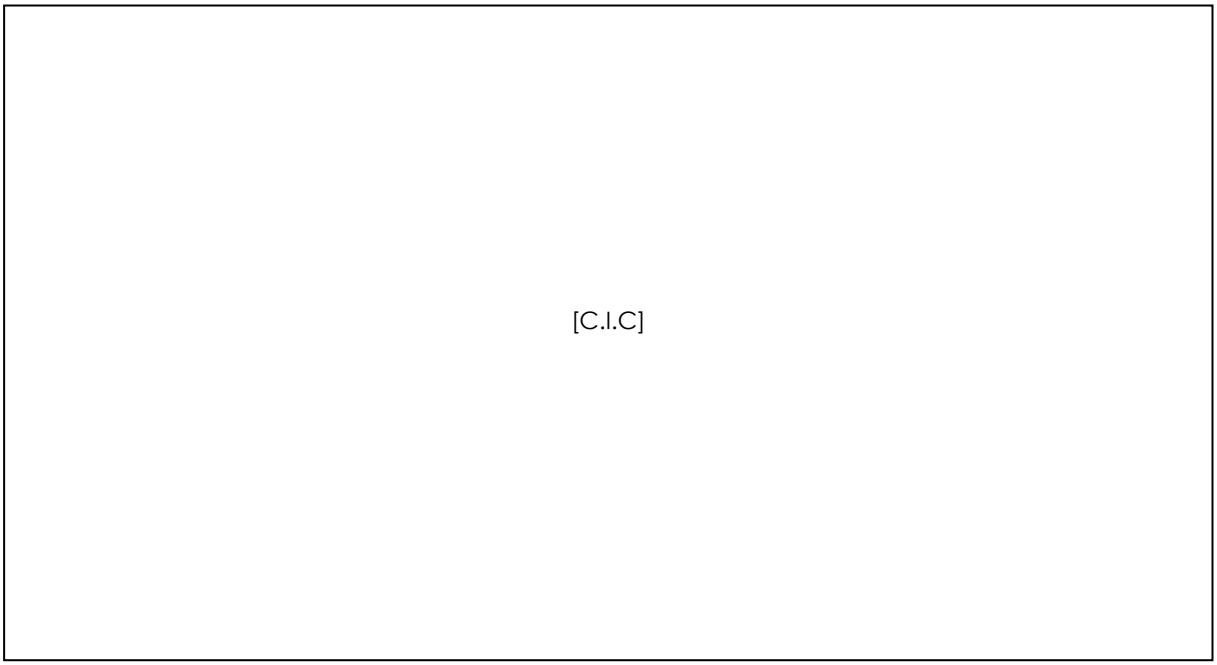

Figure 11: Tarneit network and reinforcement

Project Details:

See AMS 30-17-Tarneit for additional project details and performance analysis.

4.8. Ballarat

The existing Ballarat network will be unable to support projected growth concentrated in the Western and Northern growth corridors and expanding further away from existing supply sources located in the Eastern region of Ballarat. This reinforcement project will ensure capacity will be increased at sufficient level and remain available in growth areas.

Project Overview:

- [C.I.C]

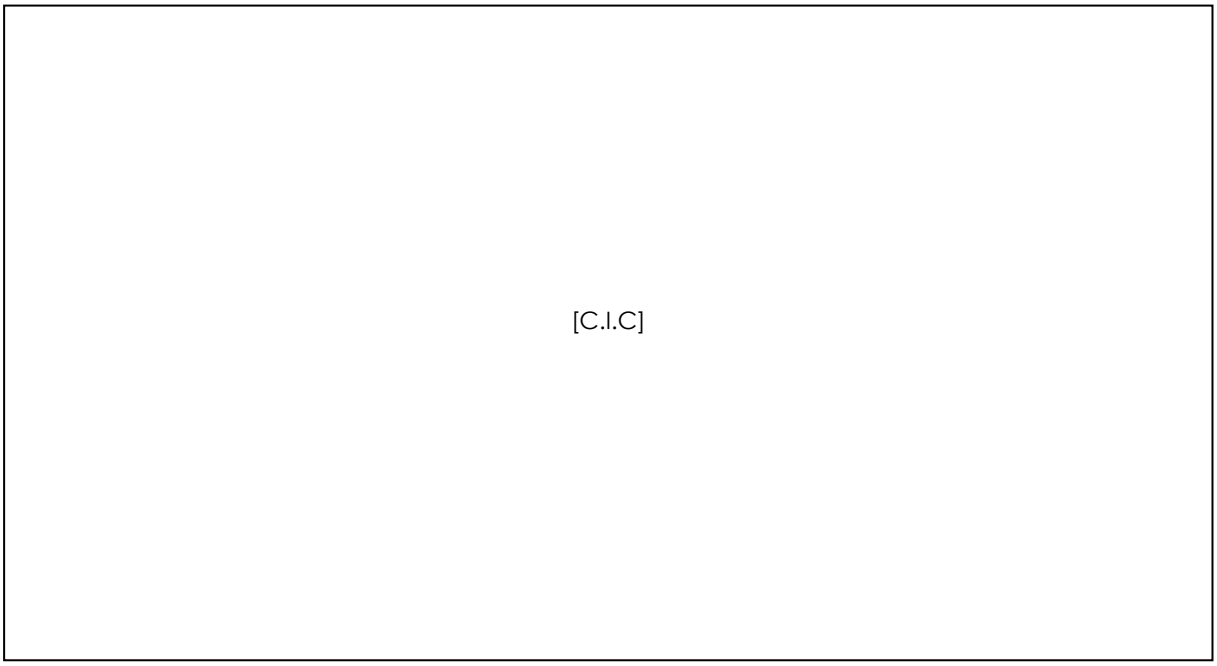

Figure 12: Ballarat Network transmission pipeline reinforcement

Project Details:

See AMS 30-17-Ballarat for additional project details and performance analysis.

4.9. Bendigo

The existing Bendigo network will be unable to support projected growth concentrated in the North-Eastern Corridor. This reinforcement will boost further capacity towards the Northern Eastern growth corridor forecasted to experience capacity constraints.

Project Overview

- [C.I.C]

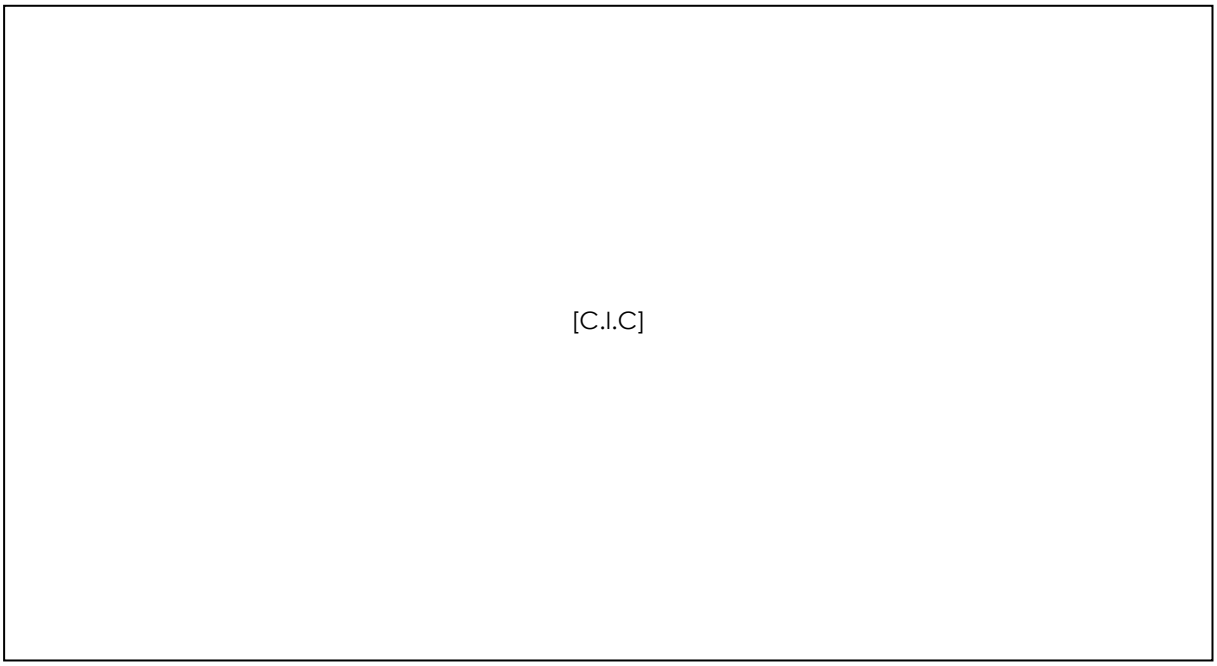

Figure 13: Bendigo network and reinforcement

Project Details:

See AMS 30-17-Bendigo for additional project details and performance analysis.

4.10. Geelong Bellarine Stage 2

The Southern corridor of the Geelong Bellarine Peninsula network will be unable to support the projected growth in Ocean Grove and Point Lonsdale area. As a result, and to ensure minimum supply pressures are maintained, the reinforcement at Buckley Grove in Stage 1 is to continue with Stage 2 of installing 180 mm P10 main along Grubb Rd.

Installation of a large diameter supply main will improve network pressures and ensure capacity remain available for the Southern growth corridor at Geelong Bellarine.

Project Overview:

Stage 2:

- [C.I.C]

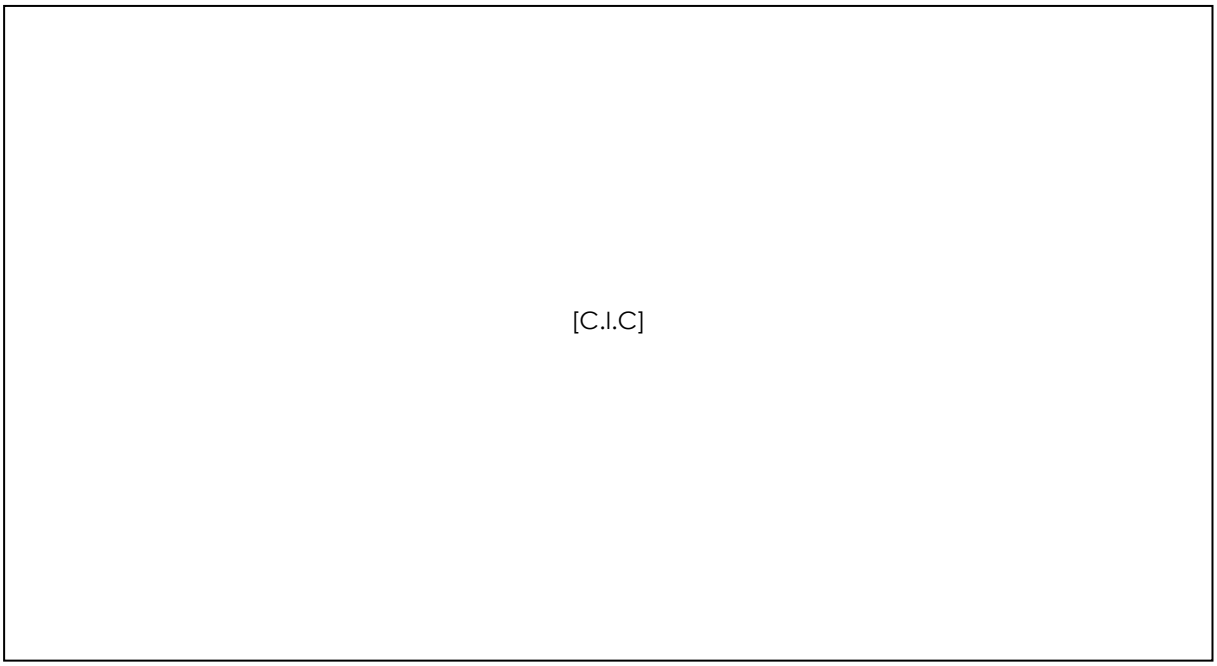

Figure 14: Bellarine network and reinforcement stage 2

Project Details:

See AMS 30-17-Bellarines for additional project details and performance analysis.

4.11. Werribee

The western Growth Corridor of Werribee has and is continuing to experience considerable residential development. Five regulators support this network and with the South-Western and Northern fringe locations expanding outwards and supply pressures are declining.

As a result, to ensure minimum supply pressures are maintained, the construction of 4,000m of an additional large diameter supply main and City Gate will deliver greater capacity to the South-Western fringes.

Project Overview:

- [C.I.C]

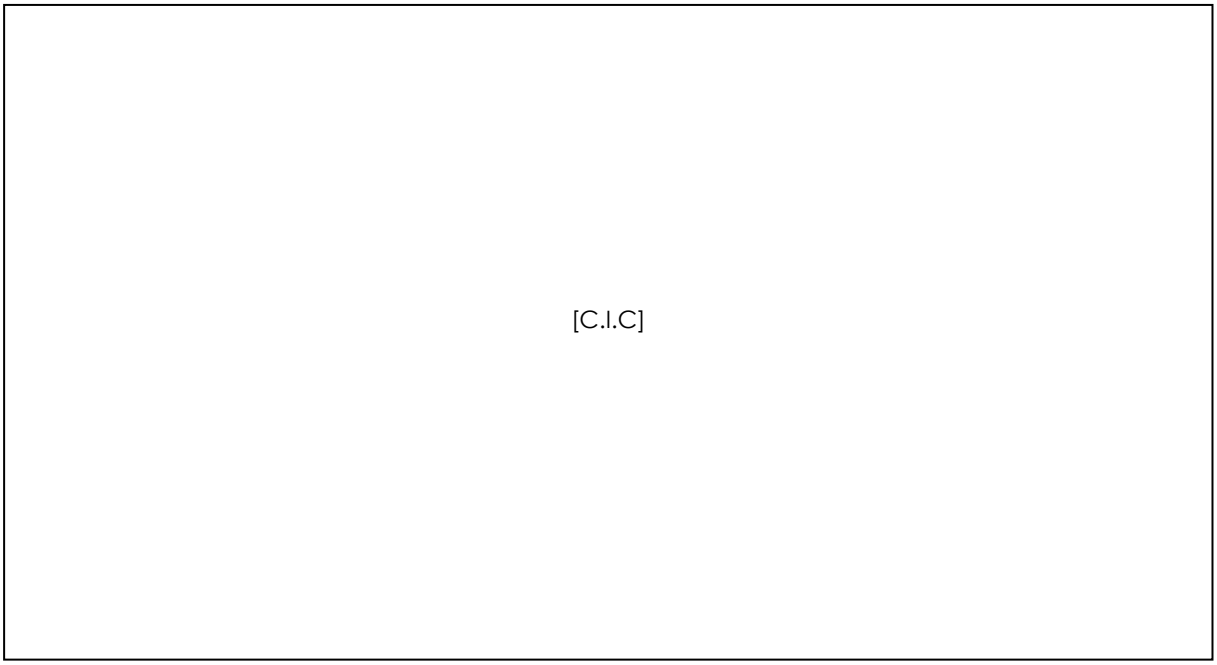

Figure 15: Werribee network and reinforcement

Project Details:

See AMS 30-17-Werribee for additional project details and performance analysis.

5. Existing Facility Upgrades

The volume of gas a field regulator can deliver depends primarily on its size. As the network expands along with steady demand the existing regulators gradually approach their supply capacity. Several existing facilities will require sizing upgrades to increase their supply capability and meet network demand.

The capacity of a regulator is represented by gas flow, measured in standard cubic meters per hour, Sm^3/h. The need for a capacity upgrade of a facility arises when the demand (Sm^3/h) is projected to exceed the throughput capacity of the facility. If the facility cannot meet demand then gas flow becomes choked through and accelerates regulator wear.

The network model indicates how much gas is flowing through each station. The tables below are the identified upgrades needed and the timing of those upgrades solely based on the facility demand/capacity relationship.

Table 4: Regulating Facilities Upgrade

Year	Asset Type	Existing Maximum Capacity	Forecast Demand	Affected Customers	Modifications
FY2022/23	[C.I.C]	12,010 Sm^3/hr	23,000 Sm^3/hr	23,000	Increase outlet pipework to 150mm
		12,000 Sm^3/hr	16,000 Sm^3/hr	8,000	Increase inlet pipework to 100mm
		2,900 Sm^3/hr	4,000 Sm^3/hr	2,000	Increase inlet pipework to 100mm Increase Regulators Sizes to DN80 Axial Flow
FY2023/24		12,580 Sm^3/hr	15,000 Sm^3/hr	12,000	Increase outlet pipework to 250mm

Project Details:

See AMS 30-17-Facility_Upgrades for additional project details and performance analysis.

6. Detailed Capital Expenditure Requirements

6.1. Phasing and Financial Disclosure

All programs are defined in Australian financial years, aligning to regulatory years from July until June of the ensuing year.

All financial figures quoted within this document, including all historic and forecasted expenditure – unless otherwise specifically stated – have the following characteristics:

- Real Expenditure / Cost (reference year – 2022);
- Direct Expenditure only (i.e. excludes overheads and finance costs); and
- In units of $1,000 (i.e. '000).

6.2. Project Cost Estimation Tables

Table 5: Planned Augmentation Capex Summary ($2022, $'000)

[C.I.C]

Table 6: Facility Installations

								[C.I.C]											

Table 7: Existing Facility Capacity Upgrades

										[C.I.C]									

Table 8: Financial Summary

							[C.I.C]												

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